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1. Learning From the Past

Inclusive economic growth is essential to achieving long-term poverty reduction and development goals. The transition from traditional, rural societies dominated by farm systems with low productivity toward more diversified, urban-centred societies with high productivity is a complex process that depends on the country's resource endowments, institutions and other factors.[1] Within the structural transformation of an economy the role of agricultural transformation is essential.[2] Successes and failures along the path have serious consequences in terms of the social outcomes, environmental impacts and the economic efficiency of the development process.

This report summarizes government policies and public investments at the country level that have driven agricultural transformation in Africa, Asia and Latin America over a 45-year period between 1970 and 2015. Important achievements have been made during this period to reduce undernourishment and provide employment opportunities outside of agriculture in lower and middle-income countries. The strongest success has been in Asia, Latin America and parts of North Africa, while sub-Saharan Africa has not experienced the same growth.

In 1970 most countries in Africa, Asia and Latin America were still characterized by high levels of undernourishment, heavy dependence on agriculture for employment and low productivity. By 2015, most countries had largely achieved transformation, with only sub-Saharan Africa still lagging behind. (See Map 1 and Annex 1 for a list of countries).

Today, only 10 countries are still in the earliest phase of agricultural transformation—subsistence agriculture—compared with 30 countries in 1970 (see Figure 1 and Annex 1 for a list of countries).[3] Farm systems in most countries have commercialized and use modern inputs. No country is at a lower phase of agricultural transformation today than it was in 1970.

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[1] Acemoglu & Robinson, 2012.

[2] Agricultural transformation can broadly be defined as the process by which an agri-food system transforms over time from being subsistence-oriented and farm-centred into one that is more commercialized, productive and off-farm centred. As labour and other resources move from traditional into more modern economic activities, overall productivity rises and incomes expand. Agricultural transformation is considered inclusive when the results lead to poverty reduction, increased food security, and improvements in gender equality and women's empowerment.

[3] Please note that Figure 1 shows only five countries still characterized by subsistence agriculture in 2015. This is because seven countries (Democratic Republic of Congo, Equatorial Guinea, Eritrea, Republic of Congo, Somalia, South Sudan, Sudan) are excluded from the analysis due to lack of data. Many of these countries are in conflict situations. Therefore, the actual number of countries in subsistence agriculture would have been about 30 countries in 1970 and about 10 countries in 2015.

Map 1. Agricultural Transformation: 1970–2015
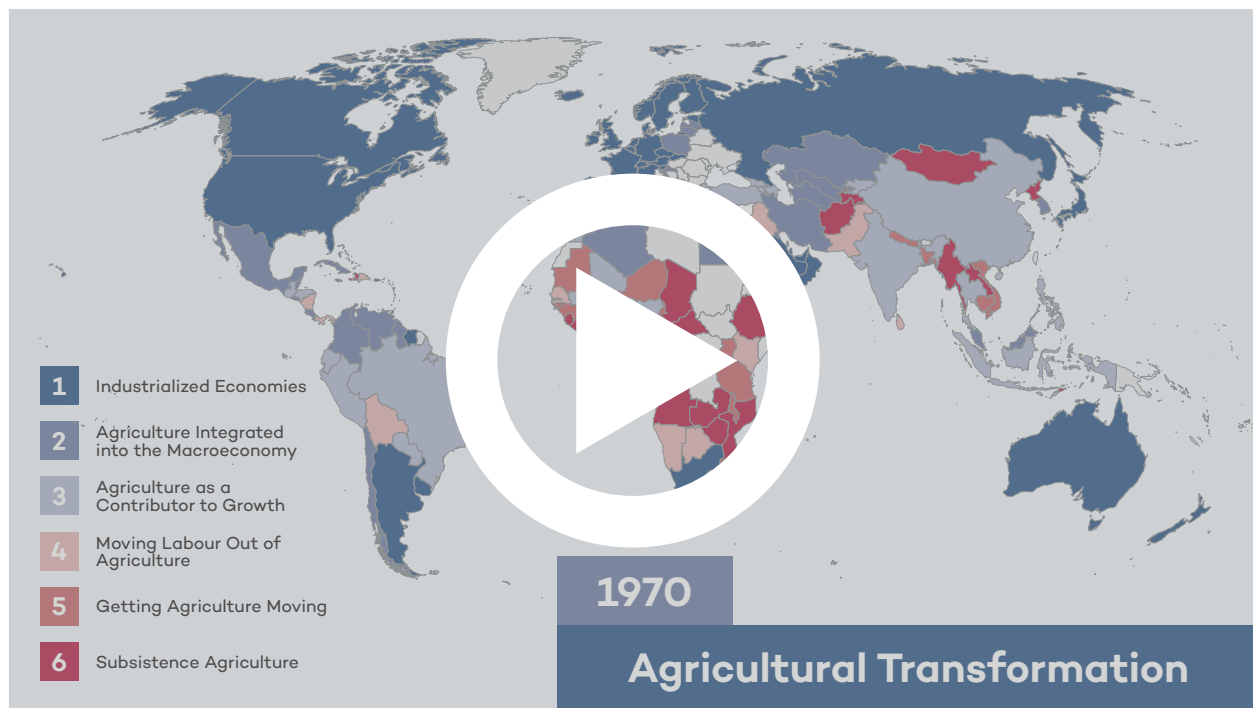
How was this progress achieved in the countries that transformed? And what do the remaining countries need to prioritize in order to join them? These questions have been debated in development literature for decades.
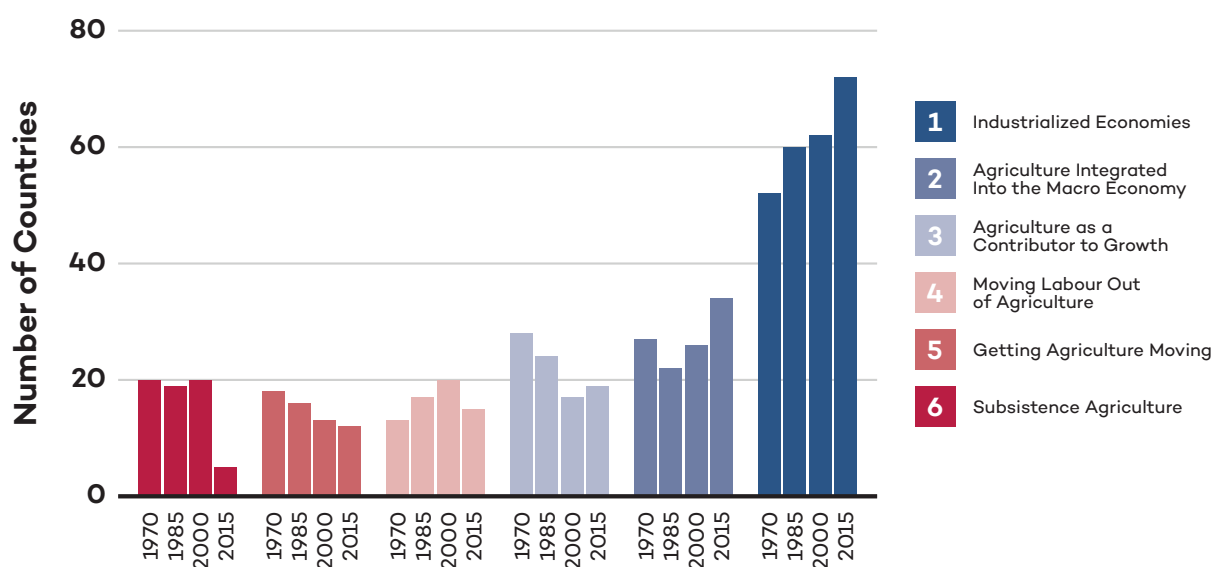
This report is the first attempt to map the agricultural transformation path of 117 countries over a 45-year period using an analytical framework with a global cluster analysis.[4] The analytical framework is rooted in Timmer's (1988) agricultural transformation framework and assesses the level of agricultural transformation by using data on the prevalence of undernourishment and the share of agricultural employment.[5] Six non-linear phases of agricultural transformation are identified: (1) Industrialized economies; (2) agricultural integrated into the macro economy; (3) agriculture as a contributor to growth; (4) moving labour out of agriculture; (5) getting agriculture moving; and (6) subsistence agriculture.

Next, recognizing that countries are heterogeneous, the same 117 countries are clustered in groups that shared similar contexts in 1970, as defined by a number of structural drivers (birth rate, land availability and fertility). Our hypothesis is that we stand to learn the most from comparing and contrasting the agricultural transformation trajectories of countries whose initial starting conditions were similar. Five transformation contexts are identified: (1) Low birth rates and scarce land; (2) high birth rates and scarce but fertile land; (3) high birth rates and scarce land; (4) abundant and fertile land; and (5) abundant but infertile land.

