

Some Determinants of Growth in Off-Java Lagging Regions Since Decentralization

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ABSTRACT

This study explores some determinants of sub-national growth in Indonesia, and focuses particularly on off-Java manufacturing outcomes since the country's "Big Bang." Since 2001, Indonesia has been undergoing administrative, fiscal and governance decentralization. Often referred to as the "Big Bang," provincial and local (district) governments began to assume control over many policies. District governments – with varying levels of capacity – coordinate local service delivery such as health programs and local roads, in addition to elections of local and national representatives. In 2006, transfers to sub-national governments increased again. Indonesia's provinces and districts now spend a record 37 percent of total public funds, which is higher than the OECD average.

One of the main inquiries in this study is whether urbanization or localization effects are more significant for development in off-Java lagging districts, since the Big Bang. Our analysis excludes districts on Java completely. Java is the most-populated island in the Indonesian archipelago, and also generates the most economic activity.

Our intent is to examine the impacts of urbanization (urban growth and population concentration), localization (concentration of like businesses), government investment in infrastructure, population, human capita, and other relevant factors, on economic growth in the manufacturing sectors, since economic decentralization began in 2001. To this end, we develop two sets of econometric models to examine panel data for Indonesian administrative districts (*kabupaten* and *kota*) for the seven years between 2001 and 2007. We choose three outcome variables and estimate separate equations for each of them: number of manufacturing establishments in a district, number of manufacturing jobs in a district, and total manufacturing value-added *per capita*. We define a "lagging" district as one with less than the median *per capita* income for overall Gross Regional Domestic Product (GRDP).

We analyze off-Java urban and rural areas separately. We estimate the general overall effect of a given variable, and also the differential effect for lagging districts using interaction terms. This set of interaction terms was introduced because we found disappointing levels of significance on most growth variables when the differential effects of lagging regions were not accounted for. In general, the outcomes for leading and lagging regions are so different that their combination can skew the findings.

Our findings indicate that lagging districts in both urban and rural areas respond much better to localization than to urbanization. This presents two issues for consideration. First, the more immediate gains to the industrial sectors are to be gained from the concentration of industry. Second, Indonesia is failing – at least with regards to the manufacturing sectors – to leverage its urbanization for economic growth. We also find that, in both urban and rural districts, the presence of state- and local-government-owned enterprise boosts economic outcomes, but government participation in industry suppresses growth in urban districts. As we said above, this makes a strong case that government-led industrial growth can provide a core set of firms and value-added in lagging regions, but future policy programs should focus on growing the private sector.

INTRODUCTION

This study explores some determinants of sub-national growth in Indonesia, and focuses particularly on off-Java manufacturing outcomes since the country's "Big Bang." Since 2001, Indonesia has been undergoing administrative, fiscal and governance decentralization. Often referred to as the "Big Bang," provincial and local (district) governments began to assume control over many policies. District governments – with varying levels of capacity – coordinate local service delivery such as health programs and local roads, in addition to elections of local and national representatives. In 2006, transfers to sub-national governments increased again. Indonesia's provinces and districts now spend a record 37 percent of total public funds, which is higher than the OECD average (Adams, Fengler et al. 2007).

The bulk of studies that address the spatial issues of the New Economic Geography (Krugman 1991a; Krugman 1991b; Krugman 2007) focus on countries as the unit of analysis. While this type of study is useful, they cannot address critical questions such as how to handle the particular issues of lagging sub-national regions. With more than 17,000 islands and vast regional disparities in incomes, health, accessibility, infrastructure, ethnicity, literacy, governance, and levels of urbanization, Indonesia provides an enough internal variation to study sub-national growth outcomes while also providing a stable over-arching political and cultural context.

One of the main inquiries in this study is whether urbanization or localization effects are more significant for development in off-Java lagging districts. Our analysis excludes districts on Java completely. We already know that on-Java districts are richer, with higher Gross Regional Domestic Products (GRDP) *per capita* than all but a few districts in the outlying Islands (Vidyattama, Hill et al. 2009). Economic activity in Indonesia is concentrated on Java, and on Java, it is even more concentrated in the Jakarta Metropolitan Region (JMR). In 2004, Java contributed 61, 66, and 67 percent of the country's total GDP, non-mining GDP, and household expenditure, respectively. In 1975, no province held more than a 20-percent share in the manufacturing economy. By 2004, seven provinces and three on Java, has shares greater than 20 percent – with West Java holding 43 percent. The only significant case of "deindustrialization" since the mid-1980s in Indonesia has occurred in Jakarta, where the manufacturing has declined as factories migrate to outlying districts of the JMR (Vidyattama, Hill et al. 2009). We know that firms are much more likely to locate on Java than anywhere else in Indonesia, to take advantage of agglomeration economies (Deichmann, Kaiser et al. 2005).

What we know less about, are the factors that induce growth in off-Java regions. Any analyses of growth in Indonesia that include Java – even if they don't focus on Java specifically – are essentially using Java's attributes as a baseline. Using Java as a baseline is appropriate in some contexts – for instance, when studying firm location choice, since firms will locate where conditions are most favorable. The problem with this approach is that the (relatively) overpowering growth and productivity on Java can mask albeit smaller effects that could be instructive on other islands. Our study attempts to fill this knowledge gap.

With a GDP of about \$3,039 nominal USD *per capita* in 2010 (WB 2010), Indonesia still has some way to go before it reaches the roughly-\$10,000 threshold, after which Brülhart and Sbergami (Brülhart and Sbergami 2009) conclude that agglomeration provides few benefits in terms of economic output. Thus, Indonesia is well-positioned to take advantage of agglomeration economies, though it has historically failed to do so (Ellis, Dowall et al. 2011).

The remainder of this paper provides a brief review of the background literature, a summary of our approach to the analysis (including data, indicators, and modeling), findings, conclusions and recommendations.

