1. EMPLOYMENT, PRODUCTIVITY, AND TRADE IN DEVELOPING-COUNTRY AGRICULTURE

Acknowledgements
This is a chapter from "Cheong, D., Jansen, M. and Peters, R (eds.). 2013. *Shared Harvests: Agriculture, Trade, and Employment*. International Labour Office and United Nations Conference on Trade and Development". The edited volume was produced with the support of the European Union. The contents of this chapter are the sole responsibility of the authors and can in no way be taken to reflect the views of the ILO, UNCTAD, or the European Union.

1.1 INTRODUCTION

Agriculture employs more than a billion people in developing countries. In low- and middle-income countries, the agricultural sector tends to be the primary source of employment. Productivity increases in the agricultural sector - through the use of more efficient inputs and better technology - can not only raise agricultural output but also improve the work conditions of agricultural workers. More broadly, higher agricultural productivity is considered to be a key driving force of structural transformation and economic development. Trade policy and trade flows can have an important impact on both employment and productivity in the agricultural sector. Trade also affects access to agricultural products, whether produced domestically or abroad, in various ways. Thus, the links between employment, productivity, and trade in agriculture are crucial to understanding why policies related to agriculture are often considered sensitive, why the agricultural sector remains controversial in trade negotiations, and why agriculture is at the heart of the development debate.

This chapter provides an overview of the characteristics of and trends in agricultural trade and employment in developing countries. We also look at the relationship between productivity and employment in the sector. By focusing on these topics, this survey contributes to the broad literature on the role of agriculture in development and the more specific literature on linkages between trade and employment in developing countries.[2]

The agricultural sector has fallen in and out of favour among development thinkers and policy-makers several times in the last six decades. In the 1950s and

[1] Marion Jansen contributed to this chapter during her stay at the International Labour Office (ILO) as the Head of the Trade and Employment Programme of the ILO's Employment Sector. The opinions expressed in this chapter can in no way be taken to reflect the views of the ILO or the World Trade Organization (WTO).

[2] See Dethier and Effenberger (2011) for a brief review of the literature on agriculture and development. For an overview on the linkages between trade and employment in developing countries, see Jansen and Lee (2007) and Jansen et al. (2011).

1960s, development strategies strongly emphasized industrialization and urbanization. Governments taxed agriculture through overvalued exchange rates and export taxes while affording trade protection and investment to manufacturing activities (for Latin America see Baer, 1972, and for East Asia see Wade, 2003). In the 1970s development policy began to acknowledge that, in the development process, squeezing agriculture was not a sustainable strategy. Agriculture was not just a "resource reservoir" but rather a sector interdependent with the rest of the economy (Timmer, 1988). Hence, the agricultural sector was integrated into development planning and modernization efforts, with an emphasis on the mechanization and industrialization of agricultural production. International development aid became increasingly directed at developing-country agriculture; the "Green Revolution" was one of its most important results. Agricultural modernization, however, had an immediate and significant impact in only a minority of countries and in most of the developing world proceeded slowly. In the 1990s and 2000s, the development community's focus shifted away from agriculture again. Success in the manufacturing and services sectors of East and South Asia, respectively, drew attention back to "engines of growth", while governance issues took centre stage in reform efforts. The agricultural sector's share of international development aid dwindled from about 10 per cent in the mid-1990s to about 5 per cent in the mid-2000s (Islam, 2011). More recently, there have been calls to put agriculture back onto the development and trade agenda, given fears for food security and the ecological consequences of industrial agriculture as well as concerns that developing countries have been left out of or short-changed in globalization processes (Byerlee et al., 2009).

Following this introduction four sections form the core of this chapter. Section 2 looks at patterns and trends in developing-country agricultural employment. It also discusses the terms and conditions of employment, wages and earnings, and mobility of agricultural workers in developing countries. Section 3 focuses on agricultural productivity and its effects on the employment structure of a representative developing country. This section also discusses agricultural innovation in developing countries and obstacles to modernizing agriculture. Section 4 surveys the nature and extent of agricultural trade policies and domestic support measures in developing countries and the distortions caused in agricultural markets. It also discusses how linkages between developing-country agriculture and global markets affect agricultural terms of trade, price volatility, and food security. The section also assesses the potential for regional trade agreements to liberalize agricultural trade. Section 5 reviews the evidence and provides an analysis of the impact of trade liberalization on agricultural employment in developing countries. Section 6 provides our conclusions and the policy implications of the findings.

1.2 AGRICULTURAL EMPLOYMENT IN DEVELOPING COUNTRIES

In developing countries about 50 per cent of workers are employed in the agricultural sector. In contrast, in developed countries agriculture employs just over 4 per cent of workers. Thus, 98 per cent of the world's agricultural workers are employed in

developing countries. Although agriculture is the largest employer in most developing countries, there are wide regional differences in the agricultural share of the labour force. Table 1.1 shows that the share in East Africa in 2010 was almost 75 per cent, whereas that in South America was only 13 per cent.

Since 1980 agricultural shares of the labour force have declined in all countries, both developed and developing. Table 1.1 shows that the importance of agricultural employment has fallen most in North Africa and in West Asia and the Middle East;

Table 1.1: Economically active population, agricultural share of labour force, and change in agricultural share of labour force by region, 1980, 1995, and 2010

Geographic units	Total economically active population (millions)			Agricultural share (% of total)			Percentage point change in agricultural share, 1980 to 2010
	1980	1995	2010	1980	1995	2010	
World	1 895	2 575	3 282	50.4	46.1	39.9	–10.5
Countries in developed regions	542	575	625	13.1	7.5	4.2	–8.9
Countries in developing regions	1 353	2 001	2 657	65.3	57.2	48.2	–17.1
Africa	173	268	408	68.4	60.3	53.1	–15.3
Sub-Saharan Africa	148	227	347	71.9	65.4	58.4	–13.5
Middle Africa	21	34	51	73.9	67.0	57.7	–16.2
East Africa	61	97	153	84.7	80.6	74.5	–10.2
North Africa	32	50	75	53.1	37.8	28.3	–24.8
West Africa	48	71	108	65.7	55.6	46.4	–19.3
Asia excluding Japan	1 053	1 533	1 964	68.6	61.1	52.0	–16.6
Central Asia	n.a.	21	29	n.a.	27.6	20.5	n.a.
East Asia excluding Japan	527	737	856	72.4	67.2	58.6	–13.8
South-East Asia	148	221	299	63.2	56.0	46.8	–16.4
South Asia	349	497	700	67.2	59.3	51.1	–16.1
West Asia and Middle East	29	57	81	44.0	30.4	19.2	–24.8
Latin America and the Caribbean	126	196	280	33.6	22.0	14.8	–18.8
Caribbean	11	14	18	33.6	25.3	20.4	–13.2
Central America	30	46	64	37.5	26.8	18.6	–18.9
South America	85	135	197	32.3	20.0	13.0	–19.3
Oceania excluding Australia and New Zealand	2	3	4	72.1	65.8	59.0	–13.1

n.a.=not available

Source: Adapted from FAO, 2011, table A4. The agricultural sector includes agriculture, hunting, fishing, and forestry.

in both regions there has been a 24.8 percentage point decline in the agricultural share of the labour force.[3] From a continental perspective Africa and Asia (excluding Japan) experienced similar declines in the proportion of workers in agriculture, with almost the same starting and end points.

This change in the sectoral composition of employment has occurred for two main reasons. First, the structure of world production has changed. The share of agricultural value-added in World gross domestic product (GDP) fell from 6.6 per cent in 1980 to 3.2 per cent in 2010 (World Bank, 2011). In low- and middle-income countries, this share fell from 20.7 per cent in 1980 to 10.2 per cent in 2010, while in high-income countries it declined from 4 per cent in 1980 to 1.3 per cent in 2010. Worldwide, there has been a clear structural shift in economic production from agriculture to manufacturing and services. Second, there has been an increase in the productivity of agricultural workers, which has therefore reduced labour demand in agriculture. High-income countries have seen the average value-added per worker in agriculture rise by almost 300 per cent from 1980 to 2009, while in low- and middle-income countries the increase in productivity has been about 75 per cent.

Despite relative declines, the agricultural sector continues to be an important source of employment in developing countries. As can be gleaned from table 1.1, the absolute number of agricultural workers has increased worldwide, from 955 million in 1980 to 1.31 billion in 2010. Since 1980 countries in developing regions have accounted for well over 92 per cent of the world's agricultural workers. In absolute terms these countries accounted for 884 million agricultural workers in 1980 and 1.28 billion in 2010.

1.2.1 Forms of agricultural employment

Employment in developing-country agriculture takes different forms, depending on production orientation, technique used, and crops planted, which are themselves interrelated. Production orientation is defined as the value-driven aims of and constraints on agricultural activity (Van Ittersum and Rabbinge, 1997). Agricultural production may be oriented towards subsistence (own immediate consumption) or towards sale in domestic or export markets. In an analysis of 14 developing countries around the year 2000, Davis et al. (2007) find that 60 to 99 per cent of rural households participated in agriculture and derived some part of their income from it. In each of these countries, except Nigeria and Ghana, less than 15 per cent of rural households were subsistence-oriented.[4] A household was classified as subsistence-oriented if 50 per cent or less of its agricultural production was sold to the market. On average, 32 per cent of

[3] North Africa includes Algeria, Egypt, Libya, Morocco, Sudan, Tunisia, and Western Sahara. West Asia and the Middle East covers Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, the Occupied Palestinian Territory, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, and the United Arab Emirates.

[4] The countries were Albania, Bangladesh, Ecuador, Ghana, Guatemala, Indonesia, Madagascar, Malawi, Nepal, Nicaragua, Nigeria, Pakistan, Panama, and Vietnam.

rural households derived more than 75 per cent of their income from wage employment in both farm and non-farm activities. Another 34 per cent of households, on average, had diverse sources of income from sale of their own farmed products, wage employment in farm and non-farm activities, and urban employment.

Subsistence agriculture is characterized by high labour intensity and minimal use of other inputs. It is carried out by poor farmers on small plots that are mainly communal. Employment in subsistence farming comprises self-employment, family employment, and some wage labour provided by very poor, often landless, households. Taylor (2001) conducted an employment-based analysis of agriculture on the Yucatan Peninsula, where subsistence farming dominates. Peasant farmers and their families use a traditional Mayan production system (*milpa*) of rotational slash-and-burn agriculture to grow corn, beans, and squash. The traditional rotation period, 16 to 25 years, in this system is sufficiently long for sustainable agricultural production, but population growth and conversion of fields to pastures for cattle ranching has shortened the rotation period to six to eight years. The land has become less fertile, farming productivity has dropped, and nutrition levels have fallen. Some farmers have invested in improved technology (improved *milpa*) to reverse these trends. Taylor estimated that the traditional system provided employment for about 32 people per 100 ha per year, while the improved system more than doubled labour requirements, to 75 people per 100 ha per year. He estimated that cattle ranching employed only

Table 1.2: Size of land holdings and production technique

Type of holdings	Production technique
Micro holdings very limited area	• subsistence agriculture
Small holdings under 10 ha	• traditional methods • small cattle-raising • small locally marketable surplus
Middle-sized farms 10 to 50 ha	• traditional methods and semi-mechanized agriculture • small cattle-raising • nationally and internationally marketable production
Large farms 50 to 500 ha	• advanced mechanized agriculture with great use of chemicals • intensive and extensive industrial agriculture and cattle raising • nationally and internationally marketable production
Larger farms above 500 ha	• advanced mechanized agriculture with great use of chemicals • intensive and extensive industrial agriculture • large cattle-raising • nationally and internationally marketable production

Source: ILO, 2000a.

5 people per 100 ha per year, but, in monetary terms, cattle ranching was the most profitable. Taylor concluded that, "if policymakers are concerned about sustainability, increased employment for the poor, and a more equitable distribution of income, they should promote traditional *milpa* over cattle production and improved *milpa* over traditional *milpa*."

Market-oriented, or commercial, agriculture is aimed at supplying food and fibres to domestic and export markets. Higher agricultural productivity distinguishes market-oriented agriculture from subsistence farming. The most productive market-oriented farms tend to export. Commercial farms specialize in cash crops, notably grain and horticulture. Land use tends to be on a larger scale, with more mechanization and the use of chemical fertilizers and pesticides and high-yielding seed varieties (table 1.2). Hence, the labour intensity of production is reduced, in general. However, given larger output, market-oriented farming tends to increase the absolute level of employment while creating more differentiation and specialization of agricultural employment by skills and tasks, e.g. tilling, ploughing, sowing, planting, weeding, reaping, harvesting and herding. Self-employment and family employment decline, while temporary wage labour (which is seasonal, subcontracted, and/or migrant) assumes a larger share of agricultural employment. Larger farms may also employ permanent wage labour.[5]

Traditional production techniques, which characterize subsistence and small-scale farming, require the intensive use of human and animal labour. In a study of agriculture in the Muzaffarnagar district of western Uttar Pradesh in India, Parikh (1985) found that farms were rarely mechanized, and farmers operated mainly with labour provided by the farmers themselves, their families, animals, and wage labour. Moreover, he found that: (i) On small farms wage labour could substitute for the farmer's own labour and family labour, while on medium-size farms this relationship did not hold. (ii) Hired labour was more price-elastic for small farms, and so, if the wage rate was raised, there were greater reductions in employment on small-size farms than on medium-size farms. (iii) On medium-size farms the use of major implements was complementary to family labour, which suggests that more mechanized tasks were allocated to family workers instead of to hired hands.

