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Urbanization and Economic Transformation: A CGE Analysis for Ethiopia

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Abstract

Strong economic growth in urban areas has not led to rapid urbanization in Ethiopia, possibly as a result of prevailing land tenure policies. We examine the economic implications of accelerated urbanization using a rural–urban economywide model that explicitly captures internal migration and agglomeration effects. Simulation results indicate that accelerated urbanization would strengthen economic growth, improve rural welfare, and reduce the rural–urban divide. However, without supporting investments in urban areas, the welfare gains for poorer households remain small and urban inequality worsens. At the same time, while allocating more public resources to urban areas encourages economic growth, it is less likely to benefit poor households' welfare. Indeed, even though an agriculture-oriented investment plan slows economic growth, it is more effective at improving welfare for poorer households in both rural and urban areas. We conclude that combining reforms to overcome the constraints to internal migration together with increased investment in rural areas (even at the cost of urban investment) produces outcomes most conducive to future economic development and structural transformation in Ethiopia.

Keywords: Internal migration; rural-urban linkages; structural transformation.
JEL codes: Q18 R13 R23

1. Introduction

There is considerable debate surrounding the sources of economic development and structural transformation in low-income countries. Traditional views favor a strong role for agriculture, which is seen as having strong growth linkages to the rest of the economy, the potential to release labor into nonagricultural sectors, and a crucial role in maintaining agricultural prices for urban consumers and downstream industrial sectors. Advocates support agriculture-led development strategies, a view clearly articulated in the 2008 World Development Report (World Bank 2007). More recently, there has been growing interest in the potential role of urban industry and the spillovers or additional productivity gains from concentrating economic activity within dense urban centers. Advocates of urban-led development see greater potential for agglomeration effects (i.e., knowledge-sharing and thicker labor markets) in cities than in more sparsely populated rural areas. The view that urban growth should play a more central role in economic development is well articulated in the 2009 World Development Report (World Bank 2008).

The debate on rural-led versus urban-led growth is crucial for Ethiopia. The country has grown rapidly in recent years; this growth has been accompanied by significant improvements in household welfare. However, even though economic growth has been stronger in cities and towns, the country still has one of the lowest levels of urbanization in Sub-Saharan Africa (SSA), with little indication that a process of urbanization is taking place commensurate with the pace of urban industrial growth and the size of rural–urban wage differentials. While many factors undoubtedly influence a country's internal migration patterns, there are a number of studies suggesting that Ethiopia's slow rural-to-urban migration is due, at least in part, to current land tenure practices. These practices discourage migration to urban areas by tying residency in rural areas to land use rights. This discourages workers from leaving rural areas to explore job opportunities in urban centers. Thus, if land tenure is indeed a binding constraint to internal migration, the pace of urbanization appears to be a policy instrument available to the government that might in turn influence that nature and rate of economic development over the coming decades.

In this paper we quantitatively examine the implications of more rapid urbanization in Ethiopia for economic development and structural transformation. This is done using a dynamic computable general equilibrium (DCGE) model designed to capture the economic linkages between Ethiopia's rural and urban areas. In the next section a brief overview of public investments in Ethiopia is presented, followed by a description of the country's regional economic structure using the database compiled for the model. In the fourth section we describe the model and its treatment of regional production and trade, rural–urban migration, and industrial agglomeration. The fifth section presents the model results for the three growth strategies, while the final section concludes with policy recommendations and areas for further research.

2. Overview of public investment scene

Poverty reduction strategies in Ethiopia have relied primarily on agricultural and rural development investments. This is due to the overwhelming numbers of inhabitants that derive their livelihoods from rural activities. In 2006/07, output of agricultural sectors (much of which is concentrated in Ethiopia's urban areas) contributed 46 percent to GDP, whereas agricultural sectors contributed 15 percent to GDP in SSA as a whole and 25 percent to GDP in low-income countries in 2005 (Arndt et al. 2009; MoFED 2005). Although the majority of the population lives in rural areas, the government of Ethiopia has identified the need to not only enhance rural–urban linkages, but also address the overwhelming need for urban planning and infrastructure improvement. The Ministry of Finance and Economic Development (MoFED) of Ethiopia contends that "while the focus of much pro-poor development must inevitably remain rural-based, urban development will play a more central role in the next phase of Ethiopia's development" (MoFED 2006).

It is against this setting that the Government of Ethiopia drafted the National Urban Development Policy (NUDP) which became operational in 2005. Two principal packages make up this policy—the Urban Development Package and the Urban Good Governance Package. A set of initiatives and targeted programs were also outlined under the NUDP which include: strengthening of urban-rural and urban-urban linkages for sustainable development; expanding growth opportunities through balanced development of urban centers; reducing urban poverty and unemployment; increasing participation of the community in different aspects of urban development; constructing strong partnerships with the private sector; and creating more decentralized urban governance. The NUDP highlights the need for expansion of small and micro enterprises in urban areas, construction of low-cost houses, improved access to land for private sector investments and urban residents including the poor, and expansion of social services (MoWUD 2006).

In addition to the NUDP, the PASDEP also outlines an urban development strategy with four main pillars. These pillars include: reducing urban unemployment to less than 20%, developing integrated housing in order to reduce slums in Ethiopia's main cities by 50%, improving access to urban land infrastructure and services, and promoting urban–rural and urban–urban linkages. As a strategy to promote rural–urban linkages, the PASDEP outlined small-town development as a key instrument to enhance forward and backward linkages. The target includes developing 600 small towns (towns with less than 20,000 people) between 2005/06 and 2009/10.

Of course, rapid urbanization does not necessarily produce growth or improved household welfare. In the absence of sound overall macroeconomic policy, sufficient investments in infrastructure, adequate provision of social services, and well-functioning institutions (including public security and judicial institutions), rapid rural–urban migration can result in sprawling slums of underemployed poor people. However, slow urbanization in Ethiopia over the last several decades is somewhat puzzling when seen in light of other recent developments in the country. Since the fall of the Derg, a federal government structure was put in place that has invested in large public infrastructure (primarily roads, but also on

electricity and telecommunications) during the last ten years, which raised rural–urban connectivity and expanded the educational system. In addition to improvements in infrastructure and education, the government has sought a more liberal policy toward markets and resource flows (Rashid, Assefa, and Ayele 2009), and acknowledges the significance of urbanization and rural–urban linkages for economic growth and poverty reduction.

Overall, the allocation of government spending between rural and urban sectors has reflected the spending priorities of the Agricultural Development Led Industrialization (ADLI) policy. Defining rural expenditures as those on agriculture and road construction outside of Addis Ababa, and urban expenditures as those on urban development and all Addis Ababa expenditures, total identifiable urban expenditures in 2007/08 were 7.5 billion birr, or 11.6 percent of total spending (Table 2.1). Total identifiable rural expenditures were 18.6 billion birr, or 28.8 percent of total spending. "Other" expenditures, including all other categories of expenditures (e.g. education, health, defense, etc.), accounted for the remaining 60 percent of spending.[1]

Table 2.1. Government of Ethiopia expenditures (rural, urban, and other), 1999/00 and 2007/08

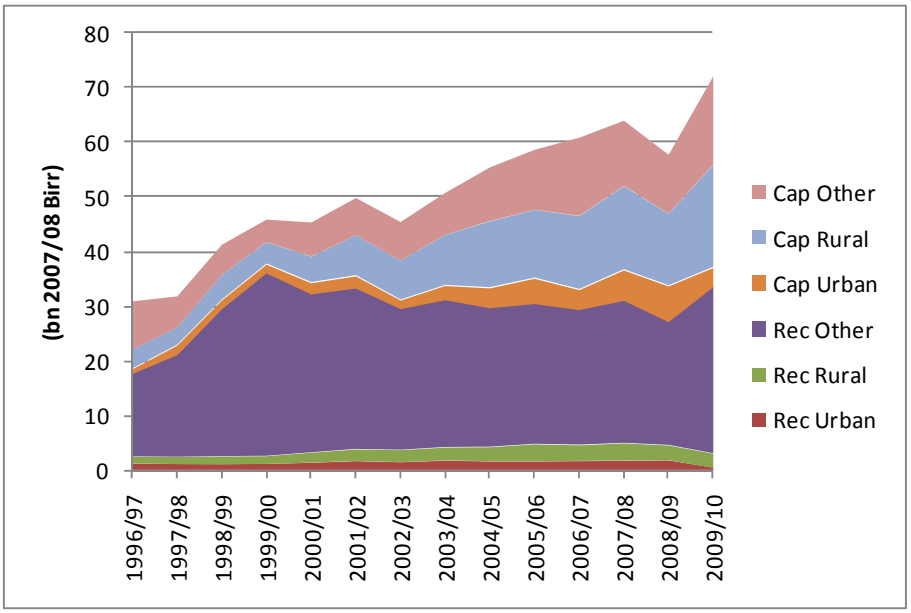
	1999/00 (bn 07/08 birr)	1999/00 (share)	2007/08 (bn 07/08 birr)	2007/08 (share)	Growth Rate
Recurrent	36.1	79.0%	31.1	48.8%	-7.2%
Urban	1.2	2.7%	1.9	2.9%	22.9%
Rural	1.4	3.1%	3.2	5.0%	49.0%
Other	33.5	73.2%	26.0	40.8%	-11.8%
Capital	9.6	21.0%	32.7	51.2%	84.6%
Urban	1.6	3.5%	5.6	8.7%	86.8%
Rural	3.9	8.5%	15.2	23.8%	97.5%
Other	4.1	9.0%	11.9	18.7%	70.5%
Total	45.7	100.0%	63.7	100.0%	18.1%

Source: Author's calculations from Ministry of Finance and Economic Development Data.
Notes: Urban includes urban development and all Addis Ababa expenditures.
Rural includes agriculture and road construction outside of Addis Ababa.

