CHAPTER 21

Cities in Developing Countries: Fueled by Rural–Urban Migration, Lacking in Tenure Security, and Short of Affordable Housing

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Abstract

This chapter surveys and synthesizes existing research on urbanization and housing in developing countries. The goal is to provide a unified overview of the principal urban issues that arise in developing countries, painting a coherent picture that can provide a starting point for policy analysis. The chapter covers empirical work on rural–urban migration, theoretical research on migration and city-size determination, theoretical and empirical work on tenure security and squatting, and the issue of housing affordability.

Keywords

Rural–urban migration, Squatting, Property rights, Housing affordability, Land-use regulations

JEL Classification Codes

R1, O18

21.1. INTRODUCTION

According to the World Bank (2013), developing countries must prepare to house an additional 2.7 billion people between now and 2050, as migrants move in unprecedented numbers from rural areas to pursue their hopes and aspirations in cities. While many migrants seek the jobs that cities can offer, others come in search of public services not available in rural areas or seeking refuge from climate shocks that increase the vulnerability of rural livelihoods. Surging populations will place intense pressure on basic services and urban infrastructure at a time when developing-country cities still lack the resources and institutions to provide all the new arrivals with access to jobs, housing, and basic services. In fact, international evidence highlights that much urbanization takes place early in development, before countries have reached middle incomes (World Bank, 2008). As a result, migrants often settle in slums and squatter areas, which may provide inadequate shelter and lack security of tenure. The United Nations estimates that at least 860 million people live in slums across the developing world, with the number of slum dwellers growing by 6 million each year from 2000 to 2010 (United Nations Habitat, 2012). In sub-Saharan Africa, slum populations are estimated to be growing at 4.5% per annum, projected to double every 15 years (Marx et al., 2013).

While such settlements are not new in the history of rapidly growing cities, their persistence is as much an outcome of policy failures that restrict the supply of affordable housing as it is a result of surging urban populations, as argued by Hammam (2013). Improving the living conditions of slum dwellers by improving access to affordable housing is thus an imperative for urban policy. Housing also plays an important role in economic development as it is predominantly a private, household investment and usually the largest asset for most households. Some estimates suggest that housing often accounts for half a country's tangible capital stock and one-fifth to one-third of gross fixed capital formation and generates services equal to 10–30% of consumption expenditure (Malpezzi, 2012).

The purpose of this chapter is to survey and synthesize existing research on these aspects of urbanization in developing countries. The goal is to provide a unified overview of the principal urban issues that arise in developing countries, painting a coherent picture that can provide a starting point for policy analysis. We begin in Section 21.2 with a treatment of the main driving force behind urbanization in developing countries: rural–urban migration. Traditional empirical work on such migration is summarized, and the discussion highlights new empirical research designed to improve on past studies. This new work studies the effect of public service availability on migration decisions, the role of income risks at the migration destination and of environmental risks (such as rainfall variability) in the home region, and the effect of using a broader set of individual migrant and household characteristics in measuring the migration impacts of traditional economic variables.

With this background in the empirical aspects of migration, Section 21.3 turns to a discussion of theoretical models that capture the role of rural–urban migration in determining city sizes in developing countries. The famous Harris–Todaro model is the starting point, but the discussion then considers models where urban cost-of-living escalation, in the form of higher housing prices, chokes off rural–urban migration, providing an equilibrating mechanism different from the familiar unemployment channel in the Harris–Todaro model. Hybrid models, where both unemployment and cost-of-living forces jointly serve to equilibrate city sizes, are also explained. Our attention then shifts to the social optimality of the city sizes generated by rural–urban migration, identifying forces that may lead to inefficient migration equilibria, where cities are either too large or too small.

Section 21.4 focuses on insecure housing tenure, a major feature of housing markets in developing countries. Insecure tenure derives from "land-rights insecurity," or the insecurity of property rights to land and housing. The initial discussion emphasizes that housing markets in developing countries frequently offer a "continuum" of property rights, ranging from a complete lack of legal tenure security in squatter settlements, to moderate security levels among households with some legal documentation but no formal title, to the full security usually associated with a title. The bulk of this section, however, focuses on one end of the tenure-security continuum by providing an extensive survey of research on urban squatting in developing countries. The chapter's emphasis on squatting is justified by the existence of a sizable theoretical and empirical literature on the topic, which represents one of the most substantial and coherent bodies of work by economists on urban phenomena in the developing world. Theoretical work on squatting is considered first, with the discussion reviewing the structure of several alternative models of the squatting phenomenon. Attention then shifts to empirical work on squatting, which attempts to measure the dollar cost of tenure insecurity as well as its various effects (including low housing investment by squatters).

Lack of affordable housing is another major problem in developing countries, and this issue is the subject of Section 21.5. The discussion starts with an appraisal of the housing-supply response to urbanization that is driven by rural–urban migration, recognizing that responsive supply is crucial in maintaining affordability in the face of population pressure. Our attention then turns to other factors affecting affordability, including subsistence pressure that prevents households from diverting an appreciable share of their budgets away from food expenditure. The role of land-management policies in limiting the supply of affordable housing is also discussed. The policies include minimum-lot-size regulations, which are prevalent in many developing countries, other restrictions such as building-height limits that reduce densities and thus cut housing supply, and urban growth boundaries (UGBs), which also depress the supply of land and raise prices, with unfavorable effects on affordability. The discussion concludes by considering the role of urban public services in making urban living affordable to migrant households. The chapter's overall conclusions are presented in Section 21.6.

21.2. THE EMPIRICAL ASPECTS OF RURAL–URBAN MIGRATION

Economic growth in less-developed countries has been accompanied by explosive urbanization. United Nations data show that the annual growth rate of the urbanized population in developing countries ranged between 2.7% and 4.2% across the years between 1950 and 2010, far outpacing the urban growth rates in developed countries, which ranged between 0.6% and 2.4%. Because of its faster growth, the urbanized share of the population in developing countries rose rapidly from 17.6% in 1950 to 46% in 2010, but still falls well short of the 77.5% share in developed countries for 2010. The explosive urban growth in developing countries has also created very large cities. In 2014, only four of the world's largest 15 cities are in developed countries.

Although high birth rates make the natural increase of the population an important source of city growth in developing countries, rural–urban migration is an even more significant force driving the urbanization process. This migration has been the focus of substantial research by economists, demographers, and other social scientists. The research, which is epitomized in the early studies of Fields (1982) and Schultz

(1982), shows that rural–urban migration responds to economic incentives in a natural fashion.[1]

Migration depends on forces that "pull" migrants to their destinations as well as forces that "push" them to leave their origins. Better economic opportunities in cities, partly due to agglomeration economies, are a major pull factor, often providing the main motivation for internal migration. But people are also pushed off their land by severe declines in agriculture, by the pressures of population growth, and by environmental changes that make cultivation no longer viable. Historically, droughts have had sudden and prolonged impacts on the population distribution in developing countries, particularly in sub-Saharan Africa and South Asia.[2] Conflict has also pushed people to migrate in sub-Saharan Africa and in many other developing regions.

In many low- and middle-income countries, another important push factor propels internal migration: the lack of adequate basic services in rural areas or in economically lagging regions. To a large extent, this topic has been overlooked in empirical analysis of migration decisions. In reality, however, the location of schools, health care centers, hospitals, and other public amenities can significantly influence migration. In Africa, disparities in school enrollment and neonatal care across cities, towns, and villages are attributable to the near absence of schools and health facilities in outlying areas, and they constitute a force driving migrants toward cities. Evidence from Central Asia shows that, in the isolated parts of Tajikistan, schools are inadequately heated, drinking water is scarce, and garbage and sewage removal is lacking, again making migration attractive.[3]

Even though many forces provide strong incentives for migration, cultural and linguistic factors tend to make labor less mobile than capital, which moves quickly in a globalizing economy. Moreover, relative to capital, labor is subject to more political restrictions and to explicit and implicit barriers.[4] For example, the household registration (or hukuo) system in China constitutes a major barrier to rural–urban migration since migrants without hukuo rights do not qualify for public education or health benefits. Recent research for China indicates that removing such mobility restrictions would reallocate labor across areas, reduce wage differences, and lower income inequality (Whalley and Zhang, 2004).

[1] See Lall et al. (2006a) for a comprehensive survey of the literature on rural–urban migration in developing countries.

[2] See Iliffe (1995) for the historical impact of drought on the population distribution in Africa, Bryceson (1999) for the Sahel and Sudan, and Hardoy and Satterthwaite (1989) for Mauritania. Wandschneider and Mishra (2003), cited in Deshingkar and Grimm (2004), provide evidence regarding the drought-induced migration of 60,000 people out of Bolangir, in the Indian state of Orissa, in 2001.

[3] See Sahn and Stifel (2003) and Anderson and Pomfret (2005).

[4] See World Bank (2009).

21.2.1 Early studies

Harris and Todaro (1970) produced the seminal conceptual work on rural–urban migration in developing countries. Their framework diverges from a standard model with full employment and flexible wages by introducing a politically determined minimum urban wage, which exceeds the agricultural wage and generates urban unemployment. Migration occurs as a response to the rural–urban difference in expected earnings, which depends on the city's unemployment rate, and migration proceeds until expected earnings are equalized. This dual-economy model demonstrates the rationality of migration from rural to urban areas despite the possibility of urban unemployment.

The model generates a potential paradox—namely, that one extra minimum-wage job could induce more than one agricultural worker to migrate to the urban area, hence increasing the unemployment rate. Todaro (1976) asks whether the conditions leading to this paradox hold empirically. To this end, he analyzes developing-country data and estimates rural–urban migration elasticities, finding that their values are in a range where the paradoxical result seems to hold. On the basis of this evidence, Todaro (1976) concludes that "there would thus appear to be no strictly urban solution to the urban unemployment problem. Rural development is essential."

Fields (1982) and Schultz (1982), like other migration researchers, incorporate the main insight of Harris and Todaro (1970) by including employment rates at both the origin and the destination as determinants of migration along with a host of other variables, finding confirmation of their importance. These articles also reflect the variety of empirical specifications used in migration research, with Fields estimating a linear regression explaining migration flows and Shultz estimating a multinomial logit model.

In addition to labor-market conditions, another important determinant of migration is distance, which is highlighted by gravity models. Intuition suggests that a greater spatial gap between two regions means a lower flow of migrants between them. Schwartz (1973) argues that a longer distance may raise the psychic cost of moving while decreasing the information available about the destination. The psychic cost arises because a longer migration distance means less frequent reunions with family and friends left behind. Even though the advancement of communication and media technologies weakens the foundation for these hypotheses, empirical evidence shows that distance plays an important role in individual migration decisions. The effect is seen in the studies of Fields (1982) and Schultz (1982) and virtually every other migration study.

21.2.2 More recent research

Some recent additions to the body of migration research draw on the past seminal studies while improving their empirical methods and exploiting relatively richer information in newer datasets. Other recent additions identify and study new factors in the migration decision.

21.2.2.1 Adding covariates to combat selection bias

Recent research recognizes that unobservable family and community characteristics of migrants can be different from the characteristics of those who stay behind, possibly biasing estimates of the impacts of observables on migration decisions. This selectivity effect may be different for distinct migrant destinations as well as for different sectors of employment at the destination. One way to reduce selectivity bias is to measure and include more household and community-level variables in the empirical models, thus reducing the number of omitted factors. Accordingly, household variables such as assets and the human capital of nonmigrant household members are allowed to have an impact on migration decisions via their effect on migration costs and remittances. Life cycle-related variables, such as marital status or changes in status, influence the migration decision as well. Added community variables include transportation access to commercial centers, in the belief that good access raises the incentive to migrate. "Network" variables capturing the presence of previous migrants at the destination, which can help migrating individuals adapt and find jobs, hence inducing them to migrate, may also have an influence.

Using nationally representative data on rural households in Mexico, Mora and Taylor (2007) estimate multinomial logit models that capture the effects of individual, family, and community variables on observed migration outcomes. The estimates show that greater family landholdings imply less migration and that better transportation links (measured by service frequency) encourage migration. The presence of nonfarm enterprises in the village makes migration to destinations with such jobs less likely. Furthermore, Mora and Taylor's results indicate that the presence of other household members at a destination encourages migration to it. This network effect is also studied by Giulietti et al. (2014) using data from China. Building on the distinction between weak and strong ties in social-network theory (Granovetter, 1973), they distinguish between the presence at the destination of immediate family members (strong ties) and the presence of other residents from the same village (weak ties). A theoretical model predicts a larger migration effect from weak ties, and the Chinese evidence supports this prediction. Finally, Marre (2009) shows that family size and home ownership are important factors reducing the incentive to migrate as they are strongly and positively associated with the costs of moving.

21.2.2.2 Introducing access to public services in migration decisions

Another set of studies draws attention to availability of basic public services as a determinant of migration. With the goal of evaluating the importance of this push factor relative to the traditional pull factors, Lall et al. (2009) study migration from lagging to leading regions in Brazil. They combine a rich dataset of public services at the municipality level with individual records from four decades of Brazilian census data to evaluate the relative importance of wage differences and public services in the migrant's decision to move. Predictably, wage differences are the main factor influencing migration choices. While basic public services are not important in the decision to move for better-off rural residents, access to such services matters for the poor. Indeed, poor migrants are willing to accept lower wages to get access to better services. A Brazilian minimum-wage worker earning R$7 per hour (about US$2.30 in February 2008) was willing to pay R$420 a year to have access to an additional hospital, R$87 for a one percentage point increase in the likelihood of water access, and R$42 for a one percentage point increase in the likelihood of electricity access. Although these results show that better public-service access benefits individual migrants, Lall, Timins, and Yu argue that the economy as a whole may end up worse off since the relocation is likely to add to congestion in urban areas without creating offsetting productivity benefits.[5]

These authors also raise an important methodological issue by pointing out that ignoring public service differentials may bias the estimated effects of wage differentials. The reason is that places with more job opportunities may also have better public services. By failing to control for public-service differentials, econometric estimates may thus overstate a migrant's willingness to move in response to wage differences.

The effect of the public-services push factor is seen in Sri Lanka (World Bank, 2010) where lack of access to basic public services such as water and electricity also influences migration decisions. Using data from the Sri Lanka Integrated Survey for working-age people between the ages of 15 and 49 years, the analysis finds that migration decisions in the 1990s were influenced by district-level differences in access to well water and electricity, particularly for the less educated. For individuals with a secondary-school education or less, a 1% difference in the share of well-water coverage between the origin and the destination increased the likelihood of moving by 0.5%. Water supply differentials did not matter for the better educated.

Recent evidence from Nepal also points to the importance of access to basic services in influencing migration decisions. Dudwick et al. (2011) use the population census in 2001 with the objective of understanding why migrants are attracted to particular locations. They examine the roles of income, access to basic services, and physical and social distances in influencing rural–urban migration decisions. The indicators of basic services include access to facilities such as schools, hospitals, markets, and banks. While they find the usual effects of distance on migration, the results show that migrants choose destinations with better access to schools, hospitals, and markets. Moreover, a terrain elevation variable, meant to capture transport barriers, has a negative effect.

From a policy perspective, all of these findings imply that providing access to basic services can help eliminate a major push factor that leads to migration from rural areas in developing countries.[6] Development policies should recognize the importance of such

[5] See Ferre (2009) on the impact of internal migration for the receiving urban areas in Brazil.

[6] Economies of scale in the provision of health services and other public services would lead to a counter-argument in favor of spatial concentration of these services, with dispersion across both urban and rural areas desirable on equity grounds but potentially inefficient.

access as a determinant of the population distribution in these countries. Mourmouras and Rangazas (2013) offer a theoretical analysis of this issue, analyzing a model with rural–urban migration where the government allocates public services between the two areas with the goal of maximizing the country's overall welfare.

21.2.2.3 Climate migrants

In addition to the influence of public services on migration, other important drivers include environmental factors. According to the Intergovernmental Panel on Climate Change, climate change will degrade the environment considerably during this century (Reuveny, 2007),[7] with the impacts felt more in developing countries than in developed countries, because of both geography and a more limited scope for policy intervention. Thus, environmental conditions may play an increasingly important role as a push factor as they threaten the livelihoods of rural residents. For this reason, the environmental dimension of migration has recently begun to gain the attention of researchers.

From this perspective, scholars view migration as an adaptation strategy in the face of worsening environmental conditions due to drought, soil quality deterioration, and deforestation.[8] This focus aligns with a new perception of migration among labor economists as a household strategy for income diversification in response to environmental and other risks. Hunter et al. (2011), for example, study the effect of rainfall on emigration from rural Mexico. The study focuses on international migration (specifically to the United States), but the same force affects internal migration within both Mexico and other developing countries. The results indicate an association between rainfall patterns and migration, where dry years cause a migration push and wet years inhibit migration from rural areas.

Barrios et al. (2006) investigate the effect of rainfall on urbanization in sub-Saharan African. They point out that the sub-Saharan African economies are particularly dependent on rainfall, which has been declining since the late 1950s. This dependence makes the agriculture-dependent rural population highly vulnerable to variations in rainfall, potentially affecting rural–urban migration patterns. They assert that "climate change scenarios tend to suggest that extreme climate variations are likely to cause abrupt changes in human settlements and urbanization patterns in sub-Saharan Africa more than anywhere else in the world."

Reuveny (2007) also provides a careful analysis of climate change-induced migration across countries, providing information on environmental push factors at individual country levels. He states that 20–30 million people moved from Gansu and Ningxia

[7] In particular, Reuveny (2007) reports that since the 1950s, the average global temperature rose by about 0.1 °C per decade, winter snow cover declined by 10%, the frequencies and intensities of droughts, storms, and warm periods rose, and the sea level rose by 20 cm.

