American Economic Journal: Macroeconomics 2010, 2:1, 169–188
http://www.aeaweb.org/articles.php?doi=10.1257/mac.2.1.169

Productivity Differences Between and Within Countries[†]

By Daron Acemoglu and Melissa Dell*

We document substantial within-country (cross-municipality) differences in incomes for a large number of countries in the Americas. A significant fraction of the within-country differences cannot be explained by observed human capital. We conjecture that the sources of within-country and between-country differences are related. As a first step toward a unified framework, we propose a simple model incorporating differences in technological know-how across countries and differences in productive efficiency within countries. (*JEL* E23, I31, J31, O15, O18, O47, R23)

Spatial differences in income per capita motivate much of growth theory and development economics. While income differences across countries and across regions within some countries have been documented extensively, there is little systematic evidence on how interregional income differences (within countries) compare and relate to inequality across countries. The relative magnitudes of cross-country, cross-municipality, and within-municipality differences are important for at least two related reasons. First, they shed light on the extent to which sources of major economic differences in income and productivity are national, local, and idiosyncratic in nature, documenting patterns that comprehensive explanations of growth and development should strive to match. Second, they signal the possible presence of important interlinkages between local and national determinants of productivity, which would necessitate a unified theoretical framework for analysis.

This paper documents the magnitudes of cross-country, cross-municipality, and within-municipality inequality in labor incomes and household expenditure for the Americas (Canada, Latin America, and the United States), a large geographic region containing almost 1 billion people and about 30 percent of global gross domestic product (GDP). Our contribution is two-fold. First, we document substantial within-country (and cross-municipality) differences in output and standards of living for

* Acemoglu: Department of Economics, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA 02139 (e-mail: daron@mit.edu); Dell: Department of Economics, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA 02139 (e-mail: mdell@mit.edu). We thank conference participants at the 2009 American Economic Association meetings, and an anonymous referee for useful suggestions. We also gratefully acknowledge financial support from the Air Force Office of Scientific Research and the National Science Foundation. A number of individuals provided invaluable assistance in locating and accessing the many data sources used in this paper. We thank, in particular, Luis Bértola, Rafael Moreira Claro, Sebastian Galiani, Brett Huneycutt, Ana María Ibañéz, Oscar Landerretche, Jose Antonio Mejia-Guerra, Ezequiel Molina, Glenn Graham Hyman, Daniel Ortega, Carmen Pages, Pablo Querubin, Marcos Robles, Oscar Roba Stuart, Carmen Taveras, José Tesada, Jimmy Vasquez, and Gaston Yalonetzky.

[†] To comment on this article in the online discussion forum, or view additional materials, visit the articles page at: http://www.aeaweb.org/articles.php?doi=10.1257/mac.2.1.169.

a large number of countries. For example, among 11 Latin American countries for which we have municipality level data, the between-municipality differences in individual labor income are about twice the size of between-country differences (when the United States is included, this ratio is reversed). About half of between-country and between-municipality differences are explained by observed human capital, the remainder being due to "residual" factors. Disparities in physical capital across regions are unlikely to be the primary factor explaining these differences because of the relatively free mobility of capital within national boundaries. Therefore, similar to the residual in cross-country exercises, these regional residual differences can be at least partially ascribed to differences in the efficiency of production across subnational units.

The dominant empirical approach for understanding differences in income per capita starts with the neoclassical (Solow) growth model. The neoclassical framework explains growth and output levels by human capital, physical capital, and technology. Since technology is exogenous in the neoclassical model, the emphasis in empirical studies starting with this model is often on the dynamics of the capital stock. Our view is that, given the mobility of physical capital inside national boundaries, the neoclassical model offers limited insight into efficiency differences across regions within countries. Thus, the second contribution of our paper is to take a first step toward developing a unified theoretical framework for the analysis of cross-country and within-country differences. Our framework emphasizes the importance of local differences in the efficiency of production, likely shaped by *institutions* (defined as the rules determining how collective decisions are made). More specifically, within countries, productive efficiency is determined, among other things, by local institutions. Local institutions influence how local and regional collective decisions are made, how lower levels of government interact with the national government, and how political power is distributed at the local level.[1] Through these channels, local institutions impact important determinants of the efficiency of production, such as the provision of local public goods and the security of local property rights. At the country level, productive efficiency is determined by the average of local institutions, by national institutions, and by the technology adoption and use decisions of profit-maximizing firms. A country in which local institutions in several regions create inefficiencies will exhibit not only within-country differences but also lower national income. Aggregate output is lowered directly, due to the presence of these low-income regions, and indirectly because low demand from poorer regions will lead to a smaller market size for new technologies, discouraging technology adoption at the national level.

It is sometimes (explicitly or implicitly) assumed that even though institutional differences may be important for understanding cross-country differences in economic outcomes, they do not play a major role in explaining interregional

[1] Examples of national institutions include the structures imposed by the national constitution and laws. Examples of local institutions include the degree to which regional and local elections are free and fair, the de facto control of some regions by local economic and political elites and organized criminals, and in federal systems, state constitutions that may give regional lawmakers substantial powers to determine local laws and policies.

differences (e.g., Guido Tabellini 2006). This view is predicated on the notion that institutions are national and cannot explain within-country differences. However, both de jure and de facto institutions vary greatly within countries. In countries with federal systems, such as Mexico and Brazil, states have considerable authority in changing laws, and de jure institutions, and de facto institutions (e.g., the degree of enforcement of national laws, the extent to which local and regional elections are free and fair, the degree of de facto control by local elites, and the functioning of the judiciary) often vary substantially within national boundaries.[2] Moreover, national institutions and policies may have differential effects in different regions (e.g., a tariff policy promoting industrial development will likely affect urban and rural areas differently).

As preliminary evidence on the importance of local public goods and institutions, we document large disparities in access to paved roads—a specific and important public good—within countries in the Americas. We show that differences in access to paved roads are highly correlated with individual incomes (after controlling for various geographic and other observable factors). Finally, we also discuss several existing empirical studies that connect public goods and economic prosperity to specific local institutions.

The remainder of the paper is organized as follows. In Section I, we discuss existing approaches to cross-country and cross-regional income differences. Section II describes the micro datasets we use for investigating within-country differences. Section III provides various decompositions of cross-country and within-country differences in the Americas. Section IV summarizes evidence on the extent of within-country differences in institutional quality and availability of public goods. Section V introduces our theoretical framework, and Section VI concludes. The Web Appendix contains additional details on data sources and further results.

I. Approaches to Cross-Country and Cross-Region Differences

The dominant empirical approach for examining differences in income and growth rates between countries, and between regions within countries, begins with the neoclassical (Solow) growth model. As is well-known, the neoclassical model has no theory of technology differences and a minimal theory of differences in human capital. Much of its focus is on the dynamics of physical capital. At the cross-country level, N. Gregory Mankiw, David Romer, and David N. Weil (1992) have argued in a seminal contribution that the neoclassical growth model provides a good account for cross-country differences in income per capita without significant technology differences. In another prominent series of contributions, Robert J. Barro and Xavier Sala-i-Martin (1995) suggest that convergence across Organisation for Economic Co-operation and Development (OECD) countries, convergence across US regions, and cross-country growth dynamics can be understood through the closed-economy neoclassical growth model.