Over time, government spending has shifted toward investment. Capital (investment) expenditures rose rapidly between 1999/00 and 2007/08 for both rural and urban investments, as well as for "other" investments (Figure 2.1). With recurrent expenditures actually declining in real terms, the share of capital expenditures in the overall budget rose from 21.0 percent to 51.2 percent.

[1] Further analysis could be undertaken to determine the rural–urban split of some of these categories (particularly education and health).

Figure 2.1. Government of Ethiopia expenditures (rural, urban, and other), 1996/97 to 2007/08



Source: Author's Calculations
Notes: Urban includes urban development and all Addis Ababa expenditures.
Rural includes agriculture and road construction outside of Addis Ababa.
2004/05 to 2008/09 are "pre-actual" figures;

Although Ethiopia is developing the infrastructure, human capital, and market processes to spur agglomeration economies, urbanization and industrialization is unachievable without sufficient increases in agricultural productivity. Agricultural surplus at the household level is critical to enabling farmers to release family labor to staff growing factories in the cities, while also maintaining food production at home (Rondinelli 1988). Strong agricultural policies that promote efficient and productive farming practices and hence income earning potentials of farmers in the rural areas are key to promoting urbanization. Ethiopia has underlined the importance of ADLI through initiatives such as the Rural Development Policies and Strategies (RDPS), Food Security Strategy, Food Security Programme, Productive Safety Net Program, Participatory Demonstration and Training Extension System (PADETES), Sasakawa Global 2000, and the National Extension Intervention Program (NEIP).

The RDPS, as well as the extension and food security programs, aims to provide smallholder farmers with agricultural inputs to promote more intensive production strategies, while also providing drought-prone areas with cash or food transfers or both in order to prevent asset depletion during hunger periods. Specifically, different agricultural development packages aim to provide improved seeds and fertilizers, enhanced farm implements and pesticides, expanded extension services, construction of small scale irrigation schemes, minimization of post-harvest losses, and development of livestock resources through improved feed base and veterinary services. Furthermore, RDPS seeks to educate rural inhabitants on proper use of land, to expand rural infrastructure (health, education, access to safe water, and rural roads), to organize accessible rural financial systems for smallholders, and to develop and strengthen rural institutions.

Although the RDPS provides input packages to enhance production, the institutional arrangement for the distribution of agricultural inputs and credit may be hindering effective distribution mechanisms. While the retail price of fertilizer is liberalized, the institutional arrangement for delivery is controlled by the regional governments and input enterprises. Credit for fertilizer and delivery of fertilizer are usually organized under one transaction (Dercon et al. 2009). Regardless of the size of the harvest—even where there is crop failure—the credit has to be paid; there is no insurance mechanism or provision for postponement of this payment. Coupled with the devaluation and removal of subsidy, this has in fact exposed smallholders to unfavorable relative price movements and high increases in prices of fertilizer relative to crops' prices, and has increased the risk involved in using fertilizer (Alemu Zewdu and Malek 2010).

In addition to agricultural input packages and extension and food security programs, an important policy reform needed in order to assure greater labor mobility and enhanced rural–urban linkages is the land tenure and certification program. In order to address uncertainties of land rights, the government set forth a land registration and certification program in 2004/05. Even with this new system, a work commissioned by USAID in 2004 found that rural landholders do not perceive a strong system for tenure rights. Furthermore, these landholders contend that although they have land certification papers, they are not protected from government expropriation and periodic land redistribution. Given continued uncertainty, the land certification program has shown little effect at incentivizing agricultural investment and migration thus far. A study completed by Deininger and Jin (2006) assessed farmers perception of land rights and found that most farmers would prefer higher levels of land tenure security. They found that a large share of farmers would change their farming practices and undertake more investments if more tenure security was provided (Table 2.2). Urbanization requires increases in agricultural production as well as labor mobility to seek opportunities of income diversification. If farmers perceive disincentives to migration, they will not respond to economic forces, and efficiency gains from greater economic and geographic interaction are lost.

In the next section, Ethiopia's rural and urban economies are described using the database for the DCGE model.

Table 2.2. Subjective land rights, tenure security, and investment in Ethiopia

		Region				
	National	Tigray	Amhara	Oromiya	SNNPR	Others
Land tenure security						
Woreda had redistribution since 1990	9%	14%	18%	6%	4%	4%
Affected by redistribution since 1990	8%	17%	20%	4%	2%	4%
Expects redistribution next 5 years	9%	10%	10%	10%	6%	12%
Expects no redistribution	27%	42%	26%	23%	30%	37%
Has land conflict with authorities	23%	23%	23%	26%	14%	22%
Perceives right to rent/sharecrop	91%	98%	89%	92%	85%	95%
Perceives right to mortgage/inherit	23%	18%	32%	18%	26%	35%
Perceives right to sell	4%	1%	1%	4%	3%	12%
Land tenure preferences						
Prefers higher tenure security	48%	61%	43%	51%	41%	48%
Prefers private ownership	31%	22%	38%	31%	30%	26%
Prefers redistribution	4%	10%	4%	3%	5%	4%
Would invest if land privatized	47%	29%	47%	49%	44%	68%
• build terraces	38%	24%	41%	39%	35%	56%
• plant trees	13%	12%	19%	14%	7%	8%
• adopt other improvements	11%	6%	10%	12%	15%	11%
Actual investment since 1999						
Built or maintained terraces	47%	81%	88%	34%	31%	20%
Planted trees	39%	50%	43%	41%	36%	8%

Source: Deininger and Jin (2006) and EEA/EEPRI (2001)

3. Ethiopia's rural and urban economies

In developing the rural–urban DCGE model of Ethiopia, we first constructed a rural–urban social accounting matrix (SAM), which is a database that provides a complete picture of Ethiopia's real economy for the year 2005. The SAM was based on an earlier national SAM produced by Ahmed et al. (2009), which reconciled a wide range of data sources, including national accounts, supply-use tables, government budgets, and the 2005 Household Income and Consumption Expenditure Survey (HICES). These data were first arranged within a consistent accounting framework containing the incomes and expenditure flows of the government and many producers and households. However, due to different collection methods and accuracies, it was necessary to reconcile the information from these data sources. Cross-entropy estimation was used to balance the SAM with as few changes to the original data as possible (see Robinson, Cattaneo, and El-Said 2001). In this section we use the SAM to describe the structure of Ethiopia's rural and urban economies.

3.1. National economic structure

Agriculture has performed well over the last few years and has remained the most important sector in the economy. In 2005, agriculture accounted for almost half of the national GDP and four-fifths of total employment (see Table 3.1). Agricultural exports also account for more than two-fifths of total export earnings and two-thirds of goods exports. Coffee, oilseeds, and chat, together with certain livestock products, are the main export crops. However, there is little downstream value-addition of these crops, with processed agricultural products (e.g., foods) accounting for only a small share of both GDP and total exports.

Table 3.1. Ethiopia's economic structure, 2005

	Share of total (%)			Export intensity (%)	Import intensity (%)
	GDP	Exports	Imports		
Total GDP	100.00	100.00	100.00	6.69	25.60
Agriculture	48.09	46.43	5.41	8.05	4.14
Crops	28.96	39.23	4.61	10.31	5.75
Livestock	14.40	4.55	0.00	3.79	0.00
Other	4.74	2.65	0.80	5.29	4.99
Manufacturing	4.81	16.97	70.50	7.37	67.06
Agro-processing	2.38	4.39	3.23	3.14	15.71
Other	2.43	12.58	67.27	11.97	80.94
Other industry	6.67	0.63	0.24	0.40	0.52
Private services	31.18	35.97	23.84	9.28	16.60
Public services	9.25	0.00	0.00	0.00	0.00

Source: Authors' calculations based on an adjusted version of the 2005 social accounting matrix of Ethiopia (EDRI 2009).
Notes: Export-intensity is the share of exports in domestic production; import-intensity is the share of imports in domestic demand.