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[4] Doing a systematic classification of that many countries over such a large period of time is not a simple task. Until now, the literature has tackled the challenge of data scarcity and quality by focusing on individual case studies or subsets of countries. This leads to significant selection and sampling biases. We used a simplified framework relying on a few indicators to avoid sacrificing sample coverage. The groups of countries in the cluster analyses are created using the K-means methodology according to a set of indicators over a period from 1970 to 2015.

[5] Timmer, 1988.

Figure 1. Agricultural Transformation Progress, 1970–2015

Legend:
1 — Industrialized Economies
2 — Agriculture Integrated Into the Macro Economy
3 — Agriculture as a Contributor to Growth
4 — Moving Labour Out of Agriculture
5 — Getting Agriculture Moving
6 — Subsistence Agriculture

Source: Authors' calculations. Available online here.

In the third stage we conduct reviews of literature from 1970–2015 focusing on the policies and public investments of 27 countries that either transformed or are still lagging behind. Over 250 papers and reports were reviewed for lower and middle-income countries, including 14 transformed countries and 13 focus countries still lagging behind.[6]

The findings are presented in such a way that any country, by locating itself in the correct cluster, can identify analogue countries and consider the policy and public investment strategies used in the past to help guide future decisions. But today's context matters. The global economic and environmental context has changed dramatically since the transformations of the Green Revolution.[7] Countries will not necessarily be able, nor need, to replicate those early strategies that focused on primary production of staples.

Urbanization has progressed ahead of structural transformation in many countries that have not yet transformed agriculture. Dietary changes and the modernization of the food distribution and processing create new opportunities as well as challenges of overnutrition The increased frequency of extreme weather-related events as a result of climate change, deforestation, biodiversity loss and freshwater scarcity are disrupting agriculture's potential and require new approaches to achieve economic growth and poverty reduction. At the same time, advances in science and technology create new approaches and opportunities to support agriculture. And the international community is demanding that a broad range of economic, environmental and social issues be integrated into future development pathways, as reflected by the Sustainable Development Goals (SDGs).[8]

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[6] The 14 transformed countries are: Brazil, Chile, China, Colombia, Costa Rica, Ghana, Indonesia, Malaysia, Morocco, Peru, South Africa, South Korea, Thailand and Vietnam. The countries were selected because of geographical and structural diversity, and the transformation process has taken place in the past 45 years. The 13 focus countries are: Burkina Faso, Ethiopia, Kenya, India, Malawi, Mali, Mozambique, Rwanda, Tanzania, Togo, Uganda, Zambia and Zimbabwe. They were selected because they still have a large share of employment in agriculture, relatively high prevalence of undernourishment, and are of interest to policymakers and donors, including most of the AGRA priority countries. For a list of the 250 papers please see here. In earlier versions of this report Nigeria was considered transformed due to progress in the prevalence of undernourishment between 2000 and 20015. Nigeria has been removed from the list of transformed countries due to recent revisions in the prevalence of undernourishment, which rose above 10 percent between 2015 and 2018 as a result of internal conflict and economic recession.

[7] AGRA, 2017.

[8] AGRA, 2017.

2. Five Key Findings

A. **The availability and fertility of agricultural land, as well as population dynamics, are core to the role of agriculture in economic transformation**. Where countries have abundant and fertile agricultural land and high birth rates, increasing agricultural productivity is a key priority to spur economic growth in the early phase of transformation. This is evident from many successful Latin American countries studied, such as Brazil and Colombia. Where countries have high birth rates but limited agricultural land and water per capita, increasing non-agricultural productivity is a key priority to spur economic growth in the early phase of transformation. This is evident from many successful Asian countries studied, such as China, Malaysia and Vietnam.

B. **Price policies play a key role in agricultural transformation**.[9] Price policies can provide positive or negative assistance to farmers relative to the rest of the economy. Where the relative assistance is negative it is referred to as the anti-agricultural bias. This is significant because in all the successful countries studied, agricultural transformation took off when countries removed the anti-agricultural bias. This is the case for Brazil, Indonesia, South Korea, and Vietnam. On the other hand, countries that have not yet transformed their agricultural sector, such as Ethiopia, Malawi, Togo and Uganda, maintained an anti-agricultural bias for the entire 45-year period. Stable macroeconomic policies also played an important role, including through exchange rate interventions and managing inflation.

C. **Public investment is important but not sufficient for success**. Significantly expanding public investment in support of agricultural development is key for most successful countries (e.g., China, Costa Rica and Malaysia). But some countries achieve impressive growth without significant increases in public investment (e.g., Ghana and Peru). For the group of countries studied, investments in research and development (R&D) and extension services are the most important type of public investments and tend to have a greater impact when accompanied by other measures. Rural infrastructure is also an important public investment, particularly electrification and irrigation, which delivers even greater results when combined with roads.

D. **Institutional change and legal reforms are critical**. Land and other institutional reforms are especially critical in the initial stages to jumpstart agricultural productivity growth and generate surpluses to facilitate structural change. Combining these reforms with public investment leads to much greater success, particularly when well-coordinated and in a proper sequence. This is the case with agricultural institutional reforms in China and Vietnam, land reforms in Vietnam and South Korea, and provision of public credit in Brazil and Colombia.

E. **Complementarity is essential**. No single measure on its own is sufficient to make progress. No country succeeds without a combination of policies and public investments that complemented each other at a given juncture. Moreover, the composition of spending on public goods matters.

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[9] Price policies include border measures, such as tariffs, and export taxes, or internal measures, such as guaranteed prices for producers and subsidies.

3. The Phases of Agricultural Transformation

The analytical framework of the report starts with a global cluster analysis to define six non-linear phases of agricultural transformation for 117 countries over 45 years, using two indicators:[10]

- An indicator of the resources allocated to agriculture: the share of agricultural employment in total employment,[11] and
- A food security outcome indicator: the prevalence of undernourishment.[12]

Implicitly, the combination of these two dimensions describes the efficiency and inclusiveness of the agricultural transformation process: in the long run, achieving food security with a small workforce requires large productivity gains (either in the domestic agricultural sector or through greater reliance on imports and accrued competitiveness in other sectors). Our clusters are consistent with the process of agricultural transformation described by Timmer,[13] while differentiating earlier phases of transformation in terms of food security outcomes. Countries do not move across the different phases in a linear way since multiple policy options and socioeconomic conditions lead countries through various pathways. Figure 2 shows the prevalence of undernourishment and the share of agricultural employment in total employment for each of the six phases. For a list of countries in each phase see Annex 1.

Figure 2. Phases of Agricultural Transformation
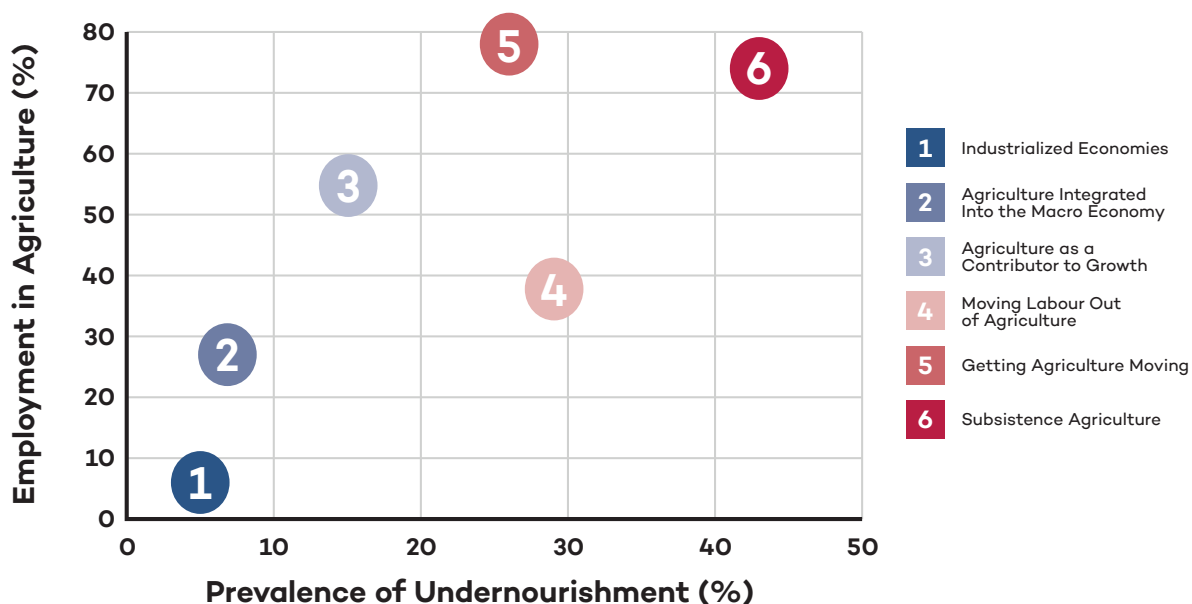
Source: Authors' calculations.

