SUPERMARKETS AND LOCAL AGRICULTURE

- A Ramsey analysis of productivity linkages[*]

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Abstract

As part of the globalization process multinational supermarket chains are expanding in developing countries. To study the impact on local agriculture, I apply an intertemporal general equilibrium model that highlights the adjustment mechanisms involved. There are potential productivity gains from delivering intermediates to supermarkets. Whether farmers are able to take advantage of the productivity linkage depends on their learning capacity. While high-skilled commercial farmers benefit from the entry of supermarkets, an economy dominated by traditional agriculture might get stuck in a low productivity trap. But simulations show that in the latter case the supermarket sector has an incentive to contribute to skill-upgrading in agriculture.

JEL no: O33, O41, O55, Q16.

Keywords: Supermarkets; Backward productivity spillovers; Skill-upgrading; Developing countries.

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1. Introduction

The past decades have seen a rapid rise of supermarket chains in the developing part of the world. In Latin America the supermarkets' share of food sales increased from 10-20% in 1990 to 50-60% in 2000. This corresponds to a change in the retail sector that took about 50 years in the US (Reardon and Berdegue, 2002). Reardon et al. (2003) analyze the pattern of supermarket diffusion in Africa, Asia and Latin America. The expansion started in major cities in the richest countries of Latin America, followed by East and Southeast Asia, before spreading to poorer countries and neighbourhoods in the two regions. More recently, the supermarket sector is expanding in Eastern and Southern Africa, but so far, it is dominated by regional, and not multinational, chains. The rise of supermarkets in Africa is driven by South Africa and Kenya, but is gradually spreading to poorer countries as well (Weatherspoon and Reardon, 2003). Reardon et al. (2003) discuss the determinants of the observed supermarket expansion in developing countries. On the demand side, urbanization, higher income and a growing middle class are important factors, while reduction of foreign direct investment regulations is the main driver on the supply-side.

The impact of the supermarket expansion on the rural poor is widely discussed in the literature, but with no conclusive answer (D'Haese and van Huylenbroeck, 2005, IFPRI, 2003, Reardon and Berdegue, 2002, Reardon et al., 2003, Weatherspoon and Reardon, 2003, among others). The entry of supermarket chains represents both opportunities and challenges for the agricultural sector. There are potential productivity gains from delivering intermediates to the supermarket sector, but it is a challenge for local farmers to meet the higher safety and quality demands of the supermarkets. The expansion of supermarkets might affect the skill level and relative wages in agriculture, and as consumers the rural poor benefit from lower food prices and higher food safety.

This paper's contribution to the literature is to study the supermarket expansion within an intertemporal general equilibrium framework that highlights the adjustment mechanisms involved. The model specification assumes an archetype developing economy with

duality in both agriculture and the food retail sector. To capture the potential spillover effect from supermarkets to local agriculture, productivity growth in commercial agriculture is endogenously determined. Whether farmers are able to take advantage of the productivity linkage depends on their learning capacity (measured by the skill-ratio).

The analysis separates between two cases dependent on the development level in agriculture. The high-skill scenario represents an economy with a well-developed commercial agricultural sector (like South Africa), while the low-skill scenario represents a typical African economy with mainly traditional agriculture. First, a highly skilled agricultural sector benefits from an expanding supermarket sector and relative productivity increases over time. Domestic farmers are the main intermediate suppliers to the supermarkets, and commercial agriculture expands at the cost of traditional agriculture. Income distribution within agriculture worsens, but the sector as a whole benefits. Second, in a less developed economy where agriculture mainly consists of unskilled labour, the presence of supermarkets may generate a low productivity trap. Local farmers are not able to meet the quality and safety demands of the supermarket sector, which choose to import most of its intermediate goods. However, numerical simulations show that the supermarket sector has an incentive to contribute to skill-upgrading in agriculture.

The rest of the paper is organized as follows. Section 2 presents the modelling of the productivity linkage between supermarkets and commercial agriculture, while the full intertemporal model is given in section 3. The impact of an expanding supermarket sector on local agriculture in the high-skill and low-skill scenario is analyzed in sections 4 and 5, respectively. Section 5 also shows the impact of exogenous skill-upgrading. Section 6 offers concluding remarks.

2. Productivity dynamics

Entry of global or regional supermarket chains represents foreign direct investment (FDI), and may generate productivity spillovers to the domestic economy. The idea is

that interaction with supermarkets at the intermediate market contributes to productivity growth through backward linkages. Higher quality and safety demands combined with increased competition from foreign intermediate suppliers contribute to the positive productivity effect from delivering goods to the supermarkets. Whether local farmers are able to take advantage of the productivity linkage depends on their learning capacity. Productivity upgrade involves adoption of new technology and new production techniques, which is likely to require a certain skill level.