Mechanized production techniques tend to be labour-saving. In an early set of International Labour Office (ILO) country studies (1973), the use of tractors was found to displace labour in certain countries in East Africa, Latin America, and East and South Asia. In a study of the North-West Frontier Province (currently Khyber Pakhtunkwha) of Pakistan, Ali and Parikh (1992) also found that tractors had substituted for human labour. They suggested that, since tractors had no significant effect

[5] For example, Labowitz 2007) documents that in Karnataka and Maharashtra, India, hybrid vegetable seed production requires a long-term, stable workforce to carry out the specialized production activities. Farmers, therefore, make long-term arrangements with workers by making pre-season payment advances and loans to them. Collins and Krippner (1999) document the predominance of permanent labour contracts among workers on vineyards in the Sao Francisco Valley in Brazil in the early 1990s.

on productivity and cropping intensity, tractorization could not promote labour absorption. They also found that: (i) Seeds were complements to labour, i.e., a reduction in the price of seed induced more demand for labour. (ii) Changes in the prices of other inputs had no significant effect on the demand for labour. (iii) An increase in output due to technological change (either introduction of high-yielding varieties or changes in the crop mix) did not have labour-displacing effects.

The timing of and level of demand for different types of agricultural labour vary according to which crops are planted, crop duration, and crop combination. For example, on a per-hectare basis, gram and barley require less labour than wheat and rice, which in turn have lower labour requirements than fruit and vegetable production (see Bala and Sharma, 2005, for an example from India). Labour demand and the set of required agricultural tasks also are influenced by land characteristics and irrigation. The size of plots determines the feasibility of animal or vehicle tractors (and less use of labour); soil fertility determines whether agricultural workers apply fertilizer; and the availability and quality of water determine if agricultural workers need to draw and carry water from tanks, wells, or rivers.

In many developing countries there has been a decline in average smallholder farm sizes and an increase in landlessness over the past 50 years. The 2011 Rural Poverty Report (IFAD, 2010, p. 89) provides examples: (i) In India average landholding size fell from 2.6 hectares in 1960 to 1.4 hectares in 2000. (ii) In Bangladesh, the Philippines, and Thailand, average farm sizes have declined and landlessness has increased over approximately the last 20 years. (iii) In Cambodia rural landlessness went from 13 per cent of the population in 1997 to 20 per cent in 2004. (iv) In eastern and southern Africa, cultivated land per capita has halved over the last generation, and, in a number of countries, the average cultivated area per capita today amounts to less than 0.3 hectares. These trends in land distribution have been driven by increasing concentration of land ownership, land degradation, and rapid population growth.

1.2.2 Terms and conditions of agricultural employment

Agricultural employment is physically demanding. Workers are prone to physical injury due to the intense rhythm and long duration of work (i.e. the workday varies from 9 to 12 hours per day, with a few short breaks) and the difficult working postures for agricultural tasks. Health problems are common because workers are in the open air and are exposed to allergens, poisons, parasites, chemicals, and biological products.

Farm workers in developing countries usually engage in multiple activities, such as household production, trading, agro-processing, manufacturing, commercial, and service activities on a small scale. Rural households engage in these non-farm activities to provide consumption goods (such as clothing, processed food, furniture, and household items) and farm inputs (such as ploughs and tools) for themselves or for sale to others.

In the ILO LABORSTA database, workers whose main activity is in agriculture are classified according to the following employment-status categories: (i) employees,

(ii) employers, (iii) own-account workers, (iv) members of producers' cooperatives, and (v) contributing family workers. The first category, employees, includes all hired agricultural workers; their wages may be pecuniary (fixed, daily or monthly, or at a piece rate) or in kind. The contractual arrangements for wage workers may be formal or informal, permanent or temporary, and explicit or implicit about tasks and remuneration. The second category, employers, refers to farmers who hire labour and typically own or lease farm assets such as land and equipment. The third category, own-account workers, consists of self-employed farmers who are independent and do not have any employees. The fourth category, members of producers' cooperatives, refers to persons who are active members of an agricultural cooperative. The fifth category, contributing family workers, consists of rural family members, often women and children, who work without pay.

Table 1.3 reports the mean shares of agricultural workers by employment status from a sample of 42 developing countries over the period 2001 to 2008. The average shares show that, globally, own-account workers (with an average share of 38 per cent) form the largest group of agricultural workers. Agricultural wage workers are the second largest group, with an average share of 30 per cent. On average, about one-quarter of agricultural workers are contributing family workers. These figures suggest that informal employment is widespread in developing-country agriculture, as own-account workers and contributing family members, who together account for 62 per cent of the agricultural workforce, are often informally employed (Bacchetta et al., 2009). The predominance of informal workers in developing-country agriculture reflects the low wages paid to formal agricultural employees and insufficient employment opportunities in the regulated sectors of the economy.

Table 1.3: Shares of the agricultural workforce by employment status in developing countries, 2001 to 2008

	Employees	Employers	Own-account workers	Members of producers' cooperatives	Contributing family workers	Not classifiable
Global	30%	6%	38%	0.52%	24%	2%
South-East Asia	12%	22%	35%	0%	28%	4%
Europe and central Asia	26%	2%	53%	0.36%	19%	0%
Latin American and the Caribbean	40%	7%	34%	1%	17%	2%
Middle East and North Africa	25%	7%	30%	0.26%	38%	0%
South Asia	4%	1%	50%	0.60%	45%	1%
Sub-Saharan Africa	44%	3%	23%	0%	24%	7%

Source: Authors' computations using statistics from the ILO database LABORSTA (2012). The sample included 42 countries that reported employment status data by the International Classification by Status in Employment (ICSE) 1993 classification in the period 2001 to 2008. The global shares are the sample means, and the regional shares are the sample means of countries within each region.

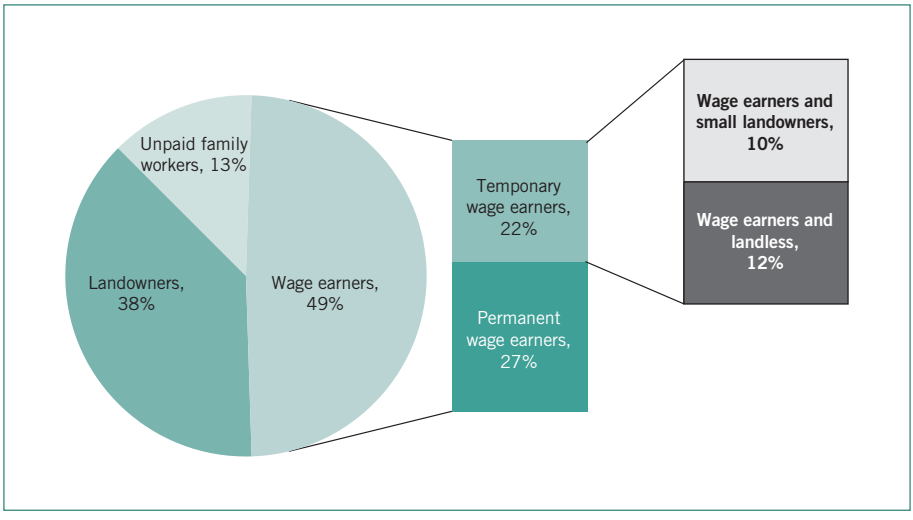
The regional mean shares of agricultural workers by employment status in table 1.3 show that own-account workers are dominant in the developing countries of Europe and central Asia and South Asia. Family labour is relatively widespread in the Middle East and North Africa. In contrast, employees (or wage workers) account for the largest share of the agricultural labour force in sub-Saharan Africa and in Latin American and the Caribbean.

In most developing countries except for certain Central and South American countries, the share of the agricultural workforce attributable to wage labour is increasing (World Bank, 2007, chapter 9). In India, Brazil, and Chile, more than half of agricultural wage workers are temporary (ILO, 1996). In contrast, in Central America temporary wage workers represent less than half of agricultural wage workers. The significance of permanent labour contracts in Central American agriculture may reflect the dominance of large-scale, export-oriented agriculture, the output of which must meet high product standards that necessitate more control over the quality of agricultural work (Collins and Krippner, 1999). However, besides having unstable work, temporary wage workers in Central American agriculture also tend to be landless or smallholders (figure 1.1).

1.2.3 Wages and earnings in developing-country agriculture

Wages earned in the agricultural sector tend to be lower than in the rest of the economy, including the rural non-farm and manufacturing sectors. Table 1.4 compares average agricultural earnings or wages in the period 2000–2008 to those in manufacturing for selected low-income and lower-middle-income countries. In these countries

Figure 1.1: Distribution of agricultural workers by category in Central America



Source: ILO. Project RLA/93/MO3/DAN – Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama (Geneva, 1998), unpublished; quoted in ILO (2000b).

earnings or wages from agriculture were, on average, 60 per cent of those in manufacturing. The relative earnings ratio was as low as about one-quarter in Kyrgyzstan and Nicaragua. Only Swaziland and Fiji had ratios above one, but not by much. Without these outliers, the average earnings or wages of agricultural workers relative to those of manufacturing workers was about 60 per cent. From 1980 to the present, agricultural wages have been declining absolutely in most Latin American countries but increasing in most Asian and African countries (World Bank, 2007, chapter 9).

A number of factors independent of the sector of activity may explain part of the difference in earnings between agricultural and manufacturing workers reflected in table 1.4. Agricultural workers may be willing to accept lower earnings or wages because the cost of living is lower in rural areas; they are often compensated in kind; and the work may not require as much training or skills as work in manufacturing. Productivity differences provide a broader explanation for the wage gap, however. Gollin et al. (2011), using a sample of more than 100 developing countries, find that agricultural workers are initially only one-quarter as productive as workers in the rest of the economy; the productivity ratio rises to 50 per cent after adjustment for omitted

Table 1.4: Average earnings or wages of agricultural and manufacturing workers in selected developing countries in the period 20002008 in US dollars

Country	Type of Data	Agriculture (A)	Manufacturing (M)	Relative (A/M)
Nicaragua	Earnings per month	53.36	220.56	0.24
Kyrgyzstan	Earnings per month	23.32	92.32	0.25
Tanzania, United. Rep. Of	Wage rates per month	62.45	155.92	0.40
El Salvador	Earnings per month	94.04	214.01	0.44
Tajikistan	Earnings per month	9.72	21.76	0.45
Moldova	Earnings per month	58.18	124.99	0.47
Madagascar	Earnings per hour	0.48	1.01	0.48
Philippines	Wage rates per day	2.38	4.96	0.48
Georgia	Earnings per month	63.35	128.97	0.49
Ukraine	Earnings per month	82.83	351.04	0.50
Sri Lanka	Earnings per day	1.70	3.23	0.53
Indonesia	Wage rates per month	50.61	90.54	0.56
Guatemala	Earnings per month	157.29	276.26	0.57
Mongolia	Earnings per month	60.11	103.62	0.58
Paraguay	Earnings per month	110.92	161.44	0.69
Syrian Arab Republic	Earnings per month	574.23	759.47	0.76
Armenia	Earnings per month	93.41	120.43	0.78
Egypt	Earnings per week	25.72	32.51	0.79
Swaziland	Earnings per month	464.28	456.35	1.02
Fiji	Wage rates per day	10.75	10.19	1.06

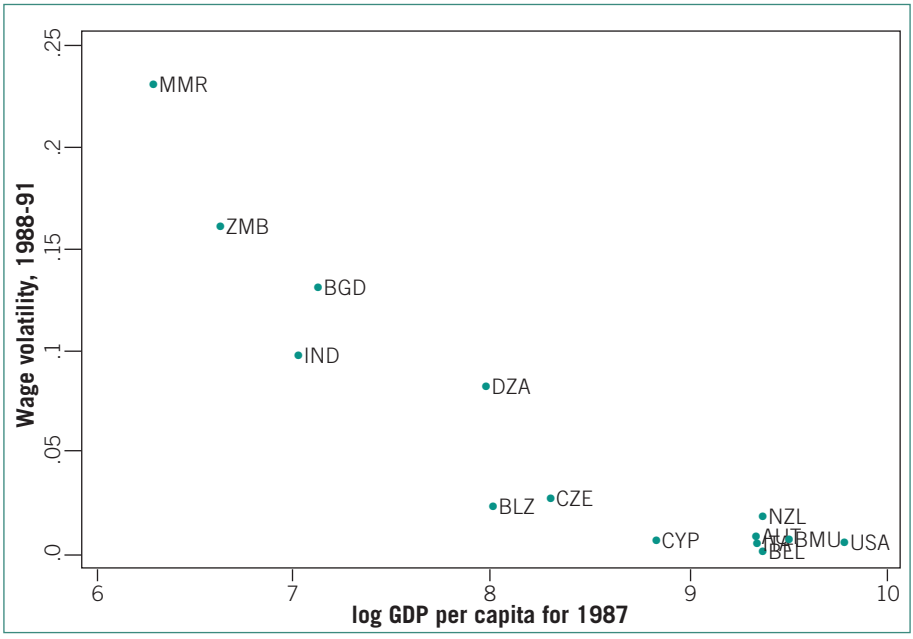
Notes: (i) Source: ILO LABORSTA database (2012). (ii) The countries shown are low- and lower-middle income countries (per the World Bank income classification in 2011) for which relevant wage or earnings data (in local currency units) are available in any year from 2000 to 2008. (iii) All wage or earnings data refer to those of both men and women, except for Swaziland, which are for men only. (iv) Exchange rates for conversion of local currency to US dollars come from the World Development Indicators.

factors. Education appears to be one of the factors explaining productivity differences and resulting wage differences, as wage differences tend to disappear once educational differences are taken into account. In the 2008 World Development Report (p. 212), a comparison of agricultural and rural non-farm workers with no schooling in India, Mexico, and Uganda found little difference in the distribution of wages.

Not only are the wages and earnings of developing-country agricultural workers lower than those of their counterparts in other sectors, they also are more volatile. Agricultural workers' wages and earnings are subject to uncertainties in the weather, risks of land degradation or dispossession, fluctuating prices and availability of farm inputs and outputs, and personal and household ill health. The lack of finance and insurance markets and limited social security provision prevent developing-country farm workers from insuring against or avoiding the risks mentioned above.

Using a sample of countries, Jayachandran (2006) plots agricultural wage volatility in 1988–91 against GDP per capita in 1987 (figure 1.2).[6] There was a clear negative relationship between national average incomes and agricultural wage volatility.

