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Quality and Inclusion of Small Producers in Value Chains: A Theoretical Note

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Abstract

This paper develops a formal theory of the endogenous process of the introduction of high quality products in developing countries. Initial differences in income and capital and transaction costs are shown to affect the emergence of and the size of the high quality economy. Initial differences in the production structure and the nature of transaction costs – as well as the possibility of contracting between producers and processors – are shown to determine which producers are included in the high quality economy, and which not.

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1. Introduction

Recent technological developments and globalization are transforming the industrial organization and international location of production. One of the most important mechanisms underlying the globalization process lies in the transfer of advanced production capabilities to low-wage economies. These capabilities comprise both an increase in productivity and in product quality (Goldberg and Pavcnik, 2007; Eswaran and Kotwal, 2007). Sutton (2001) argues that the quality aspect is far the more important element: poor productivity can be offset by low wage rates, but until firms attain some threshold level of quality, they cannot achieve any sales in global markets, however low the local wage level.

These quality requirements affect poorer countries through several channels.[1] First, increasing public quality requirements in richer countries are also imposed on imports and consequently have an impact on producers and traders in exporting nations (Jaffee and Henson, 2005; Unnevehr, 2000). Second, global supply chains are playing an increasingly important role in world food markets and the growth of these vertically coordinated marketing channels is facilitated by increasing quality standards (Swinnen, 2005; 2007). For example, modern retailing companies increasingly dominate international and local markets in fruits and vegetables, including those in many poorer countries, and have begun to set standards for food

[1] This paper focuses on the development implications of changes in the demand for high quality products There are several related areas in the literature on product quality standards, including a) analyses of asymmetric information problems which may be one of the reasons for companies or public regulators to introduce standards (Fulton and Giannakas, 2004; Gardner, 2003); b) studies on the role of standards in reducing consumption externalities (Copeland and Taylor, 1995; Besley and Ghatak, 2007); c) the role of standards in providing non-tariff trade protection (Anderson et al., 2004; Fischer and Serra, 2000); and d) the political economy of standards (Swinnen and Vandemoortele, 2008).

quality and safety in this sector wherever they are doing business (Dolan and Humphrey, 2000; Henson et al., 2000). Third, rising investment in processing and retailing in developing countries also has begun to be translated into higher quality standards, as buyers are making new demands on local producers in order to serve the high-end income consumers in the domestic economy or to minimize transaction costs in their regional distribution and supply chains (Dries and Swinnen, 2004; Dries et al., 2004; Reardon et al., 2003).

Importantly, the early literature posited that the rise of quality standards could have sharp negative influences on equity and poverty. Several of the studies argued that modern supply chains in developing countries would systematically exclude the poor and negatively affect the incomes of small farmers; in other words, it was being suggested that unlike other waves of rising economic activity, the poor would suffer from this process (Farina and Reardon, 2000). The predictions from these studies included the poorest parts of the world. For example, several studies of farm communities in Latin America and Africa argued that small farmers were being left behind in the supermarket-driven horticultural marketing and trade (Dolan and Humphrey, 2000; Humphrey et al., 2004; Key and Runsten, 1999; Reardon et al., 2003; Weatherspoon et al., 2001). In a study on Kenya, Minot and Ngigi (2004) demonstrated that modern supply chains put intense pressure on smallholders (although smallholders were still participating). Even more extreme, in the case of Côte d'Ivoire, almost all of the fruit and vegetables being produced for exports were being cultivated on large industrial estates. Likewise, Weatherspoon and Reardon (2003) argued that the rise of supermarkets in Southern Africa failed to help small producers who were almost completely excluded from dynamic urban markets due to quality and safety requirements.

Recent research suggests a more nuanced picture of the effect on poverty and its overall development implications. Dries and Swinnen (2004) find that high standards lead to increased vertical coordination in supply chains that is realized in their study area by the emergence of extensive contracting between processing companies and farmers. The rise of contracting, far from leading to the exclusion of poorer farmers, is shown to improve access to credit, technology and quality inputs for poor, small farmers that heretofore were faced with binding liquidity and information constraints due to poorly developed input markets. Minten et al. (2009) and Maertens and Swinnen (2009) also find increased vertical coordination in newly emerging supply chains between buyers and poor, small farmers in African countries, such as Madagascar and Senegal. According to their work, poor rural households experienced measurable gains from supplying high standard horticulture commodities to global retail chains. In China Wang et al. (2007) found that while rising urban incomes and emergence of a relatively wealthy middle class were associated with an enormous rise in the demand for fruits and vegetables, almost all of the increased supply was being produced by small, relatively poor farmers that sell to small, relatively poor traders. Despite sharp shifts in the downstream segment of the food chain towards modern retailing (e.g., there has been a rapid increase in the share of food purchased by urban consumers in supermarkets, convenience stores and restaurants), modern marketing chains have almost zero penetration to the farm level.

These conflicting empirical findings are puzzling. Why would one observe such different outcomes? To understand better why different outcomes may emerge, this paper is the first[2] to develop a formal theory of the process where modern supply

[2] Exceptions are some recent studies on the relationships between the local suppliers and modern processors/retailers in developing countries focusing on vertical coordination and rent distribution (Marcoul and Veysierre, 2008; Swinnen and Vandeplas, 2007). However these studies do not seek to explain the variations in the structure of the modern supply chains that one observes.

chains and demand signals are directing producers to grow and sell high quality and safe foods. We will use this theory to analyze whether this process may result in different outcomes when economies are characterized by different structural conditions. In particular, we analyze which producers are most likely to be included in these modern supply chains, and how the inclusion process is affect by factors such as the productivity distribution of producers and the nature of the transaction costs involved. In the last part of the paper we analyze the impact of contracting between processors and producers.

The paper is organized as follows. In Section 2, we present a formal model to analyse the endogenous process of the introduction of high quality products in developing countries. We discuss the structural factors of the market equilibrium resulting from this model. Sections 3 and 4 analyze how the inclusivity of this process towards producers is influenced by respectively the production structure and the nature of transaction costs. Section 5 discusses the impact of contracting between processors and producers on this process and its inclusivity. Section 6 concludes.