BACKGROUND

Studies on economic growth in Indonesia are relatively sparse, especially since the Big Bang administrative decentralization that began in 1999. McCulloch and Sjahrir (McCulloch and Sjahrir 2008) examine value-added growth and convergence in all sectors (not just manufacturing), and including Java, and conclude that poorer districts tend to grow faster than better-off districts, and that nearness to a growing district is associated with growth. They find no evidence of spatial divergence in growth after 2001. They do not differentiate between urban and rural districts. They also rely solely on GRDP as an outcome variable, which even they admit is very noisy.

In Indonesia, most studies focus on the country as a whole (McCulloch and Sjahrir 2008) (Deichmann, Kaiser et al. 2005) or on Java only (Henderson, Kuncoro et al. 1996; Kuncoro and Dowling 2004; Kuncoro and Dowling XXXX????). Few studies examine off-Java effects specifically. In a national study, Deichmann and Kaiser (2005) conclude that road-infrastructure improvements would do little to draw manufacturing to outlying, lagging districts in East Kalimantan and South Sulawesi provinces in Eastern Indonesia. Although they address the issue of regional disparity in firm location, their approach is cross-sectional, only for 2001. Our study examines change over time in Indonesia's post-Decentralization period, beginning in 2001.

Numerous studies have commented on various legacy factors that can lend advantage to certain regions within a country. Natural advantages – endowments that make regions attractive for investment by firms – can include legacy investment such as roads and power (Ellison and Glaeser 1999). Production externalities, on the other hand, result from attributes of the local economy that provide efficiencies for a firm's production process, interactions with its market, suppliers, and pools of qualified labor. This study attempts to differentiate effects of natural advantage and local externalities.

Local externalities can include the institutional and regulatory climate (Peck 1992; Amin 1999). McCulloch and Sjahrir (2008) note, although do not have the data to study, the potential influence of institutional factors such as strong local leaders, on growth in Indonesia. As they note, forthcoming data on local parliaments and leaders are available only after 2004, so our analysis leaves out leadership variables. However, our analysis attempts to capture the effects of institutional legacy on growth in the manufacturing sectors. Other studies in the enormous literature on political and institutional policies that affect growth, have concluded that pre-Bang national policies in Indonesia favored Jakarta, resulting in better economic outcomes there (Henderson and Kuncoro 1996; Kaiser 1999). In a cross-country study, Davis and Henderson (Davis and Henderson 2003) argue that investment in both inter-regional infrastructure and fiscal decentralization promote growth of population and economic activity away from primate cities and into lagging hinterland cities. Our study pays particular attention to the issue of government involvement in manufacturing activity.

Beginning with Krugman's seminal work on the New Economic Geography (Krugman 1991a; Krugman 1991b; Krugman 2007) numerous theorists have argued that transaction costs affecting trade can be reduced by lessening distances – a concept that is operationalized in the World Development Report 2009 (Lin, Gill et al. 2009) as "economic distance." Our analysis also pays particular attention to the issue of economic distance in the formulation of critical indicators of urbanization and localization.

APPROACH

Our intent is to examine the impacts of urbanization, localization, government investment in infrastructure, population, human capita, and other relevant factors, on economic outcomes in the manufacturing sectors. To this end, we choose three outcome variables and estimate separate equations for each of them: number of manufacturing establishments in a district, number of manufacturing jobs in a district, and total manufacturing value-added *per capita*. We note that value-added is measured per resident in the district, not per worker. This was

done because we wish to measure the size of the industry, not its per-worker productivity. We define a “lagging” district as one with less than the median *per capita* income for overall Gross Regional Domestic Product (GRDP). We take the median of GRDP for urban districts, and a separate median for rural districts.

We analyze off-Java urban and rural areas separately. We estimate the general overall effect of a given variable, and also the differential effect for lagging¹ districts using interaction terms. Like McCulloch *et al* (McCulloch and Sjahrir 2008), we found disappointing levels of significance on most growth variables when the differential effects of lagging regions were not accounted for. In general, the outcomes for leading and lagging regions are so different that their combination can skew the findings. Noting that wealthier districts will be slower-growing while lagging districts play catch-up, we decided to isolate the effects of growth on lagging districts.

For each of these spatial designations (urban and rural), we develop two sets of models:

1) *Cross-Area Panel Growth Regression (CAPGR)*. These models are a variation of the cross-country panel growth regressions initially developed by Barro and Sala-i-Martin (1991a) and subsequently used extensively in analysis of economic growth, e.g., (Hausmann, Klinger et al. 2008). This model regresses GDP per-capita growth over a period of time against the logarithm of initial GDP per capita and other explanatory factors:

$$g_{it} = \gamma + \alpha \log(y_{i,t-1}) + X_{it}B + X_{it}(L)B + \varepsilon_i$$

where

γ is a constant

g_t is the nominal growth of GDP per capita over the time period

y_{t-1} is the initial level of GDP per capita

X is a matrix of relevant district characteristics

B is a vector of coefficients to be estimated

L is a dummy variable denoting a lagging district

ε_i is an idiosyncratic error term.

A note regarding equilibrium is in order. The CAPGR and fixed-effects models were chosen because they most-closely match the effects that we wish to observe. We recognize, however, that the CAPGR models were developed as long-run growth models, and that one limitation of our application of these models here is that it is difficult to conclude the long-term effects of policy changes from them, since they do not reflect long-run equilibrium (Acemoglu 2010), i.e., changes in supply and demand of various factors as a long-term result of policy changes. We present the findings here, mindful that system equilibrium adjustments could affect the outcomes we report.

