



Munich Personal RePEc Archive

# **Understanding Malaysian State Governments Fiscal Behavior: The Role of Intergovernmental Transfers**

Abdul Jalil, Ahmad Zafarullah and Abdul Karim, Noor  
Al-Huda

Universiti Utara Malaysia

2009

Online at <https://mpra.ub.uni-muenchen.de/25188/>  
MPRA Paper No. 25188, posted 20 Sep 2010 16:43 UTC

# Understanding Malaysian State Governments Fiscal Behavior: The Role of Intergovernmental Transfers

Ahmad Zafarullah Abdul Jalil, PhD\*  
Noor Al-Huda Abdul Karim, PhD\*\*

## Abstract

*As of late, several state governments in Malaysia have been identified as having serious difficulty in meeting their financial needs, to the extent of the government being qualified as on the verge of bankruptcy. One of the explanations put forward is that state governments have been acting irresponsibly in managing finances. Thus, the question that ensues is: why do state governments behave in such irresponsible manner fiscally and financially in the first place? In this paper, we relate the financial difficulties faced by these governments within the confines of the institutional and political environment currently in place within the country. We will examine one of the institutional features of the intergovernmental system in Malaysia – the intergovernmental grants systems. More precisely, there are two hypotheses that will be tested in this research.. First, federal transfers may stimulate more spending by state governments which leads them to increase spending beyond the means available to them. Second, financial problems may be the consequence of a state governments' incapacity to utilize tax capacities to the fullest, which in turn may be explained by the disincentives effects that are embedded (whether intended or not) within the transfer system.*

(Keywords: State Governments, Fiscal Behavior, Intergovernmental Relations).

---

\* Ahmad Zafarullah Abdul Jalil, PhD, [zafar@uum.edu.my](mailto:zafar@uum.edu.my), College of Arts and Sciences, Universiti Utara Malaysia

\*\* Noor Al-Huda Abdul Karim, PhD, [alhuda@uum.edu.my](mailto:alhuda@uum.edu.my), College of Law, Government and International Studies, Universiti Utara Malaysia

## Introduction

For the past few years, several state governments in Malaysia have been identified as having serious difficulty in meeting their financial needs to the extent of being qualified as on the verge of bankruptcy<sup>1</sup>. In this paper, we will try to relate the financial difficulties faced by these state governments within the institutional and political environment currently in place in the country. Our main assumption is that the dire financial situation of some state governments in Malaysia is the direct result of the way the intergovernmental system is organized within the country. More precisely, there are two hypotheses that we test in this research. First, federal transfers may stimulate more spending by state governments which lead them to increase spending beyond the means available to them. Second, financial problems may be the consequence of the state governments' incapacity to utilize tax capacities to the fullest, which in turn may be explained by the disincentives effects that are embedded (whether intended or not) within the transfer system.

Although the level of dependency of the state governments in Malaysia on federal transfers can be considered relatively low as it stood at less than 30% of their total revenue, this cannot be interpreted as a sign that the country is free from problems usually associated with countries which are highly dependant on federal transfers (see for example Rodden 2005). According to Bird (1998), it doesn't matter whether the transfer constitute 90 or 10% of the subnational governments' revenue but what is important is whether the transfer system is properly designed in the sense that it makes the subnational governments accountable of their actions both to the citizens and to the federal governments. In our case, we are concerned with the issue of whether the transfer system in Malaysia is designed in such a way that it renders the state governments to be less efficient in their fiscal behavior.

The paper is organized as follows. In the first section, we will briefly review the studies on the impact of intergovernmental on subnational governments. In section two, we will present the intergovernmental grant system as it is practiced in Malaysia currently. Our empirical methodology will be presented in section three and the results will be analyzed in section four. Finally, section five concludes.

---

<sup>1</sup> In the report published by the Auditor-Generals Office in 2004, it was revealed that 7 out of 13 states in <Malaysia were “*at the verge of bankruptcy* » due to financial situations that were judged as insufficient as compared to their financial obligations and commitments. It was also revealed that these seven states have accumulated more than RM 2 billions (USD 570 million) of arrears in loan payments to the federal government.

## **1. Literature Review: The Effects of Intergovernmental Transfers on Local Government Behavior:**

If it is a common place in fiscal decentralization literature to consider the existence of a relationship between transfers and fiscal effort, there is still no consensus regarding its direction or magnitude. The available empirical evidence is not conclusive and in some cases, it is contradictory (Litvack, Ahmad et al. 1998). Most of the analyses of the effect of transfers on fiscal efforts are based on descriptive statistics like comparing the evolution of tax collection and intergovernmental transfers (Cabrero and Orihuela 2000). On the other hand, the use of econometric models has been limited by data availability and has been concentrated in developed countries such as the United States, Canada and Germany (Gramlich 1987a; Bird 1994).

In the case of Latin American countries, Bird (1994) finds evidence of a strong correlation between transfers and local expenditure reductions in Colombian transfer programs. He concludes that receptor communities reduced their fiscal effort due to transfers. This result is consistent with Correa and Steiner (1999) who find evidence of “fiscal apathy” at the sub-national level in Colombia. Their estimates suggest that 96% of transfers are used to reduce local taxes and only 4% is allocated to increase local expenditures. Nevertheless, these results are not robust in regards to the changes in the time span under analysis. For instance, Garzón (1997) examines the period before and after the increase of transfers (1986 and 1996). He does not find evidence of a reduction in general tax collections among Colombian municipalities. Chaparro et al (2004) examines fiscal data for a large number of Colombian municipalities for the 1985-1999 period with an objective to describing the effects of the transfer system on horizontal balance among municipalities. According to the authors, the correlation between aggregate taxes and transfers cannot be construed as evidence of a causal relationship between the two, nor can it indicate how local revenues would respond if transfers were reduced in the future. This is due to the fact that local revenues may have increased because of other decentralization reforms that were contemporaneous with, but otherwise unrelated to, the increase in transfers. Consequently, Chaparro et al (2004) used an approach that allows for the possibility that per capita tax revenues vary from year to year in all municipalities, and consistently differ among municipalities, in ways that are unrelated to the effects of the transfers. In effect, their estimate of the effect of transfers on revenues, measures the impact of changes in the transfers received by one municipality, relative to others at a given point in time, on relative municipal tax revenues. Chaparro et al (2004) conclude that there is some evidence that transfer growth has discouraged tax efforts by the municipalities, even in the case of formula-driven *Participaciones Municipales* (PM) which should not in itself create a soft budget constraint problem. The current system of decentralization in Colombia, according to the authors, act as an impediment in the mobilization of local fiscal resources. More recently, Aragon and Gayoso (2005) examine the relationship between intergovernmental transfers and local fiscal efforts using an empirical model with data from local Peruvian governments. The paper exploits a quasi experiment and uses panel data in order to address any identification problems due to non-random transfer allocation and the presence of omitted variables. Indeed, in 2001, an additional transfer (“*asignación adicional*”) was conferred to Peruvian local governments receiving a minimum level of Foncomun (“*Fondo de Compensación Municipal*” or Municipal Compensation Funds) regardless of local tax collection or total expenditures. Participation in this program can

be used as an instrumental variable since it explains increases on transfers but it is not correlated to local tax collection. These results confirm the existence of a negative relationship between transfers and local fiscal efforts in Peru. Aragon and Gayoso (2005) also found that the effect of transfers on local efforts decrease with the level of per capita expenditure of the local government. The reduction of fiscal efforts is higher among local governments with lower levels of expenditures. As long as expenditure levels increase, the effects tends to disappear.