There is a broad empirical literature on productivity spillovers from foreign direct investments. Javorcik (2004) applies firm-level data from Lithuania during 1996-2000 and offers empirical support for the existence of backward productivity spillovers from FDI. Girma et al. (2004) find similar results in an analysis of UK manufacturing industries. Minten et al. (2006) document positive productivity spillovers and improved technology adoption among farmers in Madagascar that produce vegetables for supermarkets in Europe. The positive role of human capital (skills) in productivity growth and technology adoption is empirically documented by Baumol et al. (1989), Benhabib and Spiegel (1994), and Frantzen (2000), among others.

To capture the productivity linkage between supermarkets and their domestic intermediate suppliers, productivity growth in commercial agriculture is endogenously determined. The starting point of the productivity specification is the technology gap formulation offered by Nelson and Phelps (1966). Technology adoption depends on the distance to the technological frontier (representing the learning potential) and the level of human capital (representing the learning capacity). In the present model the supermarket sector acts as the technological frontier. I extend the productivity dynamics to include backward spillovers from the supermarkets. This implies that the barriers to technology adoption are determined by the skill level and the degree of interaction with the supermarkets at the intermediate market. A related specification with productivity spillovers from the export sector to its intermediate suppliers is applied by Diao et al. (2006) for the case of Thailand, while Stokke (2004) offers a non-linear technology gap specification with multiple equilibria.

Productivity growth in commercial agriculture in period t ($\hat{A}_{c,t}$) is specified as follows:

$$\hat{A}_{c,t} = \lambda \left(\frac{Ls_t}{Lu_{c,t} + Ls_t} \right)^{\theta_1} \left(\frac{ND_t}{N_t} \right)^{\theta_2} \left(1 - \frac{A_{c,t}}{A_{s.t}} \right) \quad (1)$$

where $A_{c,t}$ and $A_{s,t}$ represent the productivity levels of commercial agriculture and supermarkets, respectively, and $\frac{A_{c,t}}{A_{s,t}}$ is the technology gap. Ls_t is the supply of rural skilled labour (which is only used in commercial agriculture), while $Lu_{c,t}$ is unskilled rural labour employed in commercial agriculture. The first term in equation (1) gives the skill-ratio in commercial agriculture. The second term represents the share of intermediate supply to the supermarkets by domestic farmers. ND_t is the intermediate demand for the domestic commercial agricultural good, while N_t is total intermediate demand by the supermarket sector. λ, θ_1 and θ_2 are constant parameters. The productivity level of supermarkets grows at an exogenous rate given by g.

The extent of productivity spillovers from supermarkets is determined by the technology gap and the degree of interaction at the intermediate market, while the ability to take advantage of these spillovers depends on the skill level of farmers. When the barriers to technology adoption are not too high, the productivity dynamics is consistent with technological convergence. Long-run productivity growth is given by the exogenous growth rate of the supermarket sector, and the technology gap is constant (marked as $(A_c/A_s)^E$ in Figure 1). The degree of catch up depends on the skill level in commercial agriculture and the degree of interaction with the supermarket sector. The linear relationship between productivity growth and the technology gap in equation (1) limits the advantage of backwardness compared to the Nelson-Phelps specification. Lack of interaction with supermarkets and/or low skill level may generate technological divergence with increasing technology gap over time. This is consistent with the formulation applied by Benhabib and Spiegel (2005). The productivity dynamics are illustrated in Figure 1 below, where curve *i* and *ii* represent low and high barriers to technology adoption, respectively.

Figure 1 about here.

3. A Ramsey model of an archetype developing economy

To study the impact of an expanding supermarket sector on local agriculture the productivity dynamics are placed in an intertemporal general equilibrium setting. The main advantage of this methodology is to clarify the adjustment mechanisms involved. Existing Ramsey analyses with focus on agriculture typically model the interaction between a traditional agricultural sector and a modern industrial sector (see for instance Love, 1997; Stifel and Thorbecke, 2003). General equilibrium modelling of supermarkets and local agriculture is scarce, and the recent contribution by Roe and Diao (2004) is the only analysis to my knowledge. In a Ramsey growth framework they show that the supermarket expansion can be understood as a natural process of economy-wide economic growth. The results are driven by differences in capital intensity between supermarkets and the traditional food retail sector. The analysis includes a vertical linkage between the retail sector and agriculture in the sense that commercial farmers deliver goods to supermarkets, while traditional farmers supply the traditional retail sector. But the analysis does not capture the potential productivity linkage between supermarkets and commercial agriculture, which is the main focus of the present paper. The importance of agricultural productivity for overall economic growth is illustrated by Irz and Roe (2005), while Diao et al. (2005) discuss the interplay between productivity and capital accumulation.

