SPATIAL INEQUALITY AND DEVELOPMENT

Edited by

Ravi Kanbur and
Anthony J. Venables

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List of Acronyms and Abbreviations

ACCRA American Chamber of Commerce Researchers Association
BLS Bureau of Labor Statistics (USA)
BNPP Bank Netherlands Partnership Programme
CASE Centre for Analysis of Social Exclusion (LSE)
CDF Cumulative distribution function
CEE Central and Eastern Europe
CIS Commonwealth of Independent States
COLA Cost of Living Adjustment programme (USA)
CPD country product dummy method
CPI consumer price index
DFID Department for International Development (UK)
EBRD European Bank for Reconstruction and Development
EGI National Statistical and Geographical Institute (Mexico)
ELI entry-level item
ECV Encuesta de Condiciones de Vida (Ecuador)
EPM Enquête Permanente Auprès des Méenages (Madagascar)
FDI foreign direct investment
FGLS feasible generalized least squares
FGT Foster–Greer–Thorbecke
FIPE Fundaç ao Instituto de Pesquisas Econômicas (Brazil)
f.o.b. free on board
GATT General Agreement on Tariffs and Trade
GIS Geographical Information Systems
GLS generalized least squares
GMM generalized method of moments
HBS Household Budget Survey
IAF Inquérito Nacional aos Agregados Familiares sobre as Condições de Vida (Mozambique)
IBGE Instituto Brasileiro de Geografia e Estatistica
ICP International Comparison Programme
INEC Instituto Nacional de Estadistica y Census (Ecuador)
INEGI Instituto Nacional de Estadística Geografía e Informática (Mexico)
INSTAT Institut National de la Statistique (Madagascar)
ISI import substitution industrialization
LFS Labour Force Survey
LIS Luxembourg Income Study
LISA local indicator of spatial association
LSE London School of Economics and Political Science

LSMS Living Standards Measurement Study
MAR Marshall-Allyn-Romer
MSI minimum subsistence income
NAFTA North American Free Trade Agreement
NEG new economic geography
NBS National Bureau of Statistics (China)
OECD Organisation for Economic Co-operation and Development
OLS ordinary least squares
PCE per capita expenditure
PCSE panel corrected standard error
PNAD Pesquisa Nacional por Amostra de Domicílios (IBGE, Brazil)
PPP purchasing power parity
RHS Rural Household Survey (China)
RLMS Russian Longitudinal Monitoring Survey
RPED Regional Programme on Enterprise Development
SMEs small- and medium-sized enterprises
SUSENAS Indonesian National Socioeconomic Survey
TVE township and village enterprise
UDHS Uganda Demographic and Health Survey
UNICP United Nations International Comparison Programme
WHO World Health Organization
WIDER World Institute for Development Economics Research

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Foreword

Many developing and transition countries exhibit significant regional disparities in average incomes, the incidence and depth of poverty, health indicators, education status, and other correlates of living standards and human development. Spatial variations are particularly high in large countries like Brazil, China, Russia, and South Africa. But they are also evident in smaller developing nations, especially in Africa, and they continue to be an important social concern in developed countries—for example, with regard to US poverty rates and UK health indices.

Variations in living standards within countries have a number of underlying causes. They reflect historical differences in the pace of development (S ao Paulo versus northeast Brazil), the uneven impact of economic reform (Guangdong versus Qinhai), discrimination in the provision of economic and social infrastructure (South Africa during apartheid), and impediments to labour migration (China and Russia). Unfavourable agricultural conditions and geographical remoteness from principal markets also play a role. Whatever the original source, there is a widespread perception that spatial disparities in human development have recently become more visible and that they are increasing over time. Despite the recognition of the problem and its policy significance, there has been very little systematic scholarly analysis into the causes of growing inequalities within countries and their cumulative detrimental impact on human development. Under the direction of Ravi Kanbur and Tony Venables, the UNU-WIDER project on *Spatial Disparities in Human Development* drew together expertise from all regions of the globe in order to better understand the incidence, significance, and causes of spatial variations within countries, and to contribute to the global policy debate. This book is a collection of country, regional, and comparative studies presented and discussed at a conference at the London School of Economics in June 2002. It is the first serious attempt to examine spatial inequality in a global context from multiple perspectives and disciplines, and will be essential reading for academics and students interested in this research topic. It also provides valuable background information and advice for both policymakers and policytakers, and will be useful reading material for lay readers interested in learning more about a topic of growing national and international significance.

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PART I INTRODUCTION

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1 Spatial Inequality and Development

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1.1. FIVE QUESTIONS

What exactly is spatial inequality? What are its determinants? How has it been evolving? Why does it matter? And what, if any, should be the policy response to spatial inequality?

