Economic Growth and Structural Changes in Indonesia

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I. Background and Objectives Introduction

Under market-oriented factor mobility, factor inputs (capital and labor) relocate to regions offering higher returns. If producers move to the most profitable locations for plants and workers move to provinces with the highest wages, the more (less) the factor inputs in subnational regions with higher productivities, the greater the increase (decrease) in national output.

The standard neoclassical economics literature that analyzes national growth considers two sources: increase in factor inputs and productivity growth. However, the extent to which interregional factor mobility has contributed to a national economy has been infrequently examined because of regional data constraints. This research examines efficiency growth in interregional resource allocation, which is attributed to interregional allocation of factor inputs from low-productivity to high-productivity regions.

II. Methodology and Data

II.1 Methodology: Efficiency Index and Growth

The efficiency growth in interregional resource allocation, measured by growth in efficiency index, is computed by the following two empirical results: (i) estimation results in the province-level regional production functions and (ii) Pareto-optimal interregional allocation of the factor inputs.

The efficiency index is calculated by comparing actual national output values with the efficiently allocated national value at which social welfare is maximized. The index comprises efficiencies in resource utilization and resource allocation in the national economy, employing two types of outputs: *efficiently utilized GDP* (hereafter referred to as "potential GDP") and *efficiently allocated GDP* (hereafter referred to as "optimal GDP"). The potential GDP is the value of GDP when resources are fully employed without reallocating resources across provinces, while the optimal GDP is the value of GDP when total social welfare is maximized by reallocating resources across provinces.

Let Y_t, Y_t^*, and Y_t^{**} be actual GDP, potential GDP, and optimal GDP in a national economy in year *t*, respectively. The efficiency index, E_t, represents the interrelationships among the three GDP types, and can be expressed as the actual-to-optimal GDP ratio of a nation in year *t*,

$$E_t = Y_t \big/ Y_t^{**} = Y_t \big/ Y_t^{*} \cdot Y_i^{*} \big/ Y_t^{**} = E_t^U \cdot E_t^A \tag{1}$$

where E_t^U and E_t^A refer to efficiency in utilization (hereafter referred to as the "utilization efficiency index") and efficiency in allocation (hereafter referred to as the "allocation efficiency index"), respectively. Similarly, taking the first derivative of the right-hand side of Equation (1) with respect to time *t*, the efficiency index can be expressed as

$$\partial E_t \big/ \partial t = \partial E_t^U \big/ \partial t + \partial E_t^A \big/ \partial t \tag{2}$$

Equation (2) presents the additive decomposition of the growth in efficiency index into the sum of growth in utilization efficiency and allocation efficiency indexes.

II.1.1 Provincial Production Function

A simple Cobb-Douglass aggregate production function for each province *i* is employed and it is assumed coefficients for variables may change over time

$$\ln(Y_{it}) = \alpha_0 + \alpha_{1i} + \alpha_2 t + \sum_j \beta_{1j} \cdot \ln(X_{ijt}) + \sum_j \beta_{2j} \cdot \ln(X_{ijt}) \cdot t + \varepsilon_{it}, \tag{3}$$

where Y = GDP, α = coefficient indicating total factor productivity (TFP), and X = input factors; β represents elasticity values of the corresponding input factor *j*. The input factor *j* refers to both capital and labor variables in this study. For each provincial function, a constant return of scale within each time period *t* is assumed: $\sum_j B_j = 1$.

II.1.2 Welfare Maximizing Interregional Resource Allocation

In the first fundamental theorem of welfare economics, a perfect competition across provinces leads to a Pareto-optimal interprovincial resource allocation. For any given year, efficient allocation of resources can be determined by a computational problem in resource allocation, which is equivalent to solving a small computable general-equilibrium model with the objective function of maximizing social welfare, subject to technology and resources constraints. The technology constraint refers to the estimation results of the aggregate provincial production function in Equation (3). The result is a set representing efficient resource allocation, defined as optimal resource allocation of inputs, X_{ijt}^{**}, and optimal GDP, Y_{it}^{**}.

Then, we can solve a central planner's problem to obtain the optimal input allocations:

$$\max_{(Y_{it}, X_{it})} W = \prod_{it} Y_{it}^{Si}, \tag{4}$$

subject to

production technologies: $Y_{it} = F(X_{ijt})$ (5)

Endowments: $\sum_i X_{it} = \overline{X}_t \; (X_{it} \geq 0 \;\; for\ all\ i)$ (6)

where W is a social welfare function of the Cobb–Douglas form with the actual provincial output shares S_i used as weights. In endowments, input variables without the subscript *i* indicate the corresponding national values as well.