The model represents an archetype developing economy with duality in both agriculture and the food retail sector. The economy is disaggregated into five sectors: Traditional and commercial agriculture, traditional and modern food retail sectors, and the rest of the economy. The modern food retail sector includes supermarkets, large discount stores and hypermarkets (to simplify the notation I use the term ‘supermarkets’), while the traditional food retail sector consists of small shops and public markets. I separate between rural and urban labour, where the first is employed in agricultural sectors and the

second in the three other sectors. Since the focus of the analysis is on agriculture the rural labour force is further divided into skilled and unskilled workers.

Traditional and commercial agriculture differ with respect to skill level, extent of foreign competition and potential markets. Traditional agriculture delivers intermediate products to the traditional food retail sector, while commercial agriculture also supplies supermarkets, and faces competition from foreign producers. This specification is consistent with the South African experience, where supermarkets are mainly supplied by commercial agriculture (D'Haese and van Huylenbroeck, 2005). To simplify the analysis agricultural exports are ignored.

Value added in traditional and commercial agriculture ($X_{i,t}$) is specified as follows:

$$X_{a,t} = A_{a,t}^{\alpha_1} AD_{a,t}^{\alpha_2} Lu_{a,t}^{\alpha_1} LD_a^{\alpha_2} K_{a,t}^{\alpha_3} \tag{2}$$

$$X_{c,t} = A_{c,t}^{\beta_1+\beta_2} AD_{c,t}^{\beta_3} Lu_{c,t}^{\beta_1} Ls_t^{\beta_2} LD_c^{\beta_3} K_{c,t}^{\beta_4} \tag{3}$$

where $Lu_{i,t}$ and Ls_t are unskilled and skilled rural labour, respectively, $LD_{i,t}$ is land, and $K_{i,t}$ is capital ($i = a, c$). The subscripts a and c represent traditional and commercial agriculture, respectively. Unskilled labour is perfectly mobile and is allocated between traditional and commercial agriculture based on marginal productivities, while skilled rural labour is only employed in commercial agriculture. Given land supply being constant over time, exogenous land augmenting technical change ($AD_{i,t}$) is assumed in order to have balanced growth in the long run. As explained in the previous section, labour augmenting technical progress ($A_{c,t}$) is endogenized in commercial agriculture to capture the potential productivity linkage with supermarkets. In all other sectors productivity grows exogenously at the long run rate.

Consumption goods are produced by the food retail sectors and the rest of economy, while capital is produced in the rest of the economy. Value added in the food retail sectors and the rest of the economy is specified as a Cobb-Douglas function of urban labour ($L_{j,t}$) and capital ($K_{j,t}$):

$$X_{j,t} = A_{j,t}^{\gamma_j} L_{j,t}^{\gamma_j} K_{j,t}^{1-\gamma_j} \qquad j = m,s,tr \tag{4}$$

where the subscripts *m*, *s* and *tr* represent the rest of the economy, supermarkets, and traditional retail, respectively.

The representative household receives income from labour, capital and land, and pays interests on its foreign debt. As discussed later in this section the household is forward looking and maximizes its intertemporal utility. Within-period consumption is modelled through a Stone-Geary demand system with minimum consumption levels for each good. In this way the household has non-homothetic preferences, and the income elasticity may differ between goods. Aggregate consumption for each time period (Q_t) is defined as:

$$Q_t = cs \cdot \prod_j (C_{j,t} - \overline{C}_j)^{\alpha c_j} \qquad j = m,s,tr \tag{5}$$

where $C_{j,t}$ is consumption of each final good and $\overline{C}_j$ is the minimum consumption level, which is constant over time. αc_j and *cs* are constant parameters.

It follows that the household demand for each commodity is given by:

$$P_{j,t} \cdot (C_{j,t} - \overline{C}_j) = \alpha c_j \cdot PQ_t \cdot Q_t \tag{6}$$

In the model calibration the minimum consumption level is assumed to be relatively higher for traditional retail goods, which means that the income elasticity is lower here. When the income increases, demand is gradually shifted towards goods from the supermarket sector and the rest of economy at the cost of traditional retail goods. As illustrated by the numerical simulations the change in the consumption pattern contributes to the expansion of the supermarket sector.

