

Rethinking Agriculture and Growth in Ethiopia: A Conceptual Discussion

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Agriculture and Growth in Ethiopia¹*

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1. Introduction: Planning for the role of agriculture in growth

This paper sets out a conceptual framework for understanding the role of smallholder agriculture in Ethiopian growth prospects. It seeks to answer two questions: first, what economic conditions are required to foster growth in smallholder agriculture? And second, how does growth in agriculture relate to growth in other sectors: to what extent can agriculture spur growth elsewhere, and to what extent does it depend on other sectors for its own continuation?

The current growth and development strategy in Ethiopia has its genesis in the policy of agricultural development-led industrialization (ADLI). This strategy is well captured by its name: in essence, growth has to start from growth in agriculture, which then stimulates growth in other sectors of the economy, most notably industry. It was first very eloquently articulated in a paper by the then Ministry of Planning and Economic Development in 1993 [18]. Much of the intellectual justification for a model of industrialization via agriculture stems from various interpretations of the historical accounts of the industrial revolution in Europe, not least in England [4]. Much recent policy work, including the 2007 World Development Report effectively underwrites the primacy of agricultural development to stimulate growth in many poor countries such as Ethiopia [53]. Agriculture has retained a leading role in the recent evolution of the Government of Ethiopia's conceptualization of growth, embodied in the Planned for Accelerated and Sustained Development to End Poverty (PASDEP). In this current framework market mechanisms have taken on increasing prominence. For example, PASDEP proposes a two-pronged strategy to the achievement of a "massive push to accelerate growth": the commercialization of agriculture, and the acceleration of private-sector development ([19], p. 45).

In this paper, we offer a conceptual framework for understanding whether and how agriculture-led growth can work in Ethiopia. We combine theory and evidence from other growth experiences to discuss both some of the key factors relevant for stimulating growth in smallholder agriculture in Ethiopia and the role it can play in overall growth.

Much of the evidence on the primacy of agriculture stems from research arguing that multipliers from growth in agriculture are higher than from any other sector [33, 53]. We argue in this paper that this approach is incomplete. It is misleading to formulate policy by comparing multipliers from hypothetical, exogenous increases in the growth rates of different sectors for two reasons. First is a simple issue of calibration: since we are ultimately interested in the multipliers stemming from government *policy*, marginal growth rates should be weighted by the fiscal cost of bringing about these increments to growth. Second and more fundamentally is the presumed exogeneity of growth in a 'driving' sector: where this growth comes from cannot be asked independently from what is happening in other sectors.

To address the second of these, we draw upon the workhorse dual economy models that have their roots in the seminal work of W. Arthur Lewis [30]. We consider alternative specifications of such models, their relevance for the Ethiopian case, and their consequences for the interplay between agriculture and other sectors in the growth process. We also draw upon the vast empirical literature that estimates (typically static) linkages between sectors. Putting these elements together, we present a case that modest consumption linkages from agriculture to industry necessitate policies that actively promote other sectors, ideally strengthening inter-sector linkages in the process. The economic incentives required to sustain agricultural growth require either high and rising urban demand or access to export markets. Conversely, growth in urban economic activity requires low food prices, which can be sustained by strategies of imports (which frees agriculture to focus on higher value-added products, but which requires improvements to the effective tradability of cereals); by raising land productivity in cereals production; or by creating more efficient links between urban and rural sectors. The latter in particular will help provide the incentives required to sustain agricultural growth, while sustaining low food prices required for this agricultural productivity to impact the growth of the economy as a whole.

The remainder of the paper proceeds as follows. In the remainder of this section, we describe the theoretical underpinnings of ADLI. Section 2 distinguishes alternative mechanisms to growth in agriculture. Section 3 considers the relationship between agricultural growth and growth in other sectors. Brief conclusions – and a discussion of policies that aim to change the structure of relationships between sectors, rather than taking them as given – are presented in Section 4.

Background: the role of agriculture under ADLI

Current policies towards the development of the agricultural sector and its role in the Ethiopian economy as a whole are guided by the strategy of *Agricultural Development Led Industrialization* (ADLI), put forward by the Government of Ethiopia in 1993. ADLI has as its aim “to bring about a structural transformation in the productivity of the peasant agriculture and to streamline and reconstruct the manufacturing sector, so that it makes extensive use of the country’s natural resources and manpower” [18]. Since 1993, this strategy has been developed further and fine-tuned, most recently in the more nuanced Plan for Accelerated and Sustained Development to End Poverty (PASDEP), Ethiopia’s strategic framework for the five-year period 2005/06-2009/10.

This emphasis on structural transformation is reflected in ADLI’s *phased* approach to development policy. Under ADLI, the government set out: first, to improve agricultural technologies, particularly seeds; second, to expand irrigation, infrastructure, and the use of modern inputs, including fertilizers and pesticides; and third, to expand rural non-agricultural opportunities. ([18], p. 19).

What is the understanding of growth process that gives birth to this framework? The basis is put forward unapologetically as the agricultural sector: “agriculture should be the starting point for the structural transformation of the economy” ([18], p.5). A key assertion is that the primary driver of demand for industrial output will be *domestic*, rather than foreign, demand, based on first initiating growth in agriculture. With an eye toward domestic demand as a constraint on the growth prospects of that sector, it is suggested that incomes should be a focus (presumably, both of agricultural policy, which is not mentioned, and of industrial policy). The implication is that labour-intensive technologies play an important role. “While agriculture constitutes the primary market, the services sector should not be ignored as a market for industrial products.” (p. 21). But the role of industry is evidently quite secondary: it is relegated to creating employment for “redundant” rural labour, and to providing an “expanding market for other sectors of the economy.”

However, part of the agricultural orientation of Ethiopian development strategy under ADLI reflects the view that the process of industrialization should build on domestic inputs. While such a strategy is doubtlessly useful as a means to add value to agricultural production, recent global trade patterns cast doubt on whether processing of domestic products will suffice to gain Ethiopia a more substantial point of entry into industrial trade. In particular, the model of domestic processing is contrary to the growing pattern of *trade in tasks* [21], whereby trade in manufactured goods has increasingly relied on imported inputs. Recent research has shown that when countries are *unable* to export goods that are produced using imported inputs, their ability to export is significantly hampered: Collier and Venables [8] show that differences in Rules of Origin across trade agreements have significant effects on trade flows. Against this backdrop, the case for focusing export activity only on those products that can be produced using entirely domestic inputs is weakened – a strategy of exporting only entirely domestically produced goods is akin to self-imposing the very same restrictions that have been shown to restrict exports when imposed by other countries. Given the growing importance of trade in tasks, it may be sensible to free the focus of agricultural policy from its role as supplier of inputs to industry.

In sum, ADLI can be seen as a phased development strategy, starting in the agricultural sector, which then will offer labour, inputs and a source for demand for the non-agricultural sector. Growth in the agricultural sector is expected to be driven by yield (output per hectare) increases, stemming from technology first, and then further infrastructure, irrigation and other modern input increases. In what follows we will discuss the theoretical and empirical basis of each of these key aspects in more detail: how growth in agriculture comes about and how growth in agriculture and the non-agricultural sector can relate.

Planning for strategic support in a dynamic context

In reconsidering both the role of agriculture in Ethiopian growth, and the role of policy in improving this performance, a conceptual distinction appears. There is an important difference between the *drivers* of growth, on the one hand, and the optimal government decisions to invest in one sector or another. Many analysts of growth prospects have

concentrated on the growth multipliers of narrow, single-sector growth, to argue that a given growth rate in one sector has the greatest impacts on the growth rate of the economy as a whole. But this does not imply that this is the best area for government intervention: policy intervention should be guided by comparison of the returns – at the margin – to transferring an economy’s physical resources across sectors.

This approach represents a departure from traditional use of CGE models to guide policy. Consider for example a recent study by Diao et al. [14], who present a pair of economy-wide models for Ethiopia, based on parameterizations of input-output coefficients, demand elasticities, and other estimated parameters of the economy. These models are used both to explore the growth impacts of a given, exogenous rate of technological improvement in one sector or another, and to compare growth rates required in specific subsectors in order to achieve a given target rate of growth for the economy as a whole. However, these models do not set out to consider the *causes* of growth in these agricultural subsectors; nor (since they generally make simplifying assumptions about the elasticity of supply from industry or other sectors) do they emphasize the tradeoffs in resource allocation and the complementarities in demand and production implied.

The causes of agricultural productivity growth cannot be divorced from the study of growth outcomes and linkages – fundamentally, incentives to innovate in any sector depend on relative prices, themselves a function of growth rates elsewhere in the economy. Moreover, and equally important as a guide to policy, it is important in a world of finite budgets to consider the tradeoffs made in allocating government investments across sectors. The relevant question is not one of which combinations of sectoral growth rates suffice to produce a given target growth rate. Rather it should be the question of which allocation of the physical and human resources available – both in the private sector and in the government - produces the highest possible growth rate.² The answer to this question will depend on equating marginal growth impacts across potential investments, for which it is necessary to understand the multipliers from *policies* to single-sector growth rates.