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[10] The two indicators have parallels with the two variables used by the World Bank in the 2008 World Development Report, including agriculture's contribution to total economic growth and the rural poverty ratio, which are closely correlated to the indicators selected. While conducting the analysis on two indicators can be seen as a limitation, we have checked the robustness of our approach by adding additional indicators (e.g. actual labour productivity in agriculture, intensity of chemical fertilizers used in agriculture) on a restricted sample. Aside from a few exceptions, the position of various countries in our agricultural transformation space is not modified.

[11] ILO estimates. (It is worth noting that for some countries and some periods there are weaknesses in the data sets available. While we have selected the most reliable data source in each case, and restricted our variables accordingly, oddities remain for specific cases. Therefore, diagnostics at the country level should be conditional on cross-checks with other sources.)

[12] FAOSTAT.

[13] Timmer, 1988.

4. The Transformation Context

The process of economic transformation moves an economy from low productivity in all sectors to high productivity in all sectors. The key question is: What pathway should a given country take to best chart its course? The development transition can be achieved through an emphasis on higher agricultural productivity (the *push* strategy, because it counts on rural areas driving growth), or through higher productivity in non-agricultural sectors (the *pull* strategy, because it requires growth in the non-farm economy to pull people out of agriculture); and often a mix of both. Openness to trade and access to markets can play a role in creating the right price incentives.

The structural endowments of a country, such as the land, water, soils, and demographics, influence the degree and sequencing of the *push* and *pull* strategies. Pushing agricultural productivity is not the highest priority, especially when the country has limited and infertile agricultural land available per capita and high birth rates. In those cases, the pull strategy may be a higher priority. Either way, sustainable increases in the standard of living can only be realized by longer-term productivity growth in both agricultural and non-agricultural sectors.

In the second stage of the global cluster analysis, we used three structural endowment indicators that identify distinctive groupings of countries to determine their transformation contexts in 1970 (see Annex 2):[14]

- A metric of relative land endowment: agricultural land in production per capita (a key metric to compare agriculture endowment across countries): square kilometres per person.[15]
- A metric of potential agricultural productivity based on biophysical characteristics of land suitability for agriculture: USD per hectare.[16]
- An indicator of demographic change, the birth rate, to reflect population pressure and to differentiate trajectories based on per capita endowments: births per 1000 persons.[17]

By separating countries in this way we were able, subsequently, to conduct literature reviews targeted to each group that allowed us to compare and contrast the transformation pathways of structurally similar countries. We identified five distinct transformation contexts into which countries fall. We chose 1970 as the base year for the analysis because of data availability and it is an important period for agricultural transformation progress in lower and middle-income countries in East Asia and Latin America (See Map 2 and Annex 3 for list of countries).

Importantly, recognizing the distinct transformation contexts of the five groups of countries is helpful to better understand the policy and investment priorities of countries in each group that successfully transformed. For example, where there is abundant and fertile land (Group 4), a country might first prioritize the push transformation strategy, focusing

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[14] The global cluster analysis was also conducted on governance indicators for the periods 1990 and 2000 using the Worldwide Governance Indicators (WGI) and the Economic Freedom Index of the Heritage Foundation, but it was difficult to find a proxy to cover the full range of countries over the 45-year time period. We challenged our findings with the other indicators by performing a sensitivity analysis on the governance indicators, as well as primary education level. There were no major differences in the position of countries when performing the sensitivity analysis.

[15] World Development Indicators.

[16] Authors computations based on Global Agro-Ecological Zones (GAEZ) and FAOSTAT databases for potential yields and average prices between 2011–2015.

[17] Average crude birth rate, per 1,000 people, World Development Indicators.

Map 2. Transformation Contexts, 1970: Global
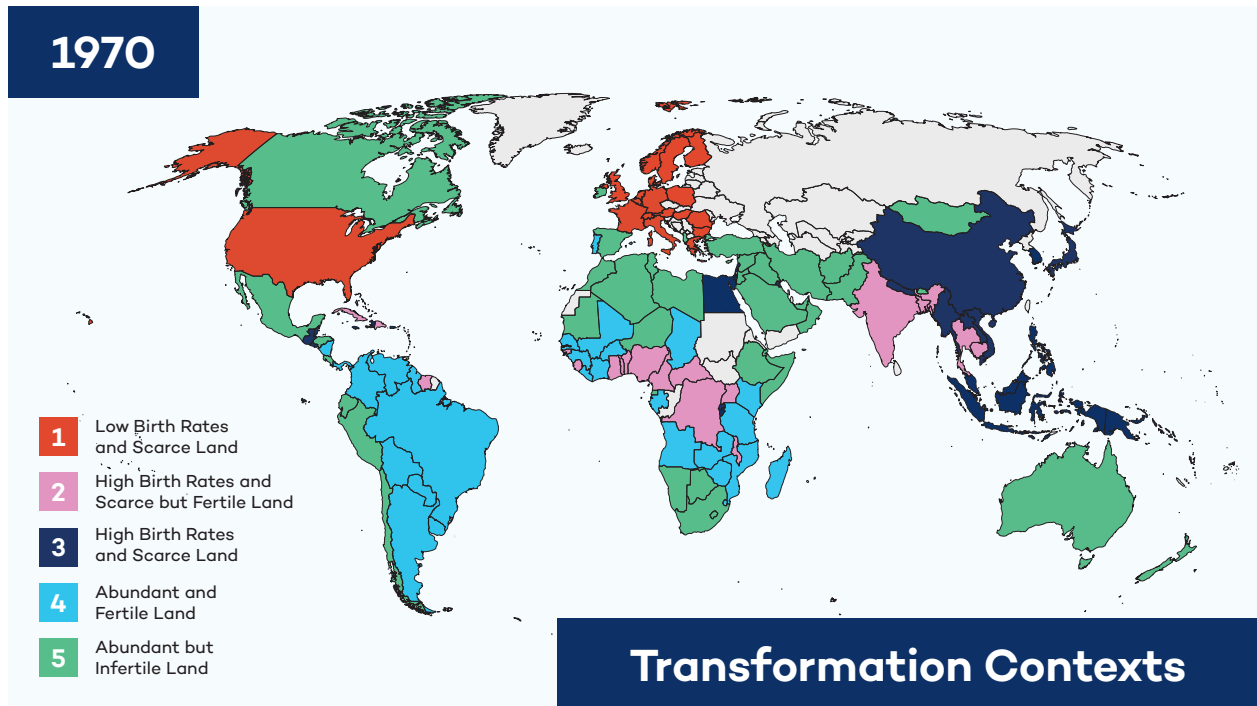
Source: Authors' calculations. Available online here.

first on growth in agricultural productivity. This is how many Latin American countries succeeded in the past 50 years. On the other hand, where there is high birth rates and scarce land per capita (Group 3), a country might first prioritize the pull transformation strategy, focusing first on growth in non-agricultural productivity. This is how many Asian countries succeeded in the same period.[18]

What does this mean for countries that have yet to transform? The results show, for example, that in 1970, Zambia and Zimbabwe had abundant and fertile land (Group 4) and therefore could have been inspired by the policy approaches of Brazil and Colombia. It would not have been wise for these countries to follow the lead of China, which had scarce land per capita in 1970 (Group 3). On the other hand, Rwanda could have been inspired by the policy approaches of China because it also had scarce land per capita in 1970.

It is important to note that the term "scarce land" is used to describe countries where there is scarce agricultural land per capita based on actual land use, rather than potential arable land. Countries like Indonesia, Ghana and Thailand, fall into this category even though they had a significant amount of unexploited land. These countries pursued an extensive model of agriculture, which resulted in significant land use change and high levels of deforestation. To avoid promoting this strategy we opt for a definition of average agricultural land in production.

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[18] The structural drivers are also suggestive of the specific types of policies and investments most appropriate for raising agricultural productivity, regardless of whether a push or pull strategy predominates (Hayami & Ruttan, 1971). Countries with scarce agricultural land per capita have focused on increasing output per unit of land (for example, irrigated rice systems in Indonesia) while those with scarce labour have favoured raising output per unit of labour (for example, mechanized broadacre systems in Australia and the United States).

5. The Role of Policies and Public Investments in Transformed Countries

Before discussing future policy options, the third stage of the analytical framework consists of a literature review, organized in a way that allows us to identify and compare policy priorities while controlling for the heterogeneous endowments resulting from the clusters formed in stages one and two. This section reviews the policy priorities of the 14 transformed countries, and the next section looks at the 13 focus countries.[19] The findings for the 14 transformed countries are summarized in Table 1.

