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ARE FISCAL RULES HELPFUL IN MITIGATING THE IMPACT OF OIL MARKET FLUCTUATIONS?

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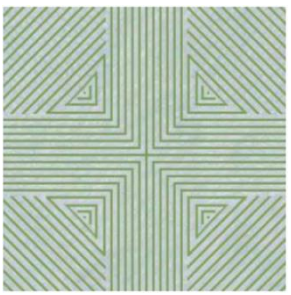

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Are fiscal rules helpful in mitigating the impact of oil market fluctuations?*

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Abstract

In this paper we empirically examined the role of fiscal rules in mitigating the impact of oil market fluctuations in resource-rich economies using a structural panel VAR framework following P. Pedroni (2013) and incorporating identification scheme of Kilian (2009). Our key findings can be summarized as: l) oil exporting developing countries exhibit procyclical respond to positive oil market specific demand shock, 2) there are significant cross-country differences in the way governments respond to the oil market shocks, 3) fiscal rules mitigate the shocks and generate fiscal discipline only if when all fiscal rules are imposed simultaneously, 4) we couldn't identify any significant role of wealth funds as a budget stabilization policy.

JEL Classification: C12; C22; C23; E62.
Keywords: fiscal rule; structural panel VAR; oil shocks

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1 Introduction

In recent two decades, oil exporter countries took advantage of oil price hikes and perished during a sharp drop. Global oil prices ballooned during the 14 year period between 2000 and 2014 from $ 26.87 per barrel in the first quarter of 2000 to $ 113.52 in the second quarter of 2014. Accordingly, fiscal appetite of those countries were propagated by this increase. On the other hand, between the third quarter of 2008 and the first quarter of 2009, oil price per barrel plummeted from $ 118.4 to $ 43.79 (63 % decline) and consequently oil producers had to tighten their belts in a response to lower oil revenues. GDP of these economies also took a nose dive. Considering those facts, oil shocks offer a good natural experiment to study fiscal behavior in oil exporting countries.

How should governments respond to oil windfalls? Dynamic optimization implies countries should accumulate foreign assets during a period of temporarily terms of trade shocks in order to maintain high consumption after the boom (Obstfeld and Rogoff, 1999; Sachs, 1982). Since, in oil exporting countries oil rents constitute a significant share of national income and total government revenues, unexpected commodity price fluctuations may significantly alter public spending dynamics. Many resource-rich countries are therefore advised to adopt some type of fiscal policy framework (i.e., a fiscal spending rule), which, if operated countercyclically, should shelter the economy from commodity price fluctuations and prevent over-spending on the part of the government, see e.g. Barro (1979), or Portes and Wren-Lewis (2015) for a recent overview.

In practise governments often seem to follow a procyclical fiscal policy. Cuddington (1989), Talvi and Vegh (2000) and Sinnott (2009) among others, document that governments save little or even dissave in booms. Procycli-

cality is most evident in Latin America Gavin, Hausmann, Perotti, and Talvi (1996), Gavin and Perotti (1997), Stein, Talvi, and Grisanti (1998)) but is also present in OECD countires Talvia and Vegh (2005), Arreaza, Sorensen, and Yosha (1999), Lane (2003). Using quarterly data and a set of econometric models to correct for the potential reverse causality from fiscal policy to business cycle, Ilzetzki and Vegh (2009) provide evidence that fiscal policy in developing countries is procyclical.

The problem of procyclicality seems to be especially acute for commodity-rich countries (Ilzetzki and Vegh, 2009; Huseynov and Ahmadov, 2014; Rahmanov, 2016). In those countries, commodity-linked revenues (taxes, royalties, profits) can be large portion of government revenue (see Sinnott, 2009). During the period of high volatility of commodity prices revenues may become very volatile and so can be spending and the fiscal balance. If expenditures react more than proportionally to revenue increases, then fiscal balance can move with the cycle (see Sturm, Gurtner, and Alegre, 2009; Erbil, 2011).

However, Barhoumi, Cherif, and Rebei (2016) show that pro-cyclicality could be a short-run phenomenon and some governments still might conduct counter-cyclical policies in the long-run. This may come from the fact that, some of those countries to some extend follow policy rules and enact legislation and juridical base to restrict fiscal authority from rent seeking appetite (see Schaechter et al., 2012) for comprehensive international database on de jure fiscal rules).

The adoption of a fiscal rule, however, does not in itself ensure that fiscal policy works to insulate the domestic economy from commodity price fluctuations (Bova, Carcenac, and Guerguil, 2014). The constructed rule may be too lax over the commodity price cycle, the actual conduct of fiscal policy might not be in accordance with the rule, or both. Hence, what works

in theory may not necessarily work in practice.

To examine the quality of fiscal rules in practice we propose a structural panel VAR framework following P. Pedroni (2013) to analyze fiscal policy's response in a resource-rich economy to oil price shocks over time. Several attempts (e.g., Sturm, Gurtner, and Alegre, 2009; Basnet and Upadhyaya, 2015; Omojolaibi and Egwaikhide, 2014; Anshasy and Bradley, 2012) have been made to study the impact of oil prices to fiscal policy in panel framework. In general those studies employed conventional panel methods, where they assume homogeneous dynamic response shocks for all member countries. However, this assumption in macro studies may lead to inconsistent estimations, (see P. Pedroni, 2013; Pesaran and Smith, 1995. Fortunately, P. Pedroni (2013) allows dynamics of individual country responses to be heterogeneous among all member countries of the panel. After obtaining individual country responses we will be able to regress them on several fiscal rules as well as on some institutional indicators. The main motivation is to examine to what extent fiscal rules have insulated the domestic economy from oil price fluctuations or, conversely, exacerbated their effect.

There is another problem regarding the estimation of impact of oil prices on the fiscal policy in the empirical literature. In general, empirical models on the effect of oil price shocks to the economy have typically been constructed under the premise that one can think of varying the price of crude oil, while holding all other variables in the model constant. In other words, oil prices are treated as exogenous with respect to the global economy. This premise is not credible (see, e.g., Barsky and Kilian, 2001; Barsky and Kilian, 2004; Hamilton, 2009). There are good theoretical reasons and there is string empirical evidence that global macroeconomic fluctuations influence the real price of crude oil (see Ilzetzki and Vegh, 2009). For example, it is widely

accepted that a global business cycle expansion (as in recent years) tends to raise the real price of oil. This is in particular evident during the financial crisis, when both global activity and oil prices fell sharply.