These questions have become important in recent years as, amidst a growing concern about increasing inequality, the spatial dimensions of inequality have begun to attract considerable policy interest. In China, Mexico, Russia, India, and South Africa, as well as most other developing and transition economies, there is a sense that spatial and regional inequality, of economic activity, incomes, and social indicators, is on the increase. To some extent this may be a normal feature of economic growth, as new activities develop around coasts or border regions. But are such patterns transient or permanent? What factors are conducive to the spread of activity from booming to backward regions? Also important in the policy debate is a perceived sense that increasing internal spatial inequality is related to greater openness of economies, and to globalization in general.

Spatial inequality matters for a number of reasons. Market failures, and the positive and negative externalities associated with clustering and congestion, mean that outcomes are likely to be inefficient. The growth of megacities may be one aspect of this, but policy responses are far from clear. Should infrastructure expenditure be concentrated or dispersed? Should internal migration flows be restricted, or facilitated in order to narrow spatial wage gaps? Spatial inequality is a dimension of overall inequality, but it has added significance when spatial and regional divisions align with political and ethnic tensions to undermine social and political stability.

But despite these important popular and policy concerns, there is remarkably little systematic documentation of the facts of what has happened to spatial and regional inequality over the past ten to twenty years. Correspondingly, there is insufficient understanding of the determinants of internal spatial inequality in a globalizing world. As a result, the policy discussion tends to take place in something of an analytical and empirical vacuum. This volume of studies is the result of the first in a series of general and region-specific conferences on spatial inequality and development, which are in turn part of a project organized by the United Nations University's World Institute for Development Economics Research (UNU-WIDER) in Helsinki.

Collectively, the studies in this volume represent an attempt to answer the questions posed above, based on data from some twenty-five countries covering all regions of the world. They bring together perspectives and expertise in development economics and in economic geography. They form a well-researched entry point into an area of growing analytical and policy importance. This introduction provides an outline of the volume and brief descriptions of the chapters, and ends by highlighting key issues and areas for further research.

1.2. OVERVIEW OF THE VOLUME

The volume begins with chapters on measurement issues. An essential first step in measuring spatial inequality in a country is to develop accurate measures of real income disparities across regions within countries. The recent spurt of interest in economic geography has led to a greater focus on regional-level estimates of output within a country, but Chapter 2 by Aten and Heston addresses head-on the important question of accounting for regional price differences in making these calculations. While the Purchasing Power Parity (PPP) project has been invaluable in generating data on price variations across countries, there is very little comparable data on price variations across regions within countries. Given this limitation, the authors develop indirect methods, by modelling the variation in prices for the regional units in the world for which there is indeed regional price data, as a function of variables for which data is more generally available. The preferred estimated relationship can then be used to generate price indices for other regions of the world, and these prices can in turn be used to convert nominal output data into real output. The technique developed by Aten and Heston will prove indispensable to empirical researchers working on spatial inequality, whether in developing or developed countries.

Data availability is equally a problem in terms of household surveys which form the basis of much of the empirical work on interpersonal inequality, and the measurement of poverty in developing countries. The problem here is that while household surveys collect detailed information on income, consumption, and social indicators, their sample sizes are not large enough to allow adequate disaggregation to regional or subregional levels within a country. On the other hand, census data do not have much of the detailed information at the household level needed for inequality and poverty analysis. The obvious answer is to combine these data sources, and Chapter 3 by Elbers *et al.* does just that. Their approach is similar in some ways to that of Aten and Heston in Chapter 2. The variable of interest which is available only in the household survey, in this case some measure of household well-being, is modelled as a function of explanatory variables in the household survey that are also available in the census (or a survey with a much larger sample survey). The relationship estimated on the household survey is then applied to the census to generate an effectively larger sample of household well-being, which can then be disaggregated at the regional and subregional levels to study spatial inequality in household well-being. Elbers *et al.* illustrate the power of the technique by applying it to Ecuador, Madagascar, and Mozambique, decomposing

national inequality into inequality within and between spatial units at successively finer levels of disaggregation. A major conclusion, consistent with the general inequality decomposition literature, is that the within-group component of inequality stays high (in excess of 75 per cent) even at what seem to be very high levels of disaggregation (in Ecuador, for example, down to the level of 915 local units with an average of just over 1,000 households). Thus, the contribution of average variations across spatial units, to total interpersonal inequality, seems to be no greater than 25 per cent. Does this mean that spatial inequality is not a phenomenon of great policy interest? In fact, the studies in this volume suggest otherwise, and this point will be taken up towards the end of this introductory chapter.

