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Estimating Stochastic Frontier Tax Potential: Can Indonesian Local Governments Increase Tax Revenues Under Decentralization?

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ESTIMATING STOCHASTIC FRONTIER TAX POTENTIAL : CAN INDONESIAN LOCAL GOVERNMENTS INCREASE TAX REVENUES UNDER DECENTRALIZATION ?

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Abstract

One consequence of Indonesian fiscal decentralization is that local governments will have to seek additional revenues coming from their own resources. The first thing that they should do is to exploit their revenue potential from existing taxes before implementing any new taxes. This study attempts to estimate the tax potential of two sources of revenue for local governments: local taxes and property tax -- by using the special regression analysis of the stochastic frontier. Our empirical findings show that none of the local governments have maximized their tax potential. If all local governments were able to utilize all their tax potential, then they would get very substantial additional tax revenues (0.10 and 0.20 percent of GDP from local taxes and property tax, respectively, while current total local tax revenue is about 0.36 percent of GDP). What they have to do is to improve their tax collection performance in terms of efficiency by reducing tax evasion, mostly through decreasing corruption. In addition, support and cooperation from the central government are very important. For local taxes, the central government should modify its subsidy formula to local governments by giving a bigger portion of INPRES subsidies that are used for local development, which in turn will increase local governments' tax ratios. For property taxes, the central government should change its policy of setting targets for its property tax district offices.

Keywords: Tax potential; Inefficiency; Stochastic frontier; Decentralization; Corruption; Indonesia

JEL Classification: H0; H2; H7; O1

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I. Introduction

Indonesia has been going through a major change in its intergovernmental system since 2001 by adopting a much more decentralized regime, widely termed fiscal decentralization. Local governments now have more responsibility to provide public goods and services that were previously provided primarily by the central government through its deconcentrated ministries or agencies. On the other side, local governments also have greater power, at least in theory, to manage and collect their own revenues, especially taxes. It should be noted that the central government must still give some subsidies or grants to local governments when the primary objective is that of redistribution. The grants, however, are to be distributed based on a new formula that is especially designed to support the fiscal decentralization program.

This paper studies tax potential of provinces in Indonesia ***before*** decentralization [1)]. In essence, this study attempts to develop a tax *frontier* (which is a collection of tax potential) for Indonesian local governments, a function that expresses the *maximum* amount of tax obtainable from given bundles of determinant characteristics of tax revenues. First, it is important to identify the determinants of tax potential for local governments that can be derived from the stochastic frontier regression analysis. However, the main objective of this paper is to look at and compare how those provinces have decided to use their tax potential. The estimated tax potential may provide useful information for local governments in preparing for greater independence, especially in terms of revenues, so that provinces are forced to seek additional revenues that have to come from their own resources. Intuitively, it will be

1) Indonesian fiscal decentralization actually devolved more power or regional autonomy to district government levels, not on provincial levels. Due to the unavailability of data, the analysis here is conducted in provincial levels.

easier for provinces with large unused tax potential to collect bigger revenues needed to fund their new responsibilities under the decentralized system, while provinces with small unused tax potential will struggle hard to survive. The knowledge of local governments' tax potential might also help the central government in designing its transfer formula.

Today, Indonesian local governments are enormously concerned about having revenue shortfalls because of decentralization -- for the first year of the implementation of decentralization alone (up to the end of 2001), they had authorized approximately 1000 new taxes and charges. Even so, Lewis (2003) finds no empirical evidence that the creation of those new taxes is driven by lack of fiscal capacity, as many people believe. Studying the potential of *existing* taxes would be expected to reduce the panic and partially solve the ostensible fiscal deficit problem. It is obviously more reasonable for local governments to utilize their existing tax potentials first before hurriedly imposing any new taxes.

In an attempt to find an appropriate formula for federal grant provisions, Ahmad *et al.* (2002) estimate Indonesian local governments' revenue capacity. In their model, revenue capacity is computed as the sum of all standard tax bases times the standard tax rate. A province would use all its revenue capacity if it taxes all standard tax bases with the standard tax effort by applying the standard tax rates. The use of standard tax rates makes the derived revenue capacity conceptually closer to *average* rather than *maximum* tax capacity.

In this paper, we develop a tax frontier for two types of taxes: local taxes and property tax. Local taxes basically are all taxes that are controlled and collected by local governments, with the biggest component coming from the sales tax or development tax [2)]. Sales tax rates, also property tax rates, are virtually identical across provinces, so that differences in local tax revenues across provinces really are determined by their tax bases. Therefore this paper in reality studies the variance of tax bases across provinces.

Unlike in other countries, property tax in Indonesia is still run, organized, managed, and collected by the central government, through its district tax offices all over the country. All policies and regulations, such as effective tax rates, coverage, assessment values, target, and tax administration and supervision, are made by the central government. Local governments are given tax property revenue collected after subtracting a designated collection fee for the central governments. Local governments, almost without doing anything, will receive net revenues of property tax every year with a very low collection cost. Because of those different characteristics, sales and property taxes should not be treated the same, especially in terms of tax policies.

The rest of paper is organized as follows: section II explains the decentralization process in Indonesia, including the Indonesian local governments' revenue structure prior to decentralization. Definition and econometric techniques to derive local governments' tax potential and frontier are discussed in Section III. Section IV explains the econometric model, and Section V discusses the results of regression analysis of the

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2) By law, income taxes currently are collected only by the federal government. Therefore, unlike in the U.S., for example, local governments cannot have or collect regional income tax. Also, the central government imposes value added tax for (almost all) goods and services sold in the country, so any sales tax charged by local governments will create "double" taxation. That is why Indonesian law authorizes local governments only some (limited) goods and services sales taxes to be levied. Moreover, other taxes, such as the airport departure tax, contribute only insignificant amounts.

stochastic frontier and the comparison of tax potential used up by various local governments. Section VI discusses policy implications and Section VII provides conclusions.

II. Fiscal Decentralization in Indonesia

One impact of the economic and political crisis that hit Indonesia in 1997-1998 was an increased pressure for regional autonomy, known as fiscal decentralization. As a result, the government passed two new decentralization laws: Law No. 22/1999 on Regional Government, and Law No. 25/1999 on the Fiscal Balance between the Central and Local Governments. Both were implemented as of 2001. These new laws substantially reform the practice of intergovernmental relations in Indonesia. If they are successfully implemented, Indonesia will be transformed from one of the most centralized among large economies to one of the most decentralized [IMF, 2002]. Alm, *et al.* (2001) consider Indonesia an exception compared to other economies with its characteristics, such as a large and diverse population residing in a very large area, as their empirical results implied that Indonesia would have been expected to adopt a more decentralized government much earlier.