Manufacturing has also grown rapidly in recent years, but it still accounts for less than five percent of national GDP, half of which is in agro-processing. Manufactured exports include mainly textiles and leather, although both subsectors remain small. Most manufactured goods in the country are imported, especially capital goods. For instance, almost all

machinery demand in Ethiopia is supplied by imports. The rest of the private sector is dominated by construction and trade services. Finally, the government accounts for almost ten percent of national GDP and is the largest employer of skilled labor in the country.

At the macro-level, Ethiopia's dependence on imported capital goods is reflected in the country's large trade deficit (25 percent of GDP), with total import demand three times larger than export earnings. According to Ahmed et al. (2009), the external deficit is mostly offset by foreign donor grants (6.6 percent of GDP), private remittance flows (8.3 percent of GDP), and by foreign borrowing by the public sector to finance capital investments (8.9 percent of GDP). Foreign grants are especially important for the public sector as they finance almost half of total current expenditures (i.e., consumption spending and social transfers). Similarly, foreign remittances generate 7.5 percent of total household incomes and a much larger share for non-poor urban households.

3.2. Distinguishing cities, towns, and rural areas

To capture rural–urban linkages and the spatial impacts of alternative investment strategies, we disaggregated the national economy into three subnational regions. We first divided the country into rural and urban areas. The former comprises mainly agriculture and some manufacturing and services, such as local food processing, construction and trade. We then used the Industrial Census and HICES to separate out the country's major cities or metropolitan areas, which included the capital city, Addis Ababa, as well as the large regional hubs of Dire Dawa and Harari. Together these cities account for 3.6 million people out of Ethiopia's total population of 71 million in 2005. Since these cities form the core of Ethiopia's formal industrial economy, we treat them as a separate region in the model. The remaining urban centers have a total population of 7.1 million people (i.e., 10 percent of the population). Therefore, the three regions in the model are (1) urban cities, (2) urban towns, and (3) rural areas.

3.3. Rural–Urban characteristics

Using the 2005 HICES and 2003 Industrial Census, we disaggregated production and employment across the three regions in the model for each of the 69 sectors in the Ethiopia SAM. The regional SAM indicates that, while rural areas contain 84.9 percent of Ethiopia's total population, they account for only 53.3 percent of national GDP (see Table 3.2). As such, per capita consumption is low in rural areas at US$121 per year compared to the national average of US$186 (unadjusted for purchasing power). Low consumption levels are also reflected in higher poverty headcount rates, with 41.8 percent of the country's population living in the bottom two quintiles residing in rural areas. Agriculture is heavily concentrated in rural areas, with an underrepresentation of industry and services compared to the national economic structure. As such, there is a higher concentration of lower-skilled workers in rural areas, including the country's large workforce of unpaid family members.

Table 3.2. Ethiopia's rural–urban economic structure, 2005

	Rural	Towns	Cities	Ethiopia
Population (millions)	60.3	7.1	3.6	71.0
Poor population (millions)	25.2	2.5	0.7	28.4
Consumption per capita ($US)	121.3	510.9	629.6	186.0
Population share (%)	84.9	10.0	5.1	100.0
Poor population share (%)	88.7	8.9	2.5	100.0
Poverty rate (%)	41.8	35.5	19.2	40.0
Workers (millions)	22.3	2.6	1.3	26.2
Skilled	0.1	0.4	0.2	0.7
Semi-skilled	0.9	1.2	0.8	2.9
Unskilled	6.1	1.0	0.4	7.5
Family farmers	15.2	0.0	0.0	15.2
Total GDP shares (%)	53.3	26.4	20.4	100.0
Agriculture	90.2	9.8	0.0	100.0
Industry	15.0	36.0	49.0	100.0
Services	20.2	43.3	36.5	100.0

Source: Authors' calculations based on an adjusted version of the 2005 social accounting matrix of Ethiopia (EDRI 2009) and the 2005 Household Income and Consumption Expenditure Survey (HICES).
Notes: 'Cities' include Addis Ababa, Dire Dawa and Harari; 'Towns' include all remaining urban centers. Per capita consumption is in unadjusted dollars

Even though urban towns account for 7.1 percent of the population, they generate more than a quarter of national GDP. As such, per capita consumption in towns is well above the national average at US$511 (i.e., almost four times the rural average). Although some agricultural production takes place within the boundaries of urban towns, it is the industrial and service sectors that are most important. Accordingly, of the ten percent of Ethiopia's workforce that work in towns, most have semi-skilled or skilled occupations (e.g., professionals, technicians and transport operators).

Although the three major cities contain only 5.1 percent of the population, they generate 20.4 percent of national GDP, and thus form the industrial core of Ethiopia's economy. Most of Ethiopia's small manufacturing sector, especially the formal production sector, is based in cities.

Services, such as hotels, banking and finance, make up more than half of the city economy. Average per capita consumption is highest in the cities at US$630 per year. This is more than five times larger than consumption among rural households, reflecting the sharp divide between rural and urban areas in Ethiopia. This rural–urban divide has been exacerbated by particularly fast growth in urban industry, especially construction within major cities, and the relatively slow pace of internal rural-to-urban migration.

In the next section we develop an economywide model based on the 2005 rural–urban SAM that will allow us to examine alternative internal migration scenarios and reallocations of public capital investments across rural areas, towns, and cities.

4. An economywide rural–urban model of Ethiopia

In order to assess the growth and distributional impacts of alternative regional investment options, we developed a DCGE model of Ethiopia. The model is recursive dynamic and is run over the 20-year period 2005-2025. This means that the model is solved as a series of equilibriums with economic actors optimizing their behavior within each period (i.e., there is no inter-temporal or long-run optimization). Given this assumption of adaptive expectations, the model can be separated into a within-period component, in which producers and consumers maximize profits and utility, and a between-period component, in which the model is updated to reflect changes in the population and labor force, capital and technology accumulation, and agglomeration economies.

The model is initially calibrated to the 2005 rural–urban SAM, which provides information on demand and production for 69 detailed sectors in each of the three regions (cities, towns, and rural areas) identified in the previous section. Based on this SAM, the production technologies in each sector and region are calibrated to their current situation (i.e., 2005) including producers' use of primary inputs, such as land, labor, and capital, and intermediate inputs. To capture differences in labor markets, the model classifies employed labor into four occupation-based skill categories: skilled (e.g., managers and professionals), semi-skilled (e.g. technicians and traders), unskilled workers (e.g., farmers and laborers), and unpaid family farm workers. With the exception of family labor, workers are assumed to be fully employed with flexible nominal wages. Family farm labor has an upward-sloping labor supply curve to capture underemployment and incentives from rising wages. Information on both paid and unpaid employment and on wages by sector and region was taken from the 2005 HICES.

Within each period workers in the model can migrate across sectors within cities, towns, and rural areas, but between periods they can only migrate between these regions in response to wage differentials. As with labor, capital can also move freely across sectors within regions. Between periods we capture the accumulation of private and public capital, which depends on previous period investments financed by domestic savings and foreign inflows (e.g., donor grants). New private capital stocks are allocated across regions and sectors according to current profit rate differentials, such that regions whose capital is earning above-average profits receive a larger share of new capital stocks. The regional allocation of new public capital is determined exogenously based on current patterns. The final factors in the model, agricultural land and livestock, are used exclusively in rural areas and are endogenously allocated across crops in order to maximize returns.

An important factor determining a sector's contribution to economic growth is its linkages with other sectors in its own region and other regions. The model captures production linkages by explicitly defining a set of nested constant elasticity of substitution (CES) production functions that allow producers in each region to generate demand for both factors and intermediates. The model also captures forward and backward production linkages between sectors. However, while we include differences in regional production patterns, we assume that there is a national commodity market for traded commodities in Ethiopia. This is

equivalent to assuming that producers in cities, towns, and rural areas supply their products to a central market and that a national price adjusts to equate demand and supply at the national rather than the regional level. We do allow regional markets for certain non-traded commodities, such as construction and trade services. For these commodities there is a unique regional price that equates regional demand and supply. Foreign import competition and export opportunities is modeled by allowing national-level production and consumption to shift between domestic and foreign markets depending on the relative prices of imports, exports, and domestic goods. More specifically, the decision to supply domestic or foreign markets is governed by a constant elasticity of transformation (CET) function, while substitution possibilities exist between imports and domestically supplied goods under a CES Armington specification.