[8] See Henry et al. (2003) for a study of the effect of environmental factors on internal migration in Burkina Faso.

provinces to urban centers in China during the 1980s and 1990s because of floods, land degradation, desertification, and water scarcity. Similarly, Reuveny's evidence shows that 600,000–900,000 people migrated from the rural areas of Mexico to urban centers and the United States because of environmental degradation combined with other factors. Finally, around 70,000 people moved from the Arctic region in Russia to urban centers because of extreme weather conditions and socioeconomic decline in the 1990s.[9]

21.2.2.4 Income risk as a factor governing migration

The income risk faced by migrants at their destination has been recognized as a factor in the migration decision, and it is partly addressed by studies that measure the presence of other household members at the destination, which may ease the job-finding process. However, several recent studies model the sources of income risk in a more fundamental fashion while carrying out empirical tests. The studies of Bryan et al. (2014) and Munshi and Rosenzweig (2013) both note the existence of unexploited migration opportunities in particular developing countries, with the first article investigating a famine-prone region of Bangladesh where migration presumably has large benefits but is puzzlingly low, and the second article focusing on India, where rural–urban migration is low relative to that in other countries despite a large rural–urban wage gap that would appear to make it attractive. Both studies attribute the lack of migration to the income risk faced by migrants, providing different types of evidence in favor of this view.

Bryan et al. (2014) hypothesize that a migrant does not know in advance his suitability for urban employment (e.g., whether he will be trusted by a rickshaw owner to operate this valuable asset as a driver), which makes incurring the cost of migration risky. The study carried out an experiment where some residents of the famine-prone Bangladesh region of Rangpur were offered a subsidy to cover migration costs if they chose to temporarily migrate to an urban area during the preharvest famine months. The subsidy predictably increased migration, but the striking observation was an increase in migration by the same individuals in the subsequent year, when the subsidy was not offered. This observation is consistent with a reduction in income risk as subsidized migrants learned their suitability for city jobs, acting on this knowledge in the next season. Bryan et al. developed a theoretical model capturing this phenomenon, which also showed that the households closest to subsistence should be least prone to migrate in the absence of a subsidy, fearing a catastrophic drop in disposable income in the event of costly, unfruitful migration. This prediction also finds empirical support in the article.

Munshi and Rosenzweig (2013) argue that migration income risk in India comes from the loss of support from the local caste-based insurance network in the rural home region. These networks provide a form of income pooling designed to help households suffering drops in income, and migration to the city reduces or eliminates the support that

[9] For further details, see Table 1, panel B in Reuveny (2007).

can be expected from the network. As a result, income risk is higher in the city than in the home region, but for a reason different from that in Bryan et al. (2014). The resulting empirical prediction, supported by a theoretical model, is that higher-income rural households, which tend to subsidize rural households through the network rather than benefiting from it, should be more likely to migrate than lower-income households. The basic empirical results in the article confirm this prediction, with additional effort expended on estimation and simulation of a structural model.

21.3. MODELS OF MIGRATION AND CITY SIZES IN DEVELOPING COUNTRIES

As seen in Section 21.2, rural–urban migration is a major force that drives city growth in developing countries. This same migration process led to the high urbanization levels that now exist in developed countries, but the process was largely complete long ago. Given the centrality of rural–urban migration in developing countries, researchers have offered various formal treatments showing how the migration process determines city sizes. These models formalize the incentives for migration and derive the condition that characterizes a migration equilibrium, where the population flow from the countryside stops.

As recognized in all of the empirical work discussed in Section 21.2, the incentive for migration in the theoretical models depends on the difference in living standards between the rural and urban areas. When the urban standard of living exceeds the rural standard, an incentive exists for rural–urban migration, so that population leaves the countryside and cities grow. Migration equilibrium is achieved when urban and rural living standards are equalized. The costs of migration are disregarded, being implicitly assumed to equal zero.

The models are mostly silent about the forces that produce a surge of rural–urban migration from a starting point where migration is absent. But the implicit scenario is one where modern production technologies are adopted by urban firms, greatly increasingly worker productivity and wages and thus creating a large gap between urban and rural living standards that prompts migration to the city.

To reach a migration equilibrium, the rural–urban population flow must close this gap between living standards, and the models differ in their portrayals of the forces that achieve this closure. As noted above, the seminal article of Harris and Todaro (1970) assumes that the equilibrating force is adjustment of the urban unemployment rate. This rate rises as migrants flow into the city, reducing a migrant's chance of finding a well-paying job and ultimately choking off migration. Another equilibrating force not captured in the Harris–Todaro model is escalation of the urban cost of living as migrant flows raise the city's population. This cost-of-living increase will arise mainly in the housing market through rising rents, a force that is captured in the model of Brueckner (1990). Once living costs have risen enough to offset the benefit of a higher urban income, the incentive for migration is eliminated. The hybrid models developed by Brueckner and Zenou (1999) and Brueckner and Kim (2001) combine these approaches by assuming that increases in both the urban cost of living and unemployment jointly serve to equilibrate the migration process.

Since all of these models are static in nature, predicting the achievement of a stable population split between rural and urban areas, they do not match the reality in developing countries, where rural–urban migration is ongoing. This mismatch can be remedied by embedding the models in a dynamic context, where the rural and urban populations slowly adjust toward the equilibrium predicted by the static model. Alternatively, the reality could involve continual disruption of static equilibria (resulting, for example, from technical change that leads to an upward time trend in urban incomes), with the economy constantly on the move to new equilibria with larger city sizes.

A further question concerns the economic efficiency of the migration equilibria achieved under the models. The efficiency question is whether rural–urban migration produces the "right" division of the population between the city and the countryside from society's point of view. The following subsections discuss the models and consider this question.

21.3.1 The Harris–Todaro model

Many variables are potentially endogenous in a model of rural–urban migration. In addition to the rural and urban populations themselves, these variables include the prices of the (nonhousing) goods produced in the city and countryside, the wages of workers in these two locations (which depend partly on the output prices), and the capital and land inputs used along with labor in urban and rural production. Harris and Todaro (1970) assume that the capital and land inputs are fixed, but they allow wages and output prices to adjust with the rural–urban population split. However, since nonhousing price adjustment is largely inessential in describing the main elements of the models of rural–urban migration, it will be suppressed in the ensuing discussion. Instead, the prices of the nonhousing goods produced in the rural and urban areas will be fixed, reflecting the assumption that the goods produced in both locations are traded on world markets. In other words, portions of both the agricultural good produced in the countryside and the manufacturing good produced in the city are exported, so local prices must reflect world prices, which are fixed from the point of view of any one country.

With the fixed output prices both set equal to 1, annual wages are then just equal to the (annual) marginal product of labor, which diminishes with the number of workers employed. Denoting the city population by N, the urban income level is then given by $y_u(N)$ and the rural income is given by $y_r(\overline{N} - N)$, where $\overline{N}$ is the fixed total population of the country. The functions y_u and y_r, which give the (annual) marginal products of labor in the two locations, are constant or decreasing in the usual fashion

(y_u', $y_r' \leq 0$). Note that, while the analysis assumes the existence of a single city containing the entire urban population, this assumption can be relaxed to allow for multiple cities.[10]

The Harris–Todaro model suppresses decreasing housing (or land) consumption, with workers in both the city and the countryside implicitly assumed to consume only the outputs of the urban and rural production sectors. With consumption prices thus being the same regardless of a worker's location, urban and rural costs of living are identical, and income differences alone guide migration decisions. In the absence of any restrictions on the urban labor market, rural residents would want to move to the city as long as $y_u(N) > y_r(\overline{N} - N)$. The condition for migration equilibrium would then be

$$y_u(N) = y_r(\overline{N} - N), \tag{21.1}$$

which determines the city population size that equates urban and rural incomes. If marginal productivity tends to be higher in city employment than in the rural sector (with $y_u > y_r$ holding at a common population size), substantial migration would be required to equate urban and rural incomes, with N possibly approaching $\overline{N}$.

The Harris–Todaro model modifies the equilibrium condition in (21.1) to incorporate another feature of cities in developing countries that has been claimed to coexist, in a puzzling fashion, with large rural–urban population flows: high urban unemployment. To explain the apparent anomaly of rural migrants moving to the city despite a large chance of being unemployed, Harris and Todaro observed that the *expected* urban income (in a probabilistic sense) can still be high relative to the rural income if wages while employed in the city are high.

To formalize this idea, Harris and Todaro assumed the existence of an urban minimum wage, yielding annual income of $\overline{w}$. At this wage, urban employers are willing to hire J workers, where J satisfies $y_u(J) = \overline{w}$. With urban jobs thus fixed at J, migration to the city has no effect on the incomes of those employed, although it does reduce the expected wage. Assuming the absence of any unemployment assistance, the expected urban income equals the probability of employment times $\overline{w}$, or $(J/N)\overline{w}$. The migration equilibrium condition now equates this expected income value to the (certain) rural income level, being written as

$$\frac{J}{N}\overline{w} = y_r(\overline{N} - N), \tag{21.2}$$

a condition that assumes risk neutrality on the part of migrants. Note that while an increase in N previously reduced the urban marginal product in (21.1), helping to decrease the attractiveness of further migration, a higher N now reduces the chance

[10] With m cities of population N, the rural population would be $\overline{N} - mN$. To endogenize the number of cities, an approach like that of Henderson and Wang (2005) could be used.

of urban employment, with the same equilibrating effect (which is reinforced by the migration-induced rise in y_r).

If the rural marginal product of labor is constant, making rural income constant at $\overline{y}_r$, then (21.2) gives a direct solution for N:

$$N = \frac{\overline{w}}{\overline{y}_r} J, \tag{21.3}$$

which indicates that the urban population equals a multiple of the number of available jobs ($\overline{w}/\overline{y}_r > 1$ holds). From (21.3), an increase in $\overline{y}_r$ reduces N by raising the attractiveness of the countryside, while an increase in J with $\overline{w}$ held fixed (caused, say, by an increase in urban productivity) raises the chance of employment and leads to an offsetting increase in N that restores the original employment probability. Since an increase in $\overline{w}$ also leads to a decrease in J, the effect on N is ambiguous, with the sign depending on the elasticity of the y_u function. N rises if a higher $\overline{w}$ raises $\overline{w}J$, falling otherwise.

It should be noted that because prices are fixed in this version of the Harris–Todaro model, the paradox described in Section 21.3, where an increase in J leads to an increase in the unemployment rate (a decrease in J/N) cannot occur. This outcome can be seen directly in (21.3), where J/N is constant, and it also can be established when y_r is variable by differentiating (21.2). Thus, price flexibility is required for the paradox to emerge.

21.3.2 Urban cost of living as an equilibration mechanism

As explained above, the cost of living is the same in rural and urban areas under the Harris–Todaro model, ruling it out as an equilibrating force. To introduce cost-of-living differences, it is natural to use the standard urban model developed by Alonso (1964), Mills (1967), and Muth (1969) to capture the effect of population size on a city's cost of living, following Brueckner (1990). In the standard model, all residents commute to jobs at the city center, paying an (annual) transportation cost of t per mile, so tx gives the cost of commuting from a residential location at distance x from the center. Urban residents consume housing, represented as direct consumption of land in the simplest form of the model, along with a composite nonhousing good made up of the outputs of the urban and rural sectors. Residents living far from the center, who incur high commuting costs, are compensated with lower land rents. Land rent p thus declines as distance x from the center increases, with rent falling to the fixed rural rent p_r at the edge of the city, which lies at distance $\overline{x}$.

The higher urban cost of living relative to that in rural areas is due to a combination of higher land rents and commuting-cost outlays. By comparison, rural workers spend nothing on commuting by living near the fields they till, and (like farmers) they pay p_r for the land they consume, an amount less than urban residents pay in the city's interior. But since an urban resident living at the edge of the city pays the same land rent as rural residents (p_r), his higher cost of living comes entirely in the form of a higher commuting cost. After paying this cost, the disposable income of the edge resident is equal to $y_u - t\bar{x}$. Since they face the same land rent, rural residents will therefore reach the same utility level as the city's edge resident if their income y_r is equal to $y_u - t\bar{x}$. But since the utility levels of all city dwellers are equal in the urban equilibrium (matching the edge's resident's utility), the condition $y_u - t\bar{x} = y_r$ ensures that the rural utility will equal that of *an urban resident living anywhere in the city*. This condition, therefore, becomes the migration equilibrium condition when both incomes and the urban cost of living are taken into account.

To use this condition to analyze the properties of the migration equilibrium, comparative-static results from the standard urban model can be exploited. Wheaton (1974) first presented these results, showing that $\bar{x}$ is an increasing function of the urban population N, a natural conclusion. He also established that $\bar{x}$ increases with the urban income level y_u (richer cities take up more space) and that $\bar{x}$ decreases with t, the commuting cost per mile (cities with high commuting costs are more compact). Therefore, $\bar{x}$ can be written as $\bar{x}(N, y_u, t)$, with $\bar{x}_N > 0$, $\bar{x}_{y_u} > 0$, and $\bar{x}_t < 0$, where the subscripts denote partial derivatives.[11]

Recognizing that the income levels generally depend on N, we can write the migration equilibrium condition as

$$y_u(N) - t\bar{x}(N, y_u(N), t) = y_r(\bar{N} - N). \tag{21.4}$$

The value of N that satisfies this condition gives the equilibrium size of the urban population. To explore the implications of this condition, it is helpful to follow Brueckner (1990) by initially assuming constant marginal products of labor and thus fixed urban and rural incomes. Substituting $\bar{y}_u$ and $\bar{y}_r$ in place of the income expressions in (21.4), the condition becomes

$$\bar{y}_u - t\bar{x}(N, \bar{y}_u, t) = \bar{y}_r, \tag{21.5}$$

which determines the urban population N as a function of the remaining variables, $\bar{y}_u$, $\bar{y}_r$, and t.

From the signs of the $\bar{x}$ derivatives, comparative-static analysis of the equilibrium is simple and intuitive. When $\bar{y}_r$ increases, the left-hand side of (21.5) must increase as well, which requires a decline in $\bar{x}$ and thus a decline in N. Formally,

$$\frac{\partial N}{\partial \bar{y}_r} = -\frac{1}{\bar{x}_N} < 0. \tag{21.6}$$

Thus, as higher rural income makes the countryside more attractive, the urban population falls. This population decline reduces the urban cost of living (as represented by

[11] Another result is that $\bar{x}$ decreases with the rural rent level, but this conclusion is not needed in the present context.

the commuting cost of the edge resident), making the city and countryside equally attractive again.

Additional results rely on further conclusions of Wheaton (1974), who showed that the urban utility level rises with the urban income level $\overline{y}_u$ and falls with the commuting cost per mile t, results that are natural. With the land price paid by the edge resident fixed at p_r, these utility changes must be mirrored in the change in disposable income for the edge resident, which therefore must rise with y_u and fall with t. From differentiation of the left-hand side of (21.5), $1-t\overline{x}_{y_u}>0$ and $-\overline{x}-t\overline{x}_t<0$ must then hold even though the signs are not clear from inspection. Totally differentiating (21.5) then yields

$$\frac{\partial N}{\partial \overline{y}_u}=\frac{1-t\overline{x}_{y_u}}{\overline{x}_N}>0, \qquad \frac{\partial N}{\partial t}=-\frac{\overline{x}+t\overline{x}_t}{\overline{x}_N}<0. \tag{21.7}$$

Intuitively, when y_u rises, the city becomes more attractive, and its population grows until the cost of living (represented by the commuting cost for the edge resident) has risen enough to nullify the gain. Similarly, when t rises, indicating the presence of an inferior transport network, the city becomes less attractive as the commuting cost of the edge resident rises. The population must then fall to reduce the edge resident's cost to its original level.

Returning to the general form (21.4) of the equilibrium condition, where incomes are no longer fixed, only one parameter remains—namely, t. An increase in t reduces the left-hand side of (21.4) as before, reducing the difference between the expressions on the left-hand side and the right-hand side, but the required change in N (which must raise this difference in an offsetting fashion) is not immediately clear. However, using previous results, the derivative of the difference between the left-hand side and right-hand side of (21.4) with respect to N is $-t\overline{x}_N+[1-t\overline{x}_{y_u}]y_u'+y_r'<0$. Therefore, a decline in N is required to raise the difference, offsetting the higher t. The inverse relationship between N and t is thus preserved under the general model, and the comparative-static effects for income can also be recovered by introducing shift factors that move the y_u and y_r functions. Writing these functions as $y_u(N)=\alpha_u f_u(N)$ and $y_r(N)=\alpha_r f_r(\overline{N}-N)$, it is easily seen that an increase in α_u raises N, while an increase in α_r has the opposite effect. Thus, an increase in urban productivity encourages additional migration to the city, while an increase in rural productivity prompts a return to the countryside, as before.

21.3.3 Hybrid models

Brueckner and Zenou (1999) and Brueckner and Kim (2001) develop hybrid models where unemployment and cost-of-living adjustments combine to equilibrate rural–urban migration. In Brueckner and Zenou's model, employed and unemployed residents constitute distinct groups who live in different parts of the city, with the unemployed residents subsisting on government-assistance payments. Brueckner and Kim offer a simpler model where employment status is determined anew each period, with workers also smoothing their incomes via saving as they alternate between employment and joblessness. With this approach, the city can be modeled as containing a single group of residents with incomes equal to the expected value of income across the employed and unemployed states. Assuming as before that assistance payments are zero, this expected income is again $(J/N)\overline{w} \equiv w_e$.

Although Brueckner and Kim carry out their analysis from first principles, an equivalent and simpler approach relies on the framework from above. In particular, the migration equilibrium condition comes from simply replacing $y_u(N)$ in (21.4) with w_e, so equilibrium is characterized by the following two conditions:

$$w_e - t\overline{x}(N, w_e, t) = y_r(\overline{N} - N), \tag{21.8}$$

$$w_e = \frac{J}{N}\overline{w}. \tag{21.9}$$

Since w_e decreases with N like $y_u(N)$, this hybrid model has the same properties as the general model analyzed above. In particular, N falls with an increase in t or with an increase in a rural productivity parameter α_r. In addition, N increases with J, a change that would result from an increase in an urban productivity parameter α_u. As before, the effect of an increase in $\overline{w}$ depends on the elasticity of the y_u function. N again rises if a higher $\overline{w}$ raises $J\overline{w}$, falling otherwise.