Previous studies addressing this issue have typically ignored any simultaneity between global activity and oil prices, and instead treated oil prices as exogenous, see e.g., Pieschacón (2012) and Cespedes and Velasco (2014) among others. In particular, Cespedes and Velasco, 2014 draw their conclusion from comparing government expenditures over two different commodity price cycles by a large panel of commodity exporting countries, while Pieschacón (2012) designs a counterfactual analysis comparing the impulse responses to an exogenous oil price shock in Norway and Mexico in the period 1986-2006. Doing so, both studies provide evidence of reduced fiscal procyclicality to commodity price changes in the recent commodity price boom, and attribute this to improved institutional quality, i.e., adopted fiscal policy rules.

Yet, if global demand is an important source of variation in commodity prices one should expect fiscal policy to be, exactly, countercylical. Not necessarily because the countries have reduced government expenditures relatively to GDP, but simply because GDP has increased. But also prior to the crisis, global demand and oil prices moved together. The fact that the same economic shocks that drive macroeconomic aggregates also may drive also crude oil makes it impossible to separate cause and effect in studying the effect of higher oil prices on fiscal policy without a structural model of oil prices. In line with this, recent studies have emphasized the role of global demand as a driver of oil prices, see, e.g., Kilian (2009). Furthermore, Kilian (2009) shows that if oil prices increase due to spurs of demand (rather than disruptions of supply capacity, see, e.g., Lane (1983)), global economic

activity will be positively affected, at least in the short run.Thus, and in line with these reasoning, when analyzing fiscal policy responses to commodity price shocks, we control for shocks to global activity following Kilian (2009) methodology.

Considering all these gaps in the literature, our study may have important contribution in understating nature of the relationship between government spending and oil revenues (shocks) in developing oil exporter countries. Moreover, the study also tries to shed light on the effectiveness of the fiscal rules and their relation between the oil market shocks which may be helpful in designing of optimal fiscal policy.

The remaining part of the paper consists of the following sections. In Estimation and Identification Strategy section we discuss general overview of the methodology and identification strategy. Data section provides detailed information about source of data and related issues. In Empirical Results section will discuss about econometric estimation results of the theory. In Conclusion section we summarize the main results. In addition, Appendix contains results of econometric test statistics and graphs.

2 Estimation and Identification strategy

2.1 Overview of the Methodology

As we discussed above, our aim is to estimate the magnitude of the fiscal policy response to the real oil price shock in (net) oil exporter countries. And then to assess the qualitative relationship between fiscal responses and fiscal rules. The conventional dynamic panel framework is a general methodology employed to get inference about group dynamics. In doing this kind of exercises main difficulty may arise due to heterogeneous nature of relationship between oil price and fiscal policy in the members of panel. And this is rea-

sonable argument since, the oil exporting nations are different along many economic, political and cultural dimensions, and this variation obviously will transmit to the dynamics of the relationship. Therefore, there is no strong evidence to convince that the way oil prices and fiscal policy interact over time across in oil exporting countries are the same.

Another important objection may arise from the fact that whether the innovations those are effecting real oil prices and fiscal policy originate locally or somewhere else. For instance, nature of the impact of demand shock on fiscal policy (or other macro variables) may depend on whether the demand shock is global (common) or local (idiosyncratic). Countries in general exposed by some combination of these shocks (namely common shocks). Omitting this fact creates a potential further complexity in the form of a cross sectional, or spatial dependence of macro variables P. Pedroni (2013) among the oil producers. Good news is that oil prices comprise only common component. Price of oil like other commodity goods are determined in the global market. Implication is that any unexpected shock in oil market is perceived as a common shock for every market participant, so probably there is no idiosyncratic portion of it which may alter the interaction between oil price and fiscal policy. This may not case for some big market participants such as, Saudia Arabia, Russia, Iran and etc. Nevertheless Alquist, Kilian, and Vigfusson (2013) show no evidence to support the important price maker behaviour of those countries.

For these reasons, our empirical approach is one that accommodates potentially complex dynamic endogeneities that differ among countries, and which are responding to potentially unobserved shocks that occur either at the national and international level. In particular, the methodology that we use is based on the panel structural VAR approach developed in P. Pedroni

(2013), Yepes, L. Pedroni P., and Hu (2015). Specifically, the approach models heterogeneous country-specific dynamic responses to unobserved shocks that occur either at the country level or at the national and international level. In this manner, the technique accommodates both the heterogeneity and the cross sectional dependence that arise from the responses to shocks that are common across countries. The shocks are treated as structural and unobserved. They are identified and estimated via a method of structural identification analogous to the conventional structural VAR approach. The panel methodology then exploits the statistical relationship of the structural shocks to decompose them efficiently into shocks that are common to the members of the panel versus shocks that are idiosyncratic to individual members of the panel. The relative importance of the idiosyncratic versus common shocks is permitted to differ for each member of the panel, and each member is permitted to respond in a heterogeneous member specific manner to both the common and idiosyncratic shocks.

As is typical in structural VAR approaches, the responses to the structural shocks are represented as impulse responses, and the importance of the shocks are represented as dynamic variance decompositions. In the context of our panel approach, our identification provides us with sample estimates of a set of country specific responses and variance decompositions to both the idiosyncratic and common structural shocks for each of the 22 countries. This sample distribution of country-specific responses allows us to study the economic conditions and characteristics of the countries that are associated with particular patterns among the responses. For example, using the distribution of individual country responses we can investigate which fiscal rule or country characteristics are associated with larger or smaller responses of fiscal expenditures to unexpected changes in oil market shocks. Of course,

in doing so, we must take into account the fact that the responses and decompositions are estimated and are subject to uncertainty from the sampling variation associated with the estimation.