[2] See, among others, Edward L. Gibson (2005) and Guillermo O'Donnell (1993). See, also, Acemoglu and James A. Robinson (2008) for a model of de jure and de facto institutional differences, with a discussion of the importance of de facto institutional differences in the development of the US South.

While influential, this emphasis on physical and human capital has been called into question by, among others, Peter J. Klenow and Andrés Rodríguez-Clare (1997) and Robert E. Hall and Charles I. Jones (1999). These authors document that, with reasonable assumptions on aggregate production functions, large technology differences are necessary to account for the significant cross-country differences in income per capita and output per worker, and to account for growth dynamics. Moreover, it is difficult to see how the *closed-economy* neoclassical growth model could provide an informative framework for understanding within-country differences, given the absence of barriers to physical capital mobility within countries.

After documenting the large within-country differences in the Americas, we develop a theoretical framework emphasizing (broadly construed) technology differences at the cross-country and cross-municipality levels. Our approach emphasizes the following potential determinants of income per capita in national and local economies:

- Technological know-how will potentially vary at the national level, thus influencing cross-national income differences.

- Efficiency of production will vary at the national and the subnational levels. We emphasize variation due to institutions (i.e., enforcement of property rights, entry barriers, and freeness and fairness of elections for varying levels of government) and the implied policy outcomes (i.e., the availability of public goods necessary for production and market transactions). Our framework is sufficiently flexible that it can also be used to think about noninstitutional determinants of local productivity, some of which are discussed in Section IV.

- Human capital of the workforce will differ across countries and within countries, in part, because of differences in institutions and policies that affect access to schooling and the costs and benefits of acquiring a marginal unit of education.

In this theoretical framework, national factors, in particular, national institutions and their impact on technology adoption, influence local outcomes, while, in turn, local institutions affect not only local outcomes, but also the overall demand for new technologies and the rate at which they are adopted at the national level.

This framework motivates (and is motivated by) our empirics in Section III. We start with micro data on individual earnings from 17 countries in the Americas. Micro data enable us to decompose labor income inequality into between-country and within-country components, and provide us with a simple methodology for separating the effect of human capital from other factors by controlling for individual-level education and experience. This exercise enables a preliminary decomposition of municipality-level economic differences between those due to education (proxying for factors embedded in workers) and those related to the locality itself.

Our work is related to a large literature on spatial inequality, most of which is focused on variation in incomes within a single country. Notably, for the United States, Antonio Ciccone and Hall (1996) estimate that doubling county employment

density (county labor input divided by county landmass area) increases average labor productivity by 6 percent. This estimated degree of locally increasing returns would account for more than half of the variation in labor productivity across US states. In light of this evidence, Section IV provides a preliminary upper bound estimate of the role of density in explaining spatial inequality in the Americas. Another set of relevant contributions are collected in Ravi Kanbur and Anthony J. Venables (2005), which, in particular, includes two studies for Latin America. Chris Elbers et al. (2005) combine nonincome census data and household survey data on income for Ecuador to produce a measure of well-being, finding that across-census tract inequality in well-being explains about 25 percent of inequality in well-being within Ecuador. Javier Escobal and Maximo Torero (2005) use household expenditure data to investigate the determinants of spatial inequality in Peru, estimating a predominant role for variation in private and public assets, such as roads.

Several studies examine within-country inequality among various countries. Most notably, David De Ferranti et al. (2004) and Juan Luis Londoño and Miguel Székely (2000) document the extent of income inequality over time within a large number of Latin American countries and provide cross-country comparisons.[3] Several features distinguish our paper from these previous studies on Latin American inequality. Through our use of population censuses and living standards measurement surveys, we have access to larger samples and higher quality labor income estimates than the existing literature, which tends to use lower quality sources in order to produce an income panel. Thus, we are able to provide a more systematic and accurate snapshot of inequality patterns. We also confirm our findings using carefully constructed household expenditure data that are more reliable than labor income data for several countries in our sample because a high fraction of the population works in the informal sector. Finally, we are not aware of other studies conducting comparative decompositions of within-municipality and cross-municipality inequality into human capital-related and residual components.

II. Data

We use data on labor income, geo-referenced to the municipality, for 11 countries in the Americas (see Web Appendix Table A1 for the list of countries). We also examine labor income data geo-referenced at the regional level for an additional six countries. Our data are drawn from a number of recent censuses and living standards measurement surveys, all conducted since 2000. A list of sources is provided in Web Appendix Table A1. We limit our attention to labor income, which is typically better reported than total income.[4] Our sample includes all individuals with positive incomes, and for some calculations, we limit the sample to males between the ages of 18 and 55 to reduce selection based on labor force participation. To increase

[3] There is also a literature on inequality across, versus within, countries at the global level. While interesting and important, due to severe data limitations, this literature makes a large number of assumptions when constructing within-country incomes from highly aggregative data.

[4] For Latin America, the data provide information on monthly labor income. So, for these countries there may be greater transitory variability than annual labor income numbers for the United States and Canada.

comparability across countries, we adjust each country's income data so that it averages to GDP per worker in constant international dollars taken from the 2003 Penn World Tables. Population weights are constructed using 2000 GIS population data (Center for International Earth Science Information Network (CIESIN) et al. 2004). Summary statistics are provided in Web Appendix Table A2.

Our baseline results do not deflate incomes for differences in regional purchasing power. Differences in cost of living are important for comparison of living standards across regions, but given our focus on productivity differences (rather than welfare), nationally deflated incomes are more informative. We, nonetheless, confirm the robustness of our general conclusions to deflating incomes using the state median of a household-specific Paasche index constructed from a number of household expenditure surveys.

To examine variation in local public goods, we use geospatial data on intercity roads compiled by the International Center for Tropical Agriculture (CIAT 2008), supplemented with more recent (2006) data on road infrastructure from the Earth Science Research Institute (Mexico) and the Peruvian Ministry of Transport (Peru). These data identify the geographic location of roads as well as their surface type (paved, gravel, or dirt).

III. Within-Country and Between-Country Differences

In this section, we perform two exercises. First, we decompose inequality in labor income into three components: inequality between countries, inequality between municipalities or regions (within countries), and inequality within municipalities/regions. Second, we decompose labor income inequality at each level of geographic aggregation into two components: that explained by observable human capital variables, and the residual.

As is well-known, the set of additively decomposable inequality indices corresponds to the general entropy class of measures. We focus on two commonly used measures within the general entropy class: the Mean Log Deviation (MLD) index and the Theil index. The MLD index of overall inequality in the Americas is

$$MLD = \ln y - \frac{1}{L}\sum_{j=1}^{J}\sum_{m=1}^{M_j}\sum_{i=1}^{L_{jm}} \ln y_{jmi}, \tag{1}$$

where y_{jmi} is the labor income of individual i in municipality m in country j, y is mean labor income in the Americas, and L is total population in the Americas.[5] Similarly, the Theil index of overall inequality in the Americas is

$$T = \sum_{j=1}^{J}\sum_{m=1}^{M_j}\sum_{i=1}^{L_{jm}} \frac{y_{jmi}}{Ly}\ln\left(\frac{y_{jmi}}{y}\right). \tag{2}$$

[5] Since our focus is on labor income inequality, we would have preferred to weight the data by the size of the labor force rather than the size of the overall population. Unfortunately, data on labor force participation are not readily available for much of the Americas at the municipality level.