The choice to allocate public resources across sectors involves several complications over and above the problem of choosing policies to achieve growth within a single sector. For instance, the choice faced by policymakers is *not* simply one of choosing between investments that have direct impacts on a single industry: indirect effects on other industries, operating through consumption, production, and investment decisions, are equally important. Second, there may be important complementarities between alternative forms of investment – so that gains are only achieved by policies that are well coordinated, both in terms of sectors, geography, and sequencing. Third, whereas equity considerations will tend to promote balanced total investments across geographic space, in an environment of increasing returns it is *not* necessarily the case that this will lead to balance in sector-specific spending across space. Instead, equitable growth may best be achieved by focusing, e.g., on education in one location and on infrastructure in another. Finally, public investments may in general play one or both of two functions: to foster growth in a specific

² We return to distributional aspects of growth below.

sector, or to strengthen growth *linkages* across sectors. The second-order effects of strengthening linkages may be equally important to overall growth prospects; such public goods may also be particularly poorly served by the market.

While most analysts have taken these linkages, or multipliers, as given features of the economy, it may be the case that important growth implications of particular types of investment – transportation infrastructure being perhaps the most obvious example – function to strengthen linkages across sectors. This point will be explored in greater detail below.

The remainder of this paper proceeds as follows. Section 2 discusses routes to growth in agricultural output. A key contribution of the theoretical framework considered here is to recognize the *endogeneity* of agricultural growth: alternative routes to growth in the agricultural sector, broadly defined, may result from different incentives in the economy. Not all of these are equal in their implications for long-run growth within the sector, or in their implications for growth multipliers to other sectors. Section 3 takes up this issue, investigating the relationship between growth in agriculture and that in other sectors. This framework has the broad implication that, while agricultural growth must be a part of any long-term strategy for growth in Ethiopia, a balance may be struck between the desire to increase agricultural production and to increase agricultural earnings and wages; moreover, given the need to harness market forces to incentivize agricultural growth, there is an important role to be played, both by policies that link agricultural output to domestic and international markets, and by policies that grow urban incomes, which will play an increasingly important role as a source of demand for agricultural goods.

It should be clear by now that simple viewpoints on the role of agriculture in development are then based on fallacies, misunderstanding essential economic interlinkages. For example, an ‘agriculture first’ viewpoint on growth priorities cannot be simply justified by stating that most of the labour force is active in the agricultural sector at this moment or because the share of agriculture in GDP is high. Even more sophisticated analyses rarely take into account the economic incentives required to induce growth in agricultural sectors. That agriculture should be the main driver of growth and that it should be the focal point for government investment should be proven, not stated. Such a proof requires us to examine the means by which agricultural growth is sustained as well as its ability to stimulate growth in other sectors.

2. Sources of growth in smallholder agriculture

Central to the role of agricultural growth in Ethiopia is an understanding of the mechanisms by which the agricultural sector itself can grow. This is a *partial-equilibrium* exercise, taking such factors as prices and demand in other sectors as exogenously given, in order to understand the relationship between the general economic context and the progress of the agricultural sector. Taking agricultural growth to be endogenous – and understanding how

incentives in other sectors drive the direction of agricultural growth – is fundamental: these incentives provide the multipliers that sustain impacts of well designed policies over time.

Within smallholder agriculture, we focus on two sources of growing productivity: adoption of new technologies – be these inputs or crops – by smallholders, and increasing of the land-labour ratio among smallholders.³ The economic conditions associated with each are discussed in turn below.

Changes in technologies and changes in factor ratios can both bring about productivity gains, in the sense of increasing the returns to land or labour. But these sources of growth do so in distinct ways. Technological change can increase the productivity of both factors, though in practice it will of necessity be biased in one direction, changing the ratio between returns *at the margin* to one factor or the other. Large-scale mechanization, for example, may decrease the marginal return to labour relative to capital and land inputs. By contrast, adoption of high-value crops, or of inputs such as fertilizer that require intensive cultivation techniques, may be seen as labour-augmenting. Like technology, changes in factor ratios alter the relative returns to land and labour. An increase in the land-labour ratio in agriculture implies rising (average and marginal) productivity of labour, but falling land productivity (assuming other inputs are held constant). Such changes in factor inputs have characterized a perhaps surprising share of recent agricultural changes in Ethiopia [1]. The Government of Ethiopia has long recognized the importance of the land-labour ratio to the growth of rural incomes in the face of mounting population pressure; in ADLI [18], for example, it is argued that the expansion of non-farm activities should be promoted "... there by [sic] increasing holding sizes for rural families." [p. 19]

This distinction will be important in considering the *form* of stimulus that agriculture will provide to other sectors. These will be discussed in detail in Section 3, but the importance of labour-versus-land bias in technological change is briefly foreshadowed here. When labour markets are competitive, increases in labour productivity represent growth in and of themselves: they result in higher wages in both rural and urban sectors.⁴ Increases in the productivity of land that are not labour-augmenting, such as mechanization, do not have the same effect on wages across the economy. Indeed, this seems to have been the case in the Philippines. Describing the process of rapid agricultural growth in that country, Bautista [7] writes that "[a]gricultural labour has not been helped by the substantial mechanization of some farm operations, particularly the preparation of land for rice and threshing of the crop" (p. 126). However, a greater supply of agricultural *output* may itself have effects on the growth potential of other sectors by maintaining favorable domestic terms of trade that

³ In this paper, we do not focus on the role of large-scale commercial farming in agricultural and economy-wide growth; this is beyond the scope of the assignment. Briefly, it is suggested here that the land-augmenting nature of mechanized farming implies relatively small direct wage effects, but that the potential growth multipliers for urban activities are strong, since consequent increases in the supply of food will help to maintain favorable terms of trade for industrial and service sectors.

⁴ In the unlikely case of *perfect* segmentation of urban and rural labour markets, there would not be a link between rural incomes and urban wages; otherwise, some link will be present.

preserve high returns to capital, which are subsequently reinvested to create industrial growth. This effect may obtain even if rural wages do not rise (for example, if the increased agricultural revenue accrues to owners of capital or land in a mechanized agricultural sector).

Given the focus of this paper on the role of smallholder agriculture in Ethiopian growth, we will not discuss in any detail the determinants of large-scale, commercial farming. Here we will simply reiterate the basic point that the growth framework must not take the expansion of commercial farming as exogenous, just as it must seek to understand the *determinants* of smallholder productivity growth. At times, similar forces may drive the two: growth of commercial farms will also require appropriate and sustained price incentives, for example. Recent emerging successes in Ethiopia and elsewhere do permit a few suggestive generalizations, however. Commercial farming can employ technologies that achieve economies of scale not accessible with smallholder technologies; they may also be profitable under some agronomic and environmental conditions that characterize parts of Ethiopia where smallholder agriculture has not been viable. For some crops, well integrated outgrower schemes may provide a means to increasing the impact of high-value crop production for rural incomes. As a source of increased cereals output, it is important to recognize the limitations of commercial agriculture – which is typically characterized in this case as a *land* (but not labour)-augmenting technological improvement. Commercial cereals production may not be a large source of employment, and as such may not have large impacts on rural wages; however, as discussed in Section 3 the increased supply of food may be crucial to the growth of other sectors.

Adoption of new technologies and crops by smallholders

Drawing on Green Revolution experiences, the standard view of agricultural growth is founded upon intensive improvements by smallholder farmers. This may take the form of farmers either adopting new *technologies* for the production of existing crops, as in the Green Revolution case, or of farmers adopting new *crops* altogether (e.g., moving into higher value-added crops, such as fruits and vegetables).

What exactly is required for this to take place? We highlight two conditions: the supply of appropriate technologies, and the magnitude of economic returns to adoption by smallholders.

First, as the experience of the Green Revolution showed, the *availability of agricultural innovations* plays an important role. The obvious first requirement is that scientific work to develop agricultural innovations takes place. As Kei Otsuka [38] has emphasized, the availability of innovations requires more: not only agricultural innovations at the level of global public goods, but also the adaptation of the resulting modern varieties (MVs) to local growing conditions. In the case of Vietnam, Otsuka argues that the “serious efforts to nurture... researchers at the national programs” of IRRI and CIMMYT played an important role in translating global innovations into locally profitable technologies. Similarly, while the orthodox story of England’s own agricultural revolution typically emphasizes the role played

by enclosure, an important role was played by the development of new systems of crop rotation and other techniques (see, e.g., Timmer [51] for an early discussion of the historical evidence).

Beyond the research stage, the effective supply of agricultural innovations to smallholder farmers clearly requires both a network of extension officers and an efficient distribution network, which reliably delivers desired seeds to farmers.

Of note here is the importance of simultaneous improvement in the distribution systems across seeds, fertilizers, and other inputs. Evidence on the returns to improved seed adoption in Africa (see Otsuka and Kalirajan [39, 40] for a helpful overview, and see Dercon and Hill [24] for recent evidence) suggests that these returns are significantly higher when farmers also adopt fertilizer. For example, Kei Otsuka and Takashi Yamano [41] find that in Kenya, maize yields on high yielding variety (HYV) areas are 24% higher when farmers use typical levels of organic fertilizer than when they do not, and 34% higher when farmers use typical levels of chemical fertilizer than when they do not. The economic returns to sustain improved seed adoption may be present when a broad set of complementary inputs are available, but may not be obtained by farmers in the absence of efficient and reliable delivery channels for fertilizer and other inputs.