It is easy to see that the Harris–Todaro paradox cannot arise in this hybrid model, as in the basic model above. In particular, N must rise by less than any increase in J, reducing the unemployment rate. To see this conclusion, note that if N were to rise enough to keep J/N constant, the urban standard of living would nevertheless fall given the escalation in land costs. With the decline in the rural population causing y_r to rise or stay constant, it follows that the standard of living is lower in the city, implying that N has increased too much. As a result, J/N must be higher in the new equilibrium.

The stability of the various equilibria considered so far has not been considered. Stability requires that the urban disposable income is greater than (less than) the rural income when N is below (above) its equilibrium value. When this condition is satisfied, migration incentives cause N to rise when it is below the equilibrium value and fall otherwise, yielding convergence to the equilibrium. The stability condition implies that left-hand-side expression minus the right-hand-side expression in an equilibrium condition must be a decreasing function of N. It is easy to see that this condition is satisfied for each of the equilibria considered above.

21.3.4 Dynamics

The previous models are static in nature, generating a city of equilibrium size and an absence of rural–urban migration. The reality in developing countries, however, is decades of ongoing migration with no apparent end in sight. One way of reconciling this reality with the previous models is to imagine that the adjustment to equilibrium is sluggish (see Brueckner, 1990). To formalize this idea, use the hybrid model, and let $N(t, \alpha_r, J\overline{w})$ denote the equilibrium urban population as a function of the model parameters. Let τ denote time, and assume that the parameters are independent of τ. Then, suppose that the population evolves according to a partial-adjustment process given by

$$\Delta N_{\tau+1} \equiv N_{\tau+1} - N_\tau = \lambda[N(t, \alpha_r, J\overline{w}) - N_\tau], \tag{21.10}$$

where λ is an adjustment parameter satisfying $0 < \lambda \leq 1$. Thus, a fraction λ of the gap between the equilibrium and the current urban population is closed each period, leading to a potentially long adjustment process. Starting with a small city size, a large equilibrium N (a result of a low t or α_r or a high $J\overline{w}$) would lead to rapid growth in the urban population, while growth would be slower with an equilibrium N of more moderate size.

This approach could be modified by allowing t, α_r, and $J\overline{w}$ to be time dependent. Then, the equilibrium population would be a moving target, and ongoing changes in N would be due to both the changing equilibrium and the sluggishness of adjustments.

Taken literally, a static model should imply instantaneous adjustment to the equilibrium urban–rural division of the population, with no ongoing migration. The dynamics in (21.10) are therefore ad hoc in nature, with a different type of model required to properly generate continuing migration. Lucas (2004) develops such a model, assuming that urban residents devote some of their time to accumulation of human capital. When this structure is combined with the assumption of human capital externalities, where individual capital accumulation is faster the higher is the capital level of the city's most skilled residents, the model generates a gradual emptying of the countryside (the details are complex). Henderson and Wang (2005) offer a simpler, related model in which savings (which occur at a fixed rate) are devoted to human-capital accumulation, with this capital raising individual productivity more in cities than in the rural area. This growing relative urban income advantage, combined with the need to equate rural and urban living standards, requires an ongoing population shift from the countryside to cities, matching the spirit of the models analyzed above.[12]

21.3.5 Socially optimal city sizes

Is the city size generated by the rural–urban migration equilibrium efficient, maximizing social welfare? To answer this question in the present context, the natural welfare function is the value of the economy's output minus resource costs. Since capital inputs are fixed in the previous models, capital costs can be disregarded in characterizing the social optimum, with the only resource cost being the commuting cost incurred by urban

[12] Their setup is actually a bit more complicated than described, since city sizes are chosen by profit-maximizing land developers and wages depend on the endogenous output price of the city-produced good. However, the underlying mechanism appears to work as described.

residents. Aggregate commuting cost is given by ACC $\equiv \int_0^{\overline{x}} [2\pi x/q(x,N))] tx \mathrm{d}x$, where $q(x,N)$ is land consumption at distance x from the urban center and $1/q(x,N)$ equals population density. N is an argument of q because individual land consumption is in general a decreasing function of the city's population, as shown by Wheaton (1974).[13] The integral weights population density by the land area of the ring of land at distance x (equal to $2\pi x \mathrm{d}x$) to get the ring population and then multiplies it by tx, the commuting cost of each ring resident, with the result summed across all locations in the city.

Consider first the simple case where the marginal products of urban and rural labor are constant and given by $\overline{y}_\mathrm{u}$ and $\overline{y}_\mathrm{r}$. Also, suppose that individual land consumption is fixed at one unit of land, thus being independent of x and N. Evaluating the above integral in this case yields ACC $= 2t\pi\overline{x}^3/3$. Since the urban and rural outputs are just $N\overline{y}_\mathrm{u}$ and $(\overline{N} - N)\overline{y}_\mathrm{r}$, the value of the economy's output net of commuting cost is

$$N\overline{y}_\mathrm{u} + (\overline{N} - N)\overline{y}_\mathrm{r} - 2t\pi\overline{x}(N)^3/3, \tag{21.11}$$

where the N argument of $\overline{x}$ is reintroduced (the previous income and t arguments are unneeded and thus suppressed). The socially optimal N maximizes this expression. To carry out the maximization, the relationship $N = \pi\overline{x}^2$ must be used, which says that the total population equals the city's land area (a consequence of $q = 1$). Differentiating this expression yields $\overline{x}_N = \partial\overline{x}/\partial N = 1/2\pi\overline{x}(N)$. Then, the socially optimal N, which comes from differentiating (21.11) and setting the result equal to zero, satisfies

$$\overline{y}_\mathrm{u} - \overline{y}_\mathrm{r} - 2t\pi\overline{x}(N)^2 \frac{\partial\overline{x}}{\partial N} = \overline{y}_\mathrm{u} - t\overline{x}(N) - \overline{y}_\mathrm{r} = 0. \tag{21.12}$$

Since this condition is the same as (21.5), the migration equilibrium condition when incomes are fixed, the equilibrium in this case is efficient. Note that the stability condition for the equilibrium (the last expression in (21.12) decreases with N) means that the second-order condition for the social optimality problem is satisfied.

Efficiency is obtained because no externalities are present under the previous assumptions. One assumption was fixed land consumption, and when this assumption is relaxed, an increase in N generates an externality by making the city denser as q falls in response to the higher population. By putting people closer to the center on average, rising density saves commuting costs, so that the higher N leads to a positive externality. Since this externality is not taken into account by migrants, the equilibrium city population is too small. Letting $\Omega(N)$ capture the positive density externality (derived in the Appendix), the optimality condition is[14]

[13] Actually, land consumption q depends positively on the urban utility level u, but since the equilibrium u is a decreasing function of N, q decreases with N.

[14] The second-order condition for this problem is assumed to hold (it cannot be checked because of the complexity of the derivative $\Omega'(N)$).

$$\overline{y}_{\mathrm{u}} - t\overline{x}(N) + \Omega(N) = \overline{y}_{\mathrm{r}}. \tag{21.13}$$

This condition implies that $\overline{y}_{\mathrm{u}} - t\overline{x}(N) < \overline{y}_{\mathrm{r}}$ holds at the optimum, implying that $\overline{x}$ and hence N are larger at the optimum than in the equilibrium. Thus, the density externality that affects commuting distances tends to make cities too small.

Another population externality operating through commuting costs, which is negative in direction, would arise if the model were to include traffic congestion. Then, while an increase in N would make the city denser and reduce the average commuting distance, the higher traffic volumes from a larger population would worsen congestion, raising commuting costs. This effect could dominate, making the net population/commuting-cost externality negative. While the model would have to be restructured to embrace traffic congestion, the resulting framework would probably imply that N is larger, not smaller, at the optimum than in the equilibrium.

Externalities can also arise in production. To begin consideration of this case, suppose that incomes are no longer constant, but that land consumption is again fixed at unity. Let $Y_{\mathrm{u}}(N)$ and $Y_{\mathrm{r}}(\overline{N} - N)$ be the total urban and rural outputs, with marginal products equal to $y_i(N) \equiv Y_i'(N)$, $i = \mathrm{u}, \mathrm{r}$.[15] The sum of Y_{u} and Y_{r} minus ACC is the objective function, and following (21.12), the first-order condition is $y_{\mathrm{u}}(N) - t\overline{x}(N) = y_{\mathrm{r}}(\overline{N} - N)$. This condition coincides with the equilibrium condition (21.4) in the variable-income case, indicating efficiency of the equilibrium, and the reason is that a production externality is not yet present.[16]

To introduce such an externality, let production in the city exhibit external economies of scale, whose source is urban agglomeration economies. In this case, the urban production function is $A(N)Y_{\mathrm{u}}(N)$. The shift factor $A(N)$, which is viewed as parametric by individual firms, satisfies $A'(N) > 0$ at low values of N, indicating economies of scale, but $A'(N)$ could become negative at large values of N, reflecting eventual diseconomies ($A'' < 0$ is assumed). In this setting, the marginal product of labor from the perspective of a firm (which gives the urban income level) is $A(N)Y_{\mathrm{u}}'(N) = A(N)y_{\mathrm{u}}(N)$.

[15] At this point, it is worth noting an interpretational issue that arises when assuming that marginal products equal consumer incomes while also being functions of the population. In effect, the model implicitly portrays the city as containing a single firm with production function $Y_{\mathrm{u}}(N)$ while assuming that, despite its size, the firm behaves competitively in the labor market, paying a wage equal to the marginal product rather than exploiting the upward-sloping supply curve of labor faced by the city. This issue, which is present in the article by Harris and Todaro (1970) and elsewhere in the literature, does not arise when labor's marginal product is constant. In that case, the city's production can be viewed as coming from a large number of small, competitive firms, each paying a wage equal to the marginal product in the usual fashion.

[16] With land consumption fixed, the dependence of $\overline{x}$ on income disappears. If land consumption were instead variable, the impact of N on $\overline{x}$ via $y_{\mathrm{u}}(N)$ would need to be considered in the social optimization problem.

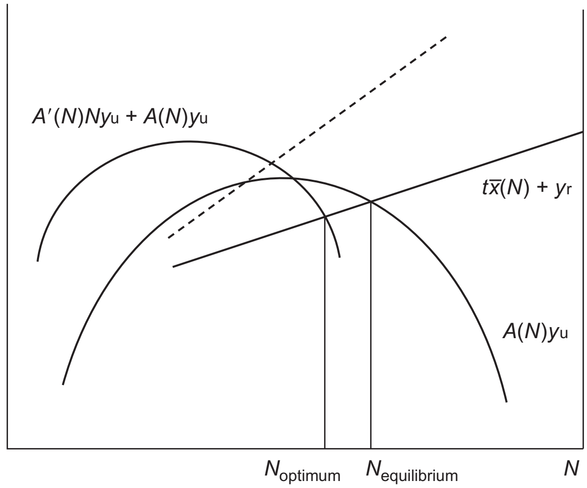

Figure 21.1 Equilibrium and optimum.

The socially optimal N maximizes $A(N)Y_u(N) + Y_r(\overline{N} - N) - \text{ACC}$, and the derivative of this expression with respect to N is

$$A'(N)Y_u(N) + A(N)y_u(N) - t\overline{x}(N) - y_r(\overline{N} - N). \tag{21.14}$$

If (21.14) decreases everywhere with N, the optimum is found by setting the expression equal to zero, as in the previous cases (the second-order condition then holds). If $A'(N)$ is positive at the optimum, then the migration equilibrium condition, which is $A(N)y_u(N) - t\overline{x}(N) = y_r(N)$, yields a smaller value of N ((21.14) includes an extra positive term). As a result, the equilibrium city size is too small, with migrants ignoring the external productivity benefits they generate in moving to the city. If, however, $A'(N) < 0$ holds at the optimum, with the optimal city so large that external diseconomies have begun to set in, then the conclusion is reversed: the equilibrium city size is too large, with migrants ignoring their negative external effects.

This outcome is illustrated in Figure 21.1, which assumes for simplicity that y_u and y_r are constants, independent of N, with $Y_u(N) = Ny_u$. $A(N)$ is an inverted U-shaped function, and the equilibrium N lies at the intersection of $A(N)y_u$ (also U shaped) and the upward-sloping line corresponding to $t\overline{x}(N) + y_r$, as shown in Figure 21.1.[17] The optimum (from (21.14)) lies at the intersection of $A'(N)Ny_u + A(N)y_u$ and the same line, yielding a lower value of N, as shown. Even when $A(N)$ is U shaped, the equilibrium could lie in a range where the function is upward sloping, yielding the reverse

[17] This expression generally need not yield a linear relationship, but one is drawn for convenience. Note also that the other intersections of the line with the U-shaped curves (which are not shown) are not relevant, yielding an unstable equilibrium or welfare minimum.

relationship between the equilibrium and the optimum (with the optimal N larger). This outcome occurs when $t\overline{x}(N) + y_r$ corresponds to the dotted line rather than solid line in Figure 21.1. Note that with y_u constant, the divergence between the equilibrium and the optimum can be seen as arising from a migrant's consideration of his average product in the city ($A(N)y_u$) rather than his marginal product ($A'(N)Ny_u + A(N)y_u$) in deciding whether to migrate.

In summary, the foregoing analysis shows that externalities can make cities either too large or too small in equilibrium relative to the socially optimal size. External diseconomies in production or the external effect of population on traffic congestion (which is not formally captured in the model) tend to make the city too large, whereas external economies in production or the population's external effect on densities (and thus commuting distances) tend to make the city too small. The lesson is that when externalities are present, the decentralized economy cannot be trusted to generate an optimal division of the population between the city and the countryside.

Such inefficiencies are also the focus of a body of literature in public economics initiated by Flatters et al. (1974), which studies the allocation of residents among urban jurisdictions providing local public goods. While the production-based externality arising via the $A(N)$ function is present in such models, an additional externality arises from the sharing of public-good costs. In particular, while an entering migrant makes his decision on the basis of the average (per capita) cost of a jurisdiction's public good, his entry drives down this average through cost sharing, an effect that he ignores. In such models, interjurisdictional transfers are needed to generate an efficient outcome, and such transfers can also achieve efficiency in the previous rural–urban context.

Arnott (1979) and Au and Henderson (2006) also analyze the optimal city size in a spatial economy, but they consider the optimal size of a city in isolation, not focusing on the optimal population split between the city and the countryside.[18] In other words, they choose N to maximize $A(N)Y_u(N) - \text{ACC}$, without considering rural output. In addition to generating analytical results, Au and Henderson (2006) also ask whether Chinese cities are optimal in size according to this criterion. They estimate the function $A(N)Y_u(N) - \text{ACC}$ using Chinese data and then find the locations of existing cities relative to the function's maximum, concluding that city populations tend to be too small. The reason, they argue, is China's institutional restrictions on rural–urban migration (the hukou rules).

21.3.6 Empirical evidence

Although there is a vast empirical literature on various aspects of urbanization, the part of this literature that focuses on the determination of city sizes is most relevant to the

[18] These models thus diverge from those in the public-economics tradition, which do not consider a single jurisdiction in isolation.

theoretical models discussed above. The regressions in Brueckner (1990) bear the closest connection since they are directly motivated by the model presented in Section 21.3.2. Using a small cross section of countries, the regressions relate measures of the extent of a country's urbanization to the urban–rural income ratio (y_u/y_r) and other variables, usually finding that this ratio has the expected positive effect (recall (21.6) and (21.7)). Additional studies, including those of Rosen and Resnick (1978), Wheaton and Shishido (1981), Ades and Glaeser (1995), Mutlu (1989), Moomaw and Shatter (1996), Davis and Henderson (2003), Henderson and Wang (2007), and Barrios et al. (2006), follow a similar approach by relating urbanization measures, sometimes including city growth or a measure of primacy (the extent of population concentration in the country's largest city),[19] to a broader set of explanatory variables in cross-sectional or panel regressions. The variables that appear in at least one of these studies include the country's level of economic development (GDP per capita), sectoral employment shares (agriculture and manufacturing), administrative centralization (captured by a federal structure), a centrally planned economy, openness to international trade, land area, overall population, education and literacy, income inequality, ethnic heterogeneity, the extent of transportation linkages, measures of political freedom, and foreign-aid assistance. Higher GDP per capita reliably spurs urbanization, as does a federal political structure.

The study of Barrios et al. (2006), mentioned in Section 21.2, includes some of these same variables, but it is distinguished by a focus on low rainfall, which depresses rural incomes, as a factor spurring rural–urban migration and city growth (an effect that is measured using panel data for countries in Africa). Poelhekke (2011) offers a related analysis that focuses on rural income risk (possibly from rainfall variability) as a motivation for migration to cities. He shows that the growth of urbanized populations in a large international panel dataset responds positively to a time-varying, country-level measure of the volatility of agricultural value added, as predicted. In another novel study discussed in more detail in the next section, Hidalgo et al. (2010) focus on the migration of urban squatters, who enter the city through a "land invasion." The study shows that land invasions in Brazil are more likely to occur and be larger when agricultural yields in the countryside are lower, indicating low rural incomes.

Young (2013) offers empirical evidence supporting a view at variance with the models described above. In particular, Young documents evidence showing a gap between living standards in urban and rural areas, rather than the equality that characterizes migration equilibrium in the preceding analysis. He argues that this gap reflects

[19] Note that, as structured, the models considered previously are not capable of handling the phenomenon of primacy, where the urban population is mostly concentrated in a single large city that coexists with other, smaller urban areas.

sorting of the population by skill (human capital) across rural and urban locations. Higher-skilled workers sort into urban areas, where modern production techniques can make use of their abilities, while less-skilled workers remain in the countryside. It appears, however, that Young's approach could be reconciled with the migration equilibrium portrayed in the previous models by positing a continuous skill distribution, where a critical skill level separates migrants and nonmigrants. The worker with this critical skill level would be indifferent to migrating or not migrating, with the higher urban cost of living exactly balancing the higher return to his skill in the city. Workers with skills higher (lower) than the critical level would strictly prefer the urban (rural) area, and the result would be a gap between average living standards in the two areas, as found by Young (2013).