2. The Model

Demand

To model the demand side, we draw upon the vertical differentiation literature.[3] We consider the unit-demand version of the standard vertical product differentiation model whereby each consumer buys at most one unit of the good. The

[3] The literature started with papers explaining the emergence of endogenous quality outcomes in monopolized markets (Spence, 1975; Mussa and Rosen, 1978) and in monopolistic competition and oligopoly markets (Gabszewicz and Thisse, 1979; Shaked and Sutton, 1982, 1983; Tirole, 1988). Ellickson (2006) examines vertical differentiation in the context of grocery retailing and Roe and Sheldon (2007) examine labelling and credence features of products using a vertical differentiation model.

model is adjusted for a limited number of product types and relates income directly to the preferences for quality, following Tirole (1988).[4]

Assume that there are only two types of products with different qualities in this market, a basic *low quality* (ϕ_L) product and a *high quality* ($\phi_H > \phi_L$) product. When both qualities are available, consumers choose among three options:

$$(1) \qquad U = \begin{cases} i\phi_H - P_H & \text{if the high quality good is bought} \\ i\phi_L - P_L & \text{if the low quality good is bought} \\ 0 & \text{otherwise} \end{cases}$$

where ϕ_H and ϕ_L are the qualities and P_H and P_L are the unit consumer prices of respectively the high and low standards product; the index $i \in (I-1, I) \subseteq R_+$ represents consumer income. Consumers with higher incomes are assumed to have higher preferences for quality. The distribution of income $F(i)$ is uniform between $I-1$ and I, where the latter is the highest income among consumers. We assume that the distribution of income does not change when income grows so that an increase of aggregate income can be represented by an increase of I.

When both high quality (HQ) and low quality (LQ) products are bought by some consumers when available and some consumers buy nothing (i.e., there is an 'uncovered' market), the aggregate market demand functions Q_H^D and Q_L^D are:

$$(2) \qquad Q_H^D = M\left(I - \frac{P_H - P_L}{\phi}\right)$$

$$(3) \qquad Q_L^D = M\left(\frac{P_H - P_L}{\phi} - \frac{P_L}{\phi_L}\right)$$

[4] Our approach implicitly assumes that the introduction of high quality reflects consumer preferences. Another reason why a company may want to introduce certain quality or process standards is to reduce transaction costs in sourcing and selling (Henson, 2006; McCluskey, 2007; Fulponi, 2007). Since the introduction of quality or process standards for these purposes would also require specific investments by suppliers (hence higher production costs) and (increased) transaction costs for the processors, most of such effects would be similar to the analysis in this paper.

subject to $\frac{P_L}{\phi_L}+1>I>\frac{P_H-P_L}{\phi}$, where M is the total number of consumers in this economy and $\phi \equiv \phi_H - \phi_L$ represents the quality difference. If $I<\frac{P_H-P_L}{\phi}$ there will be no demand for high quality products $\left(Q_H^D=0\right)$[5].

Supply

On the supply side, we assume a standard competitive industry populated by numerous producers who behave as price takers. In our model all producers are able to produce either the high quality or the low quality product. To start, we assume that producers are identical. Later in the paper we will relax this assumption and analyze how producer differences affect their integration into the high quality economy.

We assume further that producers have a production technology that requires a unit cost c_H and c_L, for the high and low quality product respectively, and that $c_H = c_L + k$, where k is the per unit additional capital costs for producing the high quality product.[6] Finally, for simplicity, we assume that the other costs remain the same and that producers can produce the same number of units of the commodity regardless of whether they produce low quality or high quality commodities.[7]

[5] See Gabszewicz and Thisse (1979) and Tirole (1988) for formal derivations of these conclusions.

[6] We ignore quality uncertainty, so each farm can meet the processor's quality threshold with certainty if it makes a predetermined capital investment. We also ignore issues of contracting and contract enforcement in the HQ chain. For more details about this, see Swinnen and Vandeplas (2007) who show that the premium itself will depend on the contract enforcement conditions.

[7] This assumption is consistent, for example, with a farmer who may produce 100 litres of non-cooled, high-bacteria milk if operating in the low quality market or, after an investment in a cooling tank is made, 100 litres of cooled, low-bacteria milk if operating in the high quality market.

Marketing and Trade

Once the products are produced in response to consumer demand, our model needs to account for the transfer of the commodities from farm to plate. For simplicity we assume that one unit of production is identical to one unit at retail (consumer) level for both high and low quality. We use different marketing assumptions for the LQ products and the HQ products. We assume that producers sell their LQ commodity in villages and city markets at price P_L under perfect competition. For the HQ supply chain, we assume that 'processors' (which may represent any company involved in processing, marketing or retailing) purchase the HQ commodity from producers at price p_H and resell this commodity to consumers at price P_H. We consider that these companies incur a unit transaction cost τ in sourcing from producers. Under perfect competition and free entry and exit for processors, it follows that the consumer price of the commodity is the sum of the producer price and the transaction cost, such that $P_H = p_H + \tau$.[8]

Structural Factors and the Market Equilibrium

With producers' supply of low and high quality products determined by their respective marginal costs c_L and c_H and the demand functions (2) and (3) we can derive the market equilibrium level of LQ products $\left(X_L^*\right)$ and HQ products $\left(X_H^*\right)$ as follows:

[8] We ignore 'processing costs' because they only complicate the mathematics but do not affect the conclusions. We also considered an alternative model with a monopolistic market structure in processing. Again, this vastly complicated the model without yielding substantial differences in the key results regarding the issues where this paper focuses on. See Swinnen and Vandeplas (2007) for an analysis of the role and effects of competition in the emergence and growth of a high quality economy.

(4) $$X_L^* = M\left(\frac{k+\tau}{\phi} - \frac{c_L}{\phi_L}\right)$$

(5) $$X_H^* = M\left(I - \frac{k+\tau}{\phi}\right)$$

Equations (4) and (5) incorporate the relationship between a series of structural variables and the relative importance of the high and low quality economies. For each of the key variables (I, k, τ, ϕ) one can identify threshold levels (either minima or maxima) for the high quality economy (HQE) to exist, i.e. for $X_H^* > 0$. For positive levels of X_H^*, one can use comparative statics to show how the variables affect the size of the HQE.

Income (I). The size of the HQE is directly related to the level of income in the economy. A minimum level of income is required for a HQE to emerge. Formally, the condition is: $I > \frac{k+\tau}{\phi}$. Hence, one of the basic results that falls out of our model is consistent with the observation that HQ markets are more likely found in countries with higher incomes than in countries with lower incomes. Additionally, once income is above this threshold, the model shows that the HQE becomes larger when income increases $\left(\frac{\partial X_H^*}{\partial I} = M > 0\right)$. The positive effect of I on X_H^* is also consistent with the observation that HQ production systems tend to emerge first in export sectors in developing countries. For example in many African economies HQ production is limited to supply chains targeted to (high income) EU consumer markets while production for domestic markets is limited to LQ production.