This first requirement, the availability of inputs, is hardly controversial. A second requirement is often overlooked: the first stages of agricultural innovation in a population require *strong economic incentives*. The returns to adoption of new technologies and crops must be high; the returns required to induce adoption are higher than those required in order to sustain use of new technologies once they have secured a firm foothold in the population. Input prices, fertilizer requirements, uncertainty about production techniques: all of these factors combine to make adoption of new agricultural technologies a costly and risky proposition, particularly for early adopters.

There are various ways of creating these high returns, most notably high yields, high output prices or low input prices. The Green Revolution in India and Southeast Asia appears to deserve its name not least because of the massive yield gains that were on offer by using new varieties. Wheat technologies developed at CIMMYT, with suitable complementary inputs, offered a more than fivefold increase in yields on small farmer demonstration plots in India [50]. Rice yields on offer via IR8 rice were early on estimated to be 5 times the traditional variety using traditional methods and 10 times using optimal input packages [9].

Often, such high yield gains are not immediately available, or difficult to immediately replicate on farms. Accordingly, periods of widespread improvement in smallholder yields are often *led* by high prices, which generate the required high returns to adoption.

Historical examples are legion: Robert Allen [4] argues that the expansion of Paris in the nineteenth century led to intensification of production techniques in its surrounds, and, similarly, that the growth of London caused enclosure of grain lands and their conversion to pasture in its surrounds. Turning to modern cases, China's agricultural growth since 1985

was precipitated by measures that offered a strong increase in returns on offer to farmers via (i) the liberalization of agricultural prices, resulting in a significant increase at the outset of the economic reform process, and (ii) the freeing of households to specialize in crops with high returns [42]. In Vietnam, the highly fertile and widely irrigated land created *agronomic* conditions conducive to large returns at the outset of that country's green revolution [38]. In the Philippines, Hayami [22] shows the green revolution from the 1960s, linked to the high yield rice varieties gradually resulted in rice price declines, resulting in only slow agricultural income increases, but started at a relatively high level of prices.

A further caveat is important to understanding the relationship between returns and adoption: the returns required to induce early adopters may have to be higher than the returns required to sustain a pattern of aggregate productivity growth in agriculture. The aggregate process of adoption itself is characterized by increasing returns. This is true for several reasons.

Importantly, farmers learn from one another, leading to well established S-shaped curves characterizing adoption. These have been documented since the seminal work of Zvi Griliches [20] on the adoption of hybrid corn in the USA in the first half of the twentieth century. Munshi's recent empirical work on the green revolution in India [35] and has affirmed the importance of learning externalities in the adoption of HYVs in that case, although this work also suggests that cross-farmer learning varies by crop. Munshi argues that rice-growing conditions in India were more variable across individuals than were wheat-growing conditions, making it more difficult to learn from the experiences of others in the cultivation of this crop. This provides a useful lesson for the diffusion of improved varieties and new crops in Ethiopia: the more variable are growing conditions for these technologies, the higher the sustained returns required in order to further their diffusion.

In light of the value of learning from neighbours' experiences, some farmers may *strategically delay* the process of adoption in order to benefit from watching those around them [6]. This further explains why early adoption is more difficult to induce than late, as at later stages of adoption the strategic incentive for delay is reduced.

Even in the absence of learning externalities *across* farmers, it may still be true that farmers – once they have adopted an individual technological improvement – find it easier to continue to adopt newly improved varieties as these become available. In Vietnam, for example, aggregate productivity gains in rice were sustained over a twenty-year period. The speed of diffusion suggests that this sustained growth was not attributable to the steady process of bringing new farmers 'into the fold'. Instead, the consensus [38] for that country is that its green revolution was brought about by a series of improved technologies, introduced in succession. Fixed costs in learning new production techniques may make it easier for farmers – having undertaken one form of agricultural innovation – to progress to others.

Taking these three broad considerations into account, our partial-equilibrium story of agricultural growth is thus: at early stages, there are two key constraints to technology

adoption, in the form of the availability of appropriate technologies on the ground and appropriately high returns to the adoption of this technology. Once initial adopters have been induced, then cross-farmer learning about techniques and profitability, within-farmer increasing returns to innovation, and alleviation of strategic adoption considerations all relax the level of returns required to sustain adoption. Dercon and Hill [24], the companion piece on sources of agricultural growth in Ethiopia, show that despite some rhetoric to the contrary, the availability of appropriate and high return technologies on the ground is limited at present in Ethiopia, affecting the scope for fast agricultural growth via adoption, although current high cereal prices should offer a window of opportunity for adoption efforts.

Increases in land-labour ratio among smallholder farmers

A second route to rising labour productivity is through an increase in cultivated land per worker in the smallholder agricultural sector. By definition, this can come about either because of an expansion in cultivated land or because of a reduction in the agricultural labour force. While many zones will have only limited scope for area expansion, it is possible that rising labour productivity may come about in this sector nonetheless, as non-farm economic activity draws labour out of the agricultural sector.

Adenew [1], Seyoum Taffesse [49] and Dercon and Hill [24] critically address the extent to which expansion in cultivated area is responsible for recent improvements in agricultural output in Ethiopia. This evidence suggests that a considerable share of recent cereal production growth has come from area expansion, even though this remains contentious. Furthermore, the area expansion has *not* led to larger farms per worker compared to 10 years ago, as during the same period the rural population continued to grow considerable.⁵ Finally, even if output growth was largely driven by area expansion, however, resource constraints imply that the continued expansion of cultivated area is not a route to sustained growth in agricultural labour productivity.

In the absence of area expansion, rising land-labour ratios may be the result of the transfer of labour to other sectors. Some of this may occur through rural non-farm activities; as studied by Loening et al. [31] and discussed by Rijkers et al. [46], rural non-farm activities are integral to the Government's Plan for Accelerated and Sustained Development to End Poverty (PASDEP) [19].

Such a reduction in the agricultural labour force can indeed be associated with increased agricultural incomes per capita. Allen [2, 3] has shown the effect of the removal of labour on agricultural productivity in England. This is also shown by historical evidence in Italy [5],

⁵ In particular, using rural population figures and CSA figures on area cultivated with the five main cereals, the land cultivated per rural person is about 0.11 ha, roughly the same figure as in 1980, 1995, and 2005, and the most recent estimates.

where the impact of the Black Death in the middle of the 14th century is associated with a rise in labour productivity in agriculture.

Growth implications of a rising land-labour ratio

Either of these mechanisms to increasing the land-labour ratio will raise the *average* product of labour. In the case of land expansion, total output will increase, whereas in the case of a reallocation of land resulting from out-migration, the effect on total output is ambiguous, as will be explained below.

In general, the *marginal* product of labour will rise in both cases. As will be discussed in Section 3, when labour markets are competitive across urban and rural areas, such an increase in the marginal product of labour will result in rising real wages across the economy; this in and of itself can be a source of growth.

In the case of increasing the land-labour ratio through labour transfer, an important question is the implication for total agricultural output. Declines in total agricultural output can, as discussed in Section 3, retard growth in other sectors by driving up wages paid there. Extensive debates of the 1960s and 1970s regarding the existence of *pure surplus labour* – the extreme case in which the marginal product of labour is zero over some range – have largely been regarded as a “red herring” [43]. If economies of scale are sufficiently powerful, it is even possible the consolidation of small farms can generate a positive net effect on total agricultural output when labour moves out of that sector. But what is important, and broadly accepted as a characterization of labour markets in many developing countries, is that the marginal product of labour in smallholder agriculture lies below its opportunity cost in other sectors. Factors including the availability of risk-coping mechanisms create incentives for household members to remain in that sector, even when a transfer of labour would increase aggregate output in the economy. Irreversibility in the decision to relocate to urban areas – which may be brought about, for example, by imperfections in the market for land – will also exert a pull, keeping labour in rural areas.

In an economy that is not completely open, a decline in total agricultural output will tend to turn terms of trade against other sectors. This results in rising nominal wages in, e.g., the industrial sector; even if the economy is closed, this decreases (accounting) profits, while if industry competes on international markets then its competitiveness will be hurt. Either mechanism has the potential to retard growth of non-agricultural sectors.

For this reason it is important to understand whether and to what extent the withdrawal of labour will reduce total agricultural output. If there are economies of scale in smallholder farms, it may in fact be the case that these will offset the reduction in labour supply – so that total output can increase as a consequence of labour withdrawal. As Dercon and Hill [24] shows, there is inconclusive evidence for the presence of such economies of scale in Ethiopia; despite a few papers showing their presence, there is no convincing evidence for

scale economies.⁶ If anything, this same evidence suggests that scale economies are stronger in food deficit areas, which would support a strategy of supporting off-farm activities in these areas.

What factors bring about an increase in the land-labour ratio?

As already noted, there has been an increase in cultivated land over the past decade. However, the potential for continued area expansion as a source of growth is limited. Incentives for a shift in labour from agricultural to non-agricultural occupations, on the other hand, may be harnessed as a means to increasing agricultural incomes among those who remain in the sector.

Returns to non-farm activities – both rural non-farm activities and urban industrial and service employment – will naturally increase over the course of the development process, as domestic demand for non-agricultural goods rises. Policies that can accelerate this process include investment in education: for example, Mogues et al. [34] find substantial consumption increases to be correlated with such public investments, although these results should be treated with caution given the challenges inherent in drawing causal inference from correlations in this context. Given the importance of informal rural insurance and other safety nets particular to rural settings [12, 26], the migration of labour to urban areas may be incentivized by government policies that strengthen safety nets in urban areas. There may be a role for land policy here: since land is among the most important assets for income security, measures that protect migrants' claims to land may reduce the risks inherent in rural-urban migration.