21.4. TENURE INSECURITY: A HALLMARK OF HOUSING MARKETS IN DEVELOPING COUNTRIES

In the analysis in Section 21.3, the cost of urban housing plays a key role in equilibrating rural–urban migration. While the dwellings in the urban housing market were depicted for simplicity as consisting only of land, housing in developing countries is in reality a more complex commodity composed of a bundle of attributes characterizing the structure and the land it occupies, just as in developed countries. In generating prices, housing markets in developing countries function in some respects just like those in developed countries, with the rents or selling prices that dwellings command reflecting the desirability of the attribute bundles they offer. Recognizing this commonality, many researchers have estimated hedonic price models for developing-country housing markets or used related approaches for the purpose of measuring willingness to pay for housing attributes. The results mirror the findings of hundreds of similar studies from developed countries. Studies of this type include those of Follain et al. (1982), Quigley (1982), Lim et al. (1984), Follain and Jimenez (1985), Daniere (1994), Gross (1988), Lall et al. (2008), Takeuchi et al. (2008), and Brueckner (2013a).

Despite some commonality with housing markets in the developed world, markets in developing countries are distinguished in part by the widespread presence of urban slums, which consist of low-quality, often self-constructed, housing much worse in quality than that found in the developed world. For a graphic description of slum conditions in developing countries, see Marx et al. (2013).[20] Case studies also suggest that a substantial share of slum residents consists of squatters, who occupy the land without paying compensation to its owner. For example, in the city of Dhaka, Bangladesh,

[20] The low quality of the housing consumed by migrants is, of course, not recognized in the models presented in Section 21.3.

squatter settlements are estimated to provide as much as 15% of the housing stock (World Bank, 2007), and the share is probably higher in some other regions.[21]

Squatting represents the most extreme case of another feature that differentiates housing markets in developing countries from those in the developed world: the widespread lack of tenure security, or "land rights" security. Tenure security in a legal sense is completely absent for squatters, although they enjoy some degree of security in practice if the threat of eviction is low. However, owing to underdeveloped legal and land registration systems, tenure is also insecure for many developing-country residents who pay for the housing they occupy but face a "continuum" of property rights, with legal gray areas. This insecurity reduces the incentives to invest in housing improvements by owner-occupiers, an effect that is present in the starkest fashion for illegal squatters, who often live in flimsy shacks constructed from abandoned materials, creating slum conditions. By reducing their attractiveness, tenure insecurity also impedes the market turnover of dwellings, although squatter housing does trade in markets internal to the settlements. Lacking legal status, however, squatters cannot sell their plots to formal users, who would require legal title to proceed with redevelopment of the land. Tenure insecurity also stunts the development of mortgage markets, which require clear title in order to treat a dwelling as loan collateral.[22] These obstacles, of course, can be overcome through government programs that transfer land titles to illegal occupants, programs that exist in some cities in the developing world (examples come from Peru and Argentina, as discussed further below).

The remainder of this section explores the issue of tenure insecurity in considerable detail. The next subsection discusses two case studies, for Mali and Vietnam, that show how a property-rights continuum, as mentioned above, works in practice. The discussion then turns to an extensive treatment of the economics of squatting, a polar case of tenure insecurity that has become the focus of a substantial literature.

21.4.1 A continuum of property rights: Mali and Vietnam

Selod and Tobin (2013) provide an extensive discussion of property rights and tenure insecurity in the West African country of Mali, while also developing a theoretical model to explain the observed patterns of security. "Customary tenure," which is prevalent in rural and periurban areas, is enforced by village chiefs and their councils of elders, following a request for land and a small symbolic payment. Although customary tenure involves no legal documents, it is legally recognized. An "attribution letter" is a document issued at the beginning of a land allocation procedure (which transfers public land to

[21] With crowding presumably higher in squatter housing, Dhaka's 15% squatter housing share would translate into a larger share of the population.

[22] An upside of tenure insecurity is that easy removal of existing occupants lowers the barrier to land redevelopment when it becomes desirable.

private individuals), and it provides a basic level of tenure security. More formal and secure tenure rights are provided by rural or urban "residency permits," which provide temporary use rights, and at the end of the continuum is "definitive title," which provides full property rights. Selod and Tobin state that only 8.5% of owners in Mali hold this title, although the share is higher in cities. They also explain that these different tenure rights are "obtained through complex processes" that are "very costly" for households.

Recognizing these costs, the study authors construct a theoretical model where households invest in tenure security, incurring a cost $C(\pi,e)$ to achieve a probability of π of keeping their property (their housing outlay is lost otherwise). The parameter e measures the household's idiosyncratic ability to interact with the land administration in pursuit of tenure security, with a higher e reducing C. The model is developed in a spatial context with commuting to a central business district, and it predicts that households are distributed across space according to their values of e, with higher e households (who achieve larger values of π) located closer to the center. The city thus exhibits different tenure-security zones, with the highest security near the center and the lowest security found on the rural fringe, a pattern that roughly matches the one seen in Selod and Tobin's survey data.

In Vietnam, as explained by Kim (2004), all the land was originally owned by the state, but is being transferred to households through a cumbersome and costly titling process. A title is known as a building occupancy and land-use certificate (BOLUC). To receive a BOLUC, a household must present a collection of "legal papers," which could include a construction permit, a notarized transfer contract, an occupancy-rights document provided by a local district committee, an inheritance document, or a number of other items. Kim points out that "legal papers" provide some tenure security in the absence of a BOLUC, with such papers appearing to serve a purpose like that of the Malian attribution letter described by Selod and Tobin (2013). In Kim's sample of properties listed for sale, about one-quarter have a BOLUC, one-quarter have legal papers, and one-third have no evidence of property rights.

To gauge the contribution of property rights to selling prices, Kim estimates an hedonic price regression that includes dwelling characteristics and property-rights dummy variables. She finds, as expected, that possession of property rights of any kind raises the dwelling price (being worth about as much as a telephone connection), with a BOLUC worth more than twice as much as legal papers. Interestingly, possession of both legal papers and a BOLUC is worth more than a BOLUC alone, apparently indicating that even a formal title does not provide indisputable property rights, with the supplementary information given by legal papers adding more evidence. Overall, Kim's results supplement the anecdotal evidence in Selod and Tobin (2013) by showing that developing countries often have a continuum of property rights, with rights in the lower and middle parts of the continuum still providing benefits.

It should be noted that property rights are limited in a different fashion in countries such as China, where all land is government owned and private developers sign long-term, transferable leases for its use. Although Chinese leases are renewable, users in principle face the possibility of losing their usage rights upon termination of a lease.

21.4.2 The economics of squatting: Theory

The discussion turns now to the case of squatting, where legal property rights are completely absent. Along with other social scientists, economists have expended considerable effort studying the squatting phenomenon, leading to a distinct literature. This literature contains theoretical contributions, which attempt to analyze the incentives and decision-making of squatters and landowners, along with empirical contributions, which rely on scarce data to explore various aspects of the squatting phenomenon. This subsection surveys the theoretical side of this literature, and the next subsection appraises the empirical side.

The existing theoretical models of squatting behavior are all built around the possibility of eviction of squatter households. While eviction is an outcome sometimes faced by legal occupants of rental housing in developed countries (though it is usually circumscribed by renter-protection laws), illegal occupancy in squatter areas makes eviction a more serious threat. In some countries, however, this threat appears to fade rapidly with the length of tenure. In a private conversation, for example, Fernando Cavillieri, Director of the Pereira Passos Institute of the city government of Rio de Janiero, asserted that squatters in that city must be evicted in their first week of occupancy if they are to be evicted at all. A quick eviction of this type figured prominently in recent news stories describing the eviction of squatters (and an ensuing riot) in a new Rio de Janiero settlement (Kiernan, 2014). In another private conversation, Zama Mgwatyu of the Development Action Group, a South African NGO, asserted that successful evictions in that country must occur within the first 48 h of occupancy.

While worldwide data on squatter evictions do not exist, these observations are consistent with a view that, despite the threat, actual evictions are relatively infrequent. This view matches the Ecuadorian survey data of Lanjouw and Levy (2002) (discussed in detail below), which show that squatters in Ecuador do not perceive eviction as being very likely. Nevertheless, the eviction threat is the foundation of most research on squatting, although one line of theoretical work (Brueckner and Selod, 2009; Brueckner, 2013b; Shah, 2014) addresses this apparent conflict by explaining how eviction can be both threatened and absent. The argument is that the organizers of squatter settlements ensure that they never expand to a size that would prompt eviction, while also taking other steps to guard against this outcome. By contrast, in the models of Jimenez (1985), Hoy and Jimenez (1991), and Turnbull (2008), eviction is an event that occurs with some probability, which may depend on how much housing squatters construct on their plots. A large housing investment can raise eviction costs, making eviction less likely. To understand the different perspectives embodied in this work, it is useful to sketch the main features of the individual models.[23]

21.4.2.1 The Jimenez model

In Jimenez (1985), a consumer (the head of a household) must decide whether to be a squatter or to rent housing in the formal sector, so squatting is a tenure choice. With formal occupancy, the consumer pays a rental price per unit equal to p_f, consuming h_f worth of housing and x_f worth of the numeraire nonhousing good. Conditional on being a formal resident, the consumer then faces the budget constraint $x_f + p_f h_f = y$, where y is income. The consumer chooses the two consumption levels to maximize utility $u(x_f, h_f)$ subject to this constraint.

As a squatter, the consumer faces the possibility of being evicted and forced to enter the formal market to secure housing. In this event, the consumer loses whatever funds were spent on squatter housing (at price $p_s < p_f$ per unit) and must make a new housing expenditure. If eviction does not occur, however, the need for this double expenditure does not arise. Note that the Jimenez model, by assuming payment of rent by squatter households, portrays a developed squatter community in which a market for housing exists despite the illegality of the settlement. Even though the land was seized initially without any payment to its owners, trade in squatter dwelling arises subsequently as the community becomes established.

With eviction, the squatter's budget constraint is $x_{fe} + p_f h_{fe} + p_s h_s = y$, where h_s is the amount of squatter housing and where the subscript fe denotes consumption levels in the formal sector following eviction. The second term is the formal housing expenditure necessitated by eviction, whereas the third term is the lost expenditure on squatter housing. Since h_s is never actually consumed when the squatter is evicted, utility in the eviction case is $u(x_{fe}, h_{fe})$. By contrast, if eviction does not occur, then the budget constraint is $x_s + p_s h_s = y$ and utility is $u(x_s, h_s)$. Note that housing consumption equals the squatter level h_s in this case, not h_{fe}.

Eviction occurs with a probability π, which is ultimately endogenous. Expected utility for the squatter household then equals $\pi u(x_{fe}, h_{fe}) + (1 - \pi)u(x_s, h_s)$, the weighted sum of the utilities in the eviction and no-eviction cases, with the weights being the relevant probabilities. Eliminating the x's using the two budget constraints from above, expected utility can be rewritten as

[23] Eviction can be viewed as an uncompensated "taking" of land, where the absence of compensation is justified by illegal occupancy. However, government-sanctioned takings that occur without (adequate) compensation are common around the world, happening in both developed countries and underdeveloped countries outside squatter settlements.

$$\pi u(y - p_f h_{fe} - p_s h_s, h_{fe}) + (1 - \pi) u(y - p_s h_s, h_s). \tag{21.15}$$

The household chooses h_s and h_{fe} to maximize (21.15). A key feature of this optimization problem is that the squatter housing level h_s is chosen recognizing that it may never be consumed. Given the possibility of this lost expenditure, the consumer will set h_s at a level lower than would be chosen if eviction were impossible. In addition, if the squatter is forced to enter the formal market, the income reduction from the lost squatter-housing expenditure will lead to an h_{fe} smaller than the h_f that would be chosen by a nonsquatter.

Although the formal housing price p_f is exogenously fixed, the squatter price p_s is determined along with the eviction probability π by the interaction of supply and demand forces. On the demand side, consumer "willingness to pay" for squatter housing helps determine its price. Willingness to pay can be found by deriving the price p_s at which a consumer would be indifferent between squatting and formal residence. To do so, note that formal utility is fixed, with its value being determined by y and p_f, both of which are exogenous. Expected utility as a squatter will also depend on these exogenous variables, but the crucial dependencies are on p_s and π, and an increase in either variable reduces expected utility. With the effects of both variables being negative, keeping expected utility constant at the fixed formal utility level means that p_s and π must vary inversely, with a lower p_s accompanying a higher π, and vice versa. As a result, willingness to pay for squatter housing is a decreasing function of the eviction probability, so that

$$p_s = g(\pi), \tag{21.16}$$

where $g' < 0$. It is easy to see that p_s from (21.16) equals p_f when the eviction probability is zero (which makes formal residence and squatting equivalent), while $p_s < p_f$ holds when $\pi > 0$. In this case, the consumer requires a price discount to bear the risk of eviction.

Two elements interact on the supply side: a limited squatter land area, and fixed amount of government funds available for eviction. The limited squatter land area means that the price of squatter housing increases with the size N of the squatter population, as more squatters compete for the available land. The resulting price equation is written as $p_s = h(N)$, where $h' > 0$. The fixed amount G of government eviction funds means that only G/E squatters can be evicted, where E is the eviction cost per squatter. But with a squatter population of N, the eviction probability is then $\pi = (G/E)/N$. Since a larger N thus reduces π while at the same time raising p_s owing to land scarcity, it follows that p_s and π are inversely related. In other words,

$$p_s = m(\pi), \tag{21.17}$$

where $m' < 0$.[24] Therefore, from the supply side, the squatter housing price is a decreasing function of the eviction probability, just as is true on the demand side.

[24] Formally, (21.3) follows from rewriting the π equation as $N = (1/\pi)(G/E)$ and substituting this into the price equation $p_s = f(N)$, which yields $p_s = f[(1/\pi)(G/E)] \equiv \Omega(\pi)$. Since $f' > 0$, it follows that $\Omega' < 0$.

The demand relationship in (21.16) and the supply relationship in (21.17) jointly determine the equilibrium values of the squatter housing price p_s and the eviction probability π. The equilibrium corresponds to the intersection of the two curves given by (21.16) and (21.17). Once the equilibrium π has been determined from this intersection, the equilibrium size for the squatter population is found via the formula $\pi = (G/E)/N$. Since both demand and supply relationships are downward sloping, they may have several intersections, which means that multiple equilibria may exist. Some of these equilibria will be unstable.

The building blocks of the Jimenez model are thus consumer indifference between squatting and formal residence on the demand side, and limited land for squatting along with fixed eviction funds on the supply side. The price p_s, the eviction probability π, and the squatter population size N all adjust to make consumers indifferent between the tenure modes, to ensure that all eviction money is spent, and to allow squatters to fit in the available land area. Comparative-static analysis of the model shows that an increase in eviction spending G reduces N and p_s while raising π, all natural conclusions. The effects of an increase in income y are ambiguous.

21.4.2.2 The Hoy–Jimenez and Turnbull Models

Rather than having the government evict squatters using a budget of fixed size, Hoy and Jimenez (1991) and Turnbull (2008) assume that evictions are instead carried out by landowners in response to emerging development opportunities for particular plots of land. These opportunities arise randomly, making eviction on a particular plot a stochastic event.

In the Turnbull model, the posteviction fate of squatters is harsher than in the model of Jimenez (1985), with housing consumption reduced to zero following eviction. Expected utility is then $\pi u(x_s,0) + (1 - \pi)u(x_s,h_s)$, and the squatter budget constraint is $x_s + p_s h_s = y_s$, where y_s is squatter income. Since squatter housing expenditure is lost with eviction, h_s is smaller when the eviction probability is higher. This relationship is written $h_s = t(\pi)$, where $t' < 0$. The squatter housing price, which plays no important role in the model, can be viewed as fixed. In addition, the tenure choice aspect of the Jimenez model is absent.

Turnbull assumes that the net revenue r that can be earned by developing a plot is a continuous random variable, which is independent across plots. Landowners each own just a single plot, and any particular landowner will evict squatters when the r realization for the plot exceeds the cost of eviction. This cost depends positively on the amount of housing on the plot, which must be cleared following eviction, being written as $c(h_s)$, with $c' > 0$. The developer thus evicts the squatter when the random development revenue r exceeds $c(h_s)$ and does not evict the squatter otherwise. Eviction is then less likely when $c(h_s)$ is large and hence when h_s is large. As a result, the eviction probability can be written as a decreasing function of h_s, with $\pi = q(h_s)$, where $q' < 0$.

Since h_s is a function of π, while π depends on h_s, the housing consumption level and eviction probability are jointly determined. The mutually consistent equilibrium values of h_s and π must satisfy both of these relationships, with $h_s = t(\pi)$ and $\pi = q(h_s)$ holding. The values thus lie at the intersection of the two curves defined by these equations. As in the model of Jimenez (1985), the curves are both downward sloping, raising the possibility of multiple equilibria, some of which are unstable. Turnbull's comparative-static analysis shows that h_s falls and π rises when favorable development returns become more likely or when squatter income falls.

Whereas landowners are atomistic in Turnbull's model, with each owning a single plot, ownership is concentrated in the Hoy–Jimenez setup, with one landowner owning all the land occupied by squatters. In addition, the random development opportunities are binary in nature. For each plot, a development opportunity yielding a fixed net revenue R arises with probability θ, and no opportunity arises with probability $1 - \theta$.

As in the Turnbull model, the eviction cost is equal to $c(h_s)$, with $c' > 0$. In addition, housing consumption again depends on the eviction probability π via the function $h_s = t(\pi)$, with $t' < 0$. But in contrast to the Turnbull model, where π for any given plot reflects the randomness of development revenue for that plot (and hence the randomness of the development decision), π in the Hoy–Jimenez model is determined by the landowner's choice of *the fraction of plots on which eviction will occur*. From the squatter's perspective, eviction looks random because no squatter knows in advance whether his/her plot will be targeted for eviction. The eviction share, however, is chosen in advance by the landowner, recognizing that the identities of the particular plots on which eviction occurs will depend on the random arrival of development opportunities.