Incomes from production, trade, and employment accrue to different households according to employment and wage data from HICES. Households in the model are disaggregated across the three regions and poor or non-poor groups (i.e., inside or outside of the bottom two per capita expenditure quintiles in 2005). Differences in household income and expenditure patterns are important for capturing distributional change, since incomes generated in different sectors will accrue to different households depending on their location and factor endowments. Households in the model receive income through the employment of their factors of production; they then pay taxes, save, and make transfers to other households. Disposable income is then allocated to commodity consumption based on a Stone-Geary utility function (i.e., a linear expenditure system of demand).

The model makes a number of assumptions about how the economy maintains macroeconomic balance (i.e., closure rules). For the current account, a flexible exchange rate maintains a fixed level of foreign savings. This means that the government cannot increase foreign debt to pay for new investments and that export earnings are needed to pay for any additional imports. For the government account, tax rates are fixed and recurrent expenditure grows at a fixed rate. The fiscal deficit therefore adjusts to ensure that public expenditures equal receipts. By contrast, investment is endogenously determined such that investment demand equals available savings (determined by fixed private savings rates as with a savings-driven investment closure).

Three factors determine each region's annual total factor productivity (TFP) growth rate. The first is an initial TFP growth rate, which is determined exogenously in order for the model to broadly track Ethiopia's long-term growth trends after accounting for changes in total factor supplies. The second factor takes into account agglomeration effects caused by changes in the density of economic activity within a particular region. Following Henderson and Wang (2005), we assume that agglomeration spillovers are a function of a region's population density. Combined with the model's treatment of internal migration, this simple specification implies that a region's TFP growth rate accelerates if the region is a net recipient of migrant workers (i.e., if its population expands faster than its initial growth rate). Given the sparse population of rural areas and the concentration of industry in urban areas, we only allow agglomeration effects to take place in towns and cities. The third and final source of TFP growth is the concentration of public capital among urban residents. Thus, TFP growth accelerates more rapidly in regions where per capita public capital stocks are expanding.

This per capita measurement therefore captures some of the adverse congestion effects caused by migration into urban centers.

In summary, the CGE model incorporates rural–urban growth linkages and distributional change by (1) disaggregating production patterns and technology across sectors and rural/urban areas, (2) allowing rural–urban labor migration, agglomeration, and congestion effects, (3) capturing region-specific transaction costs and specifying regional markets for non-traded commodities, (4) capturing income-effects through regional factor markets and price-effects through national commodity markets, and (5) translating these two effects onto different households in each region according to their factor endowment and income and expenditure patterns. This allows the model to capture the economic growth and distributional effects associated with alternative investment scenarios.

5. Modeling results

The model is used to examine the impact of two sets of simulations: (1) accelerating existing rural-to-urban migration rates, and (2) increasing the allocation of public investment to cities, towns, and rural areas. However, it is first necessary to construct a Baseline scenario, which provides a counterfactual to which the alternative growth scenarios can be compared.

5.1. Baseline scenario

The CGE model is not a projection model, so it cannot predict what will happen in Ethiopia over the next twenty years. Rather, the Baseline scenario provides a counterfactual for other simulations. However, we calibrate this scenario to track broad growth and demographic trends for such variables as population and labor supply, migration, and total factor productivity. First, we assume that Ethiopia's total population grows at two percent per year during 2005-2025 (see Table 5.1). We also assume that the total supply of skilled, semi-skilled and unskilled labor grows at two percent per year, and we assign a wage-elasticity to family labor such that the supply of these workers also grows at around two percent. This means that the national dependency ratio remains broadly constant over time. Although we initially assign the same labor supply growth rates in all regions, over time these diverge as workers migrate between regions. Thus, while the total population and workforce growth rate is largely fixed, the model endogenously reallocates labor and populations between regions.

Second, for migration, we assume that current regional wage differentials generate the levels of internal migration observed in Ethiopia during the late 1990s (as reported in Golini et al. 2001). This implies a net annual inflow of around 33,200 migrants into major cities. Most workers who migrate to cities come from smaller towns (i.e., 21,700 migrants per year), while the remaining migrants come from rural areas. Migration from rural areas to towns is considerably larger than to cities (i.e., 55,700 workers). However, this is offset by outflows to cities, such that towns experience a smaller net inflow of migrants each year. In the model we initially calibrate migration flows to capture these observed migration flows and then let

annual migration rates adjust to reflect changes in relative regional wages.[2] As mentioned earlier, inward migration will cause population growth in cities and towns to exceed the population growth rates in rural areas. Given our specification of urban agglomeration effects, this inward migration will also accelerate TFP growth in urban centers.

Table 5.1. Migration and agglomeration in the baseline scenario

	Initial	Ethiopia	Rural	Towns	Cities
Annual GDP growth rate (%)	100.0	5.40	3.92	5.23	8.17
Labor employment growth	44.0	1.87	1.56	2.86	4.12
Skilled	6.5	2.00	0.93	1.72	3.17
Semi-skilled	16.1	2.00	0.78	1.84	3.27
Unskilled	9.4	2.00	1.14	4.17	6.00
Family farmers	11.9	1.77	1.77	0.00	0.00
Crop land expansion	15.7	1.00	1.00	0.00	0.00
Livestock accumulation	5.4	1.00	1.00	0.00	0.00
Private capital accumulation	34.9	6.77	7.96	5.92	6.82
Public capital accumulation	-	6.50	6.60	5.61	6.62
TFP growth	-	1.18	1.08	0.69	2.07
Agglomeration	-	0.11	0.00	0.19	0.27
Public capital	-	0.10	0.00	0.22	0.20
Exogenous	-	0.97	1.08	0.28	1.60
Net annual migration (workers)	-	0	-55,724	22,533	33,191
Outflows	-	77,406	55,724	21,682	0
Inflows	-	77,406	0	44,215	33,191
In-migrants share of workforce (%)	-	0.00	-0.26	0.75	1.86
Population growth rate (%)	70,992	2.00	1.80	2.65	3.64
Poor	28,394	2.00	1.79	3.28	3.98
Non-poor	42,598	2.00	1.81	2.27	3.56

Source: Results from the Ethiopia Rural-Urban DCGE model.

Finally, given recent sector growth trends, we calculate that initial TFP growth is higher in cities than in towns. Furthermore, despite agriculture's strong performance in recent years, we assume that agricultural productivity growth will slow down over the next two decades. However, based on our growth accounting, exogenous productivity in rural areas will still grow faster than TFP growth in towns in the baseline scenario.

Given the above assumptions, Ethiopia's economy grows at 5.4 percent per year during 2005-2025 under the Baseline scenario (see second column of Table 5.2). This is driven by industry and private services, which grow at over six percent per year. Due to its slower productivity growth, agriculture grows below the national average at 3.3 percent. Government recurrent spending grows at a fixed rate of 5.5 percent per year, thus maintaining a constant share of national GDP.

[2] The migration rate in year *t* (from region 1 to region 2) is equal to the initial migration rate multiplied by the regional wage differential (normalized to remove the initial wage differential).

$$mr^{t}_{1\to 2} = mr^{0}_{1\to 2} \times \left(\frac{w^{t}_{2}/w^{0}_{2}}{w^{t}_{1}/w^{0}_{1}}\right)^{\eta}$$

Table 5.2. Macroeconomic results

	Initial, 2005 (%)	Baseline scenario	Urbanization scenarios			Investment scenarios		
			Double	Triple	Quadruple	Cities	Towns	Rural
		Average annual growth rate, 2005-2025 (%)						
			Point deviation from baseline result					
Total GDP	100.0	5.40	0.18	0.29	0.38	0.23	0.18	-0.08
Agriculture	48.1	3.28	-0.03	-0.06	-0.09	-0.26	-0.23	0.84
Manufacturing	4.8	6.67	0.36	0.59	0.75	0.38	0.25	-0.66
Agro-processing	2.4	5.79	0.18	0.29	0.35	0.19	0.24	-0.34
Other	2.4	7.42	0.48	0.79	1.03	0.52	0.25	-0.91
Other industry	6.7	6.34	0.25	0.41	0.52	0.32	0.31	-0.43
Private services	31.2	7.20	0.32	0.53	0.68	0.56	0.48	-0.76
Public services	9.2	5.84	0.06	0.10	0.13	0.08	0.01	-0.06
Public consumption	12.0	5.50	0.00	0.00	0.00	0.00	0.00	0.00
Private consumption	86.7	5.01	0.11	0.18	0.22	0.08	0.09	0.13
Investment demand	24.7	5.69	0.19	0.31	0.40	0.31	0.31	-0.36
Export demand	12.1	8.03	0.46	0.75	0.97	0.69	0.54	-0.75
Import supply	-35.5	6.14	0.22	0.37	0.48	0.34	0.27	-0.25
		Final year value, 2025						
Consumer price index	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Food	1.000	1.032	1.043	1.050	1.055	1.062	1.071	0.942
Non-food	1.000	0.965	0.954	0.946	0.940	0.932	0.923	1.063
Real exchange rate	1.000	1.034	1.030	1.024	1.019	1.020	1.030	1.018

Source: Results from the Ethiopia Rural–Urban DCGE model.

