An econometric study on the classification and effectiveness of natural resource funds

Taguchi, Hiroyuki and Ganbayar, Javkhlan

Saitama University

August 2022

An Econometric Study on the Classification and Effectiveness of Natural Resource Funds

Hiroyuki Taguchi
Saitama University

Javkhlan Ganbayar
Saitama University

Abstract

This article aims to examine the effectiveness of natural resource funds in resource-rich countries according to the funds' objectives by an econometric method using panel data. This study's contribution is to demonstrate fund-specific evaluation: the study classifies the funds into three kinds by their objectives: stabilization fund, investment fund and saving fund, and then evaluates each fund's effectiveness by each criteria corresponding to each objective. The econometric estimations identified the effectiveness of stabilization fund in reducing the volatility of government expenditure and primary balance and the effectiveness of investment fund in raising investment rate. They also confirmed the facilitation of the fund's effectiveness under the combination between the fund's operation and high governance. The econometric study further found that the operation of stabilization fund reduces the volatility of government expenditure by 13.6 percent and its operation with high governance reduces it by 33.2 percent, and that investment fund operation pushes up the investment rate by 9.8 percent and its operation with high governance raises it by 46.8 percent.

Key words: natural resource funds, stabilization fund, investment fund, saving fund, volatility, resource curse
JEL Classification: H29, Q38

1. Introduction

Economies rich in natural resources tend to grow more slowly and to have inferior development outcomes than those without natural resources. This puzzling phenomenon has been referred to as the "resource curse" hypothesis, initially proposed by Anty (1993). The resource curse was typically observed in the contrast that many African countries rich in minerals have stayed at the least developed stage, whereas East Asian countries have achieved the highest growth performances in the world without natural resources during the post-world-war II period. The resource curse hypothesis has been analyzed empirically and theoretically in a number of studies, and their majority has provided evidence to support the hypothesis (e.g., Gelb, 1988; Sachs and Warner, 1995 and 2001; Gylfason et al., 1999; Sala-I-Martin and Subramanian, 2003; Manzano and Rigobon, 2008; Bruckner, 2010; van der Ploeg, 2011; Fleming et al. 2015).

There have also been a variety of arguments to explain the factors and channels behind the existence of resource curse. From macroeconomic perspectives, natural resource development and dependence are considered to crowd-out manufacturing activities, as referred to as the Dutch Disease (e.g., Corden and Neary, 1982; Sachs and Warner, 1995 and 2001; Sachs, 2006; Harding and Venables, 2013), and to bring macroeconomic instability into the economy through the volatility of resource prices (e.g., Ramey and Ramey, 1995; van der Ploeg, 2007). From the aspects of political economy and governance, natural resource abundance accelerates rent-seeking behaviors, corruptions and internal wars (e.g., Karl, 1997; Ross, 2001; Jensen and Watchekon, 2004; Collier and Hoeffler, 2005; Bulte et al. 2005; Rosser, 2006; Kolstad and Soreide, 2009).

On the solution to the resource curse, such theoretical approaches have been proposed traditionally as the pricing, taxation, and optimal extraction path of natural resources (e.g., Hotelling, 1931; Dixit and Newbery, 1985; Hartwick, 1977). These approaches have, however, been criticized for their normative nature and limited practicability (van der Ploeg, 2010). Alternatively, natural resource funds as an explicit fiscal tool have become one of the main targets for the policy debates to address resource curse. The theoretical purpose of the funds is described in that the funds, by insulating the economy from the fluctuations of resource prices and from political pressures, take the roles to stabilize the macroeconomy and to finance the investments and savings necessary for future generations (e.g., Tsalik, 2003; Bacon and Tordo, 2006; IMF, 2012; Tsani, 2013 and 2015).

The empirical works on the effectiveness of resource funds have produced mixed and inconclusive outcomes. The evidence could be divided into the following three categories: the arguments supporting the effectiveness of resource funds (e.g., Baena et

al., 2012; Tsani, 2013); the arguments in conditional supports with high governance and robust fiscal rules (e.g., Bacon and Tordo, 2006; Sugawara, 2014); the arguments opposing their effectiveness (e.g., Davis et al., 2001; Ossowski et al., 2008).

For the purpose of enriching the evidence on the funds' evaluation, this article aims to reexamine the effectiveness of the 54 natural resource funds in 41 resource-rich countries according to the funds' objectives by an econometric method using panel data. This study's contributions to the literature are twofold. First, this study applies an econometric approach. In the literature to date, the majority of works has engaged in the qualitative, conceptual and comparative assessment of resource funds in selected countries, while a limited number of studies have applied a quantitative approach on the funds' roles in fiscal and macroeconomic contexts. Second, this study conducts fund-specific evaluation. The study classifies natural resource funds into three kinds by their objectives: stabilization fund, investment fund and saving fund (IMF, 2012; Ouoba, 2016), and then evaluates each fund's effectiveness by each criteria corresponding to each objective. The literature has evaluated specific funds for specific countries or assessed entire funds by a single criteria.

The remainder of this article is structured as follows. Section 2 reviews the literature related to the evaluation of resource funds and clarifies this study' contributions to the existing literature. Section 3 conducts an empirical analysis of the funds' evaluation. Section 4 summarizes and concludes.

2. Literature Review and Contributions

This section reviews the literature related to the empirical evaluation of natural resource funds, and clarifies this study' contributions to the existing literature. As was introduced in Section 1, the empirical works on the effectiveness of resource funds have produced mixed and inconclusive outcomes. The evidence could be classified into the three categories: the arguments supporting the effectiveness of resource funds; the arguments in conditional supports with high governance and robust fiscal rules; the arguments opposing their effectiveness (see Table 1 and 2).

The first category supporting resource funds contains qualitative and quantitative studies. Regarding the qualitative studies, specific stabilization and saving funds in selected countries are examined and cited as successful examples: in Kuwait (Chalk et al., 1997); in Kuwait, Norway, Chile, and the state of Alaska in (Fasano, 2000); in Kazakhstan, Azerbaijan, and Norway (Lücke, 2010); in the sates of Alaska and Alberta (Baena et al., 2012). As for the quantitative works, econometric approaches using panel data are applied

to identify the funds' effectiveness by the criteria of monetary performances (Shabsigh and Ilahi, 2007), fiscal performances (Bagattini, 2011; Sugawara, 2014), governance (Tsani, 2013 and 2015), and financial resilience (Bortolotti et al. 2020). A macroeconomic general equilibrium model also identifies the effectiveness of the stabilization fund in Russian Federation (Merlevede, et al., 2009).

The second category represents the argument that resource funds have worked well under the conditions of high governance and robust fiscal rules. In the qualitative analyses, the role of institutional capacity in the funds' success is emphasized in developing countries (Hjort, 2006; Bacon and Tordo, 2006; Le Borgne and Medas, 2007); the fiscal discipline and rules are found to be the prerequisite for the funds' workability (Fasano, 2000; Engel and Valdes, 2000; Usui, 2007); ensuring transparency is essential for the funds' management (Tsalik, 2003; Kalyuzhnova, 2006; Gould, 2010). In the quantitative works, Crain and Devlin (2003), by conducting an econometric analysis using panel data, shows that the fund establishment reduces fiscal volatility in Chile and Norway whereas it raises the volatility in oil-exporting countries, and speculates that the deference comes from fiscal policy framework. Sugawara (2014) identifies the interaction effects between the funds' operation and political institutions and between the funds' operation and fiscal rules. Allegret et al. (2018), constructing a dynamic stochastic general equilibrium model, shows that the combination between oil stabilization funds and policy rules contributes to preventing a Dutch disease effect.

