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Abstract

This paper estimates government spending multiplier for natural resource-rich low-income countries (LICs). Our estimates suggest an absence of natural resource curse in government spending multiplier. In the short-run, the government spending multiplier is around 0.7 for natural resource-rich LICs and 0.43 for all LICs. The government spending has a permanent impact on the real economic activity in resource-rich countries while having a transitory long-run impact in other countries.

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Non-technical summary

This paper estimates government spending multiplier for natural resource-rich low-income countries (LICs). The government spending multiplier is the ratio of a change in national income to any autonomous change in government spending.

1. Short-run government spending multiplier

Today government spending usually has a direct effect on aggregate country production. Our paper measures this effect and proposes interesting results useful for Uganda oil and gas additional expected revenue. The short-run government spending multiplier for natural resource-rich countries is larger than in others countries.Our finding suggests that, in the short-run, the government spending multiplier is between 0.55 and 0.74 for the natural resource-rich LICs and around 0.4 for other countries. There are two possible explanations for this difference. The first is related to credit constraint. Indeed, resource-rich countries endowed with the stock of resource are able to fund costly, with high returns, investments in infrastructure, energy or other goods. The second explanation has to do with allocation of government spending. In resource-rich countries, the government can allocate spending to pro-resource extraction spending, with the possibility of rent, it is therefore possible to have higher returns.

2. Long-run government spending multiplier

The full effect of an increase in government spending on GDP can take more than one year to be observed in the data. We, therefore, estimate longer-run GDP effects of government spending. Our estimates suggest also that government spending has a permanent impact on the real economic activity in resource-rich countries, while government spending in non-resource-rich countries has a transitory impact.

3. Government spending multiplier in recession

After the recent 2008 crisis, there are many voices advocating the used of government spending as one of the key ingredients of US recovery. However, our estimate multipliers suggest limited output effect of countercyclical responses of government spending in response to economic downturns in LICs, despite a larger effect for resource-rich countries. It is therefore not a good idea to use government spending to deal with the recession. The government should instead identify structural causes of the recession and address them in an efficient way.

1 Introduction

Empirically identifying government spending multipliers has gained the attention of economists since the 2008 crisis. Despite this new interest, very little is known about the effects of fiscal policy on economic activity and on the short versus long-run behavior of fiscal policy in low-income countries (LICs). There is no consensus about the sign and size of the multiplier and we have limited knowledge about the difference between resource-rich and other LICs. Natural resources revenues have been an important source of fiscal revenue and foreign exchange in many LICs. In a period of crisis the extraction of natural resources could play a critical role on how the spending will be financed, for instance, a country may extract more resources in the current period or reduced its saving. The abundance of natural resources can cause miss allocation of public spending in favor of resource oriented spending.

The objective of this paper is to estimate the government spending multipliers in natural resource-rich LICs. We compute the short and long run multipliers. We divide the sample into two sub-samples, high levels of natural resources (historically more than the 4.6% of real GDP, this is the median level) and low level of natural resources. Our results indicate that, in the short run, the government spending multiplier is ranges from 0.39 to 0.47 for the full sample. It means that an additional dollar of government spending raises a country GDP contemporaneously by approximatively 43 cents. This is slightly higher than the one-year government spending multiplier estimates of 0.4 in Kraay (2014). By contrast, the government spending multiplier is larger for natural resources-rich countries ranging from 0.55 to 0.74 in the short-run. Moreover, in the long-run, the multiplier is even larger for the full sample than in the short-run with natural resource-rich countries having larger multipliers. We conducted a battery of robustness checks. The estimates of the one-year government spending multiplier are different across these checks, but they are in between 0.43 and 1.07. We find evidence suggesting a larger multipliers in recessions, for countries less exposed to trade, and in countries with low aid dependence.

Larger government spending multiplier for resource-rich countries means that government spending in natural resource-rich countries is more productive. The mechanism through which the public spending is more productive in resource-rich countries maybe the following: First, natural resource revenues can improve the country financial capac-

ity which can be helpful to carry out more productive investment in infrastructure our other sectors (Budget relaxed). Moreover, expenditure in natural resource sectors can achieve extraction of natural resources more rapidly with higher returns compared to expenditures in other sectors (Resource-oriented spending).

The total effect, on GDP, of an increase in government spending can take several years to be observed. Therefore, we estimate longer-run multiplier. Our estimates suggest that government spending has a permanent impact on the real economic activity in resource-rich countries, while government spending in other countries has a transitory long-run impact. This finding support again the relaxation of the credit constraint allowing the government to pursue investments in long-run growth driver sectors.

This paper builds on previous work of Kraay (2012) and Kraay (2014). In these papers, Kraay exploited the lags between the approval and subsequent disbursements of loans by creditors to isolate a predetermined component of creditor-financed public spending that could be used as an instrument to estimate government spending multipliers. However, these papers did not specifically model the situation of resource-rich LICs, despite the importance of natural resources for their GDP. For instance, an official creditor can use natural resources as implicit collateral for lending to LICs. In such case, resource-rich countries are more likely to receive generous loan approvals. Moreover, the disbursement schedule can influence the level of extraction of natural resources. Disbursements are, therefore, likely to be correlated with natural resources production leading to the violation of the exclusion restriction, since natural resources are also used to finance government spending. This paper overcomes this problem by taking into account explicitly natural resources in our model specification. It considers Kraay's instrument as a starting point and construct the part of disbursements that are independent of natural resources. This variable is used as an instrument alongside with twice lagged natural resources rent.

This paper contributes to the literature identifying the effect of government spending on the output in the short-run. The literature has focused almost exclusively on rich countries, particularly the United States. Three main methodologies are employed, we describe them in the following paragraphs. Our empirical strategy is inspired by the first and third identification methods.

First, Barro (1981) observes that fluctuations in defence spending are an important component of fluctuations in total government spending in the United States, and

are driven mainly by geopolitical factors rather than domestic macroeconomic shocks (Kraay (2014)). Therefore, they can be viewed as a plausibly exogenous source of variation in government spending that can be used to estimate spending multipliers. Among papers extending Barro's methodology we have Ramey and Shapiro (1998), Hall (2009) Barro and Redlick (2011). As pointed out by Kraay (2014), the common drawback of these military spending-based studies is that they are not able to control for the macroeconomic effects of other key features of wartime economies, such as price controls or mandatory military service. Moreover, this identification approach is only possible for the United States, where the conflicts associated with the spending increase occurred outside the United States, so that there were no direct effects of wartime destruction on the US economy (Kraay (2014)). This cannot be the case for low-income countries.

The second methodology is set out by Blanchard and Perotti (2002). Their identification strategy is based on the assumption that discretionary fiscal policy cannot respond to macroeconomic shocks during the same quarter. This assumption allows identification of VAR-based estimates of spending multipliers in countries with high-frequency macroeconomic and fiscal data (Kraay (2014)). The contributions in this area include Ilzetzki, Mendoza, and Vegh (2013) and Auerbach and Gorodnichenko (2011), who examine the heterogeneity in the government spending multipliers, with emphasize on the state of the business cycle, and many other factors such as trade openness and the exchange rate regime. Many of these studies focused on rich countries with some exceptions like Rafiq and Zeufack (2012) who explore how the size of fiscal multipliers may change depending upon the stage of the growth cycle for developing country using the case of Malaysia. Ilzetzki (2011) and Ilzetzki and Vegh (2008) assemble quarterly data, for a sample of 27 emerging economies, they use a VAR identification approach to analyze the cyclical effects of fiscal policies. Unfortunately, this identification strategy is not applicable to the analysis of the majority of LICs, especially in the poorest low-income countries we are focusing on in the present paper, as many of them don't report fiscal or macro data on a quarterly basis.

A third strategy of the literature is to propose a variety of instruments to capture a plausibly exogenous component of government spending. For example, Shoag et al. (2010) and Clemens and Miran (2012) exploit the difference in pension fund windfalls and the stringency of balanced-budget rules respectively to create instruments for gov-

ernment spending. However, this method is applied mainly for the US. Our empirical strategy is inspired by the first and third identification methods.

The remainder of the paper is organized as follows. In the next section, we briefly present the model and the empirical strategy considered. We estimate short and long-run government spending multipliers in Section 3 and consider a variety of spending multipliers results in Section 4. Section 5 concludes.

