

Agricultural labour productivity and food prices: Fundamental development impacts and indicators

This policy brief reviews historical changes in staple food prices (in terms of international grain prices) and highlights increasing agricultural labour productivity and falling food prices as critical drivers of development, food security and poverty reduction. These drivers are, however, challenged by growing threats facing global and local agricultural and food systems. Simple indicators for agricultural labour productivity and food price changes relative to the real incomes of poor people are proposed to focus international and national attention and policy on these issues.

1. Long term staple food price changes and their impacts

Changes in staple food prices reflect a variety of changes in the opportunity cost of food consumption and production for different consumers and producers. Although nominal grain prices have risen dramatically since the 1960s, grain prices have fallen substantially relative to incomes and prices for other goods and services consumed by less poor consumers in countries that have experienced economic growth. However poor and particularly food insecure consumers in poorer economies have enjoyed much smaller price falls, although there

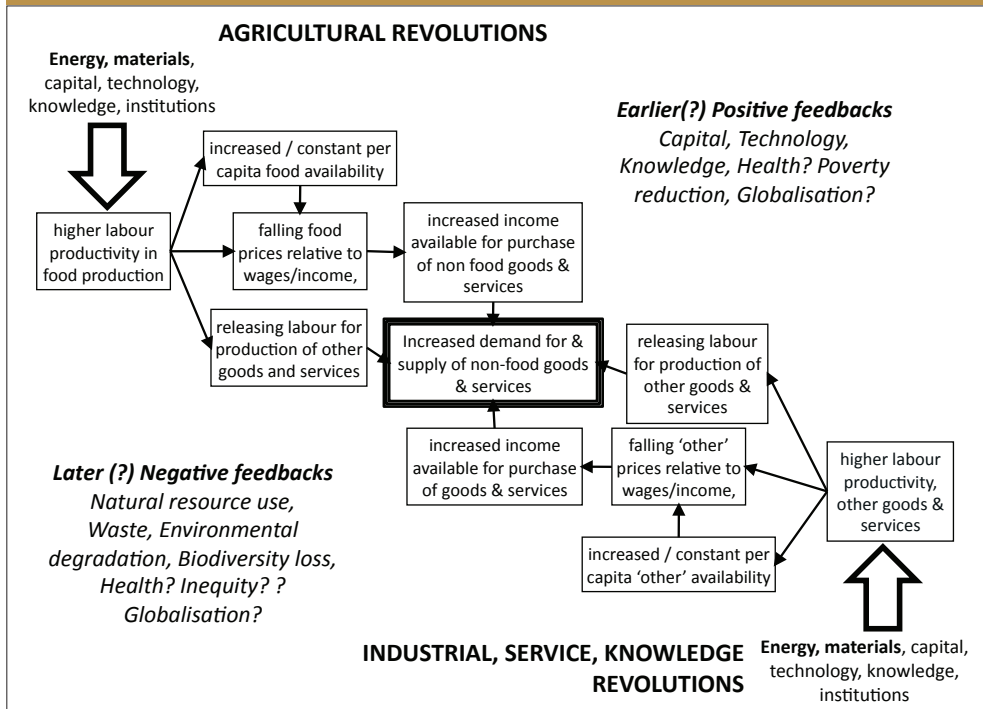
are no readily available indicators of changes more relevant to these consumers (despite the critical importance of food prices to their welfare).

Historically, successful economic development and growth have been stimulated and sustained by rising productivity of agricultural labour and hence falling real food prices. This is illustrated in figure 1, which shows how agricultural labour productivity plays a foundational role within wider economic development processes.