One major criticism of this ambitious decentralization plan of Indonesian government structure is that not all details have been planned carefully. Decentralization has to be designed such that there should be a reasonable balance between expenditure and revenue arrangements with local governments. Indonesia's two decentralization laws seemingly focus more on the devolution of expenditure responsibilities. The scope of local governments' responsibilities is much greater now that it includes public works, health, education and culture, communications, industry

and trade, capital investment, environment, land, cooperative and manpower affairs. Note that most of those functions previously were under the central government's control, partly or entirely. For the revenue side, those laws introduce a new arrangement of the grant system based on expenditure needs and revenue capacities, plus a new scheme for revenue sharing for oil and gas. In addition, the government passed Law No. 34/2000 on Regional Government Taxes and Charges. This law states which taxes can be levied by local governments, and the tax rates allowed. To avoid double taxation, only certain goods and services can be taxed by provincial and district governments, and to prevent overcharging (as defined by the central government), the range of tax rates is also set by the central government. This law replaces the old law on the same matter, with the main difference being that it gives local governments more alternatives and flexibility for their own revenue sources. Nevertheless, many people believe that this new revenue assignment is still far from sufficient, or unlike the expenditure side, the scope of revenues devolved to local governments is much more limited. In summary, local governments will now have much bigger expenditures following the new and bigger assigned responsibilities, but they only have a little room to increase their revenues that truly come from their own resources. By analyzing the local governments' fiscal behavior before the decentralization, Silver *et al.* (2001) conclude that Indonesian local governments will still be very reliant on subsidies from the central government, so one of the most important factors to ensure the success of decentralization is the effective use of the discretionary in the new grant system.

It is generally predicted that without any major change or additional detailed guidance in this decentralization process, there will be a mismatch between expenditure and revenue responsibilities that are assigned to local governments. In terms of

revenues, the IMF (2002) in its 2002 annual country report for Indonesia gave one important recommendation: give local governments a bigger and proper tax base. A simulation developed by a joint IMF-World Bank team predicts that with the current fiscal decentralization plan, local governments' development expenditures will increase to some 4 percent of GDP [Ahmad *et al.*, 2000]. Following the new formula of grant provisions, the central government will be able to provide the general grants to local governments about 3.8 percent of GDP. About 66% of this amount has to be allocated for personnel spending (2.5 percent of GDP) and the remaining 34% (1.3 percent of GDP) can be used for development spending. In addition, the central government will provide so-called specific grants, but the amount is unlikely to be higher than 2 percent of GDP. Therefore, local governments will have to find additional amount of revenues of some 0.7 percent of GDP –- an enormous challenge [3]. In this simulation, they assumed that local governments could not increase their own revenue sources, which mostly were constrained by the old law, but that has now been replaced by Law No. 34/2000.

The situation will be worse if the central government intervention remains intense even under the new regime of decentralization. It is true that local governments now have greater responsibilities to provide public goods and services; however, the central government still has some indirect control over local governments' expenditures by setting up some standards or criteria that have to be met by local governments. Local governments still seem not have too much discretion over provision of public goods and services to their people, since the level of expenditure is still implicitly determined by

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3) In 1999/2000, the ratio of total local government revenues (including grants from the central government) to total GDP is 1.31%, while the ratio of total original revenues of local governments to total GDP is 0.43%, and the ratio of total local taxes of local governments to total GDP is only 0.36%. If for instance the only alternative to close the gap of 0.7% of GDP is by using local taxes, then local governments on average would approximately have to *triple* their local tax ratios.

the central government. In summing up, local governments might need even bigger additional revenues.

To fund their expenditures, Indonesian local governments in the pre-decentralization period had 2 main sources:

1. Local Government Original Revenues that consist of:
    - Local Taxes
    - Other revenues, such as charges and fees.
2. Revenues from the Central Government that consist of:
    - Tax and Non Tax Shares, such as property taxes.
    - Grants :
        (i) Subsidies (SDO) that are used mostly for personnel spending (often called routine spending), and
        (ii) Development Contribution (INPRES) for local development projects.

    Two other revenue sources, Previous Year Surplus and Loans, were trivial.

Before decentralization, specifically the period from 1996/1997 to 1999/2000, the average revenues that came purely from local resources (known as original revenues) amounted to only 34.41% of total local governments' revenues. Local taxes contributed about 81% (28.03% of total revenues), and the rest came from charges and fees. The biggest source of local governments' revenues turns out to be revenues from the central government, averaging 58.05% of total local governments' revenues for the same period. This includes pure subsidies of 43.62%, while the difference of 14.43% consists of local taxes that are collected by the central government, with these revenues given back to the corresponding local governments, as in the case of the property tax. By looking at the

local governments' revenue structures, it can be seen that local governments in the pre-decentralization era were extremely dependent on the central government. Table 3.1 shows the actual aggregated provincial governments' revenues from 1996/1997 to 1999/2000.

Table 3.1. Actual Provincial Governments' Revenues from 1996/1997 to 1999/2000 in nominal values

TYPE OF REVENUES	1996/1997		1997/1998		1998/1999		1999/2000		AVERAGE	
(in Rp. Billions)	Rp.	%	Rp.	%	Rp.	%	Rp.	%	Rp.	%
Previous Year's Surplus	1,043	8.37%	606	4.75%	384	4.28%	1,354	10.22%	847	6.90%
Local Government Original Revenues	4,280	34.35%	4,606	36.12%	3,074	34.27%	4,364	32.92%	4,081	34.41%
					-36.68%					
Local Taxes	3,386	27.17%	3,713	29.12%	2,528	28.18%	3,663	27.63%	3,323	28.03%
Others (Retributions, Charges, etc.)	894	7.18%	893	7.00%	546	6.09%	701	5.29%	759	6.39%
Revenues from the Central Government	7,074	56.77%	7,487	58.71%	5,512	61.45%	7,327	55.27%	6,850	58.05%
					-38.84%					
Tax and Non Tax Shares (Property Tax, etc.)	1,185	9.51%	1,274	9.99%	1,882	20.99%	2,172	16.39%	1,629	14.22%
Grants	5,857	47.01%	6,170	48.39%	3,610	40.25%	5,150	38.85%	5,197	43.62%
					47.70%					
Subsidies (SDO)	4,436	35.60%	4,555	35.72%	1,791	19.97%	2,217	16.72%	3,250	27.00%
Development Contributions (Inpres)	1,421	11.41%	1,616	12.67%	1,819	20.28%	2,933	22.13%	1,947	16.62%
Others	31	0.25%	42	0.33%	20	0.22%	5	0.03%	24	0.21%
Local Government Loans	63	0.51%	53	0.42%	0	0.00%	210	1.59%	82	0.63%
TOTAL	12,460		12,752		8,970		13,256		11,860	

As we know, Indonesia started having its severe economic crisis in mid 1997. It was reflected in a significant decrease (about 30%) of total local governments' revenues between 1997/1998 and 1998/1999 in nominal values. Local governments' original revenues also decreased by 37% during that period. However, a big decrease in the central governments' grants (about 48%) was partly caused by the new policy of the central government of giving some of those grants directly to district governments, and hence no longer through the provincial governments [ICBS, 2001].