Figure 1.2: Agricultural wage volatility versus gross domestic product (GDP) per capita



Source: Jayachandran (2006). Wage volatility is calculated from Occupational Wages around the World (OWW) data (Freeman and Oostendorp, 2000). The log of annual real GDP per capita (in 1996 US dollars) is taken from the Penn World Tables. The sample consists of all countries for which farm worker wage data are available for each year in the 1988–91 period (AUT=Austria, BGD=Bangladesh, BEL=Belgium, BMU=Bermuda, BLZ=Belize, CZE=Czechoslovakia, CYP=Cyprus, DZA=Algeria, IND=India, ITA=Italy, MMR=Myanmar, NZL=New Zealand, USA=United States, and ZMB= Zambia). The OWW data set covers 1981–99; the 1988–91 period yields the largest balanced panel with at least four years per country. The patterns are similar when other subsamples are used.

[6] Agricultural wage volatility is defined as the standard deviation of log average monthly real wages for a male field crop farm worker after removing a country specific linear trend.

1.2.4 Agricultural worker mobility

Given lower and more volatile wages and earnings, why do developing-country agricultural workers not move out of the sector? Duryea at al. (2006) analyse workers' employment transitions in nine low- and middle-income countries, and they find evidence for much more persistence in agricultural employment than in non-agricultural employment.[7] The lack of agricultural worker mobility in developing countries can be ascribed to limited incentives and numerous obstacles. On the incentive side, many developing countries have not been able to industrialize, diversify their economic structures, and provide sufficient non-agricultural employment opportunities. Employment in other sectors is not only scarce but also involves giving up a secure means of obtaining food. Developing-country farmers may also be reluctant to sell or lease their land, equipment, or other farm assets because of weak property rights.

The location of the agricultural workforce in rural areas is also an obstacle to changing sectors, since most non-agricultural activities are conducted in cities.[8] Hardly any information on urban job vacancies reaches the rural population because formal communication channels are poor.[9] If there are vacancies, the costs of moving to urban areas and settling in tend to be relatively higher in developing countries due to a lack of transport and rigid housing markets. Urban social networks can contribute to reducing costs of travel and settlement (Nadal, 2000), but the higher costs of urban living may nevertheless deter agricultural workers from seeking jobs in the cities. In addition, there may be psychological costs of migration such as leaving family and friends or facing alienation or discrimination in the new urban setting. Workers who do decide to move to the city in hopes of finding a better-paid job often end up in the urban informal sector.

Another important obstacle to leaving agriculture is a lack of human and financial capital. The majority of agricultural workers in developing countries have only limited schooling and little access to non-farm vocational training. Their skills and knowledge are generally not transferable to the non-farm sector. A lack of financial capital prevents workers in agriculture from purchasing the necessary inputs to participate in cottage industry for local rural markets or in larger supply chains as sub-contractors.

1.3 PRODUCTIVITY IN DEVELOPING-COUNTRY AGRICULTURE

Although the agricultural sector is the largest employer in developing countries, it produces on average only 10 per cent of value added in GDP among low- and middle-

[7] Voluntary out-migration does occur, however. Hom et al. (2012), for instance, find evidence of significant out-migration and urbanization for remunerative employment in rural Nepal.

[8] In 2000, 60 per cent of the population in developing countries still lived in rural areas (Cohen, 2006). Most of these people were employed in agriculture and were significantly poorer than their urban counterparts.

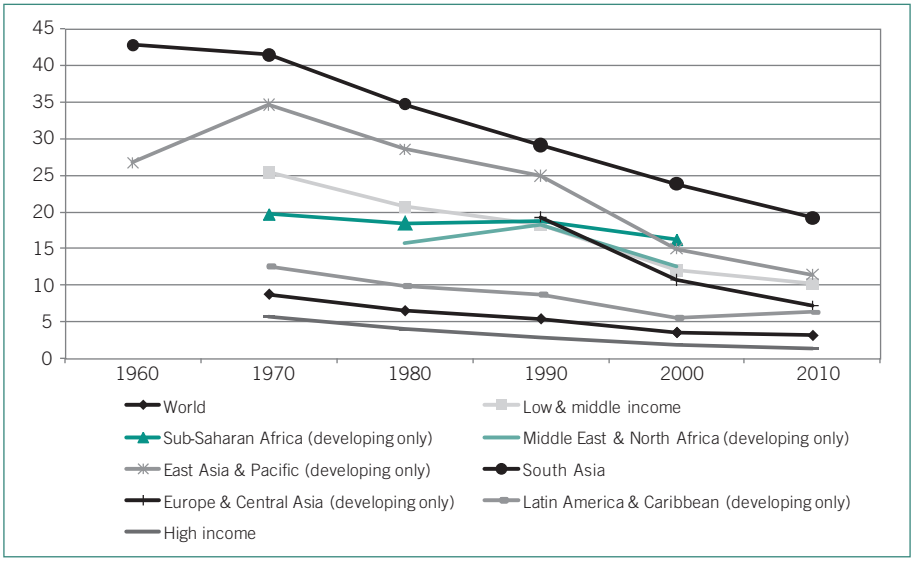
[9] Murphy and Strobl (2008) find in Trinidad and Tobago that barriers to information flows between potential employers and employees are highest in the informal sector, in rural areas, and among women.

income countries. The low share of agricultural value-added is the result of at least 40 years of structural transformation, albeit at varying speeds, in developing countries. Figure 1.3 shows that agriculture's share of value added in GDP has declined in all developing regions since 1960. South Asia and East Asia and the Pacific recorded the steepest drops in the contribution of agriculture to GDP. The fall for South Asia was 24 percentage points between 1960 and 2010, and that for East Asia and the Pacific was the same between 1970 and 2010. Agriculture in other developing regions did not contract as much, but these regions began with already lower shares in 1970. Over three decades agriculture's share in sub-Saharan Africa fell by only four percentage points.

The fact that agriculture absorbs the majority of workers but produces just one-tenth of output in developing countries implies that developing-country agricultural workers are less productive than their counterparts in other sectors. As mentioned in the previous section, value added per worker in agriculture is typically only one-quarter of that in the rest of the economy, and in certain developing countries, as low as one-eighth (Gollin et al., 2011). Low labour productivity in agriculture reflects several important characteristics of production and of workers in the sector in developing countries.

First, as described in section 1.2, agricultural production is still very labour-intensive. There is little mechanization, and much farm work is done manually with simple tools. Thus, there is high demand for labour in agricultural production relative to other sectors and in comparison with the agricultural sector in industrialized countries.

Figure 1.3: Trend in agricultural value added as a share of GDP from 1960 to 2010 by region (in per cent)



Source: World Bank, 2011.

Second, technical improvement and innovation in agricultural production have been limited and patchy. Agricultural research, which is grossly underfunded in developing countries (Beintema and Elliott, 2009), and the Green Revolution have had an uneven impact on the developing world.[10] Crop genetic improvements led to significant increases in yield in Asia and Latin America in the 1960s and 1970s, but gains arrived in the Middle East and North Africa only in the 1990s, and sub-Saharan Africa has yet to experience significant impact (Evenson and Gollin, 2003). High-yield crop varieties, advanced farming and irrigation technologies, and sophisticated fertilizers and pesticides remain out of reach for most developing-country farmers. Their unavailability or inaccessibility due to cost has kept developing-country agricultural productivity relatively low and lagging far behind that of developed countries.

Third, to supplement and diversify their incomes, many developing-country agricultural workers are also engaged in non-farm employment that competes for their time and effort. Haggblade et al. (1989) find that in sub-Saharan Africa 15 to 65 per cent of farmers have secondary employment in the non-farm sector, and 40 per cent of total family labour hours are devoted to income-generating non-farm activities. In a multi-country analysis of rural household data, Davis et al. (2009) find that off-farm sources of income account for 50 per cent of total income in almost two-thirds of the low-income countries in their dataset. Diversification into non-farm activity reduces the amount of time devoted to farming and limits the amount of agricultural output that is produced. Further, many developing-country farmers also engage in subsistence farming. Although this contributes to agricultural production, subsistence farm output is often unaccounted for in national statistics.

Fourth, farmers' lack of access to finance and education plays an important role in explaining low farm productivity. Financial market failure limits the adoption of new technologies by developing-country farmers, particularly smallholders, whose assets may not be sufficient to provide collateral for loans or to bear the risks of investment in technology.

Lastly, as described in section 1.2.2, there is often a tenuous employment relationship between the farm/plantation owner and the hired hand. Many agricultural workers are hired seasonally and paid on a task or piece-rate basis (ILO, 1996). Recruitment is often subcontracted to middlemen. Given the short-term nature of work arrangements, neither agricultural workers nor their employers have an incentive to invest in learning or training to improve the efficiency of agricultural production.

1.3.1 A model of agricultural productivity and developing-country employment

On the basis of the above, it is reasonable to expect that improvements in agricultural productivity can play a major role in improving working conditions in rural areas.

[10] See FAO (2003) for a discussion of the impact of the Green Revolution on poverty and levels of malnutrition.

But productivity increases in agriculture will also affect employment levels and conditions in other parts of the economy. In order to explain the relevant mechanisms and provide a sense of the magnitudes involved, we use in the following analysis a stylized model (Satchi and Temple, 2009) to assess the employment effects of productivity increases in agriculture.

The model represents a small, open economy with three sectors – urban manufacturing, urban informal, and rural agriculture.[11] The urban manufacturing sector uses labour and capital to produce manufactured goods, while the rural agricultural sector uses labour and land to produce agricultural commodities. The prices of manufactured and agricultural goods are exogenously fixed by world prices. The urban informal sector consists of only self-employment and requires neither capital nor land. In this model the total labour force is fixed and divided between urban and rural employment. Workers can move freely between the urban informal sector and the rural agricultural sector, which can offer as many jobs as demanded. However, the attraction of higher wages in the urban manufacturing sector induces some agricultural workers to migrate to the city. The expected urban manufacturing wage of each migrant is determined by the level of the urban manufacturing wage and the probability of finding employment in the urban manufacturing sector.

The supply of urban workers is the sum of existing urban workers and rural-to-urban migrants. Urban workers are either employed by a firm in the manufacturing sector or self-employed in the informal sector. In the model, manufacturing employment is a function of manufacturing labour demand, the efficiency of the job–worker matching process, and the supply of urban workers. The model allows workers in the urban informal sector also to search for higher-paid jobs in the formal sector. Because of matching frictions in the formal sector, the model results in some workers being unsuccessful in their search for formal jobs, and, thus, they are left underemployed in the urban informal sector. Matching depends on the search efforts of the informal-sector workers and the number of vacancies.

The model assumes that all workers in the labour force are employed. This is not an unrealistic assumption as in developing countries lack of employment opportunities is more likely to result in precarious employment than in unemployment.[12] In our model informal urban employment reflects a form of precarious employment, as those informally employed in urban areas have the combined disadvantage of low incomes and high costs of living. In the model the share of urban informal workers in the total labour force thus provides a measure of precarious employment. A reduction in this share can be interpreted as an improvement for workers.

---

[11] This model combines elements of the Harris–Todaro model of rural–urban migration with Mortensen–Pissarides labour market matching frictions.

[12] The pool of unemployed in the standard Mortensen-Pissarides model corresponds to informal urban employment in the Satchi-Temple model used here.

Table 1.5: Qualitative labour market implications of an increase in agricultural productivity in the Satchi–Temple model

Labour market indicators:	**Effect**
Urban labour force	–
Share of agricultural workers in total labour force	+
Share of urban informal workers in urban labour force	–
Share of urban informal workers in total labour force	–
Agricultural wage	+
Manufacturing wage	+
Manufacturing to agriculture wage ratio	–
Search effort	+

Notes: Adapted from Satchi and Temple (2009). Results are for the version of the model with a closed capital account and wage bargaining instead of efficiency wages.

Table 1.5 shows the effects of an increase in agricultural productivity in qualitative terms. A rise in agricultural productivity reduces the urban labour force because of increased urban-to-rural migration. The ratio of urban informal workers to urban manufacturing workers also falls because migrants are assumed to leave from the urban informal sector rather than from the manufacturing sector. Interestingly, wages in both agriculture and manufacturing rise; agricultural workers are more productive, while manufacturing workers can bargain up their wages, given the smaller pool of urban workers.[13] However, the increase in the wages of agricultural workers outweighs that of manufacturing workers, leading to a drop in the manufacturing-to-agricultural wage ratio. The higher manufacturing wage, nevertheless, causes the remaining urban informal workers to intensify their search for formal manufacturing jobs.