The top left corner of figure 1 shows how agricultural revolutions that raise agricultural labour productivity in poor agrarian economies can play multiple foundational roles in wider development processes, as increased production

per worker leads to increasing food availability per worker. This then (a) lowers the cost (and price) of food relative to agricultural worker incomes, (b) this raises agricultural workers' budget surpluses after food expenditures and hence increases their real incomes, (c) this stimulates demand for non-food goods and services and (d) simultaneously releases agricultural labour from food production to production of other goods and services (as fewer workers are needed to produce the food that society requires). Agricultural labour productivity growth in poor agrarian economies thus simultaneously raises productivity of poor countries' and poor people's abundant and critical resource (agricultural labour), raises their real incomes, and stimulates both supply and demand of non-food goods and services (in the centre of the figure).

Figure 1: Food, energy and development processes and challenges



The figure also shows, starting from the lower right corner, how industrial, service and knowledge revolutions have by the same process built on the basic, initial increase in supply and demand for non-food goods and services to lower the labour costs of their production. In this they perform the same function as the earlier agricultural revolution – but agriculture’s relative importance, and the potential benefits from increased agricultural labour productivity then fall, with food production’s shares of labour use and expenditure. This is matched by increasing importance of industrial, service and knowledge revolutions in raising the productivity of increasing amounts of labour involved in the production of non-food goods and services, responsible for a rising share of consumer expenditures.

A number of points should be noted about this analysis.

- Falling food prices relative to incomes are an essential part of this process and historically this has been a feature of all wealthy and developed economies and of all wealthy groups within rich and poor societies.
- Broad based increases in the productivity of labour applied to staple food production on small farms offer an important but challenging and transitional means of widespread, pro-poor growth in poor agrarian economies. They lead to increases in productivity and in returns to large amounts of relatively unproductive resources (land and labour) which are important both in the national economy and in the livelihoods of poor people. Increases in capital intensive productivity in large scale mechanised commercial agriculture or mining do not deliver these coordinated stimuli. Policy may of course seek to reproduce this, through taxes and subsidies (for example with social protection policies) but this presents significant political economy and governance challenges, and requires a large, highly productive and rapidly growing large scale capital intensive sector to support these very large transfers. It also misses an important potential growth opportunity by not simultaneously raising the productivity of poor people’s labour – unless rural labour can be quickly absorbed into rapidly growing labour intensive manufacturing. This may be possible in emerging and middle income economies, but despite difficulties with small-holder development is unlikely to provide efficient and rapid routes to poverty reduction and broad based growth in many poor agrarian economies.
- Both the agricultural and the industrial, service and knowledge revolutions have been based on fossil fuels replacing bioenergy sources, on increased use of material inputs, on new technologies (often associated with fossil fuel and material inputs), on new knowledge, and on accumulation and investment of private and public capital. However there is growing evidence and concern that continued dependence on fossil fuels and external inputs is constrained by environmental limits, the effects of rising energy and input prices, and increasing competition between food and energy production. Positive feedbacks that supported development processes in the past may also be reaching their limits while negative feedbacks are growing in importance.
- Finally, limits and threats to increased labour productivity in food production are also threats to the fundamental structure of ‘developed’ economies, raising serious questions about the extent to which non-industrial forms of agriculture (such as agroforestry or agro-ecological, conservation or organic farming) can support developed societies if

they require higher labour input per unit output to maintain or raise per hectare yields. These issues are also fundamentally important to aspirations about standards and modes of living and structures of society and economic activity in developed economies.

Although global agricultural production has risen partly as a result of increases in cultivated areas, public and private investments in technical and institutional change have dramatically increased land and labour productivity and driven the structural change and low 'real' food prices described above in many parts of the world (but not in poor agrarian economies). Depressed incentives for further agricultural investment, as a result of the low relative food prices in less poor economies, have been one explanation for recent food price rises across both high and low income countries.

Box 1: Low food prices as a public good?

Low food prices are a public good for a number of reasons. They are a 'good' (as opposed to a 'bad') because of the short term negative impacts of high food prices on the welfare of poor food insecure people, impacts which then affect the physical, mental and social development of affected children, and the development of their communities. They are also a 'good' because of the long term wider developmental impacts of low food prices relative to incomes, as outlined earlier. They are a 'public good' because these are non-rival and non-exclusive benefits arising as externalities from private investments in research and production aimed at increasing private profits. They are a 'global public good' because food production and consumption in different countries are increasingly linked through global trade and markets.