In the third category opposing resource funds, Davis et al. (2001), using both econometric evidence and country case studies, argues that the establishment of a resource fund did not have an identifiable impact on government spending, and countries with more prudent expenditure policies tended to establish an fund, rather than the fund itself leading to increased expenditure restraint. These arguments are followed by the case studies and qualitative analyses in Eifert et al. (2002), Devlin & Titman (2004) and Villafuerte et al. (2010). As for econometric analyses using panel data, Ossowski et al. (2008) shows that the introduction of oil funds have had no impacts on fiscal outcomes, while emphasizing the importance of sound institutions and public financial management systems. Ouoba (2016) demonstrates that resource funds have even a negative and significant effect on economic growth.

This study's contribution is to enrich quantitative evidence with an econometric approach on the effectiveness of resource funds, which has been inconclusive in a limited number of the previous works. The resource funds have been developed relatively recently and the short time frame has put practical limitations on econometric approaches. Thus, enriching the quantitative evidence is significant in reaching robust conclusions.

The largest contribution of this study is to demonstrate fund-specific evaluation. The resource funds are classified into three kinds by their objectives: stabilization fund, investment fund and saving fund, and are evaluated in their effectiveness according to their objectives. The previous works have assessed the funds by such a single criteria as fiscal performances, monetary performances, economic growth and governance.

3. Empirical Analysis

This section conducts an econometric analysis of the resource funds' evaluation. The section starts with describing the variables and data for the estimation, clarifies the estimation methodology, and then presents the estimation outcomes with their discussions.

3.1 Variables and Data Collection

This section describes the variables and data collection for the subsequent econometric estimation. The estimation equation is designed to equip four dependent variables (the indicators for evaluating the funds' effectiveness according to their objectives), three explanatory dummies for the operations of three kinds of funds (stabilization, investment and saving), and the other six explanatory variables for controlling the time-varying country-specific effects. The variables for estimating the funds' effectiveness are listed with their measurement and data sources in Table 3, and their descriptive statistics are presented in Table 4. The detailed description of each variable is as follows.

The dependent variables specify four kinds of the indicators for evaluating the funds' effectiveness according to their objectives. The data for all indicators are retrieved from World Economic Outlook (WEO) Database of International Monetary Fund (IMF)[1]. This study, based on IMF (2012)[2], classifies the funds into three kinds by their objectives: stabilization fund, investment fund and saving fund as in the list of the funds comprising the 54 funds in 41 resource-rich countries (see Table 5). The first two indicators are for evaluating the stabilization funds. The first indicator, *g_exp*, represents the volatility of government expenditure, expressed by the absolute value of the deviation from the period average of "general government total expenditure as a percentage of gross domestic

[1] See the website: https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases#sort=%40imfdate%20descending.

[2] IMF (2012) classifies Sovereign Wealth Funds into four types: 1) stabilization funds, 2) pension reserve funds, 3) reserve investment funds, and 4) saving funds. This study reclassifies them into three types by merging 2) and 4) as in Ouoba (2016).

product (GDP)" in WEO. The second indicator, *g_pbl*, denotes the volatility of government primary balance, expressed by the absolute value of the deviation from the period average of "general government primary net lending / borrowing as a percentage of GDP". The third and fourth indicators, *inv* and *sav*, are for examining the investment and saving funds, and represent "total investment" and "gross national saving" as a percentage of GDP, respectively.

The three explanatory dummies denotes the operations of three kinds of funds: *f_sta* for stabilization funds, *f_inv* for investment funds, and *f_sav* for saving funds. The funds' effectiveness could be identified when the coefficient of *f_sta* is significantly negative and those of *f_inv* and *f_sav* are significantly positive. This study assumes, as in Sugawara (2014), that it takes five years for the fund to operate substantially and have a tangible effect after its establishment. Thus, when the fund is established in the year *t*, the dummy takes the value of 1 in the year of *t+5*, otherwise the value of 0.

The other explanatory variables for controlling the time-varying country-specific effects contains six indicators: economic growth, inflation, population, openness, resource dependence, and governance. These indicators are selected from those used commonly in more than three out of six previous econometric studies listed in Table 2 (the time-invariant country-specific variables such as political institutions in Table 2 are dealt with by the country fixed effects in this study). The first three indicators, taken from WEO, are "GDP as constant prices in terms of percent change" (*gdp*), "average consumer prices in terms of percent change" (*inf*), and "population by millions of persons in terms of logarithm[3]" (*pop*). The other two indicators, retrieved from World Development Indicators (WDI) of the World Bank[4], are "sum of exports and imports of goods and services as a percentage of GDP" (*top*) and "total natural resources rents as a percentage of GDP" (*nrr*). The last indicator represents the governance of the country managing the funds, whose data are from Worldwide Governance Indicators (WGI) of the World Bank.[5] This indicator contains the following six kinds of indexes: voice and accountability (*voa*), political stability and absence of violence/terrorism (*pos*), government effectiveness (*gve*), regulatory quality (*req*), Rule of law (*rol*), control of corruption (*cor*). This study also computes the average of the six indexes above as a total index (*gov*). The index takes the number ranging from -2.5 (weak governance) to 2.5 (strong governance) with the world average being approximately zero. All the explanatory variables in this category are lagged by one year. as they might be endogenous to the model and thus there would be a

[3] The population data is transformed in logarithms to avoid scaling problems in the estimation.
[4] See the web site: https://data.worldbank.org/.
[5] See the web site: http://info.worldbank.org/governance/WGI/.

need to avoid an issue of reverse causality with the dependent variables.

3.2 Panel data setting

Based on the setting of the variables above, the study constructs the panel data using annual data for the period of 1996-2020 with 41 resource-rich economies containing the 54 natural resource funds (see Table 4). The sample period after 1996 is chosen because this study values the governance index of the country managing the funds, and the WGI database representing the governance index is available only after 1996.

For the subsequent estimation, the study investigates the stationary property of the constructed panel data by employing panel unit root tests: the Levin, Lin, and Chu test (Levin et al., 2002) as a common unit root test, and the Fisher–ADF and Fisher–PP tests (Choi, 2001; Maddala & Wu, 1999) and the Im, Pesaran, and Shin test (Im et al., 2003) as individual unit root tests. The common unit root test assumes the existence of a common unit root process across cross-sections, while the individual unit root test allows individual unit root processes that differ across cross-sections. These tests are conducted on the null hypothesis that a series of panel data in levels has a unit root by including "intercept" and "trend and intercept" in the test equations. Table 6 shows that the Levin, Lin, and Chu test rejects the null hypothesis of a unit root at the conventional significance level for all variables in both test equations. The individual unit root tests do not necessarily reject the null hypothesis in all cases, but at least the Fisher–ADF test rejects it at the conventional level for all variables in the test equation including the intercept. Therefore, we assume that there is no serious problem of the existence of unit roots in the panel data and use the panel data in levels for the estimation.