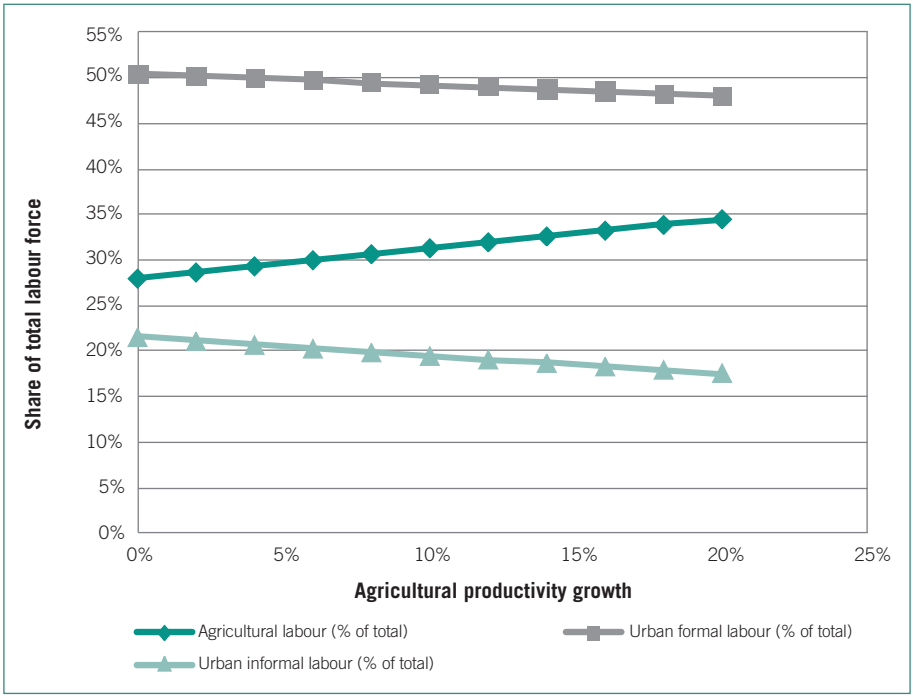
To gauge magnitudes, Satchi and Temple (2009) calibrate their model using data from Mexico. As shown in figure 1.4, they find that, for a 20 per cent increase in agricultural productivity, the share of informal workers in the total labour force falls from a baseline of 22 per cent to 18 per cent. The drop in informal employment is mainly because workers are drawn to agriculture, where the employment share rises from 28 per cent to 34 per cent. There is also a drop in the share of formal manufacturing workers (i.e. from 50 per cent to 48 per cent) because manufacturing wages rise. There is a drop in the wage ratio between manufacturing and agricultural wages

[13] The version of the Satchi–Temple model with an open capital account makes the extreme assumption that the economy is perfectly integrated into international capital markets. This assumption implies that the exogenous international return to capital fixes the domestic capital-to-labour ratio and all domestic factor returns. Hence, the ratio of urban informal workers to the urban manufacturing labour force and agricultural and manufacturing wages would not change.

from 1.80 to 1.76, which reduces income inequality. However, for a hypothesized productivity increase that would take about 20 years, the effects on employment structure and the reduction in urban informality do not seem significant.[14]

However, Mexico – as Satchi and Temple (2009) note – is a middle-income country, and its economic structure may not be representative of other developing countries. In particular, the authors use 28 per cent as the baseline share of agriculture in total employment and 22 per cent as the baseline share of informal employment. As stated in section 1.2, the average share of agricultural employment as a part of the total economically active population is about 48 per cent. Bacchetta et al. (2009) compute the incidence of own-account and unpaid family workers relative to total employment (i.e. an indicator of the share of informal employment) in developing countries and find that it was approximately 60 per cent in 2007. As there is an overlap between agricultural and informal employment in developing countries, the true shares in developing countries generally would be lower than indicated by these statistics but still higher than those for Mexico.

Figure 1.4: Impact of agricultural productivity growth on the structure of employment, Mexico

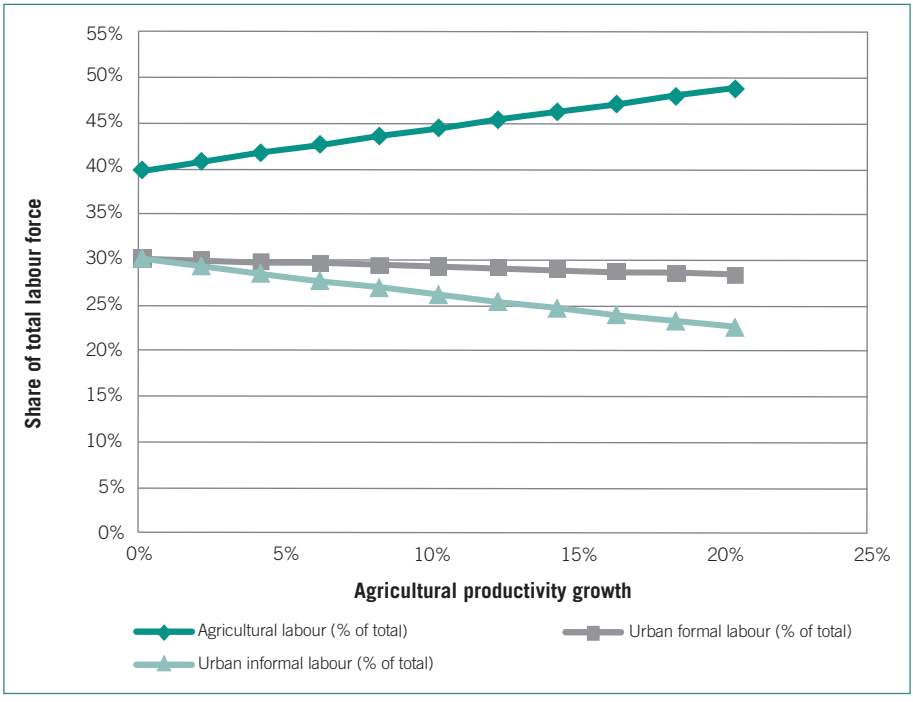


Notes: Authors' calculations. These are for the "closed economy" version of the model. The baseline agricultural employment share is 28 per cent, and the baseline informal employment share is 22 per cent.

[14] For Mexico, Klenow and Rodriguez Clare (1997) estimate an annual economy-wide productivity growth of 0.95 per cent. Hence, a 20 per cent productivity improvement would take 19.28 years.

To estimate the impact of agricultural productivity growth on a more representative developing country, we use baseline shares of 40 per cent and 30 per cent for agricultural and informal employment, respectively. Figure 1.5 depicts our simulation results. For a 20 per cent increase in agricultural productivity, there is an 8 percentage point drop in the share of urban informal workers in the total labour force (i.e. from a baseline of 30 per cent to 22 per cent). This is double the effect found for Mexico. The agricultural employment share rises from 40 per cent to 49 per cent, while the share of formal manufacturing workers drops by 2 percentage points, from 30 per cent to 28 per cent. The magnitude of contraction in formal manufacturing employment is almost the same as in the Mexican case. The ratio between manufacturing and agricultural wages falls from 1.80 to 1.77, which is slightly less than in the Mexican case but still reduces income inequality. These results show that, for the typical developing country, growth in agricultural productivity may be a potent means for reducing informal employment, relieving urban congestion, and decreasing income inequality. These effects appear to be strongest in developing countries with larger initial shares of the labour force in agriculture and informal employment.

Figure 1.5: Impact of agricultural productivity growth on the structure of employment, representative developing country



Notes: Authors' calculations. These are for the "closed-economy" version of the model. The baseline agricultural employment share is 40 per cent and the baseline informal employment share is 30 per cent.

The simulation results are consistent with theoretical and empirical findings in the literature on the impact of agricultural productivity growth on developing-country employment. In a theoretical model Ghose (2006) shows that agricultural growth cannot be neglected if employment conditions in labour-surplus economies are to improve. Headey et al. (2010) find that agricultural development (or a lack of it) has determined the differential pace and pattern of changes in the employment structures of Asia and Africa. From a broader development perspective, there is also empirical evidence that agricultural productivity growth reduces poverty.[15] Agriculture, the evidence shows, has larger multiplier effects on the rest of the economy than the non-agricultural sector (Vogel, 1994). Its multiplier effects are stronger in the rural non-farm sector than in other sectors (Lanjouw and Lanjouw, 2001). Each dollar of additional value added in agriculture generates US$0.60 to $0.80 of additional rural non-farm income in Asia and $0.30 to $0.50 in Africa and Latin America (Haggblade et al., 2007).

1.3.2 Agricultural innovation and new technologies

The previous section showed that agricultural productivity growth could have significant effects on the employment structures of developing countries. This begs at least two questions: (i) Are agricultural productivity improvements biased towards saving labour? and (ii) What determines agricultural innovation? The literature on these interrelated questions is extensive, and the dominant perspective is that of "induced innovation" (Binswanger and Ruttan, 1978; Hayami and Ruttan, 1985). Innovation is induced by the relative scarcity of an input, which provides a profit incentive for developing new technologies to substitute relatively abundant inputs for the scarce input.[16]

Land is a primary input for agriculture. Its suitability for cultivation and its distribution among the population determine how much of it is available and accessible to farmers. In developing countries, where arable land is limited and its distribution usually skewed, land is a relatively scarce input for most farmers. Agricultural productivity growth would, therefore, be mainly through innovations that make more land available or enhance the available land. These innovations would be in farming methods (e.g. irrigation improvements, crop rotation), materials (e.g. high-yield seeds, fertilizer), or machines (e.g. tube wells, pumps, mechanical threshers). So, "induced innovation" for developing-country agriculture would, in theory, be directed at saving land. For a given level of agricultural output and at constant input prices, the ratio

[15] See Christiaensen et al. (2011) for a literature review and empirical analysis of poverty reduction from agricultural productivity growth in low-income countries.

[16] For example, in the US – where labour is relatively scarce compared with land – agricultural innovation has been directed at producing labour-saving farm machinery. This has benefited Brazil, whose labour-to-land ratio is closer to that of the US, but not Bangladesh, where land is relatively scarce compared with labour.

of land to labour (or to any other input) used in production would fall. If the efficiency gains from the land-saving innovation lowered the cost and price of agricultural output and raised the quantity demanded of agricultural goods, there would be increased demand for labour.

While scarcity may be an important underlying factor for induced innovation, the emergence of new innovations requires technical feasibility and new scientific knowledge as well as the right institutional setting to provide the background for innovation activities (Sunding and Zilberman, 2001). Barrett et al. (2010) observe that many agricultural technological breakthroughs "emerged not from profit-seeking induced innovation but rather from scientific research following the non-profit motives of philanthropists, scientists, and governments". Before 1990 agricultural research and the innovations that flowed from it were driven predominantly by investments from the public sector. Moreover, in developing countries, Fan and Rao (2003) found, public spending on agricultural research had a larger impact on agricultural productivity than non-research expenditures (i.e. irrigation, roads, or subsidies for power and farm inputs). However, since 1990, the private multinational sector has become the main player in the supply of new agricultural technologies.[17]

Will developing-country farmers benefit from the privatization trend in global agricultural research and development? There is doubt that subsistence farmers will benefit, but there may be gains for larger-scale developing-country farmers (Pray et al., 2007). Multinationals are expected to focus efforts on modifying crops for application to the different agricultural settings of developing countries because the costs of adaptation are lower than the costs of generating knowledge on useful genes and engineering transgenic plants. However, a private-sector focus on the technological needs of developing-country agriculture is predicated on the ability to appropriate profits, which depends on governance institutions. Weak property rights regimes and judicial systems in developing countries may limit the profitability of serving developing-country agricultural markets. There is also a concern that the global consolidation of the bioscience industry may cause multinationals to exploit their proprietary agricultural technologies for higher profits at the expense of farmers.

Besides agricultural research, the empirical literature identifies other important determinants of agricultural innovation in developing countries. Avila and Evenson (2010) identify the adoption of modern Green Revolution varieties, increases in schooling of the labour force, and increases in nutrition as significant factors in raising agricultural productivity. Headey et al. (2010) find that pro-agricultural price policy reforms and distance to the nearest Organisation for Economic Co-operation and Development (OECD) country are significantly correlated with agricultural productivity growth. Restuccia et al. (2008) run simulations using a model of agricultural

[17] Pingali and Traxler (2002) report that in 1998 the world's top ten multinational bioscience corporations collectively spent almost US$3 billion on agricultural research and development whereas the largest developing-country programmes in China, India, and Brazil spent less than half a billion each.

productivity differences across countries and find that distortions to agricultural factor prices caused by government policies discourage farmers in poorer countries from using modern inputs to improve agricultural productivity. These findings reveal that links to global markets and the policies that affect them play a pivotal role in the transfer and adoption of more productive farm technologies in developing countries.

1.4 DEVELOPING-COUNTRY AGRICULTURE AND GLOBAL MARKETS

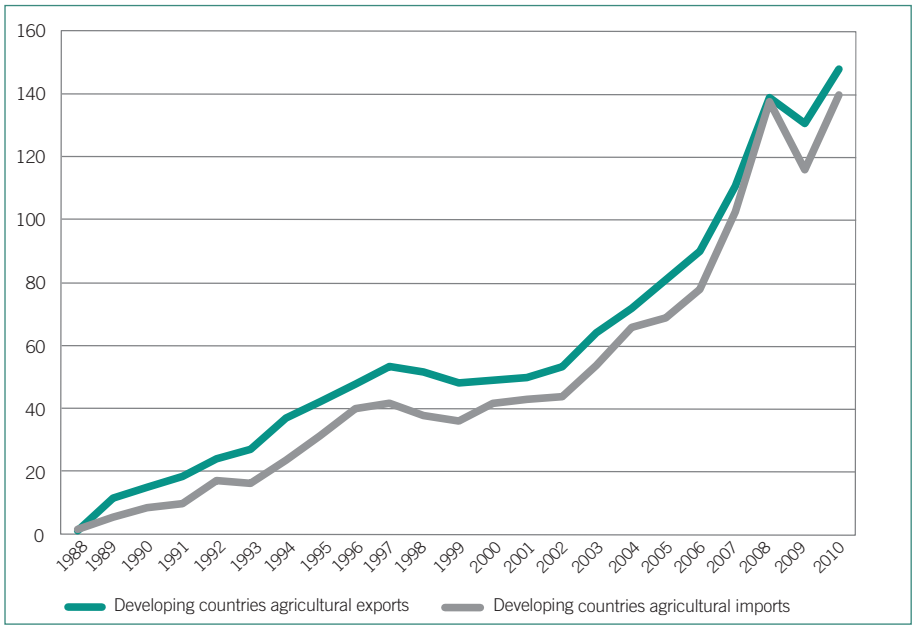
Developing countries have increased their participation in global agricultural markets over the past 25 years. In 2010 low- and middle-income countries accounted for 43 per cent of world agricultural exports, whereas 20 years earlier their share was 37 per cent. As shown in figure 1.6, from 1988 to the present, the value of developing-country agricultural trade has grown by a factor of 140, and, as a group, developing countries have been net agricultural exporters in every year since 1988. The values of developing-country agricultural exports and imports in 2010 were US$148 billion and US$140 billion, respectively, implying a US$8 billion surplus. Table 1.6 lists the 2010 developing-country trade balances for 11 agricultural commodities.[18] Just two categories account for the surplus: crops not elsewhere classified (nec), and vegetables, fruits, and nuts.[19] As a group, the developing countries were a net importer in all other categories, with the largest deficits in oil seeds and wheat. Developing countries have seen their traditional agricultural exports (e.g. coffee, tea, bananas, natural rubber, sisal) decline, while agricultural imports of cereals, livestock products, vegetable oils, and sugar have expanded, mainly to satisfy domestic demand for food.