Slower agricultural growth affects agro-processing, whose production partly depends on domestically produced agricultural inputs. Non-food manufacturing is therefore a more significant driver of overall manufacturing growth in the Baseline scenario. These heavier manufacturing sectors are more capital-intensive and generate demand for investment goods, such as machinery and construction. Accordingly, investment demand and nonagricultural imports both grow faster than national GDP, and capital stocks grow faster than other factors under the Baseline scenario. Real private consumption spending is also offset by rising food prices caused by slower agricultural growth (see the bottom of Table 5.2).

GDP growth is unevenly distributed across cities, towns and rural areas. For instance, while GDP in cities grows at 8.2 percent per year, rural areas grow only half as fast (see Table 5.1). This causes the returns to labor to diverge across regions. Stronger industrial growth in cities maintains the regional wage gap, causing 33,200 workers to migrate each year to cities during 2005-2025. This is equal to 1.9 percent of cities' total workforce. As such, while the national population grows at two percent per year, it grows faster in cities due to in-migration, eventually averaging 3.6 percent under the Baseline scenario. Population growth in towns is also above the national average at 2.7 percent per year.

In-migration causes positive agglomeration effects in towns and cities, which stimulates faster TFP growth. For example, within towns, agglomeration accounts for about one third of total productivity growth in the Baseline scenario. This is bolstered by positive TFP gains from rapid public capital investment, which grows faster than the population in all regions and at 6.5 percent nationally. However, at the national level, these agglomeration and public

investment effects are small relative to exogenously imposed TFP growth, even in cities where there is both rapid population growth and large inward migration. Here agglomeration effects contribute only 0.3 percentage points to the average total annual TFP growth rate of 2.1 percent (i.e., 14 percent of productivity growth).

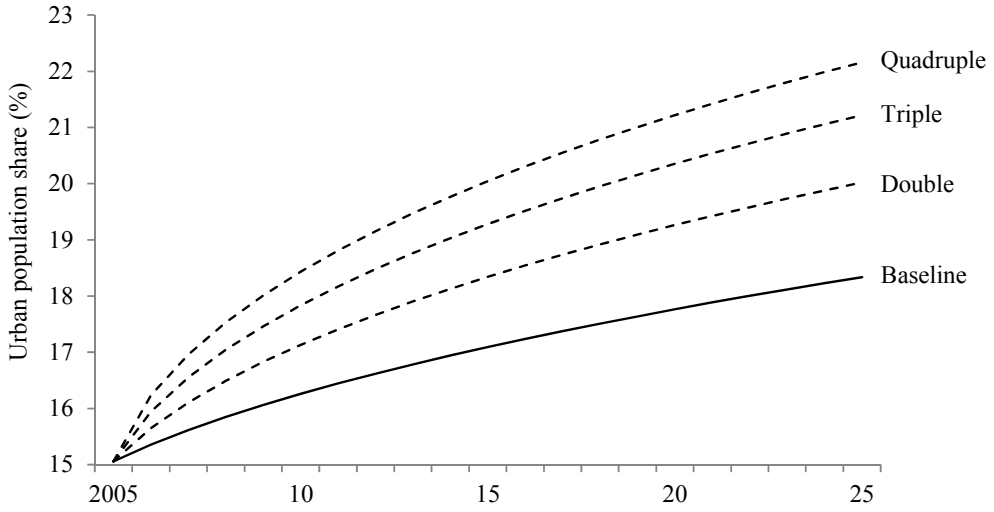
In summary, the Baseline scenario is broadly consistent with Ethiopia's long-term growth performance. Based on estimated rural–urban migration rates for Ethiopia, the country becomes slightly more urbanized over the next two decades, with the urban population share rising from 15.1 percent in 2005 to 18.3 percent by 2025. While rural areas also benefit from overall economic growth, agriculture's poorer performance relative to other sectors causes rural GDP to grow below the national average. Thus, in terms of average per capita GDP, the Baseline scenario reflects a widening rural–urban divide, underpinned in part by relatively slow migration from rural to urban areas. Within this context, we now examine the effect of accelerating urban migration rates.

5.2. Urbanization scenarios

Urbanization rates in Ethiopia are well below those of most other African countries (World Bank 2010). Moreover, the results from the Baseline scenario suggest only modest increases in the share of the population living in urban areas over the next two decades. This is despite faster growth in urban centers and a clear rural–urban earnings differential. Numerous studies have examined migration behavior in low-income countries, and found that the decision not to migrate to urban centers may be influenced by low education levels, weak social networks in destination regions, and insufficient wealth to finance the migration process. These factors may well explain part of the low migration rates observed in Ethiopia. However, one policy-related factor that may be further limiting internal migration in Ethiopia is the prevailing land tenure system, which ties physical residency of individuals to land use rights. Thus, individuals are less likely to migrate to urban centers if it involves forgoing the right to farm land, especially if it is also uncertain whether new land would be allocated to them if they return.

In the next set of simulations, we explore the implications of exogenously increasing current rural-to-urban migration rates (i.e., above the migration rates used in the Baseline scenario). We then allow the DCGE model to trace through the economic implications of this accelerated urbanization on economic growth and household welfare. For example, based on survey evidence from the late 1990s, 1.13 and 0.34 percent of rural workers moved to towns and cities each year. Similarly, 0.45 percent of workers in small towns moved to cities each year during 1994-1999. This evidence provided the DCGE with an initial estimate of migration rates for 2005-2006. We now run three additional scenarios where we double, triple, and quadruple the initial migration rates between these regions. The resulting national urbanization rates for each scenario for 2005-2025 are shown in Figure 5.1.

Figure 5.1. Population shares in the baseline and urbanization scenarios



Source: Results from the Ethiopia Rural-Urban DCGE model.

As mentioned earlier, the national urbanization rate reached 18.3 percent by 2025 in the Baseline scenario. This increases further to 20.0, 21.2, and 22.2 in the Double, Triple, and Quadruple scenarios, respectively. Increasing the initial migration rate does not lead to proportional increases in final-year urbanization rates. This is because the incentive to migrate to urban centers is lowered by heightened competition over jobs and the resulting decline in real wages that new migrants can expect in urban areas. This is evident in Table 5.3, which reports changes in regional wage ratios and migration flows and shows how the rural–urban wage gap narrows as migration rates increase. Moreover, the number of migrants leaving rural areas increases by 28,000 when initial migration rates are doubled, by a further 19,000 when they are tripled, and then by only 15,000 when they are quadrupled. Similarly, the average wage differential between towns and cities also narrows due to town-to-city migration.

Table 5.3. Regional wage ratios and migration flows

	Initial ratio 2005	Baseline scenario	Urbanization scenarios			Investment scenarios		
			Double	Triple	Quadrup	Cities	Towns	Rural
Wage ratios (final year, 2025)								
Rural / Urban	0.205	0.286	0.315	0.335	0.350	0.287	0.288	0.275
Rural / Towns	0.241	0.328	0.350	0.361	0.367	0.333	0.329	0.315
Rural / Cities	0.159	0.239	0.279	0.309	0.334	0.238	0.241	0.230
Towns / Cities	0.658	0.729	0.799	0.858	0.909	0.716	0.733	0.730
Annual migration flows								
Rural	-	-55,724	-	-	-	-	-	-57,295
Towns	-	22,533	27,497	28,748	28,528	21,604	22,452	23,840
Inflows	-	44,215	67,324	83,931	97,022	43,670	44,055	45,535
Outflows	-	21,682	39,827	55,183	68,493	22,066	21,604	21,695
Cities	-	33,191	55,880	73,932	89,095	33,645	33,078	33,455

Source: Results from the Ethiopia Rural–Urban DCGE model.
Notes: Reported wage ratios and migration flows combine results for all skill and occupation groups in the model.

Accelerated migration to urban centers reduces the supply of labor in rural areas, which slows the rate of agricultural GDP growth relative to the Baseline scenario (see Table 5.2). Conversely, urban-based industry and services benefit from increased labor supplies and lower real wages. The weak link between agriculture and downstream processing means that the agro-processing sector grows faster in the Urbanization scenarios, despite slower agricultural growth. However, agro-processing grows more slowly than other manufacturing subsectors. Overall, increasing rural-to-urban migration rates causes national GDP growth to accelerate. For example, average annual GDP growth, which was 5.4 percent in the Baseline scenario, increases by 0.4 percentage points to 5.8 percent in the Quadruple scenario. However, despite faster national growth, slower agricultural growth further increases real food prices, thereby offsetting some of the gains for private consumers. This is reflected in the smaller increase in private consumption spending relative to the overall increase in national GDP growth rates.