The retail sectors and traditional agriculture are non-traded, and the price levels are determined endogenously from the domestic market. The rest of economy good and the commercial intermediate good are imported, and the modelling assumes imperfect substitution between domestic and foreign goods through an Armington composite system. All exports are done by the rest of economy sector, where CET functions are

used to capture the imperfect substitution between goods produced for domestic markets versus export markets.

The economy faces a perfect capital market with the interest rate exogenously given from the world market. Investments can be financed through foreign borrowing, and the decisions about savings and investment can therefore be separated, although with a long-run restriction on foreign debt. Increase in foreign capital inflows (i.e., trade deficits) in the current period, together with interest payments on existing debt, augments foreign debt in the next period.

The representative household allocates its income to consumption and savings to maximize its intertemporal utility. The isoelastic utility function is maximized subject to a budget constraint, which says that discounted value of total consumption cannot exceed discounted value of total income over time. Assuming intertemporal elasticity of substitution equal to one gives the well-known Euler equation for optimal allocation of total private consumption expenditure over time:

$$\frac{Q_{t+1}}{Q_t}\frac{PQ_{t+1}}{PQ_t} = \frac{1+r}{1+\rho} \tag{7}$$

where Q_t is aggregate household consumption, PQ_t the aggregate price, r the world market interest rate and ρ is the positive rate of time preference. The growth in consumption depends on the interest rate, the time preference rate, and the price path. Higher interest rate or lower time preference rate motivate more savings and thereby higher consumption spending in the future.

The capital stock is managed by an independent investor who chooses an investment path to maximize the present value of future profits over an infinite horizon, subject to the capital accumulation constraint. A small open economy model with exogenous interest rate and no imperfections at the capital market gives immediate adjustment of the capital stock to its steady state level if the model is calibrated to an out of steady state path. The economy takes advantage of the foreign borrowing opportunity to finance the investments to fully exploit the profit opportunities along the steady state. To create

transition dynamics I follow the common practice in the literature and introduce adjustment costs in investment. Unit adjustment costs are modelled as a positive function of the investment-capital ratio. Hence, total adjustment costs (φ_t) are given as:

$$\varphi_t = \mu \cdot P_{m,t} \cdot \frac{I_t^2}{K_t} \tag{8}$$

where K_t is the aggregate capital stock, I_t is investment, $P_{m,t}$ the rest of economy price and μ is a constant parameter.

Differentiating the intertemporal profit function with respect to capital gives us the well-known no-arbitrage condition:

$$rq_{t-1} = Rk_t + P_{m,t} \cdot \mu \cdot \left(\frac{I_t}{K_t} \right)^2 - \delta \cdot q_t + \dot{q} \tag{9}$$

The condition in (9) states that the marginal return to capital has to equal the interest payments on a perfectly substitutable asset of size q_{t-1}, where q is the shadow price of capital. The first term on right hand side, Rk_t, is the capital rental rate, while the second term is the derivative of capital in the adjustment cost function. The marginal return to capital also has to be adjusted by the depreciation rate, δ, and capital gain or loss, $\dot{q}$.

Given sufficiently low barriers to technology adoption the long-run equilibrium is characterized by balanced growth. The growth rate is exogenously given as the sum of the rate of labour augmenting technical progress and the labour growth rate, while transition growth is endogenous. The capital stock and the foreign debt both grow at the constant rate in the long run. Productivity growth is given by the exogenous frontier growth rate, and the technology gap is constant. The degree of catch up in commercial agriculture depends on the skill level and the extent of spillovers from the supermarket sector. These dynamics are consistent with the common understanding that differences in income and productivity levels are permanent, while differences in growth rates are transitory (Acemoglu and Ventura, 2002).

4. Case 1: Well-developed commercial agriculture (ex: South Africa)

Based on the intertemporal model developed in the previous section I investigate the impact of an expanding supermarket sector on local agriculture. The analysis offers numerical simulations of two cases. First, in this section I focus on an economy with a well-developed commercial part of the agricultural sector, represented by for instance South Africa. Commercial agriculture in South Africa is large-scale and highly developed, while traditional agriculture is dominated by small-scale semi-subsistence farmers. The importance of supermarkets has been steadily rising since the end of Apartheid in 1994. Today, the supermarket sector accounts for about 50-60% of output in the South African food retail sector, which is similar to the average share in Latin America. Second, the next section analyzes the effects of supermarkets in a typical African economy, where traditional agriculture dominates.