2) *Fixed Effects Panel Model*. A fixed effects model was used to examine the impacts of change in the independent variables over the analysis periods, on growth over that time period. Unlike the cross-area panel growth models, which examine the effects of initial conditions on growth, the fixed-effects model examines growth as a function of change. Both models have advantages: since the effects of some processes (e.g., infrastructure investment) often need a longer time horizon for their effects to manifest, the CAPGR models are useful. However, CAPGR models cannot help us to understand the outcomes of change. For those

¹ Lagging districts are defined as those below the median GRDP *per capita* in a given year. Urban lagging regions are those below the median GRDP *per capita* for urban regions; rural lagging regions are those with GRDP *per capita* below the median for rural regions.

effects that are more immediately apparent (e.g., EXPY), the fixed effects model can perform this function. In tandem, the models tell a more complete story. The fixed-effects model has the additional advantage of controlling for time-invariant unobserved variables, which helps with the potential specification bias that we identified with the CAPGR models. A Hausman test was used before the regression was run, to determine whether the fixed or random effects model was appropriate. A fixed-effects model was run as follows:

$$y_{it} = \gamma + X_{it} \beta_1 + Z_i \beta_2 + L * Z_i \beta_3 + \alpha_i + \varepsilon_{it},$$

where

y_{it} is the nominal GDP per capita for a given year t in district i

X_{it} is a vector of time-varying regressors

Z_i is a vector of time-invariant regressors

L indicates a lagging interaction term

α_i is an unobserved effect for individual districts

ε_{it} is an error term.

One advantage to the fixed-effects approach is that it controls for the effects of unobserved and time-invariant, location-specific effects. These could include natural advantages – endowments that make regions attractive to firms like legacy investment such as roads and power (Ellison and Glaeser 1999), protracted religious and ethnic conflicts that have been running through the analysis period (as in Aceh and Maluku). We use heteroskedasticity-robust and clustered standard errors (clustered by urban agglomeration² for metropolitan areas and by Island Region³ for rural areas).

One advantage of focusing on lagging districts is that we can ignore some of the problems with endogeneity in the lagging interaction terms in the fixed-effects models. Many of the factors that are related to growth – education and human capital, population growth, capacity for innovation – are endogenous to the system. That is, we would expect (for example) higher levels of GRDP to lead to better education outcomes, in addition to the reciprocal relationship. If endogeneity is not corrected for (generally using some sort of instrumental variables technique), then bias is introduced into the models. When there are multiple endogenous relationships, suitable instruments become a problem, as is the case in this study.

Our approach assumes that most of the endogenous effects, e.g., increased median years of schooling as a result of economic growth, occur in the leading districts. Our findings imply that this is true – that is, the effects in the general case and on the lagging terms are often opposite each other in the direction of the effect. When the effect on lagging districts is isolated, as we will show below, we see effects consistent with the hypothesis that the endogenous effects are concentrated in leading districts.

We focus on the 2001 to 2006 time period for the analysis, because we are interested specifically in determinants of growth in the post-decentralization period. We recognize that 2004 provides an interesting break-point in this type of study, as Indonesia's national Gross

² Urban agglomerations are metropolitan regions, and were defined using Uchida and Nelson (2008) framework for identifying metropolitan agglomerations, with modifications to make the framework more suitable for Indonesia. In general, the process works as follows: an urban core region is identified using GOI-defined *kota* as the core. Then, surrounding non-*kota* districts are added to the agglomeration if they meet certain proximity and density standards. We refer the reader to Ellis *et al* (2011) for a detailed explanation of this process.

³ The Government of Indonesia (GOI) has designated seven Island Regions: Java-Bali, Sumatera, Sulawesi, Papua, Kalimantan, Nusa Tenggara, and Maluku.

Domestic Product (GDP) returned to pre-Asian Economic Crisis levels in 2004. However, we felt that the 2004-2006 analysis period was too short to provide interesting insights on growth. We save the post-recovery analysis for a time when sufficient data are available.

Both models include metrics designed to capture the effects of the following factors on economic outcomes:

- i. Population
- ii. Human capital
- iii. Composition of the economy
- iv. Development expenditure
- v. Innovative capacity
- vi. Capital
- vii. Urbanization and localization economies

Data were drawn largely from surveys conducted and compiled by Indonesia's Central Bureau of Statistics (BPS). In general, we draw on surveys which provide representative samples for each district, and which are conducted annually. Our outcome variables (value-added, firms, workers) come from the Manufacturing Survey of Medium and Large Firms (also known in Indonesian as the *Survei Industri*, or SI). The National Socio-Economic Survey (Susenas) is conducted annually by BPS, and has been a nationally-representative sample since 1993. For our study, Susenas provides population figures. The Regional Finance Information System (SIKD) provides data on public investment in infrastructure development.

Human capital is proxied using median years of education in the district, from Susenas. Given Indonesia's relatively recent (1999) and continuing transition to centralized to local governance, and the variation of different regions in levels of reliance on state-owned industries, we follow Fan and Scott (2003) in including the level of government intervention in the economy, and include proportions of the local manufacturing economy that are generated by nationally-owned, local government-owned, foreign-owned, and private Indonesian-owned enterprise. As another measure of economic composition, we use EXPY. EXPY is a measure developed by Hausman *et al* (2007) as an indicator of the sophistication of a country's export basket – i.e., whether a country is producing goods that are on the “upscale” end of the product spectrum. The core idea behind the EXPY computation is that, if all other factors are held constant, “an economy is better off producing goods that richer countries export.” Hausmann's results show that high EXPY values – that is, countries whose exports are more upscale – are associated with high levels of economic growth. We apply Hausmann *et al* (2007) framework to a sub-national data, to develop an indicator of the competitiveness of Indonesia's sub-national (district) economies. EXPY values are computed from ISIC Revision 2 manufacturing data at the four-digit level. We direct the reader to Appendix A of Ellis *et al* (Ellis, Dowall *et al.* 2011) for a detailed discussion of the EXPY computations.

Many studies on growth in Indonesia and throughout Asia have noted the importance of infrastructure in economic growth (Deichmann, Kaiser *et al.* 2005; Vidyattama, Hill *et al.* 2009). SIKD data on public works development (as opposed to maintenance and operations) expenditure by local governments, was used as an indicator for infrastructure investment. Electricity reliability was proxied using SI measurements showing the proportion of manufacturing energy that firms self-generate (as opposed to buying it from PLN, Indonesia's state-owned electricity company)⁴. As an approximation for capital, we use the proportion of

⁴ *Perusahaan Listrik Negara*

manufacturing value-added that is dedicated to the servicing of loans, also from SI. We note that more-precise measures of capital were not available for all study years.