This highlights major challenges in achieving welfare and developmental benefits from low food prices without undermining incentives for investment in new technologies and increased production. Low food prices are, however, a global public good (see box), and standard economic theory recognises that governments have to invest in the provision of public goods. In this governments of poor agrarian economies have a particularly difficult 'food price tightrope' to walk, using a variety of output, input, and technology and investment support policies to promote increased food crop production and productivity without 'high' prices. Some of these policies have been remarkably successful, while others have been disastrous failures (Dorward et al., 2004).

Research and policy for high rural labour productivity in sustainable and resilient agricultural and food systems therefore need much greater attention in international policy and should be a core part of any successor to the Millennium Development Goals after 2015. This needs, however, coordination around policy goals and targets, and targets need indicators.

2. Indicators of agricultural productivity change

Staple food prices and agricultural labour force productivity are critical for people's welfare and long term economic growth and structural change. However increasing yields per unit land and increasing productivity of energy and material inputs used in agriculture are also important given the global food security challenges with increasing world population, consumption of animal products, and needs to reduce agriculture's 'environmental footprint'. Box 2 puts forward three agricultural productivity indicators which provide a more holistic picture of agricultural achievements and challenges.

Box 2: Agricultural productivity indicators

Three agricultural productivity indicators together provide a holistic picture of agricultural achievements and challenges. All three can be constructed from current World Development Indicators using international cereal prices.

Cereal Equivalent Productivity of Agricultural Labour (or CEPAL) is defined as

$$\text{CEPAL} = \frac{\text{Agricultural Value Added}}{\text{Agricultural Workers} * \text{Cereal Prices}}$$

Cereal Equivalent Land Yield (or CELY) is defined as

$$\text{CELY} = \frac{\text{Agricultural Value Added}}{\text{Agricultural Workers} * \text{Cereal Prices}}$$

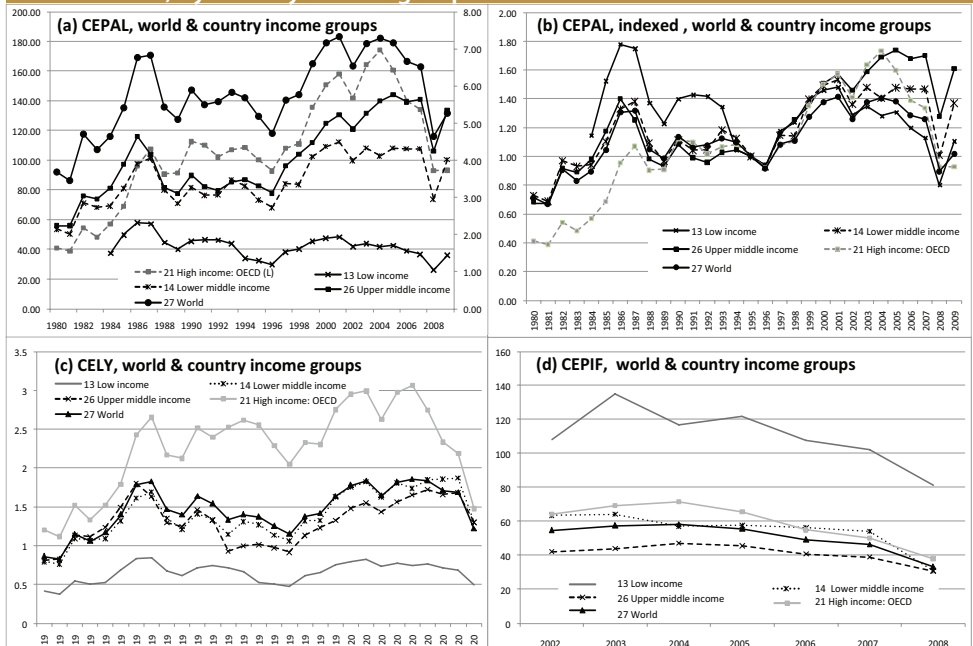
Cereal Equivalent Productivity of Inorganic Fertiliser (CEPIF) is defined as

$$\text{CEPIF} = \frac{\text{Agricultural Value Added}}{\text{Inorganic fertiliser use} * \text{Cereal Prices}}$$