The model is calibrated based on a prototype Social Accounting Matrix (SAM) for a developing economy. Since the SAM represents the long-run equilibrium it reflects an economy with an established supermarket sector. Supermarkets account for 60% of the food retail sector, which is broadly consistent with the observed share in South Africa and most of Latin America. Following data in Roe and Diao (2004), the supermarket sector is assumed to be more capital intensive than the traditional retail sector. Supermarkets receive intermediate goods from commercial agriculture and through imports, while the traditional retail sector is also supplied by domestic traditional farmers. The SAM represents an economy with a well-developed agricultural sector, where commercial agriculture accounts for 3/4 of agricultural value added and the share of skilled labour in the rural labour force is about 1/3. The long-run equilibrium path has constant growth equal to 4% (2% labour growth and 2% technical progress rate). To get transition dynamics the initial capital and productivity levels are scaled down. This takes the economy outside the steady state path, and economic growth and structural change is driven by endogenous adjustment back to equilibrium growth.

Along the transition path the supermarket sector is expanding, and contributes to a structural shift away from traditional food retail. Supermarkets initially account for about 30% of total retail production, but increase its market share to 56% during 40 years. The expansion of supermarkets is driven by both demand and supply factors in the model. The demand side effect follows from the non-homothetic utility function. The demand for the traditional retail good is income inelastic, and the share of the traditional good in total consumer spending is declining. At the supply side capital accumulation above steady state rate generates decreasing capital rental rate, while the wage rate is increasing at above steady state rate. Since the supermarket sector is relatively more capital intensive than traditional retail, it benefits from relatively lower unit costs.

Commercial agriculture takes advantage of the productivity spillovers from the expanding supermarket sector, and experiences productivity catch-up. The labour augmenting technical progress rate is initially 3.7%, which is well above the frontier rate of 2%. As the commercial sector catches up relative to the supermarket sector, the productivity growth rate decreases due to lower learning potential, consistent with standard technological convergence theory. The degree of catch-up depends on the sector's absorptive capacity, which is measured by the skill-ratio and the degree of interaction with supermarkets at the intermediate market. Since the commercial part of agriculture is well-developed when the supermarkets enter the economy, domestic farmers account for more than 70% of intermediate deliveries during the entire period of study. The strong linkage with the supermarket sector means that the barriers to learning are low and this strengthens the degree of catch-up. As explained below, inflows of unskilled labour from traditional agriculture decrease the skill-ratio and limit the productivity effect. During 40 years the average labour augmenting technical progress rate equals about 3%, which corresponds to total factor productivity (TFP) growth of 1.5%.[1] This generates an increase in commercial productivity relative to the productivity level in the supermarket sector from 0.33 to 0.49.

[1] With a labour share of 0.5 in commercial agriculture.

Higher productivity growth together with increasing demand from supermarkets generates a structural shift from traditional to commercial agriculture. The commercial sector increases its share of agricultural production from 50% to more than 70% along the transition path. The structural shift implies movements of unskilled labour from traditional to commercial agriculture. The share of unskilled labour employed in traditional agriculture decreases from 77% initially to 54% after 40 years. Since the supply of skilled labour grows at a constant rate, reallocation of unskilled labour lowers the share of skilled labour in commercial production from 67% to 51% along the transition path. As discussed above, lower skill-ratio decreases the sector's ability to take advantage of productivity spillovers, and limits the degree of catch up towards the supermarket sector.

The income distribution effects within agriculture are represented by the development in the skilled wage premium. The supermarket expansion generates an increasing wage gap between skilled and unskilled rural workers. Initially the unskilled real wage equals about 85% of the skilled real wage, but the share falls to 45% after 40 years. This follows from higher demand for skilled labour as commercial agriculture expands with the growing supermarket sector. Since the labour supply is given, the skill premium is pushed up. Even though the distribution within agriculture worsens, the sector as a whole benefits from an expanding supermarket sector, both in terms of overall GDP share and productivity level.