III. Tax Potential and Frontier : Definition and Econometric Method

The **tax ratio** is simply defined as the ratio of taxes (revenues) to output. The ratio can be calculated not only for total taxes collected by one country as a whole, but also for any kind of tax, such as a sales or property taxes, and collected by any level of government, such as a provincial government. Thus, the property tax ratio for province *X* is simply the ratio of property tax revenue collected to total output produced by that province (Gross Regional Domestic Product). **Tax potential** is defined as the tax ratio that would result if an economy uses all its resources and ability to collect all obtainable tax revenues from given bundles of determinant characteristics. Technically speaking, tax ratio is just the ratio of actual tax collections, while tax potential is the estimated tax collection resulting from the regression analysis of the stochastic frontier. The **tax frontier** is just the collection (or a function) of those different tax potentials.

Most traditional literature of international tax comparisons uses, instead of tax potential, a taxable capacity measure that is derived from the OLS regression analysis. Accordingly, **taxable capacity**, which is the OLS estimated tax ratio, actually reflects the *average* tax ratio. Moreover, the difference between tax ratio and taxable capacity for one country often has been interpreted as the degree of tax "effort" of that country. **Tax effort** is defined as the extent to which an economy uses its taxable capacity, and mathematically, it is just the ratio of actual tax collections to the estimated tax collection from the OLS regression. The interpretation of tax effort, however, has to be done very carefully. Bahl (1971) states that if one country has a tax effort lower than one, it can only be implied that this country's tax effort is relatively low compared to other countries, but it would be incorrect to conclude that this country has to increase its tax ratio. Chelliah e*t al.* (1976) argue that a simple comparison of tax ratios should be used only to

see the relative levels of taxation for different countries, but any inference on tax performance based on such a comparison fails to take into account that some countries simply choose to levy lower taxes, implying lower level provision of public goods and services, or to have a small government. Therefore, one country might have a lower tax effort intentionally, not because it lacks the energy to pursue a higher tax ratio. Tait *et al*. (1976) add that the use of term "tax effort" is potentially misleading, so they preferred to use the term "international tax comparisons" (ITC) index. Even with that limitation, opponents such as Bird (1976) note that individual countries are so unique in terms of economic, political, and institutional characteristics, that generalizing those differences will provide less meaningful information than they obscure.

This study is different from those above, in that it is not intended to compare tax performance of different economies, in this case Indonesian local governments. Instead, we try to develop a tax frontier so that this information can be used by local governments to utilize their tax potential in the effort to cope with the fiscal decentralization program.

Nevertheless, the local governments' tax performance comparison is perhaps still useful in the case of taxation of property in Indonesia. As mentioned before, the property tax in Indonesia is still managed and collected by the central government through its district tax offices all over the country. Local governments receive net revenues of property tax every year with a very low collection cost. The downside is that, unfortunately, local governments have no discretion about property tax policies. If, for instance, one local government needs to increase its revenues for next year, it cannot use the property tax as an alternative, since the amount to be collected (also tax rates) has been decided by the central government. On the other hand, the central government

does not have to take into account local governments' expenditure in determining each province's revenue collection target. Therefore, the property tax potential analysis may be used effectively to evaluate tax performance of provincial governments, since preferences of local public goods have no effect on the amount of tax collected. If one province has large unused property tax potential, then we could say that the tax effort of the district property tax office is relatively low compared to that of other district property tax offices, and this office should be able to increase its tax ratio.

The empirical study of the stochastic frontier was pioneered by Aigner, Lovell, and Schmidt (1977), and their approach has been very fundamental to the later development of econometric frontier estimation of any kind. They propose that a production frontier should be estimated with the usual regression model, but with two distinguishable error terms. The first error term (v_i) represents the usual statistical noise, something beyond the firm's control such as weather, and assumed to be independently and identically distributed with $v_i \sim N(0, \sigma_v^2)$. The second error term (u_i) represents the level of inefficiency, that is the "failure" to produce the maximum amount given some input used, so it has to be nonpositive and is also assumed to be independently and identically distributed with $u_i \sim |N(0, \sigma_u^2)|$, known as the half normal distribution [4]. Suppose a production function is given by $y_i = f(X_i; \beta)$, where y_i is output produced, X_i is the vector of input used, and β is the vector of parameters to be estimated. Then the stochastic frontier econometric model will be $y_i = f(X_i; \beta) + \varepsilon_i$, with $\varepsilon_i = v_i - u_i$. It is the non-positive error term u_i that will

4) Other one-sided error distributions that are commonly used are the exponential distribution proposed by Aigner, Lovell, and Schmidt (1977), the truncated normal distribution by Stevinson (1980), and the two-parameter Gamma distribution by Green (1990).

determine the frontier that is now defined as $[f(X_i;\beta)+v_i]$. The difference between the level of production and the new derivation of the frontier represents the degree of inefficiency of one firm's production, since the resulting difference is now purely caused by something under the firm's control. With the presence of v_i, the frontier is stochastic, as opposed to the alternative deterministic frontier approach, in which the disturbances are assumed to consist of only the one-sided error term (u_i). But the presence of v_i creates an intriguing property, since in contrast to the deterministic approach, it is now possible for one observation to lie *above* the frontier if the usual statistical noise (v_i) is very big for that particular observation.

Jondrow *et al.* (1982) show that one can easily disentangle the "inefficiency" error term u_i from the total error term ε_i, so now researchers can analyze the degree of inefficiency of each individual firm. Moreover, since the error term ε_i now consists of two different error terms v_i and u_i, then the variance of regression can be differentiated between the variance components that are caused by the usual statistical noise, σ_v, and by inefficiency, σ_u. It should be noted that the error term, ε_i, distribution will no longer be symmetric.

From the econometric standpoint, the stochastic approach seems to be more popular and widely used in the study of frontier construction and efficiency measurement [5]. Green states:

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5) The statement is actually quite subjective. In some disciplines, the use of the deterministic frontier seems more preferable. The common approach used in developing the deterministic frontier is to use the linear programming such as Data Envelopment Analysis (DEA). For example, Lewin and Lovell (1990) observe that the DEA has been used more toward the managerial implications of efficiency measurement.