2 Model and Empirical Strategy

We estimate the following simple empirical specification in equation (1). Our aim is to evaluate the short-run effects of government spending on output, this empirical strategy is closely related to Kraay (2014).

$$\Delta y_{i,t} = \beta \Delta g_{i,t} + \delta \Delta r_{i,t} + \rho \Delta r_{i,t-1} + \mu_i + \gamma_t + \varepsilon_{i,t} \tag{1}$$

with $\Delta x_{i,t} = \dfrac{x_{i,t} - x_{it-1}}{y_{i,t-1}}$, for any variable x; where, $y_{i,t}$, $g_{i,t}$ and $r_{i,t}$ denote respectively GDP, total government spending, and natural resource revenue in country i and year t, both measured in constant local currency units. The last term is the composite error term $\mu_i + \gamma_t + \varepsilon_{i,t}$. It denotes all other observed and unobserved sources of GDP changes.

We use natural resource rent as a proxy measure of the level of natural resource.[1] There are several reasons for the choice of this variable. First, the natural resource rent is a reasonable proxy for the realized resource endowment of a country. It is available for a panel of more countries compare to other natural resources variable. Its coverage of year and country is fairly wide. Second, by construction, it allows us to examine the impacts of different type of natural resources, namely oil, minerals, forestry and agriculture with a single variable.

The key parameter of interest in this paper is β. It captures the short-run government spending multiplier, i.e. the contemporaneous change in output due to a change in government spending.

[1] We consider the total natural resources rents which are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. The resource rent of a natural resource is the total revenue that can be generated from the extraction of the natural resource, less the cost of extracting the resource (including a normal return on investment to the extractive enterprise).

The standard identification problem with β is that changes in government spending are likely to be correlated with part of the composite error term such as other contemporaneous shocks to output so that OLS estimation of Equation (1) will be inconsistent.

To address this endogeneity problem, Kraay (2014) has constructed an instrument based on the lags between commitments and eventual disbursements on loans by official creditors to developing country government. Indeed, he constructed a predicted disbursements series for each loan. The prediction is based on the observed average disbursement rates for the country's geographical region for the same creditor. The average disbursement rate is applied to approved loan in each countries. These artificial predicted disbursements used only loans approved one period before, and their aggregation to the country-year level, are by construction independent of contemporaneous country-specific macroeconomic shocks under the assumption that, loan approvals and disbursement are not correlated with future shocks.

Kraay's identification is based independence on the independence of loan approval to future macroeconomics shocks. This assumption does not work for natural resources-rich countries. For some of these low-income countries, natural resources are an important source of public income. Moreover, when a natural resource-rich country faces a macroeconomic shock, it can use its natural resources to smooth its consumption. In addition, most of these countries foreign exchange revenues come from natural resources. Usually, natural resource reserves of a country are well know by their partners. Official creditors can, therefore, use oil or other natural resources as implicit collateral for lending to LICs. Thus, loans approval for countries is very much likely to be linked with their potential future natural recourse production. This means that future natural resources are used as collateral for loans. Recently, many LICs have used their natural resource more explicitly for loans through the Resource Financed Infrastructure model (see Halland, Beardsworth, Land, and Schmidt (2014) for discussion of this model). It is, therefore, possible when the predicted loan disbursement is used as an instrument, that the exclusion restriction is violated.

In this paper, we construct an instrument using official loans that are not related to natural resource revenues. The starting point of the construction of our instrument for government spending is the predicted disbursement from creditor constructed by Kraay (2014). To overcome the identification problem, we regress predicted disbursement on

countries natural resource rents. The new variable is the share of predicted disbursement that does not depend on the level of natural resource. We use these residual as an instrument for government spending with twice lagged natural resource rents. We also control for lagged natural resource rents to account for the dynamic effect of natural resource extraction on the output.

We estimate the model using 2SLS and OLS estimators for different sub-sample and under different conditions.

3 Estimation of Government Spending Multiplier

In this section, we present the results of the estimation of the government spending multiplier for low-income countries. We first present the data followed by estimation of short-run and long-run government spending multipliers.

3.1 Data

The main data required for this paper is the LICs government spending. The IMF's World Economic Outlook (WEO) database is the major source for the aggregate government expenditure series. The same date is used by Kraay (2014). He expanded the coverage of the data from 1990 to 2012 on the government spending data by assembling information present in different published sources form earlier years. The sources included the African Development Indicators of the World Bank, current and previous editions of the IMF's Government Finance Statistics, and data on total government spending available in the dataset on health and education spending compiled by Clements, Gupta, and Nozaki (2013). Another important variable for our identification strategy is the predicted disbursement from Kraay (2014). This variable data was constructed using information present in the Debtor Reporting System (DRS) database.[2] The additional variable use in our model is natural resource rents. Data for natural resource rents is extracted from World Bank indicator database.

[2]The data on countries level of debt, of the DRS maintained by the World Bank, are not publicly available, for this reason we were forced to use Kraay's outcome (predicted disbursement). We have also restricted our investigation to same time periods and countries as in Kraay's sample.

The quality of our identification strategy is based on a strong correlation between changes in government spending and those in predicted disbursements on loans from official creditors. The relevance of natural resources, in the model, is also possible if some countries rely on natural resources. Many low-income countries certainly do. When natural resource is taken into account, our identification strategy needs to be efficient that, enough LICs are significantly dependent on official creditors and natural resources as to finance their government spending. Accordingly, we restrict our sample to LICs with disbursements on loans from official creditors on average at least one percent of GDP.[3] In addition, to have meaningful within-country long enough time series point for each country, we consider the sample to countries having least 15 years of data on natural resource rents and government spending. Applying these restriction results in a regression sample with 2753 country-year observations on 99 countries listed in Table 1 and on average 27 annual observations per country. For the natural resource-rich LICs, disbursements on loans from official creditors is 12.12 percent of government spending. On average, natural resources represents 5.5 percent of government spending.

In the following empirical work, we will consider two sub-samples, corresponding to countries that are more dependant on natural resources, and other countries. We define the set of 49 countries for which the natural resources rent exceed 4.6 percent of GDP (this is the median level in the sample). We also divide the sample in the group of LICs that are eligible for concessional lending from the World Bank administered International Development Association and countries with higher disbursement rate when it exceeds 10 percent of government spending. This subdivision enable us to compare our result to Kraay's results.

Table 2 contains summary statistics on changes in natural resource rents, real GDP, actual and predicted disbursements and government spending in the natural resource-rich and low level of natural resource countries. All variables are scaled by lagged GDP (as defined in Equation (1)) and in constant price annual changes. We also remove country-specific and year-specific means before computing summary statistics. Changes in government spending and real GDP growth are stable, with standard deviations of 2.0 and 0.6 percent, respectively for the full sample of LICs. The quantities are of similar sizes in the natural resource-rich sub-samples. Actual disbursements and natural resource rents are more volatile, with standard deviations around 3 and 4% respectively

[3]Both variables are averaged over the whole period 1970-2010

in the two samples. Changes in Kraay's predicted loan disbursements are correlated with changes in government spending and are also correlated with changes in natural resource rents.

In figure 1 we can observe a positive relationship between loan disbursements and natural resources rents. To illustrate the correlation between natural resource rents and loan disbursement, figure 2 reports the disbursements on loans from official creditors to Kenya and natural resource rents from 1970 to 2010. The correlation between natural resources rent and predicted disbursements can be observed. This shows the relevance of our empirical strategy.

3.2 Short-Run Effects of Government Spending

In this subsection, we present results of the estimation of short-run government spending multipliers. The sample is divided in two sub-samples depending on the level of natural resources. The sample with high levels of natural resources (historically more than the 4.6% of real GDP) and the full sample. For each sample, we provide three different regressions. Panel (a) correspond core regression sample. Panel (b) correspond to sample of countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursements.

First, we can note that our instruments are strong. In almost all the case the first-stage F-statistics of Craag and Donald are larger than the Staiger and Stock (1997) simulate critical value in all three panels for full sample. The Hansen J statistics P-value indicates that over-identification restriction is satisfied at the 5 percent level for all panels.