In addition to using BPS-prepared statistics, we compute several spatial indicators using GIS. Urbanization and localization economies are approximated using gravity indices that represent their position relative to major population centers and sector-specific industrial concentrations. We believe this approach is an improvement over previous indicators for urbanization economies, which have considered only population or distance, but not both. For instance, Fan and Scott (2003) use population of largest city in the province in a provincial-level study of agglomeration in China. Deichmann and Kaiser (Deichmann, Kaiser et al. 2005) use road density and travel time measure access to markets and population centers. McCulloch and Sjahrir (2008) use a weighted average of GRDP growth in neighboring districts. Our analysis takes this further, employing a gravity index that considers distance and weight. Unlike these simpler measures, a gravity index provides a measure of the proximity of a place to regional attractions, weighted by the distance that must be traversed to reach those attractions. Thus, it reflects “economic distance” (Lin, Gill et al. 2009), and unlike measures that reflect accessibility to one urban concentration, the gravity index also captures the effects of smaller urban agglomerations that may be in close proximity but not adjacent. The general formula for a gravity index is as follows:

$$GI_i = \sum_j \frac{[ATTRACTION_j]}{e^{\gamma(ED)_{ij}}}$$

where

i denotes a spatial area (in our case, a district)

j denotes an attraction (in our case, metropolitan and economic centers)

GI_i is the gravity index for a given district

$ATTRACTION_j$ = denotes the attractive force of a population or economic center

γ is a analyst-defined decay coefficient, which we assume to be one

ED_{ij} is a measure of economic distance, e.g., time or physical distance between origin i and destination j (in our analysis, travel time)

Higher gravity indices denote higher levels of accessibility to the attracting areas. We use this principle to develop two sets of gravity indices:

- 1) Market gravity to proxy urbanization economies (ATTRACTION = population)
- 2) Sector economic gravity to proxy localization economies (ATTRACTION = sector value-added).

Following but modifying the procedure set forth by Hausmann *et al* (Hausmann, Hwang et al. 2007), we compute EXPY, an index reflecting the sophistication of the manufacturing basket for a district. This is done using the Industrial Statistics (see Annex XX for a detailed discussion of EXPY). Finally, using a gravity model, we compute measures of spatial accessibility to population centers, and to manufacturing hubs by sector. These gravity indices provide a measure of the proximity of a place to regional attractions, weighted by the distance that must be traversed to reach those attractions.

One complexity arising from comparisons of data over time is the large number of new districts that have been created as a result of decentralization. At the time of decentralization in 1999, there were 292 districts and five additional districts comprising Jakarta. As of 2009, there were 497 districts, including six making up Jakarta. Fortunately, districts were largely formed by splitting an existing district into two or more new districts, so it was fairly easy to collapse the data to pre-Bang spatial units. We follow McCulloch and Sjahrir (2008) in collapsing the data to the 292 pre-Big Bang districts, so that they can be compared over time. All monetary values are in 2000 constant Indonesian Rupiah (IDR).

Noting the potential influence of spatial autocorrelation, Moran's I test was run to determine whether spatial autocorrelation was present in the outcome variables. Spatial autocorrelation is a problem in regression techniques that assume independence of observations, such as OLS. We ran Moran's I test on both overall *per capita* value-added and value-added for the sectors examined in Section 6, using districts as the spatial unit of analysis. For overall GRDP *per capita*, the test reveals very weak but statistically significant spatial autocorrelation for all analysis base years. Given the weakness of the association, we assume that spatial autocorrelation will cause few problems in the analysis. For the sectors, spatial autocorrelation is again statistically significant in all years, and has larger effects, with Moran Indices of between 0.1 and 0.12 (Moran's Index varies from -1 to 1, with -1 and 1 representing perfect correlation, and zero representing no correlation). We conclude that these levels of spatial autocorrelation are unlikely to heavily bias our results.

FINDINGS

Final model specifications were chosen from a number of candidate specifications. For the general-effect variables (i.e., terms that are not interaction variables, hereafter referred to as the "overall effect") variables were allowed to remain in the final models if they were of theoretical import, regardless of significance levels. For the interaction terms, given the small sample size, variables were allowed to remain in the models if they were approaching significance, i.e., standard errors less than 0.2, and the lagging term produced an effect with the opposite magnitude as the overall term. Tables XX and XX present the final models. Note that p-values are not presented in this table, but asterisks on the coefficient indicate the level of significance. Variables with significances between 0.1 and 0.2 are presented in ***bold italics***. This section presents the findings.

Multicollinearity

Pearson correlations between population gravity and manufacturing gravity ranged from 50 percent overall to 58 percent for 2006. These high correlations would be expected to inflate standard errors, as the two metrics would partly measure the same underlying effect. However, for lagging districts, the correlations were much lower: 15 percent for all years (2001 to 2006) combined and 14 percent for 2006. This makes us reasonably confident that multicollinearity does not pose a threat to the viability of our findings.

In rural regions, correlation between population gravity and manufacturing gravity was much lower – ranging from 8 percent overall to 11 percent in 2006. Thus, we can be reasonably assured that they are not measuring the same underlying effect.

Findings – Urban Regions

Urbanization and Localization Effects

In general, larger populations are associated with higher levels of manufacturing value-added. The fixed-effects models indicate a positive association between population and manufacturing value-added: an increase in population of one million persons is associated with around 9,000 Rupiah increase in manufacturing value-added per capita (note that this is not value-added per worker, but that the metric is indexed to the entire population of the district, so the effect is large). We note the potential bias due to endogeneity; however, the bias on this variable should be downwards – that is, the additional population that would be attracted to high value-added regions would tend to pull down the average value-added per person. Thus, our estimate may be a conservative one, but we can reasonably conclude that the effect is positive, though we do not speculate on the causality of the relationship here.

For the panel growth models, the coefficient on population for lagging districts provides a counterweight to the general population effect, in the equation for manufacturing value-added. Endogeneity is not a concern for this model, as it models growth against a set of initial conditions (i.e., conditions in the district or metropolitan area in 2001, at the beginning

of the analysis period). Although there is a significant and negative effect for lagging regions, this effect does not counterbalance the positive association between population and value-added. We note that the effects on interaction terms should be interpreted as the sum of the coefficients for the overall indicator and the lagging interaction term. Thus, the effect of a population increase of one percent on value-added in lagging regions would be: $3,224.75 - 2116.15 = 1,108.60$ Rupiah. This is still a significant positive effect, though less than for leading regions.