TABLE 1—LABOR INCOME INEQUALITY (*all individuals*)

	Mean log deviation index				*Theil index*			
	Between country (1)	Within country (2)	Between munic/ region (3)	Within munic/ region (4)	Between country (5)	Within country (6)	Between munic/ region (7)	Within munic/ region (8)
Ref. to municipality								
Actual pop. weights (34.2)	0.292	0.607	0.087	0.520	0.250	0.544	0.058	0.486
Equal pop. weights (28.6)	0.231	0.663	0.113	0.550	0.285	0.622	0.088	0.534
No US (equal) (20.2)	0.054	0.675	0.120	0.555	0.048	0.706	0.114	0.592
Ref. to region								
Actual pop. weights (36.7)	0.206	0.651	0.028	0.623	0.203	0.529	0.016	0.513
Equal pop. weights (32.7)	0.138	0.677	0.037	0.639	0.139	0.615	0.026	0.589
Full sample								
Actual pop. weights (35.0)	0.289	0.613	0.079	0.534	0.253	0.542	0.054	0.488
Equal pop. weights (32.1)	0.210	0.668	0.086	0.582	0.235	0.619	0.061	0.558
No US/CA (equal) (21.6)	0.075	0.685	0.095	0.590	0.071	0.726	0.081	0.645
GDP pwkr/pc—actual pop.		0.263/0.326				0.237/0.287		
GDP pwkr/pc—equal pop.		0.178/0.247				0.183/0.257		

Notes: See Web Appendix Table A1 for sources. The numbers in parentheses give the ratio of the ninetieth percentile of the labor income distribution to the tenth percentile, and columns 1–8 decompose inequality. "Actual" refers to weighting by actual population, whereas "equal" normalizes each country's population to be of equal size.

Let us further define y_{jm} as mean labor income in municipality m in country j, L_{jm} as the number of individuals in municipality m in country j, y_j as mean labor income in country j, and L_j as the number of individuals in country j. Then the MLD and Theil indices can be decomposed into our three desired components of inequality as follows (see the Web Appendix).

$$(3)\quad MLD = \left(\ln y - \sum_{j=1}^{J} \frac{L_j}{L} \ln y_j\right) + \sum_{j=1}^{J} \frac{L_j}{L}\left(\left(\ln y_j - \sum_{m=1}^{M_j} \frac{L_{jm}}{L_j} \ln y_{jm}\right) + \sum_{m=1}^{M_j} \frac{L_{jm}}{L_j} MLD_{jm}\right),$$

where $MLD_{jm} = \ln y_{jm} - \sum_{i=1}^{L_{jm}} \ln y_{jmi}/L_{jm}$ is the MLD index for inequality in municipality m in country j. The first term in equation (3) measures between-country inequality. The second and third terms are between-municipality (within-country) and within-municipality inequality indices, respectively, weighted by country j's population share. Similarly, the Theil index can be decomposed as

$$(4)\qquad T = \sum_{j=1}^{J} \frac{L_j}{L} \frac{y_j}{y}\left(\frac{\ln y_j}{y}\right) + \sum_{j=1}^{J} \frac{L_j}{L} \frac{y_j}{y}\left[\sum_{m=1}^{M_j} \frac{L_{jm}}{L_j} \frac{y_{jm}}{y_j} T_{jm} + \sum_{m=1}^{M_j} \frac{L_{jm}}{L_j} \frac{y_{jm}}{y_j} \ln\left(\frac{y_{jm}}{y_j}\right)\right],$$

where $T_{jm} = \sum_{i=1}^{L_{jm}} (y_{jmi}/L_{jm}y_{jm}) \ln (y_{jmi}/y_{jm})$ is the Theil index for inequality in municipality m in country j. These expressions show that the MLD index weights by population shares, whereas the Theil index weights by income shares.

We begin in Table 1 by examining the ratio between the ninetieth and tenth percentiles of the labor income distribution, as well as the MLD and Theil indices, for all individuals in our sample. We decompose overall inequality in the Americas into its three component parts: inequality across countries, inequality between municipalities/regions (within countries), and inequality within municipalities/regions. When decomposing Western Hemisphere inequality, we consider two population weighting schemes. The first uses actual population, whereas the second assumes equal population in all countries, and reduces the influence of large countries such as Brazil, Colombia, Mexico, and the United States. This latter scheme is similar in spirit to the convention in the growth literature, where different countries are given equal weight. For comparison purposes, we decompose overall inequality separately for the 11 countries geo-referenced to municipalities and for the 6 geo-referenced to regions.[6] At the bottom of the table, we decompose inequality for all countries included in our sample. We also report cross-country inequality of 2000 GDP per worker and 2000 GDP per capita from the Penn World Tables for all countries in the Americas for which data are available. This increases the sample size to 33 for GDP per worker and 37 for GDP per capita primarily by adding Caribbean nations for which we do not have labor income data. The GDP data show that the cross-country inequality pattern in our sample is similar to that for the entire Americas, confirming that cross-country inequality in the subset of countries we examine is similar to that in the Americas as a whole. Web Appendix Table A3 provides additional documentation of inequality patterns, and shows the decomposition of between-municipality and within-municipality inequality separately for each country.

Table 1 documents that for our entire sample, inequality in labor income across countries is about one-half to one-third of the magnitude of inequality within municipalities/regions, and between two to four times as large as inequality across municipalities/regions, depending on the precise sample and weighting scheme. For example, using the MLD index, equal population weights, and focusing on countries with municipality data, overall between-country inequality is 0.23, while within-country inequality is 0.66, 0.11 of which is due to between-municipality inequality. The contribution of the between-municipality component is smaller with the Theil index, which gives greater weight to the top of the distribution, that is, to the United States (recall that the Theil index weights by income shares whereas MLD uses population shares). The larger magnitude of the between-country relative to the between-municipality inequality is driven by the presence of the United States (and Canada when we include countries with data geo-referenced to regions), which is much richer than the remaining countries in our sample. For this reason, decompositions without these two countries might be more informative. These are reported in the third and eighth rows of Table 1. For example, the third row shows that, again focusing on the data with municipality referencing, between-country differences are now about half of the between-municipality differences with the MLD and Theil indices (0.05 versus 0.12 with MLD and 0.05 versus 0.11 with Theil). Web

[6] Bolivia, Brazil, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, the United States, and Venezuela have data geo-referenced to the municipality. For Canada, Chile, Colombia, Costa Rica, Ecuador, and Uruguay, the data are geo-referenced to larger regions.