The results of the ordinary least squares (OLS) and two-stage least squares (2SLS) are reported (see Table 3 in the appendix). The OLS estimates of the multiplier is ranging from 0.25 to 0.3, with standard errors from 0.04 to 0.06. These multipliers are similar to those of Kraay (2014), despite the changes in the specification. However, these OLS estimates are certainly biased because the fluctuations in government spending are linked with other shocks to GDP growth that are in the error term. The 2SLS estimates, designed to account for these biases, are larger, their values are between from 0.39 to 0.47 for the full sample. This is larger than Kraay 's (2014) estimated government

spending multipliers.

Results in Table 4 indicate that, for the sample of natural resource-rich the government spending multiplier is larger ranging from 0.55 to 0.74. These values of the government spending multiplier are larger than those estimated with Kraay's instrument on the same sample. Indeed, Table 5 suggests that the government spending multiplier is 0.55 for resource-rich countries with Kraay's instrument, while it is 0.73 in our specification for the full sample of resource-rich countries.

The difference between Kraay's multiplier and the multiplier estimated taking into account natural resources rent vanish when the sub-sample of countries with high disbursement is considered.

These results suggest a larger government spending multiplier for resource-rich countries. There are two possible explanations to our result. The first possible explanation is related to credit constraint. Indeed, resource-rich countries because of their resource endowment have access to fund costly, with high returns, investments in infrastructure or other goods. This implies a larger government spending multipliers. It would be interesting to divide the spending into government consumption and investment to evaluate the effect of each of type of expenditure. The second explanation has to do with allocation of government spending. In resource-rich countries, the government can orient spending to pro-resource extraction spending, with the possibility of rents. It is therefore possible to have higher returns and higher spending multipliers. Investigating the transmission mechanism of the effect of government spending is beyond the scope of this paper and is left for future research.

Several robustness checks are made on our results. The robustness checks are made for natural resource-rich countries only. We first investigate how our results changes with a different version of Kraay's instruments. After that, we discuss some potential sources of exclusion restriction violation and omitted variable biases.

The first variant of Kraay's instrument constructs the instrument via aggregation of predicted disbursements on loans given by multilateral creditors. The second variant is based on bilateral creditors' loans. The quality of the identification, evaluated by the first-stage F-statistics, is better with multilateral predicted disbursements than with bilateral ones. The first-stage F-statistics for bilateral creditors are far bellow 10 in all three samples. However, with both instruments, the estimated multiplier are consistently large.

The predicted disbursement rate used to construct our instrument has information on the country future shocks. The disbursement rate is given by averaging across all loans within the creditor/decade/region bins, including future loans to the country in question (Kraay (2014)). As a further robustness check, we use Kraay's instrument and reconstructe it by removing loans directed to the country for which the average is compute when calculating average disbursement rates. Table 8 shows that this robustness check has slight impact on our benchmark estimates. The new estimates of the government multiplier are between 0.48 and 0.64 and slightly smaller.

Apart from the instruments construction, our estimated multiplier is potentially subject to biases due to influential observations or specification problem. In order to address these particular issues, other robustness checks are made.

Our data are from LICs who did not have a good reputation in data quality. Following Kraay (2014), the first concern is that the results on government spending multipliers could be due by a few influential country/year observations. This possibility is investigated using a procedure suggested by Hadi (1992) for identification of influential observations (see Kraay (2014) for details on the method). The results of the estimation are in Table 9. The OLS estimates of the multipliers are similar to the benchmark results. The 2SLS estimates are slightly smaller when influential observations are taken out, between 0.60 and 0.63, and they are more precisely estimated. However, they are still larger than Kraay's multipliers.

Our specification does not account for the possibility of varying country specific trends. A country may, for example, experiences a decade of steadily increasing in production of natural resources, loan approval, government spending, and the same decade may also happens to be a time of higher-than average growth. The government spending multiplier will be biased. This potential bias is investigated by adding country-specific third-order polynomial time trends to the benchmark specification, to capture country-specific slowly-moving trends (Kraay (2014)). Table 10 suggests the strength of the estimated first-stage relationship between changes in government spending and changes in predicted disbursements and changes in twice lagged natural resource rents is smaller. The first-stage F-statistics of the 2SLS estimates are smaller than those in Table 4. The estimated multipliers themselves are similar, ranging from 0.6 to 0.75, compare to 0.55 to 0.73 in the benchmark specification. This suggests that our benchmark estimates of the government spending multiplier may be unbiased or downward-biased.

The interpretation of the estimated government spending multipliers in this paper raises another concern about the anticipation effects. Following Kraay (2014), we assume that loans that ultimately take four or more years to fully disburse are unlikely to have been approved for macroeconomic policy cyclical reasons. We therefore introduce an additional control variable as to account for slowly disbursed loans. In Table 11, the additional variable has a positive coefficient in all three panels. These results suggest that anticipated future changes in spending have immediate output effects. However, our estimates of the government spending multiplier are slightly smaller, relative to estimates in Table 4.

To summarized, the government spending multiplier is larger for resource-rich countries. Taking into account natural resource is important when using Kraay's instrument for resource-rich countries, our estimated multiplier are larger than those obtained with Kraay's specification. The findings of this paper are robust to different types of the Kraay's instrument modification to address concerns about the possible incorporation of future information country-specific information in the calculation of typical disbursement profiles. They are also robust to potential sources of non-validity of the exclusion restriction for the instrument.

3.3 Longer-Run Effects of Government Spending

Most of the past empirical work have focused on estimating the short-run government spending multiplier. In this section, we estimate longer-run GDP effects of government spending using the local projections approach as in Jorda (2005) and Kraay (2014). Specifically, we estimate the impact of an increase in government spending on GDP over a multi-year horizon using the following regressions

$$\Delta y_{i,t+h} = \rho^h y_{i,t-1} + \beta^h \Delta g_{i,t} + \delta_0^h \Delta r_{i,t} + \delta_1^h \Delta r_{i,t-1} + \mu_i^h + \lambda_t^h + \epsilon_{i,t}^h \tag{2}$$

where $\Delta y_{i,t+h} = \frac{y_{i,t+h} - y_{i,t-1}}{y_{i,t-1}}$, $\Delta g_{i,t} = \frac{g_{i,t} - g_{i,t-1}}{y_{i,t-1}}$, and $\Delta r_{i,t} = \frac{r_{i,t} - r_{i,t-1}}{y_{i,t-1}}$. The coefficient β^h represents the impulse response function of the change in GDP at time $t+h$ to a change in government spending at time t, while the cumulative sum of β^h the represents the cumulative impact of an additional dollar of spending by the government on the level of GDP after h periods. The Equation 2 is estimated using

the same instruments as before, country and year dummies are included. As for the short-run effect of government spending, we use the free from natural resources part of the predicted disbursements as an instrument.

Tables 12 and 13 report the estimated effects of the government spending multiplier over a three-years horizon. In Table 12, all countries are included in the sample. Table 13 considers the samples including natural resource-rich countries.

The Cragg-Donald F statistic of weak identification test, a measure of the strength of identification, is far larger than 10 in all the three samples of the 2SLS specification in Table 12, indicating that we reject at the level of 5 percent the null that our instruments are weak. The F statistic of weak identification test is around 10 (slightly less that 10 for two of the three samples of the 2SLS specification) in Table 13. The Hansen J statistics P-values indicate that there is no evidence to reject the over-identification restriction at the level of 5 percent for all samples.

In Table 12, the estimates are all statistically significants in the first year across all three samples in the OLS and 2SLS estimations. However, for longer horizons than one year, the estimates become much less accurate, especially for the 2SLS estimates. The identification of the longer-run effects of government spending on GDP is not possible beyond the one year after the increase. In the first year horizon (i.e. at $h = 0$), the estimates are very similar to those reported in the short run specification in Table 3. The GDP effects of the government spending in the first year for the three samples of OLS specification range from 0.26 to 0.29. The government spending for the 2SLS specification are larger and range from 0.37 to 0.40. We also report the coefficients on the other regressors. The coefficient of the lagged growth is positive (of about 0.06) and significantly different from zero at 5 percent in all samples, which means a small degree of persistence in annual GDP growth rates in the sample. The coefficient of the natural resources rents is positive weakly significant, while the coefficient of the lagged natural resource rents is positive and significant, implying that the increase in the natural resource rents have a positive effect on the GDP. This results are confirmed by the coefficient of the natural resources rents which is also positive significantly different from zero at a level of 10 percent in all the three sample of the two specifications, except the sample of high disbursement countries (the last column).