The aggregate figures, however, hide considerable heterogeneity in agricultural trade positions between and within developing regions. Figure 1.7 shows that the developing-country trade surplus in agricultural commodities has been driven by the strong export performance of countries in Latin America and the Caribbean. Sub-Saharan Africa has also recorded agricultural trade surpluses for more than two decades. South Asia's record is mixed, with trade surpluses in the 1990s, trade deficits for most of the 2000s, and a return to trade surpluses since 2008. East Asia and the Pacific and the Middle East and North Africa have consistently recorded trade deficits since 1994. Within each region, agricultural trade positions vary from one country to another. In Latin America and the Caribbean, the continental countries, particularly

[18] A detailed breakdown for each activity can be found at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp

[19] Crops nec include: live plants; cut flowers and flower buds; flower seeds and fruit seeds; vegetable seeds, beverage, and spice crops, unmanufactured tobacco, cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets; swedes, mangolds, fodder roots, hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches, and similar forage products, whether or not in the form of pellets; plants and parts of plants used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal, or similar purposes; sugar beet seed and seeds of forage plants; and other raw vegetable materials.

Figure 1.6: Total developing-country exports and imports of agricultural commodities, 1988–2010 (in US$ billions)



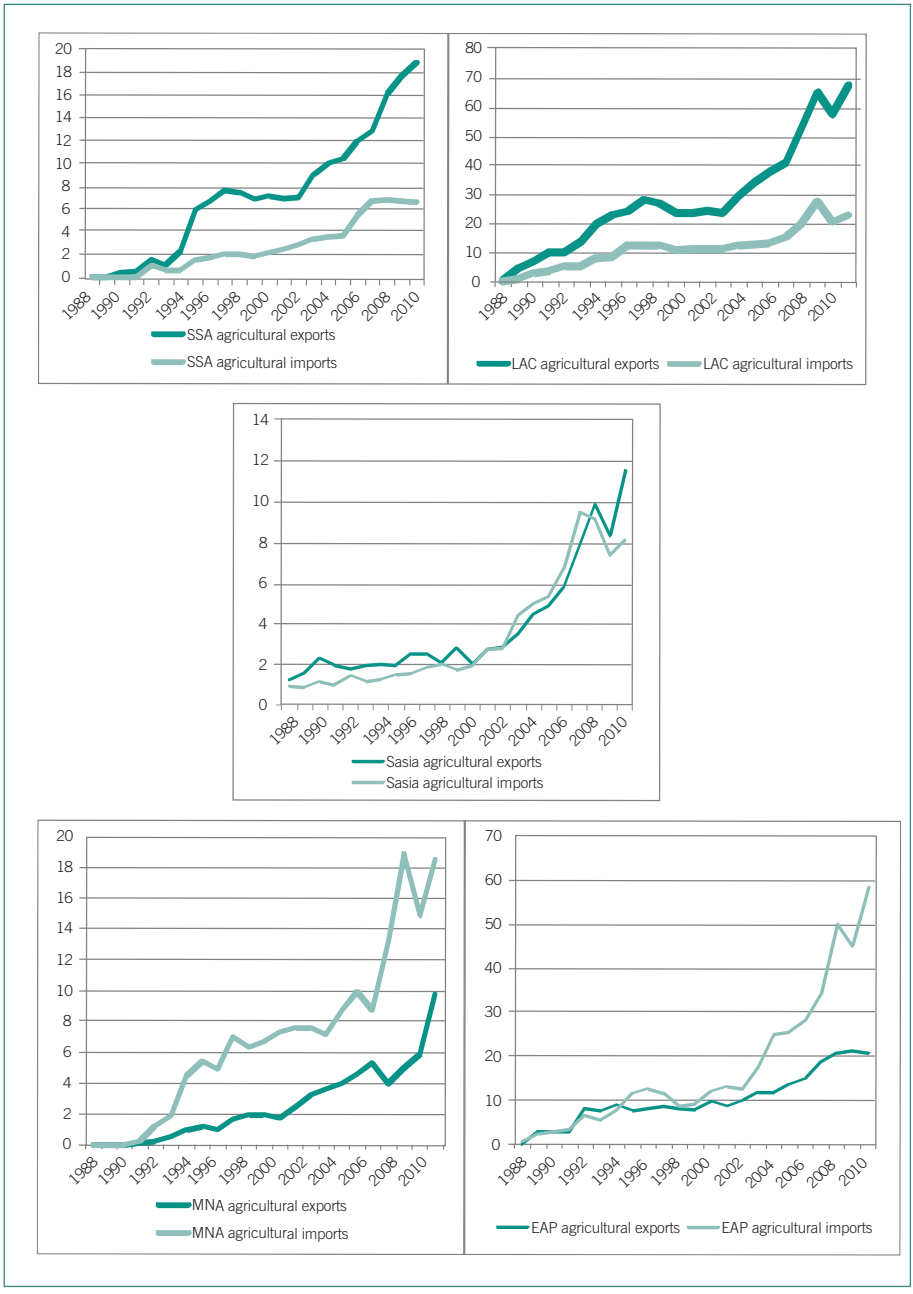
Source: UNComtrade (2012).

Table 1.6: Developing countries' net agricultural trade position by commodity, 2010 (US$ million)

Sectors	Exports minus Imports
Paddy rice	–302.53
Wheat	–12'083.44
Cereal grains nec	–2'500.00
Vegetables, fruit, nuts	21'500.00
Oil seeds	–13'400.00
Sugar cane, sugar beet	–0.36
Plant-based fibres	–6'520.99
Crops nec	23'600.00
Cattle, sheep, goats, horses	–1'139.90
Animal products nec	–289.80
Wool, silk-worm cocoons	–1'751.64

Source: UNComtrade (2012).

Figure 1.7: Developing-country exports and imports of agricultural commodities by region, 1988–2010 (in US$ billions)



Source: UNComtrade (2012).
Note: SSA=sub-Saharan Africa; LAC=Latin America and the Caribbean; Sasia=South Asia; MNA=Middle East and North Africa; EAP=East Asia and the Pacific.

Brazil, have strong net export positions, whereas the Caribbean islands are net importers. In sub-Saharan Africa, East African countries are net exporters, but West African countries have agricultural trade deficits. In South Asia India is a net exporter, whereas Bangladesh and Nepal are net importers. In East Asia and the Pacific, Malaysia, Thailand, and Vietnam have agricultural trade surpluses, but China and other East Asian countries run agricultural trade deficits.

The exceptional agricultural export performance of some developing countries masks the fact that, at present, most developing countries are net importers of agricultural commodities. Although numerous developing countries possess an endowment-based comparative advantage in agricultural production, several factors inhibit their willingness and ability to penetrate global agricultural markets:

1. Since development policy has prioritized industrialization, the export profiles of developing countries have increasingly been oriented towards manufactured goods.
2. As discussed in section 1.3, a neglect of agriculture has caused agricultural productivity to remain low and lag behind other sectors.
3. Population growth and rising incomes in developing countries have increased demand for food and focused agricultural policy on satisfying domestic food requirements.
4. Infrastructural problems (transport and communications) in many developing countries (particularly in the least-developed ones) continue to impede the access of agricultural producers to global markets.
5. Global agricultural commodity markets are now saturated, and the presence of so much competition discourages entry by new developing-country producers. The problem is compounded by farm subsidies and farmer income support in industrialized countries that artificially increase agricultural supply.
6. Agricultural tariffs (with the exception of trade preferences for the least developed countries) and non-trade barriers remain high, which reduces demand for agricultural imports. Compliance with non-trade barriers, particularly quality and sanitary and phytosanitary standards, may be difficult or impossible for developing-country producers to overcome, in which case trade preferences may be useless.
7. A lack of marketing knowledge and an absence of connections with global supply chains limit most developing-country farmers to their domestic markets.
8. Lastly, the scarcity and high cost of trade finance and insurance prohibit international transactions or make the management of transaction risk difficult.

1.4.1 Agricultural trade policies and domestic measures

In trade negotiations agriculture has been a contentious sector. Multilateral and regional trade agreements often exclude agriculture because it is politically sensitive given its links with food security and rural development. Agricultural tariffs and non-

tariff barriers remain high both in developed and developing countries, with developing countries having large gaps between bound and applied tariff rates.[20] There are direct incentives for agricultural exports in developed countries (e.g. export refunds in the European Union (EU) and the GSM 102 and GSM 103 programmes in the United States). In an analysis of the World Trade Organization (WTO) Agreement on Agriculture and its effects on agricultural trade liberalization, Hoda and Gulati (2008) asserted that expectations for the agreement were meagre and its effects were limited since the most heavily protected products had experienced no liberalization.

Besides protection through trade policies, farmers also receive direct production subsidies and income support. Developing countries perceive these measures as "unfair", given their fiscal constraints, and the agricultural producers among them are frustrated by lower world agricultural prices caused by these subsidies. Governments have used trade policies and domestic measures to directly affect the prices and quantities of farm outputs and inputs or to indirectly affect agricultural markets through measures on non-agricultural commodities. Anderson (2010) describes the pattern of these interventions in a recent major global study on agricultural price distortions. He states that:

> … poor countries tax farmers, rich countries protect them, and as countries become less agrarian in the course of their development, their policies transition from the former to the latter – and to a greater extent and earlier the weaker a country's agricultural comparative advantage. The agricultural policy regimes thus also have an antitrade bias. [p. 9]

Anderson and his collaborators have produced a database on agricultural price distortions in 64 countries over the last five decades. The key category of statistics in their database is the nominal rate of assistance (NRA), which is defined as the percentage by which government policies have raised gross returns to farmers above what they would be without the government's intervention (or lowered them, if the NRA is less than 0).[21] From these data Anderson's project distils numerous important facts on agricultural price distortions, many of which concern developing countries. Among these are:

1. The average NRA for developing countries as a group moved from negative in the 1960s and 1970s to positive in the early 2000s.
2. The NRAs on certain agricultural products (sugar, rice, and milk) still remain high in all countries.
3. The NRA on cotton is high in developed countries, while cotton output is, effectively, taxed in developing countries.

---

[20] Besides ad valorem tariffs, trade protection in agriculture can take the form of specific tariffs, mixed tariffs, tariff rate quotas, sanitary and phytosanitary (SPS) restrictions, price bands, licensing, standards, prohibitions, and state trading monopolies.

[21] An import subsidy or export tax would tend to reduce the NRA, while an import tariff or export subsidy would tend to raise the NRA.

4. Measures that affect agricultural prices have become less anti-trade mainly because of a decline in export taxes on agricultural commodities.
5. NRAs for import-competing agricultural producers have increased for developing countries as a whole, mainly because of import tariffs.
6. Trade policy instruments (i.e. export and import taxes, subsidies, and quantitative restrictions and dual exchange rates) account for at least 60 per cent of the agricultural NRAs in all countries and more in developing countries.[22]
7. Domestic subsidies on farm inputs and support for public agriculture research have not significantly offset the effective taxation of developing-country farmers.

The last three facts are consistent with the conjecture that developing countries use trade policy because it is simply easier to administer than domestic taxes or subsidies. Moreover, compared with non-agricultural trade, agricultural trade remains largely unconstrained by WTO rules, and constraints on agricultural import and export taxes and subsidies are not binding (although there are disciplines on agricultural import quotas). Mainly to raise revenues, developing-country governments tend to impose import and export taxes. The latter have depressed domestic prices of farm output in developing countries relative to world prices, effectively hurting developing-country farmers.

Gawande and Hoekman (2010) conduct a political-economy analysis of developing-country agricultural trade policies. They find that countries with a larger percentage of arable land and bigger rural population shares tend to impose agricultural export taxes.[23] This lowers agricultural prices for domestic consumers at the expense of farmers. A larger proportion of arable or irrigated land is associated with import subsidies, which also lower agricultural prices. They also find that, for staple foods, as import penetration rises, governments are more likely to impose import tariffs rather than import subsidies. Import tariffs are also more likely when there is greater electoral competition, as governments cater to the special interests of landowners and import-competing producers. Further, they provide evidence that governments increasingly subsidize cash crops but tax food crops as export-to-output ratios increase. The taxation of food exports may be motivated by a food-security objective.

There is evidence that tariff reductions and preferences for developing countries may not improve their export shares because supply-side constraints and non-tariff measures remain. In agriculture non-tariff barriers may be the main obstacle. For example, under WTO rules, sanitary and phytosanitary (SPS) measures may be used to prevent agricultural imports if they pose a health risk. Disdier and Van Tongeren (2010) study non-tariff measures (NTMs) imposed by governments in OECD member

[22] Under the dual-exchange rate arrangement, exporters are obliged to sell all or part of their foreign exchange to the government at a lower price, hence effectively taxing exports.

[23] This may be related to McMillan's (2001) hypothesis that governments will take advantage of sunk-cost commitments made by farmers and landowners and tax them for revenue.

countries on several hundred agri-food products. Their data suggest that these measures affect developing countries more than OECD countries themselves: Some 84 per cent of developing and emerging countries' exports to OECD countries are subject to NTMs, compared with 76.7 per cent of exports between OECD countries.

1.4.2 Agricultural terms of trade and price volatility

In the 1950s Prebisch and Singer famously postulated that the terms of trade of primary commodities (agriculture and minerals) would deteriorate over the long term relative to industrial goods. The theoretical explanations offered included a low income elasticity of demand for primary commodities, a lack of differentiation and stiffer competition among primary commodity producers, and surplus labour in countries that produce primary commodities, which keeps prices low. The Prebisch–Singer proposition was an important basis for the agro-pessimism that shaped development thinking and the policies that promoted industrialization. Their terms-of-trade hypothesis has been tested by many time-series studies, with mixed results.[24] Using a new dataset on 25 primary commodities (14 of which are agricultural) over several centuries, Harvey et al. (2010) find evidence for a secular decline in the prices of 11 commodities and a zero trend for the rest.[25] Their results imply that an export dependency on primary commodities is detrimental to the long-term growth of developing countries. Regarding agriculture, countries could benefit by exploring potential diversification into niche agricultural crops to avoid the commodity trap.