3. Agricultural growth in an economy-wide context

Agricultural growth does not occur either in isolation or exogenously. Multipliers from public investments in agriculture will depend not only on their ability to generate growth within that sector, but also on linkages to other sectors. Moreover, given the scale of the Ethiopian economy and given finite government resources, policies promoting growth should seek to harness market forces that can provide a continued source of incentives for innovation. In the tradition of endogenous growth models, one may view the highest

⁶ This evidence is at best puzzling: there is long-standing narrative that land pressure has meant increasing land scarcity. The (official) figures from the CSA on area expansion would appear to contradict this narrative, but farms *are* very small in Ethiopia. One way of looking at the evidence is that it shows that *given the current agricultural technology and practices*, there is no evidence that larger farms per worker would increase land productivity (yields). Given the evidence, we can only be agnostic on whether a *fundamental change in practices and technologies* would result in higher yields in Ethiopia, and whether such a change would accompany increases in farm size per worker, although we know that in other contexts across the world, higher land productivity is obtained than in Ethiopia on typically larger farms. This provides an important avenue for further work: if agricultural output and land productivity are key considerations, then the trade-off needs to be explored between encouraging this via smallholder farming and doing so via other organisational structures, such as commercial farming with rather different technologies and practices.

returns to government activity as setting into motion a process that can lead to self-sustaining processes of innovation.

We adopt a perspective rooted in the dual economy model of Lewis [30] to assess the interaction between agriculture and other sectors in Ethiopian development. Dual economy models offer an insight into the long-run growth process by focusing on the transfer of an economy's factors of production, and labour in particular, across sectors. There are two strands of dual economy models – the classical and neoclassical – and we address the empirical relevance of their key assumptions for Ethiopia in what follows. But we begin by giving a general description of the process of development in the classical model.

In both its classical and neoclassical forms, dual economy models feature two fundamentally asymmetric sectors, agriculture and industry (services can also be incorporated into these models; see, e.g., Fields[17]). The sectors differ not only in terms of their technologies of production, but also may differ in the processes determining wages and scope for investment, among other dimensions (see Kanbur and McIntosh [29] and Vines and Zeitlin [52] for an overview).

In the classical model, there is surplus labour in the rural sector. This comprises two assumptions. First, the marginal product of individual labourers in agriculture is low, and possibly zero, so that transferring individuals out of this sector and into others has, initially, little impact on total agricultural output. Second, agricultural incomes exceed this marginal product – perhaps because rural households share the returns to land as well as labour, or because there is an 'institutional' or minimum survival level below which rural labour incomes cannot fall. As workers leave the rural sector, a *surplus* of output is therefore created, over and above the amount required to pay the institutional wage to those who stay behind. It is typically assumed that this surplus is spent in its entirety on goods produced outside the rural, farm sector. This high income elasticity of consumption for non-farm goods is characteristic of both classical and neoclassical models; in the neoclassical model, it is further assumed that there is no willingness to substitute industrial for agricultural consumption below a threshold level of subsistence consumption.

The classical model allows capital accumulation in the urban sector only, while technological change can create growth in both sectors [44]. Capital accumulation in the urban sector creates jobs and draws workers out of agriculture. Until the marginal product of labour in agriculture exceeds the institutional wage in that sector, there can be no impact on real wages – in a sense the goal of development policy on this model should be to exceed processes which lead to such an efficient allocation of factors. But falling total output in agriculture causes domestic terms of trade to deteriorate against the urban sector. Since workers at low levels of incomes have only limited willingness to substitute the consumption of industrial for agricultural goods, they must be paid a higher wage in terms of industrial output, and this retards the process of capital accumulation and growth. This defines two roles for technical change in agriculture in the growth process: it can increase the *total* output of agriculture to industry, thereby helping to preserve terms of trade that are favorable to capital accumulation, and it can increase the *marginal* product of labour,

thereby speeding the arrival of the point at which this marginal product exceeds the institutional wage paid to surplus labourers, and real wages can rise. But in early stages of development, it will be *only* improvements in land productivity (or, equivalently, the average product of labour) that matter, given the surplus labour assumption.

By contrast, in a neoclassical dual economy, the surplus labour condition does not hold. Workers in the agricultural sector have positive marginal products. Moreover, labour markets are assumed to be competitive in the neoclassical model. Under this condition, this marginal product of labour in agriculture determines incomes. With agricultural incomes determined this way, increases in the *marginal* product of labour in either the urban or rural sector plays an *immediate* role in the growth of nominal wages. The importance of the marginal product of labour as a source of real income growth is a key distinction of the neoclassical model.

The way in which this translates into growth in real wages depends on income levels. Neoclassical models such as those of Jorgenson [27, 28] and Eswaran and Kotwal [16] have typically assumed that workers have hierarchical preferences: below some threshold level of consumption, they are unwilling to substitute industrial output for agricultural output, that is, to “eat shirts”. Consequently, workers do not benefit from increases in labour productivity in the industrial sector, which merely increase the supply of a good that they do not consume. On the other hand, advances in agricultural productivity are required to release labour into other sectors, and these productivity advances – by increasing the supply of food – are a source of real wage growth at low levels of income [16].

Below we examine the empirical relevance of the surplus labour assumption. In Section 0 we re-examine the role of agriculture in an open economy, and consider evidence of the openness of Ethiopia’s cereals market. In Section 0 we also consider the implication of Hirschman’s [25] notion of *linkages* in this context. Such linkages are often overlooked in models of dual economies.

Surplus labour

As highlighted above, the contrast between classical and neoclassical models of a dual economy highlights the importance of the question of surplus labour in determining agriculture’s contribution to growth. If labour markets are competitive, then increases in rural incomes can translate into *real wage* growth in urban areas. Otherwise this will not occur until a combination of labour transfer to other sectors and agricultural technical change increase the marginal product of labour above current income levels.

If there is a surplus of rural labour, growth in other sectors may be accelerated by increasing the marketed surplus of agricultural output. If this marketed surplus increases less than proportionally with the growing urban labour force, relative food prices will rise, and urban growth will slow. Two key reasons explain the failure of the marketed agricultural surplus to rise in this way. First, if the marginal product of labour(ers) in agriculture is not zero, then

total output of that sector will decline with the migration of the rural workforce. Second, if rural smallholders choose to consume rather than to sell the increment in the surplus of food per capita that accrues when family or neighbors migrate, then this absorption by the rural sector will decrease the supply of food per capita to urban areas.⁷

Below we present evidence from Ethiopia. We argue that, while it *is* possible to increase the allocation of labour to rural, non-farm activities without diminishing agricultural output, the movement of labour to urban economic activities does come at a significant cost to agricultural output (or at least to marketed agricultural output per urban worker). There is limited evidence on the relationship between agricultural and non-agricultural incomes in Ethiopia, but what is available is consistent with the view that labour markets are not competitive.

Marginal product of labour

In theory, it is possible that the withdrawal of labourers from the agricultural sector would not diminish its output. Two mechanisms may support this. On the one hand, an increase in the labour inputs of those who remain behind may compensate for lost labourers – this is the argument first put forward by Sen [48]. Alternatively, consolidation of rural landholdings may result in economies of scale that have a net positive impact on production. This possibility is discussed further by Dercon and Hill [24], but as reported above, the evidence is at best mixed.

Evidence suggests that marginal product of labourers is not zero in Ethiopia. Rural-urban migration, in the absence of technological progress in agriculture, will result in a decrease in total agricultural output. The evidence examined below is consistent with either of the two mechanisms suggested above: that agricultural production declines in response to the transfer of labour, or that the marketed surplus simply fails to rise in proportion with the growing urban labour force. However, significant transfer of labour to the rural non-farm sector appears to be possible without decreasing the effective supply of labour to agriculture.

Figure 1 presents evidence of the relationship between the transfer of labour from rural to urban areas and changes in food prices. It plots district-level averages of select cereal price inflation against the rate of *urban* population growth in each district. Food prices in Addis are a clear outlier, but would not be expected to conform to theory since this city acts as a hub for imports and so does not depend on local production.⁸ The majority of other regions conform to a clear pattern in the relationship between food prices and urban population

⁷ This aspect is not considered by Lewis [30], who models a rural economy in which landlords pay institutionally determined wages to their workers. Lewis's landlords are assumed to sell all of the surplus to urban consumers in exchange for the output of the industrial sector.

⁸ The figure for Addis Ababa may also reflect underestimation of its population growth rate over this time, which according to many observers is surprisingly low in the most recent census data.

growth; the figure plots a regression line and 95% confidence interval for this relationship among regions outside of Addis.⁹

In regions where there has been significant transfer of labour from rural to urban areas, food prices have risen more sharply than national trends. This is consistent with the view that (a) the withdrawal of labour has had a non-negligible impact on the marketed surplus from agriculture, and (b) urban consumers are unwilling to substitute the consumption of services or industrial goods for agricultural output.¹⁰

⁹ This process is *not* caused or even affected by a rise in border prices for food prices, lifting up all prices for food due to more expensive imports. For example, import parity prices for maize actually *declined* during the period 1996 – 2005, by about 11% [45]. In other words, this is a period during which domestic food prices moved closer to import parity prices, and locally, the rate at which this occurred was faster for urban areas with higher population growth. For more discussion on import parity prices, see Dercon and Hill [24].