Table 1. Growth Models for Urban Districts 2001-2006

| VARAIBLES | Fixed Effects Models | | | Panel Growth Models | | |
|--|-------------------------------|---------------|-------------------|----------------------------|--------------|-------------------|
| | VA (IDR) <i>per capita</i> | Firms (N) | Jobs (N) | VA (IDR) <i>per capita</i> | Firms (N) | Jobs (N) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log of initial manufacturing value-added <i>per capita</i> | | | | 6,384.64** | | |
| Log of initial number of firms | | | | | 57.53*** | |
| Log of initial number of workers | | | | | | 284.79 |
| <u>Urbanization and Localization Economies</u> | | | | | | |
| Log of population of the urban agglomeration (x1,000,000) | 9,051.86*** | -71.61 | -7,785.19 | 3,244.75** | -8.66 | -149.88 |
| Lagging districts | - | - | - | -2116.15** | - | - |
| Log of manufacturing gravity index (localization) | 2,076.93*** | 1.65* | 31.44 | -3,783.12* | -2.53 | -1,481.38* |
| Lagging districts | -1,908.8*** | - | - | - | - | 1,863.39** |
| <u>District Industrial Characteristics</u> | | | | | | |
| %VA generated by central government-owned firms | -75.75* | -0.01 | -0.78 | 122.32 | 1.82 | 78.37 |
| Lagging districts | 90.65** | 0.46 | - | - | -3.51 | -286.64** |
| %VA generated by local government-owned firms | 13.87 | 0.08** | 2.92 | 191.39 | 0.26 | 67.62 |
| Lagging districts | - | -0.07* | - | - | -1.12 | - |
| %VA generated by foreign-owned firms | -9.79 | -0.04 | -10.01* | 2.53 | -0.05 | 100.35 |
| Lagging districts | - | - | - | - | - | -138.04 |
| Log of EXPY | -1,107.99 | -14.95 | 978.32 | 7,810.94 | -41.41 | 2,180.50 |
| Lagging districts | 3,230.74** | 3.00 | - | - | - | -3,799.23* |
| <u>Human Capital</u> | | | | | | |
| Median years of schooling for adults over 25 | 822.24 | -2.30 | -590.02 | 144.80 | -17.72 | -880.70 |
| Lagging districts | - | - | 1,208.74** | - | - | 1,108.14 |
| <u>Energy</u> | | | | | | |
| % manufacturing energy that is firm-self-generated | 3.55 | -0.03 | -2.61 | -44.97 | 0.40 | 30.28 |
| Lagging districts | - | - | -18.31 | - | - | -59.82* |
| <u>Development Expenditure</u> | | | | | | |
| Log of infrastructure expenditure (4-year lag for FE models) | 219.92 | -6.22 | -485.07** | -4,250.34** | -13.16 | -555.29 |
| Lagging districts | - | - | 74.94 | 3,043.47* | - | - |

| Capital | | | | | | |
|----------------------------------|-------------|-----------|--------------------|---------------------|---------|------------|
| % VA dedicated to loan servicing | -1,960.54 | -40.59 | -12,607.2*** | 68,908.92 | -510.20 | -20,739.12 |
| Lagging districts | - | - | 10,611.73** | -101,843.56* | - | - |
| Constant | -45,502.16* | 495.76*** | 8,827.41 | -15,916.80 | 938.36 | 8,226.62 |
| Observations | 247 | 247 | 187 | 79 | 80 | 58 |
| R-squared | 0.467 | 0.126 | 0.192 | 0.623 | 0.583 | 0.432 |
| Number of id_292 | 85 | 85 | 65 | | | |

Robust pval in parentheses; standard errors clustered by metropolitan agglomeration

*** p<0.01, ** p<0.05, * p<0.1, 0.1<p<0.199 in *italics*

Table 2. Growth Models for Rural Districts, 2001-2006

| VARAIBLES | Fixed Effects Models | | | Panel Growth Models | | |
|---|-------------------------------|-----------------|----------|----------------------------|----------------|-------------------|
| | VA (IDR) <i>per capita</i> | Firms (N) | Jobs (N) | VA (IDR) <i>per capita</i> | Firms (N) | Jobs (N) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log of initial manufacturing value-added <i>per capita</i> | | | | 420.89* | | |
| Log of initial number of firms | | | | | 2.44 | |
| Log of initial number of workers | | | | | | -196.43 |
| <u>Urbanization and Localization Economies</u> | | | | | | |
| Log of market gravity index (urbanization economies) | 617.78 | -9.26 | 464.47 | 26.67 | 0.88 | 100.25 |
| Lagging districts | -19.84* | -0.49** | - | - | - | - |
| Log of manufacturing gravity index (localization economies) | 150.74* | 0.69 | 325.12* | -20.91 | -0.11 | -1,018.3*** |
| Lagging districts | -140.03* | - | - | - | 11.16* | 1,171.12 |
| <u>District Industrial Characteristics</u> | | | | | | |
| % VA generated by central government-owned firms | -6.65 | -0.02 | 1.35 | 6.94 | -0.67 | 55.76 |
| Lagging districts | 10.14** | - | - | - | - | - |
| % VA generated by local government-owned firms | 2.09 | 0.06* | 10.66* | -8.35 | -0.99 | -11.2 |
| Lagging districts | - | - | - | - | - | - |
| % VA generated by foreign-owned firms | 44.30 | -0.09 | -29.89** | 1.46 | -0.89 | 135 |
| Lagging districts | - | - | - | - | - | - |
| Log of EXPY | -1,529.12 | -6.22* | 25.49 | -31.07 | 18.77 | -14.41 |
| Lagging districts | 960.86* | 4.43* | - | - | -29.21* | -1,283.91* |
| <u>Human Capital</u> | | | | | | |
| Median years of schooling for adults over 25 | 341.65* | 17.20*** | 374.61 | 639.62 | -7.38 | 1,340.54 |
| Lagging districts | -283.63 | -10.34** | - | - | 14.73** | - |
| <u>Energy</u> | | | | | | |
| % manufacturing energy that is firm-self-generated | -1.18 | -0.06* | 0.52 | -2.87 | -0.18 | -12.64*** |
| Lagging districts | - | - | - | - | - | - |
| <u>Development Expenditure</u> | | | | | | |
| Log of infrastructure expenditure (4-year lagged for FE models) | 233.95 | 4.91*** | -69.39 | 394.7 | -2.63 | 882.36 |