II.2 Data

This study employs data on 26 provincial GDP and factor inputs for the period 1986–2007. As a result of political reforms in Indonesia after the 1998 economic crisis, 7 new provinces were carved out from the existing ones and the province of East Timor was granted independence. Thus, the number of provinces increased from 27 to 33; however, no retroactive adjustment of relevant data has been carried out so far. In order to avoid inconsistency, we use the data for 26 provinces and aggregate the statistics for the new and existing provinces. The sources are summarized as follows.

- GDP: The data are sourced from *Gross Regional Domestic Product of Provinces in Indonesia by Expenditure* (BPS, various years a) and all figures are converted into the 2000 constant price.
- Employment: The data are sourced from *Labor Force Situation in Indonesia* (BPS, various years b).
- Capital: Data on capital stock have not been officially published in Indonesia; therefore, the provincial capital data are employed from Kataoka (2010), which estimated on the basis of the perpetual inventory method. The data are constructed by accumulating each year's investment, obtained from the *Gross Regional Domestic Product of Provinces in Indonesia by Expenditure*, and subtracting the retirement values of the past investment.

III. Empirical Results

III. 1 Province-level Regional Production Function

In order to avoid a heteroskedasticity problem due to large regional differences, either regional dummy variables in the resource-rich provinces or regional fixed effects were employed. The five resource-rich provinces are Aceh, North Sumatra, Riau, East Kalimantan, and Papua. Additionally, considering the impact of the financial crisis on the provincial economies in Indonesia, a dummy variable that takes a value of 1 in the post-crisis period and 0 at other times is also employed.

Table 1 Provincial Production Function Estimates

	R1	R2	R3	R4
Constant	-1.416	-1.561	-1.679	-0.106
	(-10.29)	(-20.08)**	(-21.09)**	(-0.29)
Cpital	0.842	0.833	0.807	0.687
	(47.05)**	(50.19)**	(74.5)**	(22.62)**
Labor	0.161	0.184	0.213	0.056
	(6.79)**	(12.1)**	(15.37)**	(-1.08)
Time Trend	-0.014		0.011	0.022
	(-1.28)		(4.86)**	(9.82)**
Capital*t	-0.003	-0.003		
	(-2.49)**	(-2.14)*		
Labor*t	0.005	0.003		
	(2.75)**	(4.11)**		
Regional Dummy	0.246	0.246	0.244	
	(10.97)**	(10.96)**	(10.83)**	
Post-Crisis Dummy	-0.229	-0.236	-0.232	-0.230
	(-7.87)**	(-8.23)**	(-7.95)**	(-14.36)**
Provincial Fixed Effect				yes
R^2	0.979	0.980	0.979	0.994

Note 1: Figures in parenthesis are t-values.
Note 2: * and ** indicate that estimates are at the 5% and 1 % significance levels, respectively.
Note 3: Fixed-effect coefficients are not reported.

Shown at Table 1, R3 is employed as production technologies of maximizing problem because all coefficients are statistically significant and their signs are economically meaningful. Capital played an important role in Indonesia's provincial production with elasticities 0.807 and that of labor input is far smaller than that of capital at 0.213. Strong and positive coefficients for the time-trend variables implies that technical change played a vital role in promoting Indonesia's provincial production during the study period. The coefficient of the regional dummy indicates a positive and strong value, implying that resource-rich provinces have much greater output than other provinces. The coefficient of the post-crisis dummy shows a negative and strong value, implying that production values decreased significantly in the year 1998 and after.

III. 2 Pareto-optimal Interregional Allocation of Factor Inputs

We calculate the Pareto-optimal interregional factor inputs in year *t*. Tables 2 and 3 present the biggest and the smallest gap between the national share of actual and optimal values of input allocations for each province, with the year. The positive (negative) value indicates more (less) allocations than the optimal. Several interesting findings are summarized as follows.

- Table 2 shows that, apparently, there exists a large surplus of capital in the province of Jakarta. The actual provincial capital shares for Jakarta ranged from 25.5% in 1986 to 27.3% in 1997. This indicates that Jakarta, which, as the capital city, has of a number of capital-intensive industries, faces an overconcentration of economic activity.
- The resource-rich off-Java provinces show different dispositions. Riau province, the booming special economic region, shows a higher-than-optimal rate of capital formation, whereas two provinces, Aceh and North Sumatra indicate lower-than-optimal rates.