Table 5.4 reports changes in regional GDP and identifies the sources of economic growth. Rural GDP declines only slightly despite large outflows of migrant workers to urban centers. This is because declining labor supplies are partly offset by greater capital investment throughout the country as national incomes and savings rise. Capital accumulation rates therefore rise in all three regions in the model, which is the main driver behind faster overall economic growth. By contrast the additional farm labor drawn into employment has only a modest contribution. Moreover, TFP growth declines slightly despite positive agglomeration effects in towns and cities. This is because the crowding of public capital in urban areas adversely affects urban productivity growth. These congestion effects are most pronounced in cities where they are sufficient to reduce overall TFP growth. This suggests a need for supporting public investments in urban centers in order to realize the full economic growth gains from accelerated urbanization.

Table 5.4. Regional growth and agglomeration results

	Initial p.c. consumption 2005 ($US)	Average annual EV growth rate, 2005-2025 (%)						
		Baseline scenario	Point deviation from Baseline result					
			Urbanization scenarios			Investment scenarios		
			Double	Triple	Quadruple	Cities	Towns	Rural
National GDP	100.0	5.40	0.18	0.29	0.38	0.23	0.18	-0.08
Labor	44.0	1.87	0.03	0.04	0.05	-0.02	-0.01	0.08
Capital	34.9	6.77	0.28	0.46	0.59	0.41	0.42	-0.52
TFP growth	-	1.18	0.00	0.00	-0.01	-0.06	-0.05	0.21
Agglomeration	-	0.11	0.02	0.03	0.04	0.00	0.00	0.00
Public capital	-	0.10	-0.02	-0.04	-0.05	0.05	0.06	-0.13
Exogenous	-	0.97	0.00	0.00	0.00	-0.11	-0.12	0.34
Rural GDP	100.0	3.92	-0.01	-0.02	-0.04	-0.16	-0.16	0.67
Labor	44.3	1.56	-0.12	-0.21	-0.28	-0.02	-0.01	0.09
Capital	16.0	7.96	0.41	0.68	0.87	0.40	0.39	-0.57
TFP growth	-	1.08	0.00	0.00	0.00	-0.22	-0.22	0.65
Exogenous	-	1.08	0.00	0.00	0.00	-0.22	-0.22	0.65
Towns GDP	100.0	5.23	0.12	0.18	0.22	0.16	0.62	-0.64
Labor	43.5	2.86	0.20	0.27	0.29	-0.03	0.00	0.05
Capital	56.5	5.92	0.24	0.41	0.53	0.34	0.43	-0.48
TFP growth	-	0.69	0.00	-0.01	-0.01	-0.04	0.27	-0.27
Agglomeration	-	0.19	0.01	0.02	0.02	0.00	0.00	0.00
Public capital	-	0.22	-0.02	-0.02	-0.02	-0.04	0.27	-0.27
Exogenous	-	0.28	0.00	0.00	0.00	0.00	0.00	0.00
Cities GDP	100.0	8.17	0.44	0.73	0.95	0.71	0.23	-0.69
Labor	43.8	4.12	1.11	1.86	2.42	0.02	0.00	0.01
Capital	56.2	6.82	0.20	0.32	0.40	0.49	0.43	-0.51
TFP growth	-	2.07	-0.02	-0.03	-0.04	0.30	-0.05	-0.28
Agglomeration	-	0.27	0.07	0.12	0.15	0.00	0.00	0.00
Public capital	-	0.20	-0.09	-0.15	-0.19	0.29	-0.04	-0.28
Exogenous	-	1.60	0.00	0.00	0.00	0.00	0.00	0.00

Source: Results from the Ethiopia Rural-Urban DCGE model.
Notes: Land and livestock factors' contributions to economic growth are not shown since factor supplies remain constant across scenarios.

Finally, Table 5.5 reports changes in household 'equivalent variation' (EV), which is a measure of welfare that controls for changes in consumer prices. Along with economic growth, accelerated urbanization in Ethiopia improves national household welfare, with per capita EV increasing by 0.17 percentage points above the Baseline in the Quadruple scenario. However, this national average hides wide variation in gains across poor and non-poor household groups and across regions. For example, more rapid migration to urban centers drives down the welfare of urban households, especially those in the poorer household groups, which migrants are most likely to join. Conversely, rural households benefit from faster urbanization, because (1) agricultural revenues increase with rising food prices; (2) there are greater returns to their non-labor assets, such as land and agricultural capital; and (3) a smaller rural population increases overall per capita consumption for those inhabitants remaining in rural areas. However, despite some gains for rural poor households,

most of the welfare gains accrue to non-poor households due to declining welfare for poorer urban households.

Table 5.5. Per capita welfare (equivalent variation) results

	Initial p.c. consumption, 2005 ($US)	Average annual EV growth rate, 2005-2025 (%)						
		Baseline scenario	Point deviation from Baseline result					
			Urbanization scenarios			Investment scenarios		
			Double	Triple	Quadruple	Cities	Towns	Rural
National	186.0	2.88	0.09	0.14	0.17	0.04	0.06	0.17
Poor	91.5	2.30	0.03	0.04	0.04	-0.04	-0.01	0.27
Non-poor	249.0	3.02	0.10	0.16	0.20	0.06	0.07	0.15
Rural areas	121.3	2.58	0.16	0.26	0.33	-0.04	-0.02	0.27
Poor	88.0	2.39	0.13	0.22	0.28	-0.05	-0.03	0.30
Non-poor	145.2	2.65	0.16	0.27	0.34	-0.03	-0.01	0.26
Towns	510.9	2.65	-0.07	-0.07	-0.05	0.08	0.16	0.05
Poor	118.4	1.62	-0.50	-0.83	-1.08	0.00	0.09	0.14
Non-poor	727.2	3.07	0.20	0.43	0.65	0.09	0.17	0.04
Cities	629.6	2.14	-0.70	-1.19	-1.57	0.23	0.13	0.01
Poor	120.8	1.56	-0.61	-0.99	-1.27	0.13	0.05	0.08
Non-poor	750.8	2.24	-0.71	-1.23	-1.63	0.23	0.13	0.01

Source: Results from the Ethiopia Rural-Urban DCGE model.
Notes: 'Equivalent variation' is a welfare measure that controls for changes in prices. Per capita consumption is in unadjusted dollars.

Our results suggest that encouraging urbanization in Ethiopia, possibly via land tenure reforms, could lead to accelerated economic growth, an improvement in rural welfare, and a decline in the rural–urban divide. However, without significant investments to support urbanization, the welfare gains for poorer households are diminished, leading to an urbanization of poverty and a widening of inequality within urban areas. In the next section we examine the implications of reallocating public investment in favor of urban centers.

5.3. Public investment scenarios

The allocation of new public capital in Ethiopia favors the country's three major cities. This is evident by comparing the distribution of new capital shown in Table 5.6 and the population shares in Table 3.2. While rural areas contained 84.9 percent of the national population in 2005, only 81.4 percent of the government's capital investments were directed toward this region. Similarly, towns accounted for 10.0 percent of the population, yet they received 9.6 percent of public capital. By contrast, 9.0 percent of public investment was directed toward the country's three largest cities, despite them containing only 5.1 percent of the population. However, this concentration of investment in major cities is not atypical of African countries. It also does not adequately convey the government's large investment in rural infrastructure over the last ten years, which has undoubtedly underpinned rapid agricultural growth.

Table 5.6. Accelerated investment scenarios

	Allocation of new public capital investment (%)			
	Cities	Towns	Rural	Ethiopia
Baseline	9.0	9.6	81.4	100.0
Cities scenario	19.0	8.5	72.5	100.0
Towns	8.0	19.6	72.4	100.0
Rural scenario	4.2	4.4	91.4	100.0

Source: Results from the Ethiopia Rural-Urban DCGE model.

In this section we run three scenarios that explore the implications of reallocating more public investment toward either urban centers or rural areas (i.e., without increasing the overall amount of public investment in the economy). In the first simulation ('Cities') we reallocate 10 percent of public capital toward cities and away from towns and rural areas (see Table 5.6). This raises the investment share for cities from 9 to 19 percent, and proportionally reduces the investment shares for towns and rural areas. This reallocation accelerates public capital accumulation within cities, thereby alleviating some of the congestion effects identified in the Urbanization scenarios. Similarly, in the second simulation ('Towns') we redirect 10 percent of new public capital toward towns at the expense of cities and rural areas. Finally, the third simulation ('Rural') shifts investment toward rural areas and away from towns and cities. This increases the TFP growth rate of the agricultural sector.[3]

Allocating a larger share of public resources toward urban centers in the 'Cities' and 'Towns' simulations accelerates TFP growth in each region by increasing per capita public capital stocks (see Table 5.4). However, limited resources imply trade-offs between scenarios. For example, when resources are directed toward cities, it lowers TFP growth in towns. This is because in these scenarios, we assume that there is no new public capital available at the national level, implying that any additional investment in one region must be exactly offset by declining investment elsewhere. Falling TFP growth in towns or cities is, however, more than offset by accelerated private capital accumulation generated by faster national economic growth. In the two urban scenarios, economic growth is driven by a more rapid expansion of the nonagricultural sector (see Table 5.2). By contrast, declining investment in rural areas (due to investment displacement) leads to slower agricultural growth rates and higher food prices, thus constraining any additional private consumption growth.