Capital costs (k). In many developing countries capital constraints are important and the real cost of capital is high. According to our model this is another

reason that HQ markets are less likely to emerge in developing countries. If capital costs of producing HQ are too high, i.e. if $k > \phi I - \tau$, then no HQE will emerge. Moreover, given that a HQE exists, the size of the HQE will be smaller if capital costs are higher, as $\frac{\partial X_H^*}{\partial k} = -\frac{M}{\phi} < 0$.

Quality difference (ϕ): An additional condition for the emergence of a HQE is that the high quality level is sufficiently larger than the low quality level, given the extra cost of that quality difference. Formally, the quality difference ϕ must be such that $\phi > \frac{k+\tau}{I}$ holds. Given that this condition is fulfilled, the HQE will be larger for larger quality differences $\left(\frac{\partial X_H^*}{\partial \phi} = \frac{M(k+\tau)}{\phi^2} > 0\right)$.

However, as we will show in the next sections, these conclusions need to be nuanced when one allows explicitly for details on the production structure as well as on the nature of transaction costs in the model.

3. Production Structure

In addition to being able to predict the factors that underlie the emergence of the HQE, our model can also be used to gain insights on what types of producers are most likely to join the HQE (when it emerges) and what types of producers will likely be left out. As discussed in the introduction, this issue has attracted a lot of policy attention and academic debate. Some studies have argued that smallholders are excluded from HQE due to scale diseconomies and higher transaction costs; others have argued that this is not (necessarily) the case.

The arguments used in the literature are often quite simplistic. In fact, they may also be *too* simplistic. For example, the impact of scale economies is not as

trivial as often argued.[9] Scale economies can differ strongly between activities (e.g. extensive grain farming compared to intensive vegetable or dairy production). Scale economies also may be influenced by local institutions and market constraints.

While scale economies can be important, in our analysis here we focus on two other factors, the initial production structure of the economy and the nature of the transaction costs. We will show that both factors have an important impact on the size of the HQE and on who is included in the HQE.

One of our key arguments is that initial conditions matter. One might expect different outcomes from the emergence of the HQE in rural settings that have highly unequal distributions of land resources (such as, in some nations in Latin America and parts of the former Soviet Union—which have some individuals holding massive estates and many smaller, relatively poor farmers), compared to rural societies characterized by more egalitarian distributions of cultivated land (e.g., China, Vietnam and Poland). In the rest of the analysis we call this the *production structure* of the rural economy. In this section we will formally show that the initial production structure indeed matters: the share of smallholders in the production system – and the existence of large holdings amongst the smallholders – will affect both the size of the HQE and the integration of smallholders into the HQE. To analyze this we relax the assumption of a homogenous producer structure. This means that k is not necessarily

[9] There is an extensive literature showing how farm productivity, and in particular the relationship between size and productivity, tends to differ importantly by commodity (e.g. Allen and Lueck, 1998; Pollak, 1985). For example, while large producers may have scale advantages in land intensive commodities, such as wheat or corn, this is typically much less the case in labor intensive commodities, such as fruits and vegetables. In fact, there are cases in which small-scale producers may have advantages over larger farmers. In the production of some HQ commodities, small farmers may have an advantage over larger farmers because of the importance of labor governance and the quality of the labor input. This implies that the inclusion or exclusion of small farms is likely to depend importantly on the type of the commodity. This is consistent with findings from Wang et al. (2007) on China and Minten et al. (2009) on Madagascar who find that smallholders are extensively included in labor intensive fruits and vegetable production.

identical for all producers. In line with our general model, we introduce producer heterogeneity by varying the capital cost k.

We assume that capital cost k_j for producer *j* is uniformly distributed across *N* producers with $k_j \in [k-\gamma_k, k+\gamma_k] \ \forall j = \{1,...,N\}$ and $\gamma_k \in [0,k]$ with $k \geq 0$. For simplicity, we assume that individual producers only produce one unit of the high standards product, when they are involved in the HQE.[10] Producers with lower capital costs are more efficient.

We can now consider variation in the production structure by considering changes in γ_k. Specifically, the extreme case of homogeneous farms – which was the assumption in the first part of the paper – is represented by $\gamma_k = 0$. The efficiency distribution is increasingly unequal as γ_k increases. With any given distribution, the average efficiency is represented by capital cost *k* (as in the general model).

The supply curves for heterogeneous and homogeneous production structures are shown in Figure 1. In this graphical representation $X_H^S(\gamma_k = 0)$ represents the supply function for homogeneous producers. Likewise, $X_H^S(\gamma_k > 0)$ is the supply function for heterogeneous producers.

When producers choose to produce the HQ products, under the assumption that one producer produces only one unit of output in the HQE, their profits are $p_H - c_H$, with $c_H = c_L + \tilde{k}$ where $\tilde{k}$ is the capital cost of the producer that is indifferent between producing for the HQE and the LQE. Using this, we can then derive the aggregate supply of HQ products as:

[10] Alternatively, one could fix the inputs and consider variation in output, or consider variations in input and/or output size. Our specification is closer to the basic model specification and allows to derive the key results.

(6) $$X_H^S = \frac{N}{2\gamma_k} \int_{k-\gamma_k}^{\tilde{k}} dk_j = \frac{N\left(\tilde{k} + \gamma_k - k\right)}{2\gamma_k}.$$[11]

This, in turn, leads to a new expression for the equilibrium quantity in the HQ market:

(7) $$X_H^* = M\left(I - \frac{\left(k - \gamma_k + \tau\right)}{\phi}\right)\left(\frac{1}{1 + \frac{M/\phi}{N/2\gamma_k}}\right).$$

Comparing (5) and (7) yields some important insights. The second term of the right hand side (RHS) of condition (7) shows that the HQE will emerge at lower income levels with a heterogeneous production structure than with a more homogeneous structure. Specifically, $I > \frac{k - \gamma_k + \tau}{\phi}$ is the condition for the HQE to emerge. With $\gamma_k > 0$ the required income level is lower than when $\gamma_k = 0$. In addition, the required income level (for the emergence of a HQE) declines when the distribution is more unequal (that is, when γ_k is higher). The intuitive reason for this finding is that when an economy faces a more heterogeneous production structure, this implies that there are more efficient producers among the entire set of producers, ceteris paribus. As a result of this, these producers will be able to produce HQ products when it is not possible when the economy is characterized by a homogeneous production structure.