Table 2 Gap between actual and optimal allocation by province – Capital

	Max		Min		Mean
	Gap (%)	Year	Gap (%)	Year	
Sumatra					
01. Aceh	-0.4	2007	-2.3	1991	-1.4
02. North Sumatra	-0.2	1992	-0.9	2007	-0.5
03. Riau	1.8	1993	0.3	1987	1.2
04. West Sumatra	-0.3	1986	-0.6	1993	-0.5
05. Jambi	0.1	1997	-0.2	2007	0.0
06. Bengkulu	0.1	1996	-0.1	2007	0.0
07. South Sumatra	0.7	1997	0.1	1986	0.5
08. Lampung	0.0	2005	-0.5	1991	-0.2
Java-Bali					
09. West Java	-1.9	1998	-4.9	2002	-3.6
10. Jakarta	10.2	1999	7.8	1986	9.0
11. Central Java	-1.1	1994	-1.7	2005	-1.3
12. Yogyakarta	0.2	1986	0.0	1999	0.1
13. East Java	-1.0	2000	-1.9	1994	-1.4
14. Bali	0.0	1987	-0.3	2007	-0.1
Kalimantan					
15. West Kalimantan	0.3	1986	-0.2	1998	0.0
16. Central Kalimantan	0.4	2007	0.0	1998	0.1
17. East Kalimantan	0.2	1996	-1.3	1986	-0.5
18. South Kalimantan	-0.3	2002	-0.6	2006	-0.5
Sulawesi					
19. North Sulawesi	-0.1	1986	-0.3	1998	-0.2
20. Central Sulawesi	0.0	1996	-0.2	1994	-0.1
21. South Sulawesi	-0.1	1987	-0.6	1998	-0.4
22. Southeast Sulawesi	0.0	2002	-0.1	1986	-0.1
Eastern Indoneisa					
23. West Nusa Tenggara	0.1	1999	0.0	2000	0.1
24. East Nusa Tenggara	0.0	1997	-0.1	1998	-0.1
25. Maluku	0.1	2000	-0.2	1991	-0.1
26. Papua	0.6	2007	-0.5	1998	0.0

- Table 3 shows that the actual labor allocation in Jakarta is far less than what it should be. The reverse is true of West Java, the adjacent province of Jakarta. Considering that some parts of West Java is within commuting distance of Jakarta, the province has a sizable residential population working in Jakarta.
- In Ache and East Kalimantan, the actual labor allocation is far less than the optimal levels because these provincial economies specialize in non-labor-intensive mining sectors. On the contrary, the three large Java provinces, West, Central, and East Java, show far more actual

allocation of labor input than they should as these economies specialize in the labor-intensive manufacturing sector.

Table 3 Gap between actual and optimal allocation by province – Labor

	Max Gap (%)	Max Year	Min Gap (%)	Min Year	Mean
Sumatra					
01. Aceh	-0.3	2003	-3.3	1987	-1.8
02. North Sumatra	1.2	1987	-0.2	2007	0.4
03. Riau	-4.0	2007	-6.7	1987	-5.1
04. West Sumatra	0.5	1994	0.1	2007	0.3
05. Jambi	0.6	1996	0.3	2007	0.5
06. Bengkulu	0.5	1996	0.3	1988	0.4
07. South Sumatra	0.5	2002	-1.5	1986	-0.1
08. Lampung	2.5	1989	1.5	2006	1.8
Java-Bali					
09. West Java	2.6	1998	0.4	1999	1.1
10. Jakarta	-12.4	1999	-14.6	1997	-13.8
11. Central Java	9.6	1986	7.7	1997	8.3
12. Yogyakarta	1.1	1989	0.7	1998	0.9
13. East Java	7.0	1986	3.2	2006	4.4
14. Bali	1.0	1988	0.6	1998	0.8
Kalimantan					
15. West Kalimantan	0.7	1995	0.4	1998	0.6
16. Central Kalimantan	0.2	2006	-0.1	1986	0.1
17. East Kalimantan	-4.1	2007	-5.6	1986	-4.6
18. South Kalimantan	0.6	1994	0.2	2006	0.4
Sulawesi					
19. North Sulawesi	0.7	1987	0.3	2002	0.5
20. Central Sulawesi	0.5	1996	0.3	2003	0.4
21. South Sulawesi	1.9	1987	0.9	2003	1.3
22. Southeast Sulawesi	0.5	2002	0.2	1987	0.4
Eastern Indoneisa					
23. West Nusa Tenggara	1.4	1994	1.0	2005	1.2
24. East Nusa Tenggara	1.9	1987	1.3	1999	1.5
25. Maluku	0.6	2000	0.1	1988	0.4
26. Papua	0.1	1987	-0.7	1998	-0.3

III. 3 Efficiency Growth

Given the previous estimation and calculation results, the three efficiency indices as well as their growth rates are computed and shown at Table 4. The major interesting observations are summarized as follows.