5. Case 2: Typical African economy with mainly traditional agriculture

The previous section studied an economy with relatively high rural skill-ratio (1/3 of rural labour is skilled), and show how commercial agriculture benefits from an expanding supermarket sector through productivity spillovers and increasing demand. This section focuses on the impact of supermarkets in a typical African economy with mainly traditional agriculture. In the modelling this is captured by assuming a very low skill ratio in commercial agriculture (3%), which means that commercial and traditional agriculture do not differ much and the agricultural sector as a whole can be seen as mainly

traditional. Driven by supply and demand factors the share of food sales by supermarkets increases from 22% to 48% during 40 years.[2]

Lower skill-ratio implies that the commercial part of agriculture (which is now broadly similar to traditional agriculture) is not able to take advantage of its linkage to the supermarket sector. It gets stuck in a low productivity trap with technological divergence, as illustrated in Figure 2. The productivity growth rate remains stagnate at about 1.3%, and relative productivity falls from 0.33 to 0.26 during 40 years. The commercial sector is not able to meet the quality demands of the supermarkets, which become increasingly dependent on foreign intermediate goods. As seen from Figure 3 below, the share of intermediate deliveries from domestic commercial farmers decreases from about 50% to 35%, and this further weakens the commercial sector's chances of escaping the low productivity trap.

Figure 2 about here.

To avoid transportation costs related to the use of foreign goods supermarkets have an incentive to improve the productivity of local intermediate suppliers by increasing the agricultural skill-ratio. A possible understanding of skill-upgrading driven by the supermarket sector is related to sub-contracting, training within the firm and improvement of organizational structure. To capture the macroeconomic impact of this scenario I calibrate an exogenous increase in the relative supply of skilled labour, while keeping the total supply of rural labour unchanged. The share of skilled labour in the rural labour force increases gradually from 3% and stabilizes at 34% after 40 years. This implies that the qualitative differences between traditional and commercial agriculture increase over time, and the economy gradually approaches a situation with a well-developed commercial agricultural sector.

[2] Compared to the high skill scenario in Section 4, supermarkets account for a smaller share of food sales, but the degree of expansion over time is about the same.

The impact on productivity growth is illustrated in Figure 2. Higher skill-ratio lowers the barriers to learning and improves the commercial sector's ability to benefit from productivity spillovers. The sector is initially stuck in a low productivity trap with technological divergence, but the skill-upgrading gradually increase the productivity growth rate. Relative productivity increases from an initial level of 0.33 to 0.42 at the end of the period studied, compared to 0.26 in the case without skill-upgrading. As the productivity growth rate increases, supermarkets shift their intermediate demand towards domestic commercial farmers from an initial share of 50% to about 70% after 40 years (Figure 3). This further strengthens the linkage between supermarkets and commercial agriculture, and contributes to the growth out of the low productivity trap.

Figure 3 about here.

Gradual skill-upgrading increases the market share of the supermarket sector compared to the low skill scenario. With increasing skill-ratio in domestic agriculture the share of food sales by supermarkets increases from 22% to 55% during 40 years, which is 7 percentage points higher than without the skill-upgrading (Figure 4). This shows that supermarkets benefit from more productive commercial farmers domestically, and supports the assumption that the sector has an incentive to improve the productivity of its local suppliers.

Figure 4 about here.

The main results in this section are consistent with the empirical analysis of Weatherspoon and Reardon (2003), who discuss the procurement system of South African supermarket chains dominating the African market. First, they find that supermarkets prefer to use large farmers as suppliers, because they are likely to be more productive and familiar with quality and safety standards from own exporting activity. When such large suppliers are not available and small farmers do not meet the required standards, supermarkets tend to import necessary intermediate goods. Second, the analysis supports the skill-upgrading incentive of the supermarket sector: "Where

projects can be put in place to 'upgrade' the small farmers to meet the needs of supermarkets, the chains appear to be eager to participate in these schemes" (page 352).

6. Conclusion

As part of the globalization process supermarket chains enter the markets of developing countries, both in Latin America, Asia and most recently in Africa. Supermarkets represent both opportunities and challenges for local agriculture. The contribution of this paper is to analyze the supermarket expansion within an intertemporal general equilibrium framework that clarifies the adjustment mechanisms involved. The model represents an archetype developing economy with duality in both agriculture and the food retail sector. The focus is on the potential productivity gain from delivering intermediates to supermarkets. Whether farmers are able to take advantage of the productivity linkage depends on their learning capacity and skill level. The impact of supermarkets is studied in two settings: An economy with a well-developed commercial agricultural sector and an economy where traditional agriculture dominates.

While highly skilled commercial farmers benefit from the entry of supermarkets, an economy dominated by traditional agriculture might get stuck in a low productivity trap. In the latter case, supermarkets are highly dependent on foreign intermediate goods. But numerical simulations document an incentive for agricultural skill-upgrading by supermarkets when domestic suppliers do not fulfil required safety and quality standards. In light of the present analysis, expansion of supermarkets in developing countries represents an important contribution to agricultural productivity improvement. Future research should quantify the empirical importance of the productivity effect.