For the estimates in Table 13, where the results are for natural resource-rich countries, the coefficients are all statistically significant in the first year for all three samples

in the OLS and 2SLS estimations. The size of the estimates are also similar to those in Table 3. The 2SLS estimates of the longer-term GDP effects of government spending are larger for the natural resource-rich countries. In contrast, with the two year horizon, the 2SLS estimates are now more precise than those of OLS. Indeed, the effects of government spending on GDP over two year horizon increase, ranging from 0.59 to 0.91 and are significantly different from zero across all three samples in the 2SLS estimation.

Our estimates suggest that government spending has a permanent impact on the real economic activity in resource-rich countries, while government spending in other country has a transitory impact. These findings support the explanation that the relaxation of the credit constraint allows governments to pursue investment in long-run growth driver sectors.

4 Heterogeneity in Estimated Multipliers

This section examines how the short-run government spending multiplier vary with how open is the country to international trade, the state of the business cycle, and the degree of aid-dependence of the economy and the type of exchange rate regime (flexible or fixed). The results are presented in Tables 14 and 15 when samples are not restricted to rich natural resource countries and in Tables 16 and 17 we restrict samples to natural resource-rich countries.

Let us consider the effects of government spending in recession and booms. After the recent 2008 crisis, there were many voices arguing for the used of government spending as a key ingredient to the US ongoing recovery. In October 2012, the International Monetary Fund released their Global Prospects and Policies document in which they report empirical finding suggesting a multiplier above 1. Indeed , IMF-staff (2012) report, suggests that fiscal multipliers used in their forecasting process are about 0.5, but new results indicate that multipliers are actually in the range of 0.9 to 1.7 range since the Great Recession. As pointed ou,t in IMF-staff (2012) report, his finding is consistent with research suggesting that, in today's US environment of substantial economic slack, monetary policy constrained by the zero lower bound, and synchronized fiscal adjustment across numerous economies, multipliers may be well above 1.

For all LICs, we find that the estimated multipliers range from 0.39 to 0.57 during recessions, and between 0.01 and 0.14 during booms. Thus, government spending

multipliers are much larger during recessions than during booms. This is qualitatively consistent with the view that there is a greater scope for spending increases to stimulate economic activity during recessions rather than during booms.

Regarding the multiplier in the context of trade openness, we find that government spending stimulate GDP across the group of closed countries more than across the group of opened countries. The differences are important in the 2SLS estimates' case.

The exchange rate regime is another important factor affecting effectiveness of government spending. The multipliers are larger in the flexible exchange rate regime in all the OLS specifications. The multipliers are approximately 0.30 across country samples with flexible exchange rate regime, while in the fixed exchange rate group the multipliers range from 0.22 to 0.28. The 2SLS estimator of the government spending multiplier is larger for countries with flexible exchange rates. However, the identification is not very strong.

Turning to aid dependence, we find that the estimated multipliers are larger in the low-aid sample. Indeed, the OLS estimates of the multiplier for less aid-dependent countries vary from 0.33 to 0.40, while for the high aid-dependent countries, the multipliers range from 0.21 to 0.26. For the 2SLS estimates, the multipliers are larger in the less aid-dependent countries in two out of three subsamples.

These results are in line with Kraay (2014) and consistent with the theory. They are also qualitatively valid when we restrict the samples to resource-rich countries. Moreover, natural resource rents still have a positive and significant effect on GDP for most of the specifications, confirming that for LICs, natural resources should be added as control variable when estimating government spending multipliers.

5 Conclusion

In this paper, we estimate government spending multipliers for LICs, with a focus on resource-rich countries. Our identification follows Kraay (2014) by exploiting lags that occur between loan commitments and eventual loan disbursements, and uses disbursements that are not related to natural resource. The main identifying assumption is that loan approvals, and the decision to embark on associated spending plans that are not related to natural resources, can not anticipate future shocks to growth. Under this assumption, changes in non-natural resource disbursements are plausibly

exogenous to contemporaneous shocks, and can be used as an instrument for changes in government spending. Using this methodology, we find that, in the short-run, the government spending multiplier is around 0.43 for the full sample and 0.73 for the sample of resource-rich LICs. We find evidence of heterogeneity in estimated government spending multipliers that is consistent with basic economics theory.

The multipliers estimated in this paper are in the same range as Hall (2009), which suggests that the federal government spending multiplier is between 0.5 and 1. The multipliers estimated in this paper suggest that using government spending as a countercyclical response to economic downturns in LICs has a limited effect on output, with a larger effect for resource-rich countries. Our estimates also suggest that government spending has a permanent impact on real economic activity in resource-rich countries, but a transitory economic impact in other countries.

As in Kraay (2014), our empirical estimates of spending multipliers are not "deep" structural parameters. Our estimates are better interpreted as evidence of the correlation between fuctuatuins in output and a plausibly predetermined component of changes in LICs government spending.

The results presented in this paper are relevant for countries already producing oil and minerals as well as in emerging resource-rich countries such as Uganda, Kenya, Tanzania. Adopting countercyclical fiscal policy is often recommended to resource-rich countries to avoid booms and busts cycles due to the volatile nature of commodity prices. However, two conditions should be warranted. First, the country should have enough reserves to undertake such a policy, which raises the issue of how much oil/extractive revenue should be saved, not for future generations, but to serve as buffer to possible negative shocks. The second condition concerns the knowledge of the size of the fiscal multiplier and its heterogeneity including during booms and recessions as was part of the focus in this paper.

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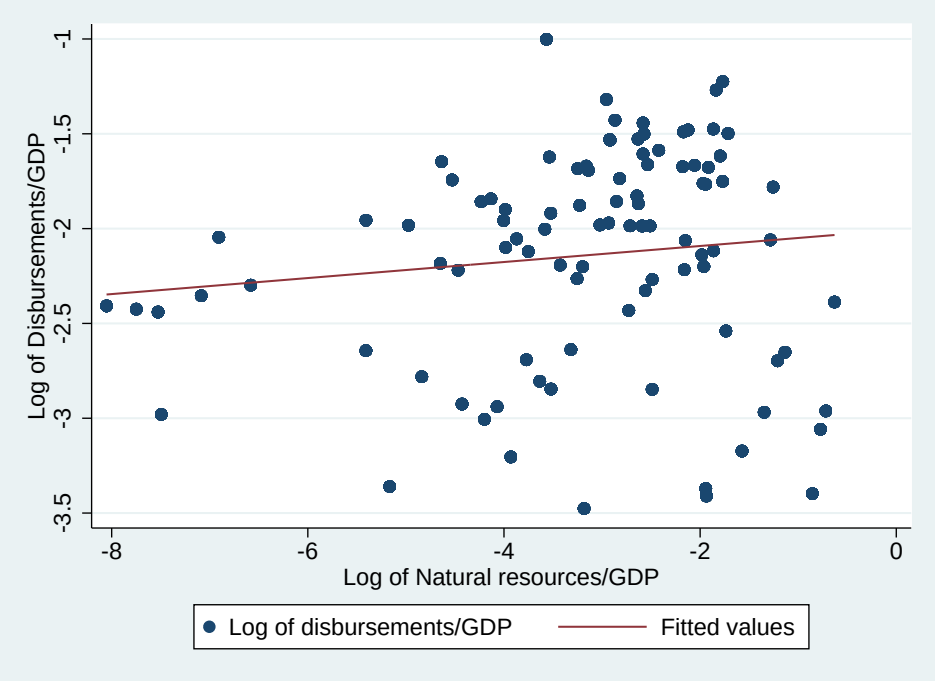
Figure 1: Relationship between disbursement and natural resource rent

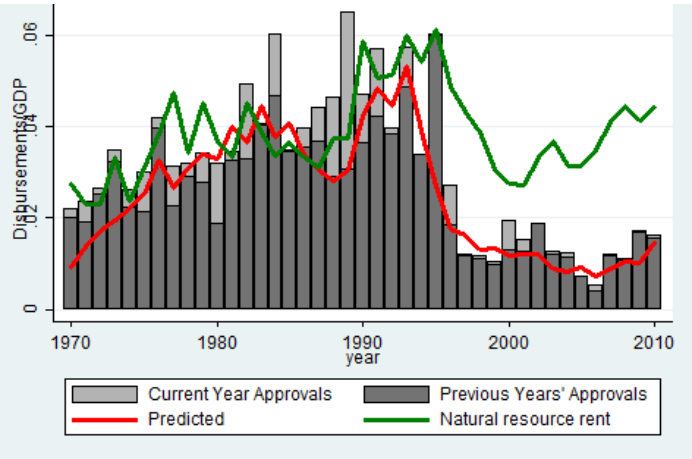


Note: This graph shows the positive linear relation between log of disbursement on loan and log natural resource rents. Raw correlation: 0.12.

