REGIONAL INCOME DISPARITIES IN INDONESIA: MEASUREMENTS, CONVERGENCE PROCESS, AND DECENTRALIZATION

BY

ANDI IRAWAN

DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Regional Planning
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2014

Urbana, Illinois

Doctoral Committee:

Professor Geoffrey J. D. Hewings, Chair
Professor Edward J. Feser
Professor Tschangho John Kim
Assistant Professor Bumsoo Lee

ABSTRACT

The unifying theme of this dissertation is spatial inequality, or regional disparities, driven by two primary motivations. First, spatial inequality can contribute to the overall inequality across households or individuals. Second, spatial inequality can jeopardize the fabric of society, upsetting social and political stability. Regional disparities have increasingly become the focus of policy and academic interests, especially in a diverse society such as Indonesia, where geographic units often align with divisions in economic performance, political and cultural aspirations, language, and religion, among others. This dissertation assesses the spatial inequality and convergence dynamics across districts in the province of East Java and studies the impact of Indonesia's 2001 fiscal decentralization on regional income disparities across districts.

East Java is chosen as a case study because of its economical and geopolitical importance to Indonesia. In addition, East Java has been dubbed a case of "balanced development," an assessment that this dissertation intends to reexamine. By synthesizing the approaches of sigma and beta convergences and distribution dynamics, and by employing a variety of methods, this dissertation suggests the strong presence of clubs convergence with slow conditional catch-up process. The clusters of poor, medium, and high income districts are expected to remain.

The 2001 fiscal decentralization attempted to promote equalization by addressing vertical and horizontal imbalances and by providing district governments with incentives for development. One important research question is whether the Indonesian decentralization delivered on its equity promise. Using fixed-effects panel estimation, this paper addresses the following questions: 1) whether there has been a reduction in income disparities across districts; 2) whether the decentralization was an inequality-reducing force; and 3) how the districts' level of development may have influenced the effect of decentralization on inequality. The striking findings reveal that a reduction in inequality is associated with greater decentralization. However, the decentralization impact on disparities is affected by the districts' level of development. Inequality may persist until Indonesian districts reach a certain level of development, which seems to be out of reach for most districts.

To my universe: parents, wife, and kids
To a true teacher and friend: Prof. H

ACKNOWLEDGEMENTS

I would like to express heartfelt gratitude to my advisor, Geoffrey J. D. Hewings, for all the guidance and support he has tirelessly given me since the beginning: opening the door, holding my hand, having my back, and occasionally sitting on my neck (which really helped keep me on track). Geoff's passion for the fields of regional science, opera, and Cardiff City Football Club are profoundly inspiring. His attention to detail, his "do your best" attitude, and his dedication to the profession are very motivating, and are great sources of learning. Observing his loyalty and kindness to families, friends, and colleagues on daily basis is a humbling experience. Geoff is a living example that being great and being nice (and fun) is not an oxymoron.

My profound gratitude also goes to those who served in my committee, lending me great support and encouragement along the way. Thanks to Ed Feser, for providing reviews and a critical perspective, and for all those great development and regional analysis classes, conversations, and insights. Thanks to Tschangho John Kim, for those Skype sessions, for an inspirational work in spatial development in Indonesia, and for those eye-opening transportation and research method classes. Thanks to Bumsoo Lee, for all the motivation and technical assistance, and for teaching me how to challenge myself and to push boundaries. I have learned so much from my committee, collectively and individually, from a wide range of technical details, to critical thinking and attitude.

Many people contributed to the completion of this dissertation and of my PhD, with whom I not only exchanged ideas, but also fears and hopes; from whom I not only received much assistance, but also soothing hellos and many uplifting remarks, such as "don't worry, everything is gonna be okay." I thank the REAL mafia worldwide and in Indonesia, particularly Suahasil Nazara and Budy Resosudarmo. I thank the current and past REAL residents: Laura Atuesta, Deniz Ay, Cihan Cagil, Sungyup Chung, Andrew Crawley, Minshu Du, Lucho Escobedo, Carlos Figueroa, Rafael Garduno-Rivera, Young Jo, Kijin Kim, Jae Hong Kim, Tae Jeong Kim, Esteban Lopez, Cristina Miller, Tota Panggabean, Dusan Parades, Domingo Perez, Bartek Rokicki, Riaz Uddin, Rafael Vera, Claudia Vicentelo, Paksi Walandouw, Jun Wan, Patrick Wu, Nori Yamano, Chenxi Yu, and many others. I would like also like to thank my DSUP family: Dustin Allred, Robby Boyer, Divya Chandrasekhar, Joanna Paulson Ganning,

Tim Green, Kanako Iuchi, Shakil Kashem, Sang Lee, Sung-won Lee, Troy Mix, Kate Nesse, Mallory Rahe, Jordi Honey-Roses, Sofia Sianis, Marisa Zapata, and many more. I could not go without thanking Daniel Wong at the Graduate College for his excellent assistance in editing and for the helpful advice throughout the writing and deposit processes.

I am very thankful for the great assistance given to me by the staff at the Department of Urban and Regional Planning (in particular, Holly Clingan, Jennifer Kowalski, and Jane Terry). Thanks also to the DURP's wonderful faculty members, from whom I received support and learned about many things, and with whom I enjoyed enriching conversation, including: the late Andrew Isserman, Arnab Chakraborty, Marc Doussard, Andrew Greenlee, Stacy Harwood, Faranak Miraftab, Rob Olshanksy, and Bev Wilson.

I greatly appreciate the financial support from Fulbright and the assistantships from IECAM, ATLAS, and Department of Urban and Regional Planning that made this journey possible. Thanks to Piet Hendrardjo (AMINEF), Megan Spillman and Joe Graff (IIE Chicago), Bernard Cesarone, Dawn Thomas, and Susan Fowler (IECAM), and Maryalice Wu and Dawn-Owens Nicholson (ATLAS) for their assistance and for being great colleagues and friends.

A challenging life as a doctoral student has been made easier by the company and help of many Indonesian families, especially the Aria family, many wonderful neighbors in Orchard Downs, and Urbana-Champaign friends who made Urbana-Champaign feel like home.

Last but not least, I would like to give a very special thanks to my wife, Dian, for her incredible support and patience during my PhD work. Her toughness, especially during some difficult times when she was also pursuing her own master's degree while at the same time getting pregnant with our third child, boosted my spirit. This journey was made complete because I have two solid armies of supporters: my kids, Nisa, Shouma, and Aydin (my "made-in-the-USA" baby), who kept insanity at bay, and my parents, whose prayers made this dream come true.

TABLE OF CONTENTS

Chapter 1

Introduction

1.1 Motivation

Spatial inequality and regional economic convergence/divergence are central issues in the literature on regional development theory and growth and planning. For decades these issues have attracted the attention of a diverse group of scholars and researchers. Economists, geographers, regional scientists, planning scholars, and other social scientists have attempted to address the central questions of whether the gap in wealth between rich and poor regions has narrowed or widened and why disparities in various social-economic indicators across regions persist.

The conceptual foundations for spatial inequality research can be traced back to neoclassical trade theory and growth theory, location theory, external scale economies, and central place theory which were already around as early as the 1920s (Dawkins 2003). Following the resurgence of interest in the 1990s regarding the relation between geography and economic activities, the following decade saw an emerging interest in spatial imbalance and its convergence process (Clark *et al*. 2000; Islam 2003; Neary 2001). Indeed, the main focus of the World Development Report 2009 (World Bank 2009) surrounds the spatial dimensions of a development process where geographic realities of development are characterized by division (i.e., territorial variations), density (core-periphery contrasts), and distance (proximity and separation).

This growing interest in spatial disparities and the convergence process was triggered by concern over the impacts of globalization and liberalization and the emergence of regions,

facilitated by scholarly advances in theory (e.g., endogenous growth theory and new economic geography) and in analytical tools (e.g., spatial data analysis and GIS). Indeed, scholars and policy makers have tried to understand these two contrasting forces. International boundaries are becoming more and more blurred and the world economy is increasingly integrated, yet regional identities and aspirations remain strongly articulated and some non-tariff barriers prevail. In addition, there is a growing recognition that innovation processes and national economic growth dynamics are essentially spatial in nature (Cheshire and Malecki 2004). As Krugman (1991: 3) asserts: "One of the best ways to understand how the international economy works is to start by looking at what happens inside nations. If we want to understand differences in national growth rates, a good place to start is by examining differences in regional growth."

In addition to this analytical reason, interest on the topic is also motivated by policy or equity issues. Knaap and Kim (1992) argue that research on disparities in regional development provides useful bases for comparison and helps to prescribe policies promoting the spatial distribution of economic activity in an economy. Further, they argue that even if such attempts fail to foster economic development or growth, a more even distribution of economic activity across regions is desirable for equity concerns alone; this is very relevant to large and spatially diverse countries like Indonesia. Therefore, research investigating regional development patterns and how they are related to decentralization are of great analytical and policy interest. Of particular concern are the issues of spatial inequality and the convergence process.

1.2 Background of the study areas

Kim (1992) provides several reasons for why spatial inequality and regional development are particularly interesting issues in Indonesia. First, from a high growth period in the 1980s and

1990s, insights can be obtained on the regional distribution of growth in a rapidly developing country. Second, Indonesia offers policy lessons on urban problems associated with the high concentration of population and economic development in the island of Java. Third, since the adoption of *Repelita* II (the Second Five-Year Economic Development Plan) in 1974, the government of Indonesia has pursued a policy that favors the dispersion of growth throughout the country. Thus, the Indonesian case is fertile ground for studying the effectiveness of government efforts in promoting the spatial dispersion of economic well-being. In Kim *et al*. (1992), Azis (1992) finds that government transfers do affect the development of regional economies, though the effects are small. Knaap and Kim (1992) observe the coincidence between the concentration of government development grants and the acceleration of the regional concentration of economic growth in Indonesia. Being particularly driven by Kim's (1992) first and third rationales, this dissertation assesses the convergence dynamics across districts in the province of East Java, one of the most dynamic provinces in Indonesia, and examines the impact of the Indonesia' 2001 fiscal decentralization (one of the major reforms at the dusk of the New Order regime in 1998) on regional income disparities across Indonesian districts.

With respect to East Java as a case for studying spatial inequality, a compilation of fairly positive assessments on the East Java's economic development in the New Order (Dick *et al*. 1993) is worth re-examining. Dick (1993: 21) states that "East Java seems to have combined impressive rates of growth with fairly balanced development in terms of sectoral composition, income distribution, and regional equity." In comparison with other Indonesian provinces, Dick (1993) suggests that the benefits of development appear to be more evenly distributed in East Java. However, as a caveat, this does not mean that there are no remarkable inequalities between

income groups or persistent imbalances between the most developed and most remote parts of the province. This dissertation is particularly interested in investigating the East Java spatial inequality using the most recent available data.

A more recent study on Indonesia's economic geography by Hill *et al*. (2009) concludes that Indonesia continues to exhibit a great diversity in economic and social indicators and the concentration of economic activity, particularly in Java (especially for non-mining activities) and Sumatra. Hill *et al*. (2009) suggest that a future research in the subject is an examination of the decentralization impact on regional dynamics. This dissertation can be considered as a response to this call by first looking at the impact of decentralization on regional disparities. It can be seen as an initial step of future research agenda, because the decentralization-regional dynamics research project, as added by Hill *et al*. (2009), should be a long-term project to discern various impacts.

Other studies (e.g., Alm *et al*. 2004; Lewis 2005) have pointed out that Indonesia has undergone a significant transformation in many ways since 2001. It is not surprising since decentralization itself is possibly the most profound transformation of government structure, especially for a country like Indonesia which, under the New Order regime, had been highly centralized. As such profound transformation, its impact on a spatial dimension of economic development, i.e., regional income disparities, is worth studying.

1.3 Convergence, growth, and inequality

This sub-section briefly presents a theoretical and empirical overview on convergence and its connection to growth and spatial inequality. In economics, the term "convergence" commonly refers to the hypothesis of a catching-up process, suggesting that poor economies should grow

faster than rich economies such that disparities in income should narrow over time. This popular view follows the dominant approach, built upon the neoclassical growth model, widely seen in the convergence literature (Sala-i-Martin 1996). This "classical approach" categorizes convergence into three primary concepts: unconditional/absolute β-convergence, conditional β-convergence, and σ-convergence. Unconditional/absolute β-convergence occurs if economies converge toward the same steady state, while the conditional β-convergence describes economies that grow toward different steady states. The β-convergence is thought to be a necessary, though not sufficient, condition for the narrowing σ-convergence or the dispersion of per capita income at a given point in time (Petrakos and Artelaris 2009).

As part of the resurgence of interests in the spatial pattern and dynamics of inequality or income differentials, the issue of convergence has continued to attract attention and to generate enormous empirical studies at various geographical scales (e.g., Pritchett 1997 for international scale; Barro and Sala-i-Martin 1992 for national scale using the US state-level data; and Higgins *et al*. 2006 for national scale using the US county-level data). Following a series of seminal cross-country studies (Abramovitz 1986; Baumol 1986; Barro 1991; Mankiw, Romer, and Weil 1992), scholars turned their attention toward regional convergence; i.e., convergence analysis on a set of regions *within* a country, where it can be reasonably assumed that there will be similar technology, institutions, and tastes. Because regions within a country are much more likely to exhibit similar structural characteristics and to allow for a higher level of factors mobility than seen in different countries, evidence of absolute convergence might be more apparent at the regional system (Martin and Sunley 1998).

Many studies favoring absolute convergence across US states, Japanese prefectures, European NUTS1 regions, Australian states, and Canadian provinces present similar speeds of

convergence, amounting to about two percent per year (see Martin and Sunley 1998 for the list of studies). However, numerous other studies do not support the absolute convergence hypothesis (e.g., Mauro and Podrecca 1994 for Italian regions; Siriopoulos and Asteriou 1998 for Greek regions; and Tsionas 2001 for US states). The contrasting results are due in part to the different empirical strategies employed. From a policy perspective, convergence analysis can provide a basis for evaluating regional policy. Meanwhile, from a theoretical point of view, the convergence study can be considered to be an empirical test for the different growth theories that offer different predictions and, therefore, would have different policy implications (Petrakos and Artelaris 2009).

Eckey and Türck (2007) list the underlying growth theories of convergence analysis and their convergence/divergence predictions. Neoclassical theory (Solow 1956; Swan 1956) predicts convergence because of diminishing capital productivity due to constant returns to scale and exogenously determined technology progress. However, the critical theories—post Keynesianism (Schmidt 1966) and polarization theory (Myrdal 1957; Hirschman 1965)—hypothesize divergence due to a spatially mobile demand, external shocks, and the domination of centripetal forces (i.e., the forces that pull population and economic activities into agglomeration). In other words, the critical theories predict that disparities in economic well-being will persist or even widen in the long run. According to the endogenous growth theory (Romer 1986; Lucas 1988) and the new economic geography (NEG) pioneered by Krugman (1991), multiple equilibria are possible, subject to some specific economic conditions, such as the presence or lack of diminishing returns to scale, positive externalities, and transport costs.

Convergence research has used different methodologies which can be broadly categorized into the following approaches: the cross-section approach, the panel approach, the

time-series approach, and the distribution approach (Islam 2003; Magrini 2004). The first three of these approaches have in part studied the β-convergence. The cross-section approach has also been generally used to study the σ-convergence. In addition to examining the σ-convergence, the distribution approach also investigates the entire shape of distribution and how it evolves over time.

1.4 Regional economic development, decentralization, regional disparities

In outlining a typology of new (endogenous) growth theories, Martin and Sunley (1998) acknowledge the role of government spending and taxation (fiscal arrangement) and public policy as the growth engine that may promote convergence. Such convergence could be indicated by, among other factors, a decline in regional disparities. Martin and Sunley (1998) also discuss the connection between institutions, indigenous (locally-based) development, and endogenous growth, while highlighting the role of institutions in shaping regional development. Ascani *et al*. (2012) argue that the localized nature of economic development and the importance of institutions would become more crucial as far as developing countries are concerned, because they are often characterized by strong patterns of spatial inequalities.

Furthermore, a growing awareness that local processes generate economic development has motivated countries to embark on bottom-up approach, of which decentralization is a part. Prud'homme (1994) defines decentralization as the transfer of power or resources from central to subnational governments. He outlines three types of administrative decentralization: a) *deconcentration*, or the redistribution of decision making to local governments; b) *delegation*, by which a semi-autonomous organization will have a closer involvement in policy making; and c)

devolution, through which a lower autonomous government tier has some degree of power or even enjoys full power in some policy areas.

Suggesting a global trend toward decentralization, Davoodi and Zou (1998) note that 63 out of 75 developing and transitional countries with populations greater than 5 million claim to have undergone some forms of power transfer to local governments or lower government tiers. Rodríguez-Pose and Gill (2003) observe the different implementations of decentralization across countries. Some countries, such as Italy and Spain, applied federalist state structures according to different degrees of decentralization. Others, such as France, the UK, and some developing countries (including Indonesia), have finally embarked on a path toward decentralization after long-standing practices of centralized governance. Federalist countries like the US, Australia, and India, have continuously refined their decentralization practices, while countries like Mexico and Brazil have been more seriously practicing their decentralization mandates than before.

The transfer of authority and resources from the central to local governments is expected to positively affect economic development. Policy formulation at a local level allows for a greater recognition of local needs and is more likely to win greater support and ensure smooth implementation, making the execution of a development plan and strategy more effective and sustainable. Amin (1999) argues that decentralization improves local governments' capacity to formulate and implement development strategies that incorporate the socio-institutional underpinnings of local economic interactions. Therefore, decentralization creates sustainable and locally-oriented policy actions, as they rely on a bottom-up approach and enjoy the support of local multi-stakeholders.

Studies that link decentralization to economic development are generally based on the efficiency or equity argument. As this dissertation's unifying theme is spatial inequality, and

other chapters address the inequality-decentralization relationship, the remaining discussion in this section will focus on the relationship between decentralization and equity.

Advocates of fiscal decentralization argue that it contributes to the reduction of income disparities between regions by encouraging territorial competition. Thus, poorer regions offer favorable conditions and incentives to attract populations and production. Because decentralization allows local governments to play an active role in managing local economic development, territorial competition presents an opportunity for poorer regions (Ezcurra and Pascual 2008). According to Canaleta *et al*. (2004), decentralization can be a means of diversifying development strategies that would benefit local economies. The central government's pursuit of traditional industrial policies is often biased in favor of the most high-performing industries; industries that are more likely to be located in rich areas. Thus, in the absence of decentralization, such strategies may exclude poor regions. Another benefit of decentralization is that the downsizing of central government may reduce the concentration of economic activity in capital or core regions, thus promoting the dispersion of such activity throughout the country and eventually narrowing spatial inequalities.

On the other hand, decentralization may also widen spatial inequalities. Rodríguez-Pose and Gill (2005) identify two mechanisms by which decentralization may have detrimental effects on equity. First, rich regions naturally exercise stronger bargaining power than poor regions when influencing the central government's decision making. This is often because the economic interests of rich regions may be better aligned with those of the central government, including having a larger electorate. Second, rich regions are considerably more competitive than poor regions. As rich regions are better endowed with physical and human capital, among other advantages, it may simply be too difficult for poor regions to pursue territorial competition. Poor

regions may also experience difficulties in implementing developmental policies because their small tax base limits their spending capacity.

1.5 Overview of the essays

This dissertation explores the geographic realities of economic development, as stated above. The essays deal with the measurement issues on spatial inequality and convergence processes and how such observed regional disparities relate to governance (in this case, decentralization). The following sub-sections present essential findings of the essays.

1.5.1 Assessing Indonesia's East Java spatial inequality and convergence process: a holistic approach

During the study period (1980-2005), disparities had widened irrespective of the inequality measures. A significantly higher level of inequality was observed in the 1990s, a period of high growth accompanied by major policy and economic events, such as deeper liberalization and economic crises. Some mobility of the middle cities to the richer group occurred in the mid-1990s, but bimodality again became sharper in the early 2000s. The distribution dynamics analysis indicates the strong presence of clubs. All else equal, such polarization will likely persist due to the high stability of the transition process. A scenario of upward mobility could take up to three decades.

The study detects a slow catching-up process that would only occur when a city's characteristics, thought to be determinants of growth, are taken into account. This research reveals mixed evidence in support of the absolute β-convergence hypothesis, which is often said to be more likely to occur across regions within a country. For the whole period (1983-2005),

the estimates fail to provide significant evidence for the absolute β-convergence hypothesis; nonetheless, the significant absolute β-convergence appeared in the shorter period (1983-1992). In the subsequent period (1993-2005), there was a tendency of divergence, by which the already richer cities consistently outgrew the poorer ones. If some cities' characteristics are controlled for, such catching-up processes appeared, lending support to the conditional β-convergence hypothesis. The widening disparities and the sustained gap between the rich and the poor cities could be attributed to the presence of divergence force in the absolute β-convergence hypothesis, the slow convergence process in the conditional β-convergence hypothesis, and the absence of spatial spillovers.

From the perspective of spatial inequality, the findings do not support the old view that suggests East Java is a case of "balanced development." This essay does not offer a specific policy recommendation, because it focuses on the inequality measurements and convergence characteristics, rather than performing a welfare analysis. However, it very briefly mentions the importance of a two-pronged approach that combines the virtue of place-based prosperity and people-centered prosperity.

1.5.2 Regional income disparities in decentralizing Indonesia, 2001-2007

Fiscal decentralization in Indonesia over the period 2001-2007 was associated with a decrease in inequality across Indonesian districts, measured by district-level per capita GDP with and without oil and gas. The observed reduction in inequality was attributable to the reduction in within-province inequality and the reduction in relative provincial means.

Estimating the fixed-effects model on a district-level panel dataset, this paper studies how the current fiscal decentralization arrangement affects the between-districts inequality. It

examines the impact of the different components of the equalization fund on the inequality. In addition, it analyzes the influence of the district's level of development on the inequality-decentralization relationship. It also studies how other factors might have affected the observed inequality.

Through various estimation strategies, this study reveals consistent results, suggesting that greater fiscal decentralization in general significantly reduces the inequality between districts. Of the fiscal decentralization measures, there is limited significant evidence of an inequality-widening effect of tax-based revenue sharing, even though the inequality-widening effect decreases as the level of development rises. On the other hand, the level of development also moderates the inequality-reducing effects of other fiscal decentralization instruments. The level of development alone plays a critical role as a determinant of observed inequality and as a modifying factor that affects the effect of a fiscal decentralization indicator on the observed inequality.

Development spending, the manufacturing sector, infrastructure, urban concentration, and public sector size are found to be the significant equalizing forces. Aside from its extensiveness and novelty, this thesis offers important policy implications. The findings can potentially help to guide efforts to address Indonesia's interregional inequality, either through improving the decentralization framework or by addressing complementary public policy options related to spending, the role and size of the public sector, infrastructure, economic structure, and urban population at the district level.

This paper demonstrates that decentralization is a welfare-enhancing and necessary policy to address regional disparities. However, this essay also shows that development level and other factors also play a role in the observed inequality dynamics. Therefore, the continuing

implementation of decentralization is justified and necessary, yet it should be integrated with a broader development strategy aimed at a higher level of development as a primary and ultimate goal. A district government, especially of poorer districts, needs to formulate and implement strategies of gain that include preserving and attracting economic activities in a sector deemed to be an engine for the economy, such as the manufacturing sector. Inward investment can be attracted by adding to or improving the quality of infrastructure. To generate and to exploit economies of scale, or because a certain kind of infrastructure is simply too expensive for a district, it is sometimes better for a district to cooperate with other districts. In this regard and in coping with inter-district issues (such as performance standard or pollution), the role of provincial government can be called for and reinforced. Cooperation between districts can take various forms; the simplest one being a forum in which to share best practices in public service deliveries.

References

Abramovitz, Moses. 1986. "Catching Up, Forging Ahead, and Falling Behind." *The Journal of Economic History* 46 (2): 385-406.

Alm, J., J. Martinez-Vazquez, and M. Indrawati, eds. 2005. *Reforming Intergovernmental Fiscal Relations and the Rebuilding of Indonesia: The Big Bang Program and its Economic Consequences*. Northampton, MA: Edward Elgar Publishing.

Amin, Ash. 1999. "An Institutionalist Perspective on Regional Economic Development." *International Journal of Urban and Regional Research* 23 (2): 365-378.

Ascani, Andrea, Riccardo Crescenzi, and Simona Iammarino. 2012. *Regional Economic Development: A Review*. SEARCH Working Paper WP1/03.

Azis, Iwan J. 1992. "National Growth and Development Policy: Performance, Impacts and Reassessment." In *Spatial Development in Indonesia*, edited by T. John Kim, Gerrit Knaap and Iwan J. Azis, 7-43. Hants: Avebruy.

Barro, Robert J. 1991. "Economic Growth in a Cross Section of Countries." *The Quarterly Journal of Economics* 106 (2): 407-443.

Barro, Robert J. and Xavier Sala-i-Martin. 1992. "Convergence." *Journal of Political Economy* 100 (2): 223-251.

Baumol, William J. 1986. "Productivity Growth, Convergence, and Welfare: What the Long-Run Data show." *The American Economic Review* 76 (5): 1072-1085.

Canaleta, Carlos Gil, Pedro Pascual Arzoz, and Manuel Rapun Garate. 2004. "Regional Economic Disparities and Decentralisation." *Urban Studies* 41 (1): 71-94.

Cheshire, Paul C. and Edward J. Malecki. 2004. "Growth, Development, and Innovation: A Look Backward and Forward." *Papers in Regional Science* 83 (1): 249-67.

Clark, Gordon L., Maryann P. Feldman, and Meric S. Gertler, eds. 2000. *Oxford Handbook of Economic Geography*. Oxford: Oxford University Press.

Davoodi, Hamid and Heng-fu Zou. 1998. "Fiscal Decentralization and Economic Growth: A Cross-Country Study." *Journal of Urban Economics* 43 (2): 244-257.

Dawkins, Casey J. 2003. "Regional Development Theory: Conceptual Foundations, Classic Works, and Recent Developments." *Journal of Planning Literature* 18 (2): 131-72.

Dick, Howard. 1993. "East Java in Regional Perspective." In *Balanced Development: East Java in the New Order*, edited by H. W. Dick, J. J. Fox and J. A. C. Mackie, 1-22. New York, NY: Oxford University Press.

Dick, H. W., J. J. Fox, and J. A. C. Mackie, eds. 1993. *Balanced Development: East Java in the New Order*. New York, NY: Oxford University Press.

Eckey, Hans-Friedrich and Matthias Türck. 2007. "Convergence of EU-Regions. A Literature Report." *Investigaciones Regionales* (10): 5-32.

Ezcurra, Roberto and Pedro Pascual. 2008. "Fiscal Decentralization and Regional Disparities: Evidence from several European Union Countries." *Environment and Planning A* 40 (5): 1185-1201.

Higgins, Matthew J., Daniel Levy, and Andrew T. Young. 2006. "Growth and Convergence Across the United States: Evidence from County-Level Data." *Review of Economics and Statistics* 88 (4): 671-81.

Hill, Hal, Budi P. Resosudarmo, and Yogi Viddyatama. 2009. "Economic Geography of Indonesia: Location, Connectivity, and Resources." In *Reshaping Economic Geography in East Asia*, edited by Yukon Huang and Alessandro Magnoli Bocchi, 115-134. Washington, DC: World Bank.

Hirschman, Albert. 1965. *The Strategy of Economic Development*. New Haven, CT: Yale University Press.

Islam, Nazrul. 2003. "What Have We Learnt from the Convergence Debate?" *Journal of Economic Surveys* 17 (3): 309-62.

Kim, T. John. 1992. "Introduction." In *Spatial Development in Indonesia*, edited by T. John Kim, Gerrit Knaap and Iwan J. Azis, 3-6. Hants: Avebury.

Kim, T. J., G. Knaap, and I. J. Azis, eds. 1992. *Spatial Development in Indonesia: Review and Prospects*. Hants: Avebury.

Knaap, Gerrit and T. John Kim. 1992. "Disparities in Regional Development." In *Spatial Development in Indonesia*, edited by T. John Kim, Gerrit Knaap and Iwan J. Azis, 133-164. Hants: Avebury.

Krugman, P. 1991. *Geography and Trade*. Cambridge, MA: MIT Press.

Lewis, Blane. 2005. "Indonesian Local Government Spending, Taxing, and Saving: An Explanation of Pre-and Post-Decentralization Fiscal Outcomes." *Asian Economic Journal* 19 (3): 291-317.

Lucas Jr., Robert E. 1988. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22 (1): 3-42.

Magrini, Stefano. 2004. "Regional (Di)Convergence." In *Handbook of Regional and Urban Economics* Vol. 4, edited by J. V. Henderson and J. F. Thisse, 2741-2796. Amsterdam: Elsevier.

Mankiw, N. Gregory, David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics* 107 (2): 407-437.

Martin, Ron and Peter Sunley. 1998. "Slow Convergence? The New Endogenous Growth Theory and Regional Development." *Economic Geography* 74 (3): 201-227.

Mauro, Luciano and Elena Podrecca. 1994. "The Case of Italian Regions : Convergence Or Dualism?" *Economic Notes* 23 (3): 447-472.

Myrdal, Gunnar. 1957. *Economic Theory and Under-Developed Regions*. London: Duckworth.

Neary, J. P. 2001. "Of Hype and Hyperbolas: Introducing the New Economic Geography" *Journal of Economic Literature* 39 (2): 536-61.

Petrakos, George and Panagiotis Artelaris. 2009. "European Regional Convergence Revisited: A Weighted Least Squares Approach." *Growth and Change* 40 (2): 314-331.

Pritchett, Lant. 1997. "Divergence, Big Time." *Journal of Economic Perspectives* 11 (3): 3-17.

Prud'homme, Rémy. 1995. "The Dangers of Decentralization." *The World Bank Research Observer* 10 (2): 201-220.

Rodríguez-Pose, Andrés and Nicholas Gill. 2003. "The Global Trend Towards Devolution and its Implications." *Environment and Planning C: Government and Policy* 21 (3): 333-351.

———. 2005. "On the 'economic Dividend' of Devolution." *Regional Studies* 39 (4): 405-420.

Romer, Paul M. 1986. "Increasing Returns and Long-Run Growth." *Journal of Political Economy* 94 (5): 1002-1037.

Sala-i-Martin, Xavier X. 1996. "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence." *European Economic Review* 40 (6): 1325-1352.

Schmidt, Herbert. 1966. *Räumliche Wirkung der Investitionen im Industrialisierungsprozess: Analyse des regionalen Wirtschaftswachstums*. Köln: Westdeutscher Verl.

Siriopoulos, Costas and Dimitrios Asteriou. 1998. "Testing for Convergence Across the Greek Regions." *Regional Studies* 32 (6): 537-546.

Solow, Robert M. 1956. "A Contribution to the Theory of Economic Growth." *The Quarterly Journal of Economics* 70 (1): 65-94.