However, the third term of the RHS of condition (7) implies that the expansion of HQ production – once it exists – proceeds more gradually when there is a heterogeneous distribution of farms. To see this, define $B = 2M\gamma_k / N\phi$. The third term then equals $1/(1+B)$, which is less than 1 with $B > 0$. Formally,

[11] When $\gamma_k = 0$, the HQ output X_H^S is completely determined by demand in the equilibrium (perfectly elastic supply) and equation (7) is irrelevant.

$\partial X_H^* / \partial I = \dfrac{M}{1+B}$. With $B = 0$ when $\gamma_k = 0$, and $\partial B / \partial \gamma_k > 0$, it follows that the growth in X_H^* with increasing income will be more gradual when there is a more heterogeneous set of producers – given that $X_H^* > 0$. These results are illustrated in Figure 1.

In Figure 1 $X_H^S(\gamma_k = 0)$ represents the supply function for homogeneous producers and $X_H^S(\gamma_k > 0)$ the supply function for heterogeneous producers. For low income, represented by demand function Q_{H1}^D for high standards products, the equilibrium output in the high standards market is zero with homogeneously distributed producers i.e. $X_{H1}^*(\gamma_k = 0) = 0$. In contrast, under a heterogeneous producer structure, the HQE does emerge and the equilibrium is at point A. HQ output is equal to $X_{H1}^*(\gamma_k > 0)$. For increasing higher income levels, represented by demand curves Q_{H2}^D and Q_{H3}^D , the market equilibrium with the heterogeneous structure shifts to points B and C, respectively. For the homogeneous production structure, there will also be positive HQ output at Q_{H2}^D and Q_{H3}^D , represented by points D and E, respectively.

Figure 1 thus illustrates that HQ production emerges at lower levels of income for heterogeneous structure (represented by point A). However, once the HQ emerges in an economy characterized by a more homogeneous structure, the growth of HQE is more rapid as income grows. When examining Figure 1, note that the growth of production is represented by the shift from point D to E is larger than for the shift from B to C.

These results are further illustrated in Figure 2. When income is too low $\left(I < \frac{k+\tau-\gamma_k}{\phi} \right)$ as illustrated by point G, there is no HQE under either the heterogeneous or homogeneous structure. As income increases, however, the HQE emerges first in the economy characterized by a heterogeneous production structure for $I > \frac{k+\tau-\gamma_k}{\phi}$, shown by point A. Under the assumption that a nation's production structure is more homogeneous, the minimum income requirement for the emergence of a HQE is higher $\left(I > \frac{k+\tau}{\phi} \right)$. When income is low $\left(\frac{k+\tau-\gamma_k}{\phi} < I < \frac{k+\tau}{\phi} \right)$, a HQE exists under the heterogeneous structure (point A), but does not (yet) exist under the homogeneous structure (point F). At higher incomes, HQ production is also positive for the homogeneous structure, but output remains higher for heterogeneous production structure, as long as income does not reach the level $I = \frac{k+\tau}{\phi} + \frac{N}{2M}$ (Point H). At higher incomes, the homogeneous producer structure produces higher output. Finally, when income is larger than $\frac{k+\tau}{\phi} + \frac{N}{M}$ but lower than $\frac{k+\tau+\gamma_k}{\phi} + \frac{N}{M}$, the HQE will include all producers under the homogeneous structure in contrast to the heterogeneous structure, shown respectively by points K and J.

This approach also allows to analyze *who is included in the HQE*. With a heterogeneous production structure, the most productive farms will start producing HQ at low income levels. However, given the same set of incomes and other factors, the less productive farms will be excluded. When the production structure of an economy is more homogeneous, HQ production will only start at higher income levels. Although beginning later in the development process, once started the process

will be more inclusive. More producers will be included. This insight can be seen graphically in Figure 3. The line that divides the graph between the LQE and the HQE is characterized by $\frac{k-\gamma_k+\tau}{\phi}$, which is the minimum income level required for a HQE to emerge under given producer heterogeneity γ_k. It illustrates again that when producers are more heterogeneous, there is a more rapid emergence of the HQE—given certain levels of income growth. In addition, under our assumption that more productive producers have lower capital costs k_j, Figure 3 also illustrates that when income increases, a homogeneous producer structure is more inclusive towards low productivity producers. At high levels of income, all producers will be included under any distribution.

4. Transaction Costs

The nature of transaction costs is another fundamental feature of an economy that can affect the HQE. First, transaction costs will affect the overall size of HQ production. Higher transaction costs constrain the size of the HQE $\left(\frac{\partial X_H^*}{\partial \tau}=-\frac{M}{\phi}<0,\right.$ see equation (5)). It makes sourcing from suppliers more costly and therefore increases the relative cost of the HQ products.

Second, transaction costs will also affect *who is included*. In the literature, a standard argument is that there are fixed transaction costs per supplier for processors. This implies that transaction costs per unit of output are lower for large producers and hence small producers will be excluded. However, such conclusion is overly simplistic and depends on the specific (often implicit) assumptions on the nature of the transaction costs. In reality there are different types of transaction costs that might

be important when processors source HQ commodities from producers. For example, one common type of transaction costs might include costs of search (by company procurement agents that are looking for producers that are willing to supply to the HQE), supervision costs, quality and process control costs and the costs of enforcement of agreements. As an illustration, consider the following example from Minten et al (2009), which studies processor-farmer interactions in a HQ vegetable production region which produce horticultural exports in Madagascar for the European Union:

> *"To monitor the correct implementation of the [HQ] conditions, the [processor] has …around 300 extension agents who are permanently on the payroll of the company. Every extension agent is responsible for about thirty farmers. To supervise these, (s)he coordinates [another] five or six extension assistants ... that live in the village itself. During the cultivation period of the [HQ] vegetables, the farmer is visited on average more than once a week …to ensure correct production management as well as to avoid 'side-selling'. …99% of the farmers say that the firm knows the exact location of the plot; 92% of the farmers say that the firm even knows …the number of plants on the plot. For crucial aspects of the production process, such as pesticide application, representatives of the company will even intervene in the production management to ensure it is rightly done. [One-third] of the farmers report that representatives of the firm will themselves put the pesticides on the crops to ensure that it is rightly done."* (p. 14).