A Tables and Figures.

This section presents tables and figures. Results are obtained from countries in Table 1 using authors calculation.

Figure 2: Relationship between disbursement and natural resource rent



Note: This graph reports annual disbursements on loans from official creditors to Kenya. The overall height of the bars shows total disbursements, and the light (dark) shaded portions separate this into disbursements on loans approved in the current year (past years). The solid red line reports predicted disbursements on loans approved in previous years and solid green line reported the the proportion of natural resource rent in the Kenya's GDP.

Table 1: Government spending (% of GDP)

Country	Gov/GDP	Country	Gov/GDP	Country	Gov/GDP
ALBANIA	34.0	GUATEMALA	12.5	PANAMA	28.9
ARMENIA	22.3	GUYANA	38.1	PERU	19.1
BURUNDI	28.8	HONDURAS	24.9	PHILIPPINES	16.3
BENIN	21.7	HAITI	14.1	PAPUA NEW GUINEA	32.1
BURKINA FASO	17.6	INDONESIA	18.7	PARAGUAY	17.4
BANGLADESH	13.9	JAMAICA	31.1	RWANDA	19.6
BULGARIA	40.1	JORDAN	39.8	SUDAN	16.8
BELIZE	28.6	KENYA	22.3	SENEGAL	21.2
BOLIVIA	28.5	KYRGYZ REPUBLIC	30.8	SOLOMON ISLANDS	31.9
BHUTAN	40.8	CAMBODIA	15.0	SIERRA LEONE	22.6
BOTSWANA	36.0	ST. KITTS AND NEVIS	31.5	EL SALVADOR	20.3
CENTRAL AFRICAN REPUBLIC	16.4	LAO PDR	19.9	SWAZILAND	22.2
COTE D'IVOIRE	25.5	ST. LUCIA	28.1	SEYCHELLES	50.8
CAMEROON	19.0	SRI LANKA	27.6	SYRIAN ARAB REPUBLIC	33.6
CONGO, REP,	30.7	LATVIA	38.9	CHAD	18.9
COLOMBIA	19.6	MOROCCO	28.7	TOGO	24.4
COMOROS	24.8	MOLDOVA	38.5	THAILAND	19.0
CAPE VERDE	37.7	MADAGASCAR	19.7	TAJIKISTAN	20.6
DJIBOUTI	38.2	MALDIVES	32.3	TONGA	30.0
DOMINICA	39.7	MACEDONIA, FYR	35.1	TUNISIA	30.2
DOMINICAN REPUBLIC	12.4	MALI	23.3	TURKEY	30.5
ALGERIA	31.8	MONGOLIA	40.7	TANZANIA	19.0
ECUADOR	23.3	MOZAMBIQUE	26.6	UGANDA	18.3
ETHIOPIA	20.2	MAURITANIA	31.6	URUGUAY	29.3
FIJI	27.0	MAURITIUS	25.4	UZBEKISTAN	36.1
GABON	29.0	MALAWI	30.7	ST. VINCENT AND G.	27.4
GEORGIA	23.8	MALAYSIA	31.4	VIETNAM	26.3
GHANA	17.8	NIGER	19.5	VANUATU	29.2
GUINEA	19.4	NICARAGUA	32.0	YEMEN, REP,	33.0
GAMBIA, THE	22.9	NEPAL	13.6	ZAMBIA	30.3
GRENADA	27.3	PAKISTAN	17.5		

Note: This table lists the countries that make up the full sample, together with the average over the period 1970-2010 of government spending.

Table 2: Summary Statistics

Full Sample	Obs.	Std. Dev.	GDP	Gov spending	Natural resources rent	Total Disbursements	Predicted Disb. except same year
GDP	2753	.019	1.0000				
Gov spending	2753	.006	0.1655	1.0000			
Natural resources rent	2753	.040	0.0014	0.0273	1.0000		
Total Disbursements	2753	.032	0.1212	0.1053	0.2560	1.0000	
Predicted Disb. except same year	2753	.039	-0.0183	-0.0048	0.0377	-0.0244	1.0000
Natural resources-rich countries							
GDP	1347	.018	1.0000				
Gov spending	1347	.006	0.1462	1.0000			
Natural resources rent	1347	.041	0.0138	0.0557	1.0000		
Total Disbursements	1347	.033	0.0979	0.1216	0.2142	1.0000	
Predicted Disb. except same year	1347	.053	-0.0402	-0.0038	0.0529	-0.0356	1.0000

Note: This table reports summary statistics on the indicated variables. All variables are expressed as constant local-currency price changes scaled by lagged GDP, as in Equation (1). In addition, all variables are in terms of deviations from country- and year-averages, consistent with the inclusion of country and year fixed effects in Equation (1).

Table 3: Benchmark Estimates of the Government Spending Multiplier

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.30***	0.26***	0.28***	0.47**	0.40**	0.40**
	(0.04)	(0.05)	(0.04)	(0.20)	(0.17)	(0.16)
Change in nat. res. rents	0.06**	0.07*	0.08**	0.06**	0.07*	0.08**
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
Lagged Change in nat. res. rents	0.08***	0.09***	0.15***	0.08***	0.09***	0.15***
F-Statistic-Weak-Ident				9.4	21	16
p-value-Hansen-J-Statistic				0.06	0.03	0.45
Number-of-Observations	2732	1468	1913	2706	1452	1896
Number-of-Countries	99	58	68	99	58	68