In their studies on the tax efficiency of 15 major states in India, Jha, et al. (2000) argue that in India, historically, tax efficiency has played a relatively minor role in resource transfers from the central government to the state and much of the transfer is made on the basis of need and backwardness characteristics of the recipient states. However, the empirical results show that that intergovernmental grants tend to be negatively correlated with tax efficiency. The higher the central grants, as a proportion of total state expenditure, the lower the tax efficiency. They also found that this effect works both directly through the variable “central grants as a proportion of total state expenditures” and indirectly through the interaction of this variable with other variables (namely state domestic products and the proportion of agricultural income to state domestic products). Rajamaran and Vashista (2000) examine the impact of state-local grants on the tax efforts of rural local governments (panchayats) for the Kerala state using data for 1993-1994. Their results show that a greater and more uniform negative impact on tax efforts of lump sums ‘untied’ grants (which was a lump sum amount of around Rs 2 lakh annually, designed to add to panchayat resources for any purpose of their choosing) that are predictable and unvarying than for a more widely defined grants total that includes components with year-to-year variability. The results show that an increase in the untied grant to panchayats by one rupee reduces own tax revenues in 12 out of 14 districts by more than one rupee, and in eight of these by more than two rupees. Reverse causality is ruled out with the single exception of Malapuram district. The authors conclude that the reduction in own tax revenue observed in the Kerala panchayat is mainly the result of a selective slackening of tax effort.

It is noteworthy to mention here that there is strong interest on this issue in Latin America which consequently has led to the publication of a number of studies in the Spanish Language. A summary of these studies can be found in Aragon and Gayoso (2005). We will now turn our attention to the fiscal arrangements in Malaysia.

## **2. Fiscal Arrangements in Malaysia**

There are essentially three forms of intergovernmental grants in Malaysia: Tax Sharing Grants, General Purpose Grants and Specific Purpose Grants.

### **2.1. Tax sharing grants**

The grants are established under the Article 110(3) of the Federal Constitution, the Assignment of Revenue (Export Duty on Iron Ore) Act 1962 & the Assignment of Export Duty (mineral Ores) Act 1964. According to the Article, 10% of the revenues collected by the Federal government from export duties on tin, iron and minerals ores need to be allocated to the producing states.

## **2.2. General Purpose grants**

### **2.2.1. Capitation grant**

The grant is established under the Article 109(1)a of the Federal Constitution with an objective of assisting state government in meeting financial requirements. The grants are not subject to any spending restrictions or tax effort requirements. The amount given is based on the population determined by the population census if the last census was taken one year before the beginning the financial year or on the annual population projection calculated as of the population census. One of the rationales behind the introduction of this new rate is to achieve fairer distribution for the poorer states assuming that the less populous states are relatively poor states.

### **2.2.2. Revenue Growth Grant**

The grant is established under the Revenue Growth Grant Act 1977 & Revenue Growth Grant Act (Amended) 1980. The grant was based on the premise that state governments should also benefit from the growth of federal government revenue. The grants are payable to the state governments if the total revenue of the Federal government after deducting tin duties and taxes raised under the Road Traffic Ordinance 1958 increases by more than 10% in a particular year over the previous year. The grants are however subject to a maximum of RM150 million (originally 100 million). The distribution formula of the RM 150 million is as follows

### **2.2.3. Special grants**

Under the article 112c(1)(a) of the Federal Constitution, special grants are allocated to the states of Sabah and Sarawak. The objective of these grants is to equalize the standard of services of the two states to that of the other states in Peninsular Malaysia.

Special grants are also allocated to Selangor which amount to RM 18 305 637.66 millions in lieu of revenues losses due to the acquisition of Kuala Lumpur (this is based on the revenue collected in 1974) and to Kedah with an amount of RM10,000 per annum according to 1869 agreement for the lands handed over to Penang.

### **2.2.4. State Reserve Fund grants**

The grants are established under the Article 109(6) of the Federal Constitution. The grants are sourced from the State Reserve Fund on an ad hoc basis. The main purpose of the fund when it was established in 1958 was to supplement the general revenue of state government facing current account deficits.

### **2.2.5. Contingencies fund grant**

Established under Article 103 of the Federal Constitution, the grant was intended to provide advances in order to meet urgent and unforeseen operating expenditures for which no other provisions exist, pending Parliament approval on the required allocation.

### **2.2.6. State Advance Fund grant**

The grants were created to provide cash advance to state governments facing cash flow problems. The fund was established in 1981. It renders immediate assistance to state governments, particularly those with limited financial resources in the form of cash advances.

## **2.3. Specific Purpose grants**

### **2.3.1. State Road grant**

The grant is established under the Article 109(1)(b) of the Tenth Schedule, Part two of the Federal Constitution. The objective of the grant is to assist State governments in maintaining state roads, municipal roads, roads to low cost housing areas and back lanes.

### **2.3.2. Economic Development grants**

The objective of the grants is to allocate more funds to less developed states to reduce economic and social disparities as well as to promote state development in line with the National Economic Plan. The share of each state is determined by the Federal government with the cooperation of states EPU based on socio-economic indicators.

### **2.3.3. Service Charge grant**

It is established under the Article 80(5) of the Federal Constitution and the National Finance Council in 1978 that concerning investments projects of the state governments,

### **2.3.4. Cost Reimbursement grant**

The grant is in support of specific programs in areas of joint responsibility between the federal and state governments. The reimbursement is 100% of the development expenditure for federally approved agriculture, veterinary, works and drainage projects. Meanwhile, for the operating expenditure of the state drainage, veterinary and welfare department the reimbursement rate is only 50% of the expenditure.

### **2.3.5. Grant to religious schools and institutions**

Since 1956 a special grant was created under the purview of the Ministry of Education to assist any registered religious school (with student equal or more than 35) not maintained by the Ministry of Education under the Education Act of 1961 or by the State government.

### 3. Econometric Estimations

#### 3.1. Methodology

The correlation between tax collection (a proxy for fiscal effort) and transfers cannot be construed as evidence of a causal relationship, nor can it indicate how subnational governments would respond in term of fiscal efforts exerted if transfers were reduced in the future. This is due to the facts that transfer allocations are not a random process and local tax collections may have increased because of other relevant but non-observable variables that were contemporaneous with, but otherwise unrelated to, the increase in transfers. In any case, simply regressing local tax collection and transfers will produce inconsistent estimates. In order to avoid this problem, some authors have resorted to the use of specific events as instruments for federal transfers<sup>2</sup>.

For want of such an event in Malaysia, we propose the use of a completely different method, namely the stochastic frontier analysis. More specifically we will use the Battese and Coelli (1995) model. However, it should be noted that by choosing this method, we will provide evidence as to the impact of intergovernmental grants on tax efficiency instead of on fiscal effort. Still, the two notions are very closely related to each others and to a certain extent can be used interchangeably. Indeed, a stylized interpretation of inefficiency is that it captures the “inability” or the “laziness” of managers (Syrjänen et al. 2006). Thus, in this research, inefficiency is interpreted as the lack of effort of state governments in collecting taxes.