TABLE 2—INEQUALITY DECOMPOSITION, THEIL INDEX (*Males 18–55*)

	Labor income			*Predicted labor income*			*Residual labor income*		
	Between country (1)	Between munic/ region (2)	Within munic/ region (3)	Between country (4)	Between munic/ region (5)	Within munic/ region (6)	Between country (7)	Between munic/ region (8)	Within munic/ region (9)
Ref. to municipality									
Brazil		0.125	0.708		0.043	0.261		0.044	0.461
Mexico		0.115	0.629		0.018	0.124		0.081	0.561
Panama		0.078	0.452		0.020	0.152		0.025	0.305
United States		0.050	0.365		0.005	0.104		0.020	0.291
Venezuela		0.030	0.913		0.002	0.024		0.024	0.879
Mun. (actual)	0.265	0.067	0.424	0.170	0.015	0.131	0.033	0.040	0.389
Mun. (equal)	0.301	0.105	0.474	0.166	0.040	0.142	0.041	0.053	0.404
No US (equal)	0.042	0.136	0.535	0.031	0.053	0.157	0.040	0.057	0.421
Ref. to region									
Canada		0.005	0.295		0.000	0.090		0.004	0.242
Region (actual)	0.234	0.019	0.485	0.105	0.004	0.122	0.043	0.013	0.422
Region (equal)	0.174	0.030	0.592	0.077	0.007	0.138	0.033	0.016	0.511
All (actual)	0.271	0.062	0.430	0.163	0.014	0.130	0.040	0.037	0.392
All (equal)	0.264	0.076	0.519	0.158	0.026	0.140	0.045	0.043	0.433
No US/CA (equal)	0.065	0.104	0.636	0.081	0.035	0.158	0.042	0.050	0.467

Notes: See Web Appendix Table A1 for sources. Columns 1–3 decompose the Theil index for labor income inequality, and columns 4–9 do the same for predicted labor income inequality and residual labor income inequality, respectively. "Actual" refers to weighting by actual population, whereas "equal" normalizes each country's population to be of equal size.

Appendix Table A4 shows a similar pattern when the data are deflated using regional price indices.

One important concern with the above inequality decompositions is that measurement error and transitory income shocks may be inflating the magnitude of within-municipality inequality. To investigate this concern, we followed the methodology proposed by Angus Deaton and Salman Zaidi (2002) to carefully construct, item by item, a comparable measure of household expenditure for a number of countries in the Americas. Inequality decompositions for household expenditure, similar to those reported for labor income in Table 1, are presented in Web Appendix Table A5. As expected given concerns about measurement error, the magnitude of within-municipality inequality in household expenditure is less than that in labor income. Nevertheless, the overall comparative patterns are similar, as within country inequality in household expenditure is substantially greater than inequality between countries.[7]

Table 2 limits our sample to males between the ages of 18 and 55 to compare incomes across a more homogenous population (particularly in terms of hours worked). Using this subsample, we perform the decomposition between predicted and residual incomes. Recall that y_{jmi} is labor income of individual i in municipality

[7] Results (available upon request) documenting educational inequality for 19 countries in the Americas, 11 of which have micro-level census data, show that inequality in education attainment across municipalities in Latin America is about twice as large as inequality in educational attainment across countries, and this pattern is reversed when the United States is included.

m in country j. Let $\mathbf{X}_{jmi}$ denote a vector of detailed education categories (in particular, zero to four years of schooling, four to eight years of schooling, some high school, high school graduate, and one or more years of higher education). Let $exper_{jmi}$ denote potential experience (defined, as usual, as age-schooling completed–6). We then decompose labor income into predicted and residual components by running the following flexible regression, which allows for a full set of interactions between education categories and a quartic in potential experience, separately for each country j:

$$\ln y_{jmi} = \sum_{k=1}^{4} \mathbf{X}'_{jmi} (exper_{jmi})^k \beta_{jk} + \delta_j + \varepsilon_{jmi}, \tag{5}$$

where δ_j is a country-specific constant, and ε_{jmi} has zero mean and country-specific variance.

Given estimates from equation (5), we examine inequality in overall labor income (y_{jmi}), inequality in predicted labor income $(\exp(\sum_{k=1}^{4} \mathbf{X}'_{jmi} (exper_{jmi})^k \hat{\beta}_{jk}))$, and inequality in residual income $(\exp(\hat{\delta}_j + \hat{\varepsilon}_{jmi}))$. Notice that country-specific constants, which are unrelated to differences in human capital, are part of residual income.

Table 2 uses the Theil index to decompose each of the components of income (overall, predicted, and residual) into inequality between countries, inequality between municipalities/regions (of countries), and inequality within municipalities, reporting results by country only for the six countries with micro census data (and large within-municipality samples).[8] Inequality in overall labor income is similar to that reported in Table 1, where we do not restrict the sample to prime-aged males. The decomposition shows sizable between-country predicted labor income differences, which become much smaller when the United States is excluded. The magnitude of between-country residual inequality is somewhat smaller (when comparing across all countries in the sample).[9] The magnitudes of between municipality inequalities in predicted and residual labor income are similar. Table 2 also shows that the bulk of the within-municipality differences are due to residual factors. This may reflect a greater dispersion in unobserved skills, labor market imperfections and discrimination, measurement error, or some combination thereof.

Overall, our evidence suggests that years of schooling and the experience of the labor force can explain a significant fraction of income disparities across and within countries, but residual factors are also significant and generally of comparable magnitude. Although these residuals undoubtedly include a component of unmeasured human capital differences within countries, they also likely reflect the effects of local factors impacting productive efficiency.

IV. Determinants of Interregional Differences

The large differences in labor incomes and residual incomes documented in the previous section are unlikely to be entirely due to differences in the physical capital

[8] Results using the MLD index are similar and available upon request.

[9] Notice that the decomposition between predicted and residual incomes is not additive, since we are taking exponential transformations of predicted and residual log incomes before the decomposition.

intensity of production, given the absence of barriers to capital mobility within countries. Instead, they likely reflect the influence of certain local factors, the nature of which will be discussed further in this section. We focus on determinants of cross-municipality differences. While within-municipality differences are also clearly ineresting and important, space constraints preclude their treatment here.

One possibly relevant local characteristic is the density of economic activity across regions, as emphasized, for example, by Ciccone and Hall (1996).[10] To examine this issue, Web Appendix Table A6 repeats the decomposition of predicted and residual inequality, adding a control for municipal-level population density to equation (5).[11] The patterns, when population density is included in the predicted component of income, are very similar to those in Table 2. This exercise suggests that the bulk of the between-municipality differences in income in the Americas is not accounted for by differences in population density (or more generally, in the density of employment, which is likely to be strongly correlated with population density).[12]

Our argument is that in the same way technology differences play an important role in shaping cross-national economic differences, they also likely play a major role in within-country differentials. We now investigate why there may be significant within-country differences in technology, broadly construed. We would ideally document the correlation between various aspects of local institutions and incomes, but unfortunately there do not yet exist uniformly constructed, municipality-level measures of institutions in the Americas. We, instead, use a novel dataset on road infrastructure to measure the within-country inequality in proximity to paved roads, an important form of public infrastructure, and the correlation between proximity to roads and labor income. Local institutions affect investments in road infrastructure and other public goods by influencing the incentives of government officials to provide public goods (related to corruption and accountability), the capacity of the local government to raise revenues to finance public investment (from local taxes or transfers from the central government), and the incentives and opportunities of citizens to effectively demand public goods from local and national politicians.