¹⁰ An alternative explanation is that rises in local urban incomes both attract migration and drive up regional food prices. Further testing of this hypothesis would make use of income data or non-food price data at the regional level. However, given that industrial goods are more likely to be tradable across locations, it is unlikely they would exhibit the same inter-regional dispersion as shown by food price changes.

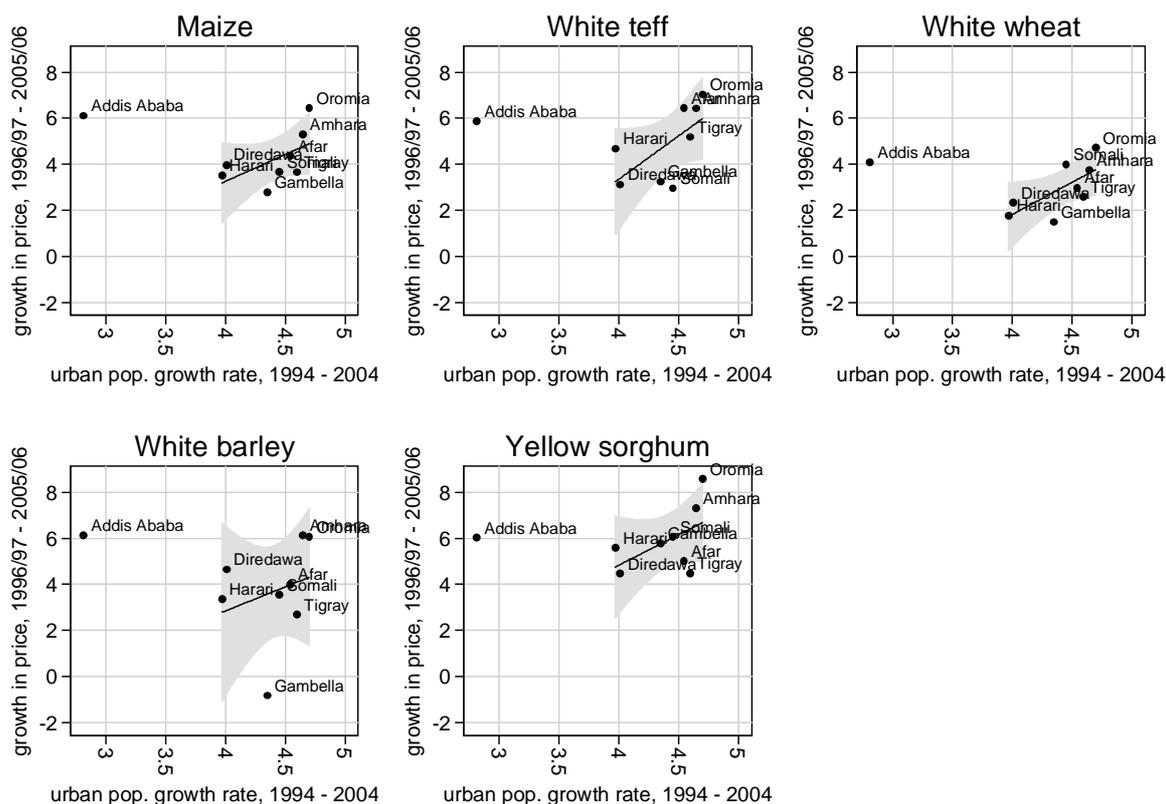


Figure 1. Population growth and food price inflation in urban Ethiopia

If indeed the transfer of labour from rural to urban areas causes rising food prices in Ethiopia, as is consistent with evidence in Figure 1, this threatens to constrain industrial growth.¹¹ Deterioration in domestic terms of trade for industrial output means that rising costs of labour will eat into the returns to capital, with consequent reductions in savings by capitalists and investments in the sector. Thus increases in agricultural productivity are required in order to maintain a balanced growth process in which terms of trade are relatively constant between sectors [44]. Note that in order to support industrial growth, technical progress in agriculture does *not* need to increase the marginal product of agricultural labour. Technologies such as mechanization which increase land productivity and *average* labour product, but have little effect on marginal labour productivity, will suffice to meet food needs in other sectors and maintain a balanced growth path.

¹¹ Note that this deterioration in the domestic terms of trade does *not* imply an increase in real wages for workers, and so does not contribute to growth in real incomes. In the classical model, nominal wages increase by just enough to maintain a constant real wage for urban workers.

Competitiveness of labour markets

The potential for increases in the marginal product of labour to be a source of real wage growth in other sectors depends on the competitiveness of labour markets. This competitiveness may potentially operate differently between rural farm and non-farm labour markets, on the one hand, and between the rural and urban labour markets more generally, on the other. Rijkers, Söderbom and Teal [46] shed some light on the tightness of the rural (farm and non-farm) labour market. They argue that seasonal participation in non-farm enterprises is common. Consequently, these authors find no strong evidence of a relationship between wages in the rural farm and non-farm sectors. Given their different seasonal demands, the rural farm and non-farm sectors do not compete for the same effective pool of labour: these labour markets are segmented by time. So long as this is the case, increases in the marginal product of labour in one type of rural activity need not translate into real income gains in the other.¹²

If the ability of labour to move flexibly from the urban (non-farm) sector to rural sectors is not fully constrained, then the labour-market equilibrium may create a competitive link between sectors. Barriers to labour mobility may break this link; e.g., Deininger and Jin provide some evidence of a relationship between migration and land rental markets in China [10]. Greater costs involved in rural-urban migration suggest that expansion of urban employment will draw meaningful amounts of labour away from rural farm and non-farm enterprises – and thereby will decrease total agricultural output, at least in the absence of substantial technological change.

Agricultural growth increases the supply of educated labour to other sectors

Finally on the supply of labour, there may be an important and often-overlooked relationship between agricultural productivity growth and the supply of semi-skilled labour to industry. If part of the increased agricultural revenues are invested in children's education – whether this investment is undertaken by households or by the government – then this will ultimately increase the supply of skilled labour to other sectors. Mao and Schive [32] argue that this was important to the absorption of Taiwan's immigrants in non-farm employment during that country's agricultural boom (a boom in which migration from rural to urban areas grew from 19,000 individuals per year during the period 1952 – 1964 to more than 93,000 individuals per year in the period 1963 – 1973). See Estudillo and Otsuka [15] and Hayami [23] for related evidence from the Philippines.

Conclusion: classical domestic markets for food and labour

Taking this evidence together, we suggest that much of the evidence is consistent with the characterization of the Ethiopian economy as a classical, rather than neoclassical, dual economy. High transaction costs involved in migration to urban centres – including limited

¹² This is clearly linked to the limited extent to which non-farm activities take place in most rural parts of Ethiopia, in comparison to neighbouring countries. Whether this limited competition with farm labour will remain the case if non-farm labour demand were to increase with growth to other seasons, is another matter. At least as far as low skilled non-farm labour is concerned, there are few reasons to expect then limited mobility between farm and non-farm labour markets.

rural land markets – allow a disconnect between wages in these sectors. The household basis of smallholder production means that the incomes of smallholder farmers are linked to the average product of their labour (since the returns to land typically accrue to the same individuals); consequently, labour markets will not equate marginal products of labour across sectors as in the competitive, neoclassical model. The empirical relationship between labour transfer from rural to urban areas and local food price inflation is also consistent with the importance of total agricultural output as a determinant of urban wages.

In this case, technological change in agriculture plays two roles. In the short term, its most important contribution to growth is through an increase in total food supply. This helps to keep down cost of living in other sectors, allowing greater capital accumulation in industry even when its goods are produced for the domestic market alone, and maintaining competitiveness if industrial output is exported. Second, agricultural technological progress, by increasing the *marginal* product of labour, helps to accelerate the arrival of what Ranis and Fei [44] call the ‘commercialization point’: the point at which this marginal product exceeds the institutionally determined (i.e., not competitive) rural wage. It is only from this point, at which the labour surplus is exhausted, that gains in productivity in any sector translate into real wage growth.

The supply of educated labour to industry provides an important caveat to this argument about domestic markets for labour and for agricultural products. First, the market for skilled labour may be considerably more competitive, given that educated workers may find it easier to migrate in search of employment. Second, and perhaps more importantly, since the proceeds from agricultural productivity gains are partially invested in human capital, progress in agricultural technology may further contribute to growth through the supply of skilled labour.

It is appropriate to qualify these arguments with poverty reduction in mind. In Ethiopia, growth is obviously needed for sustainable poverty reduction, but the nature of the growth process will matter for poverty reduction. While we may need agricultural output growth as part of a balanced growth strategy to keep the growth of nominal industrial wages in check, poverty reduction *requires* real wage growth. The extent to which agricultural growth and labour migration involves growth in the marginal product of labour is then relevant. Furthermore, to ensure more poverty reduction for the *next* generation, education, health or other means of increasing the skills of the labour force will contribute to both growth and poverty reduction, as it will reduce the segmentation of labour markets and increase migration from rural to urban areas.