Swan, T. W. 1956. "Economic Growth and Capital Accumulation." *Economic Record* 32 (2): 334-361.

Tsionas, Efthymios G. 2001. "Regional Convergence and Common, Stochastic Long-Run Trends: A Re-Examination of the US Regional Data." *Regional Studies* 35 (8): 689-696.

World Bank. 2009. *World Development Report 2009: Reshaping Economic Geography*. Washington, DC: World Bank.

Chapter 2

Assessing Indonesia's East Java Spatial Inequality and Convergence Process: A Holistic Approach

2.1 Introduction

The recognition of spatial inequality and regional convergence in Indonesia has prompted considerable scholarly attention (Akita 1988; Akita and Lukman 1999; Booth 2000; Garcia and Soelistianingsih 1998; Islam and Khan 1986). Nonetheless, three motivations drive this paper to revisit the issue and to consider East Java as a case study. First, while the literature typically emphasizes beta (β)-convergence, this paper adds to this important measure an attention to sigma (σ)-convergence: i.e., whether real per capita income disparities across regions narrow over time. Thus, σ-convergence offers more direct policy implications, including questions like whether the geographic distribution of income is becoming more equitable (Quah 1993; Friedman 1992). At the same time, this paper does not ignore the role of β-convergence as a necessary condition for σ-convergence. For a better analysis on spatial inequality, this paper employs a distribution analysis using kernel density estimation and Markov chain analysis in addition to a variety of inequality measures designed to avoid relying on one or two inequality indices, such as *Gini* or the coefficient of variation (*CV*), both heavily used in inequality studies. Aware of the possibility of the autocorrelation typically found in cross-sectional data, this paper also employs exploratory spatial data analysis (ESDA) to determine whether a spatial model is necessary to deal with spatial dependence, an aspect overlooked by previous work.

Second, unlike previous studies using cross-sectional data at the provincial level, this paper employs cross-sectional data at the city/municipal level in the East Java province. Such

finer geographic scales better capture spatial effects which might otherwise be unobservable or negligible if examined at broader aggregations of geographical units (Le Gallo and Ertur 2003). Some scholars also argue that spatial inequality and convergence studies are best carried out at the city/county level (Higgins *et al.* 2006). With an extended 25-year research frame (1980-2005) that encompasses a period of earlier and deeper liberalization, the Asian financial crisis, and the early decentralization era, this paper is well-positioned to analyze the development dynamics over a wider range.

Third, this paper solely focuses on East Java province. As such, estimations will have less nuisance given the fact that cities within a province reasonably exhibit less difference in endowments and locations than do provinces across the country (e.g., natural resources/mining/oil-rich provinces vs. others, eastern provinces vs. western provinces). Indeed, East Java represents a particularly interesting case study. It is one of two major industrial provinces to consistently thrive without mining; it maintains a regional per capita GDP never below 85 percent of the national average; and it represented one of the fastest growing provinces in the period from 1984-2004 (Hill *et al.* 2009). Thus, whether there is a variation in the distribution of per capita GDP across East Java cities and how it evolved over time are worthy of further study. Furthermore, once dubbed a "balanced development," East Java has sustained high growth rates while maintaining a fairly equal distribution of benefits across sectors, income groups, and cities (Mackie 1993). Therefore, this research presents an opportunity to examine whether this long conventional wisdom still holds, at least from the spatial perspective. Although development during the high growth period has dramatically decreased absolute poverty, relative poverty, and hence income disparities, is by no means less important, as it might represent a source of social and political instability.

With these motivations in mind, this paper's primary objective is to research the pattern of spatial disparities and its convergence process in East Java. As such, it aims to answer a set of interrelated questions:

1) Do disparities across regions in East Java fall or increase over time?

2) Can possible "catching-up" processes be detected?

3) If yes, how fast are the transition processes and how far do they extend?

4) Is there an underlying spatial dependence responsible for the observed pattern of inequality?

5) What are other determinants of the observed regional development pattern?

Section 2.2 provides background for the case study, while section 2.3 outlines the overall conceptual framework. The remaining sections address the research questions above, with a question or a combination of closely related questions constituting individual section. Methodological discussions are carried out in these question-driven sections. The final section summarizes the findings and presents conclusions.

2.2 Background

Among Indonesia's thirty-three provinces, East Java represents the country's second most populous region and the second largest regional economy. Together with Jakarta and West Java, the three provinces account for half of Indonesia's GDP, and have for years. Since the 1960s, the manufacturing industry has played a key role in East Java's economy, and the sharp growth of the industry (especially in the late 1980s) has been a driving force in East Java's economic development (Mackie 1993). Between 1998 and 2008, approximately one third of East Java's

economy was attributable to the manufacturing sector, even while the manufacturing employment's share of East Java's employment was lower in the same period: between 14% to 19% (BPS 2009; Pemprov Jatim 2002a). Furthermore, manufacturing employment in East Java is spatially concentrated. Irawan (2011) finds disparities in the employment share of large and medium scale manufacturing across East Java's cities. Some industries are more localized than others and such observed concentration patterns are higher than would be expected if the firms had chosen locations in a random manner, implying that some cities have a different industrial structure than others. Figure 2.1 depicts the location of East Java and maps the distribution of the 2002 manufacturing employment in the province.

Inequality across East Java's cities is generally observed and acknowledged in the scholarship. Indeed, many official documents[1] state that East Java exhibits some measure of inequality among its cities. During the period between 1998 and 2002, agricultural cities (e.g., Pacitan, Ponorogo, Trenggalek, Tulungagung, Blitar, Kediri, and Malang) had lower per capita GDPs, yet higher growth, than the provincial average. Meanwhile, industrial cities like Pasuruan, Sidoarjo, Gresik and other urban areas experienced relatively stable high per capita GDP with fluctuating growth rates. In some years, the per capita GDP of these industrial cities grew higher than the regional average, but in others their growth rates were lower.

There have been many policy discussions concerning the issue of regional inequality, and several regional development policies have been enacted to deal with such inequality. In fact, regional inequality has become a popular catchphrase of political jargon, especially during local and regional elections. However, scholarly work has neglected to thoroughly examine these

[1] For example: *Perda No. 8/2005*, the East Java mid-term development plan (RPJMD) 2006-2008 and *Perda No. 1/2009*, the East Java long-term development plan (RPJPD) 2005-2025, both legally defined as a regional act, as well as the province's official assessment on the regional economy (Pemprov Jatim 2002a, 2002b, 2005a, 2005b, 2009).

policy or political exercises. Such an examination should assess the particular dimensions of inequality in order to provide a more complete picture of its evolution and its underlying dynamics and to produce a set of measures. This paper intends to fill this gap, to better inform East Java's regional development planning, and to promote research-guided policies.

This paper is concerned with why some regions persistently outperform others and examines the possibility that the government can affect the patterns of spatial inequality. In this regard, this paper has a particular interest in the process of regional economic convergence that links regional output to government spending/fiscal characteristics and human capital. Key economic and policy issues to be investigated include whether there are forces that lead to convergence over time in the levels of per capita product, and how public policies affect such a convergence process.

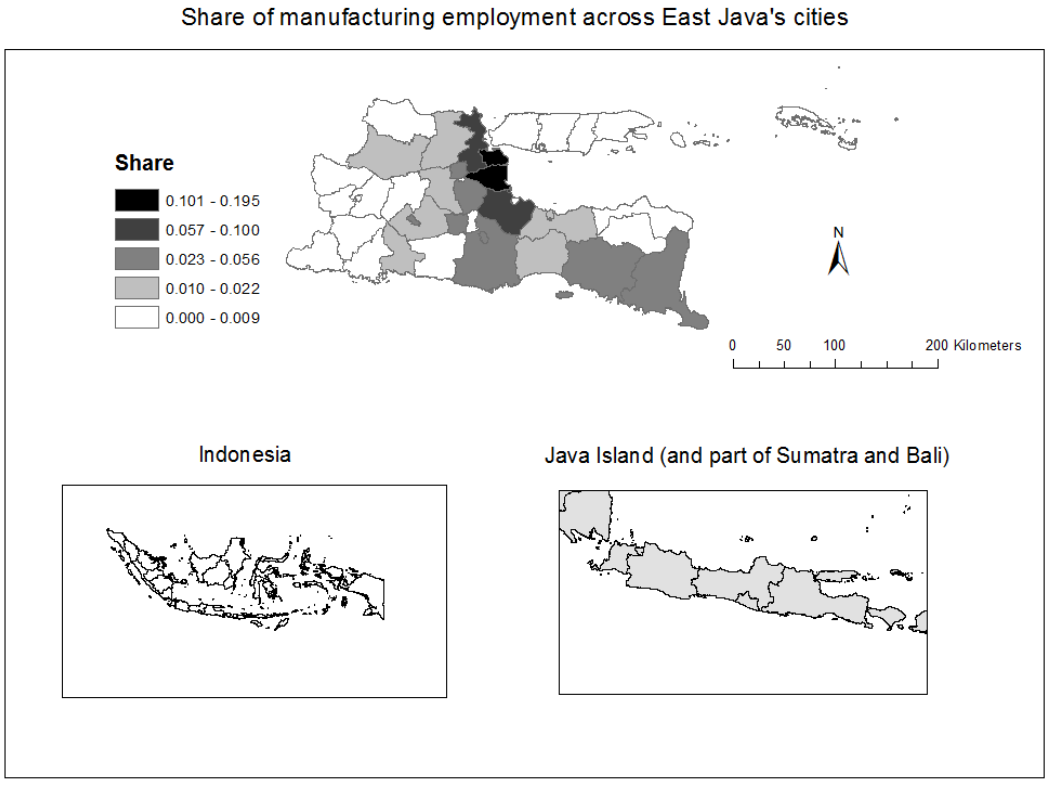


Figure 2.1 Distribution of manufacturing employment in East Java.
Source: Author's creation based on the data of BPS (2002).

2.3 Conceptual framework

2.3.1 Spatial inequality

From a theoretical perspective, spatial inequality is essentially determined by the location decisions that lead to maximizing profits for firms and in maximizing job market opportunities and utilities for households. At a regional level, observed spatial inequality is the result of the two opposing forces of concentration and dispersion, simultaneously affecting and being affected by the location decisions of both firms and households. The centripetal forces of concentration include natural advantages, Marshallian externalities (e.g., labor market pooling, non-traded intermediate services, and knowledge spillovers), and non-pecuniary externalities (e.g., market size and forward and backward linkages). The centrifugal forces of dispersion include less mobile/immobile factors and high transportation/communication costs (Kim 2008).

According to neoclassical explanations of regional inequality, the spread (or concentration) of economic activity over space will follow the spread (or concentration) of the underlying differences, which might be differences in factor intensities (the Heckscher-Ohlin model) or in technology (the Ricardian model). As Kim (2008) notes, though the models differ in defining the underlying differences, both models predict a widening regional spatial inequality if goods are mobile, but factors are immobile. This theoretical strand is also known as comparative advantage theory, which assumes perfect competition and constant returns to scale.

While still relevant, comparative advantage theory has its drawbacks, as it does not satisfactorily explain why, quite often, very similar regions end up with very different production structures (Ottaviano and Puga 1997). Two other theoretical strands are new trade theory (NTT) and new economic geography (NEG) that bring in an additional set of assumptions, such as

increasing returns to scale (either internal or external to firms), imperfect competition, and trade costs.

2.3.2 Convergence concepts

Studies examining convergence across economic units are partly driven by an interest in examining the pattern and determinants of long-term growth. There appear to be three main measures of economic convergence: σ-convergence, unconditional β-convergence, and conditional β-convergence (Barro and Sala-i-Martin 1992). There is said to be σ- convergence when dispersion (typically measured in standard deviations or the coefficient of variation, *CV*) of output or income per capita decreases over time. The latter two measures indicate that poorer economies tend to grow faster than richer ones; i.e., when there is a negative partial correlation between growth in output or income per capita over a period of time and its initial level.

One can distinguish between two types of β-convergence because they have different underlying theoretical frameworks and implications (de la Fuente 2000). Consistent with a neoclassical framework, unconditional or absolute β-convergence denotes the condition whereby each economy converges to the same output or income per capita, regardless of its initial condition. Absolute β-convergence implies an equalization of output or income per capita. Initially, poorer economies tend to grow faster until they catch up with richer ones. In the long run, the welfare indicator will be the same for all economies.[2] Conditional β-convergence thus describes the condition whereby economies are structurally different and the welfare indicator does not necessarily converge to the same level, but where in the long run, the differences across

[2] Yet, inequality may still appear, for there will be random shocks with uneven impacts on the different economies. However, the shocks may only have only transitory effects, implying that, in the long run, we should observe a fluid distribution in which the relative positions of the different economies change rapidly.

economic units become stationary and the growth rates are the same. Conditional β-convergence predicts that each economy converges to its own steady state, but these can be very different. Therefore, a high degree of inequality can persist, even in the long run. As a consequence, high persistence in the relative positions of the different economies will be observed.

Convergence literature has acknowledged the relationship between σ-convergence and β-convergence. Young *et al.* (2008) provides mathematical proof and empirical evidence, using US data at county level between 1970-1998, that β-convergence is a necessary but not sufficient condition for σ-convergence. In their study, σ-convergence is not detected in the presence of β-convergence; instead, they observe σ-divergence in many cases.

2.4 σ-Convergence

A popular methodology for investigating convergence is by running growth-initial level regressions, widely known as "Barro regressions."[3] A convergence hypothesis expects to see a negative correlation in the coefficient of the initial income level in the Barro regressions (i.e., β). However, some scholars (e.g., Friedman 1992; Quah 1993) have argued that convergence regarding dispersion of the cross-sectional distribution of income and a negative β from the growth-initial level regression does not necessarily imply a reduction in the dispersion. According to this view, convergence should be judged directly by looking at the dynamics of dispersion of income or output level across places, rather than judged indirectly through the sign

[3] The growth-initial income equation is typically expressed as follows:
$ln\left(\frac{y_{it}}{y_{i,t-1}}\right) = a\ - \beta \ln(y_{i,t-1}) + u_{it}$, where a is the parameter representing the economies' economic and social characteristics.

of β. This notion emphasizes the concept of σ-convergence, where σ represents dispersion of the cross-sectional distribution of income or output level.

Young *et al.* (2008) provide empirical evidence that σ-convergence need not accompany β-convergence. Following Sala-i-Martin's (1996) exposition assuming that β-convergence holds for each economy within the sample, Young *et al.* (2008) derive the equation of the evolution of the sample variance of log income, σ_t^2, and the equation of the steady-state variance, $(\sigma^2)^*$. Given $0 < \beta < 1$, the steady-state variance is

$$(\sigma^2)^* = \frac{\sigma_u^2}{[1-(1-\beta)^2]} \qquad (1)$$

Therefore, cross-sectional dispersion decreases with β, but increases with σ_u^2. In other words, β-convergence is a necessary, but not sufficient, condition for σ-convergence. Intuitively, this is because economies can converge towards one another, even while random shocks can push them apart. In the case of conditional β-convergence, where the parameter a representing various economic and/or socio-demographic variables in the Barro regression differs across economies, economies can converge towards different steady-states. Further, Young *et al.* (2008) find that σ-convergence did not occur across the US or within a majority of the individual US states between 1970 to 1998, even though there was evidence of β-convergence in the same period.

In sum, the concept of σ-convergence has two advantages: 1) it is a direct description of income or output across economies and 2) it does not rely on the estimation of a particular model. As a result, σ-convergence is considered to be a more reality-revealing concept and of greater policy interest with regard to equity issues (Friedman 1992; Quah 1993). This section is devoted to examining whether the disparities across regions in East Java fall or increase over time using σ-convergence approach. To do so, it computes various inequality indices and analyzes their trends and patterns.

2.4.1 Inequality indices

The most frequently used dispersion measures for the analysis of σ-convergence are the standard deviation or the coefficient of variation, *CV*. However, other summary measures of inequality have been developed. This sub-section draws on Haughton and Khandker (2009) to present the most important of these inequality measures. This paper employs *CV*, decile dispersion ratio, *Gini* coefficient, generalized entropy measures, and Atkinson's inequality measures to evaluate the distribution of per capita GDP across East Java cities. To evaluate σ-convergence, this paper uses data series on per capita output measured as the natural log of real regional per capita GDP (1993 prices) from 1980 to 2005 rather than per capita income, as the former is more readily available. The data is compiled from the BPS series on regional GDP across East Java cities (various years) and Pemprov Jatim (2002b, 2005b).

Coefficient of variation

The coefficient of variation, *CV*, is a normalized measure of dispersion of a probability distribution. It is simply formulated to be the ratio of the standard deviation to the mean and is often reported as the given ratio multiplied by 100. This ratio suggests that for a given standard deviation value, the *CV* indicates a high or low degree of variability only in relation to the mean value.

Both the *CV* and the standard deviation measure dispersion. However, because the *CV* is independent of measurement units, it is more desirable than the standard deviation. The standard deviation and the mean of a variable are expressed in the same units, so taking the ratio of these two values cancels the units. Therefore, it allows for a meaningful comparison of the

distribution of two different variables; i.e., the higher the *CV*, the greater the dispersion in the variable.

Decile dispersion ratio

The decile dispersion ratio is a simple and popular measure of inequality. It takes the ratio of the average output (or income, expenditure, or any other welfare indicators) of the richest 10% of the population to the average output (or other indicators of interest) of the poorest 10%. The dispersion ratio is flexible because it can take other percentiles, such as taking the ratio of the average of a given variable of the richest 5% (i.e., the 95^{th} percentile) to the one of the poorest 5% (i.e., the 5^{th} percentile).

By expressing the income of the "richest" (the top 10% earners) as a multiple of that of the "poorest" (the bottom 10% earners), the planning stakeholders can easily interpret the ratio and comprehend the state of inequality. Nonetheless, its disadvantage is that it ignores information in the middle of the distribution and even overlooks the distribution within the top and bottom deciles or any defined percentiles.

Gini coefficient of inequality

The *Gini* coefficient is probably the most widely used inequality index. It is derived from the Lorenz curve, a cumulative frequency curve that compares the distribution of a given variable (e.g., output or income) with the uniform distribution representing equality. The *Gini* coefficient takes a value between 0 and 1, where a *Gini* = 0 represents perfect equality, while a *Gini* = 1 indicates complete inequality.

Formally, let *xi* be a point on the horizontal axis (that depicts the cumulative percentage of cross-sectional units, e.g., poorest to richest cities or households) and *yi* represent a point on the vertical axis (that represents cumulative percentage of a given variable, e.g., output, income, or expenditure). Then,

$$Gini = 1 - \sum_{i=1}^{N}(x_i - x_{i-1})(y_i + y_{i-1}) \qquad (2)$$

Of six criteria for a good inequality measure, the *Gini* coefficient satisfies the criteria of mean independence, population size independence, symmetry, Pigou-Dalton transfer sensitivity, and statistical testability, ignoring the criterion of decomposability (Haughton and Khandker 2009). Despite a nearly satisfactory measure, the *Gini* index is not decomposable or additive across groups. The total *Gini* index of the population is not equal to the sum of the *Gini* index of its sub-populations.

Generalized entropy measures

The general formula of the generalized entropy (GE) inequality measures is

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \qquad (3)$$

where $\bar{y}$ is the mean of a given variable per capita (e.g., regional per capita GDP). The value of *GE* measures takes between 0 and infinity, with 0 representing an equal distribution and higher values representing higher levels of inequality. The parameter α can take any real value and defines the weight given to distances between values of the variable at different parts of the distribution. For lower values of α, *GE* is more sensitive to changes in the lower tail of the distribution, and for higher values of α, *GE* is more sensitive to changes in the upper tail.

The commonly used values of α are 0, 1, and 2. The *GE*(0) is also known as the mean log deviation, or *Theil's L*, and the *GE(*1) is *Theil's T*; each is expressed as follows:

$$GE(0) = \frac{1}{N}\sum_{i=1}^{N} ln\left(\frac{\bar{y}}{y_i}\right) \quad (4)$$

$$GE(1) = \frac{1}{N}\sum_{i=1}^{N} \frac{y_i}{\bar{y}} ln\left(\frac{y_i}{\bar{y}}\right) \quad (5)$$

The $GE(2)$ is equal to half the square of the coefficient of variation. The $GE(\alpha)$ can be additively decomposed as the sum of within-group inequality, $GE\_w(\alpha)$, and between-group inequality, $GE\_b(\alpha)$. Thus, the $GE(\alpha)$ measures satisfy all six criteria.

Atkinson's inequality measures

As in the generalized entropy measures, the Atkinson's inequality measures also differ in their sensitivities in different parts of the distribution. In the Atkinson class, the degree of sensitivity is defined by the inequality aversion parameter ε, which measures aversion to inequality.

The common values of ε are 0.5, 1, and 2. The more positive $\varepsilon > 0$ is, the more sensitive A_ε is to income differences at the bottom of the distribution. The Atkinson class is formulated as follows:

$$A_\varepsilon = 1 - \left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{1-\varepsilon}\right]^{1/(1-\varepsilon)} \quad , \varepsilon \neq 1 \quad (6)$$

$$A_\varepsilon = 1 - \frac{\prod_{i=1}^{N}\left(y_i^{(1/N)}\right)}{\bar{y}} \quad , \varepsilon = 1 \quad (7)$$

The Atkinson class is also decomposable, even though it is not additively decomposable:

$$A_\varepsilon = A\_w_\varepsilon + A\_b_\varepsilon - A\_w_\varepsilon * A\_b_\varepsilon \quad (8)$$

2.4.2 Observed trend of increasing disparities

The early 1990s onward witnessed *CV* levels higher than the median; such a time span was more than half of the whole research period. Even within the below-median period, there was an

increasing trend of disparities indicated by higher *CV* levels, especially in the second half of the 1980s to the early 1990s (see figure 2.2). Overall, it is reasonable to say that disparities rose within the study period.

However, if the study period is divided into sub-periods, a sequential pattern of convergence (i.e., a trend of decreasing *CV* levels, hence decreasing disparities) and divergence (i.e., a trend of increasing *CV* levels, hence increasing disparities) emerges. Let us divide the full period into four sub-periods as follows: Convergence 1(C1), 1980-1985; Divergence 1 (D1), 1986-1997; Convergence 2 (C2), 1998-2000; and Divergence 2 (D2), 2001-2005. Alternatively, because the D1 period consists of two different steepnesses of divergence, the D1 period can be further divided into two shorter periods (D1a, 1986 –1992 and D1b, 1993-1997), giving us five sub-periods. From figure 2.2, it appears that convergence was associated with the early stages of liberalization (C1) and economic crisis (C2), while divergence was observed in the deregulation and economic boom era (D1) and in the early implementation of decentralization (D2). A sharper divergence (D1b) was associated with the era of deeper liberalization.

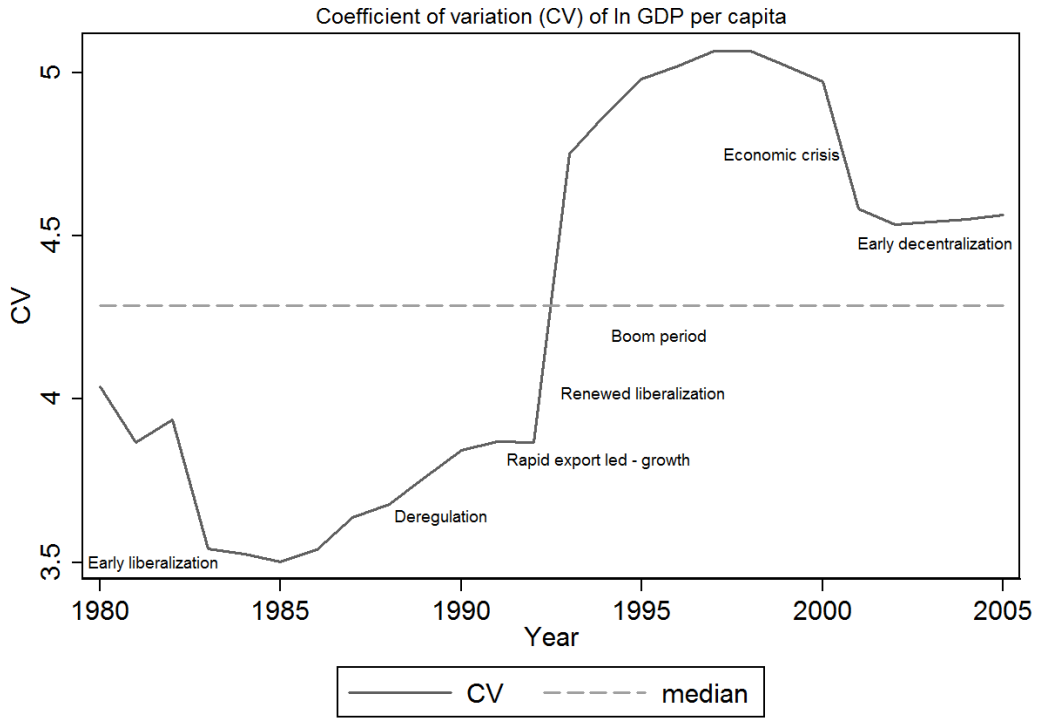


Figure 2.2 The trend of coefficient of variation of ln per capita GDP, 1980-2005. Source: Author's creation. Note: The identification of major economic policies during the 1980s and 1990s adopts the Wie (2002) classification.

From an economic geography perspective, such a pattern may suggest that the advantages of economic liberalization and decentralization disproportionately favor core regions or already richer cities (Krugman 1991; Krugman and Elizondo 1996). In their study of convergence clubs at the UK regional level, Chatterji and Dewhurst (1996) also find a similar pattern, where divergence is more apparent in a period of economic boom.

Is the observed trend of increasing disparities affected by a choice of inequality index?

Various inequality indices reveal the same pattern: there were increasing disparities over the study period. Figure 2.3 shows that the trend of widening inequality is clearly detected

regardless of the inequality measure.[4] Figure 2.4 focuses on the inequality trend by establishing the ratio of the average per capita GDP of the richest cities and the one of the poorest cities. This ratio also tells the same story of greater disparities, but is considerably more effective in communicating the inequality trend to general publics, policy makers, and planning agencies. The decile dispersion ratio roughly doubled between 1980 and 2005.

Are there distinct sub-periods? *How do they differ?*

Figures 2.2, 2.3, and 2.4 all suggest that the degree of inequality in the 1990s onward was higher than in the former years. Table 2.1 presents the values of the *Gini* coefficient in 1980-2005 with the jackknife standard errors, the *p*-value (sig), and the 95% confidence interval; these figures highlight two important findings. First, the measured inequality was highly statistically significant in every year of the study period. Second, it also suggests the same pattern as indicated by the three figures; the period of 1993-2005 experienced a higher degree of inequality than that of 1980-1992.

[4] Table A.1 in the appendix A reports the inequality levels over the years by various inequality measures previously reviewed.

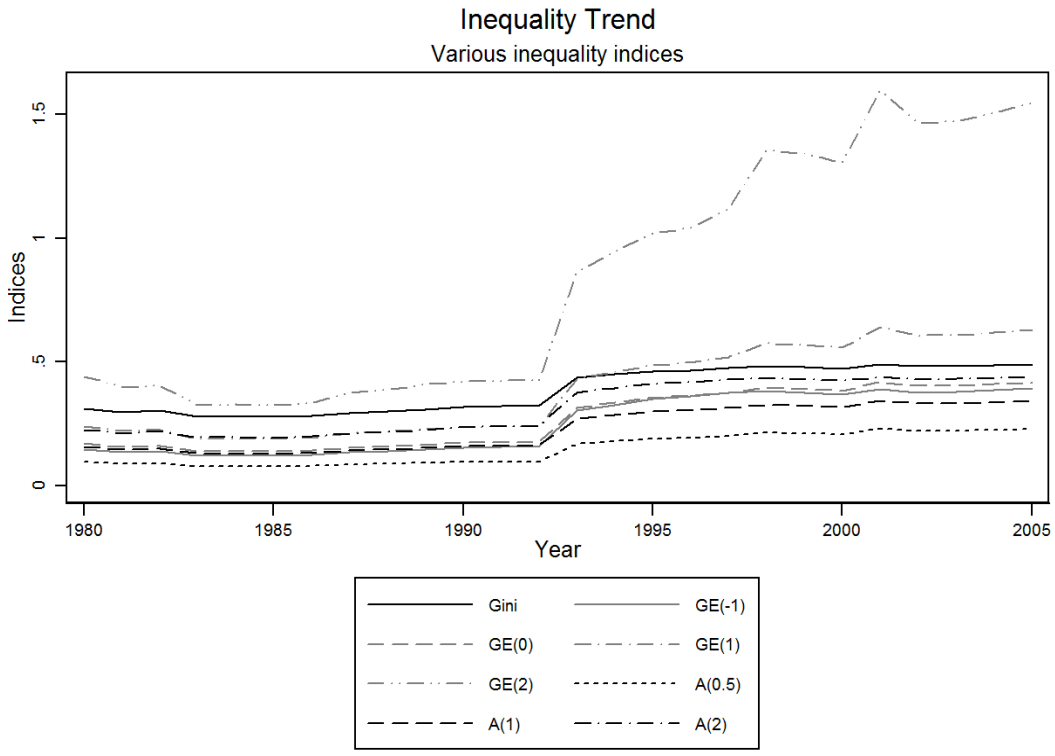


Figure 2.3 Inequality trend by *Gini*, *GE* measures, and Atkinson's inequality measures. Source: Author's creation.

Figure 2.4 Inequality trend by decile dispersion ratio, P90/P10. Source: Author's creation.

Table 2.1 The values of *Gini* coefficient with the jackknife procedure.

Year	Gini	Std. err	t	Sig	95% Conf.	Interval
1980	0.310	0.102	3.03	0.002	0.110	0.510
1981	0.297	0.098	3.03	0.002	0.105	0.489
1982	0.303	0.098	3.09	0.002	0.111	0.494
1983	0.278	0.089	3.13	0.002	0.104	0.452
1984	0.279	0.089	3.13	0.002	0.104	0.454
1985	0.278	0.089	3.14	0.002	0.104	0.451
1986	0.283	0.089	3.16	0.002	0.107	0.458
1987	0.294	0.095	3.09	0.002	0.107	0.480
1988	0.299	0.096	3.13	0.002	0.111	0.486
1989	0.308	0.097	3.18	0.001	0.118	0.498
1990	0.317	0.096	3.29	0.001	0.128	0.505
1991	0.320	0.096	3.35	0.001	0.133	0.507
1992	0.320	0.096	3.35	0.001	0.132	0.507
1993	0.434	0.120	3.63	0	0.200	0.669
1994	0.449	0.124	3.62	0	0.206	0.692
1995	0.461	0.128	3.61	0	0.211	0.711
1996	0.466	0.128	3.65	0	0.216	0.717
1997	0.474	0.133	3.55	0	0.213	0.735
1998	0.481	0.157	3.07	0.002	0.174	0.788
1999	0.478	0.157	3.04	0.002	0.170	0.786
2000	0.473	0.155	3.05	0.002	0.169	0.778
2001	0.490	0.175	2.79	0.005	0.146	0.834
2002	0.481	0.166	2.9	0.004	0.156	0.807
2003	0.483	0.166	2.91	0.004	0.157	0.808
2004	0.486	0.168	2.89	0.004	0.157	0.815
2005	0.489	0.170	2.88	0.004	0.156	0.823

Source: Author's calculation.