The reverse is true for the 'Rural' scenario, under which a larger share of public resources is directed toward rural areas. Increased rural investment encourages faster agricultural growth and greatly reduces real food prices. This is, however, more than offset by declining urban investment and the negative effect this has for industrial and service sector growth (see Table 5.2). This shift out of urban nonagricultural growth substantially reduces demand for imported goods. This prompts an appreciation of the real exchange rate relative to the Baseline scenario. Since almost half of government current expenditure is financed by

[3] We assume a spending-to-TFP growth elasticity of 0.15, which is consistent with the returns to public spending on agriculture estimated by Benin and Randriamamonjy (2008) using cross-country regressions for 18 SSA countries. We also assume that capital investment comprises half of total agricultural spending. Reallocating 10 percent of new public capital toward agriculture causes rural capital stocks to expand at an additional 13 percent per year relative to the baseline. Thus, the reallocation of capital causes agricultural TFP growth rates in rural areas to increase by almost one percentage points (i.e., $0.15 \times 13 \times 0.5 = 0.975$).

foreign grants, the appreciation reduces the value of these grants in local currency. Falling grant incomes widens the government's fiscal deficit and crowds out private investment. This causes private capital accumulation rates to decline, which hurts both rural and urban areas alike (see Table 5.4). Overall, there is a slight decline in national GDP growth as more public resources are directed toward rural areas.

Although shifting resources toward urban centers generates faster rates of national economic growth, it has the opposite effect on household welfare (see Table 5.5). Faster economic growth in the two urban-oriented scenarios increases aggregate private consumption spending. However, this is offset by higher prices for foods, which comprise a large share of households' baskets. Thus, while economic growth declines in the 'Rural' scenario, it still generates larger improvements in national private consumption than either of the urban scenarios. Moreover, faster agricultural growth leads to significant welfare improvements for poorer households, whereas urban investment favors non-poor households. Thus, while increasing urban investment favors economic growth, it reduces the 'inclusiveness' of that growth. By contrast, rural agriculture-led growth is more effective at reducing poverty, despite slower economic growth.

6. Conclusion

Even though economic growth in Ethiopia has been stronger in cities and towns, the country still has one of the lowest levels of urbanization in Sub-Saharan Africa. At least part of the small internal migration flows can be attributed to domestic policies, such as land tenure. We examined the implications of accelerating the pace of urbanization as well as reallocating public investment toward cities, towns, or rural areas. This was done using a DCGE model calibrated to an adapted version of a recently developed SAM for Ethiopia. The model captures economic linkages between rural and urban areas, including internal migration flows, and urban agglomeration and congestion effects on productivity growth.

Simulation results suggest that, under a business-as-usual or baseline growth path, urbanization levels in Ethiopia will remain low (i.e., at less than 20 percent by 2025). Alternatively, accelerating the pace of urbanization, possibly via land tenure reforms, generates faster economic growth, as well as improvements in rural welfare and a declining rural–urban divide. However, without significant investments to support urbanization, the welfare gains for poorer households are diminished, leading to an urbanization of poverty and a widening of inequality within urban areas.

Results also suggest that reallocating public investment toward urban centers encourages faster rates of economic growth, both at urban and national levels. However, an urban-oriented investment plan is less effective at improving the welfare of poorer household groups in both rural and urban areas. This is because shifting resources away from rural areas reduces agricultural growth, increases real food prices, and thereby lowers real consumption levels for poorer households. By contrast, while investing more resources in

agriculture slows the pace of national economic growth, it is more “inclusive” insofar as it significantly improves the welfare of poorer rural and urban households.

Looking forward, it is important that Ethiopia set in place the policies needed to incentivize city growth while also supporting the agricultural backbone of the Ethiopian economy. If designed and managed properly, Ethiopia has the opportunity to further develop market centers and cities that provide effective linkages to rural areas and vice versa. Within large cities, demands of good urban governance and accountability—as well as efficient and effective mechanisms for providing key services and infrastructure—will be necessary in order to reduce urban poverty. Rural areas will need consistent basic service provision, as well as secure land rights in order to incentivize more efficient and effective linkages to markets. By developing a more holistic strategy that takes into account both the need for rural capacity building and income portfolio diversification—as well as urban development and demand–supply linkages—it is expected that many of the demands echoing from Ethiopia’s cities and hinterlands could be recognized.

Overall, we conclude that constraints to internal migration may hinder structural transformation in Ethiopia by lowering economic growth and constraining urban industrial development. However, rising congestion costs will limit the effectiveness of a purely urban-led growth strategy. Moreover, reallocating public resources to overcome urban congestion will incur substantial opportunity costs by reducing the ability of economic growth to reduce poverty. Instead, investing public resources in agriculture not only reduces poverty and the rural–urban divide, but it does so without undermining urban households’ welfare or significantly slowing the pace of urbanization. Thus, combining reforms that overcome prevailing limits on internal migration together with increased investment in rural areas (even at the cost of urban investment) produces outcomes most likely to support future development and structural transformation in Ethiopia.

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Appendix

Appendix Table A.1. Activities, factors and households in the DCGE model

Activities	Teff; barley; wheat; maize; sorghum; pulses; oilseeds; vegetables; fruits; enset; cotton; sugarcane; tea; chat; tobacco; coffee; flowers; other crops; cattle; milk; poultry; animal products; fisheries; forestry; meat; dairy; vegetable products; grain milling; milling services; sugar refining; tea processing; other food processing; beverages; tobacco processing; textiles; yarn; fibers; lint; clothing; leather products; wood products; paper and publishing; petroleum; fertilizer; chemicals; non-metallic minerals; metals ; metals products; machinery; vehicles and transport equipment; electronic equipment; other manufacturing; coal; natural gas; other mining; electricity; water; construction; wholesale and retail trade; hotels and catering; transport; communications; financial services; business services; real estate; other private services; public administration; education; health.
Regions	Cities (Addis Ababa, Dire Dawa and Harari); towns (other urban centers); rural areas.
Factors	Region-specific skilled workers (e.g., professionals and managers); region-specific semi-skilled workers (technicians and sales); region-specific unskilled workers (farming and other elementary occupations); rural family farm labor (unpaid); rural crop land; rural livestock stocks; region-specific physical capital.
Households	Poor and non-poor households in each region (6 household groups). Poor is defined as households in the lowest two per capita expenditure quintiles based on the 2005 HICES.

Appendix Table A.2. Model indices, variables and parameters

Indices			
c	Commodities and activities	h	Representative households
f	Factors (land, labor and capital)	t	Time periods
Exogenous parameters (Greek characters)			
α^p	Production function shift parameter	θ^v	Value-added share of gross output
α^q	Import function shift parameter	π	Foreign savings growth rate
α^t	Export function shift parameter	ρ^p	Production function substitution elasticity
β	Household marginal budget share	ρ^q	Import function substitution elasticity
γ	Non-monetary consumption quantity	ρ^t	Export function substitution elasticity
δ^p	Production function share parameter	σ	Rate of technical change
δ^q	Import function share parameter	τ	Foreign consumption growth rate
δ^t	Export function share parameter	υ	Capital depreciation rate
ε	Land and labor supply growth rate	φ	Population growth rate
θ^h	Household labor endowment shares	ω	Factor income distribution shares
θ^i	Intermediate share of gross output		
Exogenous parameters (Latin characters)			
ca	Intermediate input coefficients	pwe	World export price
cab	Current account balance	pwm	World import price
cd	Domestic transaction cost coefficients	qfs	Total factor supply
ce	Export transaction cost coefficients	$qgov$	Base government consumption quantity
ci	Capital price index weights	$qinv$	Base private investment demand quantity
cm	Import transaction cost coefficients	$qginv$	Base public investment demand quantity
cpi	Consumer price index	rf	Factor foreign remittance rate
cw	Consumer price index weights	sn	Marginal propensity to save
dp	Migrant dependency ratios	tf	Factor direct tax rate
ga	Government consumption adjustment factor	th	Personal direct tax rate
gh	Per capita transfer from government	tm	Import tariff rate
mr	Base year migration rate	tq	Sales tax rate
pop	Household population	wh	Net transfer from rest of world
Endogenous variables			
AR	Average capital rental rate	QF	Factor demand quantity
FS	Fiscal surplus (deficit)	QG	Government consumption quantity
IPA	Private investment demand adjustment factor	QH	Household consumption quantity
IGA	Public investment demand adjustment factor	QI	Investment demand quantity
KP	Public capital per capita (regional)	QK	New capital stock quantity
MN	Number of new migrants	QM	Import quantity
PA	Activity output price	QN	Aggregate intermediate input quantity
PD	Domestic supply price with margin	QQ	Composite supply quantity
PE	Export price	QT	Transaction cost demand quantity
PM	Import price	QV	Composite value-added quantity
PN	Aggregate intermediate input price	WD	Sector distortion in factor return
PQ	Composite supply price	WF	Economywide factor return
PS	Domestic supply price without margin	YF	Total factor income
PV	Composite value-added price	YG	Total government revenues
QA	Activity output quantity	YH	Total household income
QD	Domestic supply quantity	X	Exchange rate
QE	Export quantity		