| | | | | | | |
|----------------------------------|----------|--------|---------------|----------|---------|-----------------|
| Lagging districts | - | - | 55.85* | - | - | - |
| Capital | | | | | | |
| % VA dedicated to loan servicing | -63.51 | -2.62 | 863.90 | 738.84 | -193.96 | -23,275.1** |
| Lagging districts | - | - | - | - | - | 26,530.9 |
| Constant | 5,743.09 | -32.68 | -5,615.09 | -9849.33 | -109.7 | 1003.42 |
| Observations | 517 | 517 | 500 | 101 | 101 | 99 |
| R-squared | 0.165 | 0.171 | 0.100 | 0.394 | 0.424 | 0.474 |
| Number of id_292 | 125 | 125 | 123 | | | |

Robust pval in parentheses; standard errors clustered by Island Region

*** p<0.01, ** p<0.05, * p<0.1, 0.1<p<0.199 in *italics*

With regards to localization, districts with high levels of accessibility to manufacturing centers demonstrate higher levels of value-added and more firms (Models 1 and 2), but slower growth (Models 4 and 6). This is expected, as districts with larger economies tend to grow more slowly. Model 1 indicates that lagging districts with higher levels of accessibility also have net positive levels of value-added growth (a one-percent increase in accessibility has a net effect of $2,076.93 - 1,908.80 = 168.13$ Rupiah *per capita* for lagging districts).

Interestingly, better levels of accessibility in lagging districts' is associated with higher growth in job numbers in manufacturing (Model 6). Lagging districts have a net positive effect on this variable of $(-1,481.38 + 1,863.39 = 382.01$ jobs over the 2001-06 analysis period). Although this effect does not hold for value-added or firm numbers, we read it as a positive sign that increased accessibility in lagging districts can improve growth outcomes and help lagging districts narrow the gap with leading districts.

Effects of Economic Composition

In lagging districts, higher levels of central-government participation in the manufacturing economy are associated with increased levels of value-added and more firms (Models 1 and 2). At first glance, this suggests that increased state-owned enterprise (SOE) activity has positive impacts for productivity and job growth in lagging places. However, Panel Models 5 and 6 paint a more-complicated picture. In lagging districts, increased SOE participation is associated with slower firm and job *growth* in lagging regions over the analysis period. We suspect that the legacy of SOEs in lagging regions is still strong and positive in that they provide firms and productivity to districts that would otherwise have little economic activity. However, their apparent inability to generate growth in lagging regions is worrisome.

The story with local-government participation in manufacturing is similar. For firms (Model 2), lagging districts with higher concentrations of local-government-held manufacturing, show small but net positive effects (the net effect in Model 2 is $0.0.08 - 0.07 = 0.01$), even though the impact in lagging districts is lower. In lagging districts, though, firm growth slows as local governments produce more of the value-added (Model 5).

Together, these findings suggest that government-led industrial growth can provide a core set of firms and value-added in lagging regions. However, their presence seems to have the effect of suppressing growth relative to private-sector activity (the suppressed term in this group of variables is the percent of manufacturing value-added generated by privately-held, Indonesian-owned manufacturing firms). There is no urgency for central and local governments to abandon existing industrial programs, then, but future policy programs should focus on growing the private sector.

The other industrial variable, EXPY, suggests that lagging regions with more-sophisticated economies have higher levels of value-added and more firms than lagging regions with lower EXPY levels (Models 1 and 2). Model 4 suggests that higher EXPY levels raise value-added growth in general (this includes lagging regions), but that higher EXPY can have a suppressant effect on jobs in lagging districts. This is not surprising, given that more-upscale industries tend to be less labor-intensive.

Human Capital

The variable we chose to proxy for human capital reflects the median years of schooling for adults over the age of 25. The effects of education are significant only in the jobs equations – Models 3 and 6 – and have sign and magnitude splits between the overall terms and the interaction terms. Increased levels of average education suppress the number of jobs (Model 3) and job growth (Model 6) for the overall variable. This is expected, as districts with higher levels of education cannot benefit as much from marginal education gains. However, the lagged term indicates significant gains to job numbers (Model 3) and job growth (Model 6) as education levels rise in lagging districts. We conclude that industry – particularly low- to

medium-skilled, labor-intensive manufacturing – can benefit greatly from marginal increases in the education levels of the labor pool.

Energy

As a proxy for the quality of infrastructure, we use the percent of manufacturing energy in a district that is self-generated by the firm – that is, not purchased from PLN or other off-site electricity providers. We also included variables reflecting road extensiveness and connectivity in previous iterations of these models, but they were highly correlated with the energy reliability variable and show no significant values. Thus, they were left out of the final specifications.

The expected sign on this variable was negative, as districts with less-reliable energy sources should be less likely to attract and retain firms. The jobs models show negative signs on the job numbers (Model 3) and job growth (Model 6) for lagging districts. In Model 6, the coefficient on overall job growth is positive. This likely reflects high growth outcomes in extractive industries in isolated districts, which would require self-power generation. In lagging districts, however, the effect on job growth is significant and negative – indicating that lagging districts have better growth outcomes when their PLN-supplied energy supply is reliable.