> "One-sided disturbances …… present a particularly difficult estimation problem. The primary theoretical problem is that any measurement error in *y* must be embedded in the disturbance. The practical problem is that the entire estimated function becomes a slave to any single errantly measured data point." [Green, 2000]

There has been substantial research following the pioneering work of Aigner, Lovell, and Schmidt [6]. Their early model has been criticized for its caveats. In estimating the stochastic frontier, their model used the maximum likelihood estimation (MLE) with cross-sectional data. Waldman (1982) shows that for the production frontier estimation, the use of MLE in the original Aigner, Lovell, and Schmidt model requires, critically, that the third moment of the least squares residuals has to be negative (the OLS residuals are negatively skewed). Otherwise the maximum likelihood estimates are the same as the ordinary least squares estimates, implying no efficiency relative to frontier. As a consequence, in practice the stochastic frontier estimation is very sensitive to specification.

Another criticism of Aigner, Lovell, and Schmidt's model is that it may fit well only in the case of cross-sectional data, but not in the case of panel data. Schmidt and Sickles (1984) modify the model to capture the advantage of having panel data by taking into account firm effects, but not time effects. They also show that the stochastic frontier can be estimated not only by the MLE method, but also by two other techniques, namely the *Within* OLS and the Generalized Least Squares (GLS). Cornwell *et al.* (1990) propose a stochastic frontier estimation that allows both firm and time effects. They do so by incorporating a special function of parameterized time into the production function that

6) Bauer (1990) summarizes the development of the econometric approach of the stochastic frontier until 1990 and a more recently survey can be found in Green (1997).

may be different across firms. Basically, they assume that the constant regression is $\alpha_{it} = \theta_{i1} + \theta_{i2}t + \theta_{i3}t^2$ (where i = firms, and t = years), which is linear in θ. So for regression purposes, they just add two dummy variables with linear and quadratic parameterized time function.

This paper tries to construct a tax frontier by using the stochastic frontier approach. The tax ratio, as the output of local governments' policies, can be thought of as a product of various 'inputs', in this case some determining tax revenue factors, such as tax base, tax rates, and so forth. Therefore, the tax frontier development is very similar to the formulation of the production frontier, especially as rates generally do not vary across provinces. In theory, because of similarities between firms' problems in producing output and governments' problems in generating taxes, where both types of institution are concerned with the unused production or tax potential, generally interpreted as inefficiency, the application of the stochastic frontier should work well in tax frontier estimation. However, for the stochastic frontier technique to work, it requires some conditions, such as the negative third moment of the OLS residuals. In the case of production function, output is produced by some inputs, such as labor, capital, and some other factors. The determinants of output are very clear in this problem. They are all inputs used in production. The situation may be less clear for the tax frontier estimation. Output, in this case tax ratio, is a product of some combination of inputs, such as tax bases and tax rates. Tax rates tend to be the same across local governments, but tax bases vary considerably. The problem in the empirical study of tax ratio thus is reduced to the analysis of tax bases, for which data often are not available and/or reliable, especially in developing countries. The standard proxies normally used for estimating tax bases are output or income, or some related economic indicators, such as

level of education or the use of electricity. Thus, the determining factors for tax ratio are less obvious than those in a firm's production problem. As a result, one has to be able to find the 'right' combination of tax ratio determinants to find the tax frontier, otherwise the stochastic frontier approach will not work.

Another main difference is in the interpretation. In the study of the production frontier, the difference between current production and frontier purely represents the level of inefficiency, something that the firm does not accomplish even though the factors are under its control. In the study of local tax frontiers, the difference between current tax ratio and tax frontier can be interpreted only as the level of unused tax potential, but not strictly as a measure of inefficiency. The presence of unused tax potential may be caused by at least two factors: *(i)* local people's preferences of low provision of public goods and services, so the low tax ratio is chosen intentionally, and/or *(ii)* inefficiency of local governments. However, the unused tax potential for property tax can still be interpreted as inefficiency, since this tax is controlled by the central government.

IV. Econometric Model

This paper investigates local governments' tax potential (in terms of tax ratio) of two different taxes:

1. Local Taxes.
2. Property Tax.

The (international) tax ratio model was first introduced by Lotz and Morss, now known as the Lotz-Morss equation [Lotz and Morss, 1967]. Their model simply estimates tax ratio as a function of GNP per capita, to represent the stage of development, and the ratio of total export plus import to total GNP, to represent level of openness. They argue that a higher level of economic development is usually accompanied by a higher rate of literacy, increased monetization, and stricter law enforcement, which can be expected to increase tax capacity. From the administration standpoint, it is relatively easier to impose (and enforce) tax on foreign trade than domestic transactions. Some studies added some measure of the sectoral composition, while some others tried to include the ease of tax collection and the degree of compliance as explanatory variables. Others simply used some dummy variables to represent different social, political, and political factors.

For Indonesian provincial government levels, their tax potential might depend on several factors. Due to unavailability of data, the choice of variables to represent each factor is quite restricted. Tax potential is theoretically influenced by the stage of development of that particular province, and the explanatory variable we choose is level of education. Elementary school is basically free in Indonesia, so the model uses the number of high school students per capita to distinguish between people who have a basic level of education and those who do not. Stage of development may also function as a measure of tax base. A more developed economy means a bigger tax base that in turn would be expected to give a positive impact on tax potential. Another view as suggested by Tanzi and Zee (2000) is that a more developed economy is very likely to need a higher amount of public expenditures, at least up to some point, and to meet this

increased demand, it would have to increase taxing capacity. So the expected sign for this variable is positive.

The direction of causality between the measure of tax level and stage of development might become an issue. Theoretically, some people suggest that it is the stage of development that influences the level of taxation while others argue that higher tax levels might create a bigger distortion, so economic growth would be negatively affected. Tanzi and Zee (2000) argue that despite that theoretical conflict, it is commonly assumed that the direction of causation tends to run from stage of development (usually represented by income) to taxes, not the reverse, and this argument is supported by strong international empirical evidence. The simultaneity problem, if any, however, would expectedly be less severe if we use variables other than income for stage of development, such as level of education.

Tax potential might also depend on the ease of tax collection, and the variable chosen to represent this factor is the share of the agricultural sector in GRDP. One important characteristic of this sector is that both tax objects and subjects are geographically very spread out, while the potential revenues generated are not very promising as opposed to other sectors, such as manufacturing or mining industries. Therefore, bigger agricultural sector shares should have an inverse relationship with tax potential, but only for local taxes. In the case of property tax, however, this agricultural variable may have a direct relationship. If the agricultural sector contributes a significant income in one province, then it will be difficult for cities in that province to expand. The expansion constraint on those cities that are surrounded by valuable agricultural areas will drive up property values, especially land. Therefore, a bigger agricultural sector may increase the property tax potential, resulting in a higher property tax value.