A further measurement issue is raised by the fact that regional per capita income is a blend of demographic and economic factors—for example, a combination of the age–income relationship and the age structure for a region. Chapter 4 by Azzoni *et al.* shows that recognizing this fact has important implications for the interpretation of studies of regional convergence. Using microage-income-level data across Brazilian regions, they demonstrate that the rate of convergence differs across age cohorts, and the aggregate results on convergence thus reflect the age composition of different regions, and changes in this age composition. The aggregate data suggest a speed of convergence which is much slower than the convergence for specific age cohorts. This opens up a new line of research, opening up the convergence black box as the title of the chapter suggests, which should become more prevalent as more extensive microlevel data become available for developing countries.

The second section of the volume moves from the perspective of measurement of income inequality to the perspective of economic geography. Chapter 5 by Escobal and Torero looks at the microlevel and investigates the determinants of the spatial variation in household-level well-being in Peru, using household survey data for 1991, 1994, 1996, and 1997. They first of all show the high level of spatial inequality in Peru. But, they also argue that these geographical differences can be accounted for by variation in private and, especially, public assets. Once these are accounted for, pure geography in the sense of altitude or temperature does not influence measures of household well-being. However, as they recognize and highlight, this simply pushes the question back one stage—the effect of geography on the provision of such an uneven distribution of public infrastructure, and the concentration of economic activity over and above the influence of physical geographical constraints.

The recent theoretical literature has suggested the importance of location and agglomeration externalities as key determinants of spatial concentration of economic activity and income. The empirical literature has lagged behind the theoretical developments, and the two studies in this section are attempts to identify and quantify these factors in the data. The chapter by Davis and Weinstein investigates the effect of region size on regional productivity, allowing for possible spillover effects across neighbouring regions, and other more standard explanatory factors. Using data from forty Japanese regions, they find that own size does matter in explaining regional total factor productivity—doubling own size raises productivity by 3.5 per cent. Moreover, the nature of neighbouring regions matters too for a region's own productivity. The uneven

pattern of activity in Japan contributes to overall efficiency—if aggregate activity were to be spread evenly across the regions of Japan, output would be lower by 5 per cent.

Chapter 7 is Ravallion's contribution to this volume, looking at the issue of externalities from the microlevel of household survey data. Starting with panel data on 5,600 farm households from 111 counties in four provinces of China, he seeks an explanation of household consumption growth over the period 1985–90. He estimates a model of consumption growth that has household- and locality-level explanatory variables, allowing for time-variant fixed effects. There is strong evidence of geographical externalities, in the sense that locality level variables have an effect on consumption growth over and above household-level attributes. The explanation is that the level and nature of local economic activity, in the aggregate, affects household-level returns to human capital and infrastructure.

The next two chapters investigate the importance of the regional linkage between national growth and microlevel poverty reduction. Friedman, in Chapter 8, uses six household surveys over the fifteen-year period 1984–99 to analyse the impact of growth on poverty. He finds a very close connection between national growth and poverty reduction. But he finds rural poverty reduction that was more responsive to growth in the central locations of Java and Bali than it was in the more remote regions like Kalimantan. He suggests that, once again, public infrastructure such as transport networks can explain this variation.

In their chapter, Christiaensen *et al.* investigate the relationship between growth and poverty reduction using household survey data for eight African countries. Their conclusions are similar to those of Friedman for Indonesia. While economic growth is a key correlate of poverty reduction, its impact on poverty depends crucially on how remote poor households are from the centres of economic activity, and how well-served they are to infrastructure services. During a period of strong economic growth in Uganda between 1992 and 2000, for example, the incidence of poverty fell by a half in the Central Province, but by only 9 per cent in the remote Northern Province. In Ghana between 1992 and 1998, poverty in the capital city Accra fell sharply, but not so sharply in other, less well-connected, urban areas, and indeed it increased in the remote northern Savannah zone. Further detailed analysis highlights the importance of infrastructure in explaining these variations in the extent to which national growth is translated into poverty reduction across space.

As noted at the start of this introduction, one of the areas of concern in spatial inequality is the extent to which the increases seen in the last decade or two have been connected with the opening up that many economies have experienced, to trade and to foreign direct investment. The next section of the volume takes up this important question. The findings of Rodríguez-Pose and Sánchez-Reaza in Chapter 10 are consistent with a growing literature on regional inequality in Mexico post-NAFTA (North American Free Trade Agreement). The authors find unmistakable trends towards greater regional inequality and polarization. The earlier trend towards regional convergence has been reversed, and there is growing polarization between the North and the South. Clearly, proximity to the US market has been a determinant in the

 concentration of economic activity, and these forces have interacted with uneven distribution of infrastructure and public services to create very different opportunities for the different regions of Mexico.