Looking closely at the 95% confidence intervals, two separate periods can be identified: the sub-period of 1980-1992 and that of 1993-2005 in which the 95% confidence intervals within each sub-period were more congruent. Further confirmation can be obtained with a two-sample *t*-test to examine whether the levels of inequality in the post-1990s was higher than those pre-1990s. As reported in table 2.2, the results of *t*-test on all three indices support the maintained hypothesis.

Table 2.2 *t*-test results on some indices.

Index	Mean		Sig for Ha
	Pre-1990s	Post-1990s	
Gini	0.299	0.473	0.000
GE(1)	0.216	0.553	0.000
A(1)	0.145	0.317	0.000

Source: Author's calculation.
Note: Ha, the alternative hypothesis, is defined as diff < 0, where diff = mean(Pre-1990s) – mean(Post-1990s). The post-1990s covers 1993-2005. H_0, the null hypothesis, is defined as diff = 0.

Tables 2.3 and 2.4 report the results of post-hoc Anova. The tables differ only in the number of sub-periods (see the previous discussion on the periodization associated with figure 2.2). The Tukey HSD pairwise comparisons test whether the mean difference in the measured inequality between the compared periods is statistically significant. For each comparison, the alternative hypothesis is that the average inequality level in period 2 is higher than that in period 1.

For the four sub-periods, the results are the same for the defined indices. The C1 (representing the observed trend of convergence associated with the early liberalization in 1980-1985) differed from the C2 (representing the observed trend of convergence associated with the economic crisis in 1998-2000). Both periods indicated a convergence, but the inequality level in the C2 was significantly higher than that in the C1. The C1 was also significantly dissimilar to the D2 (representing the observed trend of divergence associated with the post-decentralization in 2001-2005), while the D1 (representing the observed trend of divergence associated with the deregulation and economic boom era in 1986-1997) differed from the C2 and the D2. On the other hand, the subsequent pattern of the observed trend of convergence and divergence in the beginning of the study period (the C1 and D1) and in the end of the study period (the C2 and D2) were not significantly different from each other. This suggests that the average level of

inequality in the observed trends of convergence (the C1 and the C2) were not necessarily lower than that seen in the observed trends of divergence (the D1 and the D2) that followed accordingly.

Table 2.3 Tukey HSD pairwise comparisons, four sub-periods.

Comparison		HSD test		
period 1 vs. period 2		Gini	GE(1)	A(1)
C1	D1	3.1175	2.8711	2.984
C1	C2	7.4718*	8.4846*	7.7000*
C1	D2	7.8115*	9.7445*	8.3014*
D1	C2	4.3543*	5.6135*	4.7160*
D1	D2	4.6940*	6.8734*	5.3174*
C2	D2	0.3397	1.2599	0.6014

Source: Author's calculation. Note: Periodization derived from the pattern of convergence-divergence seen in figure 2.2. An * denotes significant mean difference between two periods.

Table 2.4 Tukey HSD pairwise comparisons, five sub-periods.

Comparison		HSD test		
period 1 vs. period 2		Gini	GE(1)	A(1)
C1	D1a	2.5771	1.4846	2.0558
C1	D1b	28.8587*	27.0915*	29.4350*
C1	C2	32.4223*	35.9174*	34.7425*
C1	D2	33.8963*	41.2508*	37.4562*
D1a	D1b	26.2815*	25.6069*	27.3792*
D1a	C2	29.8451*	34.4328*	32.6867*
D1a	D2	31.3191*	39.7662*	35.4004*
D1b	C2	3.5636	8.8259*	5.3076*
D1b	D2	5.0376*	14.1593*	8.0212*
C2	D2	1.474	5.3334*	2.7137

Source: Author's calculation.
Note: Periodization derived from the pattern of convergence-divergence seen in figure 2.2. An * denotes significant mean difference between two periods.

In the scenario of five sub-periods, the D1 is further divided into the D1a (representing the flatter trend of divergence associated with the first deregulation era of 1986-1992) and the D1b (representing the steeper trend of divergence associated with the deeper liberalization in

1993-1997). In this scenario, the story is generally the same. Both the D1a and the D1b were dissimilar to each other and, according to the *GE*(1) and *A*(1) index, to the following trends (i.e., the C2 and the D2). As expected, the D1a (the flatter divergence) did not differ from the C1, but the D1b (the steeper divergence) significantly differed from the C1. All three indices slightly disagreed in some comparisons. According to the *Gini* coefficient, the pairs that show no significant difference are the C1 vs. the D1a, the D1b vs. the C2, and the C2 vs. the D2; while according to the *A*(1) index, such indifferent pairs only include the C1 vs. the D1a and the C2 vs. the D2. According to the *GE*(1) index, all pairs are significantly different, except the C1 vs. the D1a.

Out of the findings reported in tables 2.2 to 2.4, five highlights emerge. First, there were distinct sub-periods over the observation years, broadly defined as the post-1990s (1993-2005) and the pre-1990s (1980-1992). Periodization can also be made according to the trend of convergence or divergence observed within a shorter period. The alternative periodization has four and five sub-periods, respectively. Second, what is seen as a convergence or a divergence may not actually represent a difference in terms of the average level of inequality, as shown by the C1 vs. the D1 (or the D1a) and the C2 vs. the D2. Third, the average level of inequality in a convergence trend is not necessarily lower than the one in a divergence, as shown in the D1 vs. the C2. Fourth, two trends of convergence or divergence may be dissimilar, as shown in the C1 vs. the C2, the D1 vs. the D2, or the D1a vs. the D1b. Fifth, regardless of the trend (i.e., either convergence or divergence), an observed trend in the post-1990s generally reveals a higher average level of inequality than an observed trend pre-1990s.

These highlights suggest that even while σ-convergence is considered to be a more direct test for the convergence hypothesis (Quah 1993), an alternative periodization may yield

different stories. Also, the visual observation of either convergence or divergence should be accompanied with a more formal test for mean difference as demonstrated above, because at the end, σ-convergence is primarily concerned with the level of dispersion.

2.5 Distribution dynamics

The σ-convergence approach also needs to describe how the entire shape of the distribution evolves (Islam 2003). Examining the evolution of the entire distribution of a regional per capita GDP across cities allows us to explore additional insights regarding the convergence process. Because the analysis of distribution dynamics pays attention to the entire cross-sectional distribution, and not just its first and second moments, it can reveal a richer pattern that indicates polarization or cluster of cities; i.e., convergence club (Quah 1997).

Measures of disparities are as practical and intuitive as they are relatively easy to compute and provide an overall picture of the variance of the cross-section distribution. However, they suffer from a limited ability to capture movements of the distribution. Further, the interpretation of dispersion measures may be difficult if the distribution is multimodal (Young 2008). Given the drawback of the summary measures of inequality and the need of distribution dynamics analysis, this paper applies a non-parametric approach to the dynamic analysis.

The primary advantage of a non-parametric approach is that it does not constrain its estimation to any certain family of distribution and makes no *a priori* assumptions regarding the form of density function. As such, it avoids some inflexibility or arbitrariness of parametric specification (Ahamada and Flachaire 2010). Particular methods to use are the kernel density estimator and Markov chain analysis based on transition probability matrices. The former is

particularly useful in providing a visual description, while the latter can offer some convergence statistics to characterize the distribution dynamics.

2.5.1 Kernel density estimator

Kernel estimation is used to approximate the probability density function (pdf) of a sample of observations. Unlike non-parametric estimates via histogram, kernel estimation produces a smooth graphical representation and does not rely on the choice of points of origin. The naïve estimator and kernel density estimator (henceforth, "kernel estimator") are used in kernel estimation. The kernel estimator is considered a general form of the naïve estimator, so that the estimation no longer depends on the number of intervals used, because observations in the interval centered on *y* are not given the same weight. Rather, the closer the observation is to *y*, the greater the weight given (Ahamada and Flachaire 2010).

Following Ahamada and Flachaire (2010), the kernel estimator is given as follows:

$$\hat{f}(y) = \frac{1}{nh}\sum_{i=1}^{n} K\left(\frac{y-y_i}{h}\right) \qquad (9)$$

where *n* is the sample size and *h* is the width of the intervals. The kernel function *K* must satisfy the following condition $\int_{-\infty}^{\infty} K(x)dx = 1$, so that $\hat{f}(y)$ has the properties of a density function. This paper chooses the Epanechnikov kernel[5], expressed as follows:

$$K(x) = \begin{cases} \frac{3\left(1-\frac{x^2}{5}\right)}{4\sqrt{5}} & \text{if } |x| < \sqrt{5} \\ 0 & \text{otherwise} \end{cases} \qquad (10)$$

The choice of bandwidth can be problematic. A too large bandwidth creates over smoothing, leading to the loss of some information. A too small bandwidth produces a spikey

[5] According to Silverman (1986), the choice of kernel actually has little effect on the density estimates. The Epanechnikov kernel and the Gaussian kernel are the most frequently used kernels. Both are symmetric around zero and tail gradually further from zero.

density function. To avoid this dilemma, this paper adopts the Silverman's (1986) rule of thumb to find the optimum bandwidth $h_{opt} = 1.059 \frac{q_3 - q_1}{1.349} n^{-0.2}$.

How did the shape of distribution evolve? Were there distinct groups observed?

Figure 2.5 shows the estimated density function of per capita GDP (in logarithm[6]), taking into account some comparisons of the defined periods, where each period is represented by a particular year. Viewed clockwise from the upper left, the figures represent a decade period, a comparison of convergence-divergence-convergence years, a period of convergence, and finally one of divergence. Since the variable of interest is expressed in logarithm, a shift represents a percentage change in per capita GDP. As such, the horizontal shift that is evident in figure 2.5 reflects an overall increase in the level of per capita GDP. Over the years, the shape of the per capita GDP distribution across East Java cities has also changed.

In the early 1980s (i.e., 1982 of the first convergence period), the peak was sharper and the spread was narrower. In the mid-80s (i.e., 1985), the density function began to show a bimodality, suggesting the existence of two distinct groups. Such bimodality was much less pronounced in the mid-90s (i.e., 1995, 1999), even though the peak was less pointed and the spread of density wider, suggesting that the mobility of middle cities to the group of richer cities was in the making. In the post-decentralization era, the density function was bimodal again. The distinction between two groups, the poorer and the richer cities, became sharper. These two distinct groups were not of the same size, as indicated by the different levels of density between the two modes. There were a relatively fewer number of richer cities and a higher number of poor cities.

[6] Unless otherwise stated, logarithm throughout this paper refers to natural logarithm.

Did the gap between the distinct groups persist?

Figure 2.6 shows the jointly estimated bivariate kernel estimation of per capita GDP in the initial and end periods. The figure describes how the distribution of per capita GDP evolved between 1980 and 2005. Evidently, the probability of jointly observing lower values of per capita GDP in 1980 (*X*-axis) and 2005 (*Y*-axis) is considerably high (*Z*-axis). A low per capita GDP city in 1980 had a high chance of remaining a city with relatively low per capita GDP in 2005. Similarly, the probability of observing a high per capita GDP city in 1980 become a low value city by 2005 is small. In other words, a city with a relatively higher per capita GDP in 1980 ran only a small chance of having a low per capita GDP in 2005.

In fact, the three clusters of cities were concentrated around the 45-degree line in the *X*-*Y* plane. This suggests that the club of poor, middle, and rich cities in 1980 very likely remained the same in 2005. Other methods could possibly yield similar results. However, the kernel density estimation is relatively easy to perform and its graphical output is easy to understand. These advantages are favorable, given that not all planning institutions are well-endowed with modeling/statistical resources.

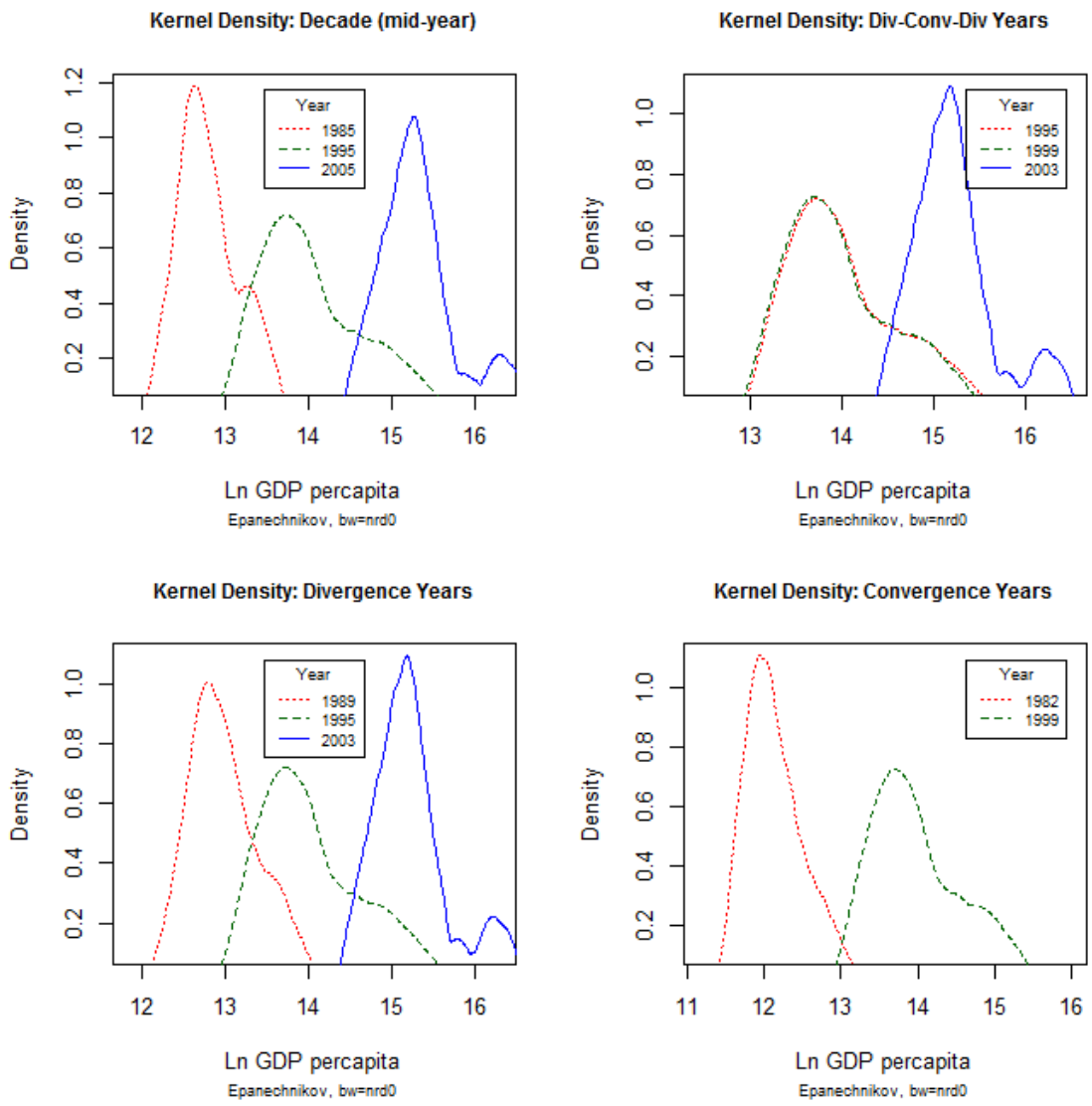


Figure 2.5 Kernel density estimation.
Source: Author's creation.

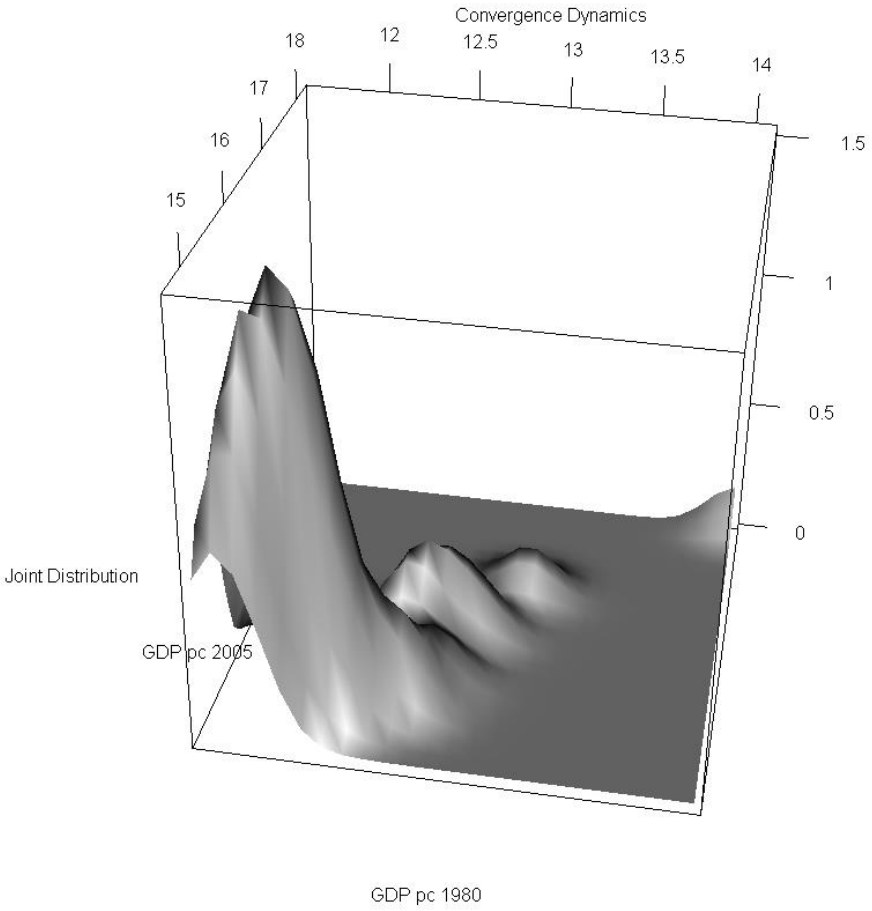


Figure 2.6 Bivariate kernel density estimation.
Source: Author's creation.

2.5.2 Markov chain analysis[7]

A Markov chain is essentially a stochastic process in which the outcome of the next *state* of the system depends only on the present state. Therefore, Markov chain analysis is used to detect mobility within a distribution and to describe its dynamics. The mobility between *n* states/groups is represented by an *n x n* matrix, called the transition probability matrix *P*, also

[7] This sub-section avoids a redundant theoretical explanation on Markov process which can be found elsewhere in much more detail (e.g., Grinstead and Snell 1997, Chapter 11), but it introduces briefly the relevant methodology and draws on Nkurunziza (2010), Monford (2008), and Pellegrini (2002). For examples of the application of Markov chain on convergence/regional studies, mostly in a European context, see Fingleton (1997), Overman and Puga (2002), and Quah (1996).

known as a Markov matrix, a stochastic matrix, or a transition matrix, with elements p_{ij} characterizing the mobility from one state to another, given by:

$$p_{ij}\,(t+1) = P[X(t+1) = j | X(t) = i] \qquad (11).$$

If the transition is analyzed over more than one period ahead, the transition probability becomes:

$$p_{ij}^{(m)} = P[X(t+m) = j | X(t) = i] \qquad (12)$$

where *m* is the number of steps.

Two essential assumptions define the transition probabilities as a time homogenous Markov chain, such that $p_{ij}(t+1) = p_{ij}(t) = p_{ij}$: (1) *P* is constant in time, and (2) p_{ij} is independent of its preceding values. The properties of the transition probability matrix *P* consists of a series of information regarding the dynamics of the distribution.

Characterizing the distribution dynamics

If the transition matrix is ergodic[8], then the chain will converge toward a steady-state and is therefore of a stationary distribution. The speed at which the distribution is supposed to converge to this steady-state can be defined as the half-life of the chain: the length of time to reach half the distance separating the current distribution from the stationary distribution. The probability of staying in the same group indicates the stability of the process (Pellegrini 2002). The half-life *h* and the Pellegrini's (2002) stability index *S* are formulated as:

$$h = -\frac{\ln(2)}{ln|\lambda_2|} \qquad (13)$$

[8] Markov chain is ergodic if it takes a finite number of steps to go from each state to any other state, and the absolute value of the second largest eigenvalue of the transition matrix is strictly smaller than 1. The ergodicity reflects the distribution in the future given the transition process *P*.

$$S = \frac{Tr(P)}{n} \qquad (14)$$

where λ_2 is the second largest eigenvalue and *Tr* is the trace of the matrix *P* with dimension *n*, respectively. A high value of *h* and *S* suggest a rapid convergence to the steady-state and a stable process respectively. A stable process indicates a low chance of mobility between categories.

Another way to describe the speed of the transition process is to calculate the mean first passage time, defined as how long it takes to move from a state *i* to another state *j*. This is described by an *n x 1* vector whose elements represent the average time needed for a transit from a state to the defined absorbing state.

Another convergence index can be derived from the transition matrix, indicating whether the mobility from the original distribution to the final one increases convergence towards the mode of the stationary distribution (Pellegrini 2002). This index represents the ratio of the sum of the probability value in the matrix modal column and in the off-diagonal cells before the column to the sum of probabilities in all cells in the matrix. A higher value for the index suggests a lower dispersion in the final distribution and a lower chance for polarization (i.e., the occurrence of multiple modes) in the long-run distribution.[9]

How persistent are the inequality dynamics? How fast is the convergence?

Given the defined five non-overlapping classes of per capita GDP,[10] the transition probability matrix over the study period is given by table 2.5 and its characteristics are presented in table

[9] This stationary distribution can be computed as fixed factor *w*, such that $w(P - I) = 0$; thus, *w* is the left null space of the matrix $(P - I)$ (Grinstead and Snell 1997).

[10] The defined categories are made slightly lower than the overall dispersion for all years, indicated by the six-number summary (min, max, mean, median, and Q1 and Q3). Two alternative categorizations are the one that is made around and one that is slightly higher than the overall dispersion. The Markov chain

2.6. Table 2.5 shows that the distribution exhibits a high degree of persistence. The diagonal values (i.e., the grey shaded cells) are high, indicating a high probability of staying in the same group. Such inertia is summarized by a high value of the stability index *S* (0.82), indicating that the process is highly stable.

Table 2.5 Transition probability matrix.

	per capita GDP (in thousand Rp.), Classes	2005				
		< 500	500 - 700	701 - 900	901 - 1500	> 1500
1980	< 500	90.3%	4.9%	3.5%	1.4%	0.0%
	500 – 700	0.0%	73.6%	18.1%	5.6%	2.8%
	701 – 900	0.0%	0.8%	77.2%	7.9%	14.2%
	901 – 1500	0.0%	0.0%	2.9%	80.0%	17.1%
	> 1500	12.2%	0.0%	0.0%	0.7%	87.1%

Source: Author's calculation.

However, some upward mobility is expected, and is more pronounced particularly in the middle classes of the distribution. About 18% of the second poorest cities in 1980 were expected to move up to the next group in 2005. Over the same period, 14% of the central class cities (i.e., the 701-900 class) were expected to jump up to the top class cities (i.e., the > 1500 class) while 17% of the second richest cities were expected to become the richest cities. Interestingly, while 12% of the richest cities in 1980 were expected to fall into the group of the poorest cities in 2005, all cities in fact remained in the top category in 2005, given the very wide range within the top category.[11] At the stationary distribution, it is expected that approximately 40% of the cities will belong to the lowest category and 30% of them will be in the top category, while less than

result according to the alternative groupings is presented in the tables A.2 and A.4 in the appendix A. It yields similar dynamic characteristics.

[11] Recall that Markov process is a stochastic process, which is explained by a mathematical model that evolves over time in a probabilistic fashion.

one third of the cities will be spread out over the three middle groups (table 2.6). As such, it is consistent with the pattern emerged in the bivariate kernel estimation (figure 2.6).

Table 2.6 Dynamic characteristics.

Stationary Distribution	
per capita GDP, Classes	Share of population
< Rp. 500,000	38%
Rp. 500,000 - Rp. 700,000	7%
Rp. 701,000 - Rp. 900,000	13%
Rp. 901,000 - Rp. 1,500,000	11%
> Rp. 1,500,000	30%
Convergence Statistics	
Half-life	3.9 periods
S	0.82
C_the 3rd	0.24
C_the 4th	0.28
Mean First Passage Time	
Class Mobility	MFPT (years)
From class 1 to class 4	36.8
From class 2 to class 4	30.1
From class 3 to class 4	31.8
From class 5 to class 4	42.6

Source: Author's calculation.

Taking the third and fourth group as the absorbing state, the indices of convergence toward these two classes (i.e., the C_the 3^{rd} and the C_the 4^{th}) take the low values of 0.24 and 0.28, respectively. The low values indicate a higher probability of dispersion and polarization in the final distribution, which is evident graphically and in the stationary distribution statistics.

Provided the process is highly stable, it appears that the observed distribution is nowhere near the steady-state distribution, as captured by the half-life index that takes a value of 3.9, which is higher than unitary. The system resistance is also indicated by the mean first passage time. All upward mobility from a lower state to the defined absorbing state (i.e., the fourth class)

was expected to take more than 30 years. The much longer mean first passage time is found for an alternative categorization that defines a set of higher intervals (tables A.3 and A.5 in the appendix A).

This sub-section is able to characterize inequality dynamics, as described visually in the previous sub-section. All these findings are consistent with or support the kernel density estimation and tell the same story. The observed inequality and some polarization are expected to remain, even though some upward mobility is also pronounced in the process toward the steady-state. Other things equal, the system is remarkably stable. Different methods of class categorization provide similar results; the only notable exception is the higher number of years in mean first passage time in the alternative categorization, which only further highlights the stability of the system.

2.6 β-convergence

This section tests the β-convergence hypothesis, adopting the widely used Barro and Sala-i-Martin's equation developed from the Solow-Swan long-run growth model (Arbia 2005):

$$\frac{1}{T} log\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha - \frac{(1-e^{-bT})}{T} log\left(y_{i,0}\right) + \varepsilon_i \qquad (15)$$

where $y_{T,i}$ $(t = 0, \dots, T; i = 1, \dots, n)$ denotes per capita GDP at time t and city i, α is a constant, and ε is the error term with zero mean. By setting $\beta = -(1 - e^{-bT})$, equation (15) can be estimated via ordinary least squares (OLS) and rewritten as:

$$log\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha + \beta log\left(y_{i,0}\right) + \varepsilon_i \qquad (16)$$

where the dependent variable $log\left(\frac{y_{i,T}}{y_{i,0}}\right)$ denotes the city i's growth rate for the entire period and the covariate $log\left(y_{i,0}\right)$ represents the logarithm of the city i's per capita GDP in the initial

period. If the estimated $\hat{\beta}$ in equation (16) is significant and $\hat{\beta} < 0$, the data favor the unconditional/absolute β-convergence. To test for a conditional β-convergence hypothesis that incorporates some other predictors in a panel data setting, equation (16) can be rewritten as:

$$log\left(\frac{y_{i,t+m}}{y_{i,t}}\right) = \alpha_i + \beta log(y_{i,t}) + \gamma_k X_{ki,t} + \varepsilon_{i,t} \qquad (17)$$

where $X_{ki,t}$ is a vector of *k* additional cities' characteristics and controls for cross-city heterogeneity in determinants of the city's steady state. Where *m*=1, the dependent variable $log\left(\frac{y_{i,t+m}}{y_{i,t}}\right)$ is the annual growth rate of the per capita GDP of the East Java cities and $log(y_{i,t})$ is the logarithm value of the city *i*'s per capita GDP at the beginning of each period over which the annual growth rate is computed. Thus, the equation (17) implies that the dependent variable is regressed on the lagged values of the right-hand side variables. This specification has the advantage of addressing the potential endogeneity issue and is also used in Higgins *et al*. (2006). The verdict will be the conditional β-convergence if the estimated $\hat{\beta}$ is negative and statistically different from zero. Two parameters govern the convergence process: first, the speed of convergence $b = -\frac{log(1+\hat{\beta})}{T}$, and second, the half-life time $h = \frac{\log(2)}{b}$. The parameter b represents the annual rate of convergence, while the parameter *h* represents the time needed to be half-way between the initial value and the steady-state.[12]

Both the absolute and conditional β-convergence hypotheses suggest that poor cities or regions grow faster than rich ones. However, the hypotheses differ in the final point of convergence. While the absolute β-convergence suggests that all economies converge to the same level of per capita GDP, the conditional β-convergence argues the economies converge to

[12] A steady-state refers to a situation where the growth rates of all variables are constant (Arbia 2005).

their own steady states. This paper finds evidence in favor for the conditional β-convergence hypothesis, but no evidence for the absolute β-convergence hypothesis.

2.6.1 Absolute β-convergence

Equation (16) is first estimated via OLS, then via maximum likelihood (ML). Table 2.7 presents these results. The estimation is done on the dataset that consists of 37 cross-sectional units and of three period types: 1) the entire period (1983-2005), 2) the first-half period (1983-1992), and 3) the second-half period (1993-2005). All three models fail to support the absolute β-convergence hypothesis. The 1983-2005 and the 1983-1992 models do not support the absolute β-convergence, but instead show significant divergence. The negative sign of the 1993-2005 model's estimated coefficient indicates convergence, but it is not significant. The estimated coefficients by both OLS and ML are the same, but the ML estimates' standard errors are generally smaller than those produced by OLS. In terms of goodness of fit (looking at the AIC, BIC, and log-likelihood statistics), the OLS and ML models are considered the same. However, the ML method is to be considered more efficient and does not suffer from assumption violations facing the OLS estimates.

The striking finding is that both methods of estimation reveal the same story: absolute β-convergence is not evident. Instead, the richer cities grew faster than the poorer ones during the study period. From an arithmetical stand point, it is possible to further calculate the speed of "divergence," because the positive sign of the coefficient. However, from an economics point of view, and considering the process of how b is derived from equation (15), the computed speed of "divergence" is difficult to interpret. The same reasoning applies to why half-life "divergence" is not calculated either for the test for the absolute β-convergence hypothesis.