The variable of level of education may also serve as a measure of tax awareness. More educated people are perhaps expected to be more tax obedient, so level of education can also represent level of ease of tax collection. In addition, Labor Force Participation Rate (LFPR) is also included to represent both tax base and level of ease with a sign expected to be positive. Another potential relevant factor is level of openness, represented by the ratio of total value of export and import to total output (Gross Regional Domestic Product). The higher the level of openness, the higher the tax potential should be, since it will be administratively easier for local governments to impose and collect taxes on foreign than on domestic transactions.

Two region dummy variables (DJAVA and DRICH) are used to control for otherwise unmeasured region-specific fixed effects. It can be easily recognized that in the pre-decentralization era, there was a significant gap of development between Java provinces, including Bali, and non-Java provinces, resulting from the very centralized regime of the old government system. On the other extreme, there are some very rich provinces with oil and mineral reserves, but their standard of living does not reflect those valuable resources they own [7)]. This weak linkage reflects national control of extractive industries, since revenues from oil and minerals were collected by the central government. Those revenues were primarily used to fund the central government, and some part of it was redistributed to all provinces by using the equality principle [8)]. Lastly, to capture both firm and time effects that have to be incorporated in a panel data analysis, the procedure by Cornwell *et al.* (1990) is adopted.

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7) From 1996/1997 to 1999/2000, those four rich provinces (Aceh, Riau, East Kalimantan, and Papua) are in the top five in terms income per capita, with East Kalimantan as the highest, followed in order by Jakarta, Riau, Papua, and Aceh.

8) Note that today revenues are being returned in larger proportion to local governments.

In summary, the regression equations of tax potential are as follows :

$$\ln \frac{T}{Y}_{itj} = \alpha_{0j} + \alpha_{1j} [\text{HS}]_{itj} + \alpha_{2j} [\text{AGRI}]_{itj} + \alpha_{3j} [\text{LFPR}]_{itj} + \alpha_{4j} [\text{OPDOL}]_{itj} + \alpha_{5j} [\text{DJAVA}]_{itj} + \alpha_{6j} [\text{DRICH}]_{itj} + \alpha_{7j} [\text{T1}]_{itj} + \alpha_{8j} [\text{T2}]_{itj} + \varepsilon_{itj}$$

with : $\varepsilon_{itj} = v_{itj} - u_{itj}$

where :

i : province
t : time (year)
j : type of taxes
$\ln \frac{T}{Y}_{itj}$: natural log of tax ratio of province i, year t, type of tax j.
$[\text{HS}]_{itj}$: number of high school student per capita of province i, year t, type of tax j.
$[\text{AGRI}]_{itj}$: shares of agricultural sector of province i, year t, type of tax j.
$[\text{LFPR}]_{itj}$: Labor Force Participation Rate of province i, year t, type of tax j.
$[\text{OPDOL}]_{itj}$: the ratio of total export plus import to GRDP of province i, year t, type of tax j.
$[\text{DJAVA}]_{itj}$: dummy variable for Java and Bali provinces of province i, year t, type of tax j.
$[\text{DRICH}]_{itj}$: dummy variable for rich provinces of province i, year t, type of tax j.
$[\text{T1}]_{itj}$: linear dummy variable for firm and time effects of province i, year t, type of tax j.
$[\text{T2}]_{itj}$: quadratic dummy variable for firm and time effects of province i, year t, type of tax j.
ε_{itj} : error term of province i, year t, type of tax j.
v_{itj} : symmetric error term of province i, year t, type of tax j.
u_{itj} : nonpositive error term of province i, year t, type of tax j.

V. Empirical Results

To estimate Indonesian local governments' tax frontier, this study uses the Aigner, Lovell, and Schmidt model solved with the MLE technique, assuming the half normal error distribution for u. This study uses Indonesian cross-provincial data published by Indonesia Central Bureau of Statistics (ICBS) and the Directorate of PBB (Land and Building Taxes), and BPHTB (Duty on Land and Building Acquisition) from 1996 to 1999. There are 26 provinces (East Timor is excluded), so in total the regression

analysis uses 104 observations. The complete estimation result of the stochastic frontier along with OLS estimates for comparison can be seen in Table 5.1.

Table 5.1. Results of Regression Analysis of the Stochastic Frontier and OLS.

EXPLANATORY VARIABLES		DEPENDENT VARIABLES			
		LOCAL TAXES (N=104)		PROPERTY TAX (N=52)	
		FRONTIER	OLS	FRONTIER	OLS
HS	coef	0.0228	0.0201	-0.0037	-0.0016
	t-stat	2.219	2.364	-0.196	-0.105
AGRI	coef	-0.3161	-0.5497	2.5586	2.3059
	t-stat	-0.570	-1.125	2.177	3.186
LFPR	coef	0.0131	0.0167	0.0128	0.0109
	t-stat	1.774	2.199	0.766	0.784
OPDOL	coef	0.0025	0.0025	0.0025	0.0022
	t-stat	3.888	5.225	2.618	3.465
DJAVA	coef	0.4696	0.4572	-	-
	t-stat	3.534	4.032	-	-
DRICH	coef	-0.9706	-0.9812	-	-
	t-stat	-5.578	-7.350	-	-
T1	coef	-0.6494	-0.7327	-0.1456	-0.1320
	t-stat	-3.255	-3.701	-0.804	-0.773
T2	coef	0.0922	0.1077	-	-
	t-stat	2.461	2.862	-	-
CONSTANT	coef	-1.3215	-1.6512	-1.7509	-1.9137
	t-stat	-2.670	-3.581	-1.624	-2.336
σ_v^2		0.06017		0.10934	
σ_u^2		0.13524		0.16064	
R-square			0.7072		0.2671

For local taxes, the stochastic frontier model seems to fit very well. All coefficients have signs as expected and are statistically significant, except the agricultural share, which has the expected negative sign but is insignificant. The variance components are $(1-2/\pi)\sigma_u^2$ = 0.04914 and σ_v^2 = 0.06017, so about 45 percent of

the total variance ε is accounted for by the variance of inefficiency u [9]. In the OLS, all coefficients have the expected signs. Again, the only insignificant variable is the agricultural share. The coefficients for both methods are almost the same, except for the constant and time variables, suggesting that the frontier has a shape similar to the estimated OLS line, only higher.