Many studies take the spatial inequality of wage rates as the relevant object of study. The next two chapters in this section of the volume investigate spatial variation in wage rates in China and in Africa, respectively. Growing regional inequalities in China over the last two decades are much discussed in the literature, and in Chapter 11, Lin takes up the interregional wage inequality dimension of this question. Specifically, she focuses on the effects on wages of differential access to international markets. Defining 'market access' and 'supplier access' variables, she finds that about a quarter of the wage difference in the coastal provinces and about 15 per cent of the differences in the interior provinces can be explained by a province's market access and supplier access. Since China's provinces are as large as many individual countries (like Mexico), this is further support for the proposition that greater openness to trade can lead to greater spatial inequality in living standards, even when such opening up increases overall efficiency and growth, as it has done in China.

The chapter by te Velde and Morrissey is a comprehensive study of wage differentials in five African countries. Not surprisingly, wages are higher in the capital city compared to the rest of the country. This is partly because workers in the capital city have more years of formal education, which is shown to be a key individual-level determinant of wages. It is also partly due to the fact that foreign-owned firms are more likely to be located in the capital city, and it is also shown that these firms are more likely to pay higher wages than indigenously owned firms. If these foreign firms are also more productive, then the efficiency gains will have to be taken into account in assessing the consequences for distribution of opening up the economy to foreign firms. Finally, correcting for individual worker characteristics like education and tenure, and firm characteristics like size and foreign ownership, they find that workers in the capital city earn a substantial premium, compared to the rest of the country, of as much as 28 per cent. One problem with interpreting this goes back to Chapter 2 in this volume, by Aten and Heston. Since te Velde and Morrissey do not have data on price variations within a country, they cannot determine definitively that the nominal wage premium they establish in fact survives in real terms. In general, since the cost of living is higher in capital cities, the real wage differentials would be far less.

Economies in transition are a particularly interesting setting in which to study spatial inequality. Their rapid liberalizations and opening up to the external world are known to have increased inequality, and in some cases poverty. What exactly are the spatial dimensions of this increase in inequality? The last two chapters in this volume take up this issue, paying particular attention to data quality and interpretation. In their study of the Czech Republic, Hungary, Poland, and Russia, Förster *et al.* present a finding that is consistent with the outcome in many other countries—the capital city and well-connected urban areas closer to Western markets in the European Union have gained from overall economic growth, while remote regions have not done as well or actually lost out from the process of transition so far. These gaps, and relatedly the rural–urban gap, have increased.

Yemtsov conducts an in-depth study of the evolution of inequality and poverty in the Russian regions over the period 1994–2000, based on the Household Budget Survey. He finds that the contribution of between-region inequality to total interpersonal inequality is 33 per cent, a little higher than in the African and Latin American studies by Elbers *et al*. But it has been growing. In fact, most of the increase in interpersonal inequality in Russia is accounted for by the increase in the between-regional component. Not surprisingly, standard convergence tests show no convergence between Russian regions. If these trends continue, Yemtsov calculates that within a decade the majority of Russia's poor will be concentrated in a few impoverished regions, a picture of poverty concentration that bears similarity to a number of other countries such as Peru, also studied in this volume.

1.3. THE FIVE QUESTIONS AGAIN

Let us return to the five questions posed at the start. First, what exactly is spatial inequality? The dominant perspective on inequality in economics comes from considerations of interpersonal inequality—how individuals differ from each other along dimensions such as income, consumption, education, and health (in what follows, we will use income/consumption as the representative dimension). One way of approaching spatial inequality is to start from interpersonal inequality and consider its spatial dimensions. For any given delineation of individuals into mutually exclusive and exhaustive spatial units, each unit can be characterized by its per capita income and its population share. With this set-up there are several possible characterizations of spatial inequality:

(i)   Unweighted variation in per capita income across spatial units.
(ii) Population share weighted variation in per capita income across spatial units.
(iii) Contribution of variation in per capita income across spatial units to income variation across all individuals.