Policies are classified into four broad categories: public investment, price interventions, macroeconomic policies, and land and other institutional reforms. Public investment includes measures that provide public goods, such as R&D, extension services, rural infrastructure, and rural education and health. Sound macroeconomic policies, proper institutions and good governance are also key public goods to be delivered by government.

Price interventions include measures that change the demand and supply of private goods. They effect market prices (for example, through trade policies, price controls and marketing boards), or they affect producer prices (through subsidies paid by taxpayers) both on inputs and outputs. Price interventions can either provide positive assistance or negative assistance to farmers compared to the rest of the economy. What really matters when assessing the bias of a price policy regarding agriculture is the notion of *relative rate of assistance*. If a country implements a 5 per cent average tariff on agricultural products but a 10 per cent average tariff on industrial products, it does not support agriculture (i.e., there is a negative relative rate of assistance). This is significant since in most countries agriculture took off when countries removed the anti-agricultural bias.[20]

A. Countries With High Birth Rates and Scarce but Fertile Land (Group 2)

Countries in this group had high population density and scarce but fertile land in 1970. Agriculture played an important role, but developing the non-farm sector was essential for the transformed countries. In 1970, Ghana and Thailand belonged to this group, with India making strong progress although still lagging. All three pursued both the push and pull strategies to improve productivity in agricultural and non-agricultural sectors. For agriculture, the literature shows that price interventions in favour of agriculture were key. Removing the anti-agricultural bias boosted the transformation process in these countries.

In terms of public investments, the quality was more important than the quantity. Increased public investment in R&D was key to improving the agricultural productivity potential in Ghana, India and Thailand, and it worked best when there was complementarity with other interventions, particularly extension services, roads and irrigation (see Figure 3).[21]

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[19] The 14 transformed countries include: Brazil, Chile, China, Colombia, Costa Rica, Ghana, Indonesia, Malaysia, Morocco, Peru, South Africa, South Korea, Thailand and Vietnam.

[20] It should be noted that beyond the average relative rate of assistance, its composition (i.e., the nature of the support) and its heterogeneity across products (e.g., variety of crops, crops vs. livestock) or agents (male vs. female, large vs. small farms) are both important elements contributing to the success or failure of some policies.

[21] Benin et al., 2009; Fan et al., 2000; Poapongsakorn, 2011; Mogues Yu, Fan, & McBride, 2012; Upali Wickramasinghe, 2017; Leturque & Wiggins, 2011; Goyal & Nash, 2017.

Improving access to public credit for smallholder farmers in the case of Thailand had a positive impact on the agricultural transformation process.[22] However, equal access to land and productive assets remains a challenge, including in Ghana and India, where it is still more difficult for women to secure land.[23]

Figure 3. Public Expenditure per Farmer: Ghana, India and Thailand
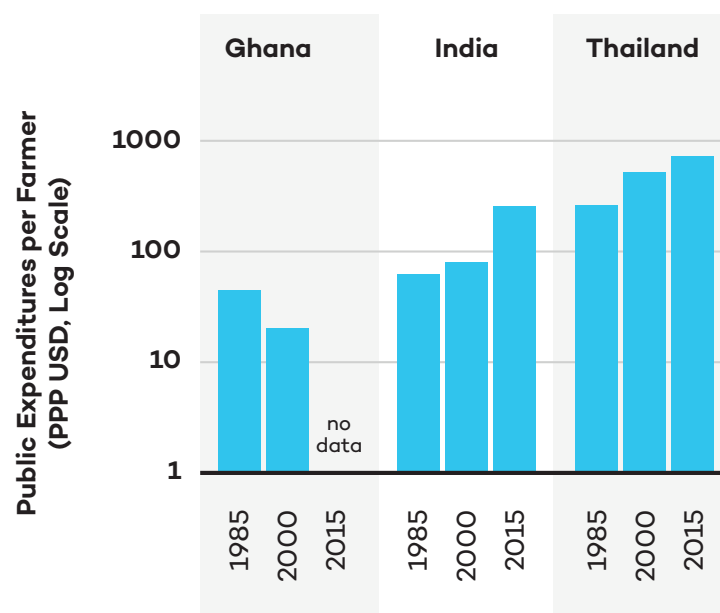
Source: Authors' calculations. Available online here.

B. Countries With High Birth Rates and Scarce Land (Group 3)

Countries in this group had scarce land per capita and strong population growth in 1970. Macroeconomic policies for the non-farm sector were key for the transformed countries in this group because of the poor agricultural land endowments. In 1970, China, Indonesia, Malaysia and South Korea were in this group. All have transformed their agricultural sector. Vietnam was also in this group and has made significant progress. Indeed, all these countries are typical examples of prioritizing the pull strategy and focusing on improving productivity in the non-agricultural sector, while at the same time developing niche agricultural markets in specific value chains. The latter was also made possible by investments in infrastructure that created access to domestic and global markets. Policies

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[22] Leturque & Wiggins, 2011.
[23] Chapoto et al., 2013; EIU, 2008.

that promoted labour mobility in rural non-farm enterprises (e.g., China) and industrial policies to absorb excess rural labour (e.g., Indonesia and South Korea) were key.[24]

Despite the non-agricultural productivity strategy, improving productivity in agriculture was still important. Price interventions in favour of agriculture were used in all the transformed countries in this group, and all saw a shift away from a negative relative rate of assistance to agriculture during their transformation process (See Figure 4).[25]

Figure 4. Relative Rate of Assistance, Scarce Land Group
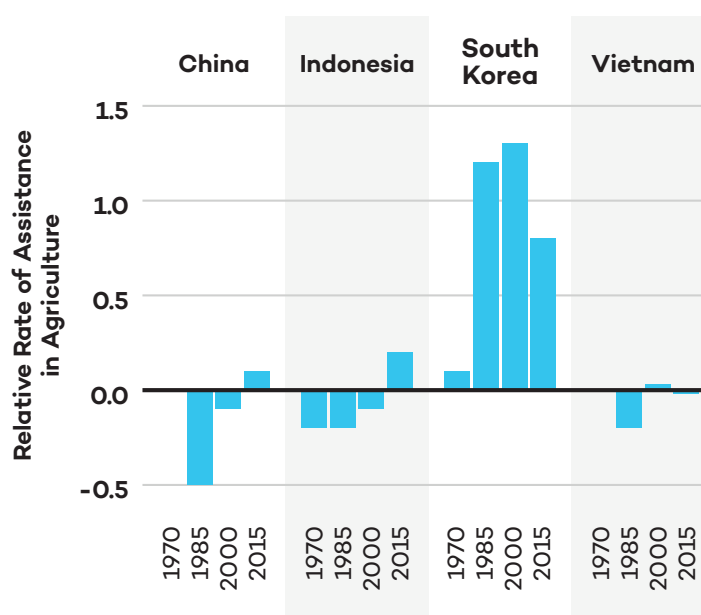
Source: Authors' calculations. Available online here.

Significant public investment in agriculture was also essential, with a particular focus on complementarity with extension services, primary education, irrigation, electricity and roads (see Figure 5).[26] Public investment in R&D had the largest impact on productivity.[27] Returns to agricultural GDP from public expenditure in education (particularly in China and Vietnam) were impressive.[28] Lastly, land reforms were critical for South Korea and China.[29]

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[24] Tsakok, 2011; Kwiecinski & Li, 2002; Ho, 1994.

[25] Tsakok, 2011; Huang et al., 2009; Honma & Hayami, 2009; Athukorala, Huong, & Thanh, 2009; EIU, 2008.
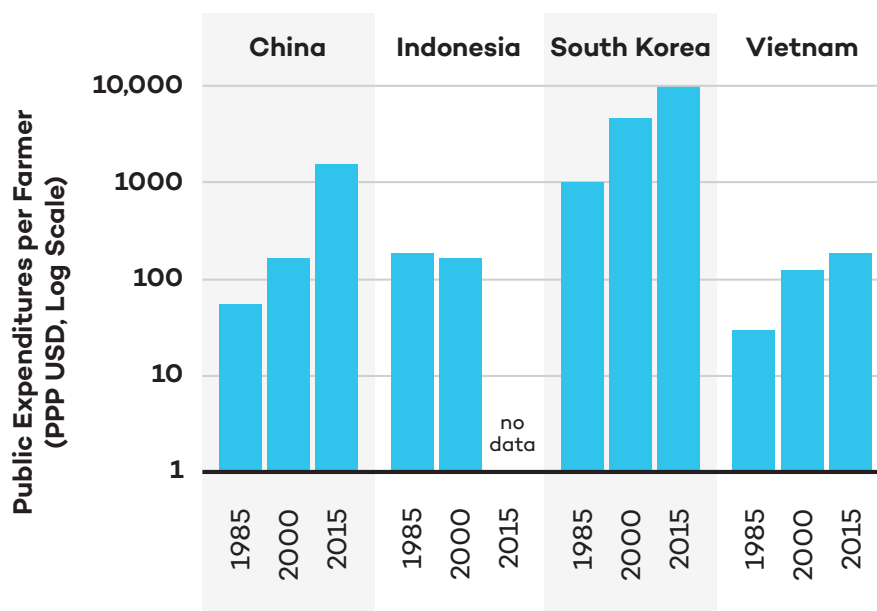
[26] Tsakok, 2011; EIU, 2008; Timmer, 2005; Fan, Zhang, & Zhang, 2004.