#### 3.2. The Stochastic Frontier Production

The stochastic frontier production function was independently proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and van de Broeck (1977). The original specification involved a production function specified for cross-sectional data which had an error term which had two components, one which accounts for random effects and the other which accounts for technical inefficiency. This model can expressed in the following form

$$Y_i = X_i\beta + (v_i - u_i), \quad (\text{eq. 1})$$
$$i = 1, \dots, N$$

Where  $Y_i$  is the production (or the logarithm of the production) of the  $i$ -th firm  $X_i$  is a  $k \times 1$  vector of (transformation of the) input quantities of the  $i$ -th firm.  $\beta$  is a vector of unknown parameters. The  $v_i$  are random variables which are assumed to be iid  $N(0, \sigma_v^2)$  and independent of the  $u_i$  which are non-negative random variables which are assumed to account for technical inefficiency in production and are often assumed to be iid  $N(m_{it}, \sigma_u^2)$ .

---

<sup>2</sup> For example, in their study of the effects of federal transfers on fiscal efforts in Peru, Aragon and Garyoso (2005) exploit the introduction of special transfers in 2001. Similarly, Chapparo et al. (2004) utilize the 1993 reforms of the Colombian transfer system in order to examine the causal relationship between transfers and fiscal efforts.

This original specification has been used in a vast number of empirical applications over the past two decades. The specification has also been altered and extended in a number of ways. Battese and Coelli (1992) propose a stochastic frontier production function for panel data which has firm effects which are assumed to be distributed as truncated normal random variables, which are also permitted to vary systematically with time. The model may be expressed as

$$\begin{aligned} Y_{it} &= X_{it}\beta + (v_{it} - u_{it}), \\ i &= 1, \dots, N, t = 1, \dots, T. \end{aligned} \quad (\text{eq. 2})$$

where  $Y_{it}$  is the logarithm of the production of the  $i$ -th firm in the  $t$ -th period  $X_{it}$  is a  $k \times 1$  vector of (transformation of the) input quantities of the  $i$ -th firm in the  $t$ -th time period.  $\beta$  is as defined earlier. The  $v_{it}$  are random variables which are assumed to be iid and independent of

$$u_{it} = u_i e^{-n(t-T)} \quad (\text{eq. 3})$$

Where the  $u_i$  are non-negative random variables which are assumed to account for technical efficiency in production and are assumed to be iid. as truncation at zero of the  $N(\mu, \sigma_u^2)$  distribution ;  $n$  is a parameter to be estimated.

A number of empirical studies have estimated stochastic frontiers and predicted firm-level efficiencies using the estimated functions and then regressed the predicted efficiencies upon firm-specific variables (such as managerial experience, ownership characteristics, etc) in an attempt to identify some of the reasons for differences in predicted efficiencies between firms in an industry. This has long been recognized as a useful exercise, but the two-stage estimation procedure has also been recognized as one which is inconsistent in its assumptions regarding the independence of the inefficiency effects in the two estimation stages. The two-stage estimation procedure is unlikely to provide estimates as efficient as those that could be obtained using a single-state estimation procedure. This issue was addressed by Kumbhakar, Ghosh and McGukin (1991) and Reifschneider and Stevenson (1991) who propose stochastic frontier models in which the inefficiency effects ( $u_i$ ) are expressed as an explicit function of a vector of firm-specific variables and a random error. Battese and Coelli (1995) propose a model which is equivalent to the Kumbhakar, Ghosh and McGukin (1991) specification, with the exceptions that allocative efficiency is imposed, the first-order profit maximizing conditions removed, and panel data is permitted. The Battese and Coelli (1995) model specification may be expressed as

$$\begin{aligned} Y_{it} &= X_{it}\beta + (v_{it} - u_{it}), \\ i &= 1, \dots, N, t = 1, \dots, T. \end{aligned} \quad (\text{eq.4})$$

where  $Y_{it}$ ,  $X_{it}$  and  $\beta$  are as defined earlier. The  $v_{it}$  are random variables which are assumed to be iid  $N(0, \sigma_v^2)$ . and independent of the  $u_{it}$  which are non-negative random variables which are assumed to account for technical inefficiency in production

and are assumed to be independently distributed as truncations at zero of the  $N(m_{it}, \sigma_u^2)$ .distribution where

$$M_{it} = Z_{it}\alpha \quad (\text{eq. 5})$$

Where  $Z_{it}$  is a  $p \times 1$  vector of variables which may influence the efficiency of a firm and  $\alpha$  is an  $1 \times p$  vector of parameters to be estimated.

### 3.3. Data Specification

The main data used in this research is sourced from Malaysian state governments' financial statements which are published and made public by the government on a yearly basis. Our data covers the period of 1980 to 2003 which means that we have a total of 312 observations. Strictly based on data availability, our measure of tax efforts will be proxied by the amount of tax actually collected by the state<sup>3</sup>.

Although it is highly desirable to have a measure of tax rate included in our estimation of tax efficiency, we could not do so due to technical and data constraints. The two main fiscal resources of the state government are from land as well as forestry resources. In the case of taxes on land, the rates not only varied across states, but they also varied across the type, use and location of land. As for forest-based taxes, the rates vary according to the type, the circumference, and the age of the tree. Thus, it will be very difficult to come up with a single rate that can summarize all the rates that are being used. As such, we decided to not include the tax rate in our estimation and replace it instead with the following three variables: the proportion of forest area in order to represent the revenues derived from the forestry resources, the rate of urbanization and the rate of agricultural activities in order to represent land-based revenues. We also include the state gross domestic product in order to represent the level of economic activity in each state. Total population is also included since populous states may have an upper hand in terms of the amount of taxes collected. Finally, time trends are introduced using the variables time and time square.

Inefficiencies are modeled as functions of other exogenous variables. These variables are observed factors that may explain differences in technical efficiency across state governments in Malaysia. The efficiency level of state governments in tax collection will in part be determined by the quality of the state apparatus. State governments that are equipped with state-of-the-art machinery and qualified personnel are more likely to be able to monitor tax collection more efficiently and use due diligence in the case of fraud. However, we do not have any data that reflects the quality of the state apparatus. Nevertheless, we believe that the latter, is in part, determined by the level of the development of the state. Assuming that there is a minimum level of waste and corruption, wealthier states should be able to invest more in modern and state-of-the art

---

<sup>3</sup> According to Besfamille and Sanguinetti (2004), although tax revenue is an accurate and observable variable, one can hardly say that it is a good estimate of tax efforts. The reason is for a given region in a given time, tax revenue are affected by a myriad of potential variables, outside the control of local governments (like idiosyncratic shocks to some specific tax bases) which are seldom well controlled for estimates of tax capacity.

equipment in order to upgrade and improve state machinery. Furthermore, since wealthier states have better amenities and facilities, they are more likely to attract qualified professionals to work for them. Thus, we will retain the level of GDP in order to control for the effects of the quality of state apparatus on tax efficiency.

It can also be argued that states with smaller land area will be able to administer and collect taxes more efficiently than states with a more vast area. On the other hand, land area will not pose any problems in term of tax collection if the state government is staffed with qualified personnel and equipped with machinery of the latest technology. To control for these two effects, we will include in our estimation the land area of a state as well as its interaction with the GDP. Finally in order for us to test for the effects of intergovernmental grants on tax efficiency, we include in our regression the share of grants in the state governments total expenditures. Table 1 provides the descriptive statistics of the variables described above.