Appendix Table A.3. Model equations

Prices	
$PM_{ct} = pwm_c \cdot (1 + tm_c) \cdot X + \sum_{c'} PQ_{c't} \cdot cm_{c'c}$	1
$PE_{ct} = pwe_c \cdot X_t - \sum_{c'} PQ_{c't} \cdot ce_{c'c}$	2
$PD_{ct} = PS_{ct} + \sum_{c'} PQ_{c't} \cdot cd_{c'c}$	3
$PQ_{ct} \cdot (1 - tq_c) \cdot QQ_{ct} = PD_{ct} \cdot QD_{ct} + PM_{ct} \cdot QM_{ct}$	4
$PX_{ct} \cdot QX_{ct} = PS_{ct} \cdot QD_{ct} + PE_{ct} \cdot QE_{ct}$	5
$PN_{ct} = \sum_{c'} PQ_{c't} \cdot ca_{c'c}$	6
$PA_{ct} \cdot QA_{ct} = PV_{ct} \cdot QV_{ct} + PN_{ct} \cdot QN_{ct}$	7
$cpi = \sum_c cw_c \cdot PQ_{ct}$	8
Production and trade	
$QV_{ct} = \alpha_{ct}^{p} \cdot \sum_f \left(\delta_{fc}^{p} \cdot QF_{fct}^{-\rho_c^p}\right)^{-1/\rho_c^p}$	9
$WF_{ft} \cdot WD_{fct} = PV_{ct} \cdot QV_{ct} \cdot \sum_{f'} \left(\delta_{f'c}^{p} \cdot QF_{f'ct}^{-\rho_c^p}\right)^{-1} \cdot \delta_{fc}^{p} \cdot QF_{fct}^{-\rho_c^p - 1}$	10
$QN_{ct} = \theta_c^{n} \cdot QA_{ct}$	11
$QV_{ct} = \theta_c^{v} \cdot QA_{ct}$	12
$QA_{ct} = \alpha_c^{a} \cdot \left(\delta_c^{a} \cdot QE_{ct}^{-\rho_c^a} + (1 - \delta_c^{a}) \cdot QD_{ct}^{-\rho_c^a}\right)^{-1/\rho_c^a}$	13
$\frac{QE_{ct}}{QD_{ct}} = \left(\frac{PE_{ct}}{PD_{ct}} \cdot \frac{(1 - \delta_c^{a})}{\delta_c^{a}}\right)^{1/(\rho_c^a - 1)}$	14
$QQ_{ct} = \alpha_c^{q} \cdot \left(\delta_c^{q} \cdot QM_{ct}^{-\rho_c^q} + (1 - \delta_c^{q}) \cdot QD_{ct}^{-\rho_c^q}\right)^{-1/\rho_c^q}$	16
$\frac{QM_{ct}}{QD_{ct}} = \left(\frac{PD_{ct}}{PM_{ct}} \cdot \frac{(1 - \delta_c^{q})}{\delta_c^{q}}\right)^{1/(1+\rho_c^q)}$	17
$QT_{ct} = \sum_{c'} (cd_{cc'} \cdot QD_{c't} + cm_{cc'} \cdot QM_{c't} + ce_{cc'} \cdot QE_{c't})$	18
Incomes and expenditures	
$YF_{ft} = \sum_c WF_{ft} \cdot WD_{fct} \cdot QF_{fct}$	19
$YH_{ht} = \sum_f w_{hf} \cdot (1 - tf_f) \cdot (1 - rf_f) \cdot YF_{ft} + gh_h \cdot pop_{ht} \cdot cpi + wh_h \cdot X$	20
$PQ_{ct} \cdot QH_{cht} = PQ_{ct} \cdot \gamma_{ch} + \beta_{ch} \cdot \left((1 - sh_h) \cdot (1 - th_h) \cdot YH_{ht} - \sum_{c'} PQ_{c't} \cdot \gamma_{c'h}\right)$	21
$GI_{ct} = IPA_c \cdot gstmv_c + IGA_c \cdot gstmv_c$	22

Appendix Table A.3. (continued) Model equations

Incomes and expenditures continued		
$QG_{ct} = gn_t \cdot qgov_c$		23
$YG_t = \sum_h th_h \cdot YH_{ht} + \sum_f tf_f \cdot YF_{ft} + \sum_c (tm_c \cdot pwm_c \cdot QM_{ct} \cdot X + tq_c \cdot PQ_{ct} \cdot QQ_{ct})$		24
Equilibrium conditions		
$qfs_{ft} = \sum_c QF_{fct}$		25
$QQ_{ct} = \sum_{c'} qa_{cc'} \cdot QN_{c't} + \sum_h QH_{cht} + QG_{ct} + QI_{ct} + QT_{ct}$		26
$\sum_c pwm_c \cdot QM_{ct} + \sum_f (1 - tf_f) \cdot rf_f \cdot YF_{ft} \cdot X_t^{-1} = \sum_c pwe_c \cdot QE_{ct} + \sum_h wh_h + cab_t$		27
$YG_t = \sum_c PQ_{ct} \cdot QG_{ct} + \sum_h gh_h \cdot pop_{ht} \cdot cpt + FG_t$		28
$\sum_h sh_h \cdot (1 - th_h) \cdot YH_{ht} + FS_t + cab_t \cdot X_t = \sum_c PQ_{ct} \cdot QI_{ct}$		29
Capital accumulation and allocation		
$AR_{ft} = \frac{YF_{ft}}{qfs_{ft}}$		30
$QK_{fct} \cdot \left(\sum_{c'} PQ_{c't} \cdot ct_{c'}\right) = \left(\frac{QF_{fct}}{qfs_{ft}} \cdot \frac{WF_{ft} \cdot WD_{fct}}{AR_{ft}}\right) \cdot \left(\sum_{c'} PQ_{c't} \cdot IPA_{c'} \cdot qptm_{c'}\right)$		31
$QF_{fct+1} = QF_{fct} \cdot (1 - v) + QK_{fct}$		32
Labor migration and population growth		
$MN_{f'ft} = qfs_{f't} \cdot mr_{ff'} \cdot \frac{WF_{ft}}{WF_{ft}} \cdot \frac{WF_{f't}}{WF_{f't}}$		33
$qfs_{ft+1} = qfs_{ft} \cdot (1 + e_f) + \sum_{f'} (MN_{ff't} - MN_{f'ft})$	Labor only	34
$pop_{ht+1} = pop_{ht} \cdot (1 + g_h) + dp \cdot \theta_{hf}^h \cdot \sum_{f'} (MN_{f'ft} - MN_{ff't})$		35
Agglomeration, congestion effects and exogenous productivity growth		
$KP_{ct+1} = KP_{ct} \cdot (1 - v) + \left(\sum_{c'} PQ_{c't} \cdot IPA_{c'} \cdot qptm_{c'}\right) \cdot \left(\sum_{c'} PQ_{c't} \cdot ct_{c'}\right)^{-1} \cdot \left(\sum_h pop_{ht}\right)^{-1}$		36
$a_{ct+1}^p = a_{ct}^p \cdot (1 + g_c) \cdot \left(\frac{pop_{ht}}{pop_{h0}}\right)^{0.08} \cdot \left(\frac{KP_{ct}}{KP_{c0}}\right)^{0.11}$	Urban centers	37
$a_{ct+1}^p = a_{ct}^p \cdot (1 + g_c)$	Rural areas	38
Land and livestock supply, and other miscellaneous dynamic updates		
$qfs_{ft+1} = qfs_{ft} \cdot (1 + e_f)$	Land & livestock	39
$gn_{t+1} = gn_t \cdot (1 + \tau)$		40
$cab_{t+1} = cab_t \cdot (1 + \pi)$		41