References

Acemoglu, D. and J. Ventura (2002), The world income distribution, *Quarterly Journal of Economics* 117, 659-694.

Baumol, W., S. Blackman and E. Wolff (1989), *Productivity and American leadership: The long view*, Cambridge, Mass. and London: MIT Press.

Benhabib, J. and M. Spiegel (1994), The role of human capital in economic development: Evidence from aggregate cross-country data, *Journal of Monetary Economics* 34, 2, 143-173.

Benhabib, J. and M. Spiegel (2005), Human capital and technology diffusion, Ch. 13 in P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, vol.1A.

D'Haese, M. and G. Van Huylenbroeck (2005), The rise of supermarkets and changing expenditure patterns of poor rural households case study in the Transkei area, South Africa, *Food Policy* 30, 97-113.

Diao, X., J. Rattsø and H. Stokke (2005), International spillovers, productivity growth and openness in Thailand: An intertemporal general equilibrium analysis, *Journal of Development Economics*, 76, 2, 429-450.

Diao, X., J. Rattsø and H. Stokke (2006), Learning by exporting and structural change: A Ramsey growth model of Thailand, *Journal of Policy Modeling* 28, 3, 293-306.

Frantzen, D (2000), R&D, human capital and international technology spillovers: A cross-country analysis, *Scandinavian Journal of Economics* 102, 1, 57-75.

Girma, S., H. Gorg and M. Pisu (2004), The role of exporting and linkages for productivity spillovers from FDI, GEP Research paper no 2004/30, Leverhulme Centre, University of Nottingham.

IFPRI (2003), Will supermarkets be super for small farmers? IFPRI Forum, December 2003.

Irz, X. and T. Roe (2005), Seeds of growth? Agricultural productivity and the transitional dynamics of the Ramsey model, *European Review of Agricultural Economics* 32, 2, 143-165.

Javorcik, B. (2004), Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages, *American Economic Review* 94, 3, 605-627.

Love, D. (1997), A dynamic general equilibrium model of industrialization when manufacturing are unnecessary, *Journal of Development Economics* 54, 357-385.

Minten, B., L. Randrianarison and J. Swinnen (2006), Global retail chains and poor farmers: Evidence from Madagascar, LICOS Discussion Paper 164/2006, Katholieke Universiteit Leuven.

Nelson, R. and E. Phelps (1966), Investment in humans, technology diffusion and economic growth, *American Economic Review* 56, 1/2, 69-75.

Reardon, T. and J. Berdegue (2002), The rapid rise of supermarkets in Latin America: Challenges and opportunities for development, *Development Policy Review* 20, 4, 371-388.

Reardon, T., C. Timmer, C. Barrett and J. Berdegue (2003), The rise of supermarkets in Africa, Asia, and Latin America, *American Journal of Agricultural Economics* 85, 5, 1140-1146.

Roe, T. and X. Diao (2004), Capital accumulation and economic growth: The case of the retail food industry in developing countries, *American Journal of Agricultural Economics* 86, 3, 788-794.

Stifel, D. and E. Thorbecke (2003), A dual-dual CGE model of an archetype African economy: trade reform, migration and poverty, *Journal of Policy Modeling* 25, 207-235.

Stokke, H. (2004), Technology adoption and multiple growth paths: An intertemporal general equilibrium analysis of the catch-up process in Thailand, *Review of World Economics* 140, 1, 80-109.

Weatherspoon, D. and T. Reardon (2003), The rise of supermarkets in Africa: Implications for agrifood systems and the rural poor, *Development Policy Review* 21, 3, 333-355.

Figure 1: Productivity dynamics.

i) Low barriers: Technological catch-up and constant long-run gap

ii) High barriers: Technological divergence and increasing gap

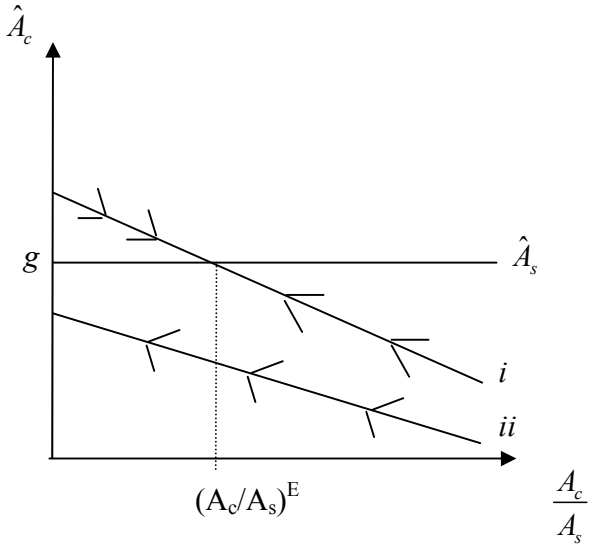

Figure 2: Labour augmenting technical progress in commercial agriculture. Low skill-ratio scenario vs. Skill upgrading scenario.