2.2 Overview of the Identification Strategy

In this section we discuss identification strategy associated with our panel methodology. The vector of demeaned variables used in our model expressed as $z_{it} = (gprod_t, wea_t, op_t, rgdp_{it}, fis_{it}, prod_{it})'$, where $gprod_t$ indicates global oil production level, wea_t indicates world economic activity, op_t indicates world real oil prices, $rgdp_{it}$, fis_{it}, $prod_{it}$ indicates real GDP level, fiscal expenditures and oil production level at time t for country i consequently. So our structural vector moving average representation can be expressed $\Delta Z_{it} = A(L)\varepsilon_t$, where $A(L) = \sum_{j=0}^{Q} A_j L^j$ are the moving average coefficients that give us the structural impulse responses and variance decompositions of interest. There are six structural shocks those we want to identify: ε_t^{GAS} denotes shocks to the global supply of crude oil (henceforth "oil supply shock"); ε_t^{GAD} captures shocks to the global demand for industrial commodities (including crude oil) that are driven by global real economic activity ("aggregate demand shock"); ε_t^{GOMD} denotes an oil-market specific demand shock; ε_t^{AS} captures country specific aggregate supply shock; ε_t^{AD} denotes an country-specific demand shock; and lastly ε_t^{COP} captures idiosyncratic oil production shock. Notice that evaluation $A(L)$ at 0, yields instantaneous (short-run) structural response of the differenced variables to shocks. On the other hand evaluating the expression at 1 gives as the accumulated (long-run) response of the differenced variables to the shocks.

In general in order to extract structural shocks we need 15 restrictions, since we have 6 variables in the system. The first three variables are key in

identifying structural oil shocks, thus we will assume exogeneity of oil price shocks with respect to fiscal policy and to domestic economy in general. The exogeneity assumption would be violated if a country is not a price taker in the international oil market and its oil market strategy is dependent on the country's taxation and expenditure policy. The exogeneity condition is less stringent than price-taking by itself because, even if the country has market power in the international oil industry, its pricing behavior may still be independent of its own fiscal policy. If, for example, there is a strategy that maximizes the present value of net revenues, it may be followed regardless of the profile of non-oil taxes and expenditure.

Identification restrictions to extract structural oil market shocks are given by Kilian (2009). Recall that empirical models of the effect of oil price shock on the economy in general have typically been constructed under the premise that one can think of varying the price of crude oil, while holding all other variables in the model constant. In other words, oil prices are treated as exogenous with respect to the global economy. This premise is not credible (see, e.g., Barsky and Kilian, 2001; Barsky and Kilian, 2004; Hamilton, 2009). There are good theoretical reasons and there is strong empirical evidence that global macroeconomic fluctuations influence the real price of crude oil (see Ilzetzki and Vegh 2009). To construct *ceteris paribus* analysis Kilian (2009) estimated a structural VAR model based on the percent change in global crude oil production, a measure of global real economic activity in industrial commodity markets, and the real price of crude oil. He postulates that three structural shocks are main driving forces of fluctuations in the real price of oil: ϵ^{as} denotes shocks to the global supply of crude oil (henceforth "oil supply shock"); ϵ^{ad} captures shocks to the global demand for industrial commodities (including crude oil) that are driven by global real economic

activity ("aggregate demand shock"); and ϵ^{oild} denotes an oil-market specific demand shock. The latter shock is designed to capture shifts in precautionary demand for crude oil that reflects increased concerns about the availability of future oil supplies that are by construction orthogonal to the other shocks ("oil-specific demand shock").

Kilian (2009) assumes that (1) crude oil production will not respond to oil demand shocks within the quarter, given the costs of adjusting oil production and the uncertainty about the state of the crude oil market; (2) that increases in the real price of oil driven by demand shocks that are specific to the oil market will not lower global real economic activity in industrial commodity markets within the quarter; and (3) that innovations to the real price of oil that cannot be explained by oil supply shocks or aggregate demand shocks must be demand shocks that are specific to the oil market. These assumptions imply a recursively identified model and allow us to examine their dynamic effects on the dependent variables.

After imposing oil market restrictions we left with 3 assumptions to just identify the system. One of the possible restrictions is to assume that unexpected domestic aggregate demand shocks do not alter domestic oil production level in the same quarter, that is $A(0)_{i,56} = 0$. Reasonable explanation for this assumption is that to change the production in the short-run incurs high operating costs (such as, lease operation, gathering, processing and transport, water disposal) (Administration (2016)) which may confine countries to change the production in response to higher oil prices.

The last two restrictions, $A(1)_{i,45}$ and $A(1)_{i,46} = 0$, postulate that unexpected change in aggregate demand and aggregate oil production do not affect output in the long-run. Theoretical macro models assume that impact of aggregate demand shocks are short-lived and had only transitory effect

on real economic activity, whereas long-run trend is driven by productivity shocks. Conventional story works in this way. Surge in aggregate demand shifts aggregate demand curve to the right. Output higher than long-run level triggers inflation to raise. Consequently, increase in price level will decrease demand on goods and services. This process will continue until previous steady-state level will be restored.

In sum short-run $A(0)$ matrix is:

$$\begin{bmatrix} u_t^{GOP} \\ u_t^{GEA} \\ u_t^{OP} \\ u_{it}^{RGDP} \\ u_{it}^{FISC} \\ u_{it}^{OPR} \end{bmatrix} = \begin{bmatrix} \bullet & 0 & 0 & 0 & 0 & 0 \\ \bullet & \bullet & 0 & 0 & 0 & 0 \\ \bullet & \bullet & \bullet & 0 & 0 & 0 \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & 0 & \bullet \end{bmatrix} \begin{bmatrix} \epsilon_t^{GAS} \\ \epsilon_t^{GAD} \\ \epsilon_t^{GOMD} \\ \epsilon_{it}^{AS} \\ \epsilon_{it}^{AD} \\ \epsilon_{it}^{COP} \end{bmatrix}$$

Two more restrictions on $A(1)$ will be sufficient to extract structural shocks:

$$\begin{bmatrix} \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & 0 & 0 \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \end{bmatrix}$$

Relying on these assumptions we will be able to get 21 impulse responses for each of the 22 countries.