**Table 1. Descriptive Statistics**

	<b>Mean</b>	<b>Standard Errors</b>	<b>Min</b>	<b>Max</b>
<b>Own Revenues (RM'000)</b>	549.63	358.31	24.64	1790.63
<b>Forest area (km2)</b>	14911.39	24252.63	66.08	86368.30
<b>Urbanization rate (%)</b>	40.57	14.30	32.04	80.00
<b>Agricultural activities (km2)</b>	218654.38	188207.19	31937.00	1070349.00
<b>GDP (RM '000)</b>	10.936	5.950	3.219	37.110
<b>Population ('000)</b>	1355.86	754.88	209.10	4498.10
<b>Grant share (%)</b>	0.31	0.20	0.02	0.81
<b>Size (km2)</b>	25374.07	34341.67	795.00	124450.00

### 3.4. Empirical Specification

Following Battese and Coelli (1995), the frontier is defined by

$$TA_{it} = \exp(X_{it}\beta + (v_{it} - u_{it})) \quad (\text{eq. 6})$$

Where  $TA_{it}$  denotes real total own tax revenues of state  $i$  in year  $t$ ,  $X_{it}$  represents a  $(1 \times K)$  vector of values, which are functions of tax capacity factors, including time for the  $i$ -th state in the  $t$ -th year, the  $v_{it}$  are assumed to be independently and identically distributed random error terms which have normal distribution with zero mean and standard deviation  $\sigma_v$ , the  $u_{it}$  are non-negative unobservable random variables (with standard deviation  $\sigma_u$ ) associated with the inefficiency of tax collection, such that, given the  $X_{it}$ , the observed level of tax collection falls short of potential.

Concurrently with the stochastic frontier, then, we estimate

$$U_{it} = Z_{it}\delta + Z_{it}^*X_{it}\delta' + W_{it} \quad (\text{eq. 7})$$

where  $Z_{it}$  is a  $(1 \times M)$  vector of explanatory variables, including time, associated with the technical efficiency effects,  $\delta$  is a  $(M \times 1)$  vector of unknown parameters to be estimated,  $\delta'$  is a vector of parameters associated with the interaction terms.

$Z_{it}^*X_{it}$  and  $W_{it}$  are unobservable random variables assumed to be independently distributed, obtained by truncation of the normal distribution with mean zero and variance,  $\sigma^2$ , such that the  $U_{it}$  is nonnegative.

Given the specification of the model, the hypothesis that the technical inefficiency effects are not random is expressed by  $H_0: \gamma = 0$ , where  $\gamma = \sigma_u^2 / \sigma^2$  and  $\sigma^2 = \sigma_u^2 + \sigma_v^2$ . Further, the hypothesis that the technical inefficiency effects are not influenced by the level of explanatory variables in equation (2) is examined by testing the significance of  $\delta$  and  $\delta'$ . The estimation used Maximum Likelihood methods with the Frontier 4.1 software.

## 4. Results

### 4.1. Baseline regressions

Relative efficiency can be measured by applying stochastic frontier techniques to individual annual samples, and to the total sample as a panel, but in many cases efficiency differences are a function of inadequate models and data, even when the frontier is stochastic. These two potential difficulties are directly addressed here. First, in many cases, a model error is likely because the functional form fitted is usually the Cobb Douglas, which is highly restrictive. Thus, the adequacy of the Cobb Douglas form should be tested against a flexible functional form, such as the translog. Second, data

error is inevitable where a model essentially representing economic production employs accounting data. However, apart from measurement error embodied in the available variables, failure to adjust for variable omissions and inappropriate aggregation is the norm rather than the exception. In addition, a third problem has been highlighted by Smith (1997), who has shown that inefficiency levels, or choice of frontier over the average production function depend on both the functional form and the level of aggregation, even if there are no missing variables. For all these reasons, inefficiencies need to be treated with a degree of caution and appropriate tests are required in order to select the correct model. This problem has been addressed by Battese and Coelli (1995). Their inefficiency model, in which the efficiency differences are simultaneously estimated from the stochastic frontier and explained by further variables, incorporates tests that choose between functional forms and between frontier and average models. The method of maximum likelihood is used to estimate the unknown parameters, with the stochastic frontier and the inefficiency effects estimated simultaneously. A number of related models can be tested, following the estimation.

The first test is the selection of the functional form, where the null hypothesis is that the Cobb-Douglas is an adequate representation of the data. The functional form of the stochastic frontier was determined by testing the adequacy of the log-linear model relative to the less simplistic translog, which includes cross products and square terms to allow for interactions and non-linearities in the data. The results of our test point to the rejection of the null hypothesis. We will thus adopt the translog specification<sup>4</sup>.

The next test was to determine whether this is indeed a frontier model and not simply a mean response function (MRF) or OLS. A weak criterion is a t-test on the estimated parameter,  $\gamma = \sigma_u^2/\sigma^2$ , which is bounded by zero and one. If  $\gamma = 0$ , technical inefficiency is not present; hence, the null hypothesis is that  $\gamma = 0$ , indicating that the mean response function (OLS) is an adequate representation of the data. The closer this is to unity, the more likely it is that the frontier model is appropriate. The results of LR tests of the hypothesis show that the technical efficiency effects are not simply random errors.

Finally, the power of the LR test is increased by testing the dual null hypothesis that both the frontier parameter and all the inefficiency effects are jointly zero  $\gamma = \delta_i = 0$ , for all  $i$ , meaning that neither the constant term nor the inefficiency effects are present in the model. Since  $\gamma$  takes values between 0 and 1, any LR test involving a null hypothesis which includes the restriction that  $\gamma = 0$  has been shown to have a mixed  $\chi^2$  distribution, with appropriate critical values (Kodde and Palm, 1986). The results points to the rejection of the null-hypothesis and suggest that the traditional production function is not an adequate representation of the data.

The results of our frontier estimation are summarized in Table 2. In column A, the distribution is assumed to be half normal while in column B, a truncated normal distribution is assumed. These maximum likelihood estimators of the translog coefficients are not informative. Rather, the elasticities for each of the four inputs, calculated from these results, at the variable means, are of interest. These elasticities with respect the inputs,  $x_j$ , for the translog is

---

<sup>4</sup> In order to discriminate between the Cob-Douglas and the Translog specification, we test the hypothesis  $H_0 = \beta_{jk} = 0$  for  $j \geq k = R, NR, E, P$  by the test of likelihood ratio:  $-LR = -2\{\ln [L(\text{Cobb-Douglas})] - \ln [L(\text{Translog})]\}$ .

$$\xi_j = \frac{\partial \ln(y_i)}{\partial \ln(x_{ji})} = \beta_j + \sum_{j=1}^4 \beta_{jh} \ln(x_j) \quad (\text{eq. 8})$$

These estimates can be expressed as

$$\xi_j = \lambda_j \hat{\theta} \quad (\text{eq. 9})$$

where  $\hat{\theta}$  is the full vector of the maximum likelihood estimators of the parameters and  $\lambda_j$  is a row vector of the same dimension, which has zero entries everywhere, except when corresponding to the elements of  $\theta$  involving  $\beta_j$  and  $\beta_{jh}$ . The reported standard errors of the elasticities are

$$\hat{V}(\lambda_j \hat{\theta}) = \lambda_j \hat{V}(\hat{\theta}) \lambda_j' \quad (\text{eq. 10})$$

where  $\hat{V}(\hat{\theta})$  is the estimated covariance matrix for  $q$ . The elasticities are reported in table 3.

The parameter of our frontier models indicates that for the first model, only the elasticity of GDP is found to be significant. As for our second model, none of the elasticities are found to be significant.