All of these conceptualizations of spatial inequality are present in the literature, and in this volume. The first of them is the effective object of interest in the large number of studies on regional convergence (although they should all pay heed to the difficulties of taking into account regional price variations, as highlighted by Aten and Heston in Chapter 2). But it is the last two conceptualizations that come closest to the instinct of mainstream economics to treat interpersonal inequality as being the fundamental object of interest. Spatial inequality is clearly related to variation across spatial units and per capita income of a spatial unit is the analogue of individual income. The question can then be asked: what would have been the inequality among individuals if all individuals within a spatial unit had the per capita income of that unit, so that the only variation across individuals was that attributable to space? This is essentially the population share weighted variation in per capita income across spatial units. From this perspective, therefore, (ii) has claim to be a measure of spatial inequality. But if the ultimate object is overall interpersonal inequality, then we are led to (iii), the percentage of

 total interpersonal inequality 'accounted for' by (ii). As shown in this volume, taking (iii) as the concept of spatial inequality leads empirically to the conclusion that spatial inequality accounts for, at most, one-third of total interpersonal inequality. Most of the variation with individuals is within spatial units, not across them, even for quite fine disaggregations, as shown by Elbers *et al.* in Chapter 3, and by Yemtsov in Chapter 14.

What are the determinants of spatial inequality? If all economic activity were to take place on a 'featureless plane', and if economic activity had the standard neoclassical properties, economic activity would be evenly distributed across space and there would be no spatial dimension to inequality. But the world does not satisfy either of these two assumptions. There are real geographical features such as mountains and coasts and forests and rivers that can affect the distribution of economic activity and spatial inequality in well-being. But one conclusion from the studies in this volume—such as the chapters by Escobar and Torero, Friedman, and Christiaensen *et al.*—and the literature more broadly, is that the impact of these natural features is not as important as the geographical distribution of other features—specifically, infrastructure and public services. As shown in a number of chapters in this volume, a key determinant of household well-being in a region, over and above household specific characteristics, is the quantity and quality of infrastructure in that region.

However, even without variations in physical features, or infrastructure variations across regions, once the standard assumptions of neoclassical economics are dropped a number of possibilities arise for the propagation of spatial inequality. The new economic geography has highlighted, in particular, location and agglomeration externalities. These can arise because of knowledge spillovers, thick market effects, or input–output linkages between firms. They operate at various spatial levels; within regions of dense economic activity, within cities, and within narrowly specialized industrial districts of cities. Evidence has slowly begun to accumulate on the magnitude of the agglomeration externalities that create these disparities. The chapters by Davis and Weinstein and by Ravallion in this volume are an important contribution to this literature, and highlight the importance of agglomeration effects and location externalities.

How has spatial inequality been evolving over the past two decades? If the evidence presented in this volume is anything to go by, it has been on the increase. Its relationship to greater openness in trade and investment is investigated by Rodríguez-Pose and Sánchez-Reaza for Mexico and by Lin for China. Even where the last two decades have brought overall growth and poverty reduction, the benefits of this growth have not flowed evenly across space. Spatial inequality has grown—especially in transition economies, as documented in the chapters by Förster *et al.* and by Yemtsov—with the result that poverty reduction has been uneven across regions within countries, as documented in the chapters for Africa by Christiaensen *et al.* and for Indonesia by Friedman. However, a number of key questions remain. To what extent is some increase in spatial inequality a natural feature of development, as growth is initially concentrated in a few regions? Is this increase temporary, and how long is it likely to take for growth to spread from region to region? Some existing research suggests

a pattern of increasing then decreasing spatial inequality, but further research is needed to identify factors that are conducive to the dispersion of activity.

Why does spatial inequality matter, and is a policy response appropriate? We have seen that spatial inequality accounts for only around one-third of total inequality, and part of this may be transient rather than permanent. Does this mean that spatial inequality is unimportant, as some might be tempted to argue? One argument in favour of doing nothing, or very little, is that if our ultimate objective is total interpersonal inequality, and if spatial inequality is at most one-third of this total, surely policy should focus on inequality *within* spatial units (which accounts for two-thirds of the total) rather than between. There are several responses to this. First, one-third is smaller than two-thirds, but is still quite big. Eliminating spatial inequality would have an impact on inequality far larger than some cross-country variations in inequality. And, as in the case of Russia, there are periods when even though spatial inequality is relatively small, much of the increase in total inequality is in fact increase in spatial inequality. However, the real question here is what policy instruments are available to address within- and between-group inequalities, and what the cost benefit of each instrument is. It may well turn out that 'per unit of inequality reduction' the instrument that addresses between-group inequality is cost-effective. This will depend on the specifics of the case—addressing between-group inequality cannot be simply dismissed because it is smaller than within-group inequality.