The main question of interest for Hoy and Jimenez is the relationship between the landowner's chosen π and the probability θ of a development opportunity, quantities that they show need not be equal. First, it is clear that no plot with a favorable opportunity for development will be passed over for eviction, while eviction occurs on some plot that lacks such an opportunity. Costs would be unaffected by switching the location of eviction, while revenue would rise. But it may be optimal for the landowner to evict squatters on all plots with development opportunities *while also evicting squatters on plots without them*, so that $\pi > \theta$. The reason is that the larger π will retard squatter investment (h_s) on all plots, limiting expected eviction costs. In this case, Hoy and Jimenez say that "apparently superfluous" evictions occur. A third possibility is that π is set low enough so that evictions do not occur on some plots with development opportunities, so that $\pi < \theta$.

Hoy and Jimenez's main conclusion is that either of these possibilities could indeed be optimal, with π either smaller or larger than θ, or possibly equal to it.[25] Comparative-

[25] Since eviction cost depends on h_s and h_s depends on π, the cost can be written as $k(\pi)$, a decreasing function, so that the expected cost per plot equals $\pi k(\pi)$. The expected profit per plot is then $\pi R - \pi k(\pi)$ when $\pi < \theta$ and $\theta R - \pi k(\pi)$ when $\pi \geq \theta$. Hoy and Jimenez show that the maximizing value of π can lie in either of these ranges.

static analysis shows that when superfluous evictions occur, marginal increases in R or θ have no effect on the chosen π. When the optimal π is less than θ, however, a marginally higher R raises π, although an increase in θ still has no effect.

Unlike in the Hoy–Jimenez setup, evictions in the Turnbull model are made atomistically, plot by plot, which means that superfluous evictions (where no development revenue is earned) will never occur. In the Hoy–Jimenez model, by contrast, the single landowner may want to carry out evictions on plots without development opportunities in order to raise the general threat of eviction, thus reducing housing investment (and making eviction easier) throughout the squatter area.

21.4.2.3 The Brueckner–Selod model

The model of squatting of Brueckner and Selod (2009) is centered around the eviction issue, but the approach is entirely different from the approaches of the previous authors. As in the Hoy–Jimenez and Turnbull models, development of the land occupied by squatters is desirable when the revenue earned is high. But instead of following previous authors by saying little about the market for posteviction developed plots, Brueckner and Selod assume that such plots *are rented out in the city's formal housing market*. For simplicity, housing capital is absent, with land consumption representing housing. So when eviction removes squatters from the land, the vacant plots are rented and occupied by formal residents. Since squatters and formal residents divide a fixed total land area, the presence of squatter settlements "squeezes" the formal market, raising the formal rent per unit of land, denoted p_f.

Eviction is desirable when p_f exceeds the eviction cost per unit of land. While this "eviction condition" follows the spirit of the other models, the key difference in the Brueckner–Selod model is the existence of a squatter organizer, who ensures that the eviction condition is not met and hence that eviction never occurs. The organizer achieves this goal by limiting the squeezing of the formal market, preventing escalation of p_f, and by controlling eviction costs. As explained above, this structure helps to explain real-world patterns, in which the threat of eviction exists but its occurrence is relatively infrequent.

The eviction costs that the organizer attempts to control depend in part on the "defensive expenditures" undertaken by squatters, which raise the cost of eviction. These expenditures, which are dictated by the squatter organizer, could go partly toward political lobbying intended to build support for the squatter community. The expenditures could also support a squatter security force for defending the settlement, or they could represent foregone labor income as squatters spend time at home to defend their plots rather than working at full capacity (Field (2007) provides evidence on such behavior, as discussed below). Jimenez (1985) briefly includes defensive expenditures in his model, but he argues that they represent a public good exploitable through free riding, implying that the equilibrium level of such expenditures will be zero. With the squatter organizer dictating individual defensive expenditures, a positive level is sustainable.

The eviction cost thus depends on defensive expenditures per household, which are denoted by A. In addition, the size of the squatter population, N_s, affects eviction costs in a positive direction. With a larger total squatter population, the political outcry caused by eviction is more substantial, making eviction more costly. These relationships are captured by the eviction-cost function $e(A,N_s)$, which gives the eviction cost *per unit of land*. The $e(\cdot)$ function is increasing in both its arguments. In order for eviction not to be worthwhile for landowners, the posteviction return to the land, given by the formal price p_f, cannot be larger than the eviction cost per acre. Formally, this "no-eviction" constraint is written

$$p_f \le e(A, N_s). \tag{21.18}$$

The squeezing process determines p_f in (21.18), as follows. Individual land consumption for squatter households is denoted by h_s, which implies that the total land area occupied by squatters equals $N_s h_s$. With the overall land area of the city fixed at $\overline{L}$, the remaining formal land area equals $\overline{L} - N_s h_s$. The fixed formal population must fit in this area, which requires the formal price p_f to adjust so as to equate the total demand for land by formal residents to the available area. This total demand depends on the size of the formal population, which is fixed at $\overline{N}_f$, and on the individual demand for land, which is given by the downward-sloping demand function $h_f = d_f(p_f)$. Total demand then equals $\overline{N}_f d_f(p_f)$, so that the condition

$$\overline{N}_f d_f(p_f) = \overline{L} - N_s h_s \tag{21.19}$$

ensures that the formal residents fit into the available land area.

The last elements of the model are the squatter utility function, $u(x_s, h_s)$, and the budget constraint. In contrast to the other models, squatters are assumed to incur no direct cost for the land they occupy, which is invaded and occupied with no payment to anyone. Squatters do, however, pay for defensive expenditures, as dictated by the squatter organizer. As a result, their budget constraint is $A + x_s = y_s$, so utility can be written

$$u(y_s - A, h_s). \tag{21.20}$$

While the squatter organizer dictates the level of A, he/she also controls the sizes of squatter plots, dictating the individual land consumption levels h_s. In addition, he/she has control over the size of the squatter population, N_s, having the power to limit the number of households participating in the land invasion. The organizer thus controls A, h_s, and N_s, and he/she chooses the levels of these variables to maximize individual squatter utility, as given in (21.20). The constraints for the optimization problem are the formal market-clearing condition (21.19) and the no-eviction constraint (21.18). It is easy to see that this constraint will bind at the solution, so that landowners are indifferent to evicting or not evicting the squatters.[26]

Given the complexity of the model, general comparative-static analysis of the squatter equilibrium is not feasible. However, using common functional forms,[27] the equilibrium solution can be computed, showing how the decision variables respond to changes in the exogenous variables. One surprising feature of the solution (a consequence of the assumed functional forms) is that squatters occupy exactly half of the city's land area regardless of the values of the other parameters. With land supply to the formal sector thus effectively fixed, the formal price depends only on the strength of formal demand and not on squatter characteristics such as income y_s. Squatter income does, however, affect N_s and h_s, which fall and rise, respectively, with y_s in an offsetting fashion so as to keep the total squatter land area constant.

If all squatters were simultaneously switched to formal residency, being required to pay for their land, they would individually be worse off and the formal residents would be better off. The formal residents gain because the squatter group squeezes them less when formalized than it did originally, allowing formal land consumption to rise. Although formalized squatters are worse off, the analysis shows that formal residents could compensate them for their losses while still coming out ahead. This potential Pareto improvement shows that the original squatting equilibrium was inefficient.

Brueckner (2013b) extends this model by assuming that the city has multiple squatter organizers who are rent-seekers rather than benevolent agents. In addition to collecting defensive expenditures, the organizers require squatters to pay rent, which they pocket as income. The article characterizes the squatting equilibrium for this case and presents a variety of comparative-static results.

21.4.2.4 The Shah model

Whereas the Brueckner–Selod model portrays the squatters as occupying privately owned land, much squatting in reality occurs on government-owned land. Shah (2014) adapts the Brueckner–Selod approach to deal with this important alternative case. The loss from squatter occupation of government-owned land could involve forsaken benefits from blocked infrastructure projects, such as enlargement of an airport ringed by squatter settlements (Mumbai, India, represents such a case), or forgone revenue

[26] In order for the organizer to face a willing supply of squatters, allowing him/her to control N_s, the utility they achieve must be greater than the utility level reached in the rural area that supplies urban migrants. However, under an alternative version of the model, the organizer cannot control N_s, although he/she is still able to dictate A and h_s. In this case, squatters enter the city until the maximized utility is pushed down to the rural level.

[27] The assumptions are that both squatters and formal residents have Cobb–Douglas preferences and that the eviction-cost function is multiplicative in A and N_s.

from sale of the land to the private sector for residential, commercial, or industrial development. Shah (2014) represents such losses in a simple, stylized fashion by assuming that vacant government-owned land generates open-space benefits for formal households (being a city park), which are reduced when the land is partly occupied by squatters.

For simplicity, housing (land) consumption for the formal households is exogenously fixed, as is the formal housing price. The disposable income of a formal household is then $\widetilde{y}_{\mathrm{f}} = y_{\mathrm{f}} - \overline{p}_{\mathrm{f}}\overline{h}_{\mathrm{f}}$, where the bars denote fixed values. With h_{f} fixed at $\overline{h}_{\mathrm{f}}$, formal utility can be written as a function of only nonhousing consumption x_{f} and open space, denoted ℓ. Formal utility is then $u_{\mathrm{f}}(x_{\mathrm{f}}, \ell)$. Letting $\overline{L}_{\mathrm{G}}$ denote the total amount of government-owned land devoted to parks, the amount of open space available after the squatter land invasion is given by $\ell = \overline{L}_{\mathrm{G}} - N_{\mathrm{s}}h_{\mathrm{s}}$. With the budget constraint given by $x_{\mathrm{f}} = y_{\mathrm{f}} - \overline{p}_{\mathrm{f}}\overline{h}_{\mathrm{f}} = \widetilde{y}_{\mathrm{f}}$, formal utility then equals $u_{\mathrm{f}}(\widetilde{y}_{\mathrm{f}}, \overline{L}_{\mathrm{G}} - N_{\mathrm{s}}h_{\mathrm{s}})$.

If the squatters are evicted, the full amount of open space $\overline{L}_{\mathrm{G}}$ can be enjoyed, but eviction costs must be incurred. The government pays these costs, but it finances the expenditure with taxes on the formal households. The total cost of evicting the squatters is the cost per unit of land, $e(A, N_{\mathrm{s}})$, times the amount of land occupied, $N_{\mathrm{s}}h_{\mathrm{s}}$. Therefore, the eviction tax on each formal household is equal to

$$\frac{N_{\mathrm{s}}h_{\mathrm{s}}e(A, N_{\mathrm{s}})}{\overline{N}_{\mathrm{f}}}. \tag{21.21}$$

If the utility of formal residents when eviction is carried out exceeds their utility with the squatters present but no eviction tax levied, then eviction will occur. Thus, to avoid eviction, the squatter organizer must ensure that the following no-eviction constraint is satisfied:

$$u_{\mathrm{f}}\left(y_{\mathrm{f}} - \frac{N_{\mathrm{s}}h_{\mathrm{s}}e(A, N_{\mathrm{s}})}{\overline{N}_{\mathrm{f}}},\ \ \overline{L}_{\mathrm{G}}\right) \le u_{\mathrm{f}}(\widetilde{y}_{\mathrm{f}},\ \ \overline{L}_{\mathrm{G}} - N_{\mathrm{s}}h_{\mathrm{s}}). \tag{21.22}$$

The constraint says that formal utility with eviction is less than or equal to formal utility with the squatters in place. As before, the organizer sets A, h_{s}, and N_{s} to maximize squatter utility, $u_{\mathrm{s}}(y_{\mathrm{s}} - A,\ h_{\mathrm{s}})$, but he/she now takes into account this new form of the eviction constraint. With squeezing of the formal housing market not an issue, a constraint such as (21.19) does not apply.

As in the case of the Brueckner–Selod model, general comparative-static analysis of the Shah model is not feasible. This obstacle is still present with the simplification of Cobb–Douglas preferences, but when the formal and squatter utility functions are linear, results can be derived. An increase in the number of formal households $\overline{N}_{\mathrm{f}}$, which lowers the per capita eviction tax, raises N_{s} as the organizer enlarges the squatter population to deter now cheaper eviction. This increase allows defensive expenditures A to be reduced, but it also requires a smaller h_s. An increase in the valuation of open space by formal residents, which again raises the incentive to evict squatters, has the same effects.[28]

Like Brueckner and Selod, Shah investigates formalization of squatters, who are given title to the land they occupy in return for a rental payment. These payments, which can be transferred to the formal households, are sufficient to compensate them for the loss of open space only when their valuation of such space is sufficiently high (note the contrast to Brueckner and Selod's unconditional formalization result). Finally, Shah investigates a hybrid model where squatting occurs both on government-owned land and on private land, with the squatters squeezing the formal residents as before. She shows that it is optimal for the squatter organizer to equally split his/her population, with half squatting on private land and half squatting on government-owned land.

21.4.3 The economics of squatting: Empirical work

Despite substantial interest in squatting, empirical work on this topic has not been particularly extensive, mainly as a result of limited data availability. One group of articles focuses on the effect of the tenure insecurity faced by squatters on the rents and values of squatter dwellings and on the ease of transferability through market transactions. Jimenez (1984), Friedman et al. (1988), Lanjouw and Levy (2002), and Kapoor and le Blanc (2008) study these effects. A pair of additional articles by Field (2005, 2007) focuses on the effect of tenure insecurity (and the resulting need to defend the squatter's dwelling) on labor force participation as well as the effect on investment in property improvements. An article by Hidalgo et al. (2010) studies land invasions by squatters in Brazil and relates their occurrence and size to a number of variables measuring local economic conditions. The connections between these empirical studies and the theories surveyed in Section 21.4.2 will be noted as the discussion unfolds.

Jimenez (1984) compares the actual rent that a squatter dwelling commands with the predicted rent for a dwelling with the same characteristics in the formal market. He expects to find a squatter discount relative to the formal rent, reflecting tenure insecurity. This prediction follows formally from equation (21.16), which showed that p_s is less than p_f when the eviction probability is positive.

[28] The model Shah analyzes is actually slightly different from the one described above. Rather than using an eviction-cost function that gives the cost per unit of land, she relies on a total eviction-cost function, which gives the cost of evicting all the squatters, a function that is written as $E(A, N_s)$. Therefore, her eviction-cost tax, equal to $E(A, N_s)/\overline{N}_f$, does not depend on h_s, in contrast to the formulation in (21.11). The (inaccurate) description in the text is meant to maintain comparability with the discussion of the Brueckner–Selod model, and Shah's comparative-static results would not necessarily emerge under the text formulation. Her particular results also require the assumption that the cross partial derivative $E_{N_s A}$ is zero or negative. This condition, which indicates that a large squatter population reduces the marginal benefit from defensive expenditures, is natural.

Jimenez combines actual data on squatter rents and dwelling characteristics for a 1983 Philippine sample with an estimated hedonic price function for formal-sector housing. This function relates formal rent to the number of rooms, measures of structure quality (including the presence of toilet facilities), a water availability index, indicators of phone and electricity access, and some neighborhood characteristics. For each squatter dwelling, the predicted formal rent is generated by substituting the dwelling's characteristics into the formal hedonic price function. The ratio of the predicted formal rent and the actual rent for the squatter dwelling is computed and then averaged across the squatter dwellings in the sample. The average value of the ratio is 1.177, indicating an 18% formal premium, or conversely a 15% discount relative to the formal rent for a squatter dwelling.[29] These findings mirror the results of Kim (2004) for Vietnam, which showed the value of different degrees of tenure security in the formal market.

Friedman et al. (1988) use the same dataset to answer the same question in a slightly different way. Instead of just estimating a formal hedonic price function, they estimate two hedonic functions, one for the formal sector and one for squatters, while also estimating a pooled hedonic price function, with a dummy variable representing squatter dwellings in the pooled sample. In the case of renters, the separate formal and squatter hedonic functions are not statistically distinguishable, allowing the pooled function to be used instead and the squatter discount to be inferred from the squatter dummy coefficient. This coefficient shows a squatter discount of around 10%, but one that is not statistically significant. The separate hedonic functions are statistically different for the case of owners, so both functions must be used to predict the squatter discount. The results show a 19%, statistically significant discount.[30] Thus, as in Jimenez (1984), the squatter discount is larger for owners.

Kapoor and le Blanc (2008) carry out a related exercise that focuses on the difference between the "rate of return" on a dwelling in the formal and squatter sectors. This rate of return is equal to the dwelling's rent-to-value ratio, which is computed using a 2002 survey from Pune, India. With a squatter dwelling under threat of seizure by the landowner, its rent flow is more uncertain than that of a formal dwelling, implying the rate of return for the squatter dwelling should be higher. In other words, the selling price should be a smaller multiple of the current rent than for a formal dwelling. Kapoor and le Blanc's results show average rates of return for formal and squatter housing of 6.7% and 8.1%,

[29] The same exercise is carried out for squatter dwellings that are owner occupied rather than rented using a separate hedonic price function estimated for formal owner-occupied housing. In this case, the average ratio is 1.578, which implies a 37% discount for squatter owner-occupied dwellings.

[30] The method is to compute the predicted formal selling price of a squatter dwelling using formal hedonic function and then to compute the predicted selling price of the dwelling as a squatter dwelling using the squatter hedonic function. The ratio is then computed and averaged across squatter dwellings, yielding an average value of 1.23, which implies a 19% squatter discount. Note that the only difference relative to Jimenez (1984) is the use of the predicted squatter price rather than the actual price in the computation.

respectively, with the difference being statistically significant. The squatter rate of return is thus higher, as predicted.[31]

Do these empirical results shed any light on the relevance of the theoretical models discussed in Section 21.4.2? The main lesson of the results is that the uncertain tenure security of squatters indeed matters for rents, values, and rates of return. Since eviction risk is a key element of the models of Jimenez (1985), Hoy and Jimenez (1991), and Turnbull (2008), the perspective taken in these models is thus supported by the results. The results are less favorable for Brueckner and Selod (2009) and Shah (2014), whose prescient squatter organizer eliminates eviction risk, although these models may still have relevance.