Table 2.7 Absolute β-convergence, OLS and ML

	1983-2005		1983-1992		1993-2005	
	OLS	ML	OLS	ML	OLS	ML
initial per capita GDP	0.3804	0.3804	0.1147	0.1147	-0.0219	-0.0219
	(.1221)**	(.1216)**	(.02651)***	(.02434)***	(0.06814)	(0.08668)
intercept	-2.184	-2.184	-1.066	-1.066	1.727	1.727
	(1.559)	(1.534)	(.3385)**	(.3091)***	(0.9558)	(1.198)
N	37	37	37	37	37	37
AIC	25.17	27.17	-87.85	-85.85	10.65	12.65
BIC	28.39	32	-84.63	-81.02	13.87	17.48
R-sq	0.2171		0.3486		0.002944	
F	9.704		18.73		0.1034	
Log-likelihood	-10.59	-10.59	45.93	45.93	-3.325	-3.325

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001
Source: Author's estimation.

2.6.2 Conditional β-convergence

Since the Barro's approach is essentially developed from the Solow-Swan's framework, while making use of the Cobb-Douglas production function (Arbia 2005), the stocks of public, private, and human capital, and other types of infrastructure are regarded important determinants of regional economic growth (Lall and Yilmaz 2001). Therefore, testing the conditional β-convergence hypothesis can be devised by estimating equation (17), which incorporates variables representing factors, policies affecting factor mobility, and other regional's characteristics. This paper employs various measures of human capital, a measure of government spending, and an interaction between the government spending at the city and the city's fiscal capacity category.

Table 2.8 presents the estimation result of six models (mod1 to mod6). The six models differ only by the measures of human capital (see the note below table 2.8 for additional variable descriptions). All six models are similar in terms of goodness of fit and they tell a consistent story. The feasible generalized least squares (FGLS) estimations in all models support the conditional β-convergence hypothesis for the entire period (1983-2005).

As expected, all human capital proxies are significant and promote growth in all six models. This means that the per capita GDP in the cities highly endowed with human capital should grow faster. Compared with other human capital measures, the ratio of people with diploma degrees to the total population (mod5) has the largest impact on growth, followed by the ratio of the number of people with university degrees to the working-age population (mod6). It may reflect a situation where vocational trainings are more favorable to local economic development.

Table 2.8 The FGLS estimations on the conditional β-convergence hypothesis, 1983-2005.

	(1) mod1	(2) mod2	(3) mod3	(4) mod4	(5) mod5	(6) mod6
per capita GDP	-0.09233	-0.08933	-0.09979	-0.09584	-0.07473	-0.04794
	(.01793)***	(.01778)***	(.01835)***	(.01815)***	(.01692)***	(.01508)**
human capital	1.426	0.9483	1.939	1.28	18.2	3.027
	(.2603)***	(.1774)***	(.3353)***	(.228)***	(3.88)***	(.9208)**
government spending	0.0338	-0.1396	0.02082	-0.1729	-0.136	0.0569
	(0.3968)	(0.3981)	(0.396)	(0.3977)	(0.3998)	(0.4017)
low fiscal capacity X	-2.427	-2.112	-2.605	-2.245	-1.46	-1.26
government spending	(1.191)*	(1.178)	(1.193)*	(1.179)	(1.162)	(1.174)
intercept	1.104	1.098	1.177	1.164	0.9281	0.6777
	(.2287)***	(.2305)***	(.2316)***	(.2332)***	(.2213)***	(.2112)**
N	814	814	814	814	814	814
AIC	350.1	351.5	346.8	348.7	357.9	368.9
BIC	387.7	389.1	384.4	386.3	395.5	406.5
Log-likelihood	-167.1	-167.8	-165.4	-166.3	-170.9	-176.4

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001
Source: Author's estimation.
Notes: The measures of human capital for model 1-6 (mod1-mod6) are defined as follows: mod1 = ratio of the number of people with high school, diploma, and university degree to the total population; mod2 = ratio of the number of people with high school, diploma, and university degree to the working-age population; mod3 = ratio of the number of people with high school degree to the total population; mod4 = ratio of the number of people with high school degree to the working-age population; mod5 = ratio of the number of people with diploma degree to the total population; mod6= ratio of the number of people with university degree to the working-age population. The government spending is measured as the ratio of government consumption expenditure to GDP.

Government spending is not significant in all models. The employed measure of government spending only covers the consumption expenditures, therefore it does not represent public capital or investment, which this paper is currently lacking of and which is expected to have positive impact. It is not clear from the evidence whether the city governments' consumption spending behavior is growth enhancing or simply due to waste. However, there is an indication and some significant evidence that higher consumption expenditure by the low-fiscally capable cities is detrimental to growth.

Table 2.9 provides estimates of the convergence speed and half-life and their corresponding 95% confidence interval resulted from the percentile and bias-corrected bootstraps. The 95% confidence interval by both bootstraps is very similar, indicating that the estimates are unbiased. Across the models, the speed of convergence is very low (i.e., less than 0.5% annually). Accordingly, it might take more than a century for East Java cities to reach even the half-way point toward their steady states. This result is consistent with the convergence statistics resulting from the Markov chain analysis in section 2.5.2, where both suggest the persistence of disparities between East Java cities.

With all favorable economic conditions and government actions along the way to the steady state, the poor cities' ultimate steady state may actually put them closer to that of the rich cities'. However, it is difficult to tell when the steady state will be achieved and what levels of development or any other welfare indicators associated will be associated with the steady state. Until then, the clusters of poor and rich cities will stubbornly persist.

Table 2.9 The convergence speed and half-life of the conditional β-convergence.

	Speed of convergence		Half-life (year)	
Model	Estimate	95% Conf. Interval	Estimate	95% Conf. Interval
mod1	0.44%	0.27% - 0.65% (P)	157.42	107.42 - 258.83 (P)
		0.29% - 0.66% (BC)		105.05 - 241.33 (BC)
mod2	0.43%	0.27% - 0.63% (P)	162.97	109.42 - 256.22 (P)
		0.28% - 0.64% (BC)		108.47 - 247.79 (BC)
mod3	0.48%	0.32% - 0.68% (P)	145.06	101.30 - 217.98 (P)
		0.32% - 0.71% (BC)		97.68 - 216.21 (BC)
mod4	0.46%	0.30% - 0.67% (P)	151.36	102.92 - 230.10 (P)
		0.31% - 0.68% (BC)		102.52 - 224.26 (BC)
mod5	0.35%	0.23% - 0.54% (P)	196.34	127.82 - 304.08 (P)
		0.23% - 0.54% (BC)		127.82 - 304.08 (BC)
mod6	0.22%	0.12% - 0.38% (P)	310.39	181.87 - 559.70 (P)
		0.12% - 0.41% (BC)		170.25 - 558.70 (BC)

Source: Author's estimation.
Note: P=percentile bootstraps; B=bias-corrected bootstraps.

2.6.3 Is there a spatial problem?

An answer to this question is important from both theoretical and empirical stand points. Barro and Sala-i-Martin (1995: 382) state that "absolute convergence is more likely to apply across regions within countries than across countries" because the differences in technology, preferences, and institutions are supposed to be smaller than those across countries. Given no evidence of absolute convergence as previously explained, do the data show the absence of some spatial spillovers? From a methodological point of view, if spatial autocorrelation is present, the estimation needs to devise spatial models. Otherwise, the parameters will not be consistently estimated (Rey and Montouri 1999). The three following approaches agree that is there is no

evidence of spatial autocorrelation: 1) Global statistics[13] of Moran's *I* and Geary'*C*; 2) Visual inspection via Moran scatter plot; and 3) Lagrange multiplier diagnostics for spatial dependence.

The respective formula for Moran's *I* and Geary'*C* is:

$$I = \frac{\sum_i \sum_j (x_i - \bar{x})(x_j - \bar{x}) w_{ij}}{\sum_i (x_i - \bar{x})^2}$$

$$C = \frac{\sum_i \sum_j \left(x_i - x_j\right)^2 w_{ij}}{\sum_i (x_i - \bar{x})^2}$$

where w_{ij} is an element of spatial weight matrix *W*. Moran's contiguity ratio takes a value of $I \in [-1, 1]$. A value of zero indicates no spatial autocorrelation, while a negative or positive value suggests neighboring places are dissimilar or similar to each other. The Geary's ratio takes a value of $C \in [0, 2]$ and its expected value is 1 for no spatial autocorrelation. A value of $C > 1$ indicates negative autocorrelation, while a value of $C < 1$ suggests positive autocorrelation (Fotheringham *et al.* 2000). Under randomization tests for both statistics, the magnitudes of spatial autocorrelation statistics are very small and are not significant (table 2.10). The visual inspections as shown in figures 2.7 and 2.8 support the tests.

Table 2.10 The statistics of spatial autocorrelation.

Year	Spatial autocorrelation			
	Moran's *I*	p-value	Geary's *C*	p-value
1980	0.031	0.200	0.590	0.072
1982	0.032	0.198	0.590	0.072
1989	0.020	0.248	0.603	0.079
1995	0.039	0.170	0.589	0.073
1999	0.014	0.232	0.597	0.087
2003	0.021	0.208	0.589	0.079
2005	0.020	0.212	0.589	0.080

Source: Author's calculation.

[13] LISA (local indicators for spatial autocorrelation) tests are also performed and the results are the same with the one provided by the global statistics, i.e., no spatial dependence is detected.

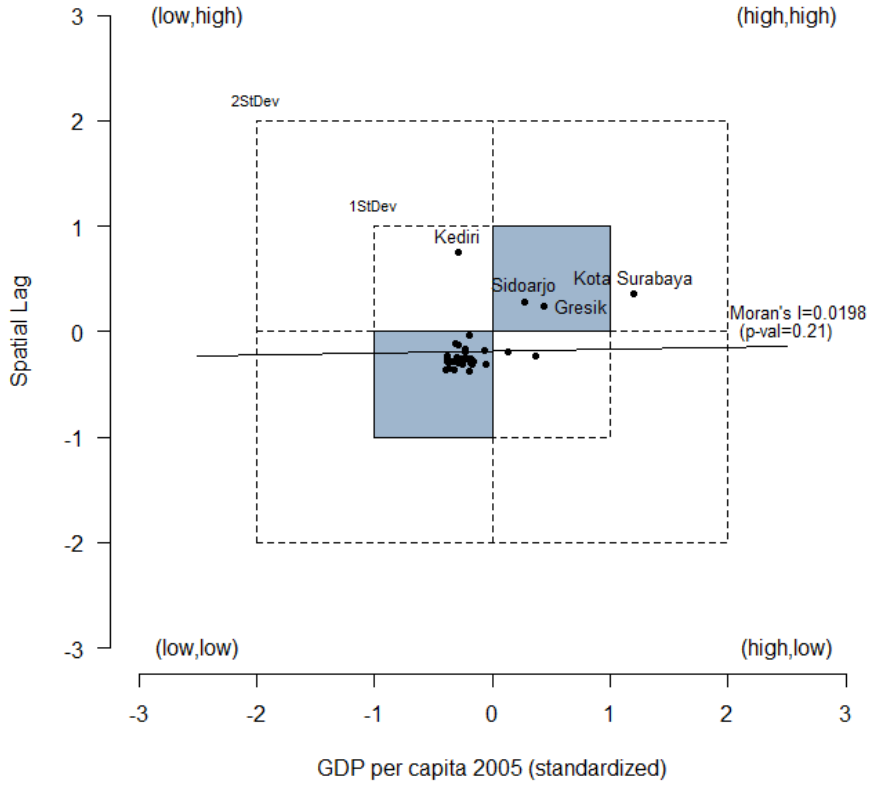


Figure 2.7 Moran scatter plot, 2005.
Source: Author's creation.

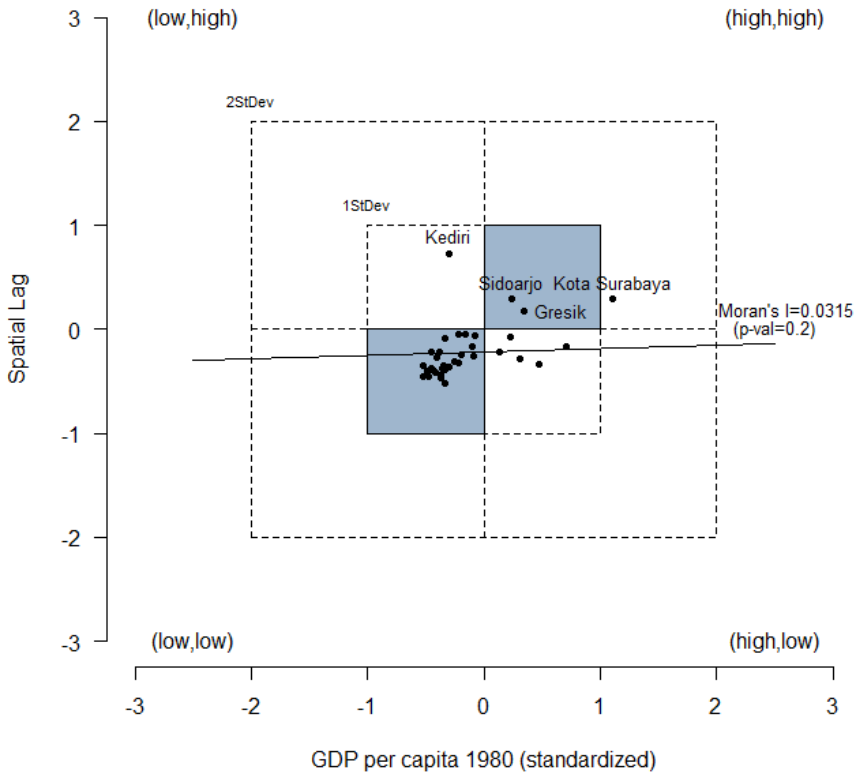


Figure 2.8 Moran scatter plot, 1980.
Source: Author's creation.

Finally, Lagrange multiplier diagnostics for spatial dependence applied on the model 1 in table 2.9 (`mod1`) further confirm the absence of spatial dependence (table 2.11). Thus, we can conclude with confidence that there is no spatial problem. Therefore, there is no need to estimate spatial lag model, $log\left(\frac{y_{T,i}}{y_{0,i}}\right) = \alpha + \beta log(y_{0,i}) + \rho W log\left(\frac{y_{T,i}}{y_{0,i}}\right) + \varepsilon_i$, and spatial error model, $log\left(\frac{y_{T,i}}{y_{0,i}}\right) = \alpha + \beta log(y_{0,i}) + (I - \zeta W)^{-1}\mu_i$ (Rey and Montouri 1999).

Table 2.11: Spatial dependence diagnostics.

	1983		2005	
Test	Stat	p-value	Stat	p-value
LMlag	0.0836	0.7724	0.392	0.5313
LMerr	1.039	0.308	1.9521	0.1624
RLMlag	1.0033	0.3165	0.9471	0.3305
RLMerr	1.9587	0.1617	2.5072	0.1133
SARMA	2.0423	0.3602	2.8992	0.2347

Source: Author's calculation.

2.7 Conclusion and policy implication

This paper provides evidence for the increasing level of disparities within the study period. The observed increasing trend of inequality is robust to the choice of one measure over another. The level of inequality was significantly higher in the 1990s, often characterized as the high growth period associated with major economic and policy events, such as deeper liberalization, economic crisis, and decentralization.

Even though the mid-90s witnessed some mobility of the middle cities to the richer group, bimodality became sharper again in the post-decentralization. Analysis on the distribution dynamics indicate the strong presence of clubs and such polarization is expected to remain, all else remaining equal, given the high stability of the transition process. A scenario of upward mobility may take at least three decades.

A catching-up process is detected, but it is very slow and only occurs when city's characteristics thought to be determinants of growth are taken into account. In other words, the absolute β-convergence hypothesis, which often said to be more likely to occur across regions within a country, does not get its empirical support in this research. Instead, what shows up in the data is a tendency of divergence, by which the already richer cities consistently outgrew the poorer ones in the study period. However, after controlling for some cities' characteristics, such

a catching-up process appears. The presence of divergence force in the absolute β-convergence hypothesis and the slow convergence process in the conditional β-convergence hypothesis, along with the absence of spatial spillovers, may be responsible for the widening disparities and the sustained gap between the rich and the poor cities.

The findings suggest that the old wisdom saying that East Java is a case of "balanced development" does not hold, at least from the perspective of spatial inequality. Since the focus of this investigation is on the measurement and characterization of convergence dynamics and not a welfare analysis, this chapter does not offer specific policy recommendations with regard to spatial inequality. Nevertheless, it is worth noting that, in general, proposed policy responses should be evaluated with regard to their effects on spatial disparities, on the one hand, and influences on the benefits of agglomeration, on the other hand. In addition, the benefits of various policy options should be weighed against costs. Such analysis is beyond the scope of this current analysis.

References

Ahamada, Ibrahim and Emmanuel Flachaire. 2010. *Non-Parametrics Econometrics*. Oxford: Oxford University Press.

Akita, Takahiro. 1988. "Regional Development and Income Disparities in Indonesia." *Asian Economic Journal* 2 (2): 165-91.

Akita, Takahiro and Rizal Affandi Lukman. 1999. "Spatial Patterns of Expenditure Inequalities in Indonesia: 1987, 1990 and 1993." *Bulletin of Indonesian Economic Studies* 35 (2): 67-90.

Arbia, Giuseppe. 2005. *Spatial Econometrics: Statistical Foundations and Applications to Regional Convergence*. Berlin: Springer-Berlin.

Barro, Robert J. and Xavier Sala-i-Martin. 1995. *Economic Growth*. Cambridge, MA: MIT Press.

———. 1992. "Convergence." *Journal of Political Economy* 100 (2): 223-51.

Booth, Anne. 2000. "Poverty and Inequality in the Soeharto Era: An Assessment." *Bulletin of Indonesian Economic Studies* 36 (1): 73-104.

BPS. 2009. *Provinsi Jawa Timur dalam Angka 2009*. Surabaya: Badan Pusat Statistik Jawa Timur.

———. 2002. *Direktori Perusahaan: Statistik Industri Besar dan Sedang di Jawa Timur 2002*. Surabaya: Badan Pusat Statistik Jawa Timur.

Chatterji, M. and J. H. L. Dewhurst. 1996. "Convergence Clubs and Relative Economic Performance in Great Britain: 1977–1991." *Regional Studies* 30 (1): 31-9.

de la Fuente, Angel. 2000. "Convergence Across Countries and Regions: Theory and Empirics." *EIB Papers* 5 (2): 25-45.

Fingleton, Bernard. 2003. "Externalities, Economic Geography, and Spatial Econometrics: Conceptual and Modeling Developments." *International Regional Science Review* 26 (2): 197-207.

———. 1997. "Specification and Testing of Markov Chain Models: An Application to Convergence in the European Union." *Oxford Bulletin of Economics and Statistics* 59 (3): 385-403.

Fotheringham, A. Stewart, Chris Brundson, and Martin Charlton. 2000. *Quantitative Geography: Perspectives on Spatial Data Analysis*. London: SAGE.

Garcia, Jorge Garcia and Lana Soelistianingsih. 1998. "Why do Differences in Provincial Incomes Persist in Indonesia?" *Bulletin of Indonesian Economic Studies* 34 (1): 95-120.

Grinstead, Charles M. and J. Laurie Snell. 1997. *Introduction to Probability*. Providence, RI: American Mathematical Society.

Haughton, Jonathan H. and Shahidur R. Khandker. 2009. *Handbook on Poverty and Inequality*. Washington, DC: World Bank.

Higgins, Matthew J., Daniel Levy, and Andrew T. Young. 2006. "Growth and Convergence Across the United States: Evidence from County-Level Data." *Review of Economics and Statistics* 88 (4): 671-81.

Hill, Hal, Budi P. Resosudarmo, and Yogi Viddyatama. 2009. "Economic Geography of Indonesia: Location, Connectivity, and Resources." In *Reshaping Economic Geography in East Asia*, edited by Yukon Huang and Alessandro Magnoli Bocchi, 115-134. Washington, DC: World Bank.

Irawan, Andi. 2011. "The Geographic Distribution of Indonesia's East Java Manufacturing Industries." *Région Et Développement* (33): 185-210.

Islam, Iyanatul and Habibullah Khan. 1986. "Spatial Patterns of Inequality and Poverty in Indonesia." *Bulletin of Indonesian Economic Studies* 22 (2): 80-102.

Islam, Nazrul. 2003. "What have we Learnt from the Convergence Debate?" *Journal of Economic Surveys* 17 (3): 309-62.

Kim, Sukkoo. 2008. *Spatial Inequality and Economic Development: Theories, Facts, and Policies.* Washington, DC: World Bank.

Krugman, P. 1991. *Geography and Trade*. Cambridge, MA: MIT Press.

Krugman, P. and R. L. Elizondo. 1996. "Trade Policy and the Third World Metropolis." *Journal of Development Economics* 49: 137-50.

Lall, Somik V. and Serdar Yilmaz. 2001. "Regional Economic Convergence: Do Policy Instruments make a Difference?" *The Annals of Regional Science* 35 (1): 153-66.

Le Gallo, Julie and Cem Ertur. 2003. "Exploratory Spatial Data Analysis of the Distribution of Regional Per Capita GDP in Europe, 1980-1995." *Papers in Regional Science* 82 (2): 175-201.

Mackie, Jamie. 1993. "The East Java Economy: From Dualism to Balanced Development." In *Balanced Development: East Java and the New Order*, edited by Howard Dick, James J. Fox and Jamie Mackie, 23-53. Oxford: Oxford University Press.

Friedman, Milton. 1992. "Do Old Fallacies Ever Die?" *Journal of Economic Literature* 30 (4): 2129-32.

Monfort, Philippe. 2008. *Convergence of EU Regions: Measures and Evolution, Working Paper no.1* Directorate-General for Regional Policy, European Union.

Nkurunziza, Janvier D. 2010. *The Distribution of Firm Size in Africa's Manufacturing Sector and its Implication for Industrial Policy.* Geneva: United Nations Conference on Trade and Development.

Ottaviano, G. I. P. and D. Puga. 1997. "Agglomeration in the Global Economy: A Survey of the "New Economic Geography"." *CEP Discussion Paper no. 356*.

Overman, Henry G., Diego Puga, and Hylke Vandenbussche. 2002. "Unemployment Clusters Across Europe's Regions and Countries." *Economic Policy* 17 (34): 115-47.

Pellegrini, Guido. 2002. "Proximity, Polarization, and Local Labor Market Performances." *Networks and Spatial Economics* 2 (2): 151-73.

Pemprov Jatim. 2009. *Perda No. 1/2009: Peraturan Daerah Provinsi Jawa Timur Nomor 1 Tahun 2009 tentang Rencana Pembangunan Jangka Panjang Daerah Provinsi Jawa Timur 2005-2025*. Surabaya: Pemerintah Provinsi Jawa Timur.

———. 2005a. *Perda No. 8/2005. Peraturan Daerah Provinsi Jawa Timur Nomor 1 Tahun 2009 tentang Rencana Pembangunan Jangka Menengah Daerah Provinsi Jawa Timur 2006-2008.* Surabaya: Pemerintah Provinsi Jawa Timur.

———. 2005b. *Analisis Indikator Makro Sosial dan Ekonomi Jawa Timur Tahun 1998-2002: Buku 4, Data Makro Indikator Sosial dan Ekonomi Jawa Timur 2002-2005.* Surabaya: Pemerintah Provinsi Jawa Timur.

———. 2002a. *Analisis Indikator Makro Sosial dan Ekonomi Jawa Timur Tahun 1998-2002: Buku 1*. Surabaya: Pemerintah Provinsi Jawa Timur.

———. 2002b. *Analisis Indikator Makro Sosial dan Ekonomi Jawa Timur Tahun 1998-2002: Buku 4*. Surabaya: Pemerintah Provinsi Jawa Timur.

Quah, Danny. 1997. Empirics for growth and distribution: stratification, polarization, and convergence clubs. *Journal of Economic Growth* 2 (1): 27-59.

———. 1996. Empirics for economic growth and convergence. *European Economic Review* 40 (6): 1353-75.

———. 1993. Galton's fallacy and tests of the convergence hypothesis. *The Scandinavian Journal of Economics* 95: 427-43.

Rey, Sergio J. and Brett D. Montouri. 1999. "US Regional Income Convergence: A Spatial Econometric Perspective." *Regional Studies* 33 (2): 143-56.

Sala-i-Martin, Xavier X. 1996. "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence." *European Economic Review* 40 (6): 1325-52.

Wie, Thee Kian. 2002. "The Soeharto Era and After: Stability, Development, and Crisis, 1966-2000." In *The Emergence of a National Economy: An Economic History of Indonesia, 1800-2000*, edited by Howard Dick, Vincent J. H. Houben, J. Thomas Lindblad and Thee Kian Wie, 194-243. Honolulu, HI: University of Hawai'i.

Young, Andrew T., Matthew J. Higgins, and Daniel Levy. 2008. "Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data." *Journal of Money, Credit and Banking* 40 (5): 1083-93.

Chapter 3

Regional Income Disparities in Decentralizing Indonesia, 2001-2007

3.1 Introduction

The extraordinary circumstances of the crisis in 1998 drove Indonesia to pursue a 'big bang' approach to decentralization by embarking on administrative, fiscal, and political decentralization at the same time. While Indonesia's 2001 decentralization might be at first a very politically-motivated policy response to such regional resentments as separatist tendencies or grievances of resource-rich regions (Booth 2003; World Bank 2003), Indonesia's decentralization should also be regarded as a policy tool to address market-led agglomeration and persistent interregional inequality (Arze del Granado 2009).

The decentralization framework is applied at the district level. Therefore, Indonesia's decentralization can be regarded as a radical reform, considering that: 1) Indonesia is a multi-tier unitary state with subnational governments consisting of provincial and district governments (*kabupaten* and *kota*);[1] and 2) Indonesia had been highly centralized since the 1950s, the post-1945 independence period has witnessed several attempts of both regional-based and ideology/religious-driven rebellion.

The applied fiscal decentralization attempted to promote equalization by addressing vertical and horizontal imbalances and to provide district governments with incentives for development. One important research issue is then to investigate whether the Indonesian decentralization delivered on its equity promise. More specifically, this paper addresses the

[1] Administratively, districts can be *kota* (city) or *kabupaten* (regency), but they are on the same level, i.e. district level. This paper refers 'local governments' or 'local levels' to district level. In this paper, 'region' or 'regional' in general refer to subnational level (in Indonesian context, it includes provinces, districts, or any other regional groupings whenever applicable).

questions whether 1) there has been a reduction in income disparities across districts; 2) the decentralization is an inequality-reducing force; and 3) the impact of decentralization on inequality is moderated by the districts' level of development, or in other words, how the districts' level of development may have an influence on the effect of decentralization on inequality.

The empirical evidence regarding the relationship between decentralization and regional disparities presented in both single-country studies (e.g., Akai and Sakata 2005; Bonet 2006) and cross-country studies (e.g., Ezcurra and Pascual 2008; Canaleta *et al*. 2004) are inconclusive. It seems that the decentralization process may operate differently in the developed and developing regions/economies. Hence, one of the primary purposes of this paper is to investigate how the level of development of individual districts may affect the impact of decentralization on inequality across Indonesian districts. A review of the literature reveals that there has been no study of the Indonesian decentralization case that has empirically investigated this issue at district level. Some unpublished work mainly focuses on the impact of decentralization on growth but these are all at the provincial level (with a shorter study period, e.g. 2001-2003), they only rely on a single indicator for the decentralization, and they do not control for the interaction between the level of development and the decentralization.

Previous studies on regional income disparities in Indonesia also rely on provincial data (e.g., Akita and Lukman 1995; García García and Soelistianingsih 1998), so the sample is small and it does not allow a within province inequality analysis. On decomposition analysis, this paper applies a more flexible and unrestrictive approach suggested by Mookherjee and Shorrocks (1982) in subgrouping the Indonesian districts, so it takes a departure from the rigid hierarchical structure approach used by Akita and Alisjahbana (2002).

This paper fills a gap in the absence of studies on the inequality-decentralization in Indonesia. Compared with previous studies, this paper offers several novelties. First, it combines both extensive descriptive, decomposition and econometric analysis, exploiting a panel dataset of the Indonesian districts during the period 2001-2007. Secondly, it constructs several proxies for decentralization rather than relying on a single indicator. Thirdly, it investigates the interaction effects between the level of development and the decentralization. Fourthly, the fixed-effect estimations also address endogeneity and control for heteroscedasticity.

This research finds that there has been a decrease in inequality across Indonesian districts due to the reduction in within and between province inequalities. The observed reduction in equality is in general associated with greater fiscal decentralization by most proxies, but there is limited evidence of the inequality-promoting force of the tax-based revenue sharing. The districts' level of development is found to be a significant determinant of the observed inequality and a significant moderator of the effect of a decentralization indicator on inequality. Development spending, the manufacturing sector, infrastructure, and urban concentration are found to be significant equalizing forces. The results of this research will provide important inputs into the evaluation of policies addressing Indonesia's regional disparities.

The next section discusses the link between decentralization and regional income disparities. Section 3.3 summarizes Indonesia's decentralization framework, while section 3.4 presents the descriptive and decomposition analysis. Section 3.5 outlines the model specifications for the empirical analysis and section 3.6 presents the estimation results. Section 3.7 concludes the paper.

3.2 The link between decentralization and regional income disparities

The main arguments in favor of decentralization have been based on efficiency and equity perspectives. From an efficiency perspective, Oates (1972) posits that local governments are better informed about and have better capacity to meet local preferences and needs. Therefore, the transfer of authority and resources to subnational governments can improve allocative efficiency (i.e., the efficiency of allocation of resources). Interregional mobility of individuals to locate in the places that offer a bundle of public services and taxes that best match their interests (Tiebout 1956) further enhances efficiency gains. Oates (1999) argues that people mobility may result in competition and policy innovations among local governments. It will ultimately create a more efficient provision of public goods and services and an increasing overall productive efficiency in the economy. From an equity perspective, that is the focus of this current paper; regional autonomy is a policy instrument to address persistent regional disparities, considered as a fertile ground for economic, social, and political problems (Tselios *et al*. 2012). Transfer of resources by some redistribution criteria can correct some horizontal imbalances among subnational entities. Fiscal decentralization with an adequate transfer system can improve development in lagging regions and finally promote interregional equity (Bonet 2006).

Efficiency and equity perspectives are related to each other. As decentralization will promote efficiency for the whole economy and assuming that more developed regions are closer to their economic efficiency frontier, then less developed regions will enjoy a greater margin of improvement. In this regard, decentralization acts as an inequality-reducing force. As less developed regions may be in greater need for fiscal competition and flexible labor markets, they may have a greater incentive to deliver public goods and services and to achieve levels of development similar to those of more developed regions, or at least to some minimum standard

of performance or service. Under these circumstances, decentralization acts as a wealth or living standard-equalizing force (Rodríguez-Pose and Ezcurra 2010).