Open-economy considerations

Openness to trade changes the relationship between agricultural productivity and growth in both the classical and neoclassical models. In the classical dual economy model of a closed economy, increases in agricultural (land) productivity were important in order to stave off deterioration in domestic terms of trade. When the classical dual economy becomes an

open one, then relative prices of agricultural and industrial goods are pinned down by international markets. In a perfectly open economy, if rural-urban migration brings about a decrease in the marketed surplus available per non-agricultural worker, this will no longer result in rising relative prices for food.

This reduces the importance (from a growth perspective) of technical changes in agriculture, such as mechanization, that increase land productivity and the average product of labour but have a limited effect on the marginal product of labour. On the other hand, this decoupling of food prices from domestic supply frees smallholder agriculture to act as a source of real wage growth in and of itself. Labour-intensive technological changes, which may include the adoption of fertilizers and shifts to high value added crops, can speed the growth in labour's marginal product, which will ultimately drive real wage growth in agriculture and beyond.

A priori, there is no reason why Ethiopian cereal markets should not be integrated with world markets, so an open dual economy model could offer guidance. However, this ignores a key feature of Ethiopia: that it is landlocked with a relatively large distance from the main cereal and demand areas from the nearest port. For example, until the last few years, maize prices in Addis Ababa were fluctuating around \$15 per quintal for many years, with transport and handling costs to Djibouti near \$6 per quintal or 40% of the mean market price. The result is that even if there were no trade distortions, for a wide range of domestic market conditions, prices would move independently from world prices. As a result, within some broad bounds, cereals are best considered non-tradable goods, suggesting that the discussion in the previous section, on the importance of domestic food production to food price inflation, remains relevant.

The evidence supports this. As argued by Rashid et al. [45], domestic cereals in Ethiopia are generally considered to be a non-tradable sector. Substantial within-country variation in cereal prices, as presented in Figure 1 and in evidence for unexploited spatial arbitrage opportunities presented by Negassa and Meyers [36] further supports the view that prices for cereals, at least outside of Addis Ababa, do not effectively compete with imports.

This does not mean that cereal prices have not exceeded import parity prices. Rashid et al. [45] show that, after accounting for price distortions created by food aid, domestic prices for wheat and maize have on several occasions exceeded import parity prices since the mid-1990s. This is definitely the case since September 2007 up to now (see Dercon and Hill [24]). Trade barriers, market imperfections, macroeconomic and foreign exchange constraints are responsible for these deviations (as food imports should have been able to keep prices on parity prices). It also shows that the status of cereals as de-facto non-tradable commodities can be changed via a review of policy parameters, and trade barriers. But as a land-locked country with considerable transportation costs to the nearest harbours, food prices will be largely domestically determined and the analysis in the previous section will remain valid.

However, it does open additional opportunities for the nature of agricultural growth. With open markets there is effectively both a ceiling and floor price for domestically consumed staples (at the export and import parity price level), via imports and exports, whatever the level of output, providing then also limits to the real wage impact of domestic food production levels. Production factors, including in agriculture, can then be allocated to the most profitable activities, less constrained by the need to keep food production growth in balance with growth in other sectors. In agriculture, this could then mean more high value crops rather than staples, or non-food cash crops for export. Such a strategy is consistent with the long-run aim of promoting real wage growth by increasing the marginal product of labour in agriculture.

Production and consumption linkages

Traditional dual economy models focus on endowments of land, labour, and capital as determinants of long-run growth. They often overlook static multipliers created by linkages between the production of intermediate goods and the market for the consumption of domestic output. Their focus is typically on the supply side. However, the linkages highlighted by Hirschman [25] may also play a role in determining agriculture's contribution to growth. Modern authors, while departing at times from Hirschman's conclusions (see, for example, Mellor [33]), have focused on two broad types of linkages from this sector to others:

- *production linkages*, whereby increases in agricultural output lead to greater supply of inputs used in non-agricultural production or, conversely, greater demand for non-agricultural outputs used in agricultural production;
- *consumption linkages*, whereby increases in agricultural income lead to increased demand for non-agricultural (as well as agricultural) consumption goods.

Much of the debate on the role of agriculture has focused on the magnitude of these linkages relative to parallel linkages stemming from growth in other sectors. On one side, Hirschman [25] has argued that weak backward production linkages and limited forward production linkages in agriculture strengthen the argument for growth led by manufacturing: according to Hirschman “the superiority of manufacturing in this respect is crushing” (p. 110). On the other hand, proponents of agriculture-led growth have responded by emphasizing the importance of consumption linkages; for example, Mellor ([33], p. 13) argues that “it is consumption linkages that are most important. ... [rural people] will spend at least 70 percent of their incremental income on consumption goods.”

There is no reason to presume a universal answer to this debate. The strength of production and consumption linkages will depend on many country-specific factors. Some of these may be taken as given – natural resource endowments, for example – while the strength of other forms of linkages may themselves be amenable to policy intervention. The latter is an often overlooked consideration in policy evaluation: not all forms of agricultural growth will have the same multiplier effects, and these multipliers may depend on the way in which agricultural growth is achieved. Growth attained by investment in roads that increases returns to agricultural innovation, for example, may also affect the underlying linkages

between sectors. In light of the country- and policy-specificity of these linkages, we visit below the theory and evidence for some key forms of linkage in Ethiopia, putting these in an international context where possible.

Production linkages

Production linkages from agriculture can be ‘forward’ – where agriculture provides inputs employed in other sectors – or ‘backward’ – where agricultural production creates demand for the output of other sectors. There is a broad consensus that backward linkages from agriculture have little power.¹³ In considering the forward linkages from agricultural production to other sectors, it is common to focus on the direct use of agricultural inputs as factors of production in industry. For this reason the ADLI strategy [18] focuses primarily on the supply of raw materials from agriculture to industry. It sets out food self-sufficiency and the production of raw materials for industry as its first two policy priorities for the agricultural sector.

Perhaps the most obvious mechanism by which agriculture can stimulate growth in other sectors is by providing raw materials or intermediate inputs for industrial production. For this reason, ADLI [18] (p. 27) emphasizes improvements in the quality and quantity of hides and skins and raw materials for the textile industry as priorities for agriculture. A social accounting matrix (SAM) developed by IFPRI (as presented in Diao et al. [14], p. 35) shows the rationale for continuation of these efforts: 50.6% of forestry and fishing output is used as an intermediate good, with coffee, tea, and chat (33.6%) and livestock (31.9%) not far behind in terms of their use in other sectors.

However, two cautionary notes are important here. While relatively high shares of domestic production of these raw materials may be used as inputs elsewhere, this does not necessarily imply either (a) that these constitute a large share of the overall intermediate goods requirements of industrial production; or (b) that domestic markets for industrial goods provide opportunities for further expansion in sectors that rely heavily on local raw materials. To the extent transport costs allow, export possibilities may help to resolve the latter difficulty. However, trade and industrial production data suggest that Ethiopia has made little progress since the early 1990s in reducing its dependency on imported inputs. As of 2002, imported industrial inputs remain approximately 48% of total input content, almost exactly their share (49%) in 1993.¹⁴ This is only slightly below the 2002 share of imported

¹³ For instance, Mellor [33], who argues that the overall growth linkages from agriculture are strong, concedes that agriculture’s demand for fertilizer and chemicals has little impact on growth elsewhere in the economy. While Mellor stresses that relatively minor forms of mechanization occurring early in the agricultural development process may have larger growth multipliers for other sectors, these are more likely to be found in commercial than in smallholder farming. There may be further exceptions: transportation services that develop to serve agricultural markets may have effects on the returns to other activities as well; while the production and propagation of improved seeds may also stimulate a supply response elsewhere in the domestic economy. However, evidence is limited on the magnitude of such effects.

¹⁴ Calculations based on Sandefur and Siddiqi [47]. Trade data are from the Trade, Production and Protection dataset of Nicita and Olarreaga [37], and production data drawn from the UNIDO Indstat database.

inputs for all of Sub-Saharan Africa, although the remainder of the region shows a marked upward trend not present in Ethiopia [47].

However, a simplified characterization of trade in manufactured goods as representing the final output of sectors that produce using only domestic inputs seems no longer to fit well with the global trade patterns. As discussed in Section 0, trade is increasingly done ‘in tasks’, with countries relying heavily on imported intermediate inputs [8]. Recent work has shown that, when economies are constrained to export only those products which are composed entirely of domestically produced inputs, this dramatically reduces export volumes [8]. This suggests that, under the modern fragmentation of trade, significant opportunities will be missed by a strategy that does not allow industry to draw upon imported inputs. More optimistically, this suggests that it is increasingly unnecessary to orient agriculture toward the production of raw materials for use in industry as a precondition for successful industrial growth.

Consumption linkages

A central tenet of the argument that agriculture leads development is that consumption linkages, operating via farmers’ demand for industrial (and service) goods, create strong linkages from agricultural growth to growth in other sectors. Mellor [33] epitomizes this view:

“[I]t is the consumption linkages that are most important. The savings rate of rural people receiving increments to their incomes tends to be high but rarely exceeds 30 percent. Thus they will spend at least 70 percent of their incremental income on consumption goods. Albert O. Hirschman’s widely quoted statement that agriculture has very poor linkages to other sectors and thus is not a sector to emphasize reflects a common tendency of development economists to ignore the stimulative role of effective demand for consumption goods and services.” (p. 13)

Mellor goes on to claim that “the producers of agricultural commodities spend little of that incremental income on increased consumption of basic food staples.” If true, this suggests that agricultural growth will tend to stimulate production in other sectors, via its demand effects. Looked at in a dual economy framework, this could be interpreted as a solution to Lewis’s deteriorating terms of trade: a small increase in the subsistence incomes of the farming population would suffice to induce very large Engel effects – which would swing domestic terms of trade in favor of industry once again.