The results of estimates of variables on the efficiency level are presented in table 4. We are particularly interested in the effects of federal grants on state governments' tax efficiency. The results show that the share of grants in the state governments' total expenditure has a positive impact on the level of inefficiency. In other words, the higher the share of federal grants of total state expenditure, the lower the tax efficiency. The result is robust to the change in distribution. As for the interaction term between grants and GDP, the estimates are significant only in the case of a truncated normal distribution. Also, the magnitude of the coefficient is rather small. These results imply that the intergovernmental grants system in Malaysia is not without consequence on the fiscal behavior of state governments. Although at first sight, the system may not seem to have any bearing on the fiscal behavior of state governments, our results show that somehow its implementation has resulted in the state governments being less efficient in tax collection.

As for other variables, we found that in model A, size is associated with less inefficiency. This may be due to the fact that states with vast area usually have a vast forest area and since forest based taxes are relatively easier to administer as compared to other taxes (especially land taxes), these states are found to be more efficient than smaller states.

In Model B, we found that GDP is positively associated with tax inefficiency, which contrary to our expectations, implies that wealthier states tend to be less efficient. It is also found that the effect of GDP on inefficiency levels is attenuated by the size of the state.

The estimates of efficiency levels for each state for the period under study are presented in Figure 1. The results show that with the exception of two states, the level of tax efficiency of state governments in Malaysia is rather low. During the entire period under study, their level of efficiency has never surpassed the 20% level. The fact that there is a low level of efficiency is nevertheless not really that surprising, especially given the huge amounts of tax arrears that are yet to be collected by state governments.

The estimates also show that there is a stark contrast between the performance of states situated in Peninsular Malaysia and the two Borneo states of Sabah and Sarawak. Indeed, these two states are found to have a relatively higher level of efficiency as compared to the rest of the country. It is also noteworthy to mention that the efficiency levels of these two states are found to be more volatile. In comparison, the efficiency level of the rest of the states fluctuated only within the 0 to 20% band throughout the whole period.

**Table 2. Frontier Estimation Results (full sample)**

	Model A		Model B	
	Coefficients	Standard Errors	Coefficients	Standard Errors
Forest	-1.1026	0.8118	-0.5671	0.8275
Forest <sup>2</sup>	0.0141	0.0222	0.0073	0.0276
Urbanization	-2.7961	1.8465	-3.6273***	0.9644
Urbanization <sup>2</sup>	0.2775	0.3694	0.3017	0.3283
Agriculture	0.8303	0.6189	1.2362*	0.6795
Agriculture <sup>2</sup>	-0.0398**	0.0175	-0.0522***	0.0233
GDP	-4.7509***	1.4956	-3.9290***	0.9526
GDP <sup>2</sup>	-0.6597*	0.3759	-0.7948	0.5186
Population	5.3438***	0.9265	4.1761***	0.8887
Population <sup>2</sup>	-0.4719	0.2918	-0.4031	0.3683
Time	-0.0423	0.0954	-0.0268	0.1413
Time <sup>2</sup>	-0.0009	0.0008	-0.0004	0.0017
Forest *Urbanization	0.2098	0.1459	0.1524	0.1788
Forest *Agriculture	0.0125	0.0305	0.0166	0.0363
Forest *GDP	-0.0573	0.1283	-0.1108	0.1679
Forest *Population	0.0484	0.1479	0.0389	0.1713
Forest *Time	-0.0115*	0.0064	-0.0088	0.0084
Urbanization*Agriculture	0.0462	0.1154	0.0695	0.1361
Urbanization*GDP	1.6035***	0.5644	1.7365***	0.6021
Urbanization*Population	-1.1773**	0.5099	-1.1475**	0.5711
Urbanization*Time	-0.0364	0.0284	-0.0438	0.0345
Agriculture*GDP	-0.0881	0.0973	-0.1236	0.1084
Agriculture*Population	0.0108	0.0981	-0.0098	0.0010

Agriculture*Time	0.0139**	0.0057	0.0181**	0.0079
GDP*Population	0.9724**	0.4394	1.1052*	0.6572
GDP*Time	-0.0332**	0.0173	-0.0288	0.0189
Population*Time	0.0461***	0.0156	0.0336	0.0217
Constant	4.4791**	1.9915	3.4261***	0.1005
Sigma squared	0.3014	0.0268	0.3332	0.0313
gamma	0.9999	0.0000	0.9999	0.000

Notes: standard error in parentheses; significant at 10% level\*, significant at 5% level\*\*, significant at 1% level\*\*\*.

**Table 3. Elasticities of Input (full sample)**

	Model A		Model B	
	Coefficient	Standard Errors	Coefficient	Standard Errors
Forest	-0.1390	0.9927	-0.0949	0.5680
Urban	-0.9827	9.3210	-1.1912	9.7162
Agric	0.4766	0.5087	0.6001	0.8397
GDP	22.8293***	6.6691	3.8366	9.4014
Pop	3.2443	6.3141	2.7876	6.2499

Notes: standard error in parentheses; significant at 10% level\*, significant at 5% level\*\*, significant at 1% level\*\*\*.

**Table 4. Efficiency Estimates (full sample)**

	Model A		Model B	
	Coefficient	Standard Errors	Coefficient	Standard Errors
Grants	1.4156***	0.1522	1.5735***	0.1609
GDP	-0.4389	0.3011	1.5253***	0.1046
Time	0.0013	0.0105	0.0036	0.0124
Size	-0.7130***	0.1367	0.0983	0.0977

Size*GDP	0.0368	0.0302	-0.1391***	0.0191
GDP*Grants	-0.0000	0.0000	-0.0000	0.0000
Constant	8.8389***	1.2667		