However, there are also circumstances under which decentralization may increase regional disparities. Potential costs associated with different institutional capacities, governance quality, and social-economic endowment across regions may outweigh the potential benefits of decentralization associated with better knowledge of local preferences and local economic potential (i.e., allocative and productive efficiencies). The loss of scale economies in policy formulation and delivery and the increased 'rent seeking' and the stronger 'local capture' by interest groups at the local levels may instead deliver goods and services in much less efficient ways as well as divert resources from productive uses or reduce resources allocated for welfare-enhancing activities (Prud'homme 1995). According to Azis (2008), local capture is both inefficient and inequitable. It manifests itself in local budgets that may be used for economically unviable or socially undesirable projects, taking away funds from other important ones with higher public values.

Poorer and less well-endowed regions generally face greater institutional constraints and thus are more exposed to the potential costs of decentralization. This situation will make the lagging regions less able to attract capital, investment, or skilled workers, which in turn will make them less able to innovate and compete with more developed regions. Under these circumstances, regional disparities can be perpetuated and even widen (Rodríguez-Pose and Ezcurra 2010).

As explained, the link between fiscal decentralization to regional disparities or income inequality could go through multiple channels. The characteristics of fiscal decentralization in place, the extent of effective autonomy in collecting revenue and spending exercised by sub-

national governments, and the quality of governance also play an important role. Two opposing arguments are the one that is skeptical about the redistribution functions being conducted by local governments versus the one that recognizes the important roles of sub-national governments carrying out redistributive policies (Prud'homme 1995). If the sub-central governments are implementing redistributive policies, depending on the degree of fiscal autonomy, sub-national governments may be able to do it through progressive taxation on the revenue side of the budget and/or through pro-poor spending policies on the expenditure side of the budget. Spending behavior is also an important factor that affects the decentralization-inequality relationship. If a greater spending autonomy would only increase government officers' salaries instead of spending for productive infrastructure, decentralization could lead to widening regional disparities, as in the case of Colombia (Bonet 2006).

As in the theoretical discussion on the link between decentralization and regional disparities, the empirical evidence regarding the relationship between the two is also inconclusive. Single-country studies confine results within an experience of a particular country, but they are less problematic in controlling for institutional differences and other peculiarities than multi-country studies. The typical findings are that decentralization reduces territorial disparities in developed economies (Canaleta *et al.* 2004), but it has the opposite effects for less developed economies (Rodríguez-Pose and Ezcurra 2010). Two possible reasons are: 1) in developed economies, sub-national governments are arguably more able to play a role in balancing resources; and 2) stronger territorial competition due to greater mobility across jurisdictions provides greater incentives for sub-national governments in developed countries to meet the residents' preferences.

Single-country studies (e.g., Bonet 2006 for Colombia, Qiao *et al.* 2008 for China, and Kim *et al.* 2003 for Korea) find that the estimated sign of the impact of fiscal decentralization on regional disparities is positive, meaning that decentralization is found to be associated with widening inequality. Other studies (e.g., Akai and Sakata 2005 for the USA and Calamai 2009 for Italy) find that the estimated sign is negative, suggesting that decentralization is an inequality-reducing force. Of cross-country studies, Ezcurra and Pascual (2008) for EU countries and Canaleta *et al.* (2004) for 17 OECD countries find a negative relationship between decentralization and regional disparities, while Rodríguez-Pose and Gill (2004) using a sample of both developed and developing countries provide mixed evidence, depending on the countries' level of development

For the Indonesian case, McCulloch and Sjahrir (2008) investigate the growth impact of the decentralization at provincial level and at a shorter period of time. Resosudarmo *et al.* (1999), using the 1996 Indonesian inter-regional computable general equilibrium model (IRCGE), study the impact of some intergovernmental transfers on income distribution among islands in Indonesia. The 'fiscal decentralization framework' in this study is an earmarked intergovernmental transfer system through regional grants (e.g., INPRES, DIP) allocated through sectoral ministries. Some grants under the framework were even more limited where the investment location was predetermined by the central government.

3.3 Background: Decentralization in Indonesia

Indonesia is part of the global trend towards decentralization since the 1970s (Rodríguez-Pose and Gill 2004). Davoodi and Zou (1998) observe that 63 out of 75 developing and transitional countries with populations greater than five million have undergone some forms of power

transfer from central government to lower government tiers. Prud'homme (1995) defines decentralization as power and/or resource transfers from central to subnational government and outlines three types of administrative decentralization, namely: 1) *deconcentration*, that is redistribution of decision making to regional governments; 2) *delegation*, by which a semi-autonomous organization will have a closer involvement on policy making; and 3) *devolution*, through which a lower autonomous government tier has some degree of power or even full degree of power in some policy areas. Administrative decentralization is generally accompanied by fiscal decentralization, broadly defined as decentralization of financial resources through an intergovernmental transfer system or a revenue sharing mechanism. Indonesia's post-1998 decentralization encompasses three types of administration decentralization and fiscal decentralization.

With respect to fiscal decentralization, empirical studies suggest that the stage of development, the size of the country, the population diversity, and the 'crisis effect' are primary driving forces for fiscal decentralization (Bahl and Linn 1992). These forces also appear to drive Indonesia to embark on a decentralization strategy. Prior to the Asian financial crisis in 1997, Indonesia was regarded as the next 'Asian Tigers' or one of the 'Asian Miracles'.[2] Indonesia's development features at that time (i.e., consistent high economic growth during the late 1980s and the early 1990s, accompanied with much improved social-economic indicators yet with relatively high inequalities among regions) made Indonesia a good candidate for decentralization. With a large population and high cultural diversity, decentralization would allow the Government of Indonesia (GOI) to take into account regional differences and to meet the local preferences in better ways, a central argument in fiscal decentralization theorem laid out

[2] These terms refer to the following economies: South Korea, Hong Kong, Taiwan, and Singapore.

by Oates (1972). Finally, the economic crisis that hit Indonesia in 1997, followed by a political crisis in 1998 and afterwards (e.g., turmoil and the resurgence of separatism tendencies in such provinces as Aceh, Papua, and East Timor[3]) and the subsequent downfall of the Soeharto regime seemed to accelerate the process of decentralization (Silver *et al*. 2001).

Such acceleration process led to the enactment of Law 22/1999 on Local Government and Law 25/1999 on the Fiscal Balance between the Central Government and the Local Governments that frame Indonesia's administrative and fiscal decentralization strategy. After a two-year timeline for preparation, Indonesia entered a new era of regional autonomy[4] in January 1, 2001 when the 1999 Laws came into effect. Both Law 22/1999 and Law 25/1999 replaced Law 5/1974 on the Principles of Regional Government. The 1999 laws grant district governments a considerably greater degree and larger scope of autonomy; in addition, it restructured the system of intergovernmental transfers to empower local economic capabilities. Despite a mild success, the rushed preparation for a quite radical change in devolution of authority and fiscal decentralization necessitated revision on the original laws to improve the clarity of intergovernmental relations or district obligatory functions that will finally ensure smooth implementation. Amendment to the 1999 laws yields Law 32/2004 on Regional Autonomy and Law 33/2004 on Regional Finance.

Many also view Indonesia's 2001 decentralization as a 'Big Bang' (e.g., World Bank 2003), because: 1) Indonesia has simultaneously embarked on administrative, fiscal, and political decentralization; 2) The new intergovernmental fiscal system shifts away from the earmarked

[3] Indeed, East Timor earned its independence after a 1999 referendum.

[4] Indonesians also widely use the term regional autonomy for decentralization. This paper uses the terms interchangeably.

grants[5] largely determined by the Central government to a general allocation fund. All in all, Indonesia's 2001 decentralization has rapidly transformed Indonesia to one the most decentralized systems in the world from one of the most centralized ones.

3.3.1 Devolution of authority

Law 22/1999 devolves much of the responsibility to the district level by assigning authority in obligatory sectors that include public works, health, education, agriculture, transport, industry and trade, capital investment, infrastructure services, environment, land, cooperatives, and manpower. The central government remains responsible for monetary and fiscal policies, international relations, national defense, justice, security, and religion affairs. Even though the Law explicitly states that there is no hierarchical relationship between province and its districts, each of the provincial governments coordinates district governments within its territory and performs functions that affect more than one district government or, by a district government's request, undertakes functions that the district government is yet unable to do so, as long as those functions are not part of the obligatory sectors (e.g., the de-concentrated tasks of line ministries at the district level). Each provincial governor (i.e., the head of the provincial government) remains the representative of the central government in the regions and administers the de-concentrated central tasks (World Bank 2003).

Law 32/2004 improves the clarity of obligatory functions for both district and provincial level and of the supervisory power of provincial governments over district governments. To improve accountability, Law 32/2004 also introduces elections for the subnational heads, i.e., governors at the provincial level and *walikota*/*bupati* for district level (World Bank 2007). Law

[5] Resosudarmo *et al*. (1999) evaluate the earmarked programs, such as Project Allocation List (*Daftar Isian Proyek, DIP*), and show that some of which were mere transfer with no change in allocation by provincial government.

32/2004 urges a better planning coordination where the national planning should take the provincial and district planning into account, and vice versa. To ensure appropriate public services delivery, Law 32/2004 requests central government to gradually enforce the minimum standard of services delivery to be adopted by district governments (Brodjonegoro 2003).

3.3.2 Fiscal decentralization

With most of responsibilities being devolved to the district level, government expenditure has been consequently shifting from highly centralized expenditure, dominated by the central budget (APBN, *Anggaran Pendapatan Belanja Negara*) to decentralized expenditure, dominated by the district and provincial budget (APBD, *Anggaran Pendapatan Belanja Daerah*). Before the 2001 decentralization, the transfers from the central government to the provincial and the district governments were made largely through earmarked grants whose largest components were the subsidies for autonomous regions (SDO, *Subsidi Daerah Otonom*) and the President Instruction (INPRES, *Instruksi Presiden*). The SDO was intended to finance the salaries of civil servants in the regions and the regions' other current expenditure. The INPRES covered development spending in the regions. It was initially a block grant for development spending in the 1980s, then included various specific grants[6] to finance various programs/projects, from primary school rehabilitation to environmental impact assessment (World Bank 2003).

The 2001 decentralization collapses the SDO and the INPRES into a general allocation fund (DAU, *Dana Alokasi Umum*). DAU, specific allocation fund (DAK, *Dana Alokasi Khusus*), and revenue sharing (based on natural resources and tax revenue) are the components of the new intergovernmental transfer, also called Balancing or Equalization Fund (*Dana*

[6] See Silver *et al*. (2001), table 2 on page 353, for a complete list.

Perimbangan), which has been dominating sources of revenue for districts. On average, district governments' own revenues (PAD, *Pendapatan Asli Daerah*) account for less than 10% of districts' total revenue. Hence, Indonesia's 2001 decentralization is widely regarded as one characterized by decentralization of expenditure, as opposed to decentralization of revenue, for the following reasons: 1) the bulk of district governments' spending is mostly financed by the balancing fund, especially the dominating DAU and 2) district governments exercise limited local taxing power (Brodjonegoro 2003). However, the 2001 decentralization largely removes the earmarking (except for the DAK-financed expenditure), but central-regional transfers remain the dominant means of financing (World Bank 2003).

The arrangement of the equalization fund is indeed necessary and justified, because there are significant differences in natural resources endowment across Indonesia's regions; hence, this uneven distribution may affect regions' abilities in generating revenue abilities and disadvantage poorly endowed regions or regions without enough agglomeration effects to boost their regional economic development. In addition to addressing vertical fiscal imbalances, the equalization fund, especially the DAU, serves to address an undesirable effect of fiscal decentralization, i.e., horizontal imbalances (Martinez-Vazquez and McNab 2003). Indeed, a good feature of Indonesia's fiscal decentralization is that the DAU allocation adopts a formula-based mechanism.[7] This formula-driven allocation avoids a regressive system of decentralization,

[7] See World Bank (2007, 120-21) for a detail explanation on the formula and some innovations in the DAU allocation between the original law (Law 25/199) and the amendment (Law 33/2004). Basically, DAU is the sum of its two major components, i.e. basic allocation (BA) to cover the wage bill of civil service and fiscal gap (FG). FG is defined as expenditure needs (EN) minus fiscal capacity (FC). EN is the sum of weighted indices multiplied by average expenditure of districts (provinces) for the DAU allocation for districts (provinces). FC is the sum of own revenue, natural-resource revenue sharing, and tax revenue sharing.

where there is a greater influence of more politically important and economically stronger regions over the distribution of transfers, as identified in Prud'homme (1995) and Rodríguez-Pose and Gill (2004). To sum up, figure 3.1 illustrates the intergovernmental transfer system discussed above, while table 3.1 details the revenue sharing scheme among government tiers.

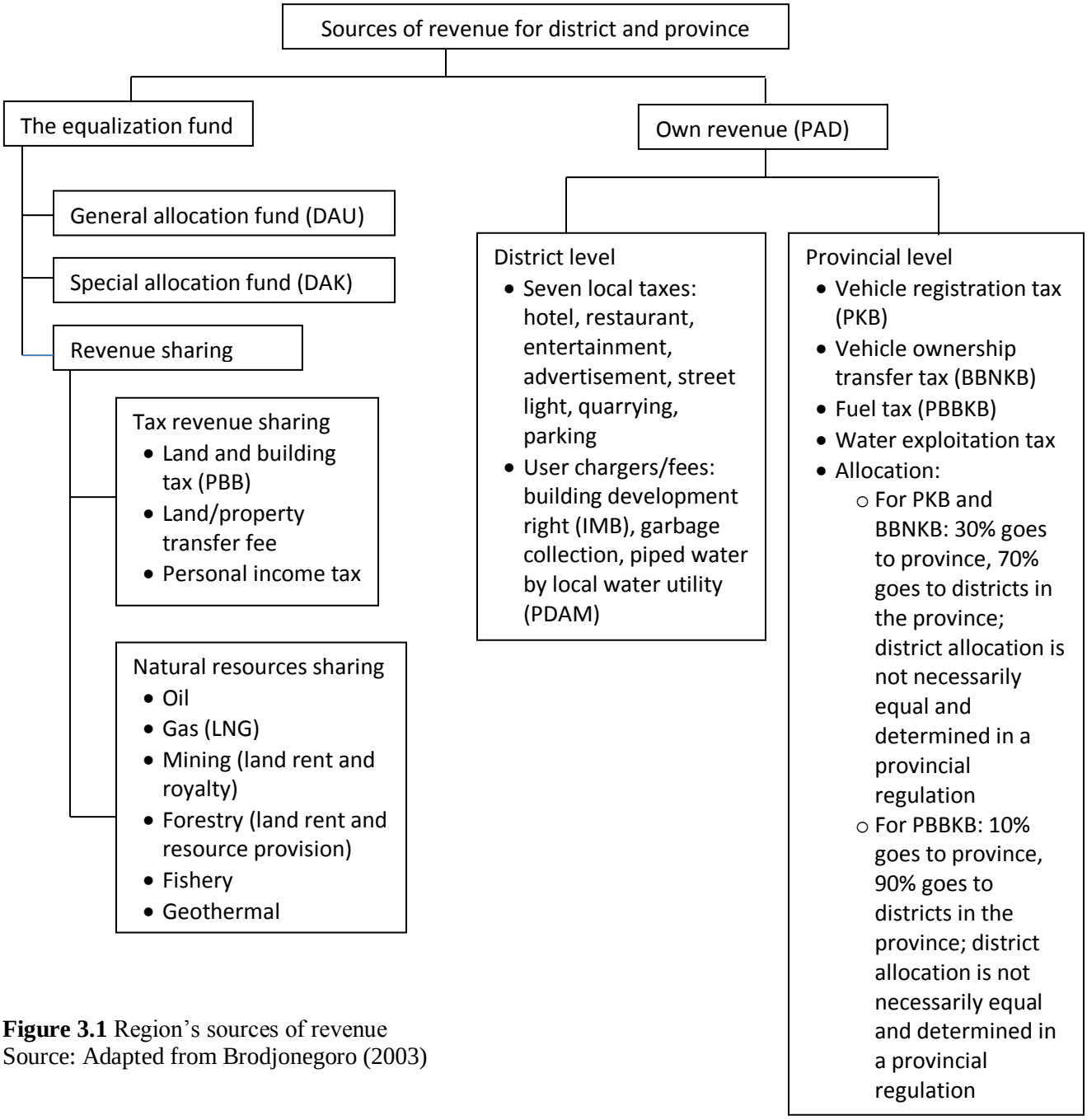


Figure 3.1 Region's sources of revenue
Source: Adapted from Brodjonegoro (2003)

Table 3.1 Revenue sharing scheme (in %)

Source	Law 25/1999		Law 33/2004					
	Central	District	Central	Province	Producing District	Districts within the same province	All Indonesia's other districts (equal share)	Collection fee
Tax								
- Land and building tax	10	90	-	16.2	-	64.8	10	9
- Land/property transfer fee	-	-	-	16	-	64	20	-
- Personal income tax	80	20	80	8	-	12	-	-
- Company tax	100	-	100	-	-	-	-	-
Natural resources								
- Oil	85	15	84.5	3.1	6.2	6.2	-	-
- Gas (LNG)	70	30	69.5	6.1	12.2	12.2	-	-
Natural resources: others	20	80	-	-	-	-	-	-
- Mining: land rent	-	-	20	16	64	-	-	-
- Mining: royalty	-	-	20	16	32	32	-	-
- Forestry: land rent	-	-	20	16	64	-	-	-
- Forestry: resource provision	-	-	20	16	32	32	-	-
- Fishery	-	-	20	-	-	-	80	-
- Geothermal	-	-	20	16	32	32	-	-

Source: Adapted from Brodjonegoro (2003).
Note: '-' denotes zero or not applicable.

3.4 Descriptive and decomposition analysis

This section estimates regional income inequality and explores its pattern and trend between 2001 and 2007, using a variety of inequality indices (as described in Chapter 2) based on district-level per capita regional GDP. The study period corresponds to an early, yet crucial, period of the implementation of decentralization. This period includes both the original and revised decentralization frameworks (that set out by the 1999 and the 2004 Laws) and captures high enthusiasm combined with high expectation for the desirable effects of decentralization among stakeholders.

The analysis has two purposes. First, it investigates whether there is any evidence of narrowing interregional inequality during the study period. Secondly, it further examines what has contributed to changes in the overall inequality across Indonesian districts. Are the changes in overall inequality driven more by changes in equality *within* provinces (or other subgroups) or by changes in equality *between* provinces (or other subgroups)? To answer this question, the analysis proceeds to decompose changes in overall inequality into changes *within* different groups and changes *between* those groups.

3.4.1 Data

The analysis employs per capita regional GDP from McCulloch's (2011) unique dataset[8] based on regional GDP and population data produced and provided by the Indonesia's Central Statistical Agency (BPS, *Badan Pusat Statistik*). For a robustness check, this paper uses both per capita regional GDP with and without the oil and gas sector. The reason for conducting this

[8] The dataset was produced as part of a research project funded by Ausaid and led by Dr. Neil McCulloch at the Institute of Development Studies, UK. It is recently made available for researchers to use the dataset for their own researches. It compiles data on socio-economic characteristics across Indonesian districts from 2001 to 2007.

check is that while per capita regional GDP is a common proxy for regional income and widely used in the previous studies of regional income disparities in Indonesia and elsewhere, per capita regional GDP excluding oil and gas is less noisy as a proxy for regional income. The presence of natural resources-based activities, in particular oil and gas sectors that has been dominating Indonesian extractive activities or mining output, inflates measured local economic activity, although these sectors have much less effect on local/host economies and their economic and social welfare.[9] Much of the returns to extractive activities, even after taking into account a new revenue sharing scheme, accrue to external entities (mostly central government and privately-owned oil and gas companies). Also, because oil and gas sectors are more highly capital intensive (as compared to forestry and small-scale gold mining), they have smaller local employment and income multipliers (Hill *et al*. 2009). Therefore, regional GDP net of oil and gas sectors is considered a better indicator for local economic activity and welfare.

The use of district-level data rather than provincial data has two advantages. First, it makes possible a decomposition analysis. Many previous studies on regional income disparities in Indonesia use provincial data (e.g., Akita and Lukman 1995; García García and Soelistianingsih 1998), so they are unable to analyze within province inequality. Secondly, it provides a large sample size, i.e., 342 districts, rather than only 30 provinces. The full sample of 342 districts used in this study consists of 73 *kotas* (cities) and 269 *kabupatens* (regencies).[10]

[9] Booth (2003) shows that the regions with high per capita GDP are not necessarily the ones with high living standards or low incidence of poverty. A popular example has been Papua (formerly called Irian Jaya).

[10] An organizational impact of decentralization is the splitting of district and province. So, the number of districts and provinces in Indonesia has changed. Excluding six non-autonomous district level governments in Jakarta, the number has grown from 336 districts and 30 provinces in 2001 to 477 districts and 33 provinces in 2009. To ensure a consistent comparison across the years, the dataset uses 2001 as a reference point and follows the definition used by the Ministry of Finance, i.e., an autonomous district/province is the one that receives DAU in the beginning of fiscal year. So, the full sample of 342

Tables B.1 and B.2 in the appendix B provide the detailed distribution of the districts across Indonesian five regions and 30 provinces.

3.4.2 Methods

This paper estimates overall inequality across districts by calculating the *Gini* coefficient of inequality, Atkinson's inequality measures, and generalized entropy (GE) measures based on district-level per capita regional GDP with and without oil and gas sectors. To see whether there is a change in the level of inequality, the indices are calculated for 2001 and 2007, the beginning and the end of study period. The indices satisfy desirable characteristics in measures of inequality: mean independence, population-size independence, and Pigou-Dalton transfer sensitivity.[11] In addition, Atkinson's and GE measures are decomposable, but only the latter is additively decomposable (Houghton and Khandker 2009). Therefore, the decomposition analysis in this current paper uses GE with a parameter value α that is set to be 0, also known as mean log deviation or *Theil's L* (henceforth, referred simply as the Theil index, T).

The *Gini* coefficient takes a value between 0 (perfect equality) and 1 (complete inequality). It is expressed as follows: $Gini = 1 - \sum_{i=1}^{N}(x_i - x_{i-1})(y_i + y_{i-1})$, where x_i is a point on the horizontal axis (that depicts the cumulative percentage of districts, from the poorest to richest ones) and y_i is a point on the vertical axis (that represents cumulative percentage of a given variable, i.e., per capita regional GDP).

---

districts and 30 provinces used in this study consists of 336 autonomous district and six non-autonomous district-level governments in Jakarta.

[11] Mean independence satisfies a condition where if all values were doubled, the measure of inequality would not change; under the criterion of population-size independence, the inequality measure should not change, if population were to change, all else equal; under the Pigou-Dalton transfer sensitivity criterion, the transfer from the rich to the poor would reduce the inequality level (Houghton and Khandker 2009).

The Atkinson class is formulated as follows:

$$A_\varepsilon = 1 - \left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{1-\varepsilon}\right]^{1/(1-\varepsilon)} \quad , \varepsilon \neq 1 \qquad (1)$$

$$A_\varepsilon = 1 - \frac{\prod_{i=1}^{N}\left(y_i^{(1/N)}\right)}{\bar{y}} \quad , \varepsilon = 1 \qquad (2)$$

with the common values of ε are 0.5, 1, and 2; while the general form the generalized entropy (*GE*) inequality measures is

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \qquad (3)$$

where $\bar{y}$ is the mean of per capita regional GDP. The *GE* measure takes on values between 0 (perfect equal distribution) and infinity (higher values representing higher levels of inequality). The parameter α can be any real value. The $GE(0)$ or mean log deviation (T) has the following expression:

$$GE(0) = \frac{1}{N}\sum_{i=1}^{N} ln\left(\frac{\bar{y}}{y_i}\right) \qquad (4)$$

For the rest of the paper, the Theil index, T denotes $GE(0)$.

This paper applies the same decomposition method as used by Mookherjee and Shorrocks (1982) and Jenkins (1995), taking advantage of the mean log deviation (T)'s characteristic of additive decomposability. Thus, T can be decomposed into between and within components (first term and second term, respectively):

$$T = \sum_k v_k T_k + \sum_k v_k\, ln(1/\lambda_k) \qquad (5)$$

where subscript *k* indicates subgroup *k*. Thus, T_k is Theil index for subgroup *k*; v_k refers to a subgroup's population share and defined as $v_k = n_k/n$, where n_k and n are the population size of subgroup *k* and the whole population, respectively; λ_k is the relative mean of subgroup *k*

defined as $\lambda_k = \mu_k/\mu$, where μ_k and μ are the mean income of subgroup k and for the whole population, respectively.

Mookherjee and Shorrocks (1982) also show that the changes in Theil index, ΔT, can be decomposed as:

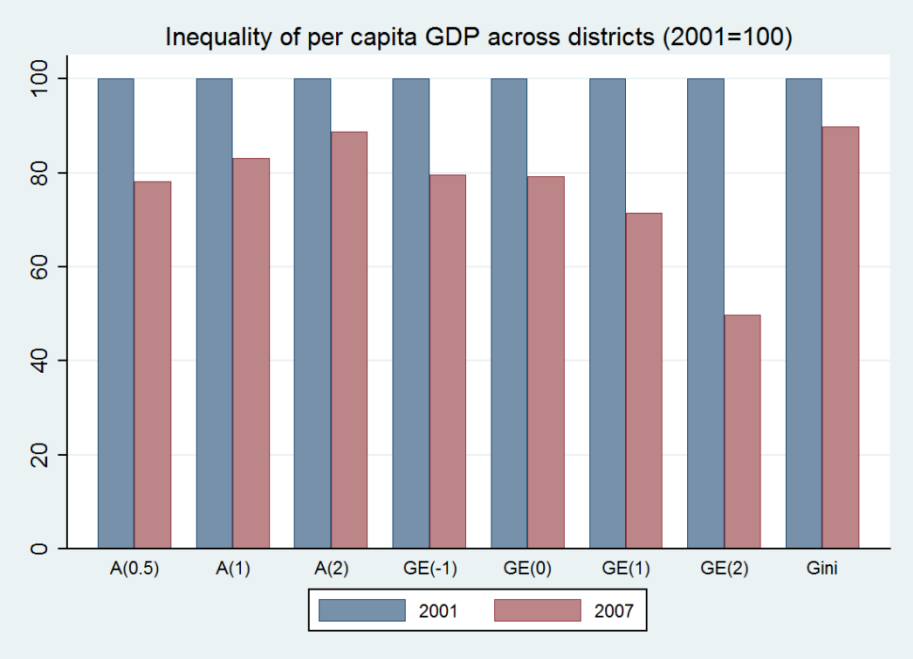
$$\Delta T \approx \sum_k \bar{v}_k \Delta T_k + \sum_k \bar{T}_k \Delta v_k + \sum_k \left(\bar{\lambda}_k - \overline{ln\lambda_k}\right)\Delta v_k + \sum_k (\bar{\theta}_k - \bar{v}_k)\, \Delta ln\mu_k \qquad (6)$$

where a bar over a variable denotes an average of the values in two points of time and Δ represent the change in the variables between the time of reference; θ_k is a subgroup's income share. The first term reflects the impact of changes in inequality within subgroups. The second and third terms capture the effect of changes in the population shares on the 'within group' and the 'between group' components, respectively. The fourth term represents the contribution to ΔT attributable to relative changes in the subgroup means. Equation (6) implies that the contributions to the overall change in inequality can come from three sources: 1) the 'pure' changes in within subgroup inequality); 2) population effects; and 3) relative income effects. In this paper, because the number of districts in the provinces is maintained to be the same in the study period, zero or almost zero population effects are expected.

Unlike the method used by Akita and Alisjahbana (2002) that imposes a rigid hierarchical structure (region-province-district) to decompose overall inequality into between-region, within-province, and between-province inequality, the advantage of Mookherjee and Shorrocks (1982)'s method is that it allows flexible and unrestrictive ways of subgrouping. This paper applies various ways in subgrouping the whole districts: by provinces, by regions, by Jawa vs. off Jawa, and by the district's administration types (i.e., regency or *kabupaten* vs. city or *kota*). What is more, Mookherjee and Shorrocks (1982)'s method is able to quantify the contributions of different sources to the observed changes in inequality.

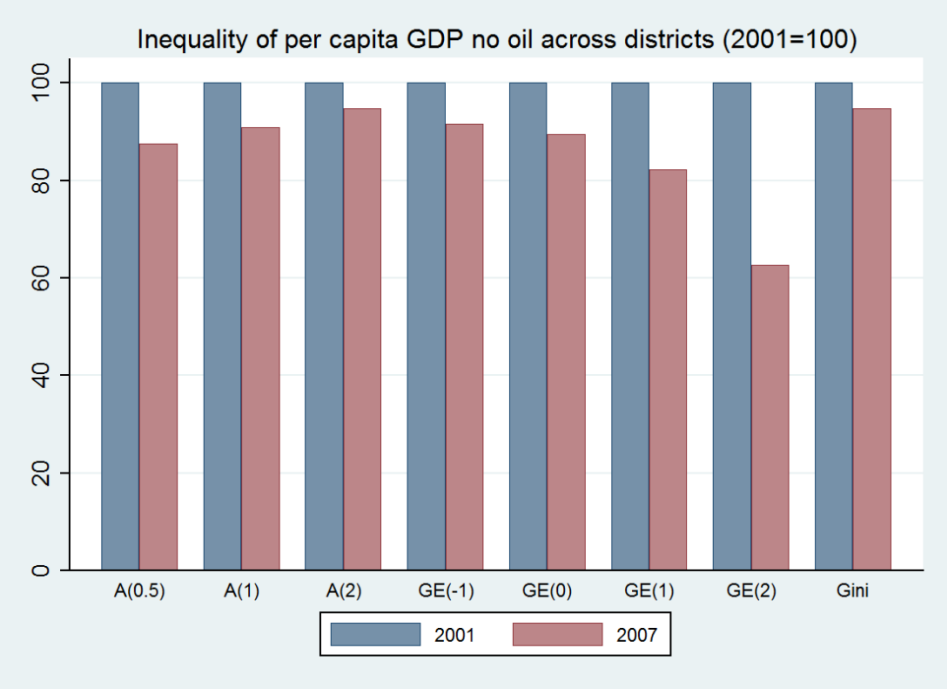
3.4.3 Results

Figures 3.2 and 3.3 compare inequality across districts between 2001 and 2007, based on per capita GDP with and without oil and gas, respectively. Both figures present various inequality indices and tell the same story. The level of inequality in 2007 was lower than the one in 2001, regardless of the choice of index. The study period that corresponds to the early implementation of decentralization witnessed a narrowing inequality. Across indices, the changes (i.e., the reduction of disparity levels) appear to be higher for per capita GDP including oil and gas sectors, suggesting the equalizing role of resources-based revenue sharing tends to be more apparent in the use of per capita GDP with oil and gas sectors.



Source: Author's calculation.