This example clearly illustrates that the notion of fixed transaction costs per supplier is not (necessarily) consistent with reality. For conceptual purposes, one could distinguish three types of transaction costs: those which are fixed per supplier (e.g. contract negotiation costs), those which are fixed per unit of output (e.g. output control costs) and those which are fixed per unit of production input (e.g. monitoring of plots and production activities).

To show that these different types of transaction costs will have different effects in the emergence, size and composition of the HQE, we compare two types of transaction costs. Specifically, we assume that τ_j is a producer specific transaction

costs. It is uniformly distributed over the interval $\left[\tau-\gamma_\tau, \tau+\gamma_\tau\right]$ with $\gamma_\tau \in \left[0, \tau\right]$ and $\tau \geq 0$. With transaction costs defined in this way, we first consider the case when transaction costs are fixed per producer. This means that transaction costs are identical for all producers (or, $\gamma_\tau = 0$ and $\tau_j = \tau$). In the second case, we consider transaction costs which are fixed per unit of input. This implies that transaction costs are negatively related to producer productivity, i.e. $\partial \tau_j / \partial k_j > 0$.

It is immediately clear that these different types of transaction costs will have fundamentally different implications for which producers will be included in the HQE. In one case, the transaction costs will be 'neutral' regarding productivity heterogeneity; in the other case, they will reinforce the productivity-bias. Formally this can be seen from the new condition for the equilibrium output of HQ products with producer specific transaction costs:

$$(8) \qquad X_H^* = M\left[I - \frac{\left(k-\gamma_k\right)+\left(\tau-\gamma_\tau\right)}{\phi}\right]\left(\frac{1}{1+\frac{M/\phi}{N/2\left(\gamma_k+\gamma_\tau\right)}}\right).$$

It follows from equation (8) that the structure with heterogeneous transaction costs, i.e. $\gamma_\tau \neq 0$, will induce earlier emergence of HQE for increasing income levels. The HQE arises when $I > \frac{\tau + k - \gamma_k - \gamma_\tau}{\phi}$, which is less restrictive for higher γ_τ (more heterogeneity in transaction costs).

Figure 4 illustrates this effect. The HQ supply function with fixed transaction costs $\left(\gamma_\tau = 0\right)$ per supplier is identical to that of Figure 1 with heterogeneous suppliers.[12] It follows from equation (8) that with heterogeneous transaction costs, the

[12] Note that in case of homogeneous suppliers, there is no effect of the nature of the transaction costs on who get included since all suppliers (and thus their transaction costs) are identical.

HQ supply function pivots around point H. This implies more HQ supply at lower levels of income (represented by Q_{H1}^{D}) but less supply at higher levels of income. As is illustrated in Figure 4, the negative relation of transaction costs with productivity reinforces the productivity effect in this pivot of the supply function.

The impact on who gets included when considering the nature of transaction costs is also analogous to the discussion over the production structure of the economy. Low productive suppliers will be less likely included with transaction costs fixed per unit of input, and vice versa. In this way, transaction costs reinforce the productivity effect, in the sense that they reduce the purchasing costs for processors from more productive farms. Farms with higher productivity will have even more cost advantages because the per unit transaction costs are lower. However, this result depends on the nature of "transaction costs." If fixed transaction costs are per farm, this is not the case.

Notice that one should be careful in interpreting these findings. Our specific findings are conditional on our model specification, which assumes there is a fixed output per farm. However, our main result, i.e. that the impact on the inclusion in the HQE depends on the nature of the transaction costs, holds in general. In reality, some transaction costs are fixed per farm, such as those for bargaining and search. Other costs however, such as product or process control costs, would at least have a component that is better modelled as per unit of output or input cost. To the extent that these variable transaction costs are more important, the cost advantage of large and more productive farms will change.

5. Contracting

In developing countries, processing firms or large traders often face lower capital costs or are less capital constrained than producers. As a consequence of this asymmetric capital market imperfection, processors and producers may start a process of vertical coordination or contracting by which the processors supply the producers with the capital necessary to produce the high quality product. This is consistent with empirical observations that the introduction of higher quality requirements in transition and developing countries has coincided with the growth of contracting (Swinnen, 2007). Empirical studies show that local producers in developing countries are engaging in complex contracting with processors selling into high quality markets. These contracts not only specify conditions for delivery and production processes but also include the provision of inputs, credit, technology, management advice etc. (Minten et al., 2009; World Bank, 2005b). The latter are particularly important for local producers who face important local factor market imperfections. If the institutional environment is such that producers and processors have the possibility to contract the production of high quality products, this may have important implications for the emergence, growth, size, and inclusivity of the HQE.

To analyze the impact of contracting in our HQE framework, we use a simplified version of the contract model that is typically used to study these problems.[13] We assume that all processors face a specific capital cost k_p. When processors contract producers, we further assume that processors can provide the capital necessary to produce the high quality product to producers at the cost k_p (instead of the producer's individual capital cost k_j).

[13] See Swinnen and Vandeplas (2007) for an extensive analysis of such models and the impact of competition and imperfect enforcement on (the efficiency of) contracting between processors and producers.

Processors and producers will only participate in this type of contracting if the processors' capital cost k_p is smaller than the producer's individual capital cost k_j. As before, we assume that the individual capital cost k_j differs among producers and is uniformly distributed, but for simplicity we assume identical transaction costs τ (i.e. transaction costs are fixed per producer).

The impact of (the possibility of) contracting on the emergence, growth, size, and inclusivity of the HQE strongly depends on the relative capital cost of processors $\left(k_p\right)$ with respect to the capital cost $\tilde{k}$ of the producer who is indifferent between producing for the HQE and the LQE if the option of contracting is not available. In other words, the latter is the equilibrium capital cost in the case without contracting, and can be derived from combining equations (2) and (6) with, as before, $P_H = c_L + \tilde{k} + \tau$ and $P_L = c_L$. Formally, the capital cost of the indifferent producer is equal to:

$$\tilde{k} = \frac{\phi I - \tau}{1 + 1/B} + \frac{k - \gamma_k}{1 + B}, \tag{9}$$

with $B = \frac{2M\gamma_k}{N\phi}$ as before. Whether contracting has an impact on the market equilibrium in the HQE depends on whether $k_p \geq \tilde{k}$ or $k_p < \tilde{k}$.