3.3 Model Specification and Estimation Method

The equation for the econometric estimation, following Sugawara (2014) and Ouoba (2016), is specified as follows.

$$effect_{i.t} = \alpha_0 + \alpha_1 fund_{i,t-5} + \alpha_2 X_{i,t-1} + \alpha_3 gov_{i,t} fund_{i,t-5} + f_i + f_t + \varepsilon_{i,t} \quad (1)$$

The subscripts of i and t denote the sample country and year. *effect* representing the indicators of the funds' evaluation comprises volatility of government expenditure (*g_exp*) and primary balance (*g_pbl*), investment rate (*inv*) and saving rate (*sav*). *fund* showing the funds' operation comprises the funds for stabilization (*f_sta*), investment

(*f_inv*), and saving (*f_sav*). The two indicators, *g_exp* and *g_pbl*, correspond to the evaluation of *f_sta*, and in this combination the coefficient, α_1, is expected to have a negative sign because the stabilization fund is supposed to reduce the volatility of government expenditure and primary balance. The indicators of *inv* and *sav* correspond to that of *f_sta* and *f_inv*, respectively, and in this combination the coefficient, α_1, is expected to be positive because the investment and saving funds are supposed to raise investment and saving rates, respectively.

X denoting the control variables includes the indicators of economic growth (*gdp*), inflation (*inf*), population (*pop*), trade openness (*top*), resource dependence (*nrr*), and governance (*gov*). f_i and f_t show a time-invariant country-specific fixed effect and a country-invariant time-specific fixed effect, respectively, ε denotes a residual error term, and $\alpha_{0...3}$ stands for estimated coefficients.

The equation contains the interaction term of governance (*gov*) and funds' operation *fund* as in Sugawara (2014). This interaction term, reflecting the previous studies' arguments in Section 2 that resource funds have worked well under the conditions of high governance and robust fiscal rules, differentiates the funds' effectiveness with and without quality governance. The coefficient, α_3, similar to α_1, is expected to be negative in the estimation of stabilization fund, and positive in those of investment and saving funds.

This panel estimation is controlled by the country-specific and time-specific fixed effects, represented by f_i and f_t. From a statistical perspective, the Hausman specification test is generally utilized to choose between fixed-effect and random-effect models (Hausman 1978). This study applies the fixed-effect model, however, because the study places a premium on the existence of exogenous country- and time-specific factors, and adopting the fixed-effect model contributes to alleviating endogeneity problem by absorbing unobserved time-invariant heterogeneity among sample countries. As shown in the previous quantitative studies in Table 2, the factors such as political institutions are assumed to be correlated with the funds' effectiveness (not distributed randomly among sample countries). In the time-series, the external shocks, such as the global financial crisis of 2008–2009, might affect the funds' performances. As a specification ignoring these effects leads to inefficient estimation, they should be controlled for by incorporating country- and time-specific fixed effects into the specification.

Before the panel estimation, the study investigates the multicollinearity among the explanatory variables. Table 7 reports the bivariate correlations and the variance inflation factors (VIF), a method of measuring the level of collinearity between regressors. It reveals that the total governance index (*gov*) and its six components (*voa*, *pos*, *gve*, *req*, *rol*, and *cor*) have a high bivariate correlation in each combination and high VIF values

that are far beyond the criteria of collinearity, namely, ten points. Thus, the equation includes the governance indicators separately as independent regressors.

Regarding the estimation technique, this study applies the ordinary least squares (OLS) estimator and the Poisson pseudo-maximum likelihood (PPML) one. The reason for the application of the PPML estimator is that the sample data including those of developing countries should be plagued by the heteroskedasticity problem, in which the OLS estimator leads to a bias and an inconsistency in its estimate, and the PPML estimator takes advantage of accounting for the heteroskedasticity, as Santos Silva and Tenreyro (2006) suggested. Thus, this study applies both estimators to ensure the robustness of the estimations.

3.4 Results and Discussion

Table 8 and 9 reports the estimation results for evaluating stabilization fund in terms of volatility of government expenditure and primary balance, respectively, and Table 10 and 11 shows those for evaluating investment and saving funds, respectively. All the tables contain the results of OLS and PPML estimations with the total governance index and PPML estimations with each component of governance index. Table 12 summarizes the results on the funds' effectiveness. The main outcomes are highlighted as follows.

Regarding the estimation of stabilization fund in Table 8 (with the indicator of *g_exp*) and 9 (*g_pbl*), the coefficients of the fund (*f_sta*) are significantly negative in both OLS and PPML estimations with total governance index and in the majority of PPML estimations with the components of governance index. In the interaction term with the governance index (*f_sta* * *gov*), all the coefficients are significantly negative except the case of *g_exp* with OLS estimation. These results, as expected, suggest that the stabilization fund effectively reduces the volatility of government expenditure and primary balance, and higher governance facilitates the effectiveness of the fund. Focusing on the case of the PPML estimation with total governance index, the operation of stabilization fund reduces the volatility of government expenditure by 13.6 percent and its operation with high governance reduces it by 33.2 percent.

In the estimation of investment fund in Table 10 (*inv*), the coefficients of the fund (*f_inv*) are significantly positive in PPML estimation (positive but insignificant in OLS estimation) with total governance index and in the majority of PPML estimations with the components of governance index. In the interaction term with the governance index (*f_inv* * *gov*), all the coefficients are significantly positive in PPML estimation with all the governance index. These results, as expected, imply that the investment fund effectively

raises investment rate and higher governance facilitates its effectiveness. There seem to be the multiple channels in which the investment fund raises investment rate: the government itself could increase public investment and the public investment in infrastructure, for instance, could induce private investment. Focusing on the case of the PPML estimation with total governance index, the operation of investment fund pushes up the investment rate by 9.8 percent and its operation with high governance raises it by 46.8 percent.

In the estimation of saving fund in Table 11 (*sav*), the coefficients of the fund (*f_sav*) are insignificant in any estimations, and those of the interaction term are negative in the majority of the estimations against the study's expectation. These results seem to come from the limitation of sample size: only the funds of Chile and Gabon are the estimation target in the sample period for 1996-2020.

The estimation results on the control variables are shortly reported as follows. The economic growth (*gdp*) has negative effects on fiscal volatility but positive ones on investment and saving rates. It is speculated that a economic growth leads to less fiscal stimulus and an increase in investment and saving. The inflation (*inf*) gives ambiguous effects on fiscal volatility and negative effects on investment and saving rates, probably because an inflation raises economic uncertainties. The population size (*pop*) has negative impacts on fiscal volatility due to insensitivities to shocks in large economies but ambiguous impacts on investment and saving rate. The trade openness (*top*) provides mixed results. The resource dependence (*nrr*) has positive effects on fiscal volatility and investment rate, which might reflect the possible existence of resource curse in resource-rich economies.

In summary, the estimation identifies the effectiveness of stabilization fund in reducing the volatility of government expenditure and primary balance and the effectiveness of investment fund in raising investment rate. It also confirms the facilitation of the fund's effectiveness under the combination between the fund's operation and high governance. These outcomes are consistent with the previous studies in the first and second categories (the arguments supporting the effectiveness of resource funds and the arguments in conditional supports with high governance and robust fiscal rules) in the literature of Section 2, in particular, with Bagattini (2011) and Sugawara (2014) in the effectiveness of stabilization fund. However, the largest contribution of this study's finding is demonstrating fund-specific evaluation and extracting the effectiveness of the funds according to their objectives, particularly, the effectiveness of investment fund in raising investment rate.