Table 3 documents substantial differences across municipalities in proximity to paved roads.[13] We calculate each municipality's proximity to intercity paved roads by overlaying a 1 km $\times$ 1 km grid on the Americas, calculating the distance (allowing for changes in elevation) from each grid cell's centroid to the closest paved road, and

[10] Other factors that have been emphasized for explaining cross-country differences include geography and culture. Regarding natural resources, Francesco Caselli and Guy Michaels (2008), find that in Brazil, discovery of oil in a municipality increases municipal public expenditures but has little impact on measured citizen well-being. Dell, Benjamin F. Jones, and Benjamin A. Olken (2009), document a statistically significant cross-sectional correlation between climate and income within a number of countries examined in this study using the same economic dataset. The quantitative magnitudes they report, though not trivial, suggest that climate cannot explain the full spatial variation in the data. This leaves significant scope for the institutional factors that we examine. The effects of culture (belief systems) have also been emphasized recently (e.g., Tabellini 2006).

[11] Ideally, we would control for employment density, but this information is not available at the municipal level for much of the Americas.

[12] Results (available upon request) are also similar when we estimate inequality separately for urban and rural areas.

[13] Results (available upon request) are similar when we consider both paved and gravel roads.

Table 3—Proximity to Paved Roads

				MLD index		Theil index		Income regressions	
	Mean dist. to road (1)	SD dist. to road (2)	90/50 ratio (3)	Between country (4)	Within country (5)	Between country (6)	Within country (7)	Baseline (8)	Controls (9)
Brazil	29.3	64.1	7.9		0.956		1.049	−0.022	−0.019
								(0.004)	(0.003)
Mexico	9.5	9.9	3.2		0.382		0.379	−0.124	−0.096
								(0.011)	(0.010)
Panama	12.4	23.2	3.0		0.643		0.756	−0.157	−0.138
								(0.026)	(0.025)
United States	1.5	3.3	3.4		0.914		0.795	−0.080	−0.076
								(0.026)	(0.021)
Venezuela	11.1	26.2	2.7		0.508		0.747	−0.017	0.010
								(0.006)	(0.006)
All (actual)	13.2	36.5	6.4	0.621	0.774	0.439	0.815		
All (equal)	18.6	37.8	5.8	0.311	0.649	0.286	0.656		
No US (equal)	19.7	38.6	5.6	0.240	0.634	0.249	0.655		

Notes: See Web Appendix Table A1 and the text for sources. The unit of measurement for distance is kilometers. Column 3 presents the ratio of the ninetieth percentile of the proximity to paved roads distribution to the fiftieth percentile. Columns 4–7 decompose inequality, using the MLD index and the Theil index, respectively. Column 8 includes state fixed effects; and column 9 includes state fixed effects, geographic controls for municipal elevation, slope, and mean temperature and precipitation between 1950 and 2000, and a full set of age dummies. The sample in columns 8 and 9 is limited to males between the ages of 18 and 55. "Actual" refers to weighting by actual population, whereas "equal" normalizes each country's population to be of equal size. The final row omits the United States from the sample. Robust standard errors, adjusted for clustering by municipality, are in parentheses.

then averaging this distance over all grid cells contained within the municipality.[14] In Table 3, we conserve space by reporting the numbers by country only for the five countries with census income data geo-referenced to the municipality. The numbers for all countries in our sample are given in Web Appendix Table A7, and the overall inequality decompositions in the final three rows of Table 3 are for this full sample of Latin American countries and the United States. The first and second columns of Table 3 report the mean and standard deviation of municipal-level proximity to paved road networks for Brazil, Mexico, Panama, the United States, Venezuela, and the Americas overall. Column 3 presents the ninetieth to the fiftieth percentile ratio, and columns 4–7 decompose inequality in proximity to paved roads into inequality across countries and inequality across municipalities within countries.[15]

Not surprisingly, the United States is, on average, the most proximate to paved roads. Of the five countries reported in Table 3, Brazil is the least proximate to paved roads. Inequality in proximity to paved road networks across municipalities in Latin America is about 2.5 times as large as inequality across countries and remains higher than inequality across countries even when the United States is included. Nevertheless, these patterns may reflect geographic factors (e.g., building roads is easier and more useful on the coasts than in the Amazon), and may be unrelated to

[14] The correlations between individual incomes and roads are similar when we calculate road network density, the municipality's total kilometers of paved roads divided by the surface area of the municipality.

[15] Note that in contrast to the previous tables, there is no within municipality variation in road networks since proximity is measured at the municipal level.

productivity and income differences. We undertake a preliminary investigation of this issue in columns 8 and 9 by computing the partial correlations between proximity to paved roads and the log of individual incomes for males between the ages of 18 and 55 in the 5 countries with census income data geo-referenced to the municipality.[16] Column 8 includes state fixed effects. States (there are 27 in Brazil, 32 in Mexico, 9 in Panama, and 23 in Venezuela) are geographically small, and including state fixed effects ensures that we are comparing municipalities in close geographic proximity. To further control for geographic characteristics that may affect the density of road networks, column 9 also includes municipal-level controls for elevation, slope, and mean annual temperature and precipitation between 1950 and 2000 (see the Web Data Appendix for sources), as well as a full set of age dummies. The correlation between distance to roads and incomes is negative and highly significant for all countries (except Venezuela in column 9). Translating these correlations into elasticities suggests that increasing a municipality's average distance from paved roads by 1 percent reduces labor income of prime-aged males by 0.06 percent in Brazil, 0.09 percent in Mexico, and 0.14 percent in Panama.

Naturally, these elasticities do not reflect the causal effect of proximity to roads on income. First, proximity to roads is likely correlated with the availability of other public goods, and we interpret it as a proxy for a bundle of public goods. Second, there are several other reasons, unrelated to the availability of public goods and local institutions, why proximity to roads may be correlated with incomes (even after we control for observable factors). Estimating the causal impact of roads (or local public goods more generally) on incomes is beyond the scope of this paper. Instead, we summarize several recent studies that provide detailed empirical evidence relating institutions to local public goods and economic prosperity within particular countries.