First, consider the situation where $k_p \geq \tilde{k}$, i.e. where the capital cost of processors is larger than the capital cost of the indifferent producer in the equilibrium without contracting (Equation (7)). In this case the possibility of contracting does not impact on the HQE as contracting will not occur. Only producers with $k_j \leq \tilde{k}$ participate in the HQE, but only producers with $k_j \geq k_p$ would benefit from contracting with a processor. However, as $k_p \geq \tilde{k}$, no producer involved in the HQE

will contract with a processor. Because the capital that processors may provide with is more costly than the capital of the indifferent producer, contracting is not desirable.

Second, when $k_p < \tilde{k}$, contracting does have an impact on the emergence, size, and inclusivity of the HQE. In Figure 5, the equilibrium without contracting is depicted by point $\left(X_H^*, \tilde{k}\right)$ and the contracting equilibrium by $\left(X_H^{c*}, k_p\right)$, where X_H^{c*} is the equilibrium HQ output under contracting. As before, X_H^* is determined by (7) while the equilibrium HQ output under contracting is now determined by:

$$X_H^{c*} = M\left(I - \frac{k_p + \tau}{\phi}\right). \tag{10}$$

Contracting will have an impact on the emergence of the HQE when $k_p < k - \gamma_k < \tilde{k}$. This case is illustrated in Figure 5 by k_p'. In an analysis similar to the one in Figure 1, for sufficiently low levels of income I and a subsequent low level of demand Q_H^D, there is a positive equilibrium in the HQE with contracting (supply function $X_H^S\left(k_p'; \gamma_k > 0\right)$) while there is no HQE without contracting (supply function $X_H^S\left(\gamma_k > 0\right)$). With contracting the threshold income for a HQE to emerge is $\frac{k_p' + \tau}{\phi}$ which is lower than the income threshold without contracting $\left(I > \frac{k - \gamma_k + \tau}{\phi}\right)$, as $k_p' \le k - \gamma_k$.

Next, consider the case where $k - \gamma_k \le k_p < \tilde{k}$. The HQE will emerge when income is above the same threshold, namely when $I > \frac{k - \gamma_k + \tau}{\phi}$, with and without contracting (see Figure 5). Therefore contracting does not have an impact on the emergence of the HQE for $k_p \ge k - \gamma_k$. However, comparing (7) and (10), it follows

that for $k_p < \tilde{k}$ contracting will have an impact on the size of the HQE and on its suppliers.

First, the HQE will be larger with the possibility of contracting, i.e. $X_H^{c*} > X_H^*$, which is clear in Figure 5. By supplying cheaper capital to producers with $k_j > k_p$, contracting enlarges the set of producers who are able to produce the high quality product at a given equilibrium price. As a consequence, for the same level of income and willingness to pay for high quality by consumers (demand function Q_H^D), the HQE will be larger when contracting is feasible. Formally, given that we derived that $\frac{\partial X_H^*}{\partial k} < 0$ and that $k_p < \tilde{k}$ (the equilibrium capital cost in the respective situations), it must be that $X_H^{c*} > X_H^*$.

Second, for levels of income I such that $k_p < \frac{\phi I - \tau}{1+1/B} + \frac{k - \gamma_k}{1+B} = \tilde{k}$, the expansion of HQ production proceeds faster under the possibility of contracting. This can be seen in Figure 5 by shifting the demand function Q_H^D to the right, which represents an increase in consumers' income. The increase in X_H^{c*} will be larger than the increase in X_H^*, ceteris paribus, which is analogous to our earlier comparison between homogeneous and heterogeneous production structures (see Figure 1). By providing capital to producers at the same cost – irrespective of the producers' different individual capital costs – processors create homogeneity in the production structure, at least for producers in the range for which $k_j > k_p$ holds.

Third, contracting between processors and producers induces the HQE to become more inclusive towards less productive producers, for two reasons. The HQE is larger under contracting and thus more producers will be included, which implies

also less productive ones. In addition, processors are indifferent towards contracting with producers j with $k_j \in \left[k_p, k+\gamma_k\right]$. As before, the possibility of contracting creates homogeneity in the production structure for $k_j > k_p$, and as we already analyzed a homogeneous production structure creates higher inclusivity (see Figure 3). Therefore contracting creates more inclusivity towards less productive producers also for this reason.

In conclusion, if processors face sufficiently lower capital costs than producers, contracting will improve the size, growth, and inclusivity of the HQE, and in extreme cases it may even lead to an earlier emergence of the HQE. This linkage between the cost of capital, contracting, and the emergence of the HQE offers an explanation for the empirical observation foreign direct investment (FDI) play an important role in the emergence of HQEs (e.g. Dries and Swinnen, 2004). Processors have developed VC arrangements with supplying farms to provide capital inputs to farms who are capital constrained, either because of the collapse of the financial system (e.g., in transition countries – see Gow and Swinnen, 1998; World Bank, 2005a) or because of general credit constraints of farmers in developing countries (e.g., Minten et al., 2009; Maertens and Swinnen, 2009). To set up such VC arrangements, processors themselves need sufficient access to capital. This is why FDI – or other institutional arrangements which enhance the access of processors to capital markets have played an important role. While FDI may have more than one effect on the emergence of a HQE, a crucial element is that, with capital market imperfections in developing countries, foreign companies frequently have lower capital costs (or face less restrictive credit constraints) than domestic companies in developing countries. Because of this, foreign firms may therefore be able to invest,

using lower cost capital when it is not possible for domestic companies to do so.[14] Through VC this, in turn, leads to reduced capital costs for farmers with FDI. Section 5 clearly showed the beneficial impact of contracting on the emergence of the HQE in line with the empirical observations.

6. Conclusions

In this paper we have developed a formal theory of the process of the endogenous introduction of high quality products in developing countries. We use our theoretical model to analyze how different structural conditions of the economy affect the emergence and size of the high quality economy (HQE). Differences in the form of the level of income, the relative cost of capital, the extent and nature of transaction costs and whether the production structure is homogeneous or heterogeneous will affect the timing of the emergence and the size of the HQE. These results can be used to gain insights on how institutional reforms, including macro-economic stabilization, liberalization of trade and foreign investment regulations can have important impacts on the growth of the HQE. In particular, these and any other policy change that reduces the cost of capital, according to our model, will play an important role in stimulating the growth of the HQE.

We also examine which factors affect who is able to participate in the HQE as it is emerging. Not surprisingly, we find that the most productive farms switch first to producing for the HQ market. Importantly, our analysis shows how the nature of the initial production structure can affect both the size and distributional effects of the

[14] In some cases, access to capital has also come from (domestic) company investments which have other sources of capital (such as the case of Russia in which there are energy firms that are willing to invest in domestic firms) or through supply contracts with international traders (as in cotton markets in Central Asia – Swinnen, 2007).