Figure 2 provides a comparison of historic changes in agricultural labour, land and fertiliser productivity in different country income groups. There are striking differences between raw

values of labour productivity between the high income group and other groups (requiring data for high income countries to be scaled separately on the left hand axis in figure 2a). Cereal

Figure 2: CEPAL, CELY and CEPIF (tonnes grain equivalent / worker, ha and fertiliser ton) by country income group



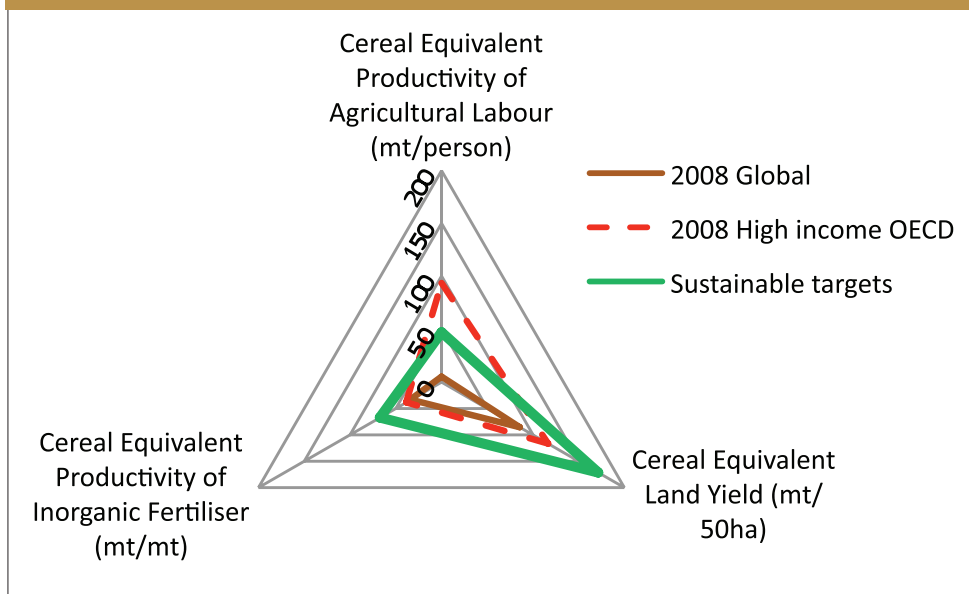
equivalent labour productivity rises steadily from low to high income groups, and has generally risen from 1980 to 2010, except for low income countries - but the extent of the rise varies between income groups and falls during periods of high cereal prices. In (a) the OECD high income group is scaled on the left hand axis, other income groups on the right.

Cereal equivalent land yield rises steadily from low to high income groups, and has generally risen from 1980 to 2010, except in low income countries, during periods of high cereal prices and from 2004 in high income countries. Although not shown in figure 2, country measures are heavily affected by land quality. Figure 2 highlights the challenge facing agriculture – how to get high income countries' high labour and land productivity (high CEPAL and CELY values) without high use of fertiliser which leads to low fertiliser productivity (CEPIF). However low income countries need higher

fertiliser use and lower aggregate fertiliser productivity to raise their yields (though there is scope for improving productivity of existing fertiliser use). Major challenges are faced by lower and upper middle income countries as these countries are responsible for the majority of the world's fertiliser use but have low fertiliser productivity. Figure 3 further highlights these challenges.