Shocks to agricultural markets are often translated into large price swings because quantities demanded and supplied of agricultural output tend be somewhat fixed. Agriculture is particularly prone to shocks and high price volatility because of fickle weather conditions and energy prices.[26] As Headey (2011) describes, global markets can multiply the sources of shocks to agricultural markets. Cyclical movements in global agricultural supply and demand, changes in foreign trade restrictions and agricultural measures, exchange rate movements, and commodity speculation all amplify price volatility in international markets. Increased exposure to global markets has made it more difficult for developing-country governments to smooth revenue flow for their farmers. Private-sector provision of insurance is still missing or limited in developing countries. The increased riskiness of agriculture due to global markets reduces the sector's viability as a source of income and employment and complicates planning. There have been proposals (see UNCTAD, 1972 and 1976) to create a global "common fund" that would manage unstable demand for primary commodities using a counter-cyclical buying or selling strategy, but there is scepticism as to the

[24] For summaries of this literature, see Greenaway and Morgan (1999) and Cuddington et al. (2007).

[25] The 11 commodities are: aluminium, coffee, hide, jute, silver, sugar, tea, tobacco, wheat, wool, and zinc. The other commodities (banana, beef, coal, cocoa, copper, cotton, gold, lamb, lead, nickel, oil, pig iron, rice, and tin) all reveal a zero trend.

[26] Agriculture is linked to energy markets on the input side (fertilizer and transportation) and the output side (biofuel).

feasibility of such an institution and how effective it would be in the face of supply-side fluctuations.

Recent episodes of price volatility have been characterized by particularly high price hikes, triggering the use of the term "the food, fuel, and financial crisis" to describe the effects of price movements in the 2008–09 period. High prices in food markets even sparked riots in a number of countries because food became unaffordable for ordinary people. This has led to a renewed interest in food security, i.e. access to food for all people.[27] In the past the concept of food security in the context of trade was more associated with the concern that countries depending on imports may lose access to food if they are suddenly cut off from international food supplies, for instance, in the situation of war. To reduce such risks, some considered it important for countries to maintain a certain level of self-sufficiency in food supply. The current debate is rather different, as it is not linked to a hypothetical situation but rather to an existing one. It is also different because current concerns about food security are not necessarily provoked by an existing lack of supply but instead by the fact that high prices make food unaffordable. In this context a number of studies have analysed whether the volatility observed in recent years is exceptional or the reflection of an increase in price instability. Both the International Monetary Fund (2009) and the World Bank (2010) warn that food price volatility may well increase in the future, with increasing speculation in commodity markets being one of the possible drivers of the phenomenon.[28]

1.4.3 Regional trade agreements[29]

Since the Doha Round of trade negotiations has been at a standstill, governments have been pursuing their objectives for trade liberalization at the regional level. The number of regional trade agreements (RTAs) concluded since the early 1990s has grown exponentially. Most RTAs cover not just the removal of intra-regional trade barriers but also harmonization of national policies and measures to increase factor mobility. The welfare effects of RTAs are theoretically ambiguous; hence, the desirability of these agreements is an empirical issue.[30]

Agricultural trade has been either excluded from RTAs or governed by different rules than non-agricultural trade, and for the same reasons as in multilateral negotiations.[31] The role of agriculture in providing food, energy, and, in the case of developing countries, a significant source of employment and income makes countries

[27] See FAO (2003) for a definition and Maxwell (1996) and Maxwell and Smith (1992) for further discussions of concepts.

[28] See also UNCTAD (2008, 2009) on this topic.

[29] The term "regional trade agreements" is used interchangeably with preferential trade agreements between countries that may or may not be geographically contiguous.

[30] See Plummer et al. (2010) for a review of methods for the economic assessment of preferential trade agreements.

[31] See also the discussion in chapter 2 of this volume.

wary of agricultural trade liberalization. However, several studies (Furtan and van Melle, 2004; Grant and Lambert, 2008; Vollrath et al., 2006; Zanhniser et al., 2002) find that the formation of RTAs tends to increase intraregional trade in agriculture. Grant and Lambert (2008) study trade flows from seven RTAs in the period 1982 to 2002 and find that there were significant increases in agricultural trade in all the RTAs except for the South–South RTAs (i.e. Mercosur and ASEAN). Larger increases occurred in agricultural than in non-agricultural trade in all the RTAS except for ASEAN.[32] Despite the evidence for increased intra-regional trade in agriculture, Jayasinghe and Sarker (2008) find that, in the case of NAFTA, agri-food trade with non-members fell, implying trade diversion. In sum, these studies show that RTAs can be effective in dismantling agricultural trade barriers and increasing agricultural trade, at least between partners, although partnership with a Northern member may be required.

Many developing countries, particularly the least developed ones, already have preferential access to developed-country markets for their agricultural exports. Agreements such as the Generalized System of Preferences (GSP) and the Lomé and Cotonou agreements between the EU and former colonies in Africa, the Caribbean, and the Pacific (ACP), the US Africa Growth and Opportunity Act (AGOA), Caribbean Basin Economic Recovery Act (CBERA), Andean Trade Preference Act (ATPA), and others offer positive discrimination, without which developing-country agricultural exports might not be competitive. Although the uptake in these programmes has been unimpressive, they may be the only way for the least developed countries to benefit from trade. Muhammad et al. (2010) study the effects of the EU's Generalized System of Preferences Plus (GSP+) incentive scheme on EU imports of cut flowers from Colombia and Ecuador.[33] They estimate that without this scheme EU flower imports from both countries would fall. However, they find that, given Colombia's dominance of the EU flower import market, a removal of trade preferences for Colombia would also reduce flower imports from other countries, indicating a degree of complementarity. Flower imports from Ecuador, which has a small share of the market, would be replaced by flowers from other countries.

The exclusion of selected agricultural commodities from RTAs is linked to domestic support measures. Hasha (2001) finds that, in the EU's RTAs with non-EU countries, agricultural commodities that receive domestic support under the Common Agricultural Policy (CAP) are excluded. Matthews (2011) notes that the tariff liberalization schedules in the ACP agreements exempt many food staples from liberalization. Burfisher et al. (2002) note that the US GSP and other preferential arrangements for

[32] The seven RTAs studied are: the North American Free Trade Agreement (NAFTA), the Canadian–US Trade Agreement (CUSTA), the European Union (EU), Common Southern Market (Mercosur), the Andean Pact, the Association of South East Asian Nations (ASEAN), and New Zealand–Australia Closer Economic Relations (CER).

[33] As of March 2012, Colombia and Ecuador are beneficiaries of GSP+, which offers developing countries tariff-free access to the EU if they ratify and implement relevant international conventions for sustainable development and good governance.

developing countries do not cover agricultural commodities such as sugar and dairy, which are linked to US domestic support programmes. As reforms of these programmes would benefit all trading partners, multilateral rather than regional negotiations would be appropriate. RTAs could be helpful, however, in promoting harmonization of support policies and providing the initial impetus for domestic reform.

1.5 TRADE LIBERALIZATION AND AGRICULTURAL LABOUR MARKETS

To date, almost all empirical studies that relate trade liberalization to employment focus on the manufacturing sector.[34] This bias may be due to the availability of data, but it is also because agriculture has mainly been excluded from trade negotiations and because of the prevalent belief that agriculture cannot be a leading sector in development and in employment creation. Studies on the manufacturing sector generally find that trade liberalization has a limited impact on the wages of manufacturing workers and the numbers of manufacturing jobs.[35] The dominance of one or a few firms in different manufacturing activities and entry barriers are possible explanations for the dampened employment response to trade liberalization.

Agricultural employment, as discussed in section 1.2, comprises a significant share of informal and temporary work.[36] The fact that many agricultural workers are unregistered means that labour market regulation is not broadly applicable in the sector. In addition, constant returns to scale in farming and the presence of many farmers and farm workers create substantial competition in the agricultural sector. These key differences from the manufacturing sector imply that, a priori, labour-market responses in agriculture may not be small. One recent empirical study of NAFTA's impact on agricultural workers in Mexico finds that there was an insignificant change in the wages of Mexican agricultural workers but a clear effect on employment. Prina (2012) finds that employment increased in agricultural activities for export (vegetables) and fell in those that were import-competing (corn). Furthermore, the employment effect was stronger in regions closer to the US–Mexican border, i.e. regions that had higher trade exposure. Her results imply that agricultural workers were mobile across agricultural activities and that skills were not crop-specific.

The employment effects of high-value agricultural trade, particularly in horticulture, are the subject of several studies (see von Braun et al. (1989) for Guatemala; and Neven et al. (2009) for Kenya). These studies find that high-value horticultural exports tend to increase the use of hired labour on farms. Other studies of the hor-

[34] For an overview of recent empirical literature, see McMillan and Verduczo (2011).

[35] Wacziarg and Wallack (2004) and Papageorgiou et al. (1991) find that trade reforms in isolation have no effects on movements of labour between sectors (broadly defined). They do find some small and weak evidence for movements of labour between activities within the manufacturing sector.

[36] See Sinha (2011) for a more general discussion on trade and informality.

ticultural export sector go further, analysing impacts on poverty. They find that employment in the horticultural export industry helps alleviate poverty (see McCulloch and Ota (2002) for Kenya; Barron and Rello (2000) for Mexico; and Maertens and Swinnen (2009) for Senegal). Further, they find that high-value horticultural export production can increase employment and the incomes of communities and of rural households that are involved in this type of export, either as small contract farmers or hired workers on agro-industrial estates. This observation contradicts the critique that large-scale farming marginalizes small businesses and poor households and benefits only multinationals and the elite of developing countries. In this case there is a positive impact on poverty because export demand creates employment opportunities, particularly for rural households without land or other assets, and, to some degree, the export price premium filters down to farm workers' wages.

In 2005 there was a spate of publications presenting ex–ante simulation assessments of the impact of agricultural trade reform in the context of the Doha Round of trade negotiations (Anderson et al., 2006; Bouet et al., 2005; Fabiosa et al., 2005; Polaski, 2006; Van der Mensbrugghe and Beghin, 2005). A few of these studies report results on employment and wages. Table 1.7 is reproduced from the study by Anderson et al. (2006). Their simulations used the World Bank's LINKAGE model – which is a global, dynamic applied general equilibrium model – to predict the effects of full global trade liberalization (agricultural and manufactured goods but not services). They also used a partial liberalization scenario modelled according to the Doha Work Program's July Framework of 2004.[37]

Table 1.7: Linkage model simulation of impact of global trade liberalization on agricultural employment in developing countries (average annual percent growth), 2005 to 2015

	Employment growth		
	Baseline	**Full global liberalization**	**Partial liberalization**
Developing countries	1.0	1.2	1.1
East Asia and Pacific	–0.5	–0.8	–0.5
South Asia	1.5	1.4	1.5
Europe and Central Asia	2.3	2.6	2.4
Middle East and North Africa	1.7	3.4	2.4
Sub-Saharan Africa	0.2	0.0	0.2
Latin America and Caribbean	0.4	1.9	1.0

Source: Extracted from table 12.17 in Anderson et al. (2006).

[37] This scenario (number 7 in their list of experiments) entails agricultural and manufacturing trade liberalization with lesser cuts for developing countries and no reform by least-developed countries.

As table 1.7 shows, their simulation projects that annual employment growth in developing-country agriculture would accelerate by 0.1 per cent under the partial liberalization scenario and by 0.2 per cent under the full global liberalization scenario. To give these numbers some economic significance, consider that overall employment growth in developing countries was about 2 per cent per year from 2000 to 2008 and has since decelerated to 0.5 per cent per year. Given that agricultural jobs account for half of all employment in developing countries, the predictions above suggest that trade liberalization could provide an important boost, in the present context, to labour absorption in developing countries. This effect will not be even. Table 1.7 shows that employment gains in developing countries will be strongest in Europe and Central Asia, the Middle East and North Africa, and Latin America and the Caribbean. Employment growth as a result of trade liberalization is predicted to be slower in East Asia and the Pacific, South Asia, and sub-Saharan Africa.

In terms of wages Anderson et al. (2006) find that full trade liberalization would raise the real wage of skilled workers in developing countries by 3 per cent and that of unskilled workers by 3.5 per cent. As their model assumes perfect mobility of workers between sectors within each country, the wage effects are national. By assuming dual labour markets and imperfect mobility of unskilled workers between agriculture and other sectors in developing countries, Bouet et al. (2005) are able to estimate specific wage effects for unskilled agricultural workers. They simulate a Doha scenario, paying careful attention to agreed modalities in agriculture, and they find that changes in the real wage of unskilled agricultural workers range from –0.2 per cent to 1.4 per cent, which are less favourable than the estimates of Anderson et al. (2006). Polaski (2006) distinguishes three types of labour – agricultural labour, urban low-skilled and urban high-skilled – and allows for unemployment among urban low-skilled workers. In a simulation of the WTO "Hong Kong" scenario, she finds that returns to agricultural labour would increase in all developing countries, with the exception of Bangladesh, which would experience a slight decrease.[38] China and Vietnam would experience the largest returns for agricultural labour: a 1.6 per cent increase in the case of China and a 2.5 per cent increase in the case of Vietnam. For developing countries as a group agricultural employment would barely increase (0.1 per cent). Agricultural employment would decline in Indonesia, India, the rest of South Asia, and Mexico.