4. Concluding Remarks

This article aims to examine the effectiveness of natural resource funds in resource-rich countries according to the funds' objectives by an econometric method using panel data. This study's contribution is to demonstrate fund-specific evaluation. The study classifies the funds into three kinds by their objectives: stabilization fund, investment fund and saving fund, and then evaluates each fund's effectiveness by each criteria corresponding to each objective.

The econometric estimations identify the effectiveness of stabilization fund in reducing the volatility of government expenditure and primary balance and the effectiveness of investment fund in raising investment rate. They also confirm the facilitation of the fund's effectiveness under the combination between the fund's operation and high governance. For instance, the operation of stabilization fund reduces the volatility of government expenditure by 13.6 percent and its operation with high governance reduces it by 33.2 percent, and that investment fund operation pushes up the investment rate by 9.8 percent and its operation with high governance raises it by 46.8 percent.

The limitation of this study is that, although the effectiveness of investment fund is verified by an econometric estimation, its effectiveness should be supported by case studies in selected countries with the fund, and that the effectiveness of saving fund is not confirmed in this study due to the lack of samples. In future researches, evidence should be enriched to demonstrate the significance of investment and saving funds.

References

Allegret, J.P., Benkhodja, M.T., and Razafindrabe, T. 2018. Monetary Policy, Oil Stabilization Fund and the Dutch Disease, *GREDEG Working Paper*, No. 2018-06.

Auty, R. 1993. *Sustaining Development in Mineral Economies: The Resource Curse Thesis*, Oxford University Press: New York.

Bacon, R., Tordo, S. 2006. *Experience with Oil Funds: Institutional and Financial Aspects*, World Bank: Washington, D.C.

Baena, C., Sevi, B., and Warrack, A. 2012. Funds from non-renewable energy resources: policy lessons from Alaska and Alberta, *Energy Policy*, 51: 569-577.

Bagattini, G.Y. 2011. The Political Economy of Stabilisation Funds: Measuring their Success in Resource-Dependent Countries, *IDS Working Paper*, No. 356, Institute of Development Studies, University of Sussex, Brighton, United Kingdom.

Bortolotti, B., Fotak, V., and Hogg, C. 2020. Sovereign Wealth Funds and the COVID-19 shock: Economic and Financial Resilience in Resource-Rich Countries, *Working Paper Series*, No. 147, Centre for Applied Research on International Markets, Banking, Finance and Regulation, University of Bocconi.

Bulte, E.H., Damania, R., and Deacon, R.T. 2005. Resource intensity, institutions, and development, World Development, 33: 1029-1044.

Bruckner, M. 2010. Natural resource dependence, non-tradables, and economic growth, *Journal of Comparative Economics*, 38: 461-471.

Chalk, N.A., El-Arian, M.A., Fennell, S.J., Kireyev, A.P., and Wilson, J.F.1997. Kuwait: From Reconstruction to Accumulation for Future Generations. *Occasional Paper*, No. 150, International Monetary Fund. Washington, D.C.

Choi, I. 2001. Unit root tests for panel data, *Journal of International Money and Finance*, 20: 249-272.

Collier, P. and Hoeffler, A. 2005. Democracy and natural resource rents, *Working Paper*, No. GPRG-WPS-016. Department of Economics, Oxford University.

Corden, W.M., and Neary, J.P. 1982. Booming sector and de-industrialization in a small open economy, *Economic Journal*, 92: 825–848.

Crain, W.M., and Devlin, J. 2003. Nonrenewable Resource Funds: A Red Herring for Fiscal Stability?" *Paper presented at the annual meeting of the American Political Science Association*, August 27, Philadelphia, PA.

Davis, J., Ossowski, R., Daniel, J., and Barnett, S. 2001. Stabilisation and Saving Funds for Nonrenewable Resources, *IMF Occasional Paper*, No. 205.

Devlin, J., and Titman, S. 2004. Managing oil price risk in developing countries, *World Bank Research Observer*, 19: 119-139.

Dixit, A.K., and Newbery, D.M.G. 1985. Setting the Price of Oil in a Distorted Economy, *The Economic Journal*, 95: 71-82.

Eifert, B., Gelb, A., and Tallroth, N.B. 2002. The Political Economy of Fiscal Policy and Economic Management in Oil Exporting Countries, *The World Bank Policy Research Working Paper*, No. 2899.

Engel, E., and Valdés, R. 2000. Optimal Fiscal Strategy for Oil Exporting Countries, *IMF Working Paper*, No. 00/118.

Fasano, U. 2000. Review of the experience with oil stabilization and savings funds in selected countries, *IMF Working Paper*, No. WP/00/112.

Fleming, D.A., Measham, T.G., and Paredes, D. 2015. Understanding the resource curse

(or blessing) across national and regional scales: Theory, empirical challenges and an application, *Australian Journal of Agricultural and Resource Economics*, 59: 624–639.
Gelb, A.H. 1988. *Windfall Gains: Blessing or Curse?*, Oxford University Press: New York.
Gould, M. 2010. Managing manna from below: sovereign wealth funds and extractive industries in the Pacific, *Economic Roundup Issue*, No. 1, Commonwealth of Australia.
Gylfason, T., Herbertsson, T.T., and Zoega, G. 1999. A mixed blessing: Natural resources and economic growth, *Macroeconomic Dynamics*, 3: 204-225.
Harding, T., and Venables, A.J. 2013. The Implications of Natural Resource Exports for Nonresource Trade. *OxCarre (Oxford Centre for the Analysis of Resource Rich Economies) Research Paper*, No. 103.
Hartwick, J.M.N. 1977. Intergenerational equity and investing rents from exhaustible resources, *American Economic Review*, 66: 972-974.
Hausman, J.A. 1978. Specification Tests in Econometrics, *Econometrica*, 46: 1251-1271.
Hjort, J. 2006. Citizen funds and Dutch disease in developing countries, *Resource Policy*, 31: 183-191.
Hotelling, H. 1931. The Economics of Exhaustible Resources, The Journal of Political Economy, 39; 137–175.
Im, K.S., Pesaran, M.H., and Shin, Y. 2003. Testing for unit roots in heterogeneous panels, *Journal of Econometrics*, 115: 53-74.
IMF 2012. *Global Financial Stability Report: The Quest for Lasting Stability*, International Monetary Fund: Washington, DC.
Jensen, N., and Watchekon, L. 2004. Resource wealth and political regimes in Africa. Comparative, *Political Studies*, 37: 816-841.
Kalyuzhnova, Y. 2006. Overcoming the Curse of Hydrocarbon: Goals and Governance in the Oil Funds of Kazakhstan and Azerbaijan, *Comparative Economic Studies*, 48: 583-613.
Karl, T.L. 1997. *The paradox of plenty: Oil booms and petro-states (Vol. 26)*. University of California Press: California.
Kolstad, I., and Soreide, T. 2009. Corruption in natural resource management: Implications for policy makers, *Resources Policy*, 34: 214-226.
Le Borgne, E., and Medas, P. 2007. Sovereign Wealth Funds in the Pacific Island Countries: Macro-Fiscal Linkages, *IMF Working Paper*, No. 07/297.
Levin, A., Lin, C.F., and Chu, C. 2002. Unit root tests in panel data: Asymptotic and finite-sample properties, *Journal of Econometrics*, 108: 1-24.
Lücke, M. 2010. Stabilization and savings funds to manage natural resource revenues: Kazakhstan and Azerbaijan vs. Norway, *Kiel Working Paper*, No. 1652, Kiel Institute for the World Economy, Kiel.
Maddala, G.S., and Wu, S. 1999. A comparative study of unit root tests with panel data and a new simple test, *Oxford Bulletin of Economics and Statistics*, 61: 631-652.
Manzano, O., and Rigobon, R. 2008. Resource Curse or Debt Overhang, *National Bureau of Economic Research Working paper*, No. 8390, Cambridge, MA.
Merlevede, B., Schoors, K., and van Aarle, B. 2009. Russia from Bust to Boom and Back: Oil Price, Dutch Disease and Stabilisation Fund, *Comparative Economic Studies*, 51: 213-241.