HQE. In countries with a mixed production structure, combining large and medium size commercial farms with small-scale household farms, such as in Latin America and parts of Eastern Europe and the former Soviet Union, the process is more likely to lead to an initial exclusion of smallholders from the HQE. In contrast, in countries such as China and Vietnam, India and parts of Africa, Eastern Europe and Central Asia, where the farm sector is more uniform and dominated by small farms, the emergence of the HQE, although delayed, can be expected to be more inclusive.

Transaction costs also play an important role as they may or may not reinforce the disadvantaged position of less productive producers – depending on the nature of the transaction costs. Reducing these transaction costs, for example by investments in infrastructure, producer associations, third party quality control and monitoring institutions, could also play a role in reducing the bias against small and less efficient producers and speed their integration into the HQE.

Additionally, we show that contracting between producers and processors may induce the HQE to be more inclusive towards less efficient producers through increased access to capital. We also explain how foreign direct investment may play an important role in this way.

While this paper is the first attempt to model the introduction of HQ products in developing countries, we realize that our analysis is only the first step. Several issues in this process require more analysis. First, the farm heterogeneity issue and its relation with the HQE which has been the subject of extensive empirical analysis and debate, requires more extensive analysis. Second, the interactions between the processors and the producers in the HQE are either modelled as spot market transactions or as simple contracts in which processors provide producers with capital at a lower cost. However, there is substantial empirical evidence that this relationship

is often more complicated, taking the form of complex contracts or other forms of vertical integration. These different governance forms that are observed in the HQ supply chain will affect both the emergence and size of the HQ chain.

While policies and institutions are not explicitly in our model, they do affect the equilibrium indirectly through their effect on the various factors which we have discussed. A few examples may indicate how an extended version of our model could be used to capture such policy effects. For example, if foreign investment rules were liberalized, they could stimulate the HQE through their effect on the inflow of FDI and reduced capital costs for producers. Public investments in infrastructure and institutions that promote quality control and food safety institutions could stimulate the HQE by reducing transaction costs in the HQ market. Economic and institutional reforms could also have non-linear dynamic effects on the HQE if they initially increase the cost of capital because of disruptions (as they did during the early years of the transition in Eastern Europe). In the longer run, however, institutional reform reduces the cost of capital as the more efficient, post-liberalization economic system develops. More generally, policies which affect macro-economic uncertainty and the security of property rights for investors are likely to affect the emergence and size of the HQE through their effects on the cost of capital for producers, either directly or through the profitability of VC arrangements.

Finally, to further complete the analysis one should also look at the interaction with labor markets. HQ investments will affect labor markets as the new investments create off-farm employment both inside the processing facility, as well as in the service sector (e.g., in the areas of extension, packaging, supervision, controlling, marketing and transport). Some – or most – of these jobs are low skilled and may be taken by the poorest of the poor. Empirical studies indicate that if HQ production

takes place through vertically integrated company-owned farms, this may have different effects on rural households than when they can start producing HQ commodities themselves (see e.g. Maertens and Swinnen, 2009; Maertens et al., 2008).

In summary, all these factors should be considered when attempting to analyze the effect of the emergence of HQ markets on households in developing and transition countries. These combined effects are likely to be complex. These and other issues should be the focus of future research and we hope that such models can build upon the theoretical framework that is developed in this paper.

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Figure 1. HQ Production under Different Production Structures