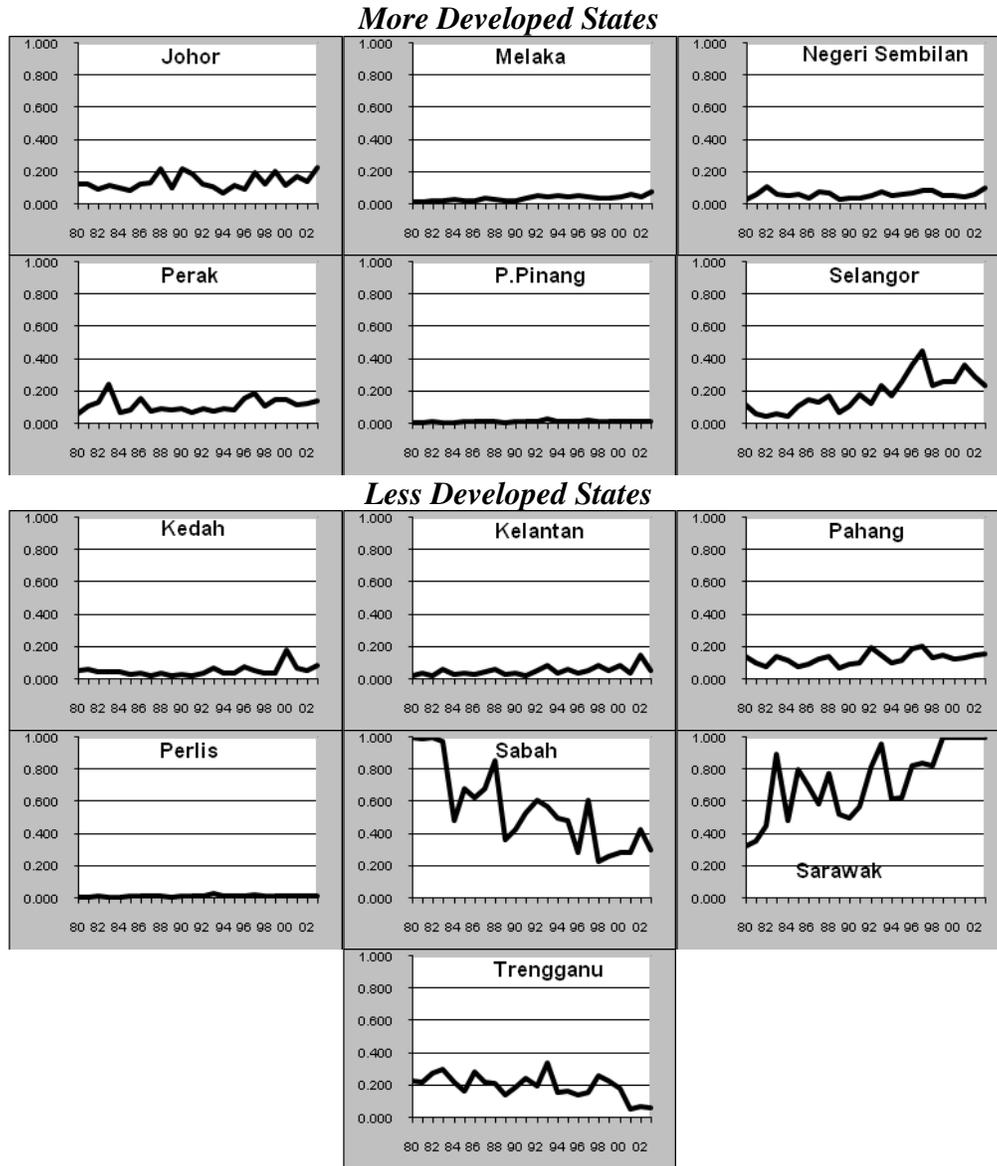
Notes: standard error in parentheses; significant at 10% level\*, significant at 5% level\*\*, significant at 1% level\*\*\*.

We also note a net difference in the evolution across time of the efficiency level of Sabah and Sarawak. In the case of Sabah, we observe a net degradation of its tax efficiency across time. In the early 1980s, this state is the most efficient state in term of tax collection. However, in the mid 1980s, there is a sharp drop in its efficiency level which continues to deteriorate over the years and then it finally reaches the level of efficiency in other states. This evolution is in net contrast to that of the state of Sarawak. In the beginning of the period under study, the level of tax efficiency in Sarawak is relatively low, especially in comparison to Sabah. However, in 1982, Sarawak has seen its level of efficiency increase to finally overtake Sabah as the most efficient state in terms of tax collection in the mid- 1980s. The evolution over time of the efficiency level of these two states somehow mirrors their standing in terms of financial management in the recently published Report by the Auditor General of Malaysia (2003). Indeed, in the Report, the Sabah state government is considered as one of the states that are in a dire financial situation while Sarawak is identified by the General Auditor as one of the states that have the best financial record.

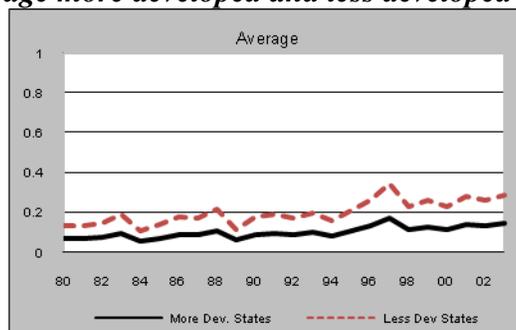
The fact that Sabah and Sarawak have a different position in term of their efficiency levels as compared to other states do not really come as a surprise. In fact, the two states are on a different footing than the rest of the states as far as their revenues and responsibilities. This is due to their special position in the Federal Constitution of Malaysia. Not only have they devolved with more revenues sources and more responsibilities as compared to another 11 states, but they are also entitled to special grants from the federal government.

Given their special position, it may seem inappropriate to put these two states in the same basket as the rest of the states. And, the relatively low efficiency level of the rest of the states as found in our estimations may be due to the inclusion of these two states in our sample. Indeed, it can be argued that the low estimates of the efficiency levels of these states may not signify that they are very inefficient but rather that they are relatively inefficient in comparison to Sabah and Sarawak. Thus, in the next section we will re-estimate our regression by dropping the two states from our sample.

**Figure 1. Efficiency Estimates (full sample)**



*Average more developed and less developed states*



## 4.2. Sub-sample of Peninsular Malaysia

After dropping the two states of Sabah and Sarawak from our sample, we re-estimate our regression. The We results of our new estimations are presented in Table 5. Again, based on these parameters, we calculated the elasticity for each of the independent variable. These results are presented in Table 6. In model A, none of the elasticities are statistically significant. However, in model B the elasticity of GDP is found to be significant. In Table 7, we present the efficiency estimates.

As far as the estimates of the level of inefficiency is concerned, we found that even after dropping Sabah and Sarawak from our sample, federal grants are still positively associated with inefficiency levels. These results may suggest that the association found previously between federal grants and tax efficiency is not spurious. Yet, the magnitude of the coefficient is somehow smaller than the one found in our preceding estimation. We also found that the effects of federal grants on inefficiency levels to be conditional on GDP. The result implies that the level of GDP will attenuate the negative impact of federal grants on efficiency levels. In other words,, federal grants are found to be more disastrous for tax efficiency amongst poorer states. However it should be noted that the magnitude of the coefficient for the interaction term is rather small.

As for other explanatory variables, we found that the coefficients of GDP to be positively associated with tax inefficiency, indicating that wealthier states tend to be less efficient in tax collection. On the other hand, it is also found that a higher dependence on grants, as well more vast land area attenuate the negative impact of GDP on inefficiency levels.

The scores of the efficiency levels for each state are presented in Figure 2. In contrast to our previous estimates, state governments are found to be more efficient this time. The average efficiency level for all states during the period under study is 67%. The results suggest that the low efficiency level of the Peninsular states found previously is due to the inclusion of Sabah and Sarawak in our sample. It is noteworthy that state governments differ widely in term of tax efficiency. The most efficient states are Perak and Pahang and the less efficient are Perlis and Penang. In figure 2, we separate the estimates of efficiency levels according to the level of development in the states. It seems that the level of efficiency does not depend on the level of development as both groups have their fair share of very efficient and less efficient states. Indeed, the average of efficiency levels for both groups is almost the same for both groups as shown in the lower panel of Figure 2.