Field (2007) explores the effect of tenure insecurity on labor supply, arguing that the squatter's need to "defend" the household plot may require a physical presence that limits labor force participation. Field uses the varying incidence across households of the Peruvian national land titling program (implemented over the 1995–2003 period) to generate tenure-security differences that then yield observable differences in labor supply in her sample. The empirical setup is a difference-in-differences framework where labor supply is regressed on squatter status and on the interaction of squatter status and a dummy variable indicating coverage of the household's neighborhood by the land-titling program, whose spatial scope was systematically expanded over the 1995–2003 period. The results show a 13 h weekly work reduction associated with nontitled squatter status, reflecting a 14% labor supply reduction for the household. By showing the large burden of "defensive expenditures" in the form of substantial forgone labor income, Field's findings lend some credence to the structure of the Brueckner–Selod and Shah models.

Field (2005) applies a similar framework to study the effect of reduced tenure insecurity on residential improvements. Recalling that a higher eviction probability reduces housing investment in the models of Jimenez (1985), Hoy and Jimenez (1991), and Turnbull (2008), Field's inquiry is closely linked to these squatting theories. Her empirical setup is again a difference-in-differences framework that relies on the spatial expansion of the Peruvian land titling program. The results show that when a squatter gains title to a plot, housing improvement spending (mainly in the form of small additions) rises by 68%. Galiani and Schargrodsky (2010), again using a natural experiment involving random allocation of titles, find a similar effect of titling on dwelling quality in Argentina, presumably a reflection of higher investment. They also show that titling reduces household size and raises child education levels.[32]

[31] Each survey respondent was asked to state both the rent and the sales value that would be commanded in the market for a dwelling similar to theirs. Both renters and owners were asked the same questions, so the rent and value, and hence the rate of return, are available for dwellings in both groups.

[32] See Galiani and Schargodsky (2010) for a broader survey of studies on the effects of property rights. See also De Soto (2000), who argues that extraction of housing equity is a major source of entrepreneurial capital that is denied to residents of developing countries who lack property rights.

The main goal of Lanjouw and Levy (2002) is to investigate the connection between tenure security and the ability to transfer a dwelling via sale or rent to another household. But as a prelude to this inquiry, the study authors provide unusual evidence about the perceived likelihood of eviction and the role of squatter organizers. Using 1995 survey data from Ecuador, Lanjouw and Levy report squatter responses to a question about the likelihood of eviction, with possible answers being that eviction is "sure or very possible," "possible," "not very possible," or "impossible." Among 142 respondents, none of whom held title to their plot, the first answer is never given, while the "possible" answer is given by only 3.5% of the respondents. This evidence appears consistent with the Brueckner–Selod/Shah view of eviction as a very unlikely event.

When the respondents are divided into groups whose squatter community has an organizer (111 respondents) or does not have an organizer (31 respondents), the total number of responses in the "sure or very possible" or "possible" categories remains below 3.5% for each group. By contrast, the split between the last two categories ("not very possible" or "impossible") differs across the groups. For respondents in communities with an organizer, 83% say that eviction is "impossible" (with 13.5% saying it is "not very possible"), while in communities without an organizer, 58% say eviction is "impossible" (with 39% saying it is "not very possible"). Therefore, the presence of a squatter organizer substantially increases a squatter's perception of freedom from eviction, consistent with the view taken in the Brueckner–Selod and Shah models. These results are reaffirmed in a probit regression where other determinants of the perceived impossibility of eviction are included (possession of an ownership document, which has a positive effect; squatting on private land, which has a negative effect).

To gauge the determinants of the transferability of a dwelling, Lanjouw and Levy run a probit regression using responses to a question asking whether the household "can sell or rent" its dwelling in an arm's length transaction, where the other party is a stranger. The age (and hence established nature) of the community raises transferability, as does the presence of a squatter organizer, with the organizer's effect being stronger the older the community.[33] Thus, the main implication of Lanjouw and Levy's results for theoretical perspectives on squatting is the revealed importance of the squatter organizer. The presence of an organizer reduces the perceived risk of eviction, as argued in the Brueckner–Selod and Shah models, and that presence also facilitates the operation of an internal market for squatter housing, presumably by giving more organizational structure to the squatter community.[34]

[33] Di Tella et al. (2007) explore another effect of tenure security from receipt of a land title: the effect on beliefs about the fairness of the operation of the market system. Receipt of a title strengthens such beliefs.

[34] Transferability is also higher when adult males are present in the household and when a title is held, and a number of other covariates have effects.

The final empirical study to be considered, that of Hidalgo et al. (2010), was mentioned above in the discussion of rural–urban migration. It investigates the occurrence and extent of squatter land invasions using community-level data. This article's remarkable dataset tabulates the occurrence of distinct land invasions in all Brazilian cities over the 1988–2004 period. Almost 5300 invasions are observed, and when an invasion occurs, the dataset indicates the number of participating households. The main hypothesis tested by the authors is that the occurrence of a land invasion is more likely (and its size greater) the lower is the agricultural income in the countryside surrounding a city, as measured by crop yields per hectare. A concern about endogeneity of agricultural incomes is the motivation for the use of an instrumental variables approach, with a rainfall measure serving as the instrument. Hidalgo et al. argue that reverse causality may arise because land invasions divert people from agricultural employment, possibly affecting the harvest and reducing crop yields, thus lowering agricultural incomes.

Estimates from a linear probability model show that, as expected, the occurrence of a land invasion becomes more likely as agricultural income falls. A different specification using a variable equal to the count of distinct land invasions in a city also shows the same negative effect of agricultural income, as does a regression where the dependent variable is the number of invading households.[35]

These findings make intuitive sense, and they also match theoretical results from Brueckner and Selod (2009) and Shah (2014). In the free-migration versions of those models, where the size of the squatter population cannot be controlled by the organizer and expands to equalize rural and urban utilities, a lower rural utility leads to a larger equilibrium squatter population.

21.4.4 Avoiding the formation of squatter settlements or relocating them

The squatting literature contains little discussion of government policies that are designed to limit squatter populations. One policy would consist in withholding public services such as water and electricity from squatter areas, which would reduce their attractiveness and limit inward migration. Feler and Henderson (2011) study this question by exploring how the availability of water connections in the informal housing areas of Brazilian cities affects population growth at the city level. They find that a higher share of informal dwellings with water connections leads to faster urban population growth, as intuition would predict. Feler and Henderson also investigate strategic interaction among cities in the choice of their water-connection shares, finding evidence that cities look to their neighbors in deciding what fraction of informal dwellings to service. Note that the

[35] The study authors also present further specifications including interaction terms where the effect of agricultural income depends on the inequality of land holdings in the region. The results show that a decrease in agricultural income raises the likelihood and the size of land invasions more when land holdings are more unequal.

findings of this article relate to the role of public services in attracting migrants, as discussed in Section 21.2. More broadly, the article suggests that policies such as the withholding of utility connections that are designed to limit urbanization may encourage slum conditions in areas where rural–urban migrants, undeterred by the policies, nevertheless arrive. In other words, poor living conditions are fostered in underserved areas that still attract migrants.

While policies designed to make squatting less attractive can limit rural–urban migration, relocation of slums and squatter areas once they come into being, which allows land to be redeveloped to a higher use, is another policy pursued in some countries. Lall et al. (2008) and Takeuchi et al. (2008) use Indian data to study the preconditions for successful policies of this type. They estimate slum dwellers' valuations of housing and neighborhood characteristics, with the goal of gauging what characteristics new (titled) settlements must have in order to make relocation welfare improving.[36]

21.5. PROVISION OF AFFORDABLE HOUSING IN DEVELOPING COUNTRIES

The squatting phenomenon, extensively discussed in the preceding section, is a symptom of the lack of affordable housing in the cities of developing countries. In other words, the initial households arriving in a squatter settlement, who occupy vacant land, are solving an affordability problem by appropriating the land for free. Policies that increase the availability of affordable housing can therefore reduce the extent of squatting and slums in developing countries while also benefiting residents in the formal housing sector, who may then gain access to better shelter at a lower cost. This section focuses on three interrelated issues related to the provision of affordable housing in developing countries: the extent of overall investment in housing, land-management policies that regulate transactions and land use, and investment in complementary infrastructure and services.

21.5.1 Investment in housing

21.5.1.1 The responsiveness of supply

Provision of affordable housing requires that housing supply responds to the increase in demand caused by rural–urban migration and rising incomes. In a classic study of supply responses, Burns and Grebler (1976) examine the share of housing investment (measured by new residential construction) in GDP, employing data from 39 countries. By regressing the investment share on GDP per capita, the change in population, and a measure of urbanization, they find that the share of housing investment in GDP increases at an early stage of development but declines past about \$6500 per capita GDP (2005 US dollars).

[36] For other approaches to fostering land development and redevelopment in developing countries, see Lozano-Gracia et al. (2013).

Subsequent to this study, there has been surprisingly little empirical work on assessing the supply elasticity of housing in response to demands from urbanization.

A new study by Dasgupta et al. (2014) provides more evidence on housing supply by building a new dataset on housing investment covering over 90 countries worldwide. The dataset explicitly accounts for investments by households, the government, and the private sector. This database uses the variable "ownership of dwelling, value added" in the National Account Statistics, and covers buildings that are used entirely or primarily as residences (including houseboats, barges, mobile homes, and caravans), together with any associated structures, such as garages, and all permanent fixtures customarily installed in residences. An important contribution of the study is the inclusion of informal housing, a necessity for accurate measurement given that formal housing constitutes a very small share of the housing stock in many developing countries. For example, in many African cities and towns, less than 10% of the population lives in formal housing.

The evidence from the study shows that investments in housing pick up as countries approach middle incomes. In fact, housing investment follows an S-shaped trajectory, with low-income economies having small income elasticities as a result of both supply and demand constraints. On the supply side, rigidities in the supply of materials, organization of the construction industry, and nascent markets for land transactions constrain housing expansion in urban areas. On the demand side, when incomes are low at early stages of development, the claims of other types of consumption expenditure, such as food expenditure, tend to dominate. But the empirical evidence shows that housing investment takes off at income levels of about \$3000 per capita (2005 US dollars) and then slows at income levels around \$36,000 per capita (2005 US dollars).

The study shows that, over time, the share of housing investment in GDP has been steadily increasing for developing and middle-income countries. Between 2001 and 2011, housing investment averaged 4.56% of GDP in low-income countries (up from 2.51% between 1960 and 1971), 6.06% in middle-income countries (up from 4.38%), and 9.12% in upper-middle-income countries (up from 5.11%). In contrast, housing investment as a share of GDP has been gradually declining in high-income (OECD) countries, having peaked in the 1960s (see Table 21.1).

The study's second main finding is that the elasticity of housing investment with respect to a country's urbanized population has steadily increased for developing countries and is estimated to be around 4 in 2011. This pattern is seen in the first panel in

Table 21.1 Decadal average of housing supply (percentage of GDP) across country income categories.

Income category	1961–1970	1971–1980	1981–1990	1991–2000	2001–2011
Low income		3.00	3.58	4.79	4.56
Lower middle income	4.38	4.97	5.41	6.10	6.06
Upper middle income	5.11	8.49	9.14	8.86	9.12
High income: OECD	11.29	9.87	8.06	6.03	5.71

Source: Dasgupta et al. (2014); countries classified as per World Bank classification.

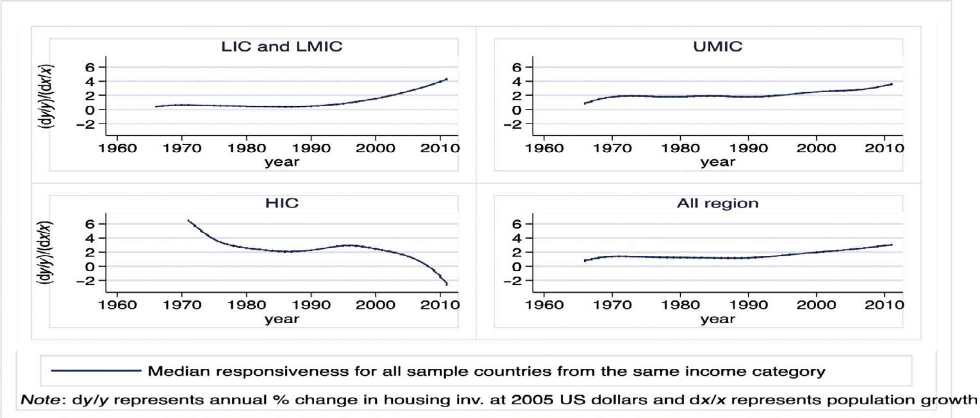

Figure 21.2 Housing supply responsiveness to urban growth across income groups.

Figure 21.2, which plots median elasticity values for low-income and lower-middle-income countries over the last 40 years. Upper-middle-income countries also experienced a rising elasticity, although the trend is less pronounced than in low-income countries (see Figure 21.2). By contrast, the elasticity has been declining for high-income (OECD) economies, where it peaked in the 1970s. This pattern reflects a moderate urban rate of growth of 2.31 during the 1961–1970 period along with a large 11.29% investment share, combined with a falling investment share (see Table 21.1) and moderating urban growth after 1970. Overall, these numbers are encouraging because they show a rising housing-supply response to urbanization in developing countries, demonstrating that market forces are reacting to surging housing demand caused by rural–urban migration and rising incomes.

To better understand the timing of housing investment in response to urbanization, Dasgupta et al. (2014) also develop the following typology of investment patterns: (a) leading, where housing investments occur ahead of urbanization; (b) synchronous, where investment occurs contemporaneously with urbanization; and (c) lagging, where housing investment trails urbanization. They find that leading countries tend to have higher magnitudes of foreign and domestic investment, as well as larger current-account trade deficits, than lagging countries. Not surprisingly, OECD countries form the majority in the leading group, while most parts of the world appear to have a synchronous relationship between investments and urbanization. However, housing investment appears to follow demand with a lag of 8 or 9 years in sub-Saharan Africa, indicating an inadequate supply response to urbanization in this part of the world.

21.5.1.2 Some determinants of housing affordability

Beyond the responsiveness of supply, affordability depends on household incomes and the cost of housing, which in turn depends on construction costs, including the price of cement and labor costs, on the market structure of the construction industry, and on building standards and other regulations. In addition, affordability depends on the trade-offs households are willing to make between housing and other necessities. Unfortunately, there is very little empirical evidence regarding housing affordability or its determinants. But Collier and Venables (2013) argue that affordability of construction is a requirement for widespread investment in housing. They provide the following illustrative example:

> *In Dar es Salaam, the typical rental rate per room is around $10 a month, and in Dakar around $16. So, a modest four-room home (equivalent to the "two-up, two-down" of 19th-century Britain) would be affordable, albeit perhaps for multioccupant use, in the repayment range of $500-$800 a year. What this implies for a viable purchase cost depends on the real interest rate and terms of financing, but it is difficult to see such a repayment rate supporting a home costing more than around $15,000. This, of course, includes the price of land, which in Dar es Salaam on the informal market is currently around $5,000 for a plot of 300 square meters. Clearly, such a plot could support more than one small house, but given current land availability, land costs per house could not be reduced much below $2,000.*

Affordability would thus require construction costs of no more than $13,000, and although this level might not be attainable under normal circumstances, Collier and Venables point to "a pilot project by Tanga Cement in Dar es Salaam, using modern techniques of pre-casting and four-storey construction" that achieved it.

In addition to income considerations, affordability must be assessed relative to the share of budgets that ordinary households are willing to devote to housing. One of the few systematic assessments of spending on housing is reported in a recent World Bank study on sub-Saharan Africa (Lozano and Young, 2014). The study finds that, across the region and income classes, household expenditures on housing were low, averaging around 12% of the budget (see Figure 21.3). This low share is due to very high levels of spending on food, which reach 60% for the poorest quintile, reflecting an early stage

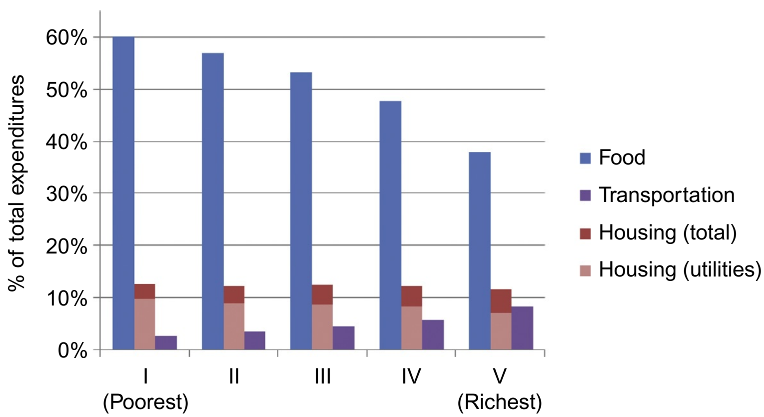

Figure 21.3 Urban household expenditures across sub-Saharan Africa.

of economic development. But even the richest quintile in sub-Saharan Africa spends a larger percentage on food than the average household in South Korea spent in 1975 (when it was a low-income country). Given the severe budget constraints reflected in these numbers, it is difficult to expect a significant increase in housing investment in Africa without commensurate rapid growth in incomes. This lesson extends beyond the African context, with other cross-country evidence showing that households in low-income countries spend around 47% of their total budgets on food (Regmi et al., 2001). Food spending consumes a smaller 29% of household budgets in middle-income countries and just 13% in high-income countries. Correspondingly, income elasticities for food tend to shrink as country incomes grow.

21.5.2 Land-management policies

Policies regulating land transactions and land use constitute another factor affecting provision of affordable housing. Such regulations are often put in place to help public authorities in planning for the provision of public services such as sewerage, roads, public schools, health services, and public transportation. In addition, zoning regulations often serve to minimize negative externalities by segregating offending land uses. But regulations can affect the supply of affordable housing through various channels. Consumption standards such as minimum lot sizes can exclude low-income groups if they are set too high. Regulations such as density limits or height restrictions reduce affordability by reducing the amount of housing the land can accommodate, thus cutting supply. Urban growth boundaries (UGBs; sometimes called greenbelts) can raise housing prices by restricting the amount of developable land in a city. Alterman (2014) provides a survey of planning laws and urban development controls along with their implications for developing countries.