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 4: Benchmark Estimates of the Government Spending Multiplier
(Sample of natural resource-rich countries)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.25***	0.27***	0.71***	0.73***	0.57***
	(0.05)	(0.06)	(0.06)	(0.23)	(0.27)	(0.22)
Change in nat. res. rents	0.06*	0.07*	0.07	0.07**	0.08*	0.07
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)
Lagged Change in nat. res. rents	0.08***	0.09***	0.15***	0.07***	0.07***	0.13***
	(0.03)	(0.03)	(0.04)	(0.02)	(0.03)	(0.05)
F-Statistic-Weak-Ident				9.7	9.2	9
p-value-Hansen-J-Statistic				0.17	0.12	0.68
Number-of-Observations	1337	1012	969	1324	1001	961
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 5: Benchmark Estimates of the Government Spending Multiplier
(Sample of natural resource-rich countries, Kraay's models)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.26***	0.28***	0.55**	0.61**	0.54*
	(0.05)	(0.06)	(0.06)	(0.27)	(0.28)	(0.29)
F-Statistic-Weak-Ident				17	17	15
Number-of-Observations	1347	1021	974	1347	1021	974
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 6: Estimates of the Government Spending Multiplier,
(Sample of natural resource-rich countries bilateral disbursements only)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.25***	0.26***	0.99	0.78	0.43
	(0.05)	(0.06)	(0.06)	(0.68)	(0.90)	(0.80)
Change in nat. res. rents	0.07*	0.07*	0.06	0.07**	0.08***	0.06
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
Lagged Change in nat. res. rents	0.08***	0.09***	0.14***	0.06*	0.07*	0.13**
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)	(0.06)
F-Statistic-Weak-Ident				1.6	.75	.6
p-value-Hansen-J-Statistic				0.17	0.09	0.38
Number-of-Observations	1338	1013	970	1325	1002	962
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 7: Estimates of the Government Spending Multiplier,
(Sample of natural resource-rich countries multilateral disbursements only)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.25***	0.26***	0.81***	0.82***	0.70**
	(0.05)	(0.06)	(0.06)	(0.31)	(0.32)	(0.29)
Change in nat. res. rents	0.07*	0.07*	0.06	0.07***	0.08***	0.07
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
Lagged Change in nat. res. rents	0.08***	0.09***	0.14***	0.07**	0.07**	0.11**
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)
F-Statistic-Weak-Ident				6.1	5.6	5.9
p-value-Hansen-J-Statistic				0.12	0.12	0.51
Number-of-Observations	1338	1013	970	1325	1002	962
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 8: Estimates of the Government Spending Multiplier,
(Resource-rich countries, dropping all loans from country in question)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.25***	0.26***	0.64**	0.61**	0.48*
	(0.05)	(0.06)	(0.06)	(0.29)	(0.30)	(0.29)
Change in nat. res. rents	0.07*	0.07*	0.06	0.07***	0.07***	0.06
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
Lagged Change in nat. res. rents	0.08***	0.09***	0.14***	0.07***	0.08***	0.13***
	(0.03)	(0.03)	(0.04)	(0.02)	(0.03)	(0.04)
F-Statistic-Weak-Ident				6.3	5.7	5.9
p-value-Hansen-J-Statistic				0.06	0.08	0.42
Number-of-Observations	1338	1013	970	1325	1002	962
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 9: Estimates of the Government Spending Multiplier, Removing Influential Observations
(Sample of natural resource-rich countries)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.25***	0.25***	0.60***	0.63***	0.60***
	(0.05)	(0.06)	(0.06)	(0.18)	(0.21)	(0.22)
Change in nat. res. rents	0.07**	0.09**	0.05	0.07**	0.09***	0.04
	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.04)
Lagged Change in nat. res. rents	0.11***	0.12***	0.16***	0.09***	0.10***	0.13***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)
F-Statistic-Weak-Ident				22	20	17
p-value-Hansen-J-Statistic				0.83		
Number-of-Observations	1293	977	945	1293	977	945
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 10: Estimates of the Government Spending Multiplier, Adding Cubic Country-Specific Time
(Sample of natural resource-rich countries)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.25***	0.25***	0.26***	0.75**	0.74**	0.60*
	(0.05)	(0.06)	(0.06)	(0.31)	(0.33)	(0.32)
Change in nat. res. rents	0.07*	0.07*	0.06	0.07***	0.08***	0.07
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
Lagged Change in nat. res. rents	0.08***	0.09***	0.14***	0.07***	0.07**	0.12***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)
F-Statistic-Weak-Ident				6.9	5.9	5.9
p-value-Hansen-J-Statistic				0.10	0.10	0.46
Number-of-Observations	1338	1013	970	1325	1002	962
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 11: Estimates of the Government Spending Multiplier, Controlling for Approvals of Slow-Disbursing loans
(Sample of natural resource-rich countries)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Change in Gov. Spending	0.24***	0.25***	0.26***	0.70***	0.68**	0.55**
	(0.05)	(0.06)	(0.06)	(0.26)	(0.28)	(0.28)
Change in nat. res. rents	0.06*	0.07*	0.05	0.06**	0.07*	0.06
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)
Lagged Change in nat. res. rents	0.08***	0.08***	0.14***	0.07***	0.07**	0.12***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)
slow	0.08*	0.08*	0.07*	0.07*	0.08*	0.06*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
F-Statistic-Weak-Ident				6.9	6.9	6.3
p-value-Hansen-J-Statistic				0.06		
Number-of-Observations	1338	1013	970	1325	1002	962
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 12: Longer-Run Effects: Estimates of the Government Spending Multiplier

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Cumulative Effect on gdp over h=0 years						
Change in Gov. Spending	0.29***	0.26***	0.27***	0.41**	0.38**	0.39**
	(0.04)	(0.05)	(0.04)	(0.20)	(0.16)	(0.16)
Change in nat. res. rents	0.05*	0.06*	0.07*	0.05*	0.06*	0.07*
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
Lagged Change in nat. res. rents	0.07***	0.08**	0.14***	0.07***	0.08***	0.14***
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.04)
Lagged Change in GDP	0.11***	0.08**	0.08**	0.10***	0.07**	0.08**
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
F-Statistic-Weak-Ident				8.9	20	16
p-value-Hansen-J-Statistic				0.10	0.05	0.60
Number-of-Observations	2732	1468	1913	2706	1452	1896
Number-of-Countries	99	58	68	99	58	68
Cumulative Effect on gdp over h=1 years						
Change in Gov. Spending	0.07*	0.04	0.10*	0.20	0.23	0.11
	(0.04)	(0.06)	(0.06)	(0.32)	(0.31)	(0.28)
Change in nat. res. rents	0.07**	0.06*	0.09*	0.07**	0.06*	0.09*
	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.05)
Lagged Change in nat. res. rents	0.02	0.03	-0.01	0.02	0.02	-0.01
	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)	(0.06)
Lagged Change in GDP	0.04	-0.00	0.03	0.03	-0.01	0.02
	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
F-Statistic-Weak-Ident				9.5	21	16
p-value-Hansen-J-Statistic				0.45	0.26	0.41
Number-of-Observations	2636	1412	1847	2610	1396	1830
Number-of-Countries	99	58	68	99	58	68
Cumulative Effect on gdp over h=2 years						
Change in Gov. Spending	0.08	0.07	0.08	-0.07	-0.07	-0.16
	(0.06)	(0.08)	(0.07)	(0.47)	(0.47)	(0.42)
Change in nat. res. rents	0.11*	0.10	0.14	0.10*	0.10	0.13
	(0.06)	(0.06)	(0.09)	(0.06)	(0.06)	(0.09)
Lagged Change in nat. res. rents	0.03	0.03	-0.08	0.03	0.03	-0.07
	(0.06)	(0.07)	(0.11)	(0.05)	(0.07)	(0.11)
Lagged Change in GDP	0.09*	0.04	0.08	0.09	0.05	0.08
	(0.05)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)
F-Statistic-Weak-Ident				11	23	18
p-value-Hansen-J-Statistic				0.23	0.27	0.86
Number-of-Observations	2541	1356	1781	2515	1340	1764
Number-of-Countries	99	58	68	99	58	68
Cumulative Effect on gdp over h=3 years						
Change in Gov. Spending	0.15**	0.15	0.17*	-0.11	-0.20	-0.21
	(0.07)	(0.09)	(0.09)	(0.72)	(0.73)	(0.64)
Change in nat. res. rents	0.15*	0.16	0.16	0.14*	0.15	0.15
	(0.08)	(0.10)	(0.12)	(0.08)	(0.10)	(0.11)
Lagged Change in nat. res. rents	0.04	0.04	-0.13	0.04	0.04	-0.10
	(0.08)	(0.09)	(0.15)	(0.07)	(0.09)	(0.15)
Lagged Change in GDP	0.08	0.04	0.09	0.08	0.04	0.08
	(0.07)	(0.09)	(0.09)	(0.07)	(0.09)	(0.09)
F-Statistic-Weak-Ident				11	23	17
p-value-Hansen-J-Statistic				0.36	0.52	0.97
Number-of-Observations	2447	1301	1717	2421	1285	1700
Number-of-Countries	99	58	68	99	58	68

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 13: Longer-Run Effects: Estimates of the Government Spending Multiplier
(Sample of natural resource-rich countries)