For property tax, the frontier is constructed by using 1996 and 1997 data, that is the period before the severe Indonesian economic crisis [10]. In the case of the property tax, regional fixed effects are not significant, so they are eliminated. The only significant variables are agricultural shares and level of openness, and they have a positive sign as expected. LFPR is not significant with the expected positive sign, while level of education is not significant either, and has an unexpected negative sign. The variance components are $(1-2/\pi)\sigma_u^2$ = 0.05836 and σ_v^2 = 0.10936, so about 35 percent of the total variance ε is accounted for by the variance of u. Unlike the local taxes frontier, the shape of the property tax frontier seems different from the OLS estimated line.

Overall, the average actual tax ratio of local taxes is 0.36 percent (the ratio of total tax revenue collected by all local governments to total GDP), while the average tax potential of local taxes is 0.46 percent. If all provinces fully utilize all their tax potential, then the additional tax ratio that can be collected is about 0.10 percent of GDP. The table of actual tax ratio, tax potential, and tax potential used can be seen in Table 5.2.

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9) As explained before, in the stochastic tax frontier analysis, the error term u may not fully represent the level of inefficiency of local governments.

10) When data of 1996 to 1999 are used, the MLE method generates the same results that the OLS method does, indicating no efficiency relative to the frontier. However, when data are broken down into before and after 1998, the stochastic frontier can be developed. As we know, the Indonesian economic crisis started affecting people's lives in 1998, and it seems likely that the central government collection's of individual taxes -- including property tax – deteriorated dramatically, but not uniformly, creating problems in estimation.

Table 5.2. Actual Tax Ratio, Tax Potential, and Tax Potential Used.

PROVINCE		LOCAL TAXES			PROPERTY TAX		
		ATR actual	ATP frontier	ATP USED diff	ATR actual	ATP frontier	ATP USED diff
1	Aceh	0.1458	0.1840	79.24%	0.4770	0.6885	69.28%
2	North Sumatera	0.3690	0.4589	80.41%	0.4796	0.6888	69.63%
3	West Sumatera	0.3281	0.4064	80.75%	0.3690	0.5021	73.49%
4	Riau	0.2618	0.3244	80.70%	0.6012	0.8372	71.81%
5	Jambi	0.4609	0.5451	84.57%	1.0912	1.2756	85.54%
6	South Sumatera	0.2581	0.3616	71.38%	0.6892	0.8214	83.91%
7	Bengkulu	0.3528	0.4185	84.29%	0.5077	0.7214	70.38%
8	Lampung	0.3397	0.4398	77.24%	0.3436	0.7931	43.32%
9	Jakarta	1.2258	1.5430	79.45%	0.4204	0.6520	64.49%
10	West Java	0.3674	0.5424	67.74%	0.3220	0.4203	76.62%
11	Central Java	0.3732	0.5514	67.68%	0.2618	0.4493	58.27%
12	Yogyakarta	0.5557	0.6802	81.69%	0.3001	0.3978	75.45%
13	East Java	0.4152	0.6218	66.77%	0.3236	0.5050	64.08%
14	Bali	0.7914	0.9015	87.79%	0.3361	0.4879	68.89%
15	West Kalimantan	0.2533	0.3522	71.93%	0.4625	0.6439	71.83%
16	Central Kalimantan	0.1690	0.2618	64.57%	1.4954	1.7170	87.09%
17	South Kalimantan	0.3571	0.4608	77.49%	1.1070	1.3054	84.80%
18	East Kalimantan	0.1370	0.1921	71.29%	0.7344	0.8956	82.00%
19	North Sulawesi	0.2743	0.3582	76.57%	0.4080	0.5581	73.10%
20	Central Sulawesi	0.3525	0.4127	85.41%	0.5146	0.7712	66.74%
21	South Sulawesi	0.4184	0.4838	86.47%	0.7517	0.9643	77.95%
22	Southeast Sulawesi	0.2045	0.2945	69.45%	0.6287	0.8163	77.03%
23	West Nusa Tenggara	0.3152	0.3842	82.03%	0.4123	0.6394	64.49%
24	East Nusa Tenggara	0.2031	0.2849	71.29%	0.7895	1.0104	78.15%
25	Maluku	0.1996	0.3336	59.85%	0.9917	1.1633	85.25%
26	Papua	0.1584	0.2124	74.56%	1.2976	1.5273	84.97%
	AVERAGE	0.3572	0.4619	76.18%	0.6199	0.8174	73.41%
	SD	0.2263	0.2721	7.43%	0.3305	0.3419	9.97%

ATR = Average Tax Ratio, ATP = Average Tax Potential, ATP Used = Average Tax Potential Used

The local tax frontier shows a systematic pattern. All Java and Bali provinces, the most developed provinces in the nation, have a very high tax potential. Those six provinces rank in the top seven; Jakarta being the highest, with its tax potential almost double that of the second ranked, Bali. It is understandable that more developed

economies should have higher tax potential. Rich provinces, such as Aceh, East Kalimantan, Papua, and Riau, which have abundant natural resources, on the other hand are at the bottom of the list. As mentioned before, those natural resource revenues are extracted to Jakarta and the generating provinces received only a very limited part of revenues as grants from the central government, where the amount is almost the same as the level other provinces receive.

For local taxes, Bali has the highest tax potential used with 88%. Bali has some special tax bases that other provinces may not have, or bigger tax bases than other provinces. Only some limited goods and services can be taxed by local governments, and the biggest local tax revenues typically come from the restaurant and hotel business. Bali is the most popular vacation destination for both domestic and foreign tourists, and there are many more restaurants and hotels in Bali than in other provinces [11]. In addition, as an isolated island, it is easy for Bali's local government to impose taxes for visitors, such as an airport tax, ferry or port taxes, and the like.

The other most developed provinces with the highest local taxes potential, Jakarta, the capital city, and Yogyakarta, which also has a large tourist base, used about 80 percent of their tax potential. Three other Java provinces (West, Central, and East Java) surprisingly used only about 67 percent of their tax potential and are in the bottom five of the list. These three provinces would survive more easily than other provinces under decentralization, since they have very high tax potential, while the amount they used so far is much lower than that potential. Because their economies are quite large, if they could successfully increase their tax ratio, the impact on to the tax ratio of the

11) The biggest source of income for Bali comes from trade and the hotel and restaurant industries. Their shares are about 30%, which is the highest number in the nation. The average for all provinces is only 16%.

economy as a whole would be more significant than that of a similar increase of tax ratio in provinces with low tax potential, such as Central Kalimantan and Maluku.