With some land-management regulations potentially having negative effects, it is natural to wonder why they would be imposed in the first place. As one explanation, Bertaud (2014) points to the predilection of urban planners for regulating the urban landscape rather than relying on market forces to guide land-use outcomes. Under this view, planners are well meaning but, in their zeal to shape cities, sometimes choose policies with unintended and unfavorable consequences for housing affordability and the welfare of urban residents. Regulations such as UGBs may also reflect the exercise of monopoly power by existing landowners, who can enrich themselves via policies that restrict housing supply and thus raise prices (see Brueckner, 1999 for a survey of the literature on urban "growth controls"). Finally, in developing countries, welfare-reducing urban regulations could also arise from a desire to limit rural–urban migration, mirroring the motivations explored by Feler and Henderson (2011).

21.5.2.1 Land-consumption standards

In the cities of developing countries, minimum land-consumption standards in the formal sector are often incompatible with the level of economic development and the incomes of the poor. While general-purpose land-use regulations can improve the functioning of the formal land and housing markets, minimum-lot-size standards raise the effective house price to income ratio, making formal housing unaffordable for the poor. For example, the minimum plot size in Dar es Salaam is 500 m^2, and the authorities are discussing whether to raise it to 700 m^2 (Collier and Venables, 2013). In Nairobi, the minimum legal plot size is 1/16 of an acre, which is unaffordable for ordinary households. Such standards are often an overhang of colonial planning, notably the 1947 British Town and Country Planning Act, which is dominant in East Africa and Southern Africa. Regardless of the fact that African per capita incomes are less than 5% of British per capita incomes, many African regulatory authorities consider modernization as synonymous with the raising of standards from time to time.

With minimum-lot-size standards making formal housing unaffordable, poor households choose to live in informal settlements, either by purchasing informally subdivided land or houses built on such developments. However, the standards may also serve as newcomer taxes for potential migrants, and they may in fact reduce migration into the city, mirroring the effect of the denial of water connections analyzed by Feler and Henderson (2011). Lall et al. (2006b) empirically explore this question by using data from four rounds of the Brazilian census. They examine the implications of state and municipal decisions to waive federal subdivision regulations and reduce the minimum lot sizes on land set aside for developing low-income housing.

In 1979, the federal government in Brazil established national legislation (Federal Law 6766) for developing, approving, and registering urban land subdivisions (World Bank, 2006). Among the parameters are a minimum lot size of 125 m^2, with a minimum frontage of 5 m, and a compulsory donation of 35% of the development area for public uses and open space. Going against the national mandate, cities such as Recife, Belo Horizonte, Porto Alegre, and Belém have classified parts of their jurisdictions as Special Zones of Social Interest in order to regularize informal settlements and produce affordable housing for the poor. The Special Zones of Social Interest have flexible zoning regulations such as reduced minimum lot sizes (90 m^2 in Belém, 50 m^2 in Fortaleza, and 40 m^2 in Belo Horizonte) and variable frontage (World Bank, 2006). Lall et al. (2006b) find that relaxing minimum-lot-size regulations increases housing supply but also prompts higher population growth. This growth is in fact faster than the formal housing-supply response, leading to an increase in slum formation. Such an outcome suggests that policies that aim to reduce affordability barriers need to be accompanied by other steps to raise housing supply. In the absence of these measures, pro-poor land regulations may in fact exacerbate slum formation.

21.5.2.2 Density regulations

Density regulations, which are one of the tools used most frequently by urban planners, cap the quantity of housing that can be developed on a plot of land. Such a cap is usually imposed by restricting the floor-space ratio (FAR) on the plot (sometimes called the floor-space index, or FSI). For example, if the FAR limit is 1, developers can only build a structure whose total floor space is less than or equal to the plot area. While in some cases it may be possible to build a one-story building on a plot that entirely covers it (therefore achieving an FAR of 1), developers will typically construct a building with a footprint smaller than the plot. For example, a developer could cover 25% of a plot and build a four-story building while still meeting the FAR limit of 1 (World Bank, 2013).

From the point of view of urban planners (see Bertaud, 2004, 2014), the "right" FAR limit in an area will depend on the existing spatial structure of the city, the street patterns and widths, the level of infrastructure (is there enough capacity to accommodate high densities?), and cultural and social factors (are skyscrapers acceptable?). In fact, there is considerable variation in FAR limits across the world's cities, with values ranging from 1 to 25, as seen in Table 21.2. Table 21.2 shows that, except for São Paulo, most of the lowest FAR values are in India (World Bank, 2013). Other cities have much higher FAR limits, ranging from 3 for Paris to 25 for Singapore. Most of the cities with high FAR values tend to have substantial levels of infrastructure per acre.

An emerging body of evidence (see Annez and Linn, 2010) suggests that if an area's FAR limit is set far below the level that would be chosen in the absence of regulation, the resulting reduction in housing supply will raise prices throughout the city, reducing housing affordability. In addition, the urban footprint will grow, pushing residences farther from job centers. Bertaud and Brueckner (2005) demonstrate these effects in a

Table 21.2 FAR limits in central business districts

City	FAR limit
São Paulo, Brazil	1
Mumbai, India	1.33
Chennai, India	1.5
Delhi, India	1.2–3.5
Amsterdam, Netherlands	1.9
Venice, Italy	2.4
Paris, France	3
Shanghai, China	8
Vancouver, Canada	8
San Francisco, United States	9
Chicago, United States	12
Hong Kong Special Administrative Region, China	12
Los Angeles, United States	13
New York, United States	15
Denver, United States	17
Tokyo, Japan	20
Singapore, Singapore	12–25

theoretical model, and they show that the resulting welfare loss for individual households can be measured by the increase in the commuting cost for the household at the edge of the city. Applying this result to the Indian city of Bengaluru (Bangalore), where FAR limits range between 1.75 and 3.25, the study predicts that the city radius would shrink from 12 to 8 km if the limits were removed. This shrinkage would reduce the commuting costs of edge households by 4% of their income, a gain that captures the welfare loss from the FAR limit. Rather than using a simulation exercise to reach such a conclusion, Brueckner and Sridhar (2012) rely on empirical estimates. They use a cross-sectional regression that relates the size of the urban footprints of Indian cities to their central FAR limits and other variables such as income and population. The results, which show that a higher FAR limit indeed shrinks the urban footprint, allow calculation of the resulting reduction in commuting distance for the edge household and thus the saving in commuting cost. This calculation shows that a unitary increase in a city's FAR limit (from an average of near 3 to 4) yields a commuting-cost saving of 0.7% of income for edge households, indicating a substantial welfare gain from a marginal relaxation in this type of land-use regulation.

While FAR limits reduce development densities and thus housing supply and prices, subdivision regulations can also have a density-reducing effect while raising housing prices through other cost-related channels. This class of interventions is well illustrated in the analyses of Malpezzi and Mayo (1997) and Bertaud and Malpezzi (2001), who study the case of Malaysia. They focus on regulations that require excessive road widths in newly developed areas (including provision of back alleys), excessive street setbacks for structures, and excessive requirements for community facilities in new developments. These authors also identify a less tangible cost-increasing factor, which grows out of the process for securing government approval of new projects. Long regulatory delays in the approval process raise the cost of development, as does uncertainty about the outcome of the process. Malpezzi and Mayo (1997) are able to generate a precise numerical estimate of the impact of these factors on the cost per dwelling. They focus on a representative dwelling with a delivery cost of about 28,000 Malaysian dollars, and they attribute 4000 Malaysian dollars of this amount to the effects of government regulations, a share of about 14%. In addition, Bertaud and Malpezzi (2001) find that if restrictions on construction and road patterns were eased so as to increase salable land to 55% of the developable land, developers' profits would double, providing a greater incentive to shift their activities to the lower-income market.

21.5.2.3 Urban growth boundaries

It is well known that UGBs can raise housing prices by restricting the amount of land available for development (see Brueckner, 2001; Cheshire and Sheppard, 2002). UGBs are present in the developed world, but the urbanization process in some developing countries, notably in South Korea in past years, has been affected by their presence.

Because cities constrained by UGBs differ from non-UGB cities in a host of other ways (including the presence of additional land-use restrictions), it is difficult to use cross-sectional regression analysis to isolate the impact of a UGB on variables such as housing prices. Despite this limitation, researchers studying South Korea present persuasive evidence that the country's UGBs (greenbelts) contributed in the past to its high housing prices. For example, data presented by Hannah et al. (1993) show that an index of Korean housing prices grew by a factor of 10 between 1974 and 1989, while real GDP rose by a factor of 3.4. Although the effect of rising incomes on demand no doubt played a role in this price escalation, the economy also faced severe land constraints. Urban residential land in South Korea grew by only 65% between 1973 and 1988 even though the urban population rose by more than 100% over that period. With the greenbelt policy slowing the growth in the supply of residential land, and with population and income both rising rapidly, the conditions were ripe for a rapid escalation in Korean housing prices and falling affordability.

21.5.3 Investment in complementary infrastructure and services

For affordable housing to increase household welfare, the structure needs to be supported by complementary physical infrastructure and social services such as roads and transport services, drainage, street lighting, electricity, water, and sewerage, together with policing, schools, waste disposal, and health care. The benefits of such services make urban living more "affordable" in a sense that goes beyond housing costs. While the capital costs of some of these services could be covered by private property developers, supply is ultimately best undertaken publicly given that the services tend to involve coordination problems. Some of the services are network-based services that cannot be provided to each household individually, and some are services that, when supplied to separate households, create substantial externalities, as in the case of sanitation (Collier, 2013). Since such services will be underprovided and underconsumed relative to the social optimum in the absence of coordination efforts, public provision is desirable.

Empirical work on valuation of services relies on contingent valuation (Cameron, 1992; Whittington, 2002), conjoint and discrete-choice analysis (Earnhart, 2002), and estimation of hedonic models (Chattopadhyay, 1999; Malpezzi, 2003; Palmquist, 2005). Several recent studies employing data from georeferenced household surveys extend these methods for valuing public services. Lall and Lundberg (2008) use a nonparametric approach to improve on the traditional hedonic method. They address the concerns about functional-form bias in hedonic valuation methods raised by Malpezzi (2003), using a variant of a three-stage estimation procedure developed in Bajari and Kahn (2005). Lall and Lundberg estimate a nonparametric hedonic function and recover the structural demand parameters using first-order conditions, following which they estimate the determinants of these demand parameters using a vector of household characteristics. Estimating the model using georeferenced household survey data for Pune, India, they find that public services are valued relatively more by the poor than by higher-income households. The services examined (water, transport, education, safety) are worth roughly 29% of the rental value of the dwelling for the wealthy, but are valued at 67% of rent by the poor. While the list of services examined is not comprehensive, the results suggest that even untargeted, across-the-board investment in public services can be progressive. With access to services, the poor migrant's limited spending on housing buys more than just shelter, effectively increasing the affordability of urban living.

By focusing only on the gains from direct consumption of services, such estimates may undervalue the affordability benefits of improved service delivery when spillovers are present. Anselin et al. (2010) address this issue by taking advantage of a unique georeferenced household survey from Bengaluru (Bangalore), India. They carry out a hedonic analysis of housing values that explicitly accounts for spatial spillovers in provision of a water service. Building on the standard hedonic literature, they use a spatially explicit framework that allows measurement of both direct effects and externality spillovers from upgrades in water systems made by neighbors. The results show that standard nonspatial hedonic benefit estimates are around 30% lower than estimates that consider spatial spillovers. By raising benefits, such spillovers enlarge the housing/public-service bundle associated with a given rental payment, thus improving affordability.

21.6. CONCLUSION

This chapter has reviewed major strands of theoretical and empirical work on urbanization and housing provision in developing countries, focusing on the three elements highlighted in the chapter's title. The initial focus is on rural–rural migration, a main driver of city growth in the developing world. The discussion summarizes the state of empirical research on such migration and sketches theoretical work in the Harris–Todaro tradition, which depicts the urbanization equilibrium generated by the migration process. The chapter then turns to the issue of tenure insecurity in developing countries, focusing mainly on the economics of squatting from both theoretical and empirical perspectives. Squatting is partly a response to limited housing affordability in developing countries, which was the third topic considered in the chapter. Following a macro-oriented comparison of housing investment in low- and high-income countries, the discussion argues that misguided land-management policies in the developing world often limit housing affordability, while also pointing out that urban public services must be part of an affordable housing package.

More generally, drawing a distinction between urbanization, on the one hand, and city development, on the other, can be beneficial in understanding the experience of developing countries. These processes are distinct since much of urbanization takes place early in development, before countries have reached middle incomes. In contrast, city development in the form of investments in durable structures (notably housing) and infrastructure accelerates later as countries approach middle incomes. This view implies that urbanization is a messy process, where surges in population density precede the fixed investments needed to properly house, transport, and service the urban population. To manage this messy process, there is a need to identify beneficial policies or policy changes that can be implemented by countries with limited administrative and financial capabilities. Three instances are particularly relevant.

First, land management must be improved by eliminating those policies that inadvertently raise the cost of housing, as discussed in Section 21.5. By making shelter more affordable, such policy changes will allow cities in developing countries to do a better job of housing their burgeoning populations. Second, the provision of urban infrastructure must be managed more effectively so as to improve the delivery of public services. Provision of some infrastructure (streets, basic drainage) can be left to private developers, while infrastructure with a broader spatial scope (local road networks, schools) should be the responsibility of city wards, with citywide investments (transport, water, sewerage) or regional infrastructure (electricity) handled at even higher levels. Devolution of responsibilities to the lowest possible level may be beneficial when central governments are weak. In making transportation investments, governments should recognize that, by easing access to jobs, such investment can improve the functioning of urban labor markets. Moreover, in making all types of infrastructure investments, governments should take into account the attractive power of public services, which tend to spur rural–urban migration.

Third, housing investment can be spurred by capital-market improvements, which should also be a policy goal. As mentioned earlier, since tenure insecurity inhibits the development of mortgage markets, steps to accelerate the process of conveying titles to residents in formal housing could spur development of mortgage markets, unleashing a mortgage-financed surge in housing investment. Granting titles to squatters and other informal residents would have a parallel effect. In addition, following the lead of the United States and other developed countries, the developed world could marshal funds for housing investment by fostering the securitization of mortgage debt once local mortgage markets gain sufficient breadth.

The chapter points to a number of possible avenues for future research. On the empirical aspects of rural–urban migration, the recent work of Giulietti et al. (2014), which applies social-network theory to understand better the interpersonal forces that spur migration, seems to be a fruitful area for further research. This social-network approach could be applied to individual-level data from countries other than China, on which these authors focused. The empirical underpinnings of the migration models considered in Section 21.3 could also be explored further. For example, the models predict equalization of rural income and the income net of the commuting cost of city workers living at the urban fringe, a relationship that could be explored empirically (in principle, at least) if cross-country data were available. Even by itself, the urban net income measure would be useful since it appropriately captures urban living standards in a developing country without the need for data on housing prices. Whether the migration process produces cities that are close to optimal in size is another question that could be addressed. Researchers could follow the method in Au and Henderson's (2006) important China study, focusing on other countries.

A number of different avenues for work on tenure insecurity are also apparent. Research on squatting would greatly benefit from international data that track squatter populations as well as eviction events across developing countries. Population estimates could be based on measurement of the land areas of squatter settlements, a task that could make use of satellite data supplemented by local expertise regarding the boundaries of the settlements. Although collection of eviction data would require monitoring of press coverage in a large number of cities around the world, the task is increasingly feasible in today's information age. Another squatting-related empirical exercise would be a test of the notion that squatter settlements squeeze the formal housing market. Empirically, the goal would be to test the prediction that formal housing prices are higher in cities with a large share of squatter households (requiring better population figures along with price data). While less general in scope, country case studies such as those of Selod and Tobin (2013) and Kim (2004) provide highly useful insights into the extent of tenure insecurity, making further studies worthwhile.

Research on housing affordability could be directed toward generating quantitative measures of the affordability gains from relaxing counterproductive land-use policies. Malpezzi and Mayo (1997) and Bertaud and Malpezzi (2001) show how to produce such measures from detailed information on building regulations, while Brueckner and Sridhar (2012) measure the gain from looser building-height restrictions using a more aggregative approach. Such quantitative information provides crucial leverage for the World Bank and other international agencies in persuading governments to reform regulation of land use, and more studies of this type will assist them in this task.

APPENDIX

With variable q, the condition $N = \pi\overline{x}^2$ is replaced by $\int_0^{\overline{x}}[2\pi x/q(x,N)]\mathrm{d}x - N \equiv \Phi - N = 0$. Total differentiation of this condition yields $\partial\overline{x}/\partial N = (1-\Phi)(\overline{q}/2\pi\overline{x})$, where $\overline{q} \equiv q(\overline{x},N)$. Differentiating $\mathrm{ACC} \equiv \int_0^{\overline{x}}[2\pi x/q(x,N)]tx\mathrm{d}x$ with respect to N then yields

$$\begin{aligned}\frac{\partial \mathrm{ACC}}{\partial N} &= \frac{\partial \mathrm{ACC}}{\partial \overline{x}}\frac{\partial \overline{x}}{\partial N} - \int_0^{\overline{x}}\frac{2\pi x}{q^2}\frac{\partial q}{\partial N}tx\mathrm{d}x \\ &= \frac{2\pi\overline{x}^2 t}{\overline{q}}\ (1-\Phi)\frac{\overline{q}}{2\pi\overline{x}} - \int_0^{\overline{x}}\frac{2\pi x}{q^2}\frac{\partial q}{\partial N}tx\mathrm{d}x = t\overline{x} + \int_0^{\overline{x}}\frac{2\pi x}{q^2}\frac{\partial q}{\partial N}t(\overline{x}-x)\mathrm{d}x \\ &\equiv t\overline{x} - \Omega(N),\end{aligned} \tag{A.1}$$

where $\Omega(N) > 0$ equals minus the negative integral in the penultimate line, which represents the reduction in ACC due to higher densities (lower values of q). Subtracting $\partial \mathrm{ACC}/\partial N$ from the increase in urban income then yields (21.13).