3 Data

We have compiled quarterly data on CPI, fiscal expenditures, exchange rates and real GDP of 22 main (net) oil exporting countries for the period of 2000-2016 from official country sources as well as from other international sources, such as OECD, IFC, GCC, CEIC, Oxford Economics IMF IV Article, etc.

Data on quarterly real GDP is obtained from the Oxford Economics. Quarterly figures of exchange rate obtained by taking simple average of three months. Nominal government expenditure data expressed in million domestic currencies mostly are from National Statistical Offices and Oxford Economics. Using CPI and exchange rate we calculated real government expenditures expressed in US dollars.

CPI is used to deflate fiscal expenditures. Dataset on consumer price index (CPI) we have gathered from CEIC database. Since in many countries budget expenditure and real GDP variables are expressed in national currency we converted them to dollar value to make consistent interpretation of the results. Bilateral exchange rates are collected IMF exchange rate database as well as from central banks web-sites. Quarterly figures of CPI, exchange rates are produced from monthly series by simple averaging. Seasonal adjustment of the all series is undertaken employing TRAMO-SEATS package.

Oil production data for each country are collected from OPEC Monthly Oil Market Report and U.S. Energy Information Administration (EIA). Production data is expressed as an average daily oil production (millions barrels per day) in a given quarter. The production data is seasonally adjusted using TRAMO-SEATS package.

Only countries showing a positive oil international trade balance are considered. The rationale for leaving out net importers of oil is that for those countries an increase in the price of oil may not be a windfall, as the terms of trade they face are negatively affected; therefore the net effect on the intertemporal budget constraint of the government is ambiguous. According to EIA data, in 1993 only 35 oil producing countries qualify as net exporters. It should be noted that some important oil producers, like the U.S., are not

included.

One of the key variables used in our model is global real economic activity index constructed by Kilian (2008a). The index of global real economic activity in industrial commodity markets is constructed from representative single voyage freight rates collected by Drewry Shipping Consultants Ltd. for various bulk dry cargoes such as coal, iron ore, fertilizer, and scrap metal. For a full discussion of the rationale and construction of this index see Kilian (2008a). Unlike alternative measures of monthly global real activity such as indices of industrial production, this index captures the recent surge in demand for industrial commodities from emerging economies such as China and India.

Fiscal rules data-set is taken from special IMF web-site has been constructed for fiscal rule database (see on detailed description of the database Schaechter et al. 2012). It provides systematic information on the use and design of fiscal rules covering national and supranational fiscal rules in 96 countries from 1985 to 2015. The dataset covers four types of rules: budget balance rules (BBR), debt rules (DR), expenditure rules (ER), and revenue rules (RR), applying to the central or general government or the public sector. It also presents details on various characteristics of rules, such as their legal basis, coverage, escape clauses, as well as enforcement procedures, and takes stock of key supporting features that are in place, including independent monitoring bodies and fiscal responsibility laws.

Other institutional data-set such as being a developed country is taken from World Bank Database, exchange rate regimes of the countries are taken from IMF, oil share to GDP from Ross (2015) as well as from World Bank database, Central Bank independence index is from Garria (2016) and lastly data on wealth funds is taken from Al-Hassan et al. (2013).

4 Empirical Results

4.1 Evolution of the Oil-Demand and Supply shocks

Figure 1 plots the time path of the structural shocks implied by the Kilian (2009) model. [1] Figure 1 shows that at any point in time, the price of oil responds to a multitude of shocks, the composition of which evolves over time. Two significant disruption of global oil price in 2008 and 2014 are apparent from the figure. Thus, oil price crash in 2008 was mostly driven by contraction of global economic activity and decrease in precautionary demand on oil. These results are consistent with Hamilton (2009). Very quick adjustment of oil prices also can be constitute to the fact that precautionary demand on oil has steadily has risen up to 2013. Oil price distributions in mid-2014 were the fact of significant slump in precautionary demand and global economic activity, with no change in oil supply.

4.2 Fiscal responses to real oil price shocks

The empirical results from figure 2 that describe the fiscal responses to oil shocks were obtained from structural panel estimations where the first difference of government expenditures are dependent variables, and with one of the estimates of oil shocks among the explanatory variables. Bands near the median of the responses are 25% and 75% percentiles of responses of countries. The first three shocks in the first raw of the figure are implied by Killian's method, namely, oil market supply shock, world demand shock and oil market specific shock. The other three shocks are idiosyncratic-country specific aggregate supply, aggregate demand and oil production shocks. Specifically we are interested in oil market specific demand shocks.

[1] Since the latest data points on world economic activity, developed by Kilian, were revised, our results may differ from his original estimations.

The key findings can be summarized as: l) oil exporting developing countries exhibit procyclical respond to positive oil market specific demand shock, 2) there are significant cross-country differences in the way governments respond to the oil shocks.

4.3 Performance of fiscal rules

The rules and regulations according to which budgets are drafted, approved and implemented have been found to influence fiscal behavior. Several seminal papers such as Alt and Robert (1994), Bayoumi and Eichengreen (1995) have shown that , at least in the short run, the stringency of budget rules affects the response to shocks. Hagen (1992), Hagen and Harden (1995) and Alesina et al. (1996) reach similar conclusions in cross-country comparisons. Basically, if budget rules matter, we may expect to find different fiscal responses to oil shocks across countries with different fiscal rules. Indeed, our estimations seems to have supportive evidences on this argument. Though, results indicate that not all fiscal rules have the same impact, probably the design matters. Even more important is that, any particular fiscal rule do not play any significant role alone. Fiscal rules mitigate shocks when all are in place simultaneously.

Even though fiscal authorities to do not tend to be counter-cyclical, imposing fiscal rules may obstinate authorities from being pro-cyclical. Figure 3 depicts correlation between ten periods mean response of public expenditures across countries and relative average year of implementation of fiscal rules across countries. It can be asserted that depending how long fiscal rules have been adopted, response quality of fiscal authorities will be better relative to ones those have been adopted in a shorter period time. The higher the number of years fiscal rules were in place, higher the performance

of fiscal rule had to be on fiscal expenditure response. Indeed, all fiscal rules negatively correlates with expenditure responses in figure 3.