For property tax, the average actual tax ratio is 0.62 percent of GDP, and the average tax potential is 0.82 percent. If all provinces could collect all their tax potential, then the additional tax ratio can be collected is about 0.20 percent of GDP. Unlike local taxes, the property tax frontier provides a less systematic pattern. Central Kalimantan apparently has the highest tax potential. Agriculture is the most important sector in this province. Its average of 43 percent is the highest in the nation, far above the national average of 26 percent. Central Kalimantan is also known as one of the centers for the forestry industry, including export. The combination of a very important agriculture sector and a high level of export explains why Central Kalimantan has a very high property tax potential. All Java and Bali provinces have quite a low property tax potential compared to less developed provinces.

For the property tax potential used, provinces with very high tax potential seem able effectively to utilize their potential. The top five provinces of the tax potential list are also the top five of the tax potential used list, with Central Kalimantan ranking first on both lists. Those five provinces are basically the medium income provinces. All Java and Bali provinces on average used only 68 percent of their tax potential, with Jakarta's utilization at only 64 percent [12]. Because of the size of their economy, if these developed provinces utilized all their tax potential, it would have a substantial impact on the whole country's tax ratio.

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12) One possible explanation is that there are many non-taxable government and international (such as embassies, the United Nations office, and so forth) properties in Jakarta, the capital city.

VI. Policy Implications

The empirical results in the previous section show that in the pre-decentralization period, Indonesian local governments had not fully utilized their tax potential. Therefore, in anticipation of revenue shortfalls resulting from decentralization, they would be wise to exploit the potential of their existing taxes before introducing new ones. The question is how those local governments could accomplish that.

As mentioned before, the decision of a local government *not* to use all of its tax potential in the period before decentralization may be a result of by two factors: *(i)* preferences for having small government, so the low tax ratio is chosen intentionally, and/or *(ii)* inefficiency of local governments. Under the new regime of decentralization, local governments do not have any choice but to pursue higher tax ratio to deal with their new (much bigger) expenditure responsibilities. Therefore, if there were some local governments that in the past had some unused tax potential because of their preferences, it would be easier for them to increase the tax ratio than it would be for provinces with a low tax ratio caused by inefficiency. However, it seems unlikely that there are provinces that fall into the former category. Most, if not all, appear to have failed to collect their tax potential due to their inefficiency, and not because of their preferences. Therefore, to close the potential deficit, local governments should concentrate on the second factor of inefficiency.

For less developed countries, especially Indonesia, the major root of inefficiency of government is very likely to be tax evasion and/or corruption [13]. Remarkably weak

13) According to the Transparency International, in 2002, Indonesia has a Corruption Perceptions Index of 1.9, and ranks 96 of 102 countries, only above Kenya, Angola, Madagascar, Paraguay, Nigeria, and Bangladesh.

law enforcement is often pointed out as the main cause of large and extensive tax evasion in Indonesia, and this weakness is obviously related to the level of corruption of local tax officials [14]. In other words, a low tax ratio (that is much smaller than the tax potential) is likely mainly to be caused by a high level of corruption, while other factors, such as incompetence of local tax officials, out-of-date technology and equipment, lack of human resources, and so forth, might contribute insignificantly [15]. From the taxpayers' standpoint, it seems more advantageous to pay some bribes to local tax officials than to pay the full amount of tax owed. From the tax officials' standpoint, they are still better off to accept those bribes even though they might also have to bribe other law enforcers so that their actions will not be prosecuted. The solution is then very straightforward, if difficult: eliminate or at least reduce levels of corruption.

There are also some other relevant factors that may influence local governments' decision not to use all their tax potential. Before decentralization, the role of the central government in both local expenditures and revenues was very vital. As a part of the old system, the central government had to give substantial subsidies every year to local governments. As a result, local governments became very dependent on such subsidies. This attitude may well have had a negative effect on local governments' efforts to collect their own revenues or to explore their tax potential. A simple regression analysis of tax ratio estimation can be used to test this claim.

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14) For example, a senior economist of the World Bank, Bert Hoffman, said that a survey conducted by the World Bank to monitor the decentralization process in Indonesia reveals that about three quarters of respondents still find a high level of corruption of local government staffs, even under decentralization

15) In contrast, these factors might outweigh the corruption factor in more developed countries.

There are two types of grants given by the central government to each local government: *(i)* SDO subsidies for routine spending and *(ii)* INPRES subsidies for local development projects. The regression model will use both types (measured as a percentage of a local government's total revenues) as explanatory variables, and they are expected to have a positive relationship with the dependent variable of level of tax potential not used by local governments (that is, the error term u). Another explanatory variable is income per capita. Year and region dummy variables are also used to control for otherwise unmeasured year-specific and region-specific fixed effects. Finally, a lagged dependent variable is now included in the model. The regression result can be seen in Table 6.1.

For local taxes, both subsidy variables have a positive sign as expected, but are not significant. SDO subsidies have much stronger effect than INPRES subsidies [16]. This supports the hypothesis that local governments are very revenue-dependent on such central government assistance. Income per capita negatively affects the level of unused tax potential as expected, and more developed provinces tend to be able to exploit their tax potential more successfully. The most significant factor, however, turns out to be the lagged variable. It seems that the amount of revenues collected by local governments largely depends on what they were able to collect in the previous year, implying that they made little effort to exploit their current or find new tax bases.

Since a local government's tax ratio is negatively affected by subsidies from the central government, especially SDO subsidies, then the central government could design a new transfer policy that would influence local governments to increase their utilization

16) To test the potential simultaneity problem of the use of the variable of income per capita, the Hausman test is carried out. The results show that the model does not possess a simultaneity problem, so the use of OLS is plausible.

of tax potential. The central government should simply give bigger INPRES subsidies to be used for local development [17]. Another advantage of giving a bigger proportion of INPRES is that with more intensive development, local governments would expand tax bases that in turn would also increase tax ratio.

Table 6.1. Results of the OLS Regression Analysis for Tax Potential Not Used.

EXPLANATORY VARIABLES		DEPENDENT VARIABLES		
		LOCAL TAXES (N=78)	PROPERTY TAX (N=26)	
			w/o target	with target
SUBSDO	Coef	0.00075	0.00036	0.00038
	t-stat	1.1219	0.8244	0.8686
SUBINPRES	Coef	0.00011	0.00020	0.00019
	t-stat	0.1598	0.3338	0.3108
GRDPCAP	coef	-0.00001	-0.00001	0.00001
	t-stat	-0.1335	-0.0007	0.1262
DJAVA	coef	0.00220	-0.00921	-0.01702
	t-stat	0.0913	-0.4797	-0.8397
DRICH	coef	-0.02306	-0.00888	-0.01062
	t-stat	-0.9358	-0.4383	-0.5262
T1	coef	0.77209	-	-
	t-stat	12.0157	-	-
T2	coef	-0.19229	-	-
	t-stat	-12.0192	-	-
LAG UNUSED TAX	coef	0.70141	0.98951	0.93384
	t-stat	9.5237	17.3539	12.4587
CONSTANT	coef	-0.559937	-0.00837	0.02411
	t-stat	-8.4690	-0.2291	0.52155
TARGET	coef	-	-	-0.03073
	t-stat	-	-	-1.1329
R-square		0.718	0.949	0.952
SE Regression		0.057	0.026	0.026
F-stat		21.971	58.433	51.016

17) From 1996 to 1999, the ratio of total SDO to INPRES subsidies for all local governments is 62% to 38%.