[27] Mogues et al., 2012; EIU, 2008; Fan et al., 2004.

[28] Fan et al., 2004; Van Arkadie & Duc Dinh, 2004.

[29] Tsakok, 2011.

Figure 5. Public Expenditures per Farmer: China, Indonesia, South Korea and Vietnam

Source: Authors' calculations. Available online here.

C. Countries With Abundant and Fertile Land (Group 4)

Countries in this group had the strongest comparative advantages in agriculture in 1970. Indeed, many of today's agricultural powerhouses in Latin America are in this group. We reviewed the literature for Brazil and Colombia, which have both transformed, as well as for Mali, which is showing strong signs of improvement.

Price interventions in favour of agriculture were critical (including floor prices and credit policies), particularly in the absence of credit and insurance markets, but this policy approach was first preceded by a period where there was relatively more support for non-agricultural sectors.[30]

Increased public investment in R&D was key to improving agricultural productivity potential. Public investment worked best when there was complementarity with other interventions—including extension services, roads, irrigation and primary education.[31] Returns from investment in primary education were particularly impressive in Colombia.[32] Public investments in input subsidies and infrastructure in Mali were key, but more needed to be spent on research (see Figure 6).[33]

Countries used a mix of macroeconomic policies to support the agricultural sector. Stable macroeconomic policies played a positive role, including through exchange rate interventions and managing inflation, although exchange rate interventions had mixed results.[34] It is also important to bear in mind that Brazil experienced periods of hyperinflation and financial crises during the 1970–2015 period.

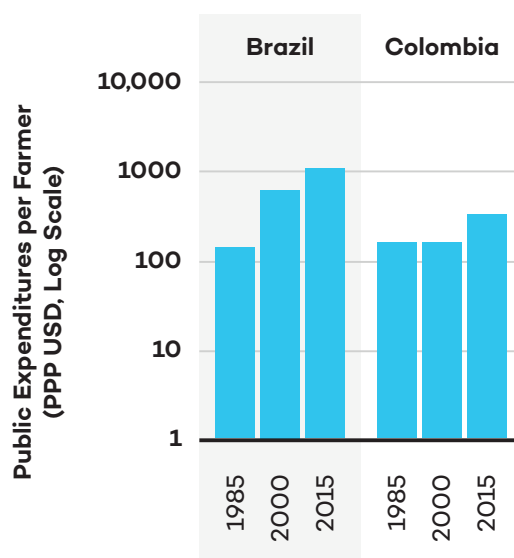[30] Santana & Nascimento, 2012; OECD, 2015.

[31] OECD, 2015; Santana & Nascimento, 2012; Alves, 2010.

[32] OECD, 2015.

[33] MAFAP, 2013; ROPPA, 2013.

[34] Tsakok, 2011; Kimenju & Tschirley, 2008; Ndlela & Robinson, 2009; Tarp et al., 2002; Poulton et al., 2002.

Figure 6. Public Expenditures per Farmer: Brazil, Colombia

Source: Authors' calculations. Available online here.

Public policies to create access to private and public credit for smallholders led to positive outcomes in some cases. The experience of Colombia in building inclusive credit markets is worthy of note.[35] Lastly, land reform was essential for countries with skewed land distribution and weak property rights. Important land reforms have taken place in Mali but must still be accompanied by complementary interventions.[36]

D. Countries With Abundant but Infertile Land (Group 5)

Countries in this group had abundant land per capita in 1970, but the land was infertile. Thus, they could not follow an intensive agricultural production strategy. In 1970, Chile, Costa Rica, Morocco, Peru and South Africa belonged to this group. All have now transformed their agricultural sectors.

Direct price policies played a key role in the agricultural transformation process, but this policy approach was first preceded by a period where there was relatively more support for non-agricultural sectors.[37] In particular, a focus on the export sector benefited this group. Both Peru and Chile succeeded with steps toward liberalization.[38] The support to agriculture was real, not just a reduction in the assistance of non-agricultural commodities. Macroeconomic policy in Chile also supported the agricultural export sector, with stabilization efforts resulting in an average 10 per cent yearly growth in agricultural exports from the mid-1990s to 2008.[39] The quality of public investments in this group was more important than the quantity. In Peru, for example, public investment in R&D was not the key to success, but spending on roads and irrigation was an important element.[40] Spending on irrigation was also beneficial in Chile, allowing the growth of the export sector.[41] Lastly, land redistribution and a dynamic rural non-farm sector played important roles.[42]

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[35] Marin-Usaga et al., 2016; OECD 2015; EIU, 2008.

[36] World Bank, 2001; MER, 2014; Aabo & Kring, 2012; Omiti et al., 2008; Poulton et al., 2002; Ndlela & Robinson, 2009.

[37] Velazco & Pinilla, 2017; Bachewe et al., 2015; Achy 2013; Valdes & Jara, 2009.

[38] Valdes & Jara, 2009; Velazco & Pinilla, 2017.

[39] Anderson & Valdes, 2008.

[40] World Bank, 2017; Bachewe et al 2015; Tsakok, 2011; Velazco, 2001.

[41] Tsakok, 2011.

[42] Foster & Valdes, 2008.

Table 1. Policies Used by Transformed Countries, 1970–2015

Transformation context in 1970	Transformed countries	Public investment			Price interventions		Macroeconomic policies		Land and other institutional reforms	
		R&D and extension services	Rural infrastructure	Rural health and education	Remove anti-agricultural bias	Trade policy reform[a]	Monetary and exchange rate policy	Economic diversification	Land reform	Credit
High Birth Rates and Scarce Land	China	●●●	●●●	●●●	●●●	●●	●	●●●	●●●	●
	Indonesia	●●	●●●	●●●	●●	●●	●●	●●●	●	●●
	Malaysia	●●●	●●	●●	●●	●	●	●●●	●	●
	South Korea[b]	●●●	●●●	●●	●●	●	●●	●●●	●●●	●
	Vietnam	●●	●●	●●●	●●	●●●	●●	●●●	●●	●
High Birth Rates and Scarce but Fertile Land	Ghana[c]	●	●	●●	●●●	●●	●●●	●	●	●
	Thailand	●●●	●●●	●●	●●●	●●	●	●●●	●	●●●
Abundant and Fertile Land	Brazil	●●	●●	●	●●	●●	●●	●	●	●●
	Colombia[d]	●●	●●	●●	●●	●●	●	●	●	●●
Abundant but Infertile Land	Chile	●	●●	●	●●	●●●	●●●	●●●	●●●	●●
	Costa Rica	●●	●●	●●	●●	●●●	●●	●●●	●	●●
	Morocco	●	●●	●	●●	●●	●●	●●	●	●●
	Peru	●	●●	●	●●	●●●	●●	●	●	●●
	South Africa	●●●	●●	●	●	●●●	●	●	●	●●

●: lower priority   ●●: medium priority   ●●●: higher priority

[a] The two sub-categories for price interventions are interrelated. Trade policy reform refers to the use of trade measures such as tariffs, export taxes, export promotion and sectoral policies. The anti-agricultural bias refers to the relative rate of assistance to agriculture compared to other sectors of the economy. It includes trade measures such as tariffs and subsidies but also other government policies that affect prices, such as input subsidies and direct price controls. It is expressed as positive, negative or neutral, relative to other sectors. This table shows that removing the negative relative rate of assistance (the anti-agricultural bias) was key in the agricultural transformation process.

[b] Many of the important reforms in South Korea occurred prior to 1970

[c] Ghana had a relatively low level of public investment during the period, but the investment was highly effective.

[d] Colombia could have prioritized land reform for better results.

6. Policy Options for Focus Countries

In light of the strategies and policy priorities pursued by the transformed countries, this section presents policy options for 13 focus countries that, as of 2015, must still make additional efforts to complete their agricultural transformation.[43] As discussed in the introduction, today's context matters, and many of the strategies pursued in the past may no longer apply today or may require different policies.