It is not sufficient from the correlations to infer about causation of fiscal rule on performance of fiscal authorities. Therefore, we have regressed fiscal rules and some institutional variables on mean of fiscal expenditure responses to oil supply, global demand and oil market specific demand shocks. We have tried several specifications and summarized the results in table 3. Main finding is that fiscal rules exhibit economically meaningful and statistical significant impact when all fiscal rules applied at the same time. Furthermore, in the third specification we have decomposed fiscal rules and explored their individual importance. Decomposition didn't reveal statistically significant impact of individual fiscal rules. In specifications 5,6,7 and 8 we have analyzed joint impact by including interaction terms of fiscal rules. This is probable scenario, since in some cases countries implement several rules at the same time. It seems that debt rule is an only fiscal rule that has statistically significant impact on the fiscal expenditure responses.

Among other institutional variables such as an exchange rate regime, being a developed country and share of oil to GDP variable has statistically and economical meaningful impact on the fiscal responses in all specifications. Coefficient on exchange rate regime indicates that if a country adopts exchange rate regime closer to pegged regime, higher the procyclical response of fiscal policy will be. Furthermore, being a developed country is also very an important factor. Developed countries enjoy a sound and developed institutional discipline in general. Therefore, being a developed country increases probability that the policy will be used as a countracyclical tool. In this respect, fiscal rules may work only if the general institutional framework is good. In specification 9 we tested joint impact of fiscal rules and being a

developed country. As expected the results are highly statistically significant and economically meaningful, that is fiscal rules work when the country has strong institutional discipline in general.

4.4 Oil Funds as a Macroeconomic Stabilization Tool

Wealth funds are the institutions devoted to manage resource revenues and they may vary according to their functions. Some funds have a clear stabilization objective in their mandate, while pension and saving objectives may come later in their objective priorities. For more details on sovereign wealth funds' functions and roles see Al-Hassan et al. (2013) and Institute (2014). We postulate that, contingent on the role of wealth fund, fiscal policy reaction to oil shocks may generate cross-country differences. Table 4 summarizes regression results of the role of wealth funds in explaining fiscal policy responses. In all specifications we couldn't identify any significant role of wealth funds in mitigating the shocks. And the results are not consistent with Sugawara (2014). We are cautious to conclude that wealth funds have no role on mitigating revenue shocks, rather will leave it for further investigations.

5 Conclusion

Vast majority of literature on developing commodity rich countries documented procyclicality of fiscal policy in commodity-rich countries. To alleviate commodity price fluctuations and prevent government from being procyclical international organizations recommended to adopt some type of fiscal policy framework (i.e., a fiscal spending rule), which, if operated countercyclically, should shelter the economy from commodity price fluctuations and prevent over-spending on the part of the government. In fact, de jure

some of those countries adopted fiscal rules to guide fiscal policy. The adoption of a fiscal rule, however, does not in itself ensure that fiscal policy works to insulate the domestic economy from commodity price fluctuations: The constructed rule may be too lax over the commodity price cycle, the actual conduct of fiscal policy might not be in accordance with the rule, or both. Hence, what works in theory may not necessarily work in practice. In one hand there are some countries without any fiscal rules in covered period, and on the other hand there some countries with sound fiscal framework or to some extend have adopted particular fiscal rule. Those facts were the main reasons to motivate us to do an event study-like exercise.

To examine quality of fiscal rules in practice we proposed a structural panel VAR framework following P. Pedroni (2013) and Yepes, L. Pedroni P., and Hu (2015) to analyze fiscal policy's response in a resource-rich economy to oil price shocks over time. Several attempts (e.g., Sturm, Gurtner, and Alegre 2009; Basnet and Upadhyaya 2015; Omojolaibi and Egwaikhide 2014; Anshasy and Bradley 2012) have been made to study the impact oil prices to fiscal policy in panel framework. In general those studies employed conventional panel methods, where they assume homogeneous dynamic response shocks for all member countries. However, this assumption in macro studies may lead to inconsistent estimations P. Pedroni (2013) and Pesaran and Smith (1995). Fortunately, P. Pedroni (2013) purposes a way to exclude fixed country effects from the dynamics and allows among dynamics of individual country responses to be heterogonous among all member countries of the panel. After obtaining individual country responses we will be able to regress them on several fiscal rules as well some on institutional indicators. the main motivation is to examine to what extent fiscal rules have insulated the domestic economy from oil price fluctuations or, conversely, exacerbated

their effect.

There is another problem regarding the estimation of impact of oil prices on the fiscal policy in the empirical literature. Empirical models of the effect of oil price shock on the economy in general have typically been constructed under the premise that one can think of varying the price of crude oil, while holding all other variables in the model constant. In other words, oil prices are treated as exogenous with respect to the global economy. This premise is not credible (see, e.g., Kilian 2009; Barsky and Kilian 2001; Barsky and Kilian 2004; Hamilton 2009).

Considering all these gaps in the literature, our study may have important contribution in understating nature of the relationship between government spending and oil revenues (shocks) in developing oil exporter countries. Moreover, the study also tries to shed light on the effectiveness of the fiscal rules and their relation between the oil revenues (shocks) which may be helpful in designing of optimal fiscal policy.

Our key findings can be summarized as: l) oil exporting developing countries exhibit procyclical respond to positive oil market specific demand shock, 2) there are significant cross-country differences in the way governments respond to the oil shocks, 3) fiscal rules mitigate the shocks and generate fiscal discipline only if when all fiscal rules are imposed simultaneously, 4) couldn't identify any significant role of wealth funds as a stabilization policy of a budget.

Among other institutional variables such as an exchange rate regime and being a developed country have statistically and economical meaningful impact on the fiscal responses in all specifications. Coefficient on exchange rate regime indicates that if a country adopts exchange rate regime closer to pegged regime, higher the procyclical response of fiscal policy will be.

Furthermore, being a developed country is also very an important factor. Developed countries enjoy a sound and developed institutional discipline in general. Therefore, being a developed country increases probability that the policy will be used as a countracyclical tool. In this respect, fiscal rules may work only if the general institutional framework is good.