Theoretically, the difference between tax potential and actual tax ratio for property tax can be interpreted as the level of inefficiency. Property tax is managed and collected by the central government through its district tax offices. The central government sets the collection target for each provincial tax office every year, and the Directorate of PBB - *Land and Building Taxes* - (2002) reveals that of 104 observations in 26 provinces between 1996 to 1999, only 8 observations (about 7.7 percent) had tax revenue collected below their target [18]. Thus, the performance of district tax offices is determined effectively by the targets set by the central government. This conclusion is supported by the findings from the regression analysis of unused property tax potential. The target (as a percentage of GRDP) has a negative effect on unused tax potential, suggesting that if the central government increases the target, then the tax collected would also increase, making it closer to the tax potential (see Table 6.1) [19]. It can be seen that the low actual tax ratio is not caused by inefficiency of district tax offices, but rather by mismanagement of the central government in setting targets too low. Furthermore, the way the central government sets up the targets (that will determine the actual tax revenue collected) is largely based on the previous years' performance. Other factors, such as current local stage of development, local performance on other taxes, general economic indicators, *etc.*, are seemingly not seriously taken into account. The results of the same regression analysis show that the only statistically significant variable is the lagged variable (see Table 6.1). Obviously, the central government should change its

18) From 1996 to 1999, the national (overall) property tax revenue collected always exceeded its target, with the average of that period is about 110%.

19) When the ratio of revenue collected to target is used as a measure of target (instead of target per GRDP) in the regression analysis, a similar result is obtained, where the coefficient is also negative, implying that a better tax performance (measured by how much revenue can be collected compared to target) will lower unused tax potential.

method of setting targets for property taxes. Targets should be set equal to tax potential, and if one province collects an amount below its target, then we could say that this province is inefficient, that it failed to pursue all their tax potential. Consequently, those more developed Java and Bali provinces should be given a higher property tax revenue target.

Provinces may also be grouped based on their tax potential and tax potential used. A province has a high tax potential if its number is above the average of all provinces, and a province is said to have a low tax potential, if its number is below the average of all provinces, and similar rules are applied for tax potential used. Table 6.2. shows the grouping for the two types of taxes.

More generally, provinces in the quadrant of low ATP (Average Tax Potential) used have better chances to successfully increase their tax ratio than provinces in the quadrant of high ATP used. Moreover, the impact on tax ratio of the economy as a whole would be bigger if provinces with low ATP used and high ATP are able to increase their tax revenues.

VI. Conclusion

One consequence of decentralization is that Indonesian local governments will have to seek additional revenues coming from their own resources. The first thing they should do is to exploit their revenue potential from existing taxes before implementing any new taxes. This study investigates the tax potential of two sources of revenues for local governments: local taxes and property tax. Tax potential can be constructed by using the special regression analysis of the stochastic frontier.

Table 6.2. Grouping of ATP Used and ATP for Local Taxes and Property Tax.

LOCAL TAXES		PROPERTY TAX	
HIGH ATP **HIGH ATP USED**	**LOW ATP** **HIGH ATP USED**	**HIGH ATP** **HIGH ATP USED**	**LOW ATP** **HIGH ATP USED**
Jambi Jakarta Yogyakarta Bali South Sulawesi	Aceh North Sumatera West Sumatera Riau Bengkulu Lampung South Kalimantan North Sulawesi Central Sulawesi West Nusa Tenggara	Jambi South Sumatera Central Kalimantan South Kalimantan East Kalimantan South Sulawesi East Nusa Tenggara Maluku Papua	West Sumatera West Java Yogyakarta Southeast Sulawesi
HIGH ATP **LOW ATP USED**	**LOW ATP** **LOW ATP USED**	**HIGH ATP** **LOW ATP USED**	**LOW ATP** **LOW ATP USED**
West Java Central Java East Java	South Sumatera West Kalimantan Central Kalimantan East Kalimantan Southeast Sulawesi East Nusa Tenggara Maluku Papua	Riau	Aceh North Sumatera Bengkulu Lampung Jakarta Central Java East Java Bali West Kalimantan North Sulawesi Central Sulawesi West Nusa Tenggara

Our empirical findings show that none local governments have optimally used their tax potential. If those local governments were able to utilize all their tax potential of local taxes, then they would get additional tax revenue of 0.10 percent of GDP. For property tax, if all property tax district offices could operate efficiently with targets set by the central government to be equal to the tax potential, then the total additional tax revenue would be 0.20 percent of GDP. In other words, by *only* pursuing the tax

potential, local governments would be able to collect additional tax revenues of 0.30 percent of GDP. Essentially, what they have to do is to improve their tax collection performance in terms of efficiency by reducing tax evasion, mostly through decreasing the level of corruption. Note that these gains can be made without making major change in tax policies, such as the implementation of Law No. 34/2000.

A simulation by IMF and the World Bank shows that the total additional revenue needed by local governments after decentralization is about 0.70 percent of GDP. At least about 43 percent of the deficit (0.30 percent of GDP) can be covered by the existing local taxes and property tax. Support and cooperation from the central government are very important. For local taxes, the central government should change its formula of subsidy provision to local governments. Instead of giving a large amount of SDO subsidies as in the past, the central government should provide a bigger portion of INPRES subsidies that would be expected to increase local governments' tax ratios. For property tax, the most important step to take is to change the central government policy in setting target for its property tax district offices. Then the remaining 57 percent (0.40 percent of GDP) should be collected from two possible sources: *(i)* new local taxes allowed by Law No. 34/2000, and *(ii)* economic impacts of the new grants system.

The use here of the stochastic frontier approach (which is commonly applied only in the firms' problems, such as production function, cost function, or profit function) for estimating tax frontier is new. Because of similarities between problems of firms and governments in producing some "outputs", the stochastic frontier approach should theoretically be applicable for estimating tax frontiers. Econometrically speaking, the stochastic frontier model requires an accurate specification, and this condition might

create a problem in estimating tax frontier, which unlike production function construction, involves determining factors that are less obvious.

VII. References

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