Development Expenditure

Local government expenditure on infrastructure development is a complicated issue in Indonesia. Districts with larger tax revenues will spend more on infrastructure, so we expect to see some positive association between infrastructure spending and economic outcomes. At the same time, high-spending regions with slower growth will likely still spend large amounts on infrastructure improvements, though their economic growth may not reflect this investment to the same degree. Also, transfers from the central government allow lagging regions to increase spending on infrastructure. Our analysis isolates the effect of infrastructure spending on lagging regions, allowing for comment on the relationship between expenditure and manufacturing outcomes in the worst-performing districts.

Models 2 and 3 suggest an inverse relationship between infrastructure spending and both firm and job numbers for the general (non-interaction) term. This is likely because firm-rich and job-rich districts have a legacy of infrastructure and do not need to spend more on new projects (they may spend more on maintenance, but our metric captures only spending on new infrastructure). We do not speculate on the causal relationship here, as there are likely positive effects in both directions, i.e., the effect of expenditure on economic outcomes, and vice versa. The net effects on the lagging districts also have a net negative effect.

The interesting relationship here is the lagging interaction term in Model 4. In lagging districts, a one percent increase in infrastructure spending in 2001, has a negative net effect ($-4,250.34 + 3,043.47 = -1,206.87$ Rupiah of value-added *per capita* for each one percent increase in infrastructure expenditure). This means that, even in lagging districts where the suppressant effect of high-income, slow-growing districts is removed, lagging districts lack the ability to generate positive returns to infrastructure spending. This is problematic and an issue worthy of further study.

Capital

Capital is a problematic issue for Indonesia's local governments. In both the overall case and in lagging regions, higher levels of capital is associated with more sluggish job markets (Model 3), though lagging regions do mitigate this effect somewhat. The negative net effects seen here could be the effect of capital-intensive industries with minimal labor needs (e.g., mining).

Even more disturbing is the effect seen in Model 4, which suggests that higher levels of capital generated stronger growth in value-added over the 2001-06 analysis period. However, for lagging regions, this trend is reversed. Lagging districts have a net negative coefficient ($68,908.82 - 101,843.56 = -32,934.64$ for each additional percent of value-added that is dedicated to loan servicing). This suggests that – even for those manufacturing firms that can secure credit – increased capital investment does not yield productive returns. This is a fundamental problem that should be addressed in future research.

Findings – Rural Regions

Urbanization and Localization Effects

For rural regions, we use an index of market gravity in the place of the size of the population agglomeration. We do this guided by the hypothesis that access to urban agglomerations will be more important to rural district development than the population of the individual district. Once manufacturing gravity is controlled, there are no significant overall (non-interaction) effects in any of the models for the market gravity index. This implies that, once we have accounted for manufacturing gravity and other relevant controls, the effect of nearness to population centers is not important. In Models 1 and 2, there is a differential effect on the lagging variables, suggesting that lagging rural districts with higher levels of accessibility to population centers have lower value-added and fewer firms compared with those further away from population centers. This is an unexpected result. Likely, the negative sign in Model 1 reflects population pressures, as high-accessibility rural districts that border metropolitan areas are often settlement areas for economic migrants to metropolitan areas.

Localization effects are larger and generally have more significance than urbanization effects. Models 1 and 3 suggest a stronger presence in value-added and jobs for districts with better access to manufacturing centers, and the lagging term in Model 1 suggests a net positive return to accessibility ($150.74 - 140.03 = 10.71$, so we expect an increase of 10.71 Rupiah *per capita* for each one percent increase in manufacturing accessibility). Furthermore, Models 5 and 6 indicate that lagging districts have net positive returns to accessibility in firm and job growth (a growth of 11.16 firms and a net growth of $-1,018.29 + 1,171.12 = 152.83$ jobs per one-percent increase in accessibility over the 2001 to 2006 analysis period).

We draw two important conclusions from these findings. First, urbanization effects are less important in growing Indonesia's manufacturing economy than localization effects for lagging rural districts. Second, accessibility to manufacturing concentrations is important for lagging districts seeking to increase their presence in the manufacturing economy. The gravity-based metric used here reflects both the magnitude of economic activity and distance to that activity. Although not much can be done about a district's geographic location, decreasing its the economic distance (Lin, Gill et al. 2009) to manufacturing hubs can have positive effects on growth. Connectivity policies and infrastructure development, then, can help to bring economic growth to lagging communities. Our infrastructure and development findings (discussed below) provide some further support for this assertion.

Effects of Economic Composition

The variables reflecting the extent of participation by central and local government, and local and foreign companies, in the manufacturing economy, are largely insignificant. Model 1 shows an effect approaching significance, which suggests that higher levels of value-added produced by central-government firms is correlated with lower manufacturing value-added *per capita*. In addition, the lagging term suggests that central government participation can have a net positive effect in lagging districts. This concurs with the findings for lagging urban regions above. For the overall variable, local government participation appears to have a positive effect on firms (Model 2) and jobs (Model 3). A higher presence of foreign-owned firms is correlated with fewer workers, which is likely because foreign firms tend to be

involved in extractive industries, which are less labor-intensive than other manufacturing activities.

EXPY is a perplexing indicator in all of the models where it is significant. Models 1 and 2 suggest that districts with higher levels of EXPY generate less value-added and have fewer firms. The net effects for lagging districts are also negative, though somewhat less in magnitude than the overall scenario. Furthermore, Models 5 and 6 indicate that higher levels of upscaleness in 2001 were associated with slower growth in firms and jobs over the 2001 to 2006 analysis period. We expected the effect to be just the opposite in both sets of models – that increased upscaleness in the economy would yield higher returns, particularly in lagging regions, and lagging districts with more-upscale economies would grow faster. Our evidence suggests that Indonesian districts do not capitalize on innovative capacity to make further gains in growth and development. We think this is a serious problem: innovation is key to economic development. Exploring this issue further is beyond the scope of our study, but worthy of future inquiry.

Human Capital

Median years of schooling has positive returns for the overall variables, and positive net returns for the lagging variables, in the fixed-effects equations for *per capita* value-added and firms. That is, even though the coefficients on both variables are negative, the net effect in Model 1 is $341.65 - 283.63 = 58.02$ Rupiah *per capita* of value-added for each additional year of schooling. The net effect in Model 2 is $17.20 - 10.34 = 6.86$ additional firms for each additional year of education.