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Appendices

Table 1: Types of wealth funds across countries

Name of the Fund	**Country**	**Fiscal Stabilization**	**Savings**	**Pension Review**
Revenue Regulation Fund	Algeria	*		
Fund Soberanu de Angola	Angola	*	*	
Australian Future Fund	Australia			*
State Oil fund	Azerbaijan	*	*	
-	Brazil			
Alberta's Heritage Fund	Canada		*	
The Colombia Saving and Stabilization Fund	Colombia	*	*	
-	Ecuador			
-	Indonesia			
Oil Stabilization Fund	Iran	*	*	
National Development Fund	Iran	*	*	
Kazakhstan National Fund	Kazakhstan	*	*	
Kuwait Investment Authority	Kuwait	*	*	
Khazanah Nasional Berhad	Malaysia	*		
Mexico Oil Stabilization Fund	Mexico	*	*	
Nigeria Sovereign Investment Authority	Nigeria	*	*	
Government Pension Fund-Global	Norway	*	*	*
Oman Investment Fund	Oman		*	
Qatar Investment Authority	Qatar	*		*
National Welfare Fund	Russia	*	*	*
Oil Stabilization Fund	Russia		*	
	Saudi Arabia			
Abu Dhabi Investment Corporation	UAE	*	*	
Abu Dhabi Investment Authority	UAE		*	
-	United Kingdom			
Stabilization Fund	Venezuela	*	*	

Source: Sovereign Wealth Funds: Aspects of Governance Structures and Investment Management

Table 3. Role of institutions in explaining fiscal responses

Dependent variable	**Mean fiscal expenditure response to oil-specific demand shock**					
Specifications	**1**	**2**	**3**	**4**	**5**	**6**
Fiscal rules	-9.410***					
	(-4.127)					
DR			-0.894	-0.901		
			(-1.239)	(-1.253)		
ER			0.768		0.131	
			(0.895)		(0.158)	
BBR			0.208			-0.206
			(0.23)			(-0.219)
BBR*ER				-0.506		
				(-0.422)		
BBR*DR					**-1.752	
					(-1.892)	
ER*DR						-0.709
						(-0.559)
Exchange rate regime	0.347**	0.473**	0.394	0.515**	0.352	0.552**
	(2.208)	(2.202)	(1.539)	(2.341)	(1.528)	(2.073)
Wealth fund	-0.089	0.61	0.566	0.169	-0.072	0.497
	(-0.188)	(0.991)	(0.712)	(0.223)	-0.095	(0.65)
Central Bank independence	0.619	-0.752	-0.398	0.088*	(1.055)	-0.734
	(0.650)	(0.554)	(-0.244)	(0.054)	0.689	(-0.452)
Country type	0.013	-2.015**	-1.669	-1.644	(-1.022)	**-1.952
	(0.016)	(-2.565)	(-1.759)	(-1.914)	(-1.165)	(-2.049)
Oil share to GDP	0.000	-0.001	-0.003	-0.004	-0.005	-0.002
	(0.002)	(-0.095)	(-0.193)	(-0.322)	(-0.445)	(-0.176)
Adjusted R^2	57	16	11	45	26	47
Nobs	22	22	22	22	22	22

Number of * indicates significance level at 1%, 5% and 10% level.

Table 4. Role of wealth funds in explaining fiscal responses

Dependent variable	Mean fiscal expenditure response to oil-specific demand shock				
Specifications	**1**	**2**	**3**	**4**	**5**
WF	0.604				
	(1.01)				
WFP		0.18	0.256		
		(0.313)	(0.525)		
WFS		0.297		0.197	
		(0.493)		(0.35)	
WFF		0.016			-0.001
		(0.026)			(-0.001)
WFF*WFS			0.387		
			(0.911)		
WFS*WFP				0.491	
				(0.705)	
WFF*WFP					0.341
					(0.657)
Exchange rate regime	0.389**	0.342*	0.382**	0.371**	0.370**
	(2.556)	(1.894)	(2.482)	(2.246)	(2.081)
Fiscal rules	-8.930***	-9.170***	-9.244***	-8.800***	-9.043***
	(-4.271)	(-3.202)	(-4.093)	(-4.031)	(-3.564)
Central Bank independence	0.319	0.216	0.114	0.199	0.369
	(0.399)	(0.161)	(0.129)	(0.224)	(0.302)
Country type	-0.309	-0.039	-0.185	-0.22	-0.172
	(-0.438)	(-0.046)	(-0.27)	(-0.287)	(-0.203)
Oil share to GDP	-0.001	-0.003	-0.004	-0.002	-0.001
	(-0.101)	(-0.286)	(-0.519)	(-0.261)	(-0.043)
Adjusted R^2	59	52	40	57	54
Nobs	22	22	22	22	22

Number of * indicates significance level at 1%, 5% and 10% level.

Figure 1. The Historical Evolution of the Structural Shocks.