Dep. var. is Change in Real GDP	OLS Estimates			2SLS Estimates		
	(a)	(b)	(c)	(a)	(b)	(c)
Cumulative Effect on gdp over h=0 years						
Change in Gov. Spending	0.24***	0.25***	0.26***	0.66***	0.71***	0.55**
	(0.05)	(0.06)	(0.06)	(0.22)	(0.26)	(0.21)
Change in nat. res. rents	0.06*	0.07*	0.06	0.06*	0.07*	0.06
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)
Lagged Change in nat. res. rents	0.07***	0.08**	0.14***	0.06***	0.07**	0.12**
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.05)
Lagged Change in GDP	0.10**	0.08*	0.06	0.08**	0.06	0.05
	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)
F-Statistic-Weak-Ident				9.4	9	8.8
p-value-Hansen-J-Statistic				0.22	0.15	0.75
Number-of-Observations	1337	1012	969	1324	1001	961
Number-of-Countries	49	39	35	49	39	35
Cumulative Effect on gdp over h=1 years						
Change in Gov. Spending	0.11*	0.10	0.11	0.71**	0.92***	0.61**
	(0.05)	(0.06)	(0.07)	(0.29)	(0.33)	(0.24)
Change in nat. res. rents	0.07**	0.07*	0.12**	0.08**	0.07*	0.12*
	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)	(0.06)
Lagged Change in nat. res. rents	0.01	0.01	-0.06	-0.00	-0.01	-0.09
	(0.03)	(0.04)	(0.07)	(0.03)	(0.04)	(0.06)
Lagged Change in GDP	0.04	0.02	0.01	0.02	-0.01	-0.00
	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)
F-Statistic-Weak-Ident				9.7	9.4	9.1
p-value-Hansen-J-Statistic				0.87	0.59	0.26
Number-of-Observations	1290	974	935	1277	963	927
Number-of-Countries	49	39	35	49	39	35
Cumulative Effect on gdp over h=2 years						
Change in Gov. Spending	0.16*	0.15	0.10	0.32	0.49	0.13
	(0.08)	(0.09)	(0.10)	(0.46)	(0.53)	(0.45)
Change in nat. res. rents	0.09	0.09	0.15	0.09	0.09	0.14
	(0.06)	(0.07)	(0.10)	(0.06)	(0.06)	(0.09)
Lagged Change in nat. res. rents	0.00	-0.00	-0.16	-0.00	-0.01	-0.16
	(0.06)	(0.07)	(0.13)	(0.05)	(0.06)	(0.11)
Lagged Change in GDP	0.13*	0.10	0.13	0.13	0.09	0.13
	(0.07)	(0.08)	(0.09)	(0.08)	(0.08)	(0.09)
F-Statistic-Weak-Ident				10	9.8	10
p-value-Hansen-J-Statistic				0.56	0.49	0.82
Number-of-Observations	1243	936	901	1230	925	893
Number-of-Countries	49	39	35	49	39	35
Cumulative Effect on gdp over h=3 years						
Change in Gov. Spending	0.23**	0.23*	0.16	0.42	0.70	0.22
	(0.10)	(0.12)	(0.12)	(0.57)	(0.69)	(0.52)
Change in nat. res. rents	0.14	0.14	0.18	0.14	0.14	0.17
	(0.08)	(0.10)	(0.13)	(0.09)	(0.10)	(0.13)
Lagged Change in nat. res. rents	0.00	-0.00	-0.21	-0.00	-0.01	-0.21
	(0.08)	(0.10)	(0.18)	(0.08)	(0.09)	(0.17)
Lagged Change in GDP	0.14	0.11	0.16	0.13	0.10	0.16
	(0.10)	(0.10)	(0.12)	(0.10)	(0.10)	(0.12)
F-Statistic-Weak-Ident				10	9.6	10
p-value-Hansen-J-Statistic				0.74	0.76	0.78
Number-of-Observations	1197	899	868	1184	888	860
Number-of-Countries	49	39	35	49	39	35

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel (a) correspond core regression sample where variables that enter in the regressions are non-missing. Panel (b) correspond to sample including countries eligible for concessional lending from International Development Association (IDA). Panel (c) correspond to sample including countries with high-disbursement.

Table 14: Heterogeneity in Estimated Multipliers (1/2)

Sample of Countries	**Full**	**IDA**	**Disb/G>10%**	**Full**	**IDA**	**Disb/G>10%**
Panel A: State of Business Cycle	**Recession**			**Boom**		
OLS Estimates						
Change in Gov. Spending	0.20***	0.19***	0.21***	0.10***	0.06	0.08**
	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
Change in nat. res. rents	0.03	0.03	0.02	0.03	0.03	0.03
	(0.03)	(0.04)	(0.05)	(0.02)	(0.02)	(0.05)
Lagged Change in nat. res. rents	0.04	0.04	0.06	0.04**	0.05**	0.08**
	(0.03)	(0.03)	(0.04)	(0.02)	(0.02)	(0.04)
2SLS Estimates						
Change in Gov. Spending	0.39**	0.44**	0.57***	0.14	0.01	0.01
	(0.17)	(0.19)	(0.22)	(0.21)	(0.14)	(0.18)
Change in nat. res. rents	0.04	0.04	0.02	0.03	0.03	0.03
	(0.03)	(0.04)	(0.06)	(0.02)	(0.02)	(0.04)
Lagged Change in nat. res. rents	0.04	0.04	0.05	0.04**	0.05**	0.09**
	(0.03)	(0.03)	(0.05)	(0.02)	(0.02)	(0.04)
F-Statistic-Weak-Ident	9	7.8	6.8	6.8	18	12
p-value-Hansen-J-Statistic	0.37	0.76	0.44	0.08	0.02	0.68
Number-of-Observations	1263	672	889	1443	780	1007
Number-of-Countries	99	58	68	99	58	68
Panel B: Trade Openness	**Closed**			**Open**		
OLS Estimates						
Change in Gov. Spending	0.34***	0.28***	0.31***	0.28***	0.22***	0.25***
	(0.06)	(0.07)	(0.07)	(0.05)	(0.07)	(0.05)
Change in nat. res. rents	0.03	0.11*	0.07	0.11**	0.06	0.10
	(0.03)	(0.06)	(0.05)	(0.04)	(0.04)	(0.06)
Lagged Change in nat. res. rents	0.07*	0.20***	0.12**	0.10***	0.07*	0.19***
	(0.04)	(0.07)	(0.05)	(0.02)	(0.04)	(0.04)
2SLS Estimates						
Change in Gov. Spending	0.69***	0.66***	0.79***	0.21	0.06	-0.02
	(0.24)	(0.22)	(0.24)	(0.40)	(0.23)	(0.28)
Change in nat. res. rents	0.03	0.07	0.05	0.10**	0.05	0.09
	(0.03)	(0.09)	(0.06)	(0.04)	(0.04)	(0.06)
Lagged Change in nat. res. rents	0.06*	0.18**	0.08	0.11***	0.08**	0.19***
	(0.04)	(0.08)	(0.06)	(0.03)	(0.04)	(0.04)
F-Statistic-Weak-Ident	7.1	11	11	3	10	6.8
p-value-Hansen-J-Statistic	0.50	0.50	0.68	0.05	0.04	0.96
Number-of-Observations	1349	729	946	1356	723	950
Number-of-Countries	61	37	45	66	41	47

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel A distinguishes recessions from booms, defined as growth below/above the country-decade average. Panel B distinguishes countries less and more open to trade, defined as the decade-average trade/GDP being below/above the corresponding sample median.

Table 15: Heterogeneity in Estimated Multipliers (2/2)