Other studies look at the effects of trade liberalization on employment at the product level. Van der Mensbrugghe and Beghin (2005) focus on two particular activities: (i) cereal and sugar, and (ii) livestock and dairy. They find that global agricultural and food reform would increase the level of agricultural employment in the average developing country. They find that, of the two agricultural activities considered, trade liberalization in cereal and sugar has a stronger employment-creating potential for developing countries than liberalization in livestock and dairy.[39]

---

[38] This so-called 'Hong Kong scenario' represents agreements reached at the WTO Ministerial Meeting in Hong Kong in December 2005 to achieve a comparable level of market access liberalization for agriculture as for nonagricultural goods.

[39] However, products such as sugar and dairy are typically excluded from trade agreements.

Table 1.8: Global Trade Analysis Project model (version 7): Simulation of impact of global trade liberalization on employment in selected agricultural activities in developing countries

	% change in unskilled employment	% change in skilled employment	Estimated change in unskilled employment level	Estimated change in skilled employment level	Total change in employment level
Paddy rice	0.68	0.78	1'598'903	13'045	1'611'948
Wheat	–4.08	–3.97	–6'518'880	–65'681	–6'584'561
Cereal grains nec	–1.37	–1.26	–3'408'805	–39'753	–3'448'558
Vegetables, fruit, nuts	1.05	1.16	13'502'486	152'829	13'655'315
Oil seeds	0.54	0.65	1'050'319	11'969	1'062'288
Sugar cane, sugar beet	3.30	3.41	2'697'104	24'467	2'721'571
Plant-based fibres	1.19	1.30	1'079'400	10'593	1'089'992
Crops nec	–0.83	–0.72	–2'731'279	–25'503	–2'756'781
Cattle, sheep, goats, horses	3.17	3.27	4'828'728	71'373	4'900'102
Animal products nec	0.61	0.71	2'849'709	32'781	2'882'490
Raw milk	–0.37	–0.27	–567'407	–5'833	–573'240
Wool, silk-worm cocoons	–11.23	–11.13	–2'985'864	–25'222	–3'011'086
Total			**11'394'414**	**155'066**	**11'549'480**

Source: Authors' calculations.
Notes: (i) The scenario is a removal of all manufacturing and agricultural import tariffs. (ii) Total initial agricultural developing-country employment is 1.3 billion. (iii) Initial employment in each agricultural activity is proportionate to the agricultural labour cost shares, as in the Global Trade Analysis Project (GTAP) 7 database. (iv) Developed and developing countries are distinguished according to the World Bank's classification.

To provide a more complete picture, we conduct some simulations of trade liberalization using the Global Trade Analysis Project (GTAP) model and version 7 of the GTAP database, which uses 2004 as the base year. For 12 agricultural activities we estimate the percentage and level changes in each activity's employment in developing countries given full global removal of all import tariffs. Table 1.8 shows our results. We find that in developing countries global trade liberalization creates larger numbers of agricultural jobs in horticulture (vegetables, fruits, and nuts) and livestock (e.g. cattle, sheep, goats, horses), while the wheat and cereal grains sub-sectors are likely to see the greatest job losses. The percentage changes for skilled and unskilled workers are the same in direction and almost equal in magnitude. However, the level changes in unskilled workers in each agricultural activity are much larger than for

skilled workers due to the preponderance of unskilled workers in developing-country agricultural activities overall. The implication is that labour-market disruptions in developing-country agriculture will mainly be an issue of helping unskilled workers to adjust.

1.6 CONCLUSIONS AND POLICY IMPLICATIONS

Agriculture is the core economic activity of the majority of workers in developing countries, but it remains a low-productivity activity that provides meagre incomes for developing-country workers. This chapter has surveyed agricultural employment and production trends in developing countries, the role of productivity in developing-country agriculture, and the links between developing-country agriculture and global markets. Concerning agricultural employment and production, the key finding is that all developing countries have seen a decline in agricultural value added per agricultural worker over the past three decades because agriculture's share of GDP has fallen considerably. Despite this contraction, agricultural employment persists in developing countries because there are significant barriers to worker mobility. These barriers take the form, for instance, of lack of access to finance or of low skill levels. Workers who do manage to move out of agriculture often end up in the informal urban sector, where employment is precarious.

In studying the role that agricultural productivity plays in determining employment structure, our overall conclusion is that a productivity improvement in agriculture can achieve multiple employment objectives. In particular, higher agricultural productivity can increase the quality of work and the wages of agricultural workers, reabsorb workers from the informal sector back into the formal agricultural sector, and leave manufacturing employment relatively unaffected. These findings are particularly important for the least developed countries and developing countries. In these countries informal employment is rampant due to a premature exit from agriculture, and more productive work is unavailable or limited in the manufacturing and services sectors. As for the sources of agricultural productivity improvement, the literature indicates that technical innovations and modern inputs, when properly adapted to developing-country settings, can enhance labour and increase demand for agricultural workers rather than displace them. The effects of agricultural innovation, however, are conditioned by policies that affect the domestic and external markets for agricultural inputs and outputs.

Regarding the links between developing-country agriculture and global markets, recent studies clearly show the high degree of policy-induced distortions in agricultural markets in both developed and developing countries. Protectionist trade policies account for at least 60 per cent of these distortions. These policies artificially support agriculture, but, at the same time, they inhibit improvements in agricultural productivity in developing countries, obstruct the realization of agricultural export potential given resource-based comparative advantages, and hamper economic diversification and creation of employment opportunities in other sectors. Simulations of a Doha

Round agreement conducted by Anderson et al. (2006) estimate that multilateral trade liberalization could double agricultural employment growth from the current rate of 0.5 per cent to just over 1 per cent per annum. Our own simulations suggest that multilateral liberalization will affect developing-country agricultural employment unevenly; job creation is expected to be highest in horticulture and livestock, while the wheat and cereal grains sub-sectors are likely to see the greatest job losses. To maximize the employment gains from trade liberalization and minimize adverse effects, governments will need to anticipate the direction and size of changes in each sector and sub-sector. In the agricultural sector this anticipation will be necessary to plan for appropriate public investments in labour (e.g. worker mobility, skills expansion, and retraining) and land (e.g. the construction of irrigation systems and physical infrastructure). As expressed succinctly by Pingali (2010), "Trade liberalization should go hand in hand with public support for improving agriculture productivity and competitiveness".

Present conditions offer a window of opportunity to harness the employment and trade benefits of agriculture in developing countries. First, in many developing countries failed attempts at industrialization and the recent global economic crisis have created a floating pool of workers who have exited agriculture but not found employment in the manufacturing sector. The expansion of agriculture, given its high labour intensity, could re-absorb this surplus labour. Second, there has been a reversal in the secular fall in the international terms of trade of agricultural products that took place throughout the latter half of the 20th century. The international prices of crops and livestock have climbed since 2000 and are expected to trend upward for the immediate future (OECD–FAO, 2011). High oil prices and biofuel mandates and support policies are expected to continue to increase the derived demand for agricultural output in biofuel production. They would also keep agricultural prices elevated. Hence, this is an opportunity for developing-country agricultural exporters to gain higher export revenues. Last but not least, the potential for yield improvement and environmentally sustainable agricultural production in most developing countries is still great, as the use of new production techniques and technology remains limited. There is also a potential for diversification of agricultural production into higher value added activities as global demand for niche agricultural products (such as organic farm produce) rises.

REFERENCES

Ali, F.; Parikh, A. 1992. "Relationships among labour, bullock, and tractor inputs in Pakistan agriculture", in *American Journal of Agricultural Economics*, Vol. 74, No. 2, pp. 371–377.

Anderson, K. (ed.). 2010. *The political economy of agricultural price distortions* (New York, NY, Cambridge University Press).

Anderson, K.; Martin, W.; van der Mensbrugghe, D. 2006. "Market and welfare implications of the Doha reform scenarios", in K. Anderson; W. Martin (eds.): *Agricultural trade reform and the Doha development agenda* (Basingstoke and Washington, DC, ,Palgrave Macmillan/World Bank), pp. 333–399.

Avila, A.F.D.; Evenson, R.E. 2010. "Total factor productivity growth in agriculture: The role of technological capital", in P. Pingali; R. Evenson (eds.): *Handbook of agricultural economics* (Amsterdam, Elsevier B.V.), Vol. 4, pp. 3769–3822.

Bacchetta, M.; Ernst, E.; Bustamante, J.P. 2009. *Globalization and informal jobs in developing countries* (Geneva, International Labour Office and World Trade Organization).

Baer, W. 1972. "Import substitution and industrialization in Latin America: Experiences and interpretations", in *Latin American Research Review*, Vol. 7, No. 1, pp. 95–122.

Bala, B.; Sharma, S.D. 2005. "Effect on income and employment of diversification and commercialization of agriculture in Kullu district of Himachal Pradesh", in *Agricultural Economics Research Review*, Vol. 18, No. 2, pp. 261–269.

Barron, M.A.; Rello, F. 2000. "The impact of the tomato agroindustry on the rural poor in Mexico", in *Agricultural Economics*, Vol. 23, No. 3, pp. 289–297, Sep.

Barrett, C.B.; Carter, M.R.; Timmer, C.P. 2010. "A century-long perspective on agricultural development", in *American Journal of Agricultural Economics*, Vol. 92, No. 2, pp. 447–468, Apr.

Beintema, N.; Elliott, H. 2009. *Setting meaningful investment targets in agricultural research and development: challenges, opportunities and fiscal realities*, paper prepared for the Expert Meeting on How to Feed the World in 2050, Food and Agriculture Organization, Rome, 24–26 June 2009.

Binswanger, H.; Ruttan, V.W. 1978. *Induced innovation: Technology, institutions and development* (Baltimore, MD, Johns Hopkins University Press).

Bouët, A.; Bureau, J.C.; Decreux, Y.; Jean, S. 2005. "Multilateral agricultural trade liberalisation: The contrasting fortunes of developing countries in the Doha round", in *The World Economy*, Vol. 28, No. 9, pp. 1329–1354, Sep.

Burfisher, M.E.; Robinson, S.; Thierfelder, K. 2002. "Developing countries and the gains from regionalism: Links between trade and farm policy reforms in Mexico", in *American Journal of Agricultural Economics*, Vol. 84, No. 3, pp. 736–748.

Byerlee, D.; de Janvry, A.; Sadoulet, E. 2009. "Agriculture for development: Toward a new paradigm", in *Annual Review of Resource Economics*, Vol. 1, pp. 15–31.

Christiaensen, L.; Demery, L.; Kuhl, J. 2011. "The (evolving) role of agriculture in poverty reduction – an empirical perspective", in *Journal of Development Economics*, Vol. 96, No. 2, pp. 239–254, Nov.

Cohen, B. 2006. "Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability", in *Technology in Society*, Vol. 28, No.1, pp. 63–80.

Collins, J.L.; Krippner, G.R. 1999. "Permanent labour contracts in agriculture: Flexibility and subordination in a new export crop", in *Comparative Studies in Society and History*, Vol. 41, No. 3, pp. 510–534, Jul.

Cuddington, J.; Ludema, R.; Jayasuriya, S. 2007. "Prebisch–Singer redux", in D. Lederman and W. Maloney (eds.): *Natural resources: Neither curse nor destiny* (Palo Alto, CA, and Washington, D.C., Stanford University Press/World Bank), pp. 103–140.

Davis, B.; Winters, P.; Carletto, G.; Covarrubias, K.; Quinones, E.; Zezza, A.; Stamoulis, K.; Bonomi, G.; DiGiuseppe, S. 2007. *Rural income generating activities: A cross country comparison*, ESA Working Paper, No. 07–16 (Rome, Food and Agriculture Organization).

Davis, B.; Winters, P.; Reardon, T.; Stamoulis, K. 2009. "Rural nonfarm employment and farming: Household-level linkages", in *Agricultural Economics,* Vol. 40, No. 2, pp. 119–123, Mar.

Dethier, J.; Effenberger, A. 2011. *Agriculture and development: A brief review of the literature*, World Bank Policy Research Working Paper, No. 5553 (Washington, DC, The World Bank).

Disdier, A.; van Tongeren, F. 2010. "Non–tariff measures in agri-food trade: What do the data tell us? Evidence from a cluster analysis on OECD imports", in *Applied Economics Perspectives and Policy*, Vol. 32, No. 3. pp. 436–455.

Duryea, S.; Marquéz, G.; Pagés, C.; Scarpetta, S. 2006. "For better or for worse? Job and earnings mobility in nine middle- and low income countries", in S. Collins; C. Graham (eds.): *Brookings Trade Forum: Global labour markets?* pp. 187–209 (Washington, DC, Brookings Institution Press).

Evenson, R.E.; Gollin D. 2003. "Assessing the impact of the green revolution, 1960 to 2000", in *Science*, Vol. 300, No. 5620, pp. 758–762.

Fabiosa, J. F.; Beghin, J. C.; DeCara, S.; Elobeid, A.; Fang, C., Isik, M.; Matthey, H.; Saak, A. 2005. "Doha Round of the World Trade Organization and Agricultural Markets Liberalization: The Impacts on Developing Economies", in *Review of Agricultural Economics*, Vol. 27, No. 3, pp. 317-335, Sep.

Fan, S.; Rao, N. 2003. "Public spending in developing countries: Trends, determination, and impact", *EPTD Discussion Papers* No. 99 (Washington, DC, International Food Policy Research Institute).

Food and Agriculture Organization. 2003. "Food security: Concepts and measurement", in *Trade reforms and food security: Conceptualizing the linkages* (Rome).

–. 2011. *The State of Food and Agriculture 2010–2011: Women in agriculture* (Rome).

Freeman, R.B.; Oostendorp, R. 2000. *Wages around the world: Pay across occupations and countries*, NBER Working Papers, No. 8058 (Cambridge, MA, USA, National Bureau of Economic Research).

Furtan, W.H.; van Melle, B.M. 2004. "Canada's agricultural trade in North America: Do national borders matter?" in *Review of Agricultural Economics,* Vol. 26, No. 3, pp. 317–331.