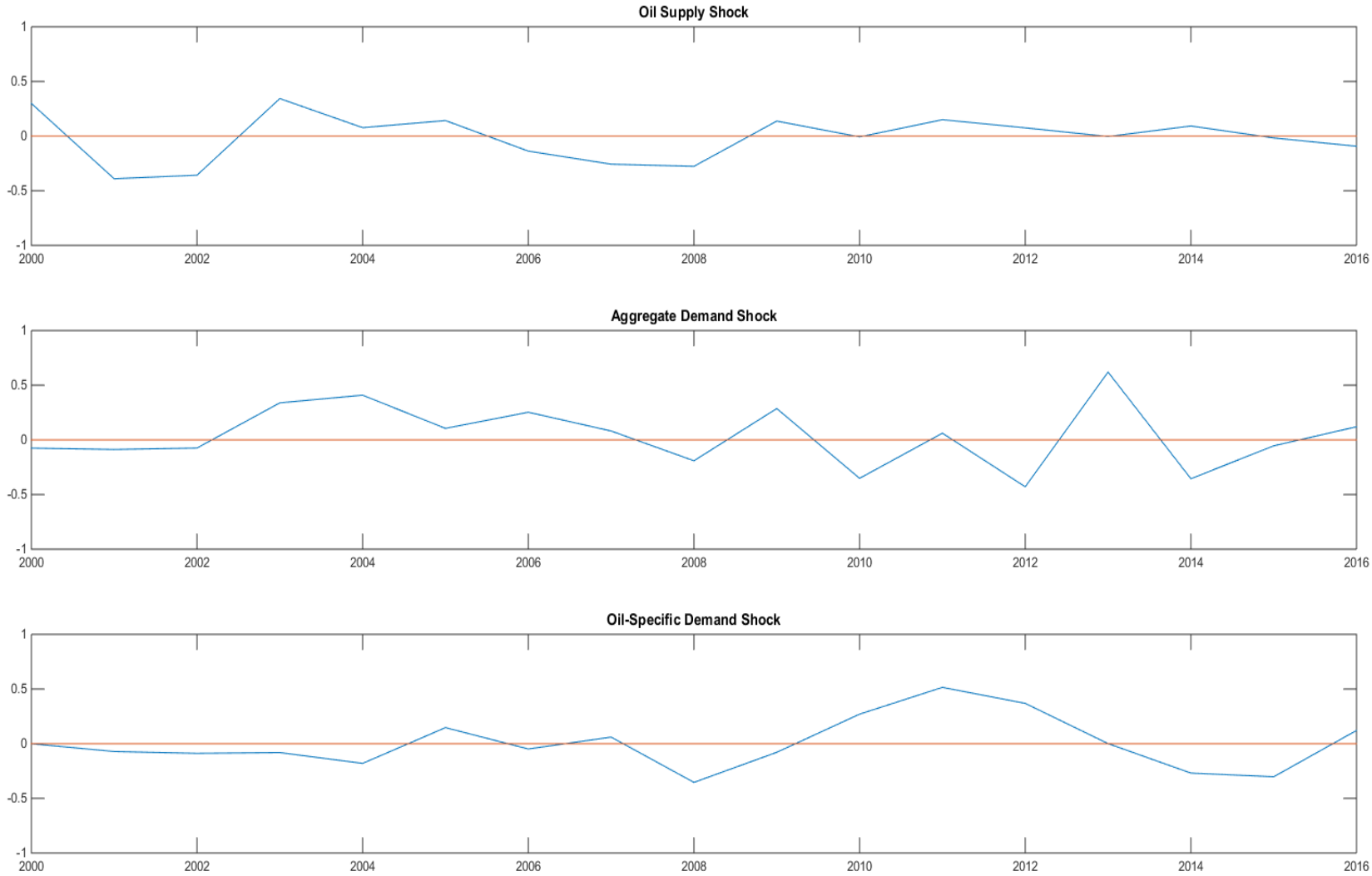


Figure 2. Responses of fiscal expenditures to

Figure 2.1 Global oil supply shock

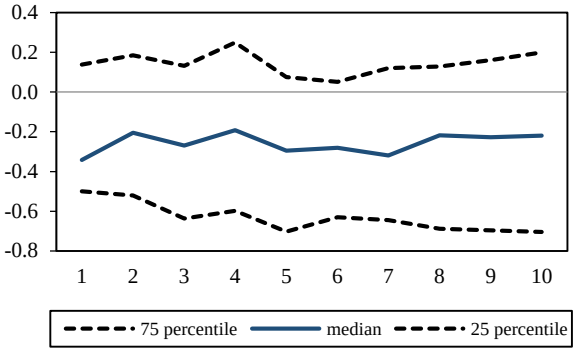


Figure 2.2 Global aggregate demand shock

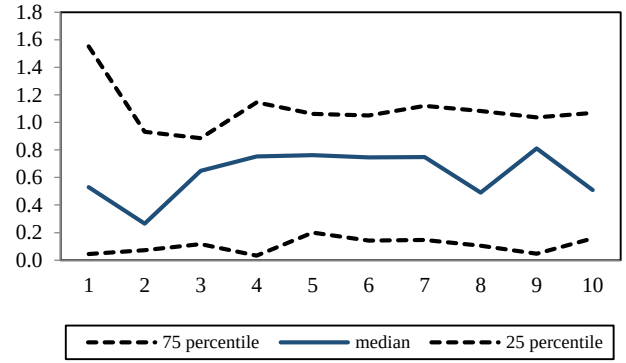


Figure 2.3 Oil specific demand shock

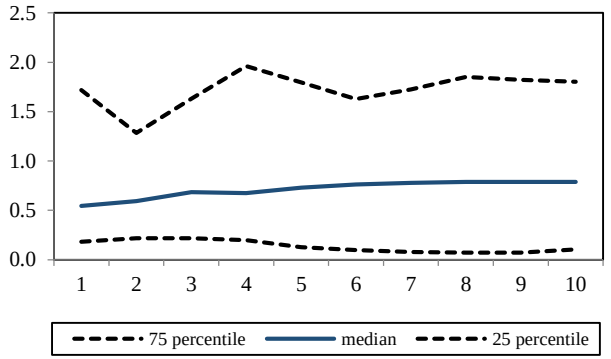


Figure 2.3 Country specific aggregate supply shock

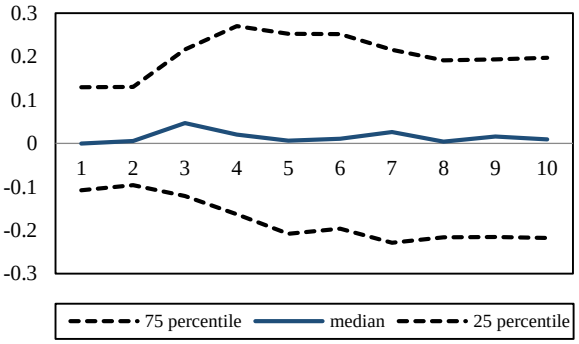


Figure 2.4 Country specific aggregate demand shock

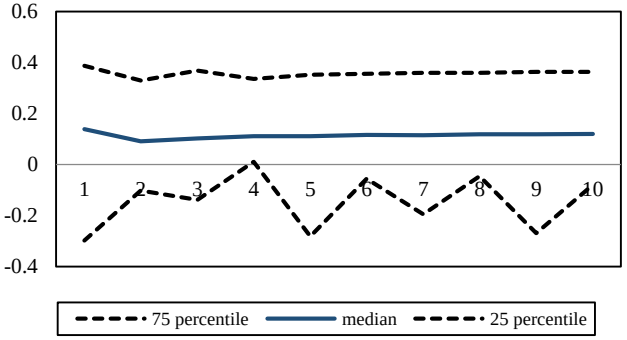


Figure 2.5 Country specific oil production shock

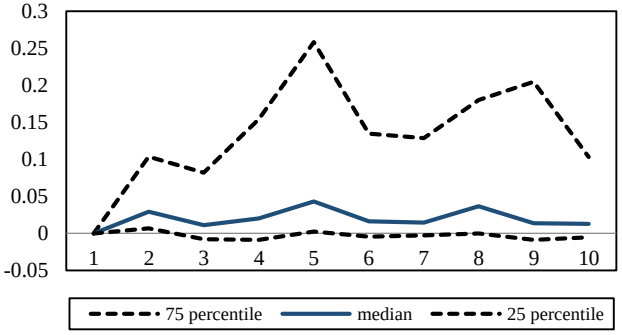
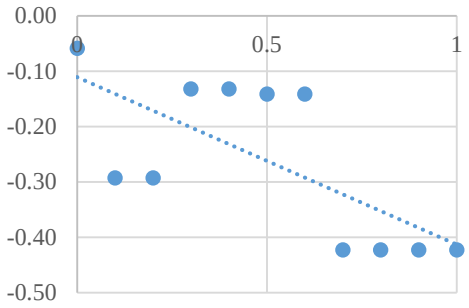