Sample of Countries	**Full**	**IDA**	**Disb/G>10%**	**Full**	**IDA**	**Disb/G>10%**
Panel C: Exchange Rate Regime	**Flexible**			**Fixed**		
OLS Estimates						
Change in Gov. Spending	0.30***	0.29***	0.29***	0.28***	0.22***	0.26***
	(0.05)	(0.07)	(0.06)	(0.05)	(0.06)	(0.05)
Change in nat. res. rents	-0.01	0.00	-0.03	0.12***	0.13**	0.11**
	(0.02)	(0.02)	(0.06)	(0.05)	(0.06)	(0.05)
Lagged Change in nat. res. rents	0.04	0.02	0.09*	0.11***	0.14***	0.16***
	(0.02)	(0.02)	(0.05)	(0.03)	(0.04)	(0.05)
2SLS Estimates						
Change in Gov. Spending	0.34	0.43**	0.27	0.51*	0.28	0.46
	(0.27)	(0.18)	(0.17)	(0.29)	(0.23)	(0.28)
Change in nat. res. rents	-0.01	-0.00	-0.04	0.13**	0.13**	0.11**
	(0.02)	(0.02)	(0.05)	(0.05)	(0.06)	(0.05)
Lagged Change in nat. res. rents	0.03	0.02	0.10*	0.10***	0.13***	0.16***
	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.05)
F-Statistic-Weak-Ident	5.8	15	12	6.3	9.3	7
p-value-Hansen-J-Statistic	0.32	0.60	0.67	0.18	0.11	0.65
Number-of-Observations	942	470	562	1763	982	1334
Number-of-Countries	71	42	47	90	55	66
Panel D: Aid Dependence	**Low**			**High**		
OLS Estimates						
Change in Gov. Spending	0.35***	0.33***	0.40***	0.26***	0.21***	0.21***
	(0.06)	(0.08)	(0.07)	(0.04)	(0.05)	(0.04)
Change in nat. res. rents	0.04	0.05	0.06	0.07	0.10	0.08
	(0.04)	(0.04)	(0.06)	(0.04)	(0.07)	(0.05)
Lagged Change in nat. res. rents	0.06**	0.08**	0.17**	0.12***	0.12**	0.14***
	(0.03)	(0.04)	(0.06)	(0.04)	(0.05)	(0.04)
2SLS Estimates						
Change in Gov. Spending	1.00*	0.41	0.48	0.50***	0.35*	0.41***
	(0.58)	(0.28)	(0.50)	(0.19)	(0.19)	(0.15)
Change in nat. res. rents	0.06	0.05	0.06	0.05	0.09	0.08
	(0.05)	(0.04)	(0.06)	(0.04)	(0.06)	(0.05)
Lagged Change in nat. res. rents	0.05**	0.08**	0.17***	0.11**	0.10**	0.12**
	(0.03)	(0.04)	(0.06)	(0.04)	(0.05)	(0.05)
F-Statistic-Weak-Ident	1.4	4.7	2.1	9.7	17	20
p-value-Hansen-J-Statistic	0.05	0.01	0.24	0.58	0.67	0.75
Number-of-Observations	1326	720	939	1380	732	957
Number-of-Countries	60	43	44	71	41	48

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel A distinguishes recessions from booms, defined as growth below/above the country-decade average. Panel B distinguishes countries less and more open to trade, defined as the decade-average trade/GDP being below/above the corresponding sample median.

Table 16: Heterogeneity in Estimated Multipliers (1/2)
(Sample of natural resource-rich countries)

Sample of Countries	**Full**	**IDA**	**Disb/G>10%**	**Full**	**IDA**	**Disb/G>10%**
Panel A: State of Business Cycle	**Recession**			**Boom**		
OLS Estimates						
Change in Gov. Spending	0.21***	0.19***	0.21***	0.08**	0.07*	0.08**
	(0.04)	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)
Change in nat. res. rents	0.02	-0.00	0.02	0.03	0.02	0.03
	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
Lagged Change in nat. res. rents	0.06	0.06	0.06	0.08**	0.11**	0.08**
	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
2SLS Estimates						
Change in Gov. Spending	0.57***	0.53**	0.57***	0.01	0.02	0.01
	(0.22)	(0.23)	(0.22)	(0.18)	(0.13)	(0.18)
Change in nat. res. rents	0.02	0.02	0.02	0.03	0.02	0.03
	(0.06)	(0.08)	(0.06)	(0.04)	(0.05)	(0.04)
Lagged Change in nat. res. rents	0.05	0.05	0.05	0.09**	0.11***	0.09**
	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
F-Statistic-Weak-Ident	6.8	5.8	6.8	12	21	12
p-value-Hansen-J-Statistic	0.44	0.56	0.44	0.68	0.50	0.68
Number-of-Observations	889	585	889	1007	688	1007
Number-of-Countries	68	49	68	68	49	68
Panel B: Trade Openness	**Closed**			**Open**		
OLS Estimates						
Change in Gov. Spending	0.32***	0.28***	0.31***	0.24***	0.23***	0.25***
	(0.07)	(0.08)	(0.07)	(0.06)	(0.06)	(0.05)
Change in nat. res. rents	0.11*	0.12**	0.07	0.06	0.05	0.10
	(0.06)	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)
Lagged Change in nat. res. rents	0.16***	0.22**	0.12**	0.16***	0.15**	0.19***
	(0.05)	(0.08)	(0.05)	(0.05)	(0.06)	(0.04)
2SLS Estimates						
Change in Gov. Spending	0.73***	0.68***	0.79***	-0.04	0.05	-0.02
	(0.20)	(0.23)	(0.24)	(0.33)	(0.21)	(0.28)
Change in nat. res. rents	0.10	0.10	0.05	0.05	0.05	0.09
	(0.07)	(0.09)	(0.06)	(0.05)	(0.06)	(0.06)
Lagged Change in nat. res. rents	0.14**	0.19**	0.08	0.16***	0.16***	0.19***
	(0.06)	(0.09)	(0.06)	(0.04)	(0.05)	(0.04)
F-Statistic-Weak-Ident	9.7	11	11	5	13	6.8
p-value-Hansen-J-Statistic	0.74	0.50	0.68	0.68	0.94	0.96
Number-of-Observations	1085	696	946	810	577	950
Number-of-Countries	47	34	45	42	33	47

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel A distinguishes recessions from booms, defined as growth below/above the country-decade average. Panel B distinguishes countries less and more open to trade, defined as the decade-average trade/GDP being below/above the corresponding sample median.

Table 17: Heterogeneity in Estimated Multipliers (2/2)
(Sample of natural resource-rich countries)

Sample of Countries	**Full**	**IDA**	**Disb/G>10%**	**Full**	**IDA**	**Disb/G>10%**
Panel C: Exchange Rate Regime	**Flexible**			**Fixed**		
OLS Estimates						
Change in Gov. Spending	0.29***	0.29***	0.29***	0.26***	0.22***	0.26***
	(0.06)	(0.08)	(0.06)	(0.05)	(0.05)	(0.05)
Change in nat. res. rents	-0.03	-0.01	-0.03	0.11**	0.09	0.11**
	(0.06)	(0.06)	(0.06)	(0.05)	(0.07)	(0.05)
Lagged Change in nat. res. rents	0.09*	0.06	0.09*	0.16***	0.18***	0.16***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
2SLS Estimates						
Change in Gov. Spending	0.27	0.41**	0.27	0.46	0.26	0.46
	(0.17)	(0.17)	(0.17)	(0.28)	(0.21)	(0.28)
Change in nat. res. rents	-0.04	-0.02	-0.04	0.11**	0.09	0.11**
	(0.05)	(0.07)	(0.05)	(0.05)	(0.07)	(0.05)
Lagged Change in nat. res. rents	0.10*	0.04	0.10*	0.16***	0.18***	0.16***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
F-Statistic-Weak-Ident	12	15	12	7	9.5	7
p-value-Hansen-J-Statistic	0.67	0.65	0.67	0.65	0.54	0.65
Number-of-Observations	562	404	562	1334	869	1334
Number-of-Countries	47	35	47	66	47	66
Panel D: Aid Dependence	**Low**			**High**		
OLS Estimates						
Change in Gov. Spending	0.42***	0.39***	0.40***	0.24***	0.19***	0.21***
	(0.09)	(0.08)	(0.07)	(0.04)	(0.06)	(0.04)
Change in nat. res. rents	0.05	0.07	0.06	0.07	0.06	0.08
	(0.06)	(0.08)	(0.06)	(0.05)	(0.06)	(0.05)
Lagged Change in nat. res. rents	0.14	0.19**	0.17**	0.14***	0.11**	0.14***
	(0.09)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)
2SLS Estimates						
Change in Gov. Spending	1.09***	0.52**	0.48	0.40**	0.36*	0.41***
	(0.41)	(0.23)	(0.50)	(0.16)	(0.19)	(0.15)
Change in nat. res. rents	0.07	0.08	0.06	0.07	0.06	0.08
	(0.08)	(0.08)	(0.06)	(0.05)	(0.05)	(0.05)
Lagged Change in nat. res. rents	0.11	0.20***	0.17***	0.13***	0.09*	0.12**
	(0.09)	(0.08)	(0.06)	(0.05)	(0.05)	(0.05)
F-Statistic-Weak-Ident	6.4	6.2	2.1	14	16	20
p-value-Hansen-J-Statistic	0.20	0.51	0.24	0.28	0.73	0.75
Number-of-Observations	738	573	939	1158	700	957
Number-of-Countries	35	35	44	55	39	48

Note: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Panel A distinguishes recessions from booms, defined as growth below/above the country-decade average. Panel B distinguishes countries less and more open to trade, defined as the decade-average trade/GDP being below/above the corresponding sample median.

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