Ossowski, R., Villafuerte, M., Medas, P., and Thomas, T. 2008. Managing the oil revenue boom: the role of fiscal institutions, *IMF Occasional Paper*, No.260.

Ouoba, Y. 2016. Natural resources: Funds and economic performance of resource-rich countries, *Resources Policy*, 50: 108-116.

van der Ploeg, F. 2007.*Africa and Natural Resources: Managing Natural Resources for Sustainable Growth*. Oxcarre, Oxford University and EUI: Florence.

van der Ploeg, F. 2010. Aggressive oil extraction and precautionary saving: coping with volatility, Journal of Public Economics, 94: 431-433.

van der Ploeg, F. 2011.Natural resources: curse or blessing?, Journal of Economic Literature, 49: 366–420.

Villafuerte, M., Lopez-Murphy, P., and Ossowski, R. 2010. Riding the Roller Coaster: Fiscal Policies of Nonrenewable Resource Exporters in Latin America and the Caribbean, *IMF Working Paper*, No. 10/251.

Ramey, G. and Ramey, V.A. 1995. Cross-Country Evidence on the Link between Volatility and Growth. *American Economic Review*, 85: 1138-51.

Ross, M.L. 2001. Does Oil Hinder Democracy?, *World Politics*, 53: 325-361.

Rosser, A. 2006. The Political Economy of the Resource Curse: A Literature Survey. *Working Paper*, No. 268. Institute of Development Studies (IDS) Centre for Future State.

Sachs, J.D. 2006. How to handle the macroeconomics of oil wealth?, Initiative for Policy Dialogue Working Paper Series, Chapter 6.

Sachs, J.D., and Warner, A.M. 1995. Natural resource abundance and economic growth, *National Bureau of Economic Research Working paper* No. 5398, Cambridge, MA.

Sachs, J.D., and Warner, A.M. 2001. Natural Resources and Economic Development: The Curse of Natural Resources, *European Economic Review*, 45: 827-838.

Sala-I-Martin, X., and Subramanian, A.A. 2003. Addressing the Natural Resource Curse: An Illustration from Nigeria, *IMF Working Paper*, WP/03/139.

Santos Silva, J.M.C., and Tenreyro, S. 2006. The log of gravity, *Review of Economics and Statistics,*, 88: 641-658.

Shabsigh, G., and Ilahi, N. 2007. Looking beyond the Fiscal: Do Oil Funds Bring Macro-economic Stability? *IMF Working Paper*, No. 07/96.

Sugawara, N. 2014. From volatility to stability in expenditure: stabilization funds in resource-rich countries, *IMF Working Paper*, No. WP/14/43. International Monetary Fund, Washington D.C.

Tsalik, S. 2003. *Caspian Oil Windfalls: Who will Benefit?*, Open Society Institute: New York.

Tsani, S. 2013. Natural resources, governance and institutional quality: The role of resource funds, *Resources Policy*, 38: 181-195.

Tsani, S. 2015. On the relationship between resource funds, governance and institutions: Evidence from quantile regression analysis, *Resources Policy*, 44: 94-111.

Usui, N. 2007. How effective are oil funds? Managing Resource Windfalls in Azerbaijan and Kazakhstan, *Asian Development Bank Policy Brief Series*, No. 50.

Table 1 List of Previous Studies

NRFs Effects	Descriptive Analyses	Quantitative Analyses
Favorable Effects	Bortolotti et al. (2020), Baena et al. (2012), Bagattini (2011), Lücke (2010), Fasano (2000), Chalk et al. (1997)	Tsani (2015 & 2013), Sugawara (2014), Bagattini (2011), Merlevede et al. (2009), Shabsigh & Ilahi (2007)
Favorable Effects with Institutions & Rules	Gould (2010), Le Borgne & Medas (2007), Usui (2007), Bacon & Tordo (2006), Hjort (2006), Kalyuzhnova (2006), Tsalik (2003), Engel & Valdes (2000), Fasano (2000)	Allegret et al. (2018), Sugawara (2014), Bagattini (2011), Crain & Devlin (2003)
No or Harmful Effetcs	Villafuerte et al. (2010), Devlin & Titman (2004), Eifert et al. (2002), Davis et al. (2001)	Ouoba (2016), Ossowski et al. (2008)

Source: Author's description

Table 2 List of Quantitative Studies

	Ouoba (2016)	Tsani (2013, 2015)	Sugawara (2014)
dependent variable	*economic growth*	*governance*	*gov. expenditure volatility*
funds	*	*	*
population	*	*	*
economic growth		*	*
inflation	*		*
resource dependence	*	*	*
trade or capital openness	*	*	*
governance	*		*
government size			*
financial market			*
export diversification			*
captal / FDI	*		
terms of trade	*		
political conflicts	*		
political institutions	*	*	*
language		*	
location			*
social & religous factors		*	
oil price			
oil export share			
Samples	28 resource rich countries	27 resource rich countries	68 resource rich countries
Methodology	Driscoll-Kraay, IV-2SLS, GMM	OLS, PCSE, Driscoll-Kraay, Quantile Regression	OLS, PCSE, fixed effect model, DID

	Bagattini (2011)	Ossowski et al. (2008)	Shabsigh & Ilahi (2007)
dependent variable	*fiscal perfromance indicators*	*primary balance & gov. expenditure*	*volatility of money, CPI, REER*
funds	*	*	*
population			
economic growth		*	*
inflation		*	
resource dependence		*	
trade or capital openness			
governance	*	*	
government size		*	
financial market			*
export diversification			
captal / FDI			
terms of trade			
political conflicts			
political institutions	*	*	
language			
location			
social & religous factors			
oil price		*	*
oil export share			*
Samples	12 countries with stabilization funds	21 oil exporting countries	15 oil exporting countries
Methodology	PCSE	OLS, fixed & random effect model, Arellano-Bond	OLS, fixed & random effect model

Source: Author's description

Table 3. List of Variables

Variables	Description	Sources
Dependent Variable		
g_exp	*General government total expenditure, percent of GDP, absolute value of the deviation from the period average*	WEO
g_pbl	*General government primary net lending/borrowing, percent of GDP, absolute value of the deviation from the period average*	
inv	*Total investment, percent of GDP*	
sav	*Gross national savings, percent of GDP*	
Explanatory Variables		
f_sta	*Stabilization fund dummy: taking a value of 1 if the fund exists in t-5*	
f_inv	*Investment fund dummy: taking a value of 1 if the fund exists in t-5*	
f_sav	*Saving fund dummy: taking a value of 1 if the fund exists in t-5*	
gdp	*Gross domestic product as constant prices, percent change, one lagged*	WEO
inf	*Inflation by average consumer prices, percent change, one lagged*	
pop	*Population by millions of persons, log term, one lagged*	
top	*Sum of exports and imports of goods and services, percent of GDP, one lagged*	WDI
nrr	*Total natural resources rents, percent of GDP, one lagged*	
gov	*Worldwide governance indicators (average), from -2.5 (weak) to 2.5 (strong)*	WGI
voa	*Voice and accountability*	
pos	*Political stability and absence of violence/terrorism*	
gve	*Government effectiveness*	
req	*Regulatory quality*	
rol	*Rule of law*	
cor	*Control of corruption*	