However, it is important to recognize that the extent of such consumption linkages cannot be expected to be present uniformly across all countries. Preferences of consumers may be different. When income elasticities of demand are not constant, the starting incomes of the agricultural sector will matter as well: marginal propensities to consume agricultural goods are likely to be higher at lower levels of income. Moreover, transportation costs and the physical and institutional linkages of markets will impact upon the marginal propensity to consume out of industrial goods in rural areas: poor access to urban markets will dampen any potential stimulative effects.

Evidence for Ethiopia suggests that consumption linkages are *not* particularly strong. Estimates presented by Diao et al. [14] provide average and marginal budget shares for a range of goods separately by occupational category.¹⁵ They find that the marginal budget share of cereals is 19.2% for farmers, as compared to 4.8% for wage earners and 2.8% for self-employed ‘entrepreneurs’. Marginal budget shares for other types of food are similarly high among farm households, who allocate 21.6% of their budget at the margin to such expenditures. And farm households allocate only 22% of their marginal income to industrial goods, as compared with 40.3% allocated at the margin by wage earners and 26.5% by the self-employed. Marginal expenditure on services is reasonably strong, at 37.4%, which compares favorably with the 31.5% of marginal expenditure spent on services by wage earners, but unfavorably with the 56.3% of marginal expenditure spent on services by the self-employed. Thus the effects on demand for industrial output are considerably lower for growth in agricultural productivity (leading to increased agricultural incomes) than they are for growth in urban incomes.

Perhaps surprisingly, marginal expenditure on industrial goods compares unfavorably, for example, to the 37% marginal budget share spent on industrial goods by farm households in Zambia, as estimated by Delgado et al. [11]. So the question becomes, why are consumption linkages relatively weak in Ethiopia? Each of the reasons suggested above plays a role. The work by Delgado et al. provides a further clue to the importance of poverty in limiting consumption linkages: for example, they find that marginal budget shares for tradables rise from 24%, in the bottom decile of per capita expenditure, to nearly 40% in the top decile of per capita expenditure. Thus it is reasonable to suggest that low levels of income create relatively low marginal propensities to consume out of industry. As we have argued the observed consumption linkages are not exogenously determined, but given current conditions—in particular, the poor transportation infrastructure and relatively isolated urban markets—the evidence suggests that agriculture in Ethiopia cannot at current levels of income be expected to play as full a role in stimulating other sectors as it would in other countries.

4. Conclusion: agriculture in relation to other drivers of growth

Ethiopia has been following a particular vision on the role of growth in smallholder agriculture, as reflected in ADLI: agriculture should be seen as the sector from which growth should emanate, and growth in agriculture will lead to industrial growth, by offering labour, inputs and demand for its products. In this paper, we have applied a ‘dual economy’ perspective to understanding the role of smallholder agriculture in Ethiopian growth, reflecting on the foundations of the ADLI strategy. This framework starts from two premises. First, agricultural innovation is not an exogenous process, but rather must be sustained by virtue of its interaction with other sectors. Second, the contribution of agriculture to growth

¹⁵ The marginal budget share of a commodity is the percentage of an increase in overall spending that is spent on that commodity.

depends on the extent of surplus labour, of open markets for agricultural goods, and of linkages (particularly consumption) between sectors.

Our discussion has led to a number of key insights relevant for understanding the scope and constraints for growth in Ethiopia. First, the premise of endogenous agricultural innovation requires us to consider sources of incentives for agricultural growth. Given government budgetary limitations, significant agricultural productivity gains at an economy-wide scale will require high and sustained economic incentives. It requires high return technologies to be available and to offer high economic returns, especially through the earlier stages of adoption. Such incentives can be brought about in one of two ways. One approach is to stimulate growth in the industry and service sectors, creating high and sustained domestic demand for agricultural produce.

Another way to sustain incentives could be via international markets. High and, over the long term, rising international food prices suggest that the latter may provide a source of stimulus for domestic innovation, giving strong incentives to boost output when imports are still required, while offering high export prices when harvests are successful. However, Ethiopia's scope to fully exploit the possibilities from international markets is limited by being a landlocked economy, with high transport and handling costs to the borders. The result is that for a wide range of prices, cereals are behaving as non-tradable commodity, with domestic demand and supply governing prices. Therefore, to fully take advantage of the incentives offered by high international prices efforts should be made to reduce transportation and other marketing costs in order to reduce import parity prices and increase export parity prices, allowing farmer to receive higher shares of world prices, while providing downward pressure on consumer prices.

Secondly, the evidence presented suggests that a *classical* model with largely closed markets for cereals remains appropriate to the Ethiopian economy. Limited responsiveness in wages to changes in other sectors is consistent with the existence of surplus labour in agriculture. A positive marginal propensity to consume agricultural goods in rural households means that rural-urban migration can bring about sharp increases in food prices, even if the marginal product of labour in agriculture is low. The available evidence suggests that urban consumers' unwillingness to substitute between consumption of agricultural and other goods contributes further to high food prices – filtering through to high costs of labour – in growing industrial areas.¹⁶ Given the high costs of import, not least in the current climate of high international food prices, the total output of the agricultural sector remains then a constraint to the growth of domestically oriented industry (through its effect on returns to capital) and the competitiveness of export-oriented industry.

¹⁶ As workers migrate to join the urban labour force, they bring with them a significant *average* budget share devoted to cereals consumption. This causes a decline in the marketed surplus per urban resident, even though *marginal* changes in the incomes of urban residents will tend not to be spent on cereals.

Any means of boosting agricultural output remains therefore important during the process of economic transformation with labour moving out of agriculture to urban areas. This suggests that technologies enhancing land productivity have an important role to play in maintaining low urban costs of living and facilitating growth in other sectors. This also suggests a potential contribution of large-scale, commercial farming to the growth of other sectors through the supply of cereals. Either way, the impact on the marginal value product of labour in smallholder agriculture would be limited, offering limited scope for real wage and earnings growth in the rural sector.

Provided import parity prices can be kept sufficiently low (via better integration with international markets and reduced transportation and marketing costs), an alternative approach would rely more heavily on food imports. If feasible, this would allow smallholder agriculture to focus on high-value and exportable crops, utilizing economies of scale both due to agglomeration (perhaps coordinated through outgrower schemes) and through the marketing chain. Such technological changes would increase the *marginal* product of labour, and so would accelerate the commercialization of agriculture, from which point further technological improvements would provide real wage growth. While this may not be on the cards immediately, it offers a route to allow agriculture to graduate from a focus on food output to a diversified agriculture offering real wage growth and therefore poverty reduction in the rural sector.

Thirdly, modest consumption linkages suggest that agricultural innovation will not be sufficient to drive growth in industry. A growing consensus that agglomeration externalities and other scale economies play an important role in industrial development suggests that it will be difficult for industries that serve only the limited domestic market to compete with foreign firms. More positively, the increasing frequency of trade 'in tasks' suggests that it may not be necessary for Ethiopian agriculture to be oriented toward the supply of raw materials for industry, nor for all industrial energies to focus on the processing of domestic raw materials.

Finally, the above analysis largely takes the extent of these 'linkages' as given. However, the most effective policies to stimulate growth may be those that strengthen domestic and international linkages. Returning to the evaluation of sector-specific government expenditures, Mogues et al [34] find that the biggest gains in consumption are correlated with investment in transportation infrastructure. Similarly, using micro data Dercon et al. [13] find statistically significant and economically meaningful impacts of road access on consumption and poverty outcomes: they find that households with access to a road capable of carrying trucks and busses throughout the year increases consumption growth by 16%, for example. Coupled with the prospect of increasing returns to scale in marketing activities – considered in Dercon and Hill [24] – this suggests that government investments to strengthen rural-urban linkages should play a central role in growth strategy. Reductions in the costs of transportation, for example, have the dual benefit of lowering urban food prices – thereby stimulating industrial growth – and raising farmgate prices – thereby incentivizing further growth in agricultural productivity. Investment in such linkages provides a means of

stimulating agricultural innovation, as well as a means of maximizing the growth effects of such innovation across the economy as a whole.