Since the 1970s, the 13 focus countries have not always pursued the mix of policies and public investments most suited to their structural endowments. For example, countries that had abundant and fertile land in the 1970s (such as Kenya, Tanzania, Zambia and Zimbabwe), and which could have pushed agricultural productivity, instead favoured growth in non-agricultural sectors, and a highly negative relative rate of assistance to agriculture that is still present today.[44] This same group had declining levels of public investment in R&D that negatively affected the agricultural sector,[45] which was further exacerbated by measures toward trade liberalization.[46]

Poor rural infrastructure, particularly roads and irrigation, was another significant hurdle to agricultural development.[47]

On the other hand, countries with high birth rates and scarce but fertile land in 1970—such as Malawi, Togo and Uganda—had the opposite problem. Growth in non-agricultural sectors was needed to provide livelihoods for the large and growing population who had no access to land. Investment in rural infrastructure, which is vital to the growth of rural non-farm enterprises, is still lacking.[48]

Today the structural endowments of the focus countries look different from what they were in 1970, mostly because of demographics. Ethiopia, India, Kenya and Rwanda have the same transformation context today as China, Indonesia, Malaysia, South Korea and Vietnam had in 1970. Similarly, Burkina Faso, Malawi, Tanzania, Togo, Uganda and Zambia, have the same transformation context today as Ghana and Thailand had in 1970. And lastly, Mali, Mozambique and Zimbabwe, have the same transformation context today, as Brazil and Colombia had in 1970 (see Table 2).

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[43] The 13 focus countries are: Burkina Faso, Ethiopia, Kenya, India, Malawi, Mali, Mozambique, Rwanda, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

[44] MAFAP, 2013; ROPPA, 2013; Bonneval, Kupper, & Tonneau, 2002.

[45] Elliot & Perrault, 2006; Jayne et al., 2007; ASTI, 2017.

[46] Morrissey & Leyaro, 2009; Ndlela & Robinson, 2009; Alfieri et al., 2009; Elliot & Perrault, 2006; Skarstein, 2005; Poulton et al., 2002.

[47] Adam et al., 2012; AICD, 2010; Alila & Atieno, 2006.

[48] Fox & Pimhidzai, 2011.

Table 2. Focus Countries and Their Relevant Cluster Matches: 1970 & 2015

Transformation context	Transformed countries (1970)	Matching focus countries (2015)
High birth rates and scarce but fertile land	Ghana and Thailand	Burkina Faso, Malawi, Tanzania, Togo, Uganda and Zambia
High birth rates and scarce land	China, Indonesia, Malaysia, South Korea and Vietnam	Ethiopia, India, Kenya and Rwanda
Abundant and fertile land	Brazil, Colombia	Mali, Mozambique and Zimbabwe

The following section provides options for the focus countries going forward. It is important to emphasize that there are no universal policy recommendations that can fit the needs and capacities of all countries—or any country at different times. However, it is still possible to provide policy options based on national structural endowments and evidence from the literature. Table 3 summarizes the policy options for the 13 focus countries.

A. Options for Countries With High Birth Rates and Scarce but Fertile Land (Burkina Faso, Malawi, Tanzania, Togo, Uganda and Zambia)

For this group, increased access to public credit can allow farmers to take full advantage of the productivity potential of their land. Public credit programs in Thailand were successful in reaching a large proportion of the farm population and increasing productivity[49] and should be prioritized by the countries in this group. This is particularly true in Togo, where poor access to credit remains a main limiting factor of agricultural development, in addition to low public investment in rural infrastructure.[50] In designing and delivering public credit programs, care must be taken not to create excessive price subsidies that can create unfair competition with a rising private sector.

Malawi, Uganda and Zambia, in particular, should follow the lead of Ghana and Thailand in providing more support to agriculture. Targeted support and price policies can help establish high-value commodities, such as the Cocoa Rehabilitation Project in Ghana,[51] and food safety and marketing efforts in Thailand.[52] Furthermore, public investment in irrigation is likely to have a larger positive effect on women—who make up a majority share of the agricultural labour force in Tanzania, Uganda and Zimbabwe—and should be prioritized.[53] The focus on poorly targeted public spending, like in the case of fertilizer subsidies in Malawi, needs to be changed in the future.

This group requires a balanced approach of improving productivity in agriculture through increased investment in R&D and extension services, as well as rural infrastructure, while at the same time giving some priority to economic diversification.
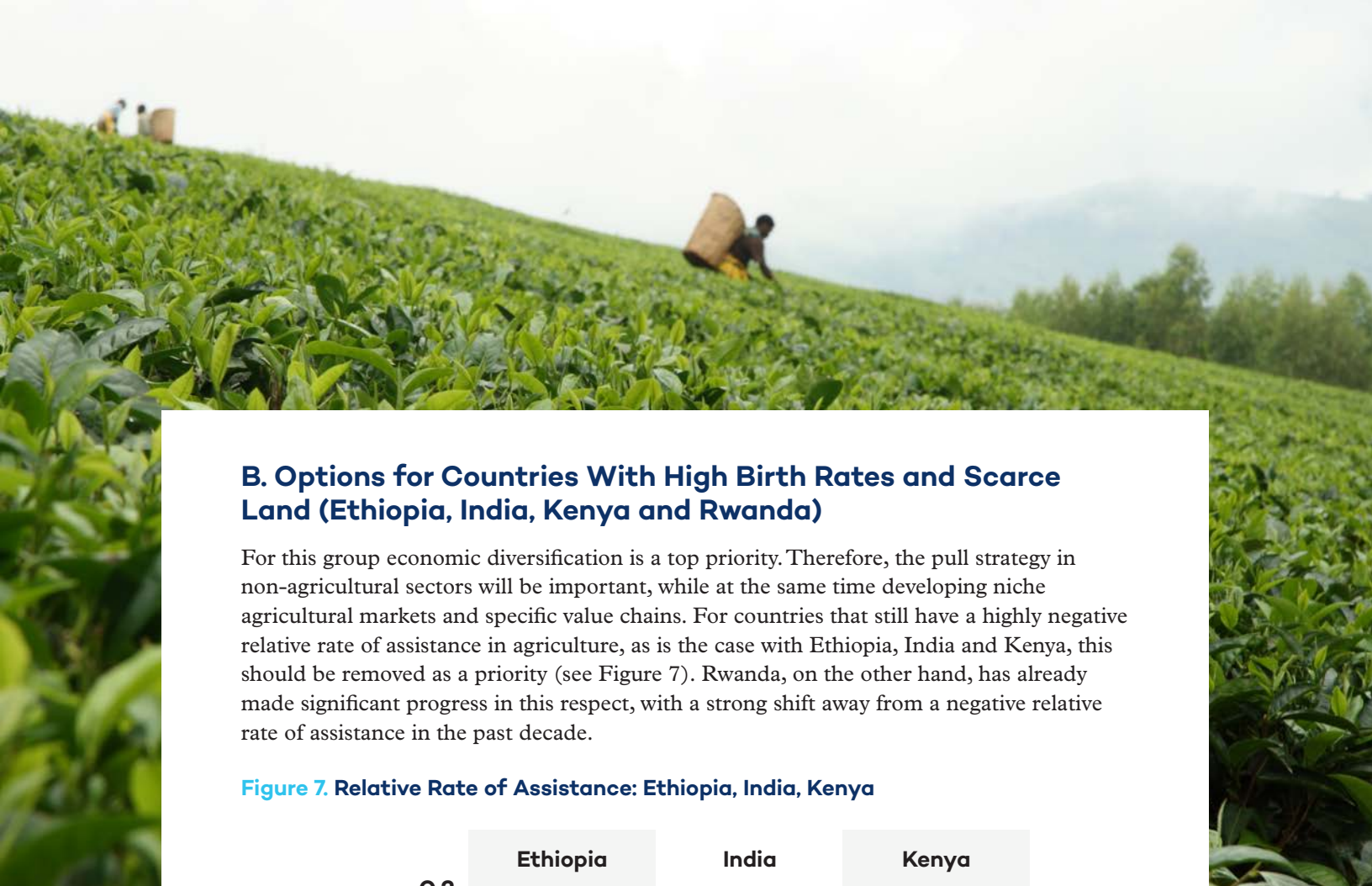
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[49] Leturque & Wiggins, 2011.
[50] ROPPA, 2012.
[51] Kolavalli & Vigneri, 2011.
[52] Upali Wickramasinghe, 2017.
[53] Slavchevska, 2016; Alila & Atieno, 2006.

B. Options for Countries With High Birth Rates and Scarce Land (Ethiopia, India, Kenya and Rwanda)

For this group economic diversification is a top priority. Therefore, the pull strategy in non-agricultural sectors will be important, while at the same time developing niche agricultural markets and specific value chains. For countries that still have a highly negative relative rate of assistance in agriculture, as is the case with Ethiopia, India and Kenya, this should be removed as a priority (see Figure 7). Rwanda, on the other hand, has already made significant progress in this respect, with a strong shift away from a negative relative rate of assistance in the past decade.