Furthermore, it might be the case that the distribution of individual attributes, such as ability, is the same in all regions. Spatial inequality is then particularly inequitable and—especially when aligned with political, religious, or ethnic tensions—may be dangerous to social and political stability. If spatial divisions align with ethnic, religious, or language splits, as so often happens, then the between-group component of inequality takes on a greater significance than its contribution to interpersonal inequality. In such cases, we ignore growing spatial inequality at our peril. Even when spatial units do not represent ethnic or other cleavages, but command the allegiance of the population as political entities, increasing disparities in group averages may lead to tensions and conflict.

Additional arguments derive from the real income losses that may be associated with spatial inequality. Spatial location decisions are associated with multiple market failures, particularly when agglomeration forces are present. These market failures depress real income, and may also retard growth as they depress the returns to job creation. For example, it is often suggested that prime cities are excessively large. There may be negative externalities arising from congestion costs in large cities. In addition, the presence of agglomeration economies and increasing returns to city formation gives rise to coordination failure, as it is not profitable for a single firm to relocate and establish a new centre of activity. What is needed, if new centres are to be established, is a collective or policy coordinated movement.

Complex policy choices also arise with migration and infrastructure. According to one view, there is too little migration and part of the problem of lagging regions arises because of individuals' reluctance to emigrate from such regions. The reason for the reluctance to migrate may be attachment to the area of birth, or may be

that individuals are locked into declining regions by location-specific human capital. However, in neither of these cases is there a market failure. Failures, and consequent arguments for policy, arise if migrating individuals exert positive or negative externalities on other individuals in the locations that they are leaving or that they are joining. It is then far from clear that there is too little migration—there may well be too much, particularly into established urban centres. Similarly with infrastructure; as Escobal and Torero (Chapter 5) show, provision of public infrastructure is an important determinant of household well-being. Such investments may allow individuals to increase the return to their general and location-specific human capital and be a powerful instrument in favour of greater spatial equality. However, the benefits of such an allocation need to be weighed against the costs, particularly as urban infrastructure needs are often pressing.

The case for policy interventions to ensure a more spatially equitable and efficient allocation of infrastructure and public services has been powerfully made in this volume. But the specifics of this policy conclusion still need to be developed. The benefits of such an allocation need to be weighed against the costs, so both will have to be quantified. In order to do this we will need a deeper and more detailed understanding of the determinants of spatial inequality, and how exactly policy interventions in infrastructure and other areas will impinge on it. The studies in this volume have made a start. A full research agenda lies ahead.

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PART II MEASUREMENT OF SPATIAL INEQUALITY

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2 Regional Output Differences in International Perspective

BETTINA ATEN AND ALAN HESTON

2.1. INTRODUCTION

The political economy of countries revolves upon leaders gaining support from different constituencies within an administrative boundary, be it a city ward, a province, or a regional configuration in larger countries. Conflicts within countries frequently centre on differences in income between regions and the extent to which these represent one area receiving more public expenditures, projects, or subsidies than another. Within and between countries, resources are often allocated inversely to a small degree to the level of per capita income, for example, the social fund in the European Union (EU). Since perceptions of regional neglect are partly based on objective estimates of income, it is important to have good estimates. To understand the distribution of world income, and concentrations of the very poor, it is important to have regional income estimates that can be compared within and between countries, and this is the focus of our chapter. We make a first step towards developing a comparable set of interarea real income comparisons for a world of about 800 subnational administrative units and countries. Some of the subunits are larger than most countries, such as Uttar Pradesh in India with 159 million, or Sichuan in China with 115 million. We use the smallest administrative unit that is available from official sources (see sources of regional data in the Appendix to this chapter), except in the case of Chile, where we used the second smallest unit since their smallest units totalled 300 plus areas. Geographically, more disaggregation is desirable for many of the large countries.

What distinguishes this study from others such as Gallup *et al.* (1998) is that we also ask what difference it makes to take into account price differences within countries. We begin with nominal estimates of regional incomes based on production or other methods of estimation, aware that the concept of income and quality of estimates of nominal levels and growth vary widely across countries.[1] Clearly, there is much work to be done to get good nominal income estimates, important research that is not attempted in this chapter. As a first step we correct the nominal incomes for

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[1] For example the *China Statistical Yearbook* for 2000 reports growth in income in all provinces but one as higher than reported for all of China.

differences in purchasing power parities (PPPs)[2] across countries and, as a second step, across regions within countries. Unfortunately, there is only limited direct data on price differences within countries so much of the chapter addresses the problem of finding an indirect way to satisfactorily estimate differences in regional price levels. We undertake this estimation because we believe these regional price differences are important, and after going through the exercise we ask whether this correction would alter our perception of the world compared to what we obtain from step one above.