Table 4 Efficiency Indexes and Growth Rates

	Efficiency Value	Efficiency Growth (%)	Utilization Value	Utilization Growth (%)	Allocation Value	Allocation Growth (%)
1986	0.896	-	0.992	-	0.903	-
1987	0.894	-0.24	0.989	-0.34	0.904	0.10
1988	0.905	1.25	1.001	1.25	0.904	0.00
1989	0.920	1.68	1.017	1.56	0.905	0.12
1990	0.935	1.54	1.030	1.29	0.908	0.25
1991	0.943	0.94	1.038	0.79	0.909	0.14
1992	0.954	1.14	1.047	0.83	0.912	0.30
1993	0.945	-1.00	1.034	-1.23	0.914	0.24
1994	0.941	-0.42	1.027	-0.68	0.916	0.27
1995	0.932	-0.87	1.014	-1.24	0.920	0.38
1996	0.911	-2.27	0.990	-2.32	0.920	0.05
1997	0.881	-3.30	0.956	-3.44	0.922	0.15
1998	0.935	6.07	1.016	6.28	0.920	-0.20
1999	0.930	-0.49	1.010	-0.57	0.920	0.09
2000	0.924	-0.64	1.004	-0.64	0.920	-0.01
2001	0.915	-1.01	0.994	-1.00	0.920	-0.01
2002	0.914	-0.06	0.995	0.06	0.919	-0.12
2003	0.927	1.34	1.004	0.95	0.923	0.39
2004	0.930	0.39	1.008	0.43	0.922	-0.04
2005	0.942	1.29	1.019	1.03	0.925	0.26
2006	0.953	1.18	1.027	0.80	0.928	0.37
2007	0.959	0.61	1.034	0.66	0.928	-0.05
Mean	0.927	0.33 (100)	1.011	0.20 (60.8)	0.917	0.13 (39.1)

- The efficiency index ranges from 0.881 to 0.959 over the observation period. The reciprocal of the efficiency index indicates national welfare growth prospects; the prospects of welfare growth are relatively greater at a potential growth rate of 4.2% to 13.4%.
- The efficiency index has grown at an arithmetic average rate of 0.33%, annually. The growth rates in the utilization efficiency and the allocation efficiency indices were 0.20% and 0.13%,

respectively, and their contribution to efficiency growth accounted for 60.8% and 39.1%, respectively. These results imply that better resource utilization contributed more to national economic growth in Indonesia than did resource allocation.

- With regard to annual variations, the allocation efficiency index constantly rose from 1986 to 1997, but the growth slowed down afterwards. This fact implies a structural change in interregional allocation of factor inputs between the pre- and post-crisis periods. In the pre-crisis period, labor and capital moved to more profitable provinces, which implies a pro-efficiency interprovincial allocation. The post-crisis period was not characterized by pro-equity interprovincial allocation.

IV. Conclusions

Given the estimation results of province-level production functions and computations of optimal resource allocation, this study examined the efficiency in interprovincial resource allocation. A structural shift can be found from a pro-efficiency allocation before the economic crisis to a non-efficiency allocation after the crisis. The overconcentration of economic activity in Jakarta did not improve the efficiency in the interregional resource allocation.

There are several the scope for improvements in this study. First, the panel-data estimation techniques for the province-level production functions can be improved. In order to examine the structural change during the economic crisis, this study employed post-crisis dummy variables. Several other econometric techniques such as CUSUM test can be an alternative application. In this model, the post-crisis dummy variables were the same across provinces. However, Akita and Alisjahbana (2002) found that the impact of the economic crisis differed across regions and that the effects were more severe in the Java provinces. Their empirical findings should be analyzed by other econometric techniques in the future.

Second, the welfare-maximizing resource allocation model can be another improvement. The model entails the application of the Cobb–Douglass production function and weighs its output by actual output values; however, there are no constraints in terms of interprovincial mobility of factor inputs. If relocation costs are assumed in the analysis, for plant and equipment and in regard to the social ties in the residential community, the results would be more relevant.

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