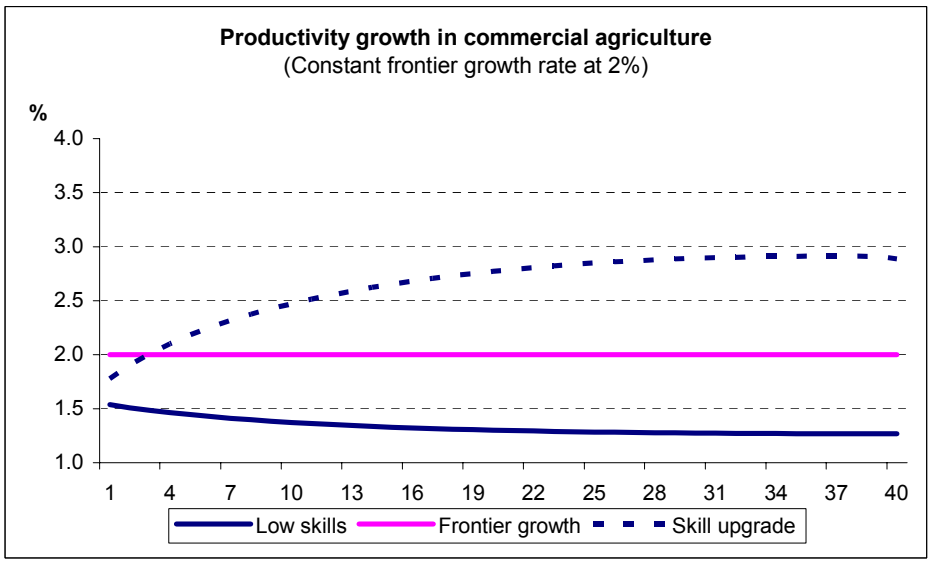

Figure 3: Share of intermediate supply to supermarkets from domestic farmers. Low skill-ratio scenario vs. Skill upgrading scenario.

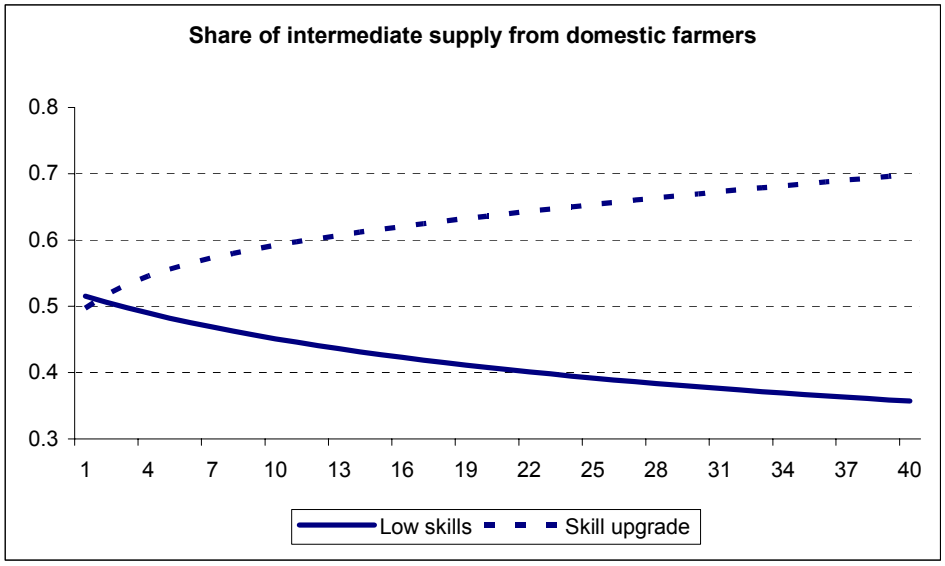

Figure 4: Supermarket expansion (measured as the share of food sales). Low skill-ratio scenario vs. Skill upgrading scenario.