Dell (2008) utilizes a regression discontinuity approach to examine the long-run impacts of the *mita*, an extensive forced mining labor system in effect in Peru and Bolivia during the colonial era. She estimates that a *mita* effect lowers household consumption today by about one-third in subjected districts. *Mita* districts historically had fewer large landowners and lower educational attainment. Today they are less integrated into road networks, and their residents, who face difficulties in transporting crops to markets due to poor road infrastructure, are substantially more likely to be subsistence farmers. Outside of Latin America, Abhijit Banerjee and Lakshmi Iyer (2005) similarly show that colonial land revenue systems in India have long-run effects on investments in health and education infrastructure. Acemoglu et al. (2007) find a robust association between political inequality in the nineteenth century in Cundinamarca, Colombia (measured by the lack of turnover of mayors in the municipalities) and economic outcomes today. They also provide evidence consistent with Dell's (2008) findings that the availability of local public goods might

[16] We limit the sample to prime-aged males to decrease selection on labor force participation. Results (available upon request) are similar when all individuals with positive incomes are included in the sample.

be a particularly important intervening channel. Similar correlations are obtained for Brazil by Joana Naritomi, Rodrigo R. Soares, and Juliano J. Assunção (2007).[17]

Our findings are also broadly consistent with a large literature on the impact of infrastructure on economic outcomes. In a series of studies on Peru (summarized in the Escobal and Torrero chapter in Kanbur and Venables (2005)), Escobal empirically connect poor local road infrastructure to higher transaction costs, lower market participation, and reduced household income. Other studies of the effects of local public goods include, among others, Esther Duflo and Rohini Pande (2007), which examines the effects of dams in India, and Dave Donaldson (2008), which analyzes the impact of railroads in colonial India.

V. Toward a Framework

In this section, we provide a simple framework to interpret cross-country and cross-municipality income differences and their dynamics, and to highlight the two-way interaction between local and national outcomes.[18] The framework builds on endogenous technological change models (e.g., Philippe Aghion and Peter Howitt 1992; Gene M. Grossman and Elhanan Helpman 1993; and Paul M. Romer 1990), and on the model of international technological diffusion presented in Acemoglu (2008, ch. 18). Motivated by the empirical results in Section III and the discussion in Section IV, we consider a model that explicitly distinguishes countries as well as regions within countries. In addition, we delineate productivity differentials resulting from technology, human capital embedded in workers, and local differences in public goods and institutions. Physical capital differences, which are the main factor emphasized by the neoclassical growth model, are omitted from this framework.

We consider an infinite-horizon world economy in continuous time. There are J countries indexed by $j = 1, 2, \ldots, J$, and M_j regions (municipalities) in country j indexed by $m = 1, \ldots, M_j$. Population in each country is normalized to one, and there is no population growth. We assume that all countries and regions produce a single final good denoted by Y, and the aggregate production function of region m in economy j at time t is

$$Y_{j,m}(t) = \frac{(\gamma_{j,m})^{\beta}}{1-\beta}\Big(\int_0^{N_j(t)} x_{j,m}(\nu,t)^{1-\beta} d\nu\Big)(h_{j,m} L_{j,m})^{\beta}, \tag{6}$$

where $L_{j,m}$ is labor input, which varies across regions; $h_{j,m}$ is the efficiency of labor, determined by education, public goods, and other institutional factors that can vary

[17] Also relevant is the political science literature on subnational institutional variation in Latin America. Gibson (2005) has developed a theoretical framework for examining "subnational authoritarianism," defined as the persistence of authoritarian regional governments in a nationally democratic society, and has emphasized large differences across Argentine provinces and Mexican states in the extent to which elections are fair and competitive, elected local authorities are protected from arbitrary removal by regional authorities, and the judicial system is accessible and independent. Similarly, O'Donnell (1993) has classified regions of Latin America based on the functioning of rule of the law, documenting substantial differences within countries.

[18] While the within-municipality differences are important, they are not our focus here.

across regions and countries; and $\gamma_{j,m}$ is a region-specific productivity term. While the $\gamma_{j,m}$'s could incorporate a number of characteristics affecting regional productivity, in accordance with the empirical evidence in Section IV, we focus on one interpretation of the $\gamma_{j,m}$'s: efficiency terms reflecting local institutions and policies (e.g., the provision of local public goods or security of property rights). In equation (6), the variable γ is raised to the power β in order to simplify the expressions that follow. This is without any loss of generality, since γ has no natural scale. Our population normalization implies that $\sum_{m=1}^{M_j} L_{j,m} = 1$. For now, we also ignore migration across regions.

The functional form in (6) is similar to the standard Dixit-Stiglitz aggregator used in endogenous growth models. Similarly, $N_j(t)$ denotes the number of machine varieties available to country j at time t. This variable captures the technological know-how of country j. Technology diffuses slowly across countries and producers can only use the technologies available in their country. This implies that N_j, and thus the available technology, varies across countries. However, once a country has a particular level of technology, it can be used in all regions in the country.[19] Finally, $x_{j,m}(\nu, t)$ is the total amount of machine variety ν used in region m in country j at time t. To simplify the analysis, let us suppose that the x's depreciate fully after use.

Each machine variety in economy j is owned by a technology monopolist, who will sell machines embodying this technology at the profit-maximizing (rental) price $p_j^x(\nu, t)$ in all regions within the country. We assume that there are no regional taxes on machines or differences in transport costs, thus machine prices will be the same across regions.[20] The monopolist can produce each unit of the machine at a marginal cost of ψ in terms of the final good, and without any loss of generality, we normalize $\psi \equiv 1 - \beta$.

We assume that each country admits a representative household with constant relative risk aversion (CRRA) preferences, with the same degree of risk aversion (intertemporal elasticity of substitution) and the same discount rate across countries. In particular, preferences at time $t = 0$ are given by $\int_0^\infty \exp(-\rho t)[(C_j(t)^{1-\theta} - 1)/(1 - \theta)]dt$, with $\rho > 0$ and $\theta \geq 0$. Although, so far, our empirical investigation has emphasized income inequality, our focus here is on differences in productivity across regions. Thus, differences in the saving and consumption behavior of households within a country are not central to our framework, and the representative household assumption enables us to suppress these. In addition, there is no international trade in goods (all countries produce the same final good) or in assets (thus, no international borrowing or lending). This implies that the following resource constraint must hold for each country j at each time t:

$$C_j(t) + X_j(t) + \zeta_j Z_j(t) \leq Y_j(t), \tag{7}$$

[19] Thus, there is no slow diffusion of technology across regions within a country, though differences in region-specific productivity embedded in the $\gamma_{j,m}$'s can capture such slow diffusion.

[20] Again, any such differences can be incorporated into the $\gamma_{j,m}$'s.

where $X_j(t)$ is spending on inputs at time t; and $Z_j(t)$ is expenditure on technology adoption at time t, which may take the form of R&D or other technology expenditures. The parameter ζ_j measures country-level distortions or institutional and policy differences, and will be a key driver of potential technology differences.

Technology in country j evolves as a result of the technology adoption decisions of profit-maximizing firms. In particular, the innovation possibilities frontier takes the form

$$\dot{N}_j(t) = \eta_j \left(\frac{N(t)}{N_j(t)} \right)^{\varphi} Z_j(t), \tag{8}$$

where $N(t)$ is an index of the world technology frontier, $\eta_j > 0$ for all j, and $\varphi > 0$ and common to all economies. This form of the innovation possibilities frontier implies that the technological know-how of country j advances as a result of the R&D and other technology-related expenditures of firms in the country. The effectiveness of these investments depends on a country-specific constant, $\eta_j > 0$, and more importantly, on how advanced the world technology frontier is relative to country j's technological know-how (captured by the term $N(t)/N_j(t)$). Each economy starts with some initial technology stock $N_j(0) > 0$, and there is free entry into research so that any firm can invest in R&D (denoted by $Z_j(t)$) and adopt new technologies according to the innovation possibilities frontier (8).