**Table 5. Frontier Estimation Results (Peninsular Malaysia)**

	Model A		Model B	
	Coefficients	Standard Errors	Coefficients	Standard Errors
Forest	0.6157	0.9328	0.5077	0.8757
Forest <sup>2</sup>	0.0023	0.0261	0.0030	0.0264
Urbanization	3.6591**	1.8277	3.2270*	1.7600
Urbanization <sup>2</sup>	-0.0022	0.3889	0.0662	0.3818
Agriculture	0.8974**	0.4274	0.9765	0.6733
Agriculture <sup>2</sup>	-0.0203	0.0181	-0.0174	0.0209
GDP	-3.0553**	1.2036	-3.3179***	1.2507
GDP <sup>2</sup>	-0.3804	0.4326	-0.3763	0.4436
Population	4.8254**	1.9261	5.3012***	1.2655
Population <sup>2</sup>	-0.5331	0.3583	-0.5661*	0.3152
Time	-0.1523	0.0973	-0.1265	0.1298
Time <sup>2</sup>	-0.0021	0.0013	-0.0020	0.0013
Forest*Urbanization	-0.1551	0.1733	-0.1512	0.1746
Forest*Agriculture	0.0127	0.0276	0.0111	0.0283
Forest*GDP	-0.1509	0.1361	-0.1468	0.1330
Forest*Population	0.0592	0.1512	0.0706	0.1549
Forest*Time	0.0016	0.0084	0.0017	0.0082
Urbanization*Agriculture	0.0369	0.1321	0.0272	0.1374
Urbanization*GDP	0.7015	0.6760	0.7271	0.6779
Urbanization*Population	-0.8305	0.6251	-0.8361	0.6086
Urbanization*Time	-0.0065	0.0231	-0.0114	0.0299
Agriculture*GDP	-0.1247	0.0875	-0.1246	0.0890
Agriculture*Population	-0.0086	0.0651	-0.0201	0.0898
Agriculture*Time	0.0094	0.0063	0.0084	0.0070
GDP*Population	1.0479**	0.4930	1.0591**	0.4938
GDP*Time	-0.0324	0.0212	-0.0331	0.0218
Population*Time	0.0431**	0.0212	0.0438**	0.0219
Constant	-	0.8859	-	1.0315
	19.8381***		20.3323***	
Sigma squared	0.3322	0.0131	0.3295	0.0246
gamma	0.2215	0.0579	0.3273	0.0779

Notes: standard error in parentheses; significant at 10% level\*, significant at 5% level\*\*, significant at 1% level\*\*\*.

**Table 6. Frontier Estimation Results**

	Model A		Model B	
	Coefficient	Standard Errors	Coefficient	Standard Errors
Forest	-0.0322	0.6645	0.3387	0.5416
Urban	0.1285	10.0599	-0.1217	8.3845
Agric	0.3842	0.3827	0.3567	0.6285
GDP	2.0330	6.6390	14.733***	4.1549
Pop	3.7294	10.7510	3.9682	8.2150

Notes: standard error in parentheses; significant at 10% level\*, significant at 5% level\*\*, significant at 1% level\*\*\*.

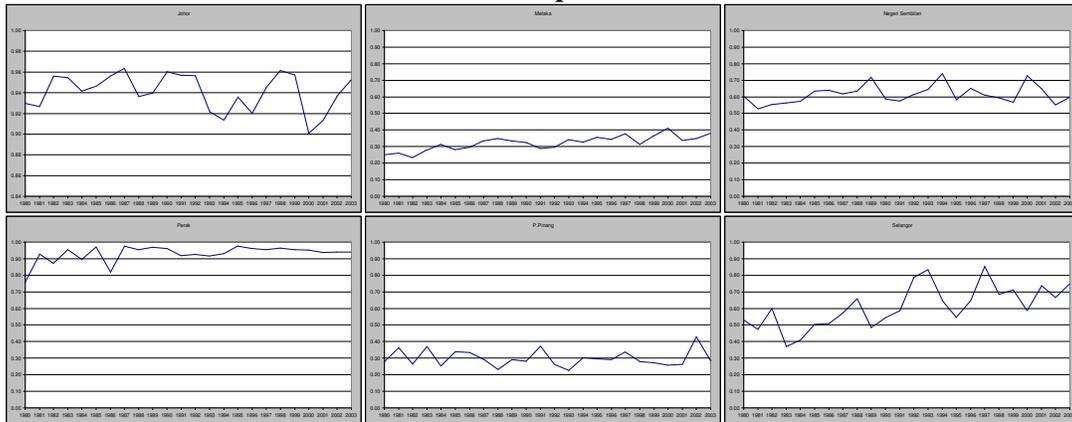
**Table 7. Efficiency Estimates (Peninsular Malaysia)**

	Model A		Model B	
	Coefficient	Standard Errors	Coefficient	Standard Errors
Grants	1.2237***	0.0984	1.2026***	0.1489
GDP	0.7238**	0.3031	0.9133***	0.1006
Time	0.0039	0.0121	0.0019	0.0142
Size	-0.1250	0.3488	-0.0169	0.1191
GDP* Size	-0.0687**	0.0289	-0.0937***	0.0266
GDP*Grants	-0.0000**	0.0000	-0.0000*	0.0000
Constant	0.7906	3.1211		

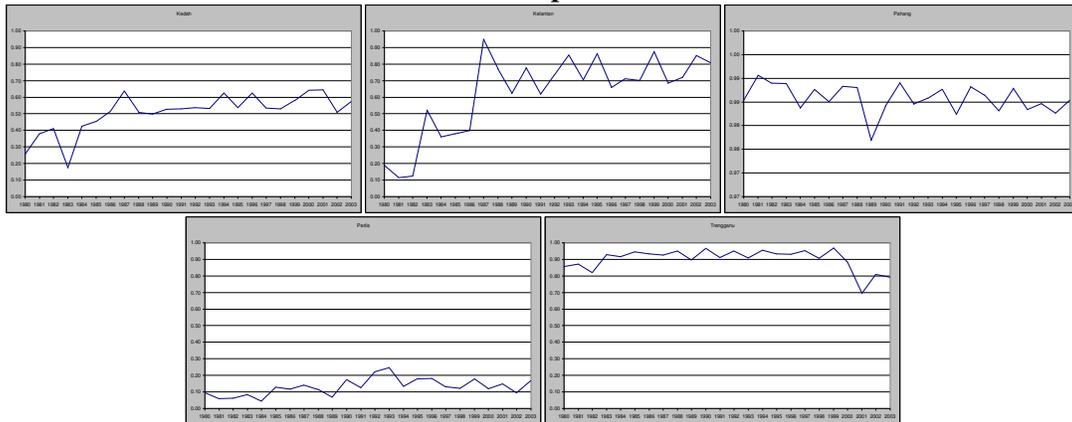
Notes: standard error in parentheses; significant at 10% level\*, significant at 5% level\*\*, significant at 1% level\*\*\*.

**Figure 2. Efficiency estimates (Peninsular Malaysia).**

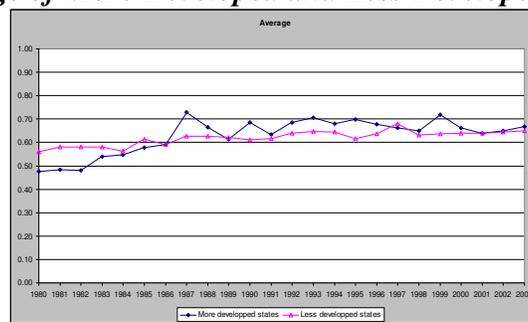
***More Developed States***



***Less Developed States***



***Average of More Developed and Less Developed States***



## Conclusion

The main objective of this paper is to examine the relationship between the fiscal performance of the state governments in Malaysia with the political and institutional environment within which they evolve. The focus of our analysis is the intergovernmental transfers system which constitutes an essential part of any intergovernmental and decentralized system.

More particularly, we tried to analyze the impact of federal grants to state governments' fiscal efficiency. Indeed, the general observation of a continuous deterioration in the financial situation in Malaysia brings us to question if state governments are making enough effort in exploiting all the revenue sources that are available. Moreover, one may wonder if the intergovernmental grants system is one of the causes that led state governments to remain slack in tax efforts.