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REFERENCES

Ades, A.F., Glaeser, E.L., 1995. Trade and circuses: explaining urban giants. Q. J. Econ. 110, 195–227.

Alonso, W., 1964. Location and Land Use. Harvard University Press, Cambridge.

Alterman, R., 2014. Planning laws, development controls, and social equity: lessons for developing countries. World Bank Law Rev. 5, 329–350.

Anderson, K., Pomfret, R., 2005. Spatial inequality and development in central Asia. Unpublished paper-World Institute for Development Economic Research (UNU-WIDER).

Annez, P.C., Linn, J.F., 2010. An agenda for research on urbanization in developing countries: a summary of findings from a scoping exercise. World Bank Policy Research Working paper No. 5476.

Anselin, L., Lozano-Gracia, N., Deichmann, U., Lall, S., 2010. Valuing access to water: a spatial hedonic approach, with an application to Bangalore. Indian Spat. Econ. Anal. 5, 161–179.

Arnott, R., 1979. Optimal city size in a spatial economy. J. Urban Econ. 6, 65–89.

Au, C.-C., Henderson, J.V., 2006. Are Chinese cities too small? Rev. Econ. Stud. 73, 549–576.

Bajari, P., Kahn, M.E., 2005. Estimating housing demand with an application to explaining racial segregation in cities. J. Busin. Econ. Stat. 23, 20–33.

Barrios, S., Bertinelli, L., Strobl, E., 2006. Climatic change and rural-urban migration: the case of sub-Saharan Africa. J. Urban Econ. 60, 357–371.

Bertaud, A., 2004. Mumbai FSI/FAR conundrum: the perfect storm: the four factors restricting the construction of new floor space in Mumbai. http://alain-bertaud.com/AB_Files/AB_Mumbai_FSI_conundrum.pdf.

Bertaud, A., 2014. The formation of urban spatial structures: markets vs. design. Working paper No. 7, Marron Institute, New York University.

Bertaud, A., Brueckner, J.K., 2005. Analyzing building-height restrictions: predicted impacts and welfare costs. Reg. Sci. Urban Econ. 35, 109–125.

Bertaud, A., Malpezzi, S., 2001. Measuring the costs and benefits of urban land use regulation: a simple model with an application to Malaysia. J. Hous. Econ. 10, 393–418.

Brueckner, J.K., 1990. Analyzing third world urbanization: a model with empirical evidence. Econ. Dev. Cult. Chang. 38, 587–610.

Brueckner, J.K., 1999. Modeling urban growth controls. In: Panagariya, A., Portney, P., Schwab, R.M. (Eds.), Environmental and Public Economics: Essays in Honor of Wallace E. Oates. Edward Elgar Publishers, London, pp. 151–168.

Brueckner, J.K., 2001. Urban sprawl: lessons from urban economics. In: Gale, W.G., Pack, J.R. (Eds.), Brookings-Wharton Papers on Urban Affairs. Brookings Institution, Washington, DC, pp. 65–89.

Brueckner, J.K., 2013a. Slums in developing countries: new evidence for Indonesia. J. Hous. Econ. 22, 278–290.

Brueckner, J.K., 2013b. Urban squatting with rent-seeking organizers. Reg. Sci. Urban Econ. 43, 561–569.

Brueckner, J.K., Kim, H.-A., 2001. Land markets in the Harris-Todaro model: a new factor equilibrating rural-urban migration. J. Reg. Sci. 41, 507–520.

Brueckner, J.K., Selod, H., 2009. A theory of urban squatting and land-tenure formalization in developing countries. Am. Econ. J. Econ. Pol. 1, 28–51.

Brueckner, J.K., Sridhar, K.S., 2012. Measuring welfare gains from relaxation of land-use restrictions: the case of india's building-height limits. Reg. Sci. Urban Econ. 42, 1061–1067.
Brueckner, J.K., Zenou, Y., 1999. Harris-Todaro models with a land market. Reg. Sci. Urban Econ. 29, 317–339.
Bryan, G., Chowdhury, S., Mobarak, A.M., 2014. Under-investment in a profitable technology: the case of seasonal migration in Bangladesh. Econometrica 82, 1671–1748.
Bryceson, D.F., 1999. Sub-Saharan Africa betwixt and between: rural livelihood practices and policies. Working paper 43/1999, Leiden, University of.
Burns, L.S., Grebler, L., 1976. Resource allocation to housing investment: a comparative international study. Econ. Dev. Cult. Chang. 25, 95–121.
Cameron, T., 1992. Combining contingent valuation and travel cost data for the valuation of non-market goods. Land Econ. 68, 302–317.
Chattopadhyay, S., 1999. Estimating the demand for air quality: new evidence based on the Chicago housing market. Land Econ. 75, 22–38.
Cheshire, P., Sheppard, S., 2002. The welfare economics of land use planning. J. Urban Econ. 52, 242–269.
Collier, P., 2013. Building African cities that work. Working paper, Oxford University.
Collier, P., Venables, A.J., 2013. Housing and urbanization in Africa: unleashing a formal market process. In: Glaeser, E., Joshi-Ghani, A. (Eds.), Rethinking Cities. World Bank, Washington, DC (forthcoming).
Daniere, A.G., 1994. Estimating willingness-to-pay for housing attributes an application to Cairo and Manila. Reg. Sci. Urban Econ. 24, 577–599.
Dasgupta, B., Lall, S.V., Lozano, N., 2014. Urbanization and housing investment. Unpublished paper. World Bank.
Davis, J.C., Henderson, J.V., 2003. Evidence on the political economy of the urbanization process. J. Urban Econ. 53, 98–125.
Deshingkar, P., Grimm, S., 2004. Internal migration and development: a global perspective. IOM Migr. Res. Ser. 19, Geneva.
De Soto, H., 2000. The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else. Basic Books, New York, NY.
Di Tella, R., Galiani, S., Schargodsky, E., 2007. The formation of beliefs: evidence from the allocation of land titles to squatters. Q. J. Econ. 122, 209–241.
Dudwick, N., Hull, K., Katayama, R., Shilpi, F., Simler, K., 2011. From Farm to Firm: Rural-Urban Transition in Developing Countries. World Bank, Washington, DC.
Earnhart, D., 2002. Combining revealed and stated data to examine housing decisions using discrete choice analysis. J. Urban Econ. 51, 143–169.
Feler, L., Henderson, J.V., 2011. Exclusionary policies in urban development: under-servicing migrant households in Brazilian cities. J. Urban Econ. 69, 253–272.
Ferre, C., 2009. Is internal migration bad for receiving urban centers? Evidence from Brazil (1995–2000). Unpublished paper. World Bank.
Field, E., 2005. Property rights and investment in urban slums. J. Eur. Econ. Assoc. Pap. Proc. 3, 279–290.
Field, E., 2007. Entitled to work: urban property rights and labor supply in Peru. Q. J. Econ. 122, 1561–1602.
Fields, G., 1982. Place-to-place migration in Colombia. Econ. Dev. Cult. Chang. 30, 539–558.
Flatters, F., Henderson, V., Mieszkowski, P., 1974. Public goods, efficiency, and regional fiscal equalization. J. Publ. Econ. 3, 99–112.
Follain, J., Lim, G.-C., Renaud, B., 1982. Housing crowding in developing countries and willingness to pay for additional space: the case of Korea. J. Dev. Econ. 11, 249–272.
Follain, J.R., Jimenez, E., 1985. The demand for housing characteristics in developing countries. Urban Stud. 22, 421–432.
Friedman, J., Jimenez, E., Mayo, S., 1988. The demand for tenure security in developing countries. J. Dev. Econ. 29, 185–198.
Galiani, S., Schargrodsky, E., 2010. Property rights for the poor: effects of land titling. J. Publ. Econ. 94, 700–729.

Giulietti, C., Wahba, J., Zenou, Y., 2014. Strong versus weak ties in migration. Unpublished paper, Stockholm University.
Granovetter, M.S., 1973. The strength of weak ties. Am. J. Soc. 78, 1360–1380.
Gross, D.J., 1988. Estimating willingness to pay for housing characteristics: an application of the Ellickson bid rent model. J. Urban Econ. 24, 95–112.
Hammam, S., 2013. Housing matters. In: Glaeser, E., Joshi-Ghani, A. (Eds.), Rethinking Cities. World Bank, Washington, DC (forthcoming).
Hannah, L., Kim, K.-H., Mills, E.S., 1993. Land use controls and housing prices in Korea. Urban Stud. 30, 147–156.
Hardoy, J., Satterthwaite, D., 1989. Squatter Citizen: Life in the Urban Third World. Earthscan, London.
Harris, J.R., Todaro, M.P., 1970. Migration, unemployment and development: a two-sector analysis. Am. Econ. Rev. 60, 126–142.
Henderson, J.V., Wang, H.G., 2005. Aspects of the rural-urban transition of countries. J. Econ. Geogr. 5, 23–42.
Henderson, J.V., Wang, H.G., 2007. Urbanization and city growth: the role of institutions. Reg. Sci. Urban Econ. 37, 283–313.
Henry, S., Boyle, P., Lambin, E.F., 2003. Modelling inter-provincial migration in Burkina Faso, West Africa: the role of socio-demographic and environmental factors. Appl. Geogr. 23, 115–136.
Hidalgo, F.D., Naidu, S., Nichter, S., Richardson, N., 2010. Economic determinants of land invasions. Rev. Econ. Stat. 92, 505–523.
Hoy, M., Jimenez, E., 1991. Squatters' rights and urban development: an economic perspective. Economica 58, 79–92.
Hunter, L.M., Murray, S., Riosmena, F., 2011. Climatic variability and U.S. migration from rural Mexico. IBS Working paper.
Iliffe, J., 1995. Africans: The History of a Continent. Cambridge University Press, Cambridge.
Jimenez, E., 1984. Tenure security and urban squatting. Rev. Econ. Stat. 66, 556–567.
Jimenez, E., 1985. Urban squatting and community organization in developing countries. J. Publ. Econ. 27, 69–92.
Kapoor, M., le Blanc, D., 2008. Measuring risk on investment in informal (illegal) housing: theory and evidence from Pune. India. Reg. Sci. Urban Econ. 38, 311–329.
Kiernan, P., 2014. Rio evicts squatters, sparking riot. Wall Street J A9, April 12.
Kim, A., 2004. A market without the 'right' property rights. Econ. Trans. 12, 275–305.
Lall, S.V., Lundberg, M., 2008. What are public services worth, and to whom? Non-parametric estimation of capitalization in Pune. J. Hous. Econ. 17, 34–64.
Lall, S.V., Selod, H., Shalizi, Z., 2006a. Rural-urban migration in developing countries: a survey of theoretical predictions and empirical findings. World Bank Policy Research Working paper No. 3915.
Lall, S.V., Wang, H.G., da Mata, D., 2006b. Do urban land regulations influence slum formation? Evidence from Brazilian Cities. Unpublished paper, World Bank.
Lall, S., Lundberg, M., Shalizi, Z., 2008. Implications of alternate policies on welfare of slum dwellers: evidence from Pune. India. J. Urban Econ. 63, 56–73.
Lall, S.V., Timmins, C., Yu, S., 2009. Connecting lagging and leading regions: the role of labor mobility. World Bank Policy Research, Working paper No. 4843.
Lanjouw, J., Levy, P., 2002. Untitled: a study of formal and informal property rights in urban Ecuador. Econ. J. 112, 986–1019.
Lim, G.-C., Follain, J., Renaud, B., 1984. Economics of residential crowding in developing countries. J. Urban Econ. 16, 173–186.
Lozano, N., Young, C., 2014. Housing demand in urban africa. Unpublished paper. World Bank.
Lozano-Gracia, N., Young, C., Lall, S.V., Vishwanath, T., 2013. Leveraging land to enable urban transformation: lessons from global experience. World Bank Policy Research Working paper 6312.
Lucas Jr., R.E., 2004. Life earnings and rural-urban migration. J. Polit. Econ. 112, S29–S59.
Malpezzi, S., 2003. Hedonic pricing models: a selective and applied review. In: O'Sullivan, A., Gibb, K. (Eds.), Housing Economics and Public Policy. Blackwell Science, Oxford, pp. 67–85.
Malpezzi, S., 2012. Global perspectives on housing markets. Unpublished paper, University of Wisconsin.

Malpezzi, S., Mayo, S.K., 1997. Getting housing incentives right: a case study of the effects of regulation, taxes, and subsidies on housing supply in Malaysia. Land Econ. 7, 372–391.

Marre, A.W., 2009. Rural out-migration, income, and poverty: are those who move truly better off? USDA-Economic Research Center Working paper.

Marx, B., Stoker, T., Suri, T., 2013. The economics of slums in the developing world. J. Econ. Perspect. 27, 187–210.

Mills, E.S., 1967. An aggregative model of resource allocation in a metropolitan area. Am. Econ. Rev. 57, 197–210.

Moomaw, R.L., Shatter, A.M., 1996. Urbanization and economic development: a bias toward large cities? J. Urban Econ. 40, 13–37.

Mora, J., Taylor, E., 2007. Determinants of migration, destination, and sector choice: disentangling individual, household, and community effects. In: Ozden, C., Shiff, M. (Eds.), International Migration, Remittances, and Brain Drain. Palgrave Macmillan, New York, NY, pp. 21–52.

Mourmouras, A., Rangazas, P., 2013. Efficient urban bias. J. Econ. Geogr. 13, 451–471.

Munshi, K., Rosenzweig, M., 2013. Networks and misallocation: insurance, migration, and the rural-urban wage gap. Unpublished paper, Yale University.

Muth, R.F., 1969. Cities and Housing. University of Chicago Press, Chicago, IL.

Mutlu, S., 1989. Urban concentration and primacy revisited: an analysis and some policy conclusions. Econ. Dev. Cult. Chang. 37, 611–639.

Palmquist, R.B., 2005. Property value models. In: Máler, K., Vincent, J. (Eds.), Handbook of Environmental Economics, vol. 2. North-Holland, Amsterdam, pp. 763–813.

Poelhekke, S., 2011. Urban growth and uninsured rural risk: booming towns in bust times. J. Dev. Econ. 96, 461–475.

Quigley, J.M., 1982. Nonlinear budget constraints and consumer demand: an application to public programs for residential housing. J. Urban Econ. 12, 177–201.

Regmi, A., Deepak, M.S., Seale Jr., J.L., Bernstein, J., 2001. Cross-country analysis of food consumption patterns. In: USDA, E.R.S. (Ed.), Changing Structure of Global Food Consumption and Trade. United States Department of Agriculture, Washington, DC, pp. 14–22.

Reuveny, R., 2007. Climate change-induced migration and violent conflict. Pol. Geogr. 26, 656–673.

Rosen, K.T., Resnick, M., 1978. The size distribution of cities: an examination of the Pareto law and primacy. J. Urban Econ. 8, 165–186.

Sahn, D., Stifel, D., 2003. Urban-rural inequality in living standards in Africa. J. Afr. Econ. 12, 564–597.

Schultz, T.P., 1982. Lifetime migration within educational strata in Venezuela: estimates of a logistic model. Econ. Dev. Cult. Chang. 30, 559–593.

Schwartz, A., 1973. Interpreting the effect of distance on migration. J. Pol. Econ. 81, 1153–1169.

Selod, H., Tobin, L., 2013. City structure and informal property rights in West Africa: theory and evidence. Unpublished paper. World Bank.

Shah, N., 2014. Squatting on government land. J. Reg. Sci. 54, 114–136.

Takeuchi, A., Cropper, M., Bento, A., 2008. Measuring the welfare effects of slum improvement programs: the case of Mumbai. J. Urban Econ. 64, 65–84.

Todaro, M.P., 1976. Internal Migration in Developing Countries: A Review of Theory, Evidence, Methodology and Research Priorities. International Labour Office, Geneva.

Turnbull, G., 2008. Squatting, eviction, and development. Reg. Sci. Urban Econ. 38, 1–15.

United Nations Habitat, 2012. State of the World's Cities. United Nations Human Settlement Programme, London.

Wandschneider, T., Mishra, P., 2003. The role of small rural towns in Bolangir District, India: a village-level perspective. NRI Report No. 2750, DFID-World Bank Collaborative Research Project on the Rural Non-Farm Economy and Livelihood Enhancement.

Whalley, J., Zhang, S., 2004. Inequality change in China and (hukou) labour mobility restrictions. National Bureau of Economic Research Working paper No. 10683.

Wheaton, W., Shishido, H., 1981. Urban concentration, agglomeration economies and the level of economic development. Econ. Dev. Cult. Chang. 100, 17–30.

Wheaton, W.C., 1974. A comparative static analysis of urban spatial structure. J. Econ. Theory 9, 223–237.

Whittington, D., 2002. Improving the performance of contingent valuation studies in developing countries. Environ. Resour. Econ. 22, 23–367.
World Bank, 2006. Brazil—inputs for a strategy for cities: a contribution with a focus on cities and municipalities. Report 35749-BR. World Bank, Washington, DC.
World Bank, 2007. Dhaka: improving living conditions for the urban poor. World Bank, Bangladesh Development Series Paper No. 17.
World Bank, 2008. World Development Report 2009: Reshaping Economic Geography. World Bank, Washington, DC.
World Bank, 2009. World Development Report. World Bank, Washington, DC.
World Bank, 2010. Connecting People to Prosperity: Reshaping Economic Geography in Sri Lanka. World Bank, Colombo.
World Bank, 2013. Planning, Connecting, and Financing Cities Now: Priorities for City Leaders. World Bank, Washington, DC.
Young, A., 2013. Inequality, the urban-rural gap, and migration. Q. J. Econ. 128, 1727–1785.