Since world growth is not the focus here, suppose that the world technology frontier advances (or frontier varieties grow) at an exogenous rate $g > 0$, that is,

$$\dot{N}(t) = gN(t). \tag{9}$$

Finally, we also assume that factor markets are competitive. The interest rate and the wage rate per unit of human capital in country j are denoted, respectively, by $r_j(t)$ and $w_j(t)$.

An equilibrium consists of sequences of technology levels, R&D levels, machine prices, interest rates and wage rates for each country, and machine demands and output levels for each region, such that final good firms and technology monopolists maximize profits, there is free entry into technology adoption, and the representative household in each country maximizes its discounted utility. A balanced growth path equilibrium (BGP) refers to an equilibrium path in which each country grows at a constant rate. In thinking about the cross-country and cross-region differences, comparisons of economies in BGP are a natural starting point.

It is straightforward to verify that in any equilibrium technology monopolists, who face iso-elastic demand curves for their machines, will set a constant markup over marginal cost $\psi \equiv 1 - \beta$, and the equilibrium price of every machine in each country at each point in time will be $p_j^x(\nu, t) = 1$. Given equation (6), this also implies that the demand for machines in each region of each country that will maximize the profits of the final good producers will be

$$x_{j,m}(\nu, t) = \gamma_{j,m} h_{j,m} L_{j,m}. \tag{10}$$

This implies the intuitive result that there will be more intensive use of technologies when workers have greater human capital and when local conditions are more favorable for business. Consequently, a technology monopolist (for machine variety ν) in country j will make the following level of profits at every point in time: $\pi_j(\nu,t) = \beta\sum_{m=1}^{M_j}\gamma_{j,m}h_{j,m}L_{j,m}$, where β is the difference between price and marginal cost (1 and $\psi \equiv 1-\beta$), while the summation gives the total machine sales of this monopolist, which follows from equation (10).

Let us start with the BGP. It is straightforward to verify that, given equation (8), all countries must grow at the same rate g as given in equation (9). The CRRA preferences of the representative household imply the standard Euler equation, which gives the growth rate of consumption of each country at each point in time as $\dot{C}(t)/C(t) = (r_j(t)-\rho)/\theta$. In the BGP, output and consumption in each country grow at the rate g, so the interest rates must also be constant and equal to

$$r^* = \rho + \theta g. \tag{11}$$

Consequently, the value of a technology monopolist in BGP in country j is

$$V_j^* = \frac{\beta\sum_{m=1}^{M_j}\gamma_{j,m}h_{j,m}L_{j,m}}{r^*}.$$

Combining this expression with the innovation possibilities frontier in equation (8), we obtain that country j's relative technology $\mu_j \equiv N_j(t)/N(t)$ in BGP will be

$$\mu_j^* = \left(\frac{\eta_j\beta\sum_{m=1}^{M_j}\gamma_{j,m}h_{j,m}L_{j,m}}{\zeta_j r^*}\right)^{1/\varphi}, \tag{12}$$

with r^* given by (11). In addition, it can also be proved that this BGP allocation is globally saddle-path stable, in the sense that starting with any strictly positive vector of initial technology levels $\{N_j(0)\}_{j=1}^J$, there exists a unique equilibrium path converging to this BGP.[21]

What does this BGP allocation imply for cross-country and cross-region inequality? The above derivation immediately establishes that the level of income per capita in region m in country j in the BGP is

$$y_{j,m}^* = \frac{\beta^{1/\varphi}}{1-\beta}\left(\frac{\eta_j\sum_{m=1}^{M_j}\gamma_{j,m}h_{j,m}L_{j,m}}{\zeta_j r^*}\right)^{1/\varphi}(\gamma_{j,m}h_{j,m})N(0). \tag{13}$$

[21] The proof of this result follows the similar derivation in Acemoglu (2008, ch. 18).

Then, summing across regions, total income in country j in the BGP is

$$y_j^* = \frac{\beta^{1/\varphi}}{1-\beta}\left(\frac{\eta_j}{\zeta_j r^*}\right)^{1/\varphi}\left(\sum_{m=1}^{M_j}\gamma_{j,m}h_{j,m}L_{j,m}\right)^{(1+\varphi)/\varphi}N(0). \tag{14}$$

These expressions give the theoretical counterparts of the regional (municipal) and national labor incomes we computed and compared in Section III, and can be used to develop more structural links between our theoretical framework and between- and within-country differences. They highlight that countries that have better possibilities for adopting world technologies (higher η_j's), where firms face less severe barriers to adopting technologies (lower ζ_j's) and have, on average, better local institutions (higher $\gamma_{j,m}$'s) and workers with greater human capital (higher $h_{j,m}$'s), will tend to be richer. Within a country, all regions share the same technology N_j, so it will be those regions that have better local institutions (higher $\gamma_{j,m}$'s) and those that have workers with higher human capital (higher $h_{j,m}$'s) that will be richer. This framework also emphasizes the two-way interaction between national and local factors. First, two regions (j,m) and (j',m') that have identical characteristics, but are situated in different countries, will have different income levels because they will have access to different country-level technologies. Second, a country with a number of regions with low $\gamma_{j,m}$'s and $h_{j,m}$'s will generate a lower demand for machines embodying new technologies (as shown by equation (10)), and this will reduce the profitability of adopting technologies from the world frontier at the national level and will tend to reduce national income. This channel also suggests that if within-country inequalities are caused by the failure of some regions to offer good business conditions, public goods, and a workforce with the requisite skills, then this will tend to reduce income in the country directly (because some regions are poorer) and indirectly (because technology adoption at the national level becomes less profitable).[22]

The framework presented above does not allow for migration across municipalities. A natural question is whether migration would affect cross-municipality differences in income and output. One may conjecture that differences due to local institutions and policies (the γ's in the model) would be arbitraged away when migration is possible. This is not necessarily the case, however, as a variety of factors make movement across municipalities costly. First, in parts of Latin America, there are explicit barriers to migration.[23] Second, and more importantly, migration will arbitrage all differences due to the γ's only when there are no differences in the cost of living and housing across municipalities. In practice, both housing costs and the prices of other goods and services differ significantly across regions.

[22] The magnitude of the indirect channel in practice will depend on the extent to which firms produce for the domestic market. Openness, defined as imports plus exports as a share of GDP (Alan Heston, Robert Summers,a nd Bettina Aten 2006) ranges considerably across the countries we consider in our empirical analysis, from around 20 percent in Argentina, 25 percent in Brazil and the United States, and 40 percent in Bolivia, Colombia, and Venzuela to about two-thirds in Mexico, Chile, and El Salvador.

[23] Notably, in regions where a substantial portion of the land is held by indigenous communities, there are legal and traditional impediments to selling land to outsiders, making larger cities, which often have significant disamenities, the main viable destinations for migration.