Bibliography

- [1] ADENEW, B. A retrospective study on the performance of Ethiopian agriculture. Report prepared for study on role of Agricultural Growth in Ethiopia, 2009.
- [2] ALLEN, R. C. The growth of labor productivity in early modern English agriculture. *Explorations in Economic History* 25, 2 (April 1988), 117–146.
- [3] ALLEN, R. C. Labor productivity and farm size in English agriculture before mechanization: Reply to Clark. *Explorations in Economic History* 28, 4 (October 1991), 478–492.
- [4] ALLEN, R. C. Ethiopian agriculture in a world-historical context. Background note prepared for study on role of Agricultural Growth in Ethiopia, 2008.
- [5] ALLEN, R. C. *The Agricultural Revolution*. Forthcoming.
- [6] BANDIERA, O., AND RASUL, I. Social networks and technology adoption in northern mozambique. *Economic Journal* 116, 514 (October 2006), 869–902.
- [7] BAUTISTA, R. M. Rapid agricultural growth is not enough: The philippines, 1965–1980. In *Agriculture on the Road to Industrialization*, J. W. Mellor, Ed. Johns Hopkins University Press, Baltimore, 1995, ch. 4, pp. 113–149.
- [8] COLLIER, P., AND VENABLES, A. Rethinking trade preferences: How Africa can diversify its exports. In *The World Economy: Global Trade Policy 2007*, D. Greenway, Ed. Wiley, Hoboken, New Jersey, 2007.
- [9] DE DATTA, S. K., TAURO, A. C., AND BALAOING, S. N. Effect of plant type and nitrogen level on the growth characteristics and grain yield of indica rice in the tropics. *Agronomics Journal* 60 (1968), 643–647.
- [10] DEININGER, K., AND JIN, S. Land rental markets in the process of rural structural transformation: Productivity and equity impacts from china. Unpublished, World Bank, October 2006.

- [11] DELGADO, C. L., HOPKINS, J., KELLY, V. A., HAZELL, P., MCKENNA, A. A., GRUHN, P., HOJJATI, B., SIL, J., AND COURBOIS, C. Agricultural growth linkages in sub-saharan africa. IFPRI Research Report 107, 1998.
- [12] DERCON, S. Income risk, coping strategies, and safety nets. *The World Bank Research Observer* 17, 2 (Fall 2002), 141–166.
- [13] DERCON, S., GILLIGAN, D. O., HODDINOTT, J., AND WOLDEHANNA, T. The impact of roads and agricultural extension on consumption growth and poverty in fifteen ethiopian villages:. CSAE Working Paper WPS/2007-01, January 2007.
- [14] DIAO, X., FEKADU, B., HAGGBLADE, S., TAFESSE, A. S., WAMISHO, K., AND YU, B. Agricultural growth linkages in Ethiopia: Estimates using fixed and flexible price models. IFPRI Discussion Paper No. 00695, March 2007.
- [15] ESTUDILLO, J. P., AND OTSUKA, K. Green revolution, human capital, and off-farm employment: Changing sources of income among farm households in central luzon, 1966–1994. *Economic Development and Cultural Change* 47, 3 (April 1999), 497–523.
- [16] ESWARAN, M., AND KOTWAL, A. A theory of real wage growth in LDCs. *Journal of Development Economics* 42 (1993), 243–269.
- [17] FIELDS, G. S. Rural-urban migration, urban unemployment and underemployment and job search activity in Idc's. *Journal of Development Economics* 2, 2 (1975), 165–188.
- [18] GOVERNMENT OF ETHIOPIA. An economic development strategy for Ethiopia: A comprehensive guidance & a development strategy for the future. Ministry of Planning and Economic Development, Addis Ababa, September 1993.
- [19] GOVERNMENT OF ETHIOPIA. A plan for accelerated and sustained development to end poverty (pasdep). Ministry of Finance and Economic Development, September 2006.
- [20] GRILICHES, Z. Hybrid corn: an exploration in the economics of technological change. *Econometrica* 25, 4 (October 1957), 501–522.
- [21] GROSSMAN, G. M., AND ROSSI-HANSBERG, E. Trading tasks: A simple theory of offshoring. NBER Working Paper No. W12721, December 2006.

- [22] HAYAMI, Y. Globalization and rural poverty: A perspective from a social observatory in the philippines. UNU-WIDER Research Paper 2006/44, 2006.
- [23] HAYAMI, Y. Globalization and rural poverty: A perspective from a social observatory in the philippines. UNU-Wider working paper no. RP2006/44, 2006.
- [24] HILL, R. V., DERCON, S., AND ZEITLIN, A. Growth constraints and scenarios for ethipian smallholder agriculture. Report prepared for study on role of Agricultural Growth in Ethiopia, 2009.
- [25] HIRSCHMAN, A. *The Strategy of Economic Development*. Yale University Press, 1958.
- [26] HODDINOT, J., DERCON, S., AND KRISHNAN, P. Networks and informal mutual support in 15 ethiopian villages. Working paper, Oxford University, July 2005.
- [27] JORGENSON, D. W. The development of a dual economy. *Economic Journal* 71, 282 (June 1961), 309–334.
- [28] JORGENSON, D. W. The role of agriculture in economic development: Classical versus neoclassical mmodels of growth. In *Subsistence Agriculture and Economic Development*, J. Clifton R. Wharton, Ed. Aldine, 1969.
- [29] KANBUR, R., AND MCINTOSH, J. Dual economies. In *The New Palgrave: A Dictionary of Economics*, J. Eatwell, M. Milgate, and P. K. Newman, Eds. The MacMillan Press, Ltd., 1987.
- [30] LEWIS, W. A. Economic development with unlimited supplies of labour. *Manchester School* 28, 2 (May 1954), 139–191.
- [31] LOENING, J., RIJKERS, B., AND SÖDERBOM, M. Nonfarm microenterprise performance and the investment climate: Evidence from rural ethiopia. World Bank, Policy Research Working Paper 4577, March 2008.
- [32] MAO, Y.-K., AND SCHIVE, C. Agricultural and industrial development in taiwan. In *Agriculture on the Road to Industrialization*, J. W. Mellor, Ed. Johns Hopkins University Press, Baltimore, 1995, ch. 2, pp. 23–66.
- [33] MELLOR, J. W. Introduction. In *Agriculture on the Road to Industrialization*, J. W. Mellor, Ed. Johns Hopkins University Press, Baltimore, 1995, pp. 1–22.

- [34] MOGUES, T., AYELE, G., AND PAULOS, Z. The bang for the birr: Public expenditures and rural welfare in ethiopia. IFPRI Research Report no. 160, 2008.
- [35] MUNSHI, K. Social learning in a heterogeneous population: technology diffusion in the indian green revolution. *Journal of Development Economics* 73, 1 (February 2004), 185–213.
- [36] NEGASSA, A., AND MYERS, R. J. Estimating policy effects on spatial market efficiency: An extension to the parity bounds model. *American Journal of Agricultural Economics* 89, 2 (May 2007), 338–352.
- [37] NICITA, A., AND OLARREAGA, M. Trade and production: 1976–2004. *World Bank Economic Review* 21, 1 (2007), 165–171.
- [38] OTSUKA, K. Strategy for agricultural growth in Ethiopia. Background note prepared for study on role of Agricultural Growth in Ethiopia, 2008.
- [39] OTSUKA, K., AND KALIRAJAN, K. An exploration in to the possibliity of a Green Revolution in Sub-Saharan Africa: An introduction. *Journal of Agricultural and Development Economics* 2, 1 (2005), 1–6.
- [40] OTSUKA, K., AND KALIRAJAN, K. P. Rice green revolution in Asia and its transferability to Africa: An introduction. *Developing Economies* 44, 2 (2006), 107–122.
- [41] OTSUKA, K., AND YAMANO, T. The possibility of a green revolution in Sub-Saharan Africa: Evidence from Kenya. *Electronic Journal of Agricultural and Development Economics* 2, 1 (2005), 7–19.
- [42] PARK, A. Agricultural development in China: Lessons for Ethiopia. Background note prepared for study on role of Agricultural Growth in Ethiopia, 2008.
- [43] RANIS, G. Is dualism worth revisiting? Yale University, Economic Growth Center, Center Discussion Paper No. 870, September 2003.
- [44] RANIS, G., AND FEI, J. C. A theory of economic development. *The American Economic Review* 51, 4 (September 1961), 533–565.

- [45] RASHID, S., ASSEFA, M., AND AYELE, G. Distortions to agricultural incentives in Ethiopia. International Food Policy Research Institute, Agricultural Distortions Working Paper 43, December 2007.
- [46] RIJKERS, B., SÖDERBOM, M., AND TEAL, F. Rural non-farm enterprises in Ethiopia: Challenges and prospects. Background note prepared for study on role of Agricultural Growth in Ethiopia, 2008.
- [47] SANDEFUR, J., AND SIDDIQI, B. Global trade in tasks. Background note for the 2008 UNIDO report, May 2008.
- [48] SEN, A. K. Peasants and dualism with or without surplus labor. *The Journal of Political Economy* 74, 5 (October 1966), 425–450.
- [49] SEYOUM TAFFESSE, A. Decomposition of growth in cereal production in Ethiopia. Background note prepared for study on role of Agricultural Growth in Ethiopia, November 2008.
- [50] SWAMINATHAN, M. S. An evergreen revolution. *Crop Science* 46, 5 (2006), 2293–2303.
- [51] TIMMER, C. P. The turnip, the new husbandry, and the English agricultural revolution. *Quarterly Journal of Economics* 83, 3 (August 1969), 375–395.
- [52] VINES, D., AND ZEITLIN, A. Dual economies. In *The New Palgrave: A Dictionary of Economics, 2nd ed.*, S. N. Durlauf and L. E. Blume, Eds. Macmillan, London. Also available online: [http://users.ox.ac.uk/~\\$exet1357/](http://users.ox.ac.uk/~$exet1357/), forthcoming.
- [53] WORLD BANK. *World Development Report 2008: Agriculture for Development*. The International Bank for Reconstruction and Development, Washington, D.C., 2007.