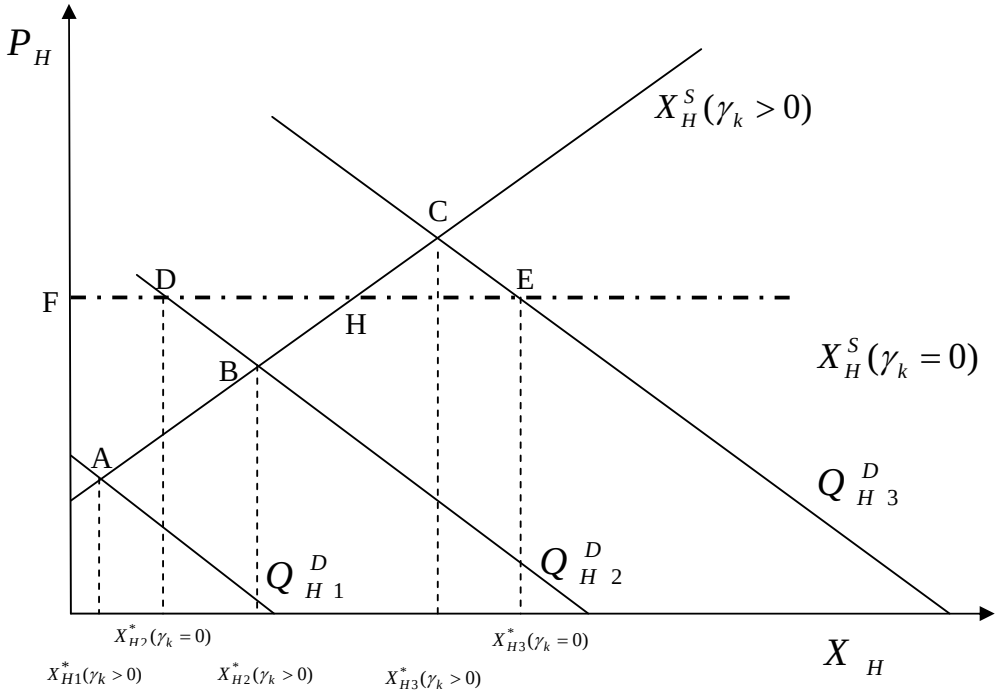

Figure 2. Size of the HQE under Different Production Structures

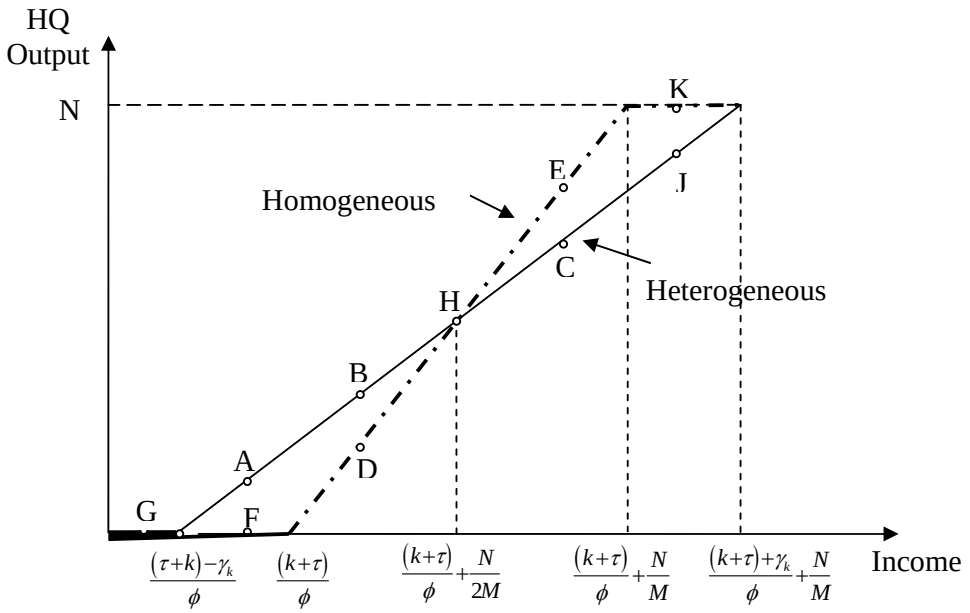

Figure 3. Combined Impact of Production Structure and Income on HQE

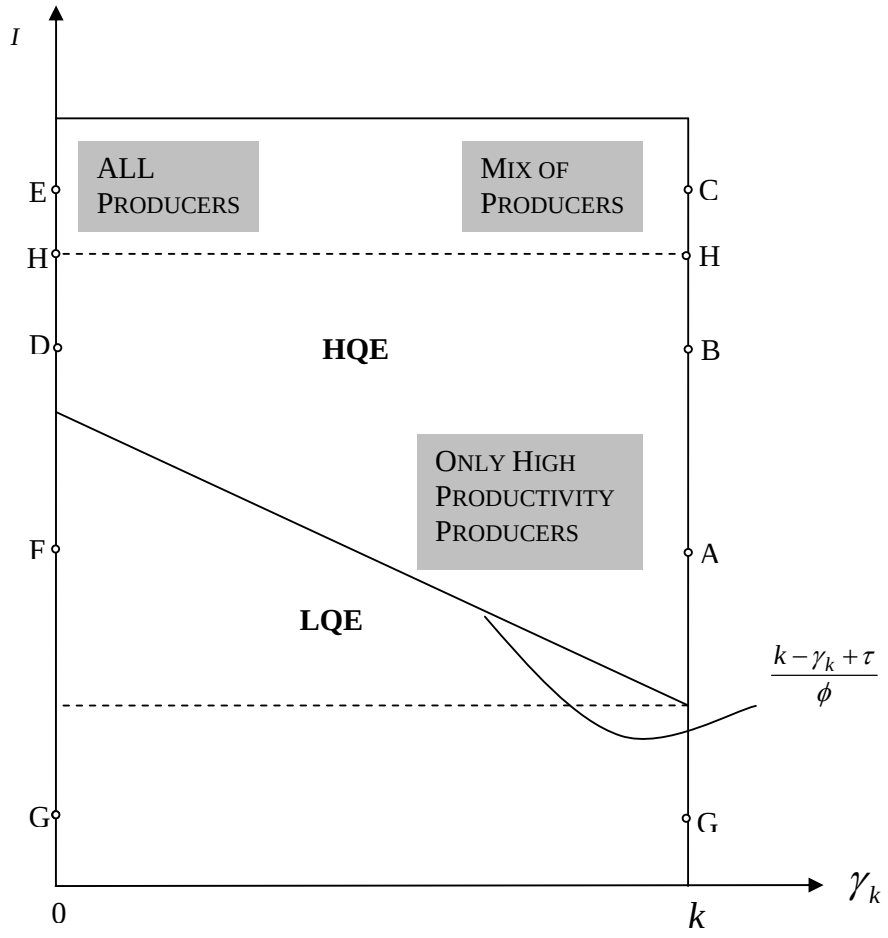

Figure 4. HQ Production under Different Types of Transaction Costs

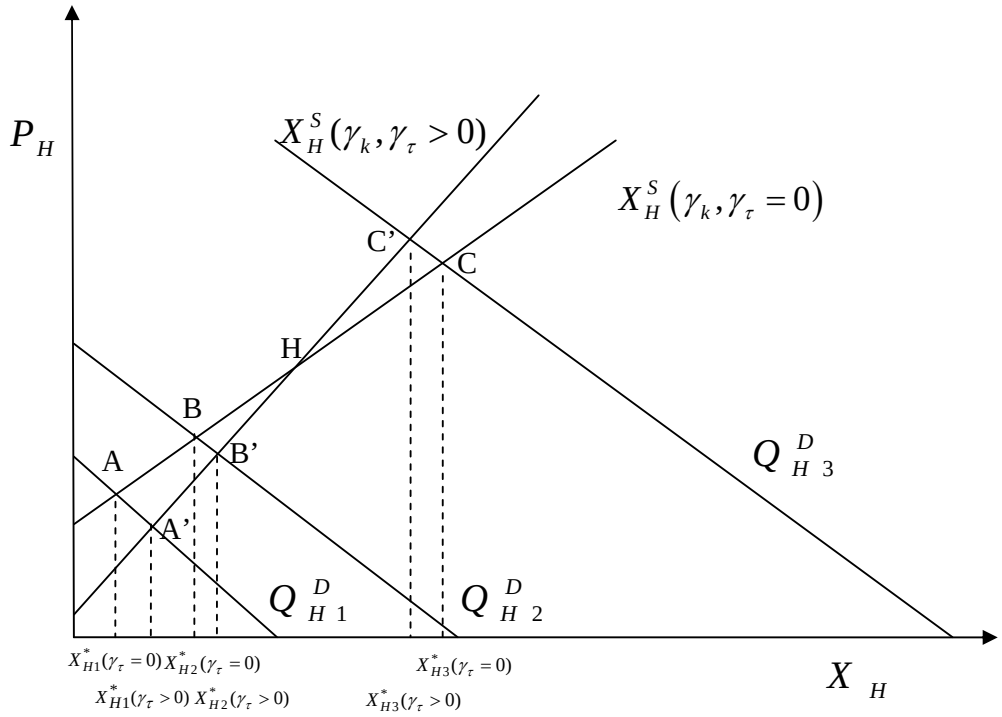

Figure 5. Impact of Contracting on the HQE Equilibrium