Fiscal effort is measured by the amount of taxes collected by the state government and the impact of federal grants on fiscal efforts is assessed by using the stochastic frontier analysis methodology. The advantage of using this method is that it allows us to obtain both the estimates of efficiency level as well as the determinants of the efficiency level.

Our estimations results seem to point to the fact that there is indeed a negative impact of federal grants on the tax efficiency of the state governments in Malaysia. The results suggest that an increase in federal grants is associated with a decrease in the tax efficiency of the state governments. On the other hand, the estimates also show that there is on average a slight increase in the level of tax efficiency of the state governments in Malaysia across time. Together, these two results suggest that a higher level of efficiency could be achieved if necessary steps are taken to minimize the effects of federal grants.

A negative relationship between federal grants and fiscal efficiency has serious policy implications. It suggests that the state governments have failed to mobilize their tax potentials to the maximum and preferred to rely on federal transfers instead to finance their expenditures. The danger of being too dependent on federal grants has been widely covered in the literature. However, within the context of our study, transfer dependence can also lead to another problem namely underdeveloped local tax system. Due to federal grants, state governments can be discouraged from investing in the improvement of their tax system. Since federal grants are easily made available to them, state governments may not find it worthwhile to employ the latest technology or to hire more qualified personnel. Without these investments local tax system will not be able to cope with the latest development in the society and become less and less productive. This in turn will lead to a higher dependence on federal grants thus creating a vicious circle.

## References

- Ahmad E. (1997). *Financing decentralized expenditures: An international comparison of grants*. Cheltenham, UK, Edward Elgar.
- Aigner D., C.A. Knox-Lovell & Peter Schmidt. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, vol. 6, pp. 21-37.
- Aragón F.M. & V. J. Gayoso. (2005). Intergovernmental transfers and fiscal effort in Peruvian local governments. Universidad del Pacífico licentiate thesis.
- Auditor-General, Malaysia (2004). *Federal Public Accounts*. Auditor-General Office Malaysia.
- Battese G. E. & T. Coelli. (1992). Frontier production functions, technical efficiency and panel data with application to paddy farmers in India. *Journal of Productivity Analysis*, vol. 3, pp.153-169.
- \_\_\_\_\_. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, vol. 20, pp. 325-33
- Bird R. M. (1994). A comparative perspective on federal finance. The future of fiscal federalism. School of Policy Studies, Queen's University, pp. 293-322.
- Boadway, R. & F. Flatters. (1982) *Equalization in a Federal State: An economic analysis*. Ottawa, Economic Council of Canada.
- Boadway R. & P.A.R. Hobson. (1993). *Intergovernmental fiscal relations*. Toronto, Canadian Tax Foundation.
- Borcherding T. E. & R. T. Deacon. (1972). The demand for the services of non-federal governments. *The American Economic Review*, vol. 62, no. 5, pp. 891-901.
- Cabrero E. & I. Orihuela. (2000). Expansión financiera y gestión hacendaria en municipios de México (1978-1997). *CIDE-Administración Publica*, Mexico.
- Chaparro J. C., M. Smart & J.G. Zapata (2004). Intergovernmental transfers and municipal finance in Colombia. *International Tax Program University of Toronto Paper* no. 0403
- Correa P. & R. Steiner. (1999). Decentralization in Colombia: Recent changes and main challenges. In *Colombia: An opening Economy?* eds. C. Callahan and F.R. Gunter. Stamford, Connecticut, JAI Press.
- Cuthbertson K., J.S. Foreman-Peck & P. Gripiaios. (1981). A model of local authority fiscal behavior. *Public Finance*, vol. 26, no 2, pp. 229-241.

Garzón H. (1997). *Colombia: Structure of municipal finances, fiscal decentralization and credit policy reform 1987-1995*. Bogotá, World Bank.

Gramlich E. M. (1987). Subnational fiscal policy. *Perspectives on Local Public Finance and Public Policy*, vol. 3, pp. 3-27.

Gramlich E. M. & H. Galper. (1973). State and local fiscal behavior and federal grant policy. *Brookings Papers on Economic Activity*, vol. 1, pp.15-58.

Hartwick J.M. (1980). The Henry George rule, optimal population, and interregional equity. *Canadian Journal of Economics*, vol.13, no. 4, pp. 695-700.

Inman R.P. (1979). The fiscal performance of local governments: An interpretative review. In *Current issues in urban economics*, eds. Peter Mieszkowski and Mahlon Straszheim. Baltimore, Johns Hopkins University Press.

Jha R.a, M. S. Mohanty, S. Chatterjee & P. Chitkara. (2000).Tax efficiency in selected Indian states. *Empirical Economics*, vol. 24, pp.641-654.

Kumbhakar S.C., S. Ghosh & J.T. McGuckin (1991). A generalized production frontier approach for estimating determinants of inefficiency in U.S. dairy farms. *Journal of Business and Economic Statistics*, vol. 9, pp. 279-286.

Kodde D.A. & F. Palm. (1987). A parametric test of the negativity of the substitution matrix. *Journal of Applied Econometrics*, vol. 2, pp. 227-235.

Logan R. R. (1986). Fiscal illusion and the grantor government. *The Journal of Political Economy*, vol. 94, no. 6, pp. 1304-1318.

Marshall L. (1991). New evidence on fiscal illusion: The 1986 tax windfalls. *American Economic Review*, vol. 81, pp. 1336–1345.

McGuire M.C. (1973). Notes on grants-in-aid and economic interactions among governments, *Canadian Journal of Economics*, vol. 6, pp.207-221.

Meeusen W. & J. van den Broeck. (1977). Efficiency estimation from Cobb-Douglas production function with composed errors. *International Economic Review*, vol.18, pp. 435-444.

Moffitt R.A. (1984). The effects of grants-in-aid on state and local expenditures: The case of AFDC. *Journal of Public Economics*, vol. 23, no. 3, pp.279-305.

Oates W. E. (1979). Lump-sum grants have price effects. In *Fiscal Federalism and Grants-in-Aid*, eds. P. Mieszkowski and W.H. Oakland. Washington, D.C, Coupe Papers in Public Economics, Urban Institute.

Quigley, J.M. & D. L. Rubinfeld. (1986). Budget reform and the theory of fiscal federalism. *The American Economic Review*, vol. 76, no.2, pp.132-137.

Rajaraman I. & G. Vasishtha. (2000). Impact of grants on tax effort of local government. *Economic and Political Weekly*, pp. 2943-2948.

Reifschneider D. & R. Stevenson. (1991). Systematic departures from the frontier: a framework for the analysis of firm inefficiency. *International Economic Review*, vol. 32, pp. 715-723.

Sanguinetti P. & M. Besfamille. (2004). [Exerting local tax effort or lobbying for central transfers?: Evidence from Argentina. Econometric Society 2004 Latin American Meetings](#) 249, Econometric Society.

Schwallie D. P. (1989). Measuring the effects of federal grants-in-aid on total public sector size. *Public Finance Quarterly*, vol. 17, no. 2, pp. 185-203.

Smith P. (1997). Model misspecification in Data Envelopment Analysis. *Annals of Operations Research*, vol. 73, pp. 233-252.

Stine W.F. (1985). Estimating the responsiveness of local revenue to intergovernmental aid. *National Tax Journal*, vol. 38, pp. 227-234.

Wilde J.A. (1971). Grants-in-Aid: The analysis of design and response. *National Tax Journal*, vol. 124, pp. 143-153.