The preferred method of directly estimating regional price differences is discussed in Section 2.2. Because few countries collect price data appropriate for directly estimating regional price levels, we discuss in Section 2.3 indirect methods that might be used to estimate price levels and real incomes within countries. Models are developed of how location and trade may influence price levels. We estimate two versions of this model, one that assumes spatial heterogeneity among countries or regions and a second that explicitly includes spatial autocorrelation effects from neighbouring and nearby units.

2.2. REGIONAL PRICE LEVELS

2.2.1. Methodology

Just as national PPPs are used to convert GDPs in national currencies to a common unit, it is desirable for making quantity comparisons to take account of price differences across regions of a country using the same currency. The creation of a euro area or the use of the US dollar in Ecuador does not lessen the need for price comparisons. Many commercial enterprises in the United States and Europe sell information on regional price levels to employers setting salaries or employees considering relocation—American Chamber of Commerce Researchers Association (ACCRA) in the United States and Employment Conditions Abroad in the United Kingdom are two such organizations. The methods used in most commercial ventures grew out of the binary comparisons between countries, especially those carried out by Gilbert and Kravis (1954: 22–3), who used the United States as the centre of a star involving the United Kingdom, France, Germany, and Italy. Direct binary comparisons among the European countries were not carried out. The direct method is used by governments and international organizations such as the United States State Department and the International Civil Service Commission.

Multilateral comparisons grew out of binary beginnings, as methods were developed to deal with the fact that binary comparisons between A/B, A/C, and B/C do not lead to transitive results; the direct comparison of B/C does not generally equal the indirect comparison obtained by dividing A/C by A/B. The International Comparison Programme (ICP), formed in 1968 at the United Nations Statistical Office, has experimented with several different multilateral methods (Kravis *et al.*1975). Many investigations of multilateral methods resulted; commonly used methods are discussed by Diewert (1999) and Rao (2001). The broad results of all the methods support the

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 most important finding of the ICP, namely that the price level (purchasing power divided by the exchange rate) of GDP rises systematically with per capita GDP; this is sometimes referred to as the Balassa–Samuelson effect (Heston *et al.* 1994).

This basic finding, when extended to regions within a country, implies that higher income regions would have higher prices than low-income regions. Whether one is making purchasing power comparisons between or within countries, the information required to carry out a full benchmark comparison are prices of comparable goods and services. In many countries substantial price information is available, especially for foods.[3] In the 1960s, the consumer price index (CPI) in the United States had enough common items across cities, collected each month within each city, to put together spatial price comparisons. However, the US Bureau of Labor Statistics (BLS) did not believe these spatial comparisons were of very good quality, and neither business nor labour was keen on having official estimates of regional price levels within the United States. Official intercity comparisons were discontinued in 1968.

The framework for the CPI that the BLS introduced in the 1970s also did not seem to readily lend itself to comparisons across space because collectors were not asked to price the same item in different outlets. The sampling frame is such that the price collector checks off, for each entry-level item (ELI), the outlet, size, packaging, and other information about the volume seller as indicated by an outlet employee. Since the CPI only required the price change for the same item from the previous period, it was not known whether the same items were priced the same in Los Angeles and Minneapolis, for instance. However, it turned out that the ELI approach to the CPI may be the model of what price data should be for making regional or international comparisons. A short discussion of the BLS experiments for the United States illustrates this point. Regional price differences remained a research subject for the BLS, and a hedonic approach was examined in the work of Kokoski *et al.* (1994) and Kokoski *et al.* (1999: 123–66).

In fact, Kokoski *et al.* began experimenting with the hedonic approach that had also been part of the early international PPP comparison work. In the ICP the method was termed the country product dummy method (CPD) by Summers (1973) to deal with the fact that not all countries collected prices for all items. The version that Summers used was a very straightforward hedonic regression model akin to those used for temporal studies—Griliches (1990: 185–206), Triplett (1990), Berndt *et al.* (1995). In eqn (2.1), $j = 1,2,\ldots,m$ countries, $i = 1,2,\ldots,$ n items in a basic heading, and p_{ij} is the price of item i in country j, and ε_{ij} is the error term. The prices are regressed against two sets of dummy variables, D_j for each country other than the numeraire country (country 1), and the second set with a dummy for each item specification, z_i.

$$p_{ij} = \sum_{i=1}^{n} \beta_i z_i + \sum_{j=2}^{m} \alpha_j D_j + \varepsilon_{ij} \, .$$

(2.1)

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[3] Aten (1999) found that in Brazil some of the poorest metropolitan areas had the highest food price levels, possibly due to higher transport costs and the lack of spatial interaction among some regions of Brazil.