Notes: The data sources are shown as follows:

WEO: World Economic Outlook Databases, International Monetary Fund

WDI: World Development Indicators, World Bank

WGI: Worldwide Governance Indicators, World Bank

Source: Author's description

Table 4 Descriptive Statistics

Variables	Obs.	Median	Std. Dev.	Min.	Max
Dependent Variable					
g_exp	970	3.198	7.923	0.004	88.125
g_pbl	922	3.310	8.685	0.003	121.534
inv	941	14.026	14.043	0.003	121.534
sav	810	26.650	12.219	0.241	120.552
Explanatory Variables					
gdp	996	3.736	5.414	-30.000	28.082
inf	996	4.448	25.526	-6.564	428.117
pop	1,008	2.229	2.171	-4.711	5.599
top	879	74.676	36.248	0.785	220.407
nrr	946	14.186	14.617	0.026	87.577
gov	1,025	-0.341	0.763	-2.000	1.822
voa	1,025	-0.632	0.884	-2.259	1.738
pos	1,000	-0.200	1.004	-3.006	1.610
gve	1,002	-0.431	0.799	-2.308	2.081
req	1,002	-0.354	0.866	-2.363	1.816
rol	1,025	-0.532	0.865	-2.346	2.037
cor	1,002	-0.477	0.836	-1.681	2.294

Source: The author’s description

Table 5 List of Natural Recourse Funds

Countries	Name of Funds	Date
	Stabilization Funds	
Algeria	Revenue Regulation Fund	2000
Azerbaijan	State Oil Fund	1999
Bahrain	Bahrain Mumtalakat Holding Company	2006
Botswana	Revenue Stabilization Fund	1972
Cameroon	Stabilization Fund for Hydrocarbon Prices	1974
Chad	Revenue Management Plan	1999
Chile	Copper Stabilization Fund	1985
Colmbia	Oil Stabilization Fund	1995
Ecuador	Oil Stabilization Fund	1999
Ghana	Stabilization Fund	2011
Iran	Oil Stabilization Fund	1999
Kazakhstan	National Fund	2000
Kiribati	Revenue Equalization Reserve Fund	1956
Kuwait	General Reserve Fund	1960
Libya	Oil Reserve Fund	1995
Mauritania	National Fund for Hydrocarbon Reserves	2006
Mexico	Oil Revenues Stabilization Fund	2000
Mongolia	Fiscal Stabilization Fund	2011
Nauru	Phosphate Royalties Trust Fund	1968
Nigeria	Petroleum Trust Fund	1995
Oman	State General Reserve Fund	1980
Papua New Guinea	Mineral Resources Stabilization Fund	1974
Peru	Fiscal Stabilization Fund	1999
Qatar	Stabilization Fund	2000
Russian Federation	Stabilization Fund	2004
Sao Tomeand Principe	Oil Fund	2004
Saudi Arabia	Monetary Agency	1974
Sudan	National Revenue Fund	2004
Timor-Leste	Petroleum Fund	2005
Trinidad and Tobago	Interim Revenue Stabilization Fund	2000
Turkmenistan	Stabilization Fund	2008
Tuvalu	Trust Fund	1987
Venezuela	Macroeconomic Stabilization Fund	1998

Countries	Name of Funds	Date
	Investment Funds	
Angola	Oil for Infrastructure Fund	2011
Botswana	Pula Fund	1996
Brunei	Investment Agency	1983
Ecuador	Special Account for Social and Productive Investment, Scientific Development, and Fiscal Stabilization	2005
Ghana	Infrastructure Investment Fund	2014
Indonesia	Government Investment Unit	2006
Libya	Investment Authority	2006
Malaysia	Investment Authority	2008
Nauru	Phosphate Royalties Trust Fund	1968
Nigeria	Sovereign Investment Authority	2004
Oman	State General Reserve Fund	1980
Qatar	Investment Authority	2003
Timor Leste	Petroleum Fund	2005
United Arab Emirates	Investment Authority	1976
Venezuela	Macroeconomic Stabilization Fund	1998
Yemen	Social Development Fund	1997
	Saving Funds	
Gabon	Fund for Future Generations	1997
Kuweit	Reserve Fund for Future Generations	1952
Chile	Pension Reserve Fund	2006
Mongolia	Future Heritage Fund	2016
Norway	Government Pension Fund	1990

Source: Author's arrangements based on Tsani (2013), Sugawara (2014), and Sugawara (2014) and Ouoba (2016).

Table 6 Panel Unit Root Tests

	Levin, Lin & Chu		Fisher ADF		Fisher PP		Im, Pesaran & Shin	
	Int.	Int. & Tre.	Int.	Int. & Tre.	Int.	Int. & Tre.	Int.	Int. & Tre.
g_exp	-4.127 ***	-1.991 ***	207.9 ***	151.5 ***	266.9 ***	206.9 ***	-7.592 ***	-4.541 ***
g_pbl	-8.693 ***	-6.177 ***	264.5 ***	201.8 ***	367.2 ***	379.2 ***	-10.66 ***	-7.939 ***
inv	-6.945 ***	-5.893 ***	220.1 ***	185.1 ***	247.1 ***	252.8 ***	-8.635 ***	-6.916 ***
sav	-3.104 ***	-6.926 ***	118.3 ***	93.42 **	156.4 ***	74.65	-3.799 ***	-2.433 ***
gdp	-8.947 ***	-9.476 ***	274.9 ***	224.3 ***	290.0 ***	274.6 ***	-10.82 ***	-8.808 ***
inf	-26.19 ***	-16.62 ***	692.3 ***	434.7 ***	458.1 ***	707.2 ***	-17.93 ***	-13.55 ***
pop	-15.228 ***	-9.414 ***	284.4 ***	333.2 ***	119.1 ***	82.31	-0.961	0.759
top	-1.813 **	-1.805 **	113.2 ***	119.4 ***	108.9 ***	119.9 ***	-2.422 ***	-2.036 **
nrr	-3.133 ***	-2 393 ***	99.82 **	56.97	96.36 *	49.83	-2.758 ***	0.870
gov	-2.475 ***	-2 854 ***	117.3 ***	114.3 **	93.80	84.42	-1.616 *	-1.634 *
voa	-7.226 ***	-3.626 ***	193.4 ***	209.2 ***	80.48	74.67	-5.325 ***	-4.483 ***
pos	-2.617 ***	-5.980 ***	137.8 ***	176.5 ***	117.9 ***	130.0 ***	-3.425 ***	-6.106 ***
gve	-1.859 **	-5.018 ***	137.3 ***	147.4 ***	120.1 ***	115.6 ***	-2.217 **	-4.480 ***
req	-2.410 ***	-1.854 **	108.7 **	124.2 ***	99.59 *	85.52	-1.291 *	-2.537 ***
rol	-1.700 **	-1.739 **	108.2 **	129.8 ***	93.26	105.3 **	-1.585 *	-2.651 ***
cor	-2.383 ***	-1.881 **	99.59 *	116.8 ***	101.5 *	103.3 *	-1.337 *	-2.273 **