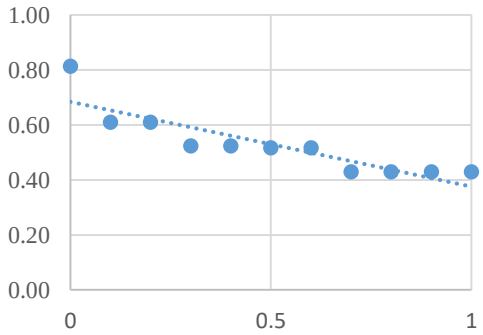
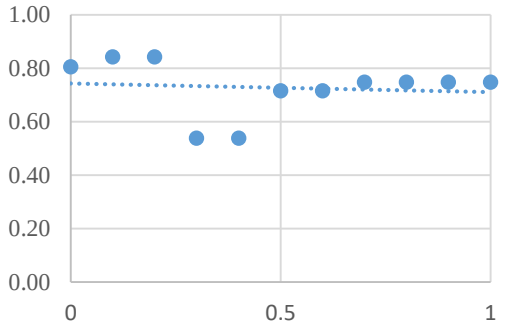
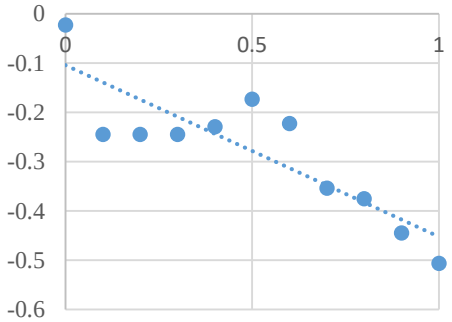
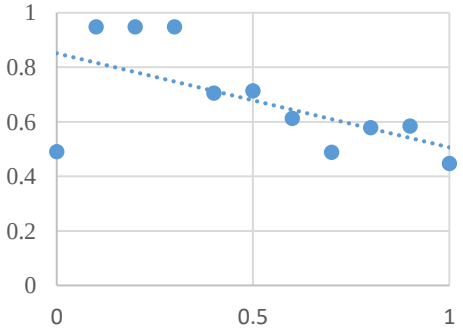
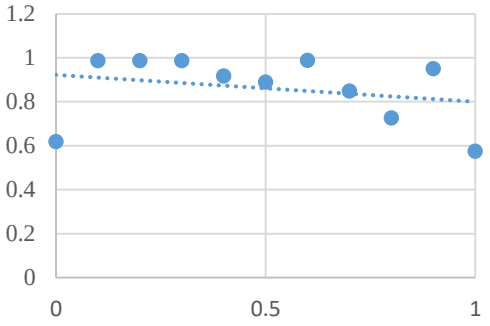
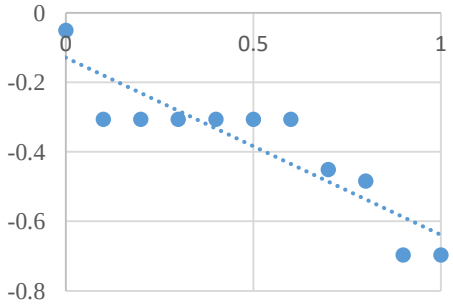
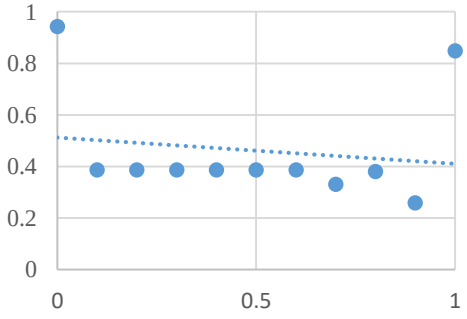
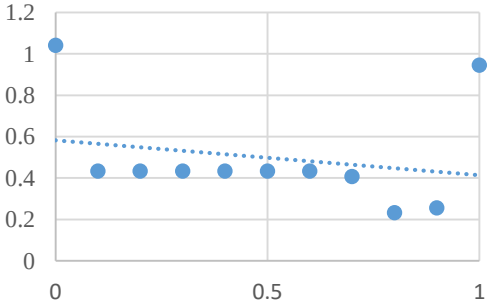


Figure 3. Correlation between 10 periods mean response of fiscal expenditures and average year of adoption of fiscal rules across countries

Shocks / Fiscal rules	Global oil supply shock	Global aggregate demand shock	Oil specific demand shock
Expenditure rule			
Balance budget rule			
Debt rule