Gawande, K.; Hoekman, B. 2010. "Why governments tax or subsidize agricultural trade" in K. Anderson (ed.): *The political economy of agricultural price distortions* (Cambridge, Cambridge University Press), pp. 241–278.

Ghose, A.K. 2006. "Economic growth and employment in labour-surplus economies", in *Economic and Political Weekly*, Vol. 41, No. 31, pp. 3430–3434, Aug.

Gollin, D.; Lagakos, D.; Waugh, M.E. 2011. *The agricultural productivity gap in developing countries*, Working Papers, No. 11–14 (New York, NY, New York University, Leonard N. Stern School of Business, Department of Economics).

Grant, J.H.; Lambert, D.M. 2008. "Do regional trade agreements increase members' agricultural trade?", in *American Journal of Agricultural Economics*, Vol. 90, No. 3, pp. 765—782, Aug.

Greenaway, D.; Morgan, C.W. (eds.). 1999. *The economics of commodity markets* (Cheltenham, Edward Elgar).

Haggblade, S.; Hazell, P.; Brown, J. 1989. "Farm-nonfarm linkages in rural sub-Saharan Africa", in *World Development*, Vol. 17, No. 8, pp. 1173—1201.

Haggblade, S.; Hazell, P.B.R.; Dorosh, P.A. 2007. "Sectoral growth linkages between agriculture and the rural non-farm economy" in S. Haggblade; P. Hazell; T. Reardon (eds.): *Transforming the rural nonfarm economy: Opportunities and threats in the developing world* (Baltimore, MD, Johns Hopkins University Press), pp. 141—182.

Hasha, G. 2001. "EU preferential trading arrangements: Heightened competition for U.S.", in *Agricultural Outlook,* No. 287, pp. 16—20, Dec.

Harvey, D.I.; Kellard, N.M.; Madsen, J.B.; Wohar, M.E. 2010. "The Prebisch–Singer hypothesis: Four centuries of evidence", in *Review of Economics and Statistics*, Vol. 92, No. 2, pp. 367—377.

Hayami, Y.; Ruttan, V. 1985. *Agricultural development: An international perspective* (Baltimore, MD, Johns Hopkins University Press).

Headey, D. 2011. "Rethinking the global food crisis: The role of trade shocks", in *Food Policy*, Vol. 36, No. 2, pp. 136—146, Apr.

Headey, D.; Alauddin, M.; Prasada Rao, D.S. 2010. "Explaining agricultural productivity growth: An international perspective", in *Agricultural Economics*, Vol. 41, No. 1, pp. 1—14.

Hoda, A.; Gulati, A. 2008. *WTO negotiations on agriculture and developing countries* (Baltimore, MD, Johns Hopkins University Press).

Hom, G.; Niehof, A.; Visser, L. 2012. "Shifting perceptions of food security and land in the context of labour out—migration in rural Nepal", in *Food Security*, Vol. 4, No. 2, pp. 181–194.

International Fund for Agricultural Development (IFAD). 2010. *Rural poverty report 2011* (Rome).

International Labour Office (ILO). 1973. *Mechanisation and employment in agriculture; case studies from four continents* (Geneva).

–. 1996. *Wage workers in agriculture: Conditions of employment and work* (Geneva).

–. 2000a. *Safety and health in agriculture: A set of fact-sheets* (Geneva).

–. 2000b. *Safety and health in agriculture,* International Labour Conference Report VI (1) (Geneva).

–. 2012. *LABORSTA Internet: Labour statistics database*. Available at http://laborsta.ilo.org/ [21 Sept. 2007].

International Monetary Fund. 2009. *World economic and financial survey* (Washington, DC).

Islam, N. 2011. *Foreign aid to agriculture: Review of facts and analysis*, IFPRI Discussion Paper, No. 01053 (Washington, DC, International Food Policy Research Institute).

Jansen, M.; Lee, E. 2007. *Trade and employment: Challenges for policy research* (Geneva, International Labour Office and World Trade Organization).

Jansen, M.; Peters, R.; Salazar-Xirinachs, J.M. (eds.). 2011. *Trade and employment: From myths to facts* (Geneva, European Union and International Labour Organization).

Jayachandran, S. 2006. "Selling labour low: Wage responses to productivity shocks in developing countries", in *Journal of Political Economy*, Vol. 114, No. 3, pp. 538–575, Jun.

Jayasinghe, S.; Sarker, R. 2008. "Effects of regional trade agreements on trade in agrifood products: Evidence from gravity modeling using disaggregated data", in *Review of Agricultural Economics*, Vol. 30, No. 1, pp. 61–81.

Klenow, P.J.; Rodríguez–Clare, A. 1997. "The neoclassical revival in growth economics: Has it gone too far?", in *NBER Macroeconomics Annual*, Vol. 12, pp. 73–102.

Labowitz, S. (ed.). 2007. *Task – and risk – mapping study of hybrid vegetable seed production in India* (Washington, DC, Fair Labor Association).

Lanjouw, J.O.; Lanjouw, P. 2001. "The rural non–farm sector: Issues and evidence from developing countries", in *Agricultural Economics*, Vol. 26, No. 1, pp. 1–23, Oct.

Madison, D.; Fang, C.; Isik, M.; Meyer, S.; Kruse, J.; Westhoff, P.; Beghin, J.; Elobeid, A.; Brown, D.S.; Fabiosa, J.; de Cara, S.; Matthey, H.; Willott, B.; Saak, A. 2005. "The Doha round of the world trade organization and agricultural markets liberalization: Impacts on developing economies", in *Review of Agricultural Economics*, Vol. 27, No. 3, pp. 317–335, Sep.

Maertens, M.; Swinnen, J.F.M. 2009. "Trade, standards, and poverty: Evidence from Senegal", in *World Development*, Vol. 37, No. 1, pp. 161–178, Jan.

Matthews, A. 2011. "Economic partnership agreements and food security", in O. Morrissey (ed.): *Assessing prospective trade policy assessing prospective trade policy: Methods applied to EU–ACP economic partnership agreements* (London, Routledge), pp. 203–222.

Maxwell, S. 1996. "Food security: A post–modern perspective", in *Food Policy*, Vol. 21, No. 2, pp. 155–170, May.

Maxwell, S.; Smith, M. 1992. "Household food security: A conceptual review", in *Household food security: Concepts, indicators, measurements* (Geneva, United Nations Children's Fund), pp. 4–51.

McCulloch, N.; Ota, M. 2002. "Export horticulture and poverty in Kenya", *IDS Working Paper,* No. 174 (Brighton, Institute of Development Studies).

McMillan, M. 2001. "Why kill the golden goose? A political-economy model of export taxation", in *The Review of Economics antatistics*, Vol. 83, No. 1, pp. 170–184, Feb.

McMillan, M.; Verduzco, I. (2011). "New evidence on trade and employment: An overview", In M. Jansen, R. Peters, and J.M. Salazar–Xirinachs (eds.): *Trade and employment: From myths to facts* (Geneva, International Labour Office)

Muhammad, A.; Amponsah, W.A.; Dennis, J.H. 2010. "The impact of preferential trade arrangements on EU imports from developing countries: The case of fresh cut flowers", in *Applied Economic Perspectives and Policy*, Vol. 32, No. 2, pp. 254–274.

Murphy, A.; Strobl, E. 2008. "Employer and employee ignorance in developing countries: The case of Trinidad and Tobago", in *Review of Development Economics*, Vol. 12, No. 2, pp. 339–353, May.

Nadal, A. 2000. «The environmental and social impacts of economic liberalization on corn production in Mexico»(Gland, Oxfam and WWF International).

Neven, D.; Odera, M. M.; Reardon, T.; Wang, H. 2009. "Kenyan Supermarkets, Emerging Middle-Class Horticultural Farmers, and Employment Impacts on the Rural Poor", in *World Development*, Vol. 37, No. 11, pp. 1802-1811, November.

Organisation for Economic Co-operation and Development (OECD); Food and Agriculture Organization (FAO). 2011. *OECD–FAO Agricultural Outlook 2011–2020* (Geneva).

Papageorgiou, D.; Michaely, M.; Choksi, A. (eds.). 1991. *Liberalizing foreign trade* (Oxford, Basil Blackwell).

Parikh, A. 1985. "Some aspects of employment in Indian agriculture", in *World Development*, Vol. 13, No. 6, pp. 691–704, June.

Pingali, P. 2010. "Agriculture renaissance: Making "agriculture for development" work in the 21st century", in R. Evenson and P. Pingali (eds.): *Handbook of agricultural economics,* Vol. 4, pp. 3867–3894.

Pingali, P.L.; Traxler, G. 2002. "Changing locus of agricultural research: Will the poor benefit from biotechnology and privatization trends?", in *Food Policy*, Vol. 27, No. 3, pp. 223–238, June.

Plummer, M.; Cheong, D.; Hamanaka, S. 2010. *Methodology for impact assessment of free trade agreements* (Manila, Asian Development Bank).

Polaski, S. 2006. *Winners and Losers: Impact of the Doha Round on Developing Countries* (Washington, Carnegie Endowment for International Peace).

Pray, C.E.; Fuglie, K.O.; Johnson, D.K.N. 2007. "Private agricultural research", in R. Evenson and P. Pingali (eds.): *Handbook of agricultural economics*, Vol. 3, pp. 2605–2640.

Prina, S. 2012. "Effects of border price changes on agricultural wages and employment", in *Journal of International Development*. Available at http://onlinelibary.wiley.com/doi/10.1002/jid.2814/abstract [21 Sep. 2012].

Restuccia, D.; Yang, D.T.; Zhu, X. 2008. "Agriculture and aggregate productivity: A quantitative cross–country analysis", in *Journal of Monetary Economics*, Vol. 55, No. 2, pp. 234–250, Mar.

Satchi, M.; Temple, J. 2006. "Growth and labour markets in developing countries", *CEDI Discussion Paper Series,* No. 06–12 (London, Brunel University, Centre for Economic Development and Institutions).

Satchi, M.; Temple, J. 2009. "Labour markets and productivity in developing countries", in *Review of Economic Dynamics*, Vol. 12, No. 1, pp. 183–204, Jan.

Sinha, A. 2011. "Trade and the Informal economy", in M. Jansen, R. Peters, and J.M. Salazar–Xirinachs (eds.): *Trade and employment: From myths to facts* (Geneva, International Labour Office).

Sunding, D.L.; Zilberman, D. 2001. "The agricultural innovation process: Research and technology adoption in a changing agricultural sector", in B. Gardner and G. Rausser (eds.): *Handbook of agricultural and resource economics.* (Amsterdam, North-Holland).

Taylor, D.F. 2001. "Employment-based analysis: An alternative methodology for project evaluation in developing regions, with an application to agriculture in Yucatán", in *Ecological Economics*, Vol. 36, No. 2, pp. 249–262, Feb.

Timmer, C.P. 1988. "The agricultural transformation", in H. Chenery and T.N. Srinivasan (eds.): *Handbook of development economics,* Vol. 1, pp. 275–331.

United Nations. 2006. *World Economic and Social Survey 2006* (Geneva). Available at: http://www.un.org/en/development/desa/policy/wess/wess_archive/2006wess.pdf [21 Sep. 2012].

United Nations. 2012. *United Nations commodity trade statistics database – UN Comtrade* (United Nations Statistics Division). Available at http://comtrade.un.org [21 Sept. 2012].

United Nations Conference on Trade and Development (UNCTAD). 1972. *Commodity problems and policies* (Geneva).

–. 1976. *New directions and new structures for trade and development* (Nairobi, United Nations).

–. 2008. Trade and Development Report 2008 (New York and Geneva, United Nations). Available at http://unctad.org/en/docs/tdr2008ch4_en.pdf [21 Sept. 2012].

–. 2009. Trade and Development Report 2009 (New York and Geneva, United Nations). Available at http://unctad.org/en/Docs/tdr2009_en.pdf [21 Sept. 2012].

Van der Mensbrugghe, D.; Beghin, J.C. 2005. "Global agricultural reform: What is at stake?", in M.A. Aksoy and J.C. Beghin (eds.): *Global agricultural trade and developing countries* (Washington, DC, World Bank).

Van Ittersum, M.K.; Rabbinge, R. 1997. "Concepts in production ecology for analysis and quantification of agricultural input–output combinations", in *Field Crops Research*, Vol. 52, No. 3, pp. 197–208.

Vogel, S.J. 1994. "Structural changes in agriculture: Production linkages and agricultural demand-led industrialization", in *Oxford Economic Papers*, Vol. 46, No. 1, pp. 136–156, Jan.

Vollrath, T.L.; Hallahan, C.B.; Gehlhar, M.J. 2006. "Consumer demand and cost factors shape the global trade network in commodity and manufactured goods", in *Canadian Journal of Agricultural Economics*, Vol. 54, No. 4, pp. 497–511.

Von Braun, J.; Hotchkiss, D.; Immink, M. 1989. *Nontraditional export crops in Guatemala: Effects on production, consumption, and nutrition*, Research Report, No. 73 (Washington, DC, International Food Policy Research Institute).

Wacziarg, R.; Wallack, J.S. 2004. "Trade liberalization and intersectoral labour movements", in *Journal of International Economics*, Vol. 64, No. 2, pp. 411–439, Dec.

Wade, R.H. 2003. *Governing the market: Economic theory and the role of government in East Asian industrialization* (Princeton, NJ, Princeton University Press).

World Bank. 2007. *World Development Report 2008: Agriculture for development* (Washington, DC). Available at http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf.

–. 2010. *Global economic prospects: Crisis, Finance, and Growth* (Washington, DC).

–. 2011. *World Development Indicators 2011* (Washington, DC). Available at http://siteresources.worldbank.org/DATASTATISTICS/Resources/wdi_ebook.pdf [21 Sept. 2012].

Zahniser, S.; Pick, D.; Pompelli, G.; Gehlhar, M.J. 2002. "Regionalism in the Western Hemisphere and its impact on U.S. agricultural exports: A gravity-model analysis", in *American Journal of Agricultural Economics*, Vol. 84, No. 3, pp. 791–797, Aug.