Note: *, **, *** denote the rejection of null hypothesis at the 90, 95, and 99% level of significance.
Sources: The author's estimation

Table 7 Correlation Matrix and Variance Inflation Factors

	gdp	*inf*	*pop*	*top*	*nrr*	*gov*
gdp	1.000					
inf	-0.059	1.000				
pop	-0.010	0.199	1.000			
top	0.110	-0.106	-0.519	1.000		
nrr	0.230	0.035	-0.198	0.200	1.000	
gov	-0.033	-0.293	-0.408	0.390	-0.189	1.000
voa	-0.065	-0.121	-0.116	0.045	-0.470	0.705
pos	0.040	-0.284	-0.665	0.502	0.112	0.787
gve	-0.037	-0.279	-0.248	0.382	-0.204	0.936
req	-0.045	-0.285	-0.226	0.328	-0.225	0.899
rol	-0.053	-0.284	-0.423	0.406	-0.122	0.964
cor	-0.025	-0.269	-0.297	0.349	-0.135	0.953
VIF	1.674	1.423	4.371	3.711	4.619	$7.305*10^6$

	voa	*pos*	*gve*	*req*	*rol*	*cor*
gdp						
inf						
pop						
top						
nrr						
gov						
voa	1.000					
pos	0.420	1.000				
gve	0.542	0.647	1.000			
req	0.572	0.562	0.903	1.000		
rol	0.592	0.734	0.915	0.863	1.000	
cor	0.601	0.699	0.915	0.836	0.953	1.000
VIF	$3.041*10^5$	$3.150*10^5$	$2.119*10^5$	$2.418*10^5$	$2.436*10^5$	$2.541*10^5$

Sources: The author's estimation

Table 8 Estimation Results on Stabilization Fund: Volatility of Government Expenditure

g_exp	(i) OLS_FE	(ii) PPML	(iii) PPML	(iv) PPML	(v) PPML	(vi) PPML	(vii) PPML	(viii) PPML
f_sta	-1.239 *	-0.758 ***	-0.133	-0.035	-0.466 ***	-0.316 **	-1.379 **	-0.736 ***
	(-1.679)	(-4.365)	(-0.211)	(-0.179)	(3.145)	(-2.148)	(-2.334)	(-4.016)
gdp	0.042	-0.071 ***	-0.085 **	-0.079 ***	-0.075 ***	-0.073 ***	-0.082 **	-0.070 ***
	(1.201)	(-4.546)	(-2.030)	(-4.998)	(-4.896)	(-4.726)	(-1.979)	(-4.532)
inf	-0.023 **	-0.013 ***	-0.001	-0.012 **	-0.014 ***	-0.016 ***	-0.016	-0.011 **
	(-2.192)	(-3.001)	(-0.104)	(-2.268)	(-3.078)	(-3.782)	(-1.389)	(-2.183)
pop	-1.975	-0.991 ***	-0.996 ***	-1.116 ***	-0.832 ***	-0.818 ***	-1.216 ***	-1.030 ***
	(-1.470)	(-20.823)	(-6.907)	(-21.524)	(-17.904)	(-17.010)	(-8.693)	(-20.889)
top	-0.005	-0.005 **	-0.015 **	-0.005 **	-0.001	-0.002	-0.004	-0.007 ***
	(-0.519)	(-2.140)	(-2.275)	(-2.262)	(-0.266)	(-0.746)	(-0.548)	(-3.345)
nrr	-0.002	0.034 ***	0.062 ***	0.058 ***	0.034 ***	0.030 ***	0.043 ***	0.047 ***
	(-0.099)	(5.568)	(3.751)	(9.973)	(5.529)	(4.877)	(2.993)	(7.837)
gov	-5.184 ***	-1.251 ***						
	(5.263)	(-10.611)						
voa			0.146					
			(0.451)					
pos				-1.300 ***				
				(-10.149)				
gve					-1.098 ***			
					(-10.060)			
req						-1.278 ***		
						(-12.274)		
rol							-1.267 ***	
							(-4.054)	
cor								-0.993 ***
								(-10.078)
*f_sta*gov*	-0.294	-1.091 ***						
	(-0.367)	(-4.666)						
*f_sta*voa*			-1.037 *					
			(-1.806)					
*f_sta*pos*				0.369 **				
				(2.106)				
*f_sta*gve*					-1.156 ***			
					(-5.811)			
*f_sta*req*						-0.662 ***		
						(-3.735)		
*f_sta*rol*							-2.274 ***	
							(-3.592)	
*f_sta*cor*								-0.970 ***
								(-4.599)
Observation	794	794	794	787	791	791	794	791

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: The Author's estimation

Table 9 Estimation Results on Stabilization Fund: Volatility of Primary Balance

g_pbl	(i) OLS_FE	(ii) PPML	(iii) PPML	(iv) PPML	(v) PPML	(vi) PPML	(vii) PPML	(viii) PPML
f_sta	-2.699 ***	-1.997 ***	-0.605 ***	-0.905 ***	-0.759 ***	-0.557 ***	-1.315 ***	-1.351 ***
	(2.973)	(-3.047)	(-3.728)	(-4.787)	(-5.654)	(-4.186)	(-6.926)	(-7.446)
gdp	-0.017	-0.116 **	-0.112 ***	-0.111 ***	-0.126 ***	-0.121 ***	-0.110 ***	-0.110 ***
	(-0.382)	(-2.501)	(-6.585)	(-6.453)	(-7.022)	(-6.713)	(-6.182)	(-6.114)
inf	0.008	-0.023 *	-0.010 ***	-0.010 ***	-0.015 ***	-0.015 ***	-0.012 ***	-0.012 ***
	(0.626)	(-1.723)	(-2.749)	(-2.626)	(-4.179)	(-4.587)	(-3.309)	(-3.470)
pop	1.213	-1.300 ***	-0.975 ***	-1.000 ***	-0.936 ***	-0.944 ***	-1.016 ***	-1.020 ***
	(0.729)	(-8.479)	(-21.444)	(-20.088)	(-20.613)	(-20.699)	(-21.789)	(-21.599)
top	0.043 ***	0.001	-0.008 ***	-0.007 ***	-0.003	-0.003	-0.005 **	-0.008 ***
	(3.179)	(0.130)	(-3.191)	(-2.882)	(-1.171)	(-1.153)	(-2.039)	(-3.091)
nrr	0.040	0.120 ***	0.118 ***	0.127 ***	0.115 ***	0.112 ***	0.117 ***	0.122 ***
	(1.258)	(7.287)	(15.696)	(19.965)	(17.287)	(16.466)	(17.988)	(18.577)
gov	-1.573	-0.241						
	(-1.284)	(-0.611)						
voa			-0.023					
			(-0.188)					
pos				0.022				
				(0.198)				
gve					-0.283 **			
					(-2.161)			
req						-0.427 ***		
						(-3.343)		
rol							-0.116	
							(-0.869)	
cor								-0.106
								(-0.843)
*f_sta*gov*	-2.298 **	-3.290 ***						
	(-2.243)	(-4.295)						
*f_sta*voa*			-0.688 ***					
			(-3.322)					
*f_sta*pos*				-0.681 ***				
				(-4.073)				
*f_sta*gve*					-1.193 ***			
					(-5.631)			
*f_sta*req*						-0.839 ***		
						(-4.290)		
*f_sta*rol*							-1.494 ***	
							(-6.266)	
*f_sta*cor*								-1.544 ***
								(-6.778)
Observation	765	765	765	758	762	762	765	762