Figure 7. Relative Rate of Assistance: Ethiopia, India, Kenya
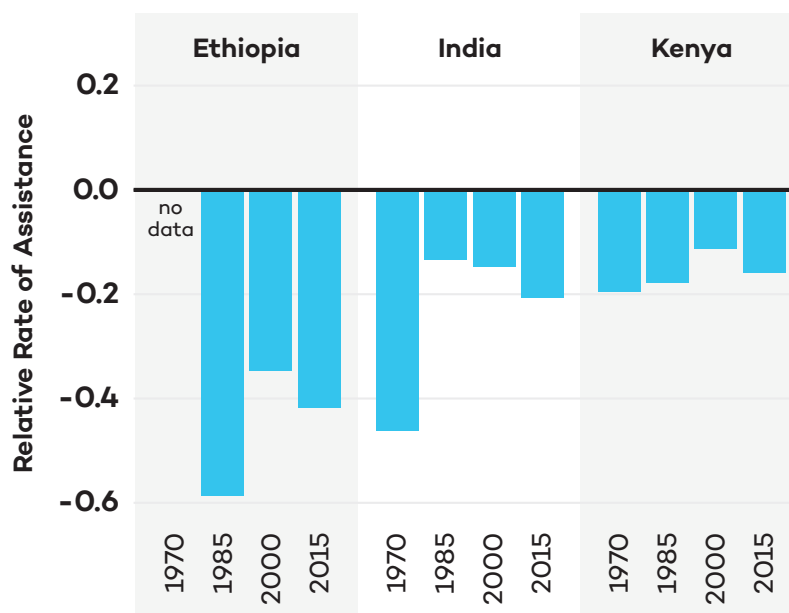
Source: Authors' calculations. Available online here.

Public investments in irrigation are likely to have a larger positive effect on women, who make up a majority share of the agricultural labour force in Rwanda. These should be prioritized.[54] Extension services have been a key priority for Ethiopia, and while important progress has been made, women's empowerment remains a challenge. Women-led farms

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[54] Slavchevska, 2016; Alila & Atieno, 2006.

have been shown to be 23 per cent less productive than those run by men, which is in part due to women receiving less, and lower-quality, extension support.[55]

India and Rwanda have made significant strides toward agricultural transformation. In both countries the priority should be the development of non-agricultural sectors, to allow rural workers to transition out of agriculture.

Increased public investment is a priority for Kenya. Reduced public spending on R&D and an ineffective extension services system have hampered agricultural transformation.[56] The lack of rural infrastructure not only constrains water availability, but also isolates farmers from markets.[57] Renewed spending on rural infrastructure is vital to increasing agricultural productivity and will be necessary as Kenya attempts to diversify and expand the non-farm sector.

This group should focus on economic diversification and remove the anti-agricultural bias.

C. Options for Countries With Abundant and Fertile Land (Mali, Mozambique and Zimbabwe)

For this group, pushing the agricultural sector is key because they have abundant and fertile land per capita. Important reforms have taken place in Mali and Mozambique but should be accompanied by complementary interventions such as access to credit, infrastructure and extension services.[58]

Public expenditure in Mali has already increased, doubling over the last 30 years in per capita terms. This has mainly focused on input subsidies but not enough on R&D and extension services, at only 4 per cent of public expenditure on agriculture. This presents problems for future productivity growth, as the sector already faces yield constraints.[59]

The experience of Brazil through the institutional innovation and management of the Brazilian Agricultural Research Corporation (EMBRAPA) could provide a useful pathway for Mali. In addition, as Mali seems to move toward more negative rates of assistance to its agricultural sector, reversing this trend to follow the path of Brazil and Colombia seems necessary in order to support the strong signs of improvement.

Mozambique also faces trouble with agricultural R&D, particularly in the extension system. Few farmers can access the extension services system, as it is concentrated on a small number of crops. Lack of extension has contributed to low uptake of inputs such as fertilizer.[60]

This group of countries should prioritize public investment in R&D and extension services to help push agricultural productivity, remove the anti-agricultural bias and improve the implementation of land reforms.

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[55] Bachewe et al., 2015.
[56] Alila & Atieno, 2006.
[57] Alila & Atieno, 2006.
[58] MER, 2014; Aabo & Kring, 2012; Omiti et al., 2008; Alfieri, Arndt, & Cirera, 2009; Poulton et al., 2002; Ndlela & Robinson, 2009.
[59] MAFAP, 2013.
[60] Alfieri et al., 2009.

Table 3. Policy Options for Focus Countries

Legend: ● : lower priority ●● : medium priority ●●● : higher priority

Transformation context (2015)	Transformed countries (1970)	Matching focus countries (2015)	Public investment — R&D and extension	Public investment — Rural infrastructure	Public investment — Rural health and education	Price interventions — Remove anti-agricultural bias	Price interventions — Trade policy reform [a]	Macroeconomic policies — Monetary and exchange rate policy	Macroeconomic policies — Economic diversification	Land and other institutional reforms — Land reform	Land and other institutional reforms — Credit
High Birth Rates and Scarce Land	China, Indonesia, Malaysia, South Korea and Vietnam	Ethiopia	●●●	●●	●●	●●●	●●●	●●●	●●	●	●●
		India	●●	●●●	●	●●	●●●	●	●●	●●	●●●
		Kenya	●●	●●●	●●	●●	●●●	●	●●●	●	●●
		Rwanda	●●●	●●	●●●	●●●	●●	●●	●●●	●	●
High Birth Rates and Scarce but Fertile Land	Ghana and Thailand	Burkina Faso	●●	●●	●	●●	●●	●●	●●	●●	●
		Malawi	●●	●●	●	●●	●●	●	●●	●	●●
		Tanzania	●●	●●	●	●	●●	●	●●	●	●
		Togo	●●	●●	●	●●	●	●	●●	●	●
		Uganda	●●	●●	●●	●●	●●	●	●●	●	●
		Zambia	●●	●●	●	●●	●	●	●●	●●	●●
Abundant and Fertile Land	Brazil, Colombia	Mali	●●	●●	●●	●●	●●	●	●●	●	●●
		Mozambique	●●	●●	●●●	●●	●	●	●●	●●●	●
		Zimbabwe	●●●	●●	●	●●	●	●	●●	●●●	●●

[a] The two sub-categories for price interventions are interrelated. Trade policy reform refers to the use of trade measures such as tariffs, export taxes, export promotion and sectoral policies. The anti-agricultural bias refers to the relative rate of assistance to agriculture compared to other sectors of the economy. It includes trade measures such as tariffs and subsidies but also other government policies that affect prices, such as input subsidies and direct price controls. It is expressed as positive, negative or neutral, relative to other sectors. This table shows that removing the negative relative rate of assistance (the anti-agricultural bias) was key in the agricultural transformation process.

7. Conclusions

Many lower- and middle-income countries have experienced remarkable progress in transforming agriculture over the past five decades. To understand the drivers of this progress, we built an analytical framework consisting of a global cluster analysis and matched this to existing literature for 27 countries from Africa, Asia and Latin America.

One of the most significant findings is that a country's land endowments and population dynamics often determine whether it should push the agricultural sector as the engine for growth, or rather pull people out of agriculture into other sectors of the economy. Many countries in Latin America with high birth rates and abundant and fertile land per capita succeeded by increasing agricultural productivity. Many Asian countries with scarce land per capita, but high birth rates, succeeded by pulling people out of agriculture and prioritizing non-agricultural productivity. The countries in Africa that have yet to experience the same success—and that had similar characteristics to these countries in 1970—did not pursue the same policies.

Price interventions played a key role in the agricultural transformation process for all the transformed countries, especially removing the anti-agricultural bias. During the periods in which price interventions were relatively higher for agriculture, the process of agricultural transformation was accelerated (e.g., Brazil, Indonesia, South Korea, Vietnam). On the other hand, the lagging countries maintained an anti-agricultural bias for the entire 50-year period (e.g., Ethiopia, Malawi, Togo, Uganda).

However, price interventions are not enough. Public investment is also needed. The literature reviewed found that public investment in research and development and extension services are the most important and tend to work even better when accompanied by strong institutions, provision of credit and investment in primary education. Rural infrastructure is also important, particularly electrification and irrigation.

No country studied succeeded without an appropriate mix of policies and public investment that complemented each other at a given juncture. No single measure alone was sufficient to make good progress. Moreover, the composition of public spending mattered: some countries had very low levels of spending in research and extension and too much focus on input subsidies.