Figure 3.2 Inequality across districts, 2001 vs. 2007 (per capita GDP)

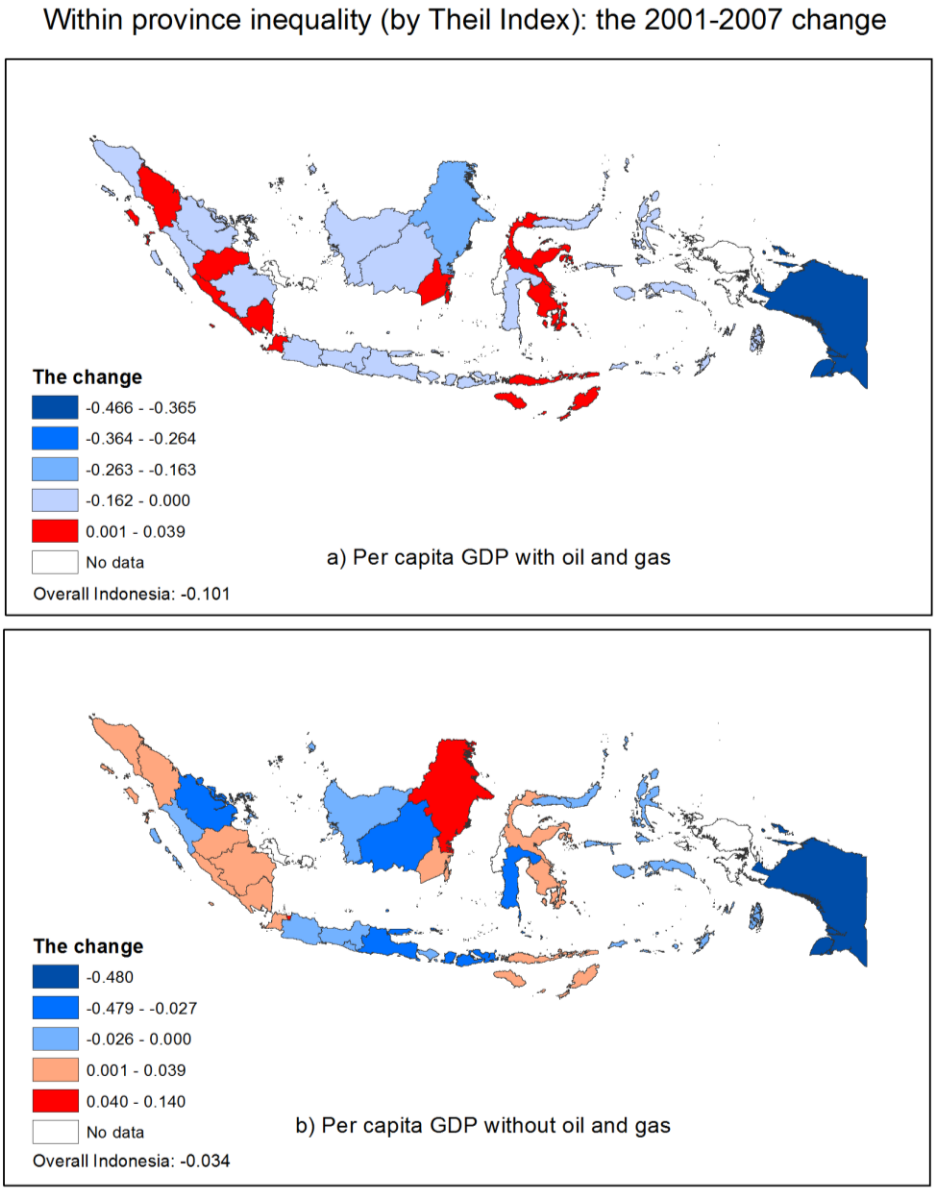


Source: Author's calculation.

Figure 3.3 Inequality across districts, 2001 vs. 2007 (per capita GDP without oil and gas)

While overall inequality decreased in 2007 (as indicated by both figures 3.2 and 3.3, also see table B.3 in the appendix B), the subnational pattern reveals some heterogeneity. Not every province, region, or category of other regional grouping experienced a reduction of disparity across its districts. Instead, some provinces experienced higher levels of inequality across their districts in 2007 (see table 3.2 and figure 3.4). Using per capita GDP and the Theil index, the provinces with higher inter-district inequality in 2007 included Sumatera Utara, Jambi, Bengkulu, Lampung, Banten, Kalimantan Selatan, Nusa Tenggara Timur, Sulawesi Tengah, and Sulawesi Tenggara. Using the same index, but excluding oil and gas from per capita GDP, the number of provinces experiencing widening inequality across their districts in 2007 increased; now, it also included some oil and gas-rich provinces, e.g., Kalimantan Timur and Nanggroe Aceh Darussalam. By regional grouping (as opposed to provincial grouping), Kalimantan

emerged as a region with higher inter-district inequality in 2007 based on per capita GDP without oil and gas; when oil and gas are excluded from per capita GDP, the Jawa-Bali region experienced the higher inter-district inequality in 2007 (see table 3.3).



Source: Author's creation.

Figure 3.4 The change in within province inequality across districts, 2001-2007

From these findings, two outcomes can be highlighted. First, inter-district inequality dynamics indicate no straightforward pattern at subnational levels/aggregations. Secondly, the pattern also depends on the variable on which the Theil index is based. Including oil and gas into per capita GDP yields a smaller number of provinces with higher inter-district inequality and the identified provinces were not those considered as oil-rich provinces. It is possible that the equalizing role of resources-based revenue sharing might be more effectively captured if inequality dynamics are examined through an inequality measure based on per capita GDP with oil and gas sectors.

To make a better sense on the pattern at the subnational levels, this paper decomposes the whole population (i.e., all Indonesian districts) into various subgroups: by province, by region, by Jawa districts vs. off Jawa districts, and by *kabupaten* vs. *kota*. The decomposition analysis considers that total inequality is the sum of the inequalities within each group and the inequality that exists between the groups. Tables 3.2 and 3.3 present the coefficient of inequality using the Theil index and its decomposition by province and by other subgroupings, respectively. Across the years and the indicators (i.e., per capita GDP with and without oil and gas), the contributions of within group inequality to the total inequality were always much higher than the contributions of between group inequality in non-provincial subgrouping (see table 3.3). In addition, broader aggregation (e.g., comparing Jawa districts vs. off-Jawa with five regions subgrouping) yields higher discrepancy in the contributions.

Table 3.2 Coefficient of inequality (Theil index) by province and its decomposition

Province	Per capita GDP			Per capita GDP no oil		
	2001	2007	Change	2001	2007	Change
Overall Indonesia	**0.486**	**0.385**	**-0.101**	**0.319**	**0.285**	**-0.034**
Nanggroe Aceh Darussalam	0.269	0.121	-0.148	0.030	0.049	0.019
Sumatera Utara	0.055	0.058	0.003	0.055	0.058	0.003
Sumatera Barat	0.039	0.030	-0.009	0.039	0.030	-0.009
Riau	0.312	0.192	-0.120	0.158	0.117	-0.040
Jambi	0.061	0.069	0.008	0.030	0.038	0.008
Sumatera Selatan	0.097	0.078	-0.019	0.035	0.041	0.006
Bengkulu	0.057	0.081	0.024	0.057	0.081	0.024
Lampung	0.021	0.024	0.004	0.022	0.026	0.004
Kepulauan Bangka Belitung	0.005	0.003	-0.002	0.005	0.003	-0.002
DKI Jakarta	0.136	0.122	-0.014	0.136	0.276	0.140
Jawa Barat	0.171	0.159	-0.012	0.173	0.164	-0.009
Banten	0.361	0.401	0.039	0.361	0.401	0.039
Jawa Tengah	0.156	0.155	-0.001	0.143	0.134	-0.008
DI Yogyakarta	0.085	0.076	-0.009	0.085	0.076	-0.009
Jawa Timur	0.406	0.371	-0.035	0.408	0.376	-0.032
Bali	0.058	0.052	-0.005	0.058	0.052	-0.005
Kalimantan Barat	0.091	0.082	-0.009	0.091	0.082	-0.009
Kalimantan Tengah	0.044	0.017	-0.027	0.044	0.017	-0.027
Kalimantan Selatan	0.079	0.082	0.003	0.065	0.069	0.004
Kalimantan Timur	0.690	0.507	-0.183	0.132	0.218	0.086
Sulawesi Utara	0.077	0.070	-0.007	0.077	0.070	-0.007
Sulawesi Tengah	0.020	0.033	0.013	0.020	0.026	0.006
Sulawesi Selatan	0.129	0.084	-0.045	0.129	0.083	-0.045
Sulawesi Tenggara	0.055	0.080	0.026	0.055	0.080	0.026
Gorontalo	0.025	0.017	-0.008	0.025	0.017	-0.008
Nusa Tenggara Barat	0.201	0.166	-0.035	0.201	0.166	-0.035
Nusa Tenggara Timur	0.069	0.082	0.013	0.069	0.082	0.013
Maluku	0.112	0.101	-0.011	0.114	0.103	-0.011
Maluku Utara	0.019	0.014	-0.005	0.019	0.014	-0.005
Papua	1.003	0.537	-0.466	1.032	0.552	-0.480
Decomposition						
"Within" province inequality (WI)	0.208	0.163	-0.045	0.170	0.147	-0.023
"Between" province inequality (BE)	0.278	0.222	-0.056	0.149	0.139	-0.011
WI as percentage of overall inequality	43%	42%		53%	51%	
BI as percentage of overall inequality	57%	58%		47%	49%	

Source: Author's calculation.

Table 3.3 Coefficient of inequality (Theil index) by regional/administrative grouping and its decomposition

Grouping (Area/Administrative)	Per capita GDP			Per capita GDP no oil		
	2001	2007	Change	2001	2007	Change
Overall Indonesia	**0.486**	**0.385**	**-0.101**	**0.319**	**0.285**	**-0.034**
Sumatera	0.292	0.181	-0.111	0.107	0.092	-0.014
Jawa-Bali	0.387	0.415	0.028	0.389	0.389	0.000
Kalimantan	0.726	0.543	-0.183	0.193	0.239	0.047
Sulawesi	0.112	0.092	-0.020	0.112	0.090	-0.022
Eastern Indonesia	0.782	0.459	-0.323	0.776	0.450	-0.327
Decomposition						
"Within" region inequality (WI)	0.411	0.326	-0.085	0.300	0.257	-0.043
"Between" region inequality (BE)	0.074	0.059	-0.016	0.019	0.028	0.009
WI as percentage of overall inequality	85%	85%		94%	90%	
BI as percentage of overall inequality	15%	15%		6%	10%	
Off-Jawa	0.514	0.358	-0.156	0.271	0.217	-0.054
Jawa	0.412	0.441	0.029	0.415	0.415	-0.001
Decomposition						
"Within" region inequality (WI)	0.481	0.385	-0.096	0.318	0.281	-0.037
"Between" region inequality (BE)	0.005	0.000	-0.005	0.001	0.004	0.003
WI as percentage of overall inequality	99%	100%		100%	99%	
BI as percentage of overall inequality	1%	0%		0%	1%	
Kabupaten	0.373	0.287	-0.085	0.256	0.204	-0.052
Kota	0.568	0.444	-0.124	0.315	0.310	-0.005
Decomposition						
"Within" group inequality (WI)	0.415	0.321	-0.094	0.268	0.226	-0.042
"Between" group inequality (BE)	0.071	0.064	-0.007	0.051	0.059	0.008
WI as percentage of overall inequality	85%	83%		84%	79%	
BI as percentage of overall inequality	15%	17%		16%	21%	

Source: Author's calculation.

However, decomposition by province (see table 3.2) shows a different pattern. For both years, the contributions of within province inequality were slightly lower than the ones of between province inequality for per capita GDP with oil and gas. The situation was reversed when per capita GDP without oil and gas is used. Nevertheless, it is reasonable to say that the

role of within province and between province inequalities to total inequality was almost equally important for both years and indicators.

Table 3.4 provides a detailed decomposition of inequality changes into components as expressed by terms in equation (6). The table decomposes total changes into four different effects: one within group inequality effect and three between group effects. Overall, the dominant effects responsible for the observed changes were changes in inequality within group and changes in relative income. The contribution to ΔT attributable to changes in within province inequality and the impact of changes in the province mean income were not so much different and reinforced each other. In other words, both effects were about the same order of magnitude and generated the same impact towards total inequality change.

Table 3.4 Decomposition of the trend in aggregate inequality (2001 vs. 2007, Theil index)

A) Per capita GDP

	Contribution to ΔT due to changes in				
Overall change ΔT	Within-group inequality	Population share (within)	Population share (between)	Mean group income	Grouping by
-0.101	-0.045	0.000	0.006	-0.062	Province
-0.101	-0.085	0.000	0.000	-0.015	Region
-0.101	-0.096	0.000	0.000	-0.004	Jawa vs. off-Jawa
-0.101	-0.094	0.000	0.000	-0.007	Kota vs. Kabupaten

Source: Author's calculation.

B) Per capita GDP no oil

	Contribution to ΔT due to changes in				
Overall change ΔT	Within-group inequality	Population share (within)	Population share (between)	Mean group income	Grouping by
-0.034	-0.023	0.000	0.008	-0.019	Province
-0.034	-0.043	0.000	0.000	0.009	Region
-0.034	-0.037	0.000	0.000	0.003	Jawa vs. off-Jawa
-0.034	-0.042	0.000	0.000	0.008	Kota vs. Kabupaten

Source: Author's calculation.

Having presented the results, the rest of this section reviews and highlights the main findings. The descriptive and decomposition analysis show that the decentralizing processes in Indonesia over the period 2001-2007 generated a reduction of regional income disparities, measured by district-level per capita GDP with and without oil and gas. Inequality levels observed in the beginning and the end of period were almost equally due to within province and between province inequalities. Consequently, the observed reduction of inequality during the period was attributable to the reduction of within province inequality and the reduction of relative provincial means. Other regional groupings show a much larger role of within group inequality. Therefore, by non-provincial groupings, the reduction of within group inequality played a greater effect to the reduction of overall inequality.

From table 3.3, including oil and gas in per capita GDP, we can identify the top five provinces that experienced the largest reduction of within province inequality across their districts. These provinces are Papua, Kalimantan Timur, Nanggroe Aceh Darussalam, Riau, and Sulawesi Selatan. All these provinces have one thing on common: they are heavily characterized by resources-based enclave economy, where resources-related industries are concentrated in few districts or even in a single district. Both Kalimantan Timur and Nanggroe Aceh Darussalam's wealth are from oil and gas (and also timber for Kalimantan Timur). Both Papua and West Nusa Tenggara are dominated by non-oil and gas mining, such as gold and copper. Riau's enclave activities are more diverse and include oil, export-oriented cash crops, and an export-oriented manufacturing center in Batam that has strong socio-economic links with Singapore.

With oil and gas excluded, the list of top provinces with the largest reduction of within province disparity changes. Papua, Riau, and Nusa Tenggara Barat remain in the list, and Sulawesi Selatan (that has traditionally been a major agricultural exporter) joins the list, ranked

second after Papua. As described before, all these four provinces' enclave sectors are non-oil and gas, though they are still resources-related activities. Interestingly, Kalimantan Timur and Nanggroe Aceh Darussalam now join the list of top 10 provinces with the largest increase in within province inequality (Kalimantan Timur and Nanggroe Aceh Darussalam are ranked second and sixth, respectively). It appears that the 2001 decentralization has significantly enriched Kutai Kartanegara regency of Kalimantan Timur and Lhokseumawe city of Nanggroe Aceh Darussalam (both are oil districts in their respective province) and it has increased the provinces' within inequality.

While this initial analysis suggests that the early period of decentralization has experienced a decrease in overall inequality across Indonesian districts, the impact may vary at subnational level and the observed patterns may be different depending on the aggregation or the indicator used. Thus, a further investigation on the relationship between decentralization and interregional inequality needs to take into account regional characteristics and other variables that may also be associated with inequality. Such investigation is carried out in the next section.

3.5 Model specification

Following the discussion on the theoretical link between decentralization and regional income disparities, the specified model adopts the Tselios *et al*. (2012) multiplicative interaction model that links regional inequality to fiscal decentralization, controlling for variables thought to moderate the relationship between inequality and decentralization, such as level of development and the interaction between the degree of fiscal decentralization and the level of development. The basic estimating equation for inequality across districts is defined as follows:

$$I_{i,t} = \alpha + \beta_1 FD_{i,t} + \beta_2 manpc_{i,t} + \beta_3 manpc^2{}_{i,t} + \beta_4 FD_{i,t} * manpc_{i,t}$$
$$+ \beta_5 devpc_{i,t} + \beta_6 expgdp_{i,t} + \beta_7 road_{i,t} + \beta_8 phone_{i,t} + \beta_9 sech_{i,t}$$
$$+ \beta_{10} shman_{i,t} + \beta_{11} ginisec_{i,t} + \beta_{12} shurb_{i,t} + \nu_i + \theta_t + \varepsilon_{i,t} \qquad (7)$$

where subscript *i* and *t* refer to district *i* and year *t*, respectively, and α, β_1,…, β_{12} are parameters to be estimated. The model specification is based on panel data analysis, where ν_i represents the district fixed effects (i.e., the unobserved time-invariant characteristics of district *i*), θ_t captures the time fixed effects, and $\varepsilon_{i,t}$ is the error term. The panel approach allows us to minimize potential problems of omitted variable bias as well as to increase the accuracy of parameter estimates and the degrees of freedom (Greene 2003; Wooldridge 2002).

Adopting the approach of Bonet (2006), the dependent variable $I_{i,t}$ is a district-level inequality measure for district *i* and year *t*, defined as:

$$I_{i,t} = \left| \frac{PCGDP_{i,t}}{PCGDP_{N,t}} - 1 \right| \qquad (8)$$

where $PCGDP_{i,t}$ is the district-level per capita GDP at year *t*, while $PCGDP_{N,t}$ is the national per capita GDP at year *t*, defined as $PCGDP_{N,t} = \frac{\sum_i GDP_{i,t}}{\sum_i POP_{i.t}}$, where $GDP_{i,t}$ and $POP_{i.t}$ are the district-level GDP and population, respectively at year *t*. There are three reasons to adopt this inequality measure. First, this research intends to fit the specified panel data model at the district level, not at any other higher regional level (such as provincial level), because the Indonesian 2001 decentralization applies at the district-level government. The inequality measure as defined in

equation (7) allows us to apply a panel estimation approach in which *i* corresponds to the districts sample (*i*=1, 2, …, 300)[12] and *t* corresponds to the study period (*t*=2001, 2002, …, 2007). Secondly, calculating alternative measures of cross-sectional inequality (e.g., coefficient of variation, *Gini*, or *Theil*) at the district level requires sub-district level information (i.e., household or person-level information) that is not available. Thirdly, quantifying inequality using other measures of cross-sectional inequality at provincial level (i.e., within-province inequality) will greatly reduce the observations, will limit the available degrees of freedom for the estimations, and will not allow the fitting of the district-level model. For example, computing the *Gini* will take all the cross-sectional district-level observations for each particular year, thus the analysis must have been completed at a level higher than district level (e.g., provincial level), which is undesirable given the first reason.

The inequality measure in equation (7) reflects how advanced a given district is in terms of per capita GDP relative to other regions, because it is based on the concept of the relative per capita GDP. For a given year and under a perfect equality condition, the district-level per capita GDP should be equal to the national per capita GDP. Thus, the inequality is measured as the distance from the relative share to the perfect equal share. Larger distance in absolute terms indicates higher inequality.

$FD_{i,t}$ is the key independent variable and a measure for the degree of fiscal decentralization for district *i* at year *t*. The approach uses three different groups of indicators for the decentralization measure: 1) aggregating the equalization funds received by district *i* at year *t* into a single proxy, i.e., the share of total equalization revenue to total revenue ($reve_{i,t}$); 2) disaggregating the equalization fund received by district *i* at year *t* into two indicators, i.e., the

[12] A full sample of autonomous districts (i.e. the districts that receive the equalization fund) will have 336 districts. For the econometric analysis, the 36 districts are dropped from the sample due to incomplete information.

share of general allocation fund to total revenue ($revgaf_{i,t}$) and the share of total revenue sharing to total revenue ($shrev_{i,t}$); and 3) disaggregating the equalization fund received by district *i* at year *t* into three indicators, i.e., the share of general allocation fund to total revenue ($revgaf_{i,t}$), the share of tax-based revenue sharing to total revenue ($revx_{i,t}$), and the share of resources-based revenue sharing to total revenue ($revres_{i,t}$).

The specified decentralization indicators capture the role of equalization fund, which is the primary ingredient of the Indonesian decentralization, in reducing or increasing between-districts inequality (see figure 3.1). By disaggregating the equalization fund into its components, we can estimate not only the overall impact of the equalization fund ($reve_{i,t}$), but also the impact of the general allocation fund ($revgaf_{i,t}$) and the revenue sharing ($shrev_{i,t}$). Similarly, disaggregating the revenue sharing even further into its two components allows us to investigate whether the tax-based revenue sharing ($revx_{i,t}$) and the resources-based revenue sharing ($revres_{i,t}$) have different impacts. The decentralization indicators exclude special allocation fund for three reasons: 1) not all districts, in fact only a few districts, receive the special allocation fund for a given year; 2) its share in the district's total revenue is very small, while the share of general allocation fund and the share of revenue sharing are dominant, on average during the study period, accounted for 67% and 14% of the district' total revenue, respectively; and 3) the special allocation fund-financed expenditure is earmarked expenditure, while the revenue sharing and the general allocation fund provides the district governments with the greatest degree of discretion in spending.

The estimated parameter values for the decentralization variables are expected to be negative, reflecting the hypothesis that the current decentralization arrangement reduces inequality. The decentralization indicators were calculated based on the data compiled from the

Indonesian government finance statistics, provided by Indonesia's Ministry of Finance, the Directorate General of Finance Equalization (DJPK, *Direktorat Jenderal Perimbangan Keuangan*).

Whether the inequality-decentralization relationship is contingent on the district's level of development is addressed by including per capita non-oil and gas manufacturing GDP ($manpc_{i,t}$) of a district and its squared value, taken as a proxy for the level of development of a district, and the interaction variables between the fiscal decentralization indicators and per capita manufacturing GDP. The specification for controlling for the level of development in explaining inequality is similar to the one used by Kuznets (1955) and Williamson (1965). However, given the construction of the dependent variable and to reduce the potential endogeneity bias, the analysis uses per capita manufacturing GDP, instead of per capita GDP as used in Kuznets (1955) and Williamson (1965). If the Kuznets/Williamson inverted U-shape for the inequality-level of development relationship holds for this current research, the estimated parameter values for $manpc_{i,t}$ and $manpc^2{}_{i,t}$ are expected to be positive and negative, respectively.

As noted in section 3.3, the 2001 decentralization in Indonesia does not only provide additional fiscal resources, but also considerable discretionary power to the district governments in formulating policies and allocating resources. Therefore, some proxies are included for this authority, namely: the spending behavior, defined as per capita development spending ($devpc_{i,t}$); the size of public sector, measured as the share of total expenditure to GDP ($expgdp_{i,t}$); the road quality in a district, defined as the share of villages in the district where the main roads are asphaltic paved ($road_{i,t}$); and the communication/information access in a district, measured as telephone access per household ($phone_{i,t}$), calculated by dividing the number of landline phone connected-households to the total households in the district. These

proxies can be considered as the indirect key independent variables. In other words, these proxies are used to indirectly capture how the decentralized district governments behave and/or the outcome of their behavior. The estimation results will provide insights into how their behavior or the outcome of their behavior affects the inequality across districts. It is expected that the estimated parameter values for the level of development spending, the road quality, and the information access will be negative. However, the impact of the size of public sector can be either positive or negative, depending on whether the expansion of public sector (which is expected in the decentralized government) promotes competition thus efficiency or is of waste due to sacrificing scale economies (Zax 1989).

The model also includes other control variables to capture some essential sources of heterogeneity among districts and the main structural and economic features of Indonesian districts. The control variables include the share of people who completed or who are in high secondary school ($sech_{i,t}$) and the role of manufacturing sector in a district's economy ($shman_{i,t}$), measured as the share of non-oil and gas manufacturing GDP to total GDP. In addition, to capture whether the district economy is dominated by a particular sector, the economic specialization/diversity of a district is also controlled for, measured as the sectoral *Gini* ($ginisec_{i,t}$). Finally, the proportion of population living in a district's urban areas ($shurb_{i,t}$) is also included. The last two control variables, providing a sense of spatial concentration of economic and human activities in a district, are proxies for agglomeration forces that are widely considered as the underlying determinants of the observed spatial inequality (Combes *et al*. 2011; Kim 2008).

Table 3.5 lists the variables and their descriptions, roles, and expected signs in the estimation. Data to calculate the fiscal decentralization variables are from the DJPK's

government finance statistics, while data to generate other variables are from the BPS' various database compiled by McCulloch (2011).

Following Brambor *et al*. (2006), the marginal effect of fiscal decentralization on inequality, defined as $\partial I/\partial FD = \beta_1 + \beta_4 manpc$, monitors changes along the observed range of per capita manufacturing GDP. This approach takes into account the continuous nature of the level of development as the moderator for the inequality-decentralization relationship.

To address a potential endogeneity problem, Greenstone's (2002) strategy is adopted by fitting the model where all independent variables are time lagged. In this current paper, the independent variables and time fixed effects are set at $t-1$ as expressed in equation (9). The time-lagged strategy effectively solves the endogeneity problem without difficulty in finding valid instruments for the variables thought to be endogenous.

$$\begin{aligned} I_{i,t} = \alpha &+ \beta_1 FD_{i,t-1} + \beta_2 manpc_{i,t-1} + \beta_3 manpc^2{}_{i,t-1} + \beta_4 FD_{i,t-1} * manpc_{i,t-1} \\ &+ \beta_5 devpc_{i,t-1} + \beta_6 expgdp_{i,t-1} + \beta_7 road_{i,t-1} + \beta_8 phone_{i,t-1} \\ &+ \beta_9 sech_{i,t-1} + \beta_{10} shman_{i,t-1} + \beta_{11} ginisec_{i,t-1} + \beta_{12} shurb_{i,t-1} \\ &+ \nu_i + \theta_{t-1} + \varepsilon_{i,t} \end{aligned} \quad (9)$$

The time-lagged approach is also intuitively suitable for the study case. It is well known that the government budget cycle at the district and other government levels or units in Indonesia is in practice heavily characterized by delayed budget approval and disbursement. In many cases, the budget will not be disbursed until the fourth quarter of the current fiscal year (i.e., around October of the calendar year). Such practice has long been the practice and continues even under the decentralization era. In addition, we also expect some time lags for the impact of the

development level, government spending, public sector, economic activities such as manufacturing, some infrastructure, human capital, and agglomeration effects on the district's production structure that will eventually affect the observed inequality across districts.

Table 3.5 Variable description

Variable	Description	Expected sign
Dependent		
I	A district-level inequality measure	
Independent, key, direct proxy for decentralization (FD)		
reve	The share of total equalization fund to total revenue	-
revgaf	The share of general allocation fund to total revenue	-
shrev	The share of total revenue sharing to total revenue	-
revx	The share of tax-based revenue sharing to total revenue	-
revres	The share of resources-based revenue sharing to total revenue	-
Independent, moderator, proxy for level of development		
manpc	Per capita non-oil and gas manufacturing GDP	+ (but - for its squared term)
Independent, indirect proxy for decentralization		
devpc	Per capita development spending	+/-
expgdp	The share of total expenditure to GDP	+/-
road	The share of villages in the district where the main roads are asphaltic paved	-
phone	Telephone access per household	-
Independent, other control variables		
sech	The share of people ever/being in high secondary school	-
shman	The share of non-oil and gas manufacturing GDP to total GDP	-
ginisec	The sectoral *Gini*	+/-
shurb	The proportion of population living in a district's urban areas	+/-

3.6 Estimation results

The descriptive statistics for the variables are reported in table 3.6. The mean, standard deviation, and minimum and maximum value for both non-lagged variables and their corresponding lagged variables are similar. The wide range between the minimum and maximum value of all variables suggests a large heterogeneity across Indonesian districts in the sample.

Table 3.6 Descriptive statistics

Variables	Observation	Mean	Standard Deviation	Min	Max
I	2,100	0.69729	1.95742	0.00021	39.64193
reve	2,100	0.84799	0.08402	0.26250	0.99226
reve (t-1)	1,800	0.84652	0.08525	0.26250	0.99226
revgaf	2,100	0.66842	0.16725	0.00121	0.98169
revgaf (*t-1*)	1,800	0.67353	0.16642	0.05482	0.98169
shrev	2,100	0.14335	0.15121	0.00615	0.92233
shrev (*t-1*)	1,800	0.14317	0.14644	0.00615	0.86561
revx	2,100	0.09006	0.07884	0.00125	0.85937
revx (*t-1*)	1,800	0.08734	0.07166	0.00125	0.85937
revres	2,100	0.06351	0.13670	3.86E-06	0.76812
revres (*t-1*)	1,800	0.06338	0.13436	3.86E-06	0.76766
manpc	2,100	1,183,539	3,762,542	2,976.49	5.57E+07
manpc (*t-1*)	1,800	1,175,033	3,754,433	2,976.49	5.57E+07
devpc	2,100	459,745	777,645	608.59	1.18E+07
devpc (*t-1*)	1,800	390,129	612,657	609	8,736,138
expgdp	2,100	0.20389	0.17178	0.00727	0.99720
expgdp (*t-1*)	1,800	0.18340	0.15208	0.00727	0.98543
road	2,100	0.62486	0.26756	0.01389	1
road (*t-1*)	1,800	0.61865	0.26736	0.01389	1
phone	2,100	0.09491	0.11302	0.00006	0.67094
phone (*t-1*)	1,800	0.09322	0.11116	0.00006	0.67094
sech	2,100	0.16380	0.07712	0.00000	0.48852
sech (*t-1*)	1,800	0.16233	0.07813	0.00000	0.48852
shman	2,100	0.13510	0.14152	0.00034	0.82674
shman (*t-1*)	1,800	0.13562	0.14217	0.00034	0.82674
ginisec	2,100	0.55272	0.10235	0.28364	0.85467
ginisec (*t-1*)	1,800	0.55429	0.10264	0.28399	0.85467
shurb	2,100	0.38299	0.31831	0	1
shurb (*t-1*)	1,800	0.38277	0.31870	0	1

The descriptive statistics truly reflect the reality of the Indonesia's geography of development, that is a high spatial diversity in resource endowments, economic structure, and population settlements. During the study period, the range of the share of people who ever attended/graduated from high school to the total population was zero in Kabupaten Puncak Jaya in Papua province to almost one half in Kota Batam in Riau province, which is an export-oriented manufacturing center that has strong socio-economic links with Singapore. Kabupaten Puncak Jaya had a zero share of urban population, while the population in the large districts in Jawa provinces and the primary districts in some off-Jawa provinces were totally urban.