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: The Author's estimation

Table 10 Estimation Results on Investment Fund

inv	(i) OLS_FE	(ii) PPML	(iii) PPML	(iv) PPML	(v) PPML	(vi) PPML	(vii) PPML	(viii) PPML
f_inv	1.029	1.559 ***	3.957 ***	2.415 ***	0.443	-0.261	0.933 *	0.793 *
	(0.819)	(3.280)	(7.680)	(5.072)	(0.966)	(-0.569)	(1.927)	(1.742)
gdp	0.134 **	0.108 ***	0.059 *	0.123 ***	0.111 ***	0.166 ***	0.123 ***	0.128 ***
	(2.363)	(3.130)	(1.932)	(3.616)	(3.130)	(4.630)	(3.506)	(3.623)
inf	0.021	0.006	0.036 ***	0.010	0.010	0.001	0.010	0.011
	(1.243)	(0.666)	(3.509)	(0.988)	(1.031)	(0.079)	(1.125)	(1.179)
pop	-1.091	-1.266 ***	-1.113 ***	-1.855 ***	-1.059 ***	-1.243 ***	-1.163 ***	-1.129 ***
	(-0.505)	(-10.866)	(-9.838)	(-14.806)	(-9.319)	(-10.581)	(-10.021)	(-9.643)
top	0.091 ***	-0.040 ***	-0.051 ***	-0.049 ***	-0.035 ***	-0.033 ***	-0.039 ***	-0.042 ***
	(4.962)	(-6.843)	(-8.581)	(-8.709)	(-6.004)	(-5.376)	(-6.554)	(-7.091)
nrr	-0.049	0.053 ***	0.062 ***	0.100 ***	0.062 ***	0.028 **	0.066 ***	0.062 ***
	(-1.238)	(4.107)	(4.443)	(8.338)	(4.828)	(2.187)	(5.250)	(4.901)
gov	0.440	-3.545 ***						
	(0.284)	(-15.111)						
voa			-2.742 ***					
			(-12.513)					
pos				-3.338 ***				
				(-14.644)				
gve					-2.581 ***			
					(-11.162)			
req						-3.031 ***		
						(-14.914)		
rol							-2.433 ***	
							(-11.060)	
cor								-2.471 ***
								(-12.412)
*f_inv*gov*	-2.020	5.916 ***						
	(-1.494)	(11.939)						
*f_inv*voa*			10.339 ***					
			(20.092)					
*f_inv*pos*				5.959 ***				
				(15.387)				
*f_inv*gve*					3.885 ***			
					(7.621)			
*f_inv*req*						2.415 ***		
						(5.064)		
*f_inv*rol*							3.710 ***	
							(7.507)	
*f_inv*cor*								4.068 ***
								(8.472)
Observation	780	780	780	773	777	777	780	777

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: The Author's estimation

Table 11 Estimation Results on Saving Fund

sav	(i) OLS_FE	(ii) PPML	(iii) PPML	(iv) PPML	(v) PPML	(vi) PPML	(vii) PPML	(viii) PPML
f_sav	-0.752	1.036	-0.910	0.426	1.200	1.807	1.743	1.650
	(-0.373)	(0.947)	(-0.851)	(0.277)	(1.119)	(1.617)	(1.559)	(1.533)
gdp	0.065	0.159 ***	0.125 ***	0.147 ***	0.172 ***	0.140 ***	0.201 ***	0.151 ***
	(1.156)	(3.549)	(2.740)	(3.258)	(3.814)	(3.020)	(4.410)	(3.320)
inf	-0.023	-0.035 ***	-0.069 ***	-0.053 ***	-0.031 **	-0.058 ***	-0.035 ***	-0.040 ***
	(-1.570)	(-2.990)	(-7.227)	(-4.979)	(-2.522)	(-4.945)	(-2.931)	(-3.324)
pop	1.204	1.614 ***	0.822 ***	1.807 ***	0.938 ***	0.863 ***	1.592 ***	1.767 ***
	(0.677)	(9.643)	(5.216)	(10.237)	(5.777)	(5.284)	(9.473)	(10.523)
top	0.087 ***	0.043 ***	0.080 ***	0.055 ***	0.031 ***	0.059 ***	0.040 ***	0.057 ***
	(4.697)	(5.799)	(11.677)	(7.689)	(3.962)	(7.780)	(5.341)	(7.706)
nrr	0.311 ***	0.543 ***	0.580 ***	0.466 ***	0.533 ***	0.507 ***	0.499 ***	0.507 ***
	(6.407)	(30.160)	(31.334)	(27.178)	(29.541)	(27.318)	(27.967)	(28.403)
gov	8.049 ***	7.170 ***						
	(5.525)	(20.621)						
voa			4.839 ***					
			(17.609)					
pos				4.605 ***				
				(17.779)				
gve					6.555 ***			
					(20.346)			
req						3.589 ***		
						(11.587)		
rol							6.322 ***	
							(19.839)	
cor								6.219 ***
								(21.036)
*f_sav*gov*	-2.741	-10.223 ***						
	(-2.278)	(-7.658)						
*f_sav*voa*			-5.740 ***					
			(-5.165)					
*f_sav*pos*				0.971				
				(0.195)				
*f_sav*gve*					-8.805 ***			
					(-7.587)			
*f_sav*req*						-5.254 ***		
						(-4.759)		
*f_sav*rol*							-9.674 ***	
							(-7.912)	-9.179 ***
*f_sav*cor*								(-8.788)
Observation	704	704	704	704	704	704	704	704

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: The Author's estimation

Table 12 Summary of Results

Dependent Var.	*WGI*	*Fund*	*Fund*WGI*
g_exp (OLS)	*gov*	*negative **	*negative*
	gov	*negative ****	*negative ****
	voa	*negative*	*negative **
	pos	*negative*	*positive **
g_exp (PPML)	*gve*	*negative ****	*negative ****
	req	*negative **	*negative ****
	rol	*negative **	*negative ****
	cor	*negative ****	*negative ****
g_pbl (OLS)	*gov*	*negative ****	*negative **
	gov	*negative ****	*negative ****
	voa	*negative ****	*negative ****
	pos	*negative ****	*negative ****
g_pbl (PPML)	*gve*	*negative ****	*negative ****
	req	*negative ****	*negative ****
	rol	*negative ****	*negative ****
	cor	*negative ****	*negative ****
inv (OLS)	*gov*	*positive*	*negative*
	gov	*positive ****	*positive ****
	voa	*positive ****	*positive ****
	pos	*positive ****	*positive ****
inv (PPML)	*gve*	*positive*	*positive ****
	req	*ngative*	*positive ****
	rol	*positive **	*positive ****
	cor	*positive **	*positive ****
sav (OLS)	*gov*	*negative*	*negative*
	gov	*positive*	*negative ****
	voa	*negative*	*negative ****
	pos	*positive*	*positive*
sav (PPML)	*gve*	*positive*	*negative ****
	req	*positive*	*negative ****
	rol	*positive*	*negative ****
	cor	*positive*	*negative ****

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: The Author's estimation