In the growth models, only the effect on firms is significant. An additional year of schooling for the median adult is associated with a positive differential firm growth. This suggests that better-educated populations help to attract manufacturing firms, and that investments in human capital can help lagging regions close the gap with leading regions.

Energy

None of the lagging terms on our proxy for energy reliability produced significant effects, but where significant, the coefficients for the overall effects produced the expected results. Models 2 and 6 suggest that districts in which firms self-produce more of their energy, have fewer firms and grow jobs more slowly than districts with lower levels of firm-produced energy. This is an argument for investment in reliable power.

Development Expenditure

Spending on capital projects appears to be associated with positive effects in all districts regardless of leading or lagging status, for value-added and firms in Models 1 and 2. Model 3 provides evidence that development expenditure in lagging districts can have a positive effect on manufacturing jobs in these districts.

Capital

Most of our models did not produce significant coefficients. The exception in Model 6, the growth model with job growth as its dependent variable. The negative coefficient on the overall variable indicates a negative correlation between loan capital and growth. As with other variables, this is more likely the effect of larger amounts of capital being concentrated in already-leading, slower-growing districts. We are more interested in the lagging term, which suggests that capital applied to lagging regions more than makes up for the negative overall effect. In lagging regions, the net return to loan capital is $-23,275.08 + 26,530.90 = 3,255.82$ Rupiah for each additional one percent of value-added dedicated to loan servicing. Though we cannot comment here on the overall average benefit for all districts, we can conclude that lagging districts where capital is more available to firms, have better growth outcomes.

DISCUSSION

Table 3 summarizes the effects for the variables considered. A plus sign indicates that an increase in the independent variable is associated with a positive effect in the dependent variable. One plus or minus character indicates a count of the three indicators (value-added *per capita*, firms, and jobs) that showed an effect in that direction, i.e., two plus signs means that two of the three dependent variables showed a significant and positive effect in the models. A negative sign indicates an inverse relationship. The cells are left blank if no effect was observed. Where the lagging term was excluded from the model, overall (non-interacted) effects are counted as affecting lagging districts (because they affect all districts).

Table 3. Summary of Effect Strengths

| | Fixed Effects Models | CAPGR Models |
|--|-------------------------|-----------------|
| URBAN | | |
| Initial | NA | ++ |
| Log of metropolitan population (urbanization economies) | | |
| Log of manufacturing gravity index (localization economies) | ++ | + |
| % VA generated by central government-owned firms | ++ | -- |
| % VA generated by local government-owned firms | ++ | - |
| % VA generated by foreign-owned firms | - | - |
| Log of EXPY | ++ | + - |
| Median years of schooling for adults over 25 | + | + |
| % manufacturing energy that is firm-self-generated | - | - |
| Log of infrastructure expenditure (4-year lag for FE models) | -- | - |
| % VA dedicated to loan servicing | - | - |
| RURAL | | |
| Initial | NA | + |
| Log of market gravity index (urbanization economies) | -- | |
| Log of manufacturing gravity index (localization economies) | ++ | ++ |
| % VA generated by central government-owned firms | + | |
| % VA generated by local government-owned firms | ++ | |
| % VA generated by foreign-owned firms | | + |
| Log of EXPY | | -- |
| Median years of schooling for adults over 25 | ++ | ++ |
| % manufacturing energy that is firm-self-generated | - | - |
| Log of infrastructure expenditure (4-year lag for FE models) | + | |
| % VA dedicated to loan servicing | | + |
| positive effects: + weak ++ moderate; +++ strong | | |
| negative effects: - weak -- moderate; --- strong | | |

Table 3 provides some insight into the kinds of policy interventions that could help improve the outcomes of lagging districts. Lagging districts in both urban and rural areas respond much better to localization than to urbanization. This presents two issues for consideration. First, the more immediate gains to the industrial sectors are to be gained from the concentration of industry. Second, Indonesia is failing – at least with regards to the manufacturing sectors – to leverage its urbanization for economic growth. If Brulhardt and Sbergami (2009) are correct in concluding that urbanization within countries boosts GDP growth up to around 10,000 USD per capita (Indonesia's GDP *per capita* was \$3,039 nominal USD *per capita* in 2010 (WB 2010), then Indonesia can capitalize on its urban areas – perhaps in manufacturing, and perhaps in other sectors.

In both urban and rural districts, the presence of state- and local-government-owned enterprise boosts economic outcomes, but government participation in industry suppresses growth in urban districts. As we said above, this makes a strong case that government-led industrial growth can provide a core set of firms and value-added in lagging regions, but future policy programs should focus on growing the private sector.

The other obvious areas of intervention are in education, power, infrastructure, and capital. A better-educated population consistently produces better economic outcomes in this analysis (all four model sets), indicating that lagging regions with a better-educated public are both better off and grow faster than their counterparts with lower education levels. The variable reflecting energy reliability, percent of energy that is generated by the firm, shows negative signs across all four sets of models, indicating that higher levels of self-generated power are associated with negative economic outcomes in the manufacturing sectors.

There is some evidence that increased expenditure on infrastructure is associated with positive effects in lagging rural districts. This encouraging result is somewhat diminished by the reverse finding in urban areas: increased infrastructure expenditure is associated with diminished outcomes in the fixed-effects models, and slower growth in the CAPGR models. Although this may simply reflect the long way that some lagging urban districts have to go to begin producing net returns on infrastructure investment, the positive effect in lagging rural regions – which would presumably be even more behind in infrastructure development than the urban districts – suggest that some other forces may be at work that are hindering urban districts from developing net positive return on infrastructure investment. This topic is worthy of significant future study.

Finally, our findings provide some evidence that the injection of capital can improve the outcomes for lagging rural districts. For the same reasons as with infrastructure expenditure, the findings for urban regions are worrying. If rural districts can realize positive growth returns with the infusion of capital, then it stands to reason that urban areas can do the same. This suggests that there are different challenges faced by Indonesia's urban and rural districts. Identifying these challenges and suggesting strategies for surmounting them, should be addressed in future research.

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