The fixed-effects estimations exploit the panel structure of the dataset for the 300 districts over the period 2001-2007 and their results are presented in table 3.7. Models 1-3 are the baseline models, based on equation (7), where fiscal decentralization is proxied by the overall equalization fund (*reve*) for model 1, by the general allocation fund (*revgaf*) and overall revenue sharing (*shrev*) for model 2, and by the general allocation fund, tax-based revenue sharing (*revx*), and resource-based revenue sharing (*revres*) for model 3. Models 4-6 are the corresponding homoscedastic results for models 1-3, where the standard errors are clustered at the district level. Models 7-9 are run to address a potential endogeneity problem, based on equation (9), where all predictors are lagged. Models 10-12 are the corresponding models for models 7-9, but with the clustered-robust standard errors to control for heteroscedasticity. The control variables are the same in all models. The interaction terms are the product of the applicable fiscal decentralization proxy and the level of development (*manpc*). Overall, the time dummies are significant, so that the inclusion of time fixed-effects is justified, but the estimates of the time dummies are not included in table 3.7.

Table 3.7 The fixed-effects estimation results

Variable	(1) fe1	(2) fe2	(3) fe3	(4) fe1_rob	(5) fe2_rob	(6) fe3_rob
Overall equalization fund, *reve*	-.01697			-.01697		
	(.1819)*			(.3319)		
General allocation fund, *revgaf*		-.0395	-.03513		-.0395	-.03513
		(.1659)**	(.1546)**		(.2179)*	(.2204)+
Overall revenue sharing, *shrev*		-.1244			-.1244	
		(.1955)***			(.6091)**	
Tax-based revenue sharing, *revx*			.001533			.001533
			(.1478)			(.59)
Resource-based revenue sharing, *revres*			-.1369			-.1369
			(.2429)***			(.8549)*
Development level, *manpc*	2.647	2.829	2.908	2.647	2.829	2.908
	(6.45e-08)***	(6.48e-08)***	(6.08e-08)***	(8.33e-07)+	(9.15e-07)	(8.17e-07)+
Development level (sq. term), $manpc^2$	-1.803	-1.865	-2.08	-1.803	-1.865	-2.08
	(1.19e-15)***	(1.20e-15)***	(1.18e-15)***	(1.39e-14)	(1.40e-14)	(1.42e-14)+
Equalization fund X Development	.1649			.1649		
level, *reve* X *manpc*	(3.21e-08)***			(8.13e-08)		
General allocation fund X Development		.1377	.117		.1377	.117
level, *revgaf* X *manpc*		(3.54e-08)***	(3.41e-08)***		(8.99e-08)	(7.48e-08)
Revenue sharing X Development		-.04301			-.04301	
level, *shrev* X *manpc*		(4.04e-08)*			(1.80e-07)	
Tax-based revenue sharing X Development			-.1938			-.1938
level, *revx* X *manpc*			(4.77e-08)***			(5.97e-07)
Resource-based revenue sharing X Development			.0001177			.0001177
level, *revres* X *manpc*			(5.82e-08)			(1.72e-07)

Standardized beta coefficients; Standard errors in parentheses
+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table 3.7 (continued)

Variable	(1) fe1	(2) fe2	(3) fe3	(4) fe1_rob	(5) fe2_rob	(6) fe3_rob
Per capita development spending, *devpc*	-.08438	-.0747	-.06949	-.08438	-.0747	-.06949
	(2.34e-08)***	(2.28e-08)***	(2.21e-08)***	(9.83e-08)*	(9.12e-08)*	(7.29e-08)*
Public sector size, *expgdp*	.1234	.1268	.1176	.1234	.1268	.1176
	(.1511)***	(.1479)***	(.1409)***	(.7694)+	(.7856)+	(.6135)*
Road quality, *road*	-.02597	-.01703	-.02268	-.02597	-.01703	-.02268
	(.1502)	(.1462)	(.1388)	(.2012)	(.199)	(.2089)
Telephone access, *phone*	-.04914	-.0574	-.05492	-.04914	-.0574	-.05492
	(.2947)**	(.2865)***	(.2717)***	(.5554)	(.6551)	(.6253)
People ever/being in high school, *sech*	.0182	.01334	.0146	.0182	.01334	.0146
	(.4255)	(.4135)	(.395)	(.4358)	(.4301)	(.4324)
Share of manufacturing GDP, *shman*	-.8287	-.8175	-.7937	-.8287	-.8175	-.7937
	(.8027)***	(.7814)***	(.7445)***	(6.683)+	(6.151)+	(5.245)*
Sectoral concentration in the economy, *ginisec*	.04801	.02177	.02083	.04801	.02177	.02083
	(.7221)	(.704)	(.6708)	(2.051)	(2.163)	(2.074)
Urban population, *shurb*	-.1113	-.1022	-.104	-.1113	-.1022	-.104
	(.3267)*	(.3177)*	(.3027)*	(.4956)	(.4728)	(.4546)
N	2100	2100	2100	2100	2100	2100
F stat	41.74	45.17	54.35	.	.	.
Likelihood stat	-517.5	-455.8	-346.8	-517.5	-455.8	-346.8
R^2 within	0.297	0.337	0.402	0.297	0.337	0.402

Standardized beta coefficients; Standard errors in parentheses
+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table 3.7 (continued)

Variable	(7) fe1lag	(8) fe2lag	(9) fe3lag	(10) fe1lag_rob	(11) fe2lag_rob	(12) fe3lag_rob
Overall equalization fund, *reve*	-.006519			-.006519		
	(.1617)			(.197)		
General allocation fund, *revgaf*		-.01982	-.02047		-.01982	-.02047
		(.1655)	(.1612)		(.1735)	(.2545)
Overall revenue sharing, *shrev*		-.09443			-.09443	
		(.2143)***			(.4356)**	
Tax-based revenue sharing, *revx*			.01608			.01608
			(.1559)**			(.5825)
Resource-based revenue sharing, *revres*			-.1152			-.1152
			(.2601)***			(.6505)*
Development level, *manpc*	2.386	2.542	2.596	2.386	2.542	2.596
	(5.95e-08)***	(6.04e-08)***	(5.92e-08)***	(6.53e-07)+	(6.91e-07)+	(6.42e-07)*
Development level (sq. term), $manpc^2$	-1.648	-1.772	-1.981	-1.648	-1.772	-1.981
	(1.07e-15)***	(1.10e-15)***	(1.09e-15)***	(1.07e-14)+	(1.09e-14)+	(1.18e-14)+
Equalization fund X Development	.09216			.09216		
level, *reve* X *manpc*	(2.82e-08)*			(4.80e-08)		
General allocation fund X Development		.179	.2391		.179	.2391
level, *revgaf* X *manpc*		(3.42e-08)***	(3.50e-08)***		(1.31e-07)	(1.74e-07)
Revenue sharing X Development		-.05603			-.05603	
level, *shrev* X *manpc*		(3.97e-08)**			(1.37e-07)	
Tax-based revenue sharing X Development			-.163			-.163
level, *revx* X *manpc*			(4.96e-08)***			(4.37e-07)
Resource-based revenue sharing X Development			.001821			.001821
level, *revres* X *manpc*			(5.60e-08)			(1.37e-07)

Standardized beta coefficients; Standard errors in parentheses
+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table 3.7 (continued)

Variable	(7) fe1lag	(8) fe2lag	(9) fe3lag	(10) fe1lag_rob	(11) fe2lag_rob	(12) fe3lag_rob
Per capita development spending, *devpc*	-.0943	-.08602	-.08624	-.0943	-.08602	-.08624
	(3.58e-08)***	(3.50e-08)***	(3.42e-08)***	(1.73e-07)+	(1.57e-07)+	(1.41e-07)+
Public sector size, *expgdp*	.1232	.1183	.1201	.1232	.1183	.1201
	(.1873)***	(.1829)***	(.1785)***	(.8197)+	(.7722)+	(.6848)*
Road quality, *road*	-.04058	-.03493	-.03765	-.04058	-.03493	-.03765
	(.1439)+	(.1403)+	(.1365)+	(.2413)	(.2294)	(.2265)
Telephone access, *phone*	-.05658	-.06825	-.06404	-.05658	-.06825	-.06404
	(.2793)***	(.2731)***	(.2657)***	(.6674)	(.705)	(.6392)+
People ever/being in high school, *sech*	.02014	.01477	.01724	.02014	.01477	.01724
	(.38)	(.3708)	(.3631)	(.3812)	(.3334)	(.3536)
Share of manufacturing GDP, *shman*	-.7636	-.7728	-.7886	-.7636	-.7728	-.7886
	(.7932)***	(.7726)***	(.7545)***	(5.205)+	(4.987)*	(4.57)*
Sectoral concentration in the economy, *ginisec*	.05002	.02489	.02751	.05002	.02489	.02751
	(.7133)	(.6955)	(.682)	(1.64)	(1.668)	(1.808)
Urban population, *shurb*	-.1098	-.1066	-.09998	-.1098	-.1066	-.09998
	(.2877)*	(.2801)*	(.2734)*	(.5095)	(.4978)	(.4404)
N	1800	1800	1800	1800	1800	1800
F stat	35.03	37.49	39.86	.	.	.
Likelihood stat	-80.96	-31.32	18.87	-80.96	-31.32	18.87
R^2 within	0.286	0.325	0.361	0.286	0.325	0.361

Standardized beta coefficients; Standard errors in parentheses
+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

3.6.1 Fiscal decentralization and its interaction with development level

The results in the baseline models (i.e., models 1-3) suggest that greater fiscal decentralization, measured by various proxies, significantly reduces the inequality between districts.[13] One exception to the expected relationship is when the fiscal decentralization is measured by the tax-based revenue sharing included in model 3, where its impact on the inequality is positive (i.e., an inequality-widening force), even though the impact is small and insignificant. One plausible explanation for this exception is due to the tax-based revenue sharing scheme (see table 3.1). The sharing scheme for the two primary shareable taxes (i.e., personal income tax and company tax) disproportionately favors the central government. All the company tax revenue generated in a district goes to the central government, while 80% the personal income tax revenue generated in a district flows to the central government. The 2004 revised fiscal decentralization law allocates no share of the personal income tax to the districts outside the province where the tax-producing district is located, while the 1999 original law does not even share the tax revenue with the other districts within the same province of the tax-producing district.

The interpretation on the coefficient signs of the interactions terms between a decentralization indicator and the level of development depends on the coefficient sign of the decentralization indicator. The positive coefficients of the interactions terms indicate that the reduction (widening) of inequality associated with decentralization decreases (increases) as the level of development increases. The negative coefficients suggest that the reduction (widening) of inequality linked to decentralization increases (decreases) as the level of development increases.

[13] Given the construction of the inequality measure as the dependent variable, the negative sign of a parameter can also be interpreted as the effect of a predictor disproportionately favor the poorer districts, hence reducing inequality.

When measured by the overall equalization fund (as in the model 1) and the general allocation fund (as in model 2 and model 3), the negative association between inequality and decentralization is significantly moderated by the level of development. In other words, the inequality-reducing effects of the overall equalization fund and the general allocation fund are reduced as the development level increases. The reason why the two indicators have the same positive interaction effects is because the overall equalization fund is the single most aggregated decentralization indicator used for the estimation and the general allocation fund had been a dominant part of the equalization fund, accounting for 73%-83% of the equalization fund during the study period. The reason why the development level moderates the inequality-reducing effect of the general allocation fund is because the important component in the general allocation fund formula is the fiscal gap component, which is calculated as the difference between the expenditure needs and the fiscal capacity (World Bank 2007). Since a higher level of development in a district implies that the district exercises greater fiscal capacity, it is reasonable to say that the general allocation fund formula favors the less developed districts, hence reducing inequality between districts, as indicated by the negative parameter sign. Therefore, as the districts become more developed and richer (i.e., become more fiscally capable), the inequality-reducing effect of the general allocation fund decreases.

When decentralization is measured by the overall revenue sharing, the inequality-reducing effect of the overall sharing revenue (as in model 2) is further augmented by the level of development. Arguably, the richer or more developed districts will have a larger tax base and greater resource endowments. The larger tax base and resource endowments the larger shared revenue a district will get, so it makes the district's relative position to other districts even better. indicated by the inequality-reducing effect of the overall revenue sharing. The estimated

interaction effect between the overall revenue sharing and the development level depicts a situation where the inequality-reducing effect of the overall revenue sharing increases as the district's development level increases.

The two components of the overall sharing revenue, i.e., the tax-based revenue sharing and the resources-based revenue sharing (as in model 3), appear to have the opposing individual and interaction effects. As explained before, on its own, the tax-based revenue sharing has a positive (though insignificant) impact on inequality, but it has a significant negative interaction effect with the development level on inequality, indicating that its potential inequality-widening effect is reduced as the district's level of development increases. In contrast, the resources-based revenue sharing has a significant negative impact on inequality, but it has an insignificant positive interaction effect with the development level on inequality, suggesting that its inequality-reducing effect is independent of the level of development. Of the components of the overall revenue sharing, the tax-based revenue sharing, when the districts become more developed, appears to exert a greater impact on system-wide equality.

There are four plausible explanations for the observed opposing direction of the interaction effects with the development level on inequality between the tax-based revenue sharing and the resource-based revenue sharing. First, resource endowments are geographically concentrated and immobile, while people and companies as the sources for the personal income and company tax are less concentrated and more mobile. Secondly, the exploitation of resources is subject to some sort of depletion and whether its exploitation to generate development follows some sustainable practices. Higher development level may entail more exploitation of resources, yet, sustainable practices in the exploitation may not be adopted. If it is the case, the revenue generated from the resources could increase at a slower rate, therefore the inequality-reducing

effect of the resource-based revenue sharing decreases as the development level increases. Thirdly, a much larger portion of the revenue generated by most resources goes to the producing districts (see table 3.1). Fourthly, a large proportion of the returns to the resource-based activities may actually accrue to external parties (e.g., foreign or national companies of the extractive industries), so the 'net revenue' to be shared under the revenue sharing scheme may be greatly discounted.

In terms of magnitudes and signs, the estimates in the homoscedastic models 4-6 are the same as in the baseline models, only they have larger standard errors, with the result that some parameters become insignificant. The single and most aggregated indicator of decentralization as measured by the overall equalization fund (as in model 4) is no longer significant. However, the other more disaggregated indicators remain significant. After controlling for heteroscedasticity, the general allocation fund, the overall revenue sharing, and the resource-based revenue sharing still appear to have an inequality-reducing effect. As was the case in model 3, the tax-based revenue sharing in model 6 remains insignificant. No interaction effects are found to be significant in models 4-6. Overall, the results in models 4-6 do not contradict the ones in model 1-3. However, models 4-6 provide estimates that remain significant under the robust-clustered standard errors.

Models 7-9 were introduced to control for endogeneity issues and their results suggest no contradiction with the earlier findings. In general, the observed individual and interaction effects in models 7-9 and in the previous models are the same; they differ only in the magnitude of the effects. As in the baseline models, all interaction effects, except the interaction effect of the resource-based revenue sharing with the development level, are significant. Compared with the results in the non-lag models (i.e., models 1-6), of the individual effects of the decentralization

proxies, the general allocation fund (as in model 8 and model 9) turns out to be insignificant, but the tax-based revenue sharing becomes significant. Still, the role of the general allocation fund as an inequality-reducing force and the role of the tax-based as an inequality-widening force remain the same as in the previous models.

Such results may actually underline the different nature between the general allocation fund and the tax-based revenue sharing and shed light on the behavior of the district governments. In addition to the fiscal gap, the other major component of the general allocation fund is the basic allocation. From the beginning of the decentralization in 2001 until 2005, the basic allocation consisted of a lump sum and a partial coverage for the civil service wage bill, but full coverage for the civil service wage bill since 2006 (World Bank 2007). In other words, some portion of the general allocation fund received by a district government is actually less tied to the productive and creative activities that possibly bring some economic gains for the district that may significantly improve the district's economic well-being compared with other districts, hence leading to the significant reduction in inequality. On the other hand, the tax-revenue sharing is reasonably more related to the district's economic activities and the performance of the district government in generating the tax revenue. The lag models that include the general allocation fund (models 8, 9, 11 and 12) show that the inequality-reducing role of the general equalization fund becomes insignificant.

Models 10-12 are the corresponding models for models 7-9, after controlling for heteroscedasticity. In terms of the signs and coefficients, the results are still consistent, but as expected, due to the larger robust-clustered standard errors in models 10-12, some parameters become insignificant. The overall revenue sharing and the resource-based revenue sharing still stand out as the significant inequality-reducing forces. Hence, the basic story remains the same,

that is a greater fiscal decentralization, as measured by the overall revenue sharing and the resource-based revenue, leads to a significant reduction in inequality between districts.

3.6.2 Marginal effect

In the section 3.6.1, we present and discuss some evidence of the interaction effects between the various decentralization proxies and the level of development. In this current section, we quantify and plot how the marginal effect of decentralization changes the indicators across the observed range of per capita manufacturing GDP. The calculation of the marginal effect is based on the estimates of models 7-9 that control for endogeneity and have nearly all significant interaction effects. The marginal effect of decentralization is plotted in figures 3.5(a)-(e) with the values of the development level reported in table 3.8. The solid sloping line in figures 3.5(a)-(e) indicates how the marginal effect of a decentralization indicator on inequality changes with the development level, while the dotted lines depict the 95% confidence interval. Following Brambor *et al*. (2006), the marginal effect is statistically significant wherever the upper and the lower bounds of the confidence interval are both above (below) the zero line.

Figures 3.5(a)-(e) support the estimates, confirming that while greater fiscal decentralization plays a role in the reduction in inequality across districts, the inequality-decentralization relationship is mediated by the development level of the districts. As the level of development increases, the inequality-reducing effect of the overall equalization fund and the general allocation fund decreases, implying that the effect is lower in the better-off districts. In contrast, the inequality-reducing effect of the overall sharing revenue increases as the level of development rises, suggesting that effect is higher in the more developed districts. The marginal effect of the overall equalization fund and the general equalization fund are insignificant for the

very least developed districts (figures 3.5(a), (b), and (d)), but the effect of the overall sharing revenue and the tax-based revenue sharing (figures 3.5(c) and (e)) are significant for all levels of development.

Some reasons for the observed pattern are proposed as follows. Firstly, the marginal effect of the overall equalization fund and the general allocation fund are similar because the general allocation fund had been dominant part of the total equalization fund. Secondly, taking into account the district's development level, the marginal effect of the general allocation fund appears to be statistically insignificant for the very least developed districts because the very least developed districts are much likely to have extremely low fiscal capacity (very small revenue base). Moreover, they might not have much options, ability, or incentive to raise their fiscal capacity. After all, the fiscal gap as the difference between their expenditure needs and their fiscal capacity will be accounted in the general allocation fund they are going to receive. Such lack of options, ability, or incentive may not significantly promote the very least developed districts' relative economic performance compared with other more developed districts, therefore making the marginal effect of general allocation fund insignificant for the least developed districts. Thirdly, the marginal effect of the sharing revenue is significant regardless of the development level because the revenue sharing scheme ensures that even non-producing districts of within the same or outside province as the producing district will get some portion of some revenue sources.

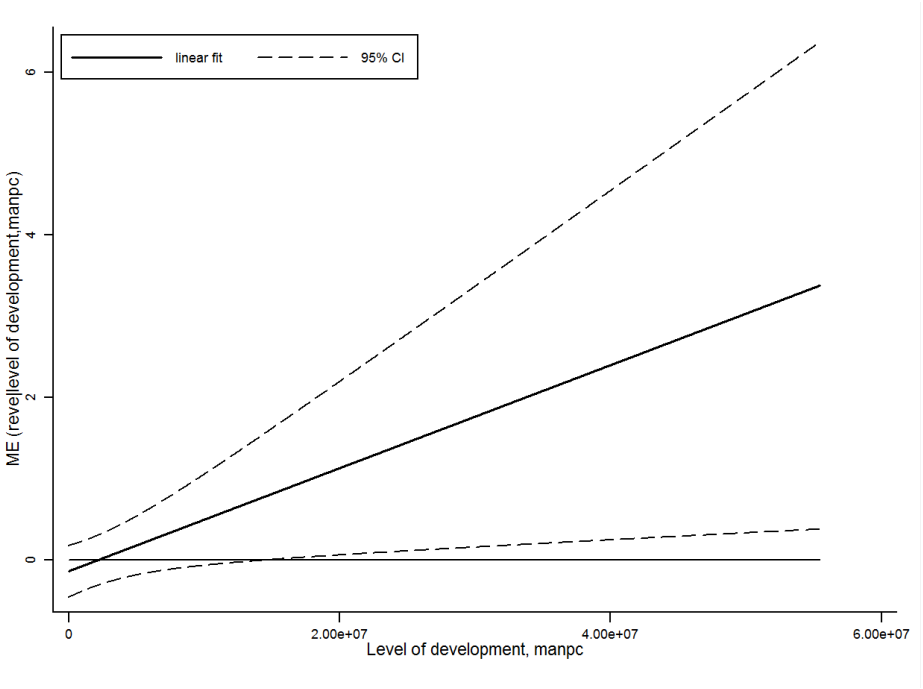


Figure 3.5(a) Marginal effect, the overall equalization fund (as in model 7)

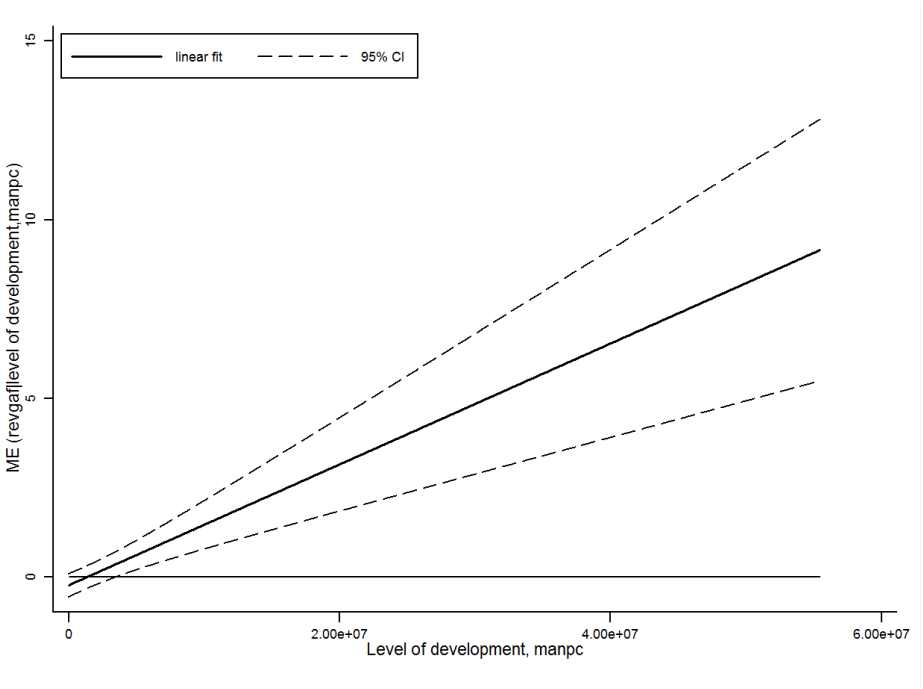


Figure 3.5(b) Marginal effect, the general equalization fund (as in model 8)

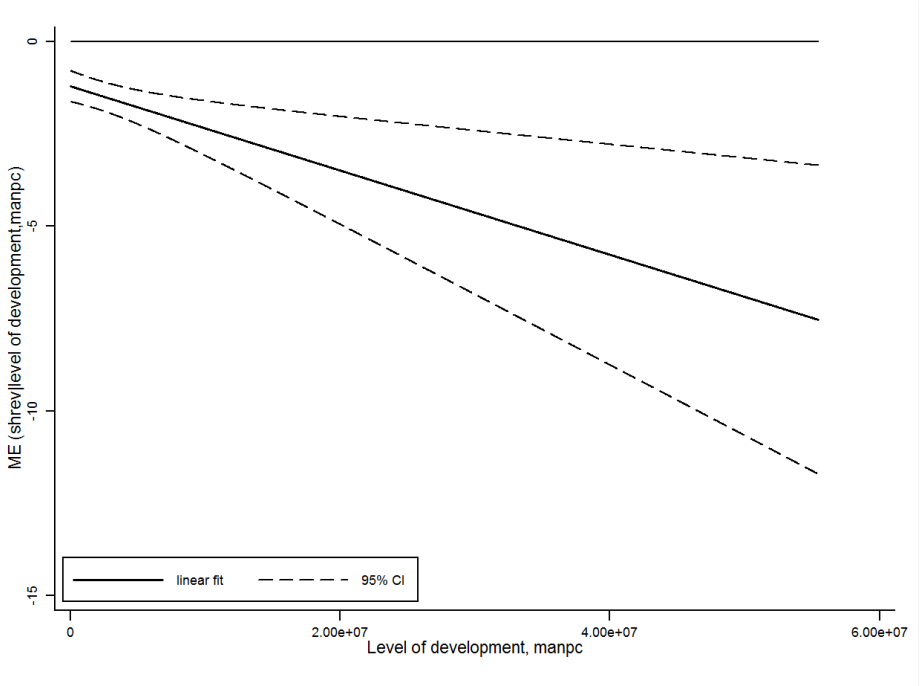


Figure 3.5(c) Marginal effect, the overall sharing revenue (as in model 8)

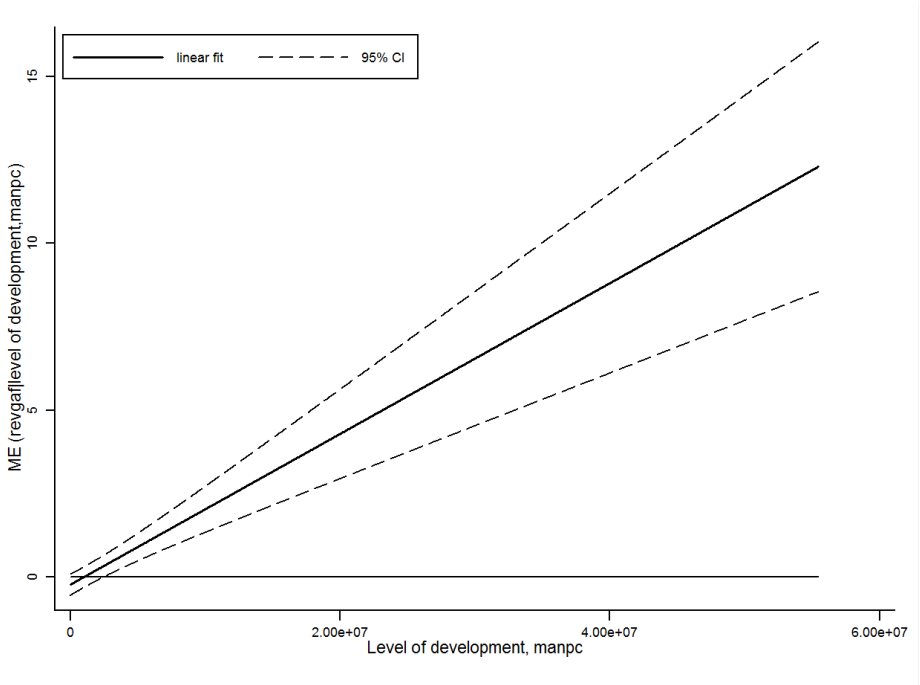


Figure 3.5(d) Marginal effect, the general allocation fund (as in model 9)

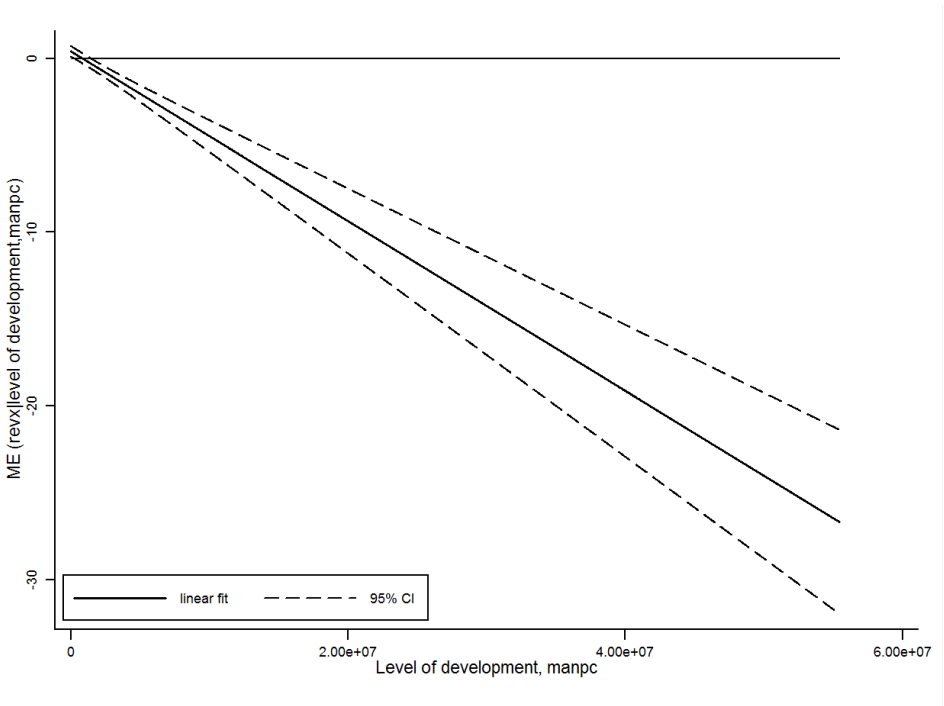


Figure 3.5(e) Marginal effect, the tax-based revenue sharing (as in model 9)

Table 3.8 Decentralization marginal effects

	Marginal effects				
Development level,	fe1lag	fe2lag		fe3lag	
manpc (Rp. million)	*reve*	*revgaf*	*shrev*	*revgaf*	*revx*
25	1.444437*	4.004028***	-4.053937***	5.417542***	-11.79882***
28	1.634838*	4.511095***	-4.396487***	6.0951***	-13.26476***
31	1.825239*	5.018161***	-4.739036***	6.772657***	-14.7307***
34	2.01564*	5.525228***	-5.081585***	7.450214***	-16.19664***
37	2.206041*	6.032295***	-5.424134***	8.127772***	-17.66257***
40	2.396443*	6.539362***	-5.766684***	8.805329***	-19.12851***
43	2.586844*	7.046428***	-6.109233***	9.482887***	-20.59445***
46	2.777245*	7.553495***	-6.451782***	10.16044***	-22.06039***
49	2.967646*	8.060562***	-6.794331***	10.838***	-23.52632***
52	3.158047*	8.567629***	-7.136881***	11.51556***	-24.99226***
55	3.348448*	9.074695***	-7.47943***	12.19312***	-26.4582***

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

3.6.3 Control variables

Many factors can act as either concentration or dispersion forces to eventually determine spatial inequality (Kim 2008). The control variables included in all models are expected to influence the observed inequality. Existing levels of development measured by per capita manufacturing GDP consistently affects inequality (significant in the lagged models, i.e., models 7-12, and in most of the non-lagged models, i.e., models 1-6). Across the models, the coefficients of the development level are similar and the parameter signs remain the same. Indeed, the development level effect is much greater than any other decentralization measures. Development level estimates suggest that the Kuznets/Williamson inverted U-shape for the inequality-level of development relationship also holds for this current research.