Finally, land reform was key in countries with unequal land distribution (for example in Brazil, South Korea and Vietnam). Gender inequality and discrimination remain persistent and have not been adequately addressed in any of the countries reviewed. Land reform and gender equality will be central in the ongoing transformation process.

Countries that must still make additional efforts can learn from the experiences of those countries that succeeded. They can better prioritize policy approaches and public investments depending on their degree of transformation and their structural endowments. Ultimately, each country will chart its own path with proper attention to the global economic, social and environmental contexts, but it will do that more effectively by drawing on the lessons of the past.

Annex 1. List of Countries and Their Phase of Agricultural Transformation: 2015

1. Industrialized Economies

- Algeria
- Argentina
- Australia
- Austria
- Bahamas
- Bahrain
- Barbados
- Belgium
- Belize
- Brazil
- Brunei Darussalam
- Canada
- Chile
- Costa Rica
- Croatia
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Iceland
- Ireland
- Israel
- Italy
- Japan
- Jordan
- Kuwait
- Latvia
- Lebanon
- Lesotho
- Lithuania
- Luxembourg
- Malaysia
- Malta
- Mauritius
- Mexico
- Netherlands
- New Zealand
- Norway
- Oman
- Poland
- Portugal
- Puerto Rico
- Qatar
- Republic of Korea
- Russian Federation
- Saudi Arabia
- Slovak Republic
- Slovenia
- South Africa
- Spain
- St. Vincent and the Grenadines
- Sweden
- Switzerland
- Trinidad and Tobago
- Tunisia
- Turkmenistan
- United Arab Emirates
- United Kingdom
- United States
- Uruguay
- Venezuela, RB
- Virgin Islands (U.S.)

2. Agriculture Integrated Into the Macro Economy

- Armenia
- Azerbaijan
- Benin
- Cambodia
- China
- Colombia
- Cuba
- Dominican Republic
- Ecuador
- Egypt, Arab Rep.
- El Salvador
- Fiji
- Gabon
- Gambia, The
- Ghana
- Guatemala
- Guyana
- Honduras
- Indonesia
- Iran, Islamic Rep.
- Jamaica
- Kazakhstan
- Kyrgyz Republic
- Morocco
- Nicaragua
- Nigeria
- Panama
- Paraguay
- Peru
- Philippines
- Sao Tome and Principe
- Thailand
- Turkey
- Uzbekistan

3. Agriculture as a Contributor to Growth

- Angola
- Bangladesh
- Cabo Verde
- Cameroon
- Cote d'Ivoire
- Georgia
- Guinea
- India
- Lao PDR
- Mali
- Mauritania
- Myanmar
- Nepal
- Niger
- Republic of Congo*
- Senegal
- Solomon Islands
- Togo
- Vanuatu
- Vietnam

4. Moving Labour Out of Agriculture

- Bolivia
- Botswana
- Burkina Faso
- Djibouti
- Iraq
- Kenya
- Liberia
- Mongolia
- Namibia
- Pakistan
- Republic of Congo
- Sri Lanka
- Tajikistan
- Timor-Leste
- Yemen, Rep.

5. Getting Agriculture Moving

- Afghanistan
- Equatorial Guinea*
- Ethiopia
- Guinea-Bissau
- Madagascar
- Malawi
- Mozambique
- Rwanda
- Sierra Leone
- Swaziland
- Tanzania
- Uganda
- Zimbabwe

6. Subsistence Agriculture

- Central African Republic
- Chad
- DR Congo*
- Eritrea*
- Haiti
- Korea, Dem. People's Rep.
- Somalia*
- South Sudan*
- Sudan*
- Zambia

* There is no underlying data available for this country. The ranking is the authors' estimates for the stage of agricultural transformation.

Structural Indicators by Cluster

Birth Rate

per 1000 persons (Median)

50
40
30
20
10
0

Ag. Land

Square km per capita (Median)

2.5
2.0
1.5
1.0
0.5
0.0

Potential Ag. Productivity

Potential USD per Ha (Median)

2500
2000
1500
1000
500
0

| 1 | Low Birth Rates and Scarce Land | 2 | High Birth Rates and Scarce but Fertile Land | 3 | High Birth Rates and Scarce Land | 4 | Abundant and Fertile Land | 5 | Abundant but Infertile Land |
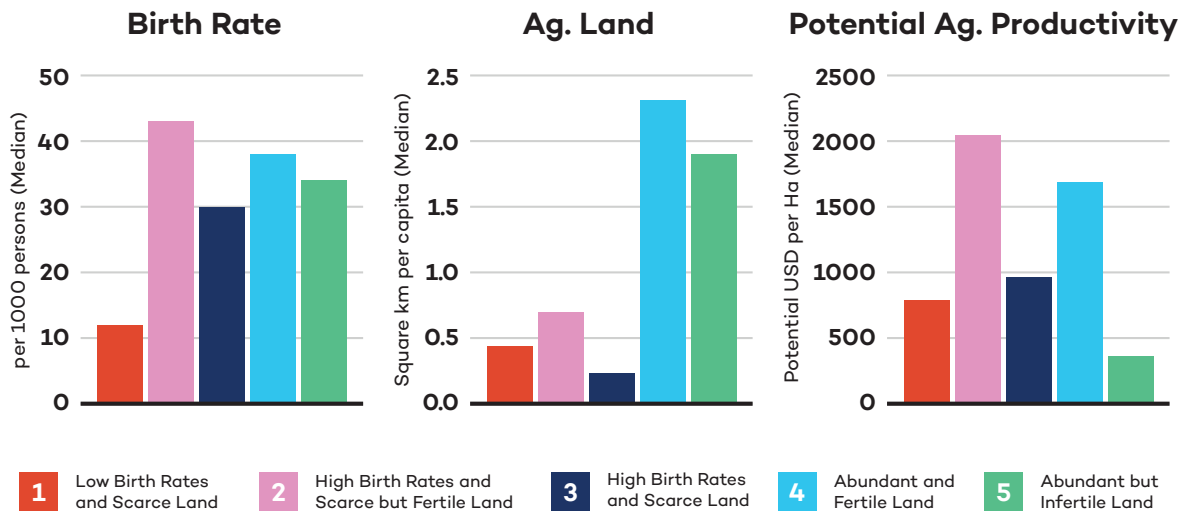
Source: Authors' calculations. Available online here.

Annex 3. List of Countries and Their Transformation Context: 1970

1. Low Birth Rates and Scarce Land

- Austria
- Bulgaria
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Italy
- Liechtenstein
- Netherlands
- Norway
- Poland
- Romania
- Sweden
- Switzerland
- United Kingdom
- United States

2. High Birth Rates and Scarce but Fertile Land

- Bangladesh
- Benin
- Cambodia
- Cameroon
- Central African Republic
- Cuba
- Dominican Republic
- DR Congo
- Gambia, The
- Ghana
- Guinea-Bissau
- India
- Malawi
- Nigeria
- Sierra Leone
- Suriname
- Thailand
- Togo
- Uganda

3. High Birth Rates and Scarce Land

- Belize
- Brunei Darussalam
- Burundi
- China
- Egypt, Arab Rep.
- El Salvador
- Guatemala
- Haiti
- Hong Kong SAR, China
- Indonesia
- Israel
- Jamaica
- Japan
- Kuwait
- Lao PDR
- Lebanon
- Malaysia
- Malta
- Myanmar
- Nepal
- Papua New Guinea
- Philippines
- Portugal
- Puerto Rico
- Republic of Korea
- Rwanda
- Singapore
- Solomon Islands
- Sri Lanka
- Timor-Leste
- Trinidad and Tobago
- Vietnam

4. Abundant and Fertile Land

- Angola
- Argentina
- Bolivia
- Brazil
- Burkina Faso
- Chad
- Colombia
- Cote d'Ivoire
- Gabon
- Guinea
- Guyana
- Kenya
- Liberia
- Madagascar
- Mali
- Mozambique
- Nicaragua
- Panama
- Paraguay
- Republic of Congo
- Senegal
- Swaziland
- Tanzania
- Uruguay
- Venezuela, RB
- Zambia
- Zimbabwe

5. Abundant but Infertile Land

- Afghanistan
- Albania
- Algeria
- Australia
- Bhutan
- Botswana
- Canada
- Chile
- Costa Rica
- Cyprus
- Djibouti
- Ecuador
- Equatorial Guinea
- Ethiopia
- Honduras
- Iran, Islamic Rep.
- Iraq
- Ireland
- Jordan
- Lesotho
- Libya
- Mauritania
- Mexico
- Mongolia
- Morocco
- Namibia
- New Zealand
- Niger
- Oman
- Pakistan
- Peru
- Saudi Arabia
- Somalia
- South Africa
- Spain
- Syrian Arab Republic
- Tunisia
- Turkey
- United Arab Emirates

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