The transitive price parity, α_j, is the logarithm of the estimated country parity for the heading relative to the numeraire country. The item coefficient, β_i, is the logarithm of the estimates of the average item price in the currency of the numeraire country (which could be a regional currency).

The innovation of Kokoski and colleagues was to apply this data to the estimation of internal price parities by BLS city using the ELI characteristics of the prices being collected. The basic idea was similar to the CPD procedure. For example, if 'apple' is the ELI, we may not be able to match the specific apple(s) priced in Philadelphia with those priced in Los Angeles. But across all the BLS cities, as long as there is overlap of specific apples priced in some cities, then a parity can be obtained for all apples between any pair of cities. Given the unit of measurement of a kilogram, there would be a code for outlet type, city, and dummies for Fuji, Rome, Granny Smith, Delicious, McIntosh, and so forth. In the CPD equation, the β_i's would provide an average price per kilogram for types of apples, and the α_j's yield the price level of apples in each city.

A formulation of this hedonic framework that seems appropriate for regional comparisons is set out in eqn (2.2), where the subscript (j) refers to regions within a country, the subscript (i) refers to item characteristics, such as brand or product identification, and (k) refers to the outlet type. The brand characteristics (B_i) and outlets (O_k) are expressed as dummy variables, so that one characteristic or outlet must be omitted to avoid perfect multicollinearity in the estimating equation. This omitted characteristic becomes the base, and β or γ is the (log) price parity relative to this base. As in eqn (2.1), the α yield the price level relative to each region.

$$ln\, p_{ikj} = \sum_{i=1}^{n} \beta_i B_i + \sum_{k=2}^{l} \gamma_k O_k + \sum_{j=2}^{m} \alpha_j D_j + \varepsilon_{ijk}\,.$$

(2.2)

In the example below, the regions are districts into which São Paulo is divided for the purpose of collecting prices for the city CPI.[4] Although the geographical dispersion of São Paulo is not as great as in a typical country, there are significant differences in prices across its districts, so the example simulates how the framework might be applied across regions at the country level. The three items used for illustration are dentists' charges for a filling, milk, and lightbulbs. For all three items there are different characteristics, namely type of outlet and brand or product, as well as various districts where the prices are collected.

Table 2.1 presents the results of the estimated equations for the three items. For lightbulbs and milk, a base price in a supermarket is provided in Brazilian reais (R$) for a particular brand. Some further remarks will be made about the districts below. The factors to modify the base price are indicated for the highest and lowest districts for that item, for the different outlets, and for different types of fillings (dentist) or brands

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[4] We thank Professor Heron do Carmo, coordinator of the CPI for the Fundação Instituto de Pesquisas Economicas (FIPE), who was kind enough to provide illustrative prices for several items that could be readily collated from the December 2001 survey. FIPE estimates a weekly CPI for São Paulo, as do several other institutions in Brazil. This survey covers over eighty districts with a range of outlets, brands, and varieties of goods and services.

Table 2.1. *Price levels within São Paulo (eqn (2.2) results)*

Item: lightbulb		
Base price	60 W GE transparent bulb (1 unit)	R$1.04
Price level relative to base		
Outlet type	Supermarket	1.00
	Hardware	0.90
Brand/product	60 W Phillips	1.17
	100 W GE	1.33
	100 W Phillips	1.50
	Fluorescent 15 W 3-pack	16.83
District		
Highest	Vila Prado	1.48
Lowest	Aricanduva	0.65
	$N = 247$, $R^2 = 98.5$, RMSE = 0.133	
Item: dentist		
Base price	Porcelain filling 1-face	R$32.24
Brand/product type	Amalgama type B	1.31
	Amalgama type C	0.42
	Resin type B	1.48
	Resin type C	0.47
	Silicate type C	0.27
District		
Highest	Jabaquara	2.39
$Lowest	Saude	0.70
	$N = 72$, $R^2 = 97.1$, RMSE = 0.138	
Item: milk		
Base price	Grade A milk 1 l	R$1.57
Outlet type	Supermarket	1.00
	Bakery	1.18
Brand/product type	Skimmed	
	Special	0.60
	Paulista	0.69
	Parmalat	0.66
	Grade B milk	
	Special	0.72
	Paulista	0.82
	Parmalat	0.81
	Long-life milk	
	Parmalat	0.69
	Paulista	0.72
	Leco	0.70
District		
Highest	Raposo Tavares	1.11
Lowest	Vila Formosa	0.86
	$N = 524$, $R^2 = 79.7$, RMSE = 0.162	

Source: FIPE (São Paulo) and calculations by the authors.