Table 3.9 lists cut-off estimates along with their percentile and bias corrected bootstrapped confidence intervals for the optimal level of development. The bootstrap repeats through 1000 iterations. A cut-off estimate is calculated as (-1)*($\hat{\beta}_{manpc}/\hat{\beta}_{manpc^2}$). For example, using the results in model 1 (i.e., fe1), the observed cut-off estimate of 33,700,000 implies that inequality increases with the level of development until its peak at Rp.33,700,000 (roughly $ 3,066.70 as of October 27, 2013) before inequality is expected to decline. For each model, the percentile and bias-corrected methods provide similar results, indicating that the calculated cut-off is unbiased. Across the models, the observed values and their confidence intervals are also similar. Overall, the optimum development level estimate is more than 25 times larger than the average level of development measured as per-capita non-oil and gas manufacturing GDP (i.e., Rp.1,183, 539; see table 3.6 for descriptive statistics). Most Indonesian districts are far from the optimum level of development after which inequality is expected to decline.

Table 3.9 Cut-off estimates of development level (Indonesian Rp.)

Model	Observed	95% Confidence Interval		
(1) fe1	33,700,000	24,000,000	51,400,000	(P)
		24,600,000	54,000,000	(BC)
(2) fe2	34,800,000	23,700,000	58,700,000	(P)
		23,700,000	58,400,000	(BC)
(3) fe3	32,100,000	18,600,000	60,400,000	(P)
		19,500,000	65,400,000	(BC)
(4) fe1_ron	33,700,000	24,000,000	51,400,000	(P)
		24,600,000	54,000,000	(BC)
(5) fe2_rob	34,800,000	23,700,000	58,700,000	(P)
		23,700,000	58,400,000	(BC)
(6) fe3_rob	32,100,000	18,600,000	60,400,000	(P)
		19,500,000	65,400,000	(BC)
(7) fe1lag	33,100,000	20,700,000	47,400,000	(P)
		22,900,000	49,200,000	(BC)
(8) fe2lag	32,800,000	18,400,000	47,200,000	(P)
		22,700,000	51,000,000	(BC)
(9) fe3lag	30,000,000	17,700,000	47,300,000	(P)
		18,400,000	50,100,000	(BC)
(10) fe1lag_rob	33,100,000	20,700,000	47,400,000	(P)
		22,900,000	49,200,000	(BC)
(11) fe2lag_rob	32,800,000	18,400,000	47,200,000	(P)
		22,700,000	51,000,000	(BC)
(12) fe3lag_rob	30,000,000	17,700,000	47,300,000	(P)
		18,400,000	50,100,000	(BC)

Note: P=percentile; B=bias corrected

In all models, a greater per capita development spending leads to a significant reduction in inequality, while a larger public sector size significantly widens inequality. There is significant evidence that infrastructure acts as an inequality-reducing force across the models. As such, it seems that telephone access is more important than road quality. Two reasons are proposed: first, by construction, the proxy for road quality only captures the road quality within districts and not that between districts (widely known as the *jalan provinsi*, "the provincial road"). The provincial roads that connect districts are possibly of poor quality, as in off-Jawa

provinces, or heavily congested, as in the Jawa's Northern Route (*Jalur Pantura*), hindering factor mobility or creating diseconomies of scale, thus limiting its capacity as equalizer. Second, telephone access allows people to obtain access to the internet, from which people receive and exchange information.[14] As a result of better information, people may become more demanding of better public services, along with greater transparency, accountability, and governance. The net result of these forces may play an important role as equalizer.

The estimates find no significant effect on the inequality of high school graduates or the district's economic concentration. There is some limited evidence of the inequality-reducing effect of the population concentration in a district's urban area. This may indicate the importance of scale economies on urban concentration, where a highly concentrated urban population facilitates better information exchange and better public service delivery in a district, leading to a reduction in equality between districts. In all models, there is significance evidence that the manufacturing sector in the economy serves as an inequality-reducing force.

3.7 Conclusion, policy implications, and research extension

3.7.1 Conclusion

Between 2001 and 2007, fiscal decentralization in Indonesia generated a decrease in inequality across Indonesian districts, measured by district-level per capita GDP with and without oil and gas. The observed reduction in inequality was attributable to a reduction in within-province inequality and a reduction in relative provincial means.

Applying the fixed-effects approach to a panel dataset at the district level, this paper analyzes the effect of the current fiscal decentralization arrangement on between-districts

[14] Even though smart mobile phones have become increasingly popular in Indonesia in the last five years, Indonesian people still largely rely on landlines for the internet access, especially within the study period.

inequality, the way in which the inequality-decentralization relationship is mediated by the district's level of development, the contribution of different components of the equalization fund on inequality, and how other factors may have affected the observed inequality.

The various estimation strategies employed in this research present a consistent pattern of results, suggesting that, in general, greater fiscal decentralization significantly reduces the inequality between districts. Yet, a finer disaggregation of the decentralization measure reveals that there is limited evidence of an inequality-widening effect of tax-based revenue sharing, even though the inequality-widening effect decreases as the level of development rises. On the other hand, the inequality-reducing effects of other fiscal decentralization instruments are also moderated by the level of development. The results show that the level of development on its own plays a critical role in determining the observed inequality while acting as a modifying factor that affects the effect of a fiscal decentralization indicator on the observed inequality.

The research also reveals significant evidence of the equalizing role of development spending, the manufacturing sector, infrastructure, urban concentration, and the inequality-promoting role of public sector size. Apart from its extensiveness and novelties, this research bears important policy implications. The findings of this research have the potential to help guide the efforts addressing Indonesia's interregional inequality, either through improving the decentralization framework or addressing complementary public policy options related to spending, the role and size of the public sector, infrastructure, economic structure, and urban population at the district level.

3.7.2 Policy implications

As demonstrated in this paper, decentralization is a necessary and welfare-enhancing policy, effective in addressing regional disparities. However, as this paper also shows, development level factors, among others, also play a role in the observed inequality dynamics. Therefore, the continuing implementation of decentralization is justified and necessary, yet it should be linked to a broader development strategy aimed at a higher level of development as a primary and ultimate objective. To catch up with richer districts, district governments need to formulate and implement good development strategies that may include preserving and attracting economic activities in a sector deemed to an engine for the economy, such as the manufacturing sector.[15]

The inward investment can be lured by increasing the level or improving the quality of infrastructure. To generate and to exploit economies of scale, or because a certain kind of infrastructure is simply too expensive, it is sometimes better for a district to cooperate with other districts. In this regard, for other functions or issues affecting many districts, the role of provincial governments can be called for or reinforced. Cooperation between districts can take various forms. The simplest option might be a forum in which to share best practices in public service deliveries.

The current level of district government revenues is much higher than that before decentralization. So, the issue is an efficient use of government resources rather than the mobilization of additional resources, especially through measures that generate additional business costs. Thus, options to ensure spending efficiency may include devising performance measurements that allow for comparisons across districts or incorporating incentives for prudent

[15] Recall that table 3.7 presents estimates in terms of standardized beta to allow for a comparison of the relative importance of the impact of the predictors that are originally measured in different scales. Both development level and the share of manufacturing sector in the economy exert the highest impacts, even larger than that of various decentralization measures.

spending into the intergovernmental transfer mechanism. Excessive additional resources and discretionary spending power can lead to unwise and wasteful spending, diverting public resources from public service delivery and pro-poor policies to excessively high administration expenditures, including civil salary increases and various benefits for local elites.

A lack of scrutiny and standards will only perpetuate wasteful spending. Effective scrutiny and standard implementation require coordination between district governments, the central government, and various government agencies. Other big challenges include streamlining the budget approval process and incorporating off-budget spending to ensure efficient spending and that the budget reflects the planning. Again, central and provincial governments are needed for technical assistance and policy coordination.

Another coordination issue is the potential conflict between the decentralization laws and the sectoral laws; hence, a power struggle results between the district governments and the line ministries over certain policy implementation. One example is the basic and secondary education sector. On one hand, decentralization has already placed the basic and secondary education sector in the hands of the district governments; however, for some reason, the ministry of national education has been deeply involved in creating programs or projects that duplicate the obligations of district governments. Such redundancy, and thus budget inefficiency, could be reduced if there is good coordination between the district government and the ministry of national education, in order to limit the latter's role in monitoring and ensuring national standards.

3.7.3 Research extension

This present research explores how the intergovernmental transfer instruments introduced in the 2001 decentralization may affect income disparities across districts. The transfer instruments of the equalization fund are essentially vertical in nature, as they are primarily administered by the central government and subsequently distributed and shared with the districts and provinces. One notable exception is the corporate income taxes that are completely collected for the central government.

This study has not yet formally addressed the horizontal relationships or interjurisdictional competition, and hence spatial spillovers, between districts, which can be expected under decentralization. The Indonesian 2001 decentralization framework represents, rather, a greater autonomy in spending than in tax or other revenue sources. Fewer constraints on the expenditure side may generate stronger interjurisdictional competition in spending. Such competition could be a good thing if it encourages yardstick competition, further creating spatial spillovers on the quality of service. During the study period, it was public knowledge that many district governments visited Jembrana in Bali province, a small district that cannot be considered a rich district, but with widely recognized service deliveries and a high quality of public health and education. However, the imitation effect could also be "the bad kind." Anecdotal evidence suggests that spending on increased salaries and benefits, cars, and buildings drives imitation between districts. Future research will explore such spatial spillovers and consider how the presence of interjurisdictional competition may affect the districts' economic performance and accountability mechanisms in decentralized Indonesia.

References

Akai, Nobuo and Masayo Sakata. 2005. "Fiscal Decentralization, Commitment and Regional Inequality: Evidence from State-Level Cross-Sectional Data for the United States." CIRJE Discussion Paper Series, Faculty of Economics, University of Tokyo.

Akita, Takahiro and Armida Alisjahbana. 2002. "Regional Income Inequality in Indonesia and the Initial Impact of the Economic Crisis." *Bulletin of Indonesian Economic Studies* 38 (2): 201-22.

Akita, Takahiro and Rizal Affandi Lukman. 1995. "Interregional Inequalities in Indonesia: A Sectoral Decomposition Analysis for 1975-92." *Bulletin of Indonesian Economic Studies* 31 (2): 61-81.

Arze del Grenado, Francisco Javier. 2009. "Spatial Considerations on Decentralization and Economies of Concentration in Indonesia." In *Reshaping Economic Geography in East Asia*, edited by Yukon Huang and Alessandro Magnoli Bocchi, 135-155. Washington,DC: World Bank.

Azis, Iwan J. 2008. "Institutional Constraints and Multiple Equilibria in Decentralization." *Review of Urban & Regional Development Studies* 20 (1): 22-33.

Bahl, Roy W. and Johannes F. Linn. 1992. *Urban Public Finance in Developing Countries*. New York, NY: Oxford University Press.

Bonet, Jaime. 2006. "Fiscal Decentralization and Regional Income Disparities: Evidence from the Colombian Experience." *The Annals of Regional Science* 40 (3): 661-76.

Booth, Anne. 2003. "Decentralisation and Poverty Alleviation in Indonesia." *Environment and Planning C* 21 (2): 181-202.

Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. "Understanding Interaction Models: Improving Empirical Analyses." *Political Analysis* 14 (1): 63-82.

Brodjonegoro, Bambang. "The Indonesian Decentralization After Law Revision: Toward a Better Future?" An unpublished manuscript.

Calamai, Lapo. 2009. "The Link between Devolution and Regional Disparities: Evidence from the Italian Regions." *Environment and Planning A* 41 (5): 1129-51.

Canaleta, Carlos Gil, Pedro Pascual Arzoz, and Manuel Rapun Garate. 2004. "Regional Economic Disparities and Decentralisation." *Urban Studies* 41 (1): 71-94.

Combes, Pierre-Philippe, Miren Lafourcade, Jacques-François Thisse, and Jean-Claude Toutain. 2011. "The Rise and Fall of Spatial Inequalities in France: A Long-Run Perspective." *Explorations in Economic History* 48 (2): 243-71.

Davoodi, Hamid and Heng-fu Zou. 1998. "Fiscal Decentralization and Economic Growth: A Cross-Country Study." *Journal of Urban Economics* 43 (2): 244-57.

Ezcurra, Roberto and Pedro Pascual. 2008. "Fiscal Decentralization and Regional Disparities: Evidence from several European Union Countries." *Environment and Planning A* 40 (5): 1185-201.

Garcia, Jorge Garcia and Lana Soelistianingsih. 1998. "Why do Differences in Provincial Incomes Persist in Indonesia?" *Bulletin of Indonesian Economic Studies* 34 (1): 95-120.

Greene, William H. 2003. *Econometric Analysis*. Upper Saddle River, NJ: Prentice Hall.

Greenstone, Michael. 2002. "The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufactures." *Journal of Political Economy* 110 (6): 1175-219.

Haughton, Jonathan H. and Shahidur R. Khandker. 2009. *Handbook on Poverty and Inequality*. Washington,DC: World Bank.

Hill, Hal, Budi P. Resosudarmo, and Yogi Viddyatama. 2009. "Economic Geography of Indonesia: Location, Connectivity, and Resources." In *Reshaping Economic Geography in East Asia*, edited by Yukon Huang and Alessandro Magnoli Bocchi, 115-134. Washington,DC: World Bank.

Jenkins, Stephen P. 1995. "Accounting for Inequality Trends: Decomposition Analyses for the UK, 1971-86." *Economica* 62 (245): 29-63.

Kim, Sukkoo. 2008. *Spatial Inequality and Economic Development: Theories, Facts, and Policies.* . Washington, DC: World Bank.

Kim, Euijune, Sung Woong Hong, and Soo Jung Ha. 2003. "Impacts of National Development and Decentralization Policies on Regional Income Disparity in Korea." *The Annals of Regional Science* 37 (1): 79-91.

Kuznets, Simon. 1955. "Economic Growth and Income Inequality." *The American Economic Review* 45 (1): 1-28.

Martinez-Vazquez, Jorge and Robert M. McNab. 2003. "Fiscal Decentralization and Economic Growth." *World Development* 31 (9): 1597-616.

McCulloch, Neil. 2011. "The Indonesian sub-national growth and governance dataset" An unpublished documentation.

McCulloch, Neil and Bambang S. Sjahrir. 2008. "Endowments, location, or luck? Evaluating the determinants of sub-national growth in decentralized Indonesia", Policy Research Working Paper no. 4769, Pacific Poverty Reduction and Economic Management Unit, World Bank.

Mookherjee, Dilip and Anthony Shorrocks. 1982. "A Decomposition Analysis of the Trend in UK Income Inequality." *The Economic Journal* 92 (368): 886-902.

Oates, Wallace E. 1999. "An Essay on Fiscal Federalism." *Journal of Economic Literature* 37 (3): 1120-49.

———. 1972. *Fiscal Federalism*. New York, NY: Harcourt Brace Jovanovich.

Prud'homme, Rémy. 1995. "The Dangers of Decentralization." *The World Bank Research Observer* 10 (2): 201-20.

Qiao, Baoyun, Jorge Martinez-Vazquez, and Yongsheng Xu. 2008. "The Tradeoff between Growth and Equity in Decentralization Policy: China's Experience." *Journal of Development Economics* 86 (1): 112-28.

Resosudarmo, Budi P., Luky E. Wuryanto, Geoffrey J. D. Hewings, and L. Saunders. 1999. "Decentralization and Income Distribution in the Inter-Regional Indonesian Economy." In *Understanding and Interpreting Economic Structure*, edited by Geoffrey J. D. Hewings, Michael Sonis, Moss Madden and Yoshio Kimura, 297-316. Berlin: Springer.

Rodríguez-Pose, Andrés and Roberto Ezcurra. 2010. "Does Decentralization Matter for Regional Disparities? A Cross-Country Analysis." *Journal of Economic Geography* 10 (5): 619-44.

Rodríguez-Pose, Andrés and Nicholas Gill. 2004. "Is there a Global Link between Regional Disparities and Devolution?" *Environment and Planning A* 36 (12): 2097-117.

Silver, Christopher, Iwan J. Azis, and Larry Schroeder. 2001. "Intergovernmental Transfers and Decentralisation in Indonesia." *Bulletin of Indonesian Economic Studies* 37 (3): 345-62.

Tiebout, Charles M. 1956. "A Pure Theory of Local Expenditures." *Journal of Political Economy* 64 (5): 416-24.

Tselios, Vassilis, Andrés Rodríguez-Pose, Andy Pike, John Tomaney, and Gianpiero Torrisi. 2012. "Income Inequality, Decentralisation, and Regional Development in Western Europe." *Environment and Planning A* 44 (6): 1278-301.

Williamson, Jeffrey G. 1965. "Regional Inequality and the Process of National Development: A Description of the Patterns." *Economic Development and Cultural Change* 13 (4, Part 2): 3-84.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge,MA: MIT Press.

World Bank. 2003. *Decentralizing Indonesia*. World Bank, Jakarta: World Bank.

———. 2007. *Spending for Development: Making the most of Indonesia's New Opportunities*. World Bank, Jakarta: World Bank.

Zax, Jeffrey S. 1989. "Is there a Leviathan in Your Neighborhood?" *The American Economic Review* 79 (3): 560-67.

Chapter 4

Concluding Remarks:

Policy Implications and Further Research

4.1 East Java convergence

The striking findings include the increasing trend of inequality, the persistence of inequality or distinct clusters of districts of low, medium, and high income, and a slow and conditional catching up process. Given the study's objective to focus on measurement issues and convergence characteristics, a specific policy prescription is not offered. However, as a note for further research, this section will outline a generic policy response with regard to the observed pattern and dynamics of spatial inequality in East Java.

The findings offer an invitation for scholars and policy makers to revisit the old, but not obsolete, debate between a strategy of place-based prosperity and of people-centered prosperity, and the specific potential applications suitable to East Java. On the strategy of place-based prosperity, the challenges include promoting the development of economic and social infrastructure in the lagging districts, and helping them to benefit from economic integration. Regarding the people-centered prosperity, the migrations of individuals or households to the other places of high and rising prosperity should be facilitated, or at least not impeded. The challenge is to balance between efforts that promote a more spatially equitable allocation of resources (e.g., infrastructure, services) and the ones that promote freer human migration.

Further research in this area should also seek to identify the economic potential of each underdeveloped district. Such an identification may reveal potential economic engines for growth that could possibly diminish the spatial income gap in the long run. Policy makers and

economic developers should remain optimistic about the possibility of devising an innovative development policy even in the lagging places that inevitably face numerous constraints. Fritsch (2003) argues that an innovation-oriented policy does not depend on the extent of centrality, as he observes that innovative activities are also evident in less agglomerated areas.

4.2 Indonesian decentralization

Decentralization has narrowed inequality between Indonesian districts. This result suggests that Indonesia should continue to implement decentralization. Moreover, decentralization should be seen as part of a broader development strategy in which the ultimate objective is a higher level of development. Preserving and attracting economic activities should be the primary features of district governments' economic development plan. These efforts entail many other measures, such as: 1) maintaining and improving the level and quality of infrastructure, and 2) reaching out for cooperation with other districts to share best practices, to share the costs of a certain development project, or to generate and exploit economies of scale.

Decentralization has provided higher levels of revenue and unprecedented opportunities for district governments. The challenge has now shifted to whether district governments are able to focus on how to spend their resources efficiently, instead of mobilizing resources in a way that can increase the costs of doing business. Discretionary spending power over vast additional financial resources can create unwise and wasteful spending, diverting public resources needed to improve public service deliveries and competitiveness to unreasonably high administration spending. Options to prevent such spending inefficiencies may include incorporating incentives for prudent spending into the intergovernmental transfer mechanism and devising performance measurements that allow for comparisons across districts.

Nonetheless, district level decentralization should not abandon the role of provincial and central government. After all, the effective incentives (including scrutiny) and implementation of the performance standards entail a good coordination between district governments, the central government, and various government agencies. Streamlining the budget approval process, incorporating off-budget spending to ensure efficiency in spending, and crafting a budget closely connected with development planning all require the role of central and provincial government for technical assistance and policy coordination.

During the implementation of certain policies, such as those in the basic and secondary education sector, decentralization may raise a potential conflict between the decentralization laws and the sectoral laws. This could result in a power struggle between the district governments and the line ministries. Although decentralization has already placed the basic and secondary education sector in the hands of district governments, the ministry of national education has remained highly involved in this policy area, carrying out programs or projects that actually duplicate the district governments' obligations. Such a redundancy not only implies budget inefficiency, but could be minimized if the district government and the ministry of national education were to develop effective coordination, such that the latter could limit its role to monitoring and ensuring national standards.

This thesis explores how the 2001 intergovernmental transfer may influence income disparities across districts. The transfer instruments of the equalization fund are essentially vertical in nature, as the central government administers and subsequently distributes them to the districts and provinces. As such, this research has not yet formally handled the horizontal relationships or interjurisdictional competition, and hence does not address some of the spatial spillovers between districts that can be expected under decentralization.

Many regard the Indonesian 2001 decentralization to be on the spending side, as its framework gives a greater autonomy in spending rather than in tax or other revenue sources. Indeed, less constrained expenditure may lead to stronger interjurisdictional competition in spending. Good competition drives yardstick comparisons that create knowledge spillovers across districts on the quality of service. Many district governments have visited Jembrana, a small and poor district in Bali province, to learn from its highly praised service deliveries and high quality public health and education. However, imitation is not always good. Anecdotal evidence suggests that expenditures by neighboring districts on increased salaries and benefits, cars, and buildings can encourage imitation by other districts. Both types of spatial spillovers will be explored in future studies. My next research project intends to understand how the presence of spatial competition/imitation may affect districts' economic performance and accountability.

References

Eckey, Hans-Friedrich and Matthias Türck. 2007. "Convergence of EU-Regions. A Literature Report." *Investigaciones Regionales* (10): 5-32.

Fritsch, Michael. 2003. *Von der innovationsorientierten Regionalförderung zur regionalisierten Innovationspolitik*. Freiberg Technische Universität-Faculty of Economics and Business Administration Working Paper 6/2003.

Appendix A

Supplementary Material to Chapter 2

Table A.1 Inequality levels by various inequality measures

Year	p90/p10	p90/p50	p10/p50	p75/p25	Gini	GE(-1)	GE(0)	GE(1)	GE(2)	A(0.5)	A(1)	A(2)
1980	2.65	2.03	0.77	1.51	0.31	0.15	0.17	0.24	0.44	0.10	0.16	0.23
1981	2.64	2.09	0.79	1.58	0.30	0.13	0.16	0.22	0.40	0.09	0.15	0.21
1982	2.72	1.95	0.72	1.62	0.30	0.14	0.16	0.22	0.40	0.09	0.15	0.22
1983	2.67	1.89	0.71	1.51	0.28	0.12	0.14	0.19	0.32	0.08	0.13	0.19
1984	2.64	1.84	0.70	1.56	0.28	0.12	0.14	0.19	0.33	0.08	0.13	0.19
1985	2.58	1.85	0.72	1.62	0.28	0.12	0.14	0.19	0.32	0.08	0.13	0.19
1986	2.66	1.87	0.70	1.63	0.28	0.12	0.14	0.19	0.33	0.08	0.13	0.20
1987	2.67	1.91	0.72	1.75	0.29	0.13	0.15	0.21	0.38	0.09	0.14	0.21
1988	2.90	2.08	0.72	1.75	0.30	0.14	0.16	0.22	0.39	0.09	0.15	0.22
1989	2.93	2.08	0.71	1.86	0.31	0.15	0.17	0.23	0.41	0.09	0.15	0.23
1990	3.15	2.21	0.70	1.91	0.32	0.15	0.17	0.24	0.42	0.10	0.16	0.24
1991	3.24	2.25	0.69	1.92	0.32	0.16	0.18	0.24	0.42	0.10	0.16	0.24
1992	3.25	2.25	0.69	1.92	0.32	0.16	0.18	0.24	0.42	0.10	0.16	0.24
1993	4.50	3.29	0.73	2.20	0.43	0.30	0.31	0.43	0.86	0.17	0.27	0.38
1994	4.60	3.38	0.73	2.29	0.45	0.33	0.34	0.46	0.94	0.18	0.29	0.39
1995	4.71	3.45	0.73	2.38	0.46	0.35	0.35	0.49	1.02	0.19	0.30	0.41
1996	4.92	3.61	0.73	2.46	0.47	0.36	0.36	0.50	1.04	0.19	0.30	0.42
1997	5.03	3.64	0.72	2.48	0.47	0.37	0.38	0.52	1.12	0.20	0.31	0.43
1998	4.30	3.22	0.75	2.46	0.48	0.38	0.40	0.57	1.35	0.21	0.33	0.43
1999	4.17	3.13	0.75	2.45	0.48	0.38	0.39	0.57	1.34	0.21	0.32	0.43
2000	4.04	3.06	0.76	2.40	0.47	0.37	0.38	0.56	1.30	0.21	0.32	0.42
2001	4.88	3.09	0.63	1.52	0.49	0.39	0.42	0.64	1.60	0.23	0.34	0.44
2002	4.92	3.04	0.62	1.54	0.48	0.38	0.40	0.61	1.46	0.22	0.33	0.43
2003	4.98	3.02	0.61	1.51	0.48	0.38	0.40	0.61	1.47	0.22	0.33	0.43
2004	5.02	3.02	0.60	1.50	0.49	0.38	0.41	0.62	1.51	0.22	0.34	0.43
2005	5.06	3.00	0.59	1.53	0.49	0.39	0.42	0.63	1.54	0.23	0.34	0.44

Source: Author's calculation

Table A.2 Transition probability matrix, Categorization 2

	per capita GDP (in thousand Rp.), Classes	2005				
		< 750	750 - 1000	1001 - 1300	1301 - 1600	> 1600
1980	< 750	91.3%	6.2%	1.1%	0.2%	1.3%
	750 - 1000	3.6%	75.7%	6.4%	0.0%	14.3%
	1001 - 1300	0.0%	10.2%	61.2%	12.2%	16.3%
	1301 - 1600	0.0%	0.0%	25.0%	50.0%	25.0%
	> 1600	12.3%	0.0%	0.4%	0.4%	87.0%

Source: Author's calculation.

Table A.3 Dynamic characteristics, Categorization 2

Stationary Distribution	
per capita GDP, Classes	Share of population
< Rp. 750,000	49%
Rp. 751,000 - Rp. 1,000,000	14%
Rp. 1,001,000 - Rp. 1,300,000	5%
Rp. 1,301,000 - Rp. 1,600,000	2%
> Rp. 1,600,000	30%
Convergence Statistics	
Half-life	3.3 periods
S	0.73
C_the 3rd	0.25
C_the 4th	0.26
Mean First Passage Time	
Class Mobility	MFPT (years)
From class 1 to class 4	137.8
From class 2 to class 4	132.8
From class 3 to class 4	96.7
From class 5 to class 4	140.7

Source: Author's calculation.

Table A.4 Transition probability matrix, Categorization 3

	per capita GDP (in thousand Rp.), Classes	2005				
		< 1000	1001 - 1300	1301 - 1600	1601 - 1900	> 1900
1980	< 1000	93.3%	2.3%	0.2%	0.5%	3.8%
	1001 - 1300	10.2%	61.2%	12.2%	0.0%	16.3%
	1301 - 1600	0.0%	25.0%	50.0%	6.3%	18.8%
	1601 - 1900	0.0%	0.0%	8.3%	58.3%	33.3%
	> 1900	12.8%	0.4%	0.0%	0.4%	86.5%

Source: Author's calculation.

Table A.5 Dynamic characteristics, Categorization 3

Stationary Distribution	
per capita GDP, Classes	Share of population
< Rp. 1,000,000	62%
Rp. 1,001,000 - Rp. 1,300,000	5%
Rp. 1,301,000 - Rp. 1,600,000	2%
Rp. 1,601,000 - Rp. 1,900,000	1%
> Rp. 1,900,000	30%
Convergence Statistics	
Half-life	2.7 periods
S	0.70
C_the 3rd	0.24
C_the 4th	0.27
Mean First Passage Time	
Class Mobility	MFPT (years)
From class 1 to class 4	191.6
From class 2 to class 4	187.7
From class 3 to class 4	168.5
From class 5 to class 4	193.8

Source: Author's calculation.

Appendix B

Supplementary Material to Chapter 3

Table B.1 Number of districts by province

Region	Province	Kabupaten	Kota	Districts
Sumatera	Nanggroe Aceh Darussalam	11	2	13
(9 provinces)	Sumatera Utara	13	6	19
	Sumatera Barat	9	6	15
	Riau	12	3	15
	Jambi	9	1	10
	Sumatera Selatan	6	1	7
	Bengkulu	3	1	4
	Lampung	8	2	10
	Kepulauan Bangka Belitung	2	1	3
Jawa-Bali	DKI Jakarta	1	5	6
(7 provinces)	Jawa Barat	16	6	22
	Banten	4	2	6
	Jawa Tengah	29	6	35
	DI Yogyakarta	4	1	5
	Jawa Timur	29	8	37
	Bali	8	1	9
Kalimantan	Kalimantan Barat	8	1	9
(4 provinces)	Kalimantan Tengah	5	1	6
	Kalimantan Selatan	9	2	11
	Kalimantan Timur	8	4	12
Sulawesi	Sulawesi Utara	3	2	5
(5 provinces)	Sulawesi Tengah	7	1	8
	Sulawesi Selatan	22	2	24
	Sulawesi Tenggara	4	1	5
	Gorontalo	2	1	3
Eastern Indonesia	Nusa Tenggara Barat	6	1	7
(5 provinces)	Nusa Tenggara Timur	13	1	14
	Maluku	4	1	5
	Maluku Utara	2	1	3
	Papua	12	2	14
	Indonesia	269	73	342

Source: Author's calculation.

Table B.2 Number of districts by region

Region	Kabupaten	Kota	Districts
Sumatera	73	23	96
Jawa-Bali	91	29	120
Kalimantan	30	8	38
Sulawesi	38	7	45
Eastern Indonesia	37	6	43
Indonesia	269	73	342

Source: Author's calculation.

Table B.3 Coefficient of inequality

Index	Per capita GDP		Per capita GDP no oil	
	2001	2007	2001	2007
GE(-1)	0.503	0.401	0.313	0.287
GE(0)	0.486	0.385	0.319	0.285
GE(1)	0.768	0.548	0.481	0.395
GE(2)	2.856	1.419	1.400	0.876
Gini	0.533	0.478	0.434	0.411
A(0.5)	0.262	0.205	0.175	0.153
A(1)	0.385	0.320	0.273	0.248
A(2)	0.502	0.445	0.385	0.365

Source: Author's calculation.