Recognizing that migration, even if it could take place without any impediments, would not lead to an equalization of nonhuman capital incomes (when not deflated fully), and implies that regional differences will have two components: those due to human capital differences (and other factors mobile with workers) and those due to differences in local conditions. These correspond to the influences of the h's and γ's in the model. We can then map the differences due to the h's to those related to education and the differences due to the γ's to the residual differences obtained in Section III after we removed the influence of education and experience. In particular, our decomposition suggests that the cross-municipality variation accounted for by these two sources are broadly similar.

VI. Concluding Remarks

This study used a novel dataset of labor incomes to document within-country (cross-municipality) income differences for a large number of countries in the Americas. Within Latin America, between-municipality differences in incomes are greater than cross-country differences. We documented that about half of the between-country and between-municipality differences can be accounted for by differences in human capital, the remainder being due to residual factors. We also proposed a simple unified framework for the analysis of cross-country and within-country income differences that emphasizes the importance of the efficiency of production. Productive efficiency is determined at the country level by the technology adoption decisions of profit-maximizing firms and by national institutions, and within countries by local institutions, such as the availability of local public goods and the security of property rights.

Future research could follow a number of promising paths for identifying the underlying determinants of local productivity differences. The empirical and qualitative evidence suggests that differences in local public goods—determined, in part, by institutions at the local and regional level—are one source of within-country differences. Such patterns call for more systematic measurement and empirical investigation of specific institutional features at the subnational level, as well as new theoretical work modeling the impact and endogenous determination of these local forces.

REFERENCES

Acemoglu, Daron. 2008. *Introduction to Modern Economic Growth*. Princeton, NJ: Princeton University Press.

Acemoglu, Daron, María Angélica Bautista, Pablo Querubín, and James A. Robinson. 2007. "Economic and Political Inequality in Development: The Case of Cundinamarca, Colombia." National Bureau of Economic Research Working Paper 13208.

Acemoglu, Daron, and James A. Robinson. 2008. "Persistence of Power, Elites, and Institutions." *American Economic Review*, 98(1): 267–93.

Aghion, Philippe, and Peter Howitt. 1992. "A Model of Growth through Creative Destruction." *Econometrica*, 60(2): 323–51.

Banerjee, Abhijit, and Lakshmi Iyer. 2005. "History, Institutions, and Economic Performance: The Legacy of Colonial Land Tenure Systems in India." *American Economic Review*, 95(4): 1190–1213.

Barro, Robert J., and Xavier Sala-i-Martin. 1995. *Economic Growth*. Hightstown, NJ: McGraw-Hill College.

Caselli, Francesco, and Guy Michaels. 2008. "Resource Abundance, Development, and Living Standards: The Case of Brazil." http://cep.lse.ac.uk/seminarpapers/21-10-08-CAS.pdf.

Center for International Earth Science Information Network (CIESIN), Columbia University; International Food Policy Research Institute (IFPRI), the World Bank; and Centro Internacional de Agricultura Tropical (CIAT). 2004. *Global Rural-Urban Mapping Project (GRUMP): Alpha Version: Population Grids.* Database, hosted by Socioeconomic Data and Applications Center (SEDAC). Palisades, NY: CIESIN, Columbia University. http://sedac.ciesin.columbia.edu/gpw. (accessed May 10, 2007.)

Center for Tropical Agriculture (CIAT). 2008. *Latin America and the Caribbean Roads Database*. Center for Tropical Agriculture.

Ciccone, Antonio, and Robert E. Hall. 1996. "Productivity and the Density of Economic Activity." *American Economic Review*, 86(1): 54–70.

Deaton, Angus, and Salman Zaidi. 2002. *Guidelines for Constructing Consumption Aggregates for Welfare Analysis*. World Bank Living Standards Measurement Study Working Paper 135. http://wwwwds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2002/07/31/000094946_02071304010552/Rendered/PDF/multi0page.pdf.

De Ferranti, David, Guillermo E. Perry, Francisco H. G. Ferreira, and Michael Walton, ed. 2004. "Different Lives: Inequality in Latin America." In *Inequality in Latin America: Breaking with History?*, 35–71. Washington, DC: World Bank Publications.

Dell, Melissa. 2008. "The Persistent Effects of Peru's Mining *Mita*." http://econ-www.mit.edu/files/3144.

Dell, Melissa, Benjamin F. Jones, and Benjamin A. Olken. 2009. "Temperature and Income: Reconciling New Cross-Sectional and Panel Estimates." *American Economic Review*, 99(2): 198–204.

Donaldson, Dave. 2008. "Railroads of the Raj: Estimating the Impact of Transportation Infrastructure." http://personal.lse.ac.uk/DONALD1S/railroadsoftheraj.pdf.

Duflo, Esther, and Rohini Pande. 2007. "Dams." *Quarterly Journal of Economics*, 122(2): 601–46.

Elbers, Chris, Peter Langjouw, John Mistiaen, Berk Ozler, and Ken Simler. 2005. "Are Neighbors Equal? Estimating Local Inequality in Three Developing Countries." In *Spatial Inequality and Development*, ed. Ravi Kanbur and Anthony Venables, 37–60, New York: Oxford University Press.

Escobal, Javier, and Maximo Torero. 2005 "Adverse Geography and Differences in Welfare in Peru." In *Spatial Inequality and Development*, ed. Ravi Kanbur and Anthony Venables, 17–122. New York, Oxford University Press.

Gibson, Edward L. 2005. "Boundary Control." *World Politics*, 58(1): 101–32.

Grossman, Gene M., and Elhanan Helpman. 1993. *Innovation and Growth in the Global Economy.* Cambridge, MA: MIT Press.

Hall, Robert E., and Charles I. Jones. 1999. "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *Quarterly Journal of Economics*, 114(1): 83–116.

Heston, Alan, Robert Summers, and Bettina Aten. 2006. *Penn World Table Version 6.2*. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Kanbur, Ravi, and Anthony J. Venables, ed. 2005. *Spatial Inequality and Development*. New York: Oxford University Press.

Klenow, Peter J., and Andrés Rodríguez-Clare. 1997. "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?" In *NBER Macroeconomics Annual 1997*, ed. Ben S. Bernanke and Julie Rotemberg, 73–114. Cambridge, MA: MIT Press.

Londoño, Juan Luis, and Miguel Székely. 2000. "Persistent Poverty and Excess Inequality: Latin America, 1970–1995." *Journal of Applied Economics*, 3(1): 93–134.

Mankiw, N. Gregory, David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics*, 107(2): 407–37.

Naritomi, Joana, and Rodrigo R. Soares, and Juliano J. Assunção. 2007. "Rent Seeking and the Unveiling of 'De Facto' Institutions: Development and Colonial Heritage within Brazil." National Bureau of Economic Research Working Paper 13545.

O'Donnell, Guillermo. 1993. "On the State, Democratization and Some Conceptual Problems: A Latin American View with Glances at Some Postcommunist Countriest." *World Development*, 21(8): 1355–69.

Romer, Paul M. 1990. "Endogenous Technological Change." *Journal of Political Economy*, 98(5): S71–102.

Tabellini, Guido. 2006. "Culture and Growth in the Regions of Europe." Unpublished.