Figure 3 further highlights these challenges, comparing 2008 global and high income (OECD) countries' CEPAL, CELY and CEPIF with illustrative targets for these variables. Although the precise targets can be debated, the challenge facing world agriculture is clear – how to dramatically raise both agricultural labour and external input productivity while maintaining land productivity when low external input productivity has been the basis for past achievement of high labour productivity in high income countries' agriculture. Unfortunately most discussions of

Figure 3: Illustrative sustainable agricultural productivity targets (added value)



the challenges facing world agriculture have paid scant attention to the critical challenge of raising agricultural labour productivity.

3. An indicator of real food prices relative to real incomes

Current measures of real food prices relative to retail or manufacturing price indices fail to represent the ‘income effect’ of high prices on poor consumers. We therefore propose an alternative real food price indicator, the Food Expenditure Ratio (or FER), defined as the expenditure required to meet essential calorific requirements divided by resources available for non-staple food after consumption of essential calorific requirements, or

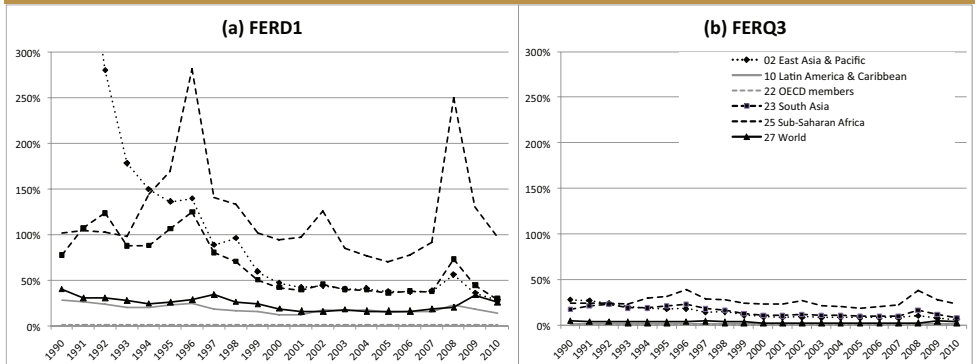
$$\text{FER} = \frac{\text{Essential calorific consumption}}{\text{Total per capita consumption} - \text{Essential calorific expenditure}}$$

The FER varies with per capita consumption, minimum calorific requirements, and calorie prices, and it can be defined for specific consumption fractiles in a population, with, for example, FERD1 for mean consumption of the first (lowest) consumption decile in a population and FERQ3 for mean consumption of the middle

quintile in a population. Details of information required and calculation of the FER are provided in Dorward, 2012. Figure 4 shows estimated FERD1 and FERQ3 for major regions of the world from 1990. FERD1 values are substantially higher than FERQ3 values and more sensitive to food price shocks (as in the mid 1990s and 2007/8), but these differences are less marked in more wealthy economies and in those that have become more wealthy over time - but they remain marked in Africa. This is consistent with the lack of income and agricultural growth in Africa in the 90s (coupled with high gini coefficients) and with observations that the food crisis impacts have been substantially mitigated by economic growth in India and China (Headey, 2011).

FERs presented here could be improved with use of domestic rather than international prices; use of country specific weights across different grains (and staple roots and tubers); improved estimates of decile and quintile incomes within and across countries; and allowance for consumption of some livestock products as

Figure 4: Food expenditure ratios (FERs) for Decile 1 and Quintile 3 by regions
 Source: see Dorward, 2012



'essential' in less poor countries and among less poor consumers in low income economies.

4. Conclusions

Agricultural labour productivity and the roles of falling of food prices relative to wages in wider economic growth and development have been surprisingly absent from current debates about responses to multiple challenges facing global agriculture and food production. There is therefore a need for indicators that provide better measures of different types of agricultural productivity and of food price impacts on poorer people. Indicators proposed in the final sections of the paper go some way to meeting this need and could help to focus coordinated international and national efforts to promote improved food security and poverty reduction if implemented

to support new international development goals when the current Millennium Development Goals expire in 2015.

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This policy brief summarises the main arguments from a working paper available at <http://eprints.soas.ac.uk/13483/>



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