Subsistence Agriculture in Transition Economies: its Roles and Determinants

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Abstract

In line with recent suggestions about the potential positive effects of subsistence agriculture in fragile economies, this paper discusses and explains the effects of subsistence agriculture with emphasis on transition countries. Some micro-economic models of subsistence agriculture are reviewed and a two-stage decision model, combining risk aversion and transaction costs explanations for subsistence is put forward. The role of subsistence agriculture is addressed in terms of a static comparison to a commercial only agriculture. It is shown that, under some conditions, subsistence can play a stabilising role and have positive impacts on total agriculture. Employing the concept of a subsistence level of consumption, the paper demonstrates that these static effects can be valid in a dynamic perspective, provided additional conditions are met. Policy recommendations and a future research agenda with regard to possible agricultural commercialisation are drawn from the analysis.

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1. Introduction

The processes of economic transition in Central and Eastern Europe brought about an unexpected result; the emergence and growth of subsistence agriculture of considerable size in relation to the total agricultural sector. It is difficult to provide a widely accepted definition of the term subsistence agriculture since it has been used "synonymously with such other concepts as traditional, small scale, peasant, low income, resource poor, low-input or low technology farming" (Brüntrup and Heidhues, 2002). A wide range of views of what constitutes subsistence agriculture is presented in Wharton (1970). Arguably the simplest definition of subsistence is that of Mosher (1970) who defines subsistence farmers as those who sell less than 50% of their production. This measures subsistence from a production point of view. Alternatively subsistence may be defined with regard to consumption, e.g. "farming in which crop production, livestock rearing and other activities are conducted mainly for personal consumption" (Todaro, 1995). Although the former definition is more convenient with regard to building quantitative models, due to the relative ease of obtaining the relevant data (Beckmann and Pavel, 2000; Mishev et al., 2002), the latter is more appropriate for measuring the significance of subsistence in the overall agricultural economy (Tho Seeth et al., 1998; Caskie, 2000; Kostov and Lingard, 2002). To add to the above ambiguities, since "the subsistence factor underlines every economy" (Gudeman, 1978), any measure of subsistence may vary from almost zero to 100%. Therefore 50% is a rather arbitrary cut-off point and the 'pure' subsistence state of 100% is unrealistic. Owing to this one may prefer to use the term semi-subsistence, emphasising prevalence of non-marketed production, but also denoting the existence of some marketed production. It is also useful to note that all the above definitions consider subsistence as a concept of market integration. This is the main meaning of subsistence used in the paper. There is also an alternative use of this term used for living standard measurement, which will be introduced later.

The extent of subsistence farming varies from country to country in transition economies, but what is striking is its universal presence. It is difficult to provide a comprehensive picture of the situation in Central and Eastern Europe, but the relative size of subsistence agriculture is considerable. Over half the consumption of major agricultural products in Bulgaria is provided from self-sufficient small production units (Mishev et al. 1999, Kostov and Lingard, 2002). According to survey data, 51% of Romanian farm households do not sell any production (Sarris et al. 1999) and in a survey for Bulgaria the figure is even higher with 77.25% of individual farms failing to sell any production. About 40% of the overall

agricultural output in Russia in 1995[1] could be attributed to the small scale self-sufficient sector (Serova et al., 1999). In Poland " …over half of all farms have practically no involvement with the market" (Kwasniewski, 1999). The low share of marketed production is however not a characteristic only of the small farms. Kostov and Lingard (2002) report data, which shows that only the largest production units in Bulgarian agriculture can be defined as commercially oriented (in that most of them sell the larger part of their production[2]). In spite of the relative scarcity of data on the relative share of subsistence, it seems to be negatively correlated to the level of economic development of the corresponding country, the latter being measured e.g. in GDP per capita. Mergos (2002) asserts that while this phenomenon deserves special attention in poorer countries, it may be ignored for the more developed CEECs[3].

It took time for analysts of transition to fully recognise the phenomenon. One possible reason for this delay is the association of subsistence agriculture with the experience in developing countries. Such an association invokes an image of underdevelopment, which is a politically sensitive area in countries, striving for accession to the EU. Viewing subsistence as the consequence of wrong economic (price) signals, absent infrastructure, and missing access to input and output markets, may lead to the conclusion that it is a result of imperfect economic policy. But if this is the case, as transition progresses, markets improve, infrastructure will develop and subsistence should fade away. The experience of transition countries so far does not fit this picture.

The analysis of subsistence agriculture in transition countries passed through two distinct stages. The first was recognition of the problem and its dimensions. Early examples of this type of analysis include Mishev (1997), FAO (1999), OECD (1999), Sarris et al. (1999) and the political recognition in Kwasnewski (1999). Even at this early stage, a major disagreement about the nature of subsistence in transition economies emerged. While OECD (1999) and Sarris et al. (1999) maintain that subsistence is an unviable alternative to commercial agriculture and a threat to agricultural development, Tho Seeth et al. (1998) and Caskie (2000) argue that subsistence is a consequence of the worsened economic situation during transition. This is an important divergence of opinions. We emphasise the economic significance of this split of views. According to the former, the existence of subsistence is a

[1] Note that currently this share is probably higher.
[2] This data has to be interpreted with caution since some vertical integration (e.g. using on-farm produced feed as further input for livestock production) can artificially lower the share of marketed production.
[3] The only two countries considered in this collection of analytical studies are Bulgaria and Slovenia, presumably at the opposite ends of the scale of subsistence in Central and Eastern Europe. Consequently the problem of subsistence is analysed in detail for Bulgaria, but not in the case of Slovenia.

phenomenon that causes inefficiency, while the latter states, in the tradition of Schultz's (1964) "poor but efficient" hypothesis of small farmer behaviour, that since subsistence is an (efficient) adaptation to the environment, this is unlikely to be the case. The policy implications of these two views are rather different. The former suggests policies aimed at discouraging subsistence behaviour, while the latter implicitly warns against this (Brüntrup and Heidhues, 2002: 20). Kostov (2002) asserts that policies to suppress subsistence production may be actually detrimental, as for example the forced collectivisation in Soviet Russia in the 1920s which managed to (temporarily) eradicate subsistence at the price of widespread famine. One of the aims of the present paper is to reconcile these conflicting views.

The second stage of analysis of subsistence agriculture in the context of economic transition, tried to substantiate the qualitative claims about the nature of subsistence agriculture and incorporate it into formal quantitative models. The gap in understanding the qualitative characteristics of subsistence agriculture has been resolved in two ways: by fitting the problem into an accepted mould of existing formal approaches as in Beckmann and Pavel (2000) and Werheim and Wobst (2001) and by redefining the problem in terms of desirable agricultural commercialisation (e.g. Mishev et al., 2002). Both approaches have merits and disadvantages, but their simulation results confirm the relative stability of subsistence agriculture in terms of its share in the overall agricultural economy. The main issue of interest addressed in the literature is not the magnitude of subsistence per se, but how to politically support a continuous shift from subsistence to commercial. Results of these models suggest that such a shift is much more likely when the driving force of commercialisation are income and job opportunities outside agriculture[4]. This is consistent with the finding that the deterioration in agricultural incomes during transition has been caused by the collapse of non-agricultural activities (Kostov et al., 1996) and the examples of successful agricultural commercialisation where this shift has been driven by forces external to agriculture (Pingali, 1997).

It is necessary to provide a conceptual model of the effects of subsistence agriculture that sheds some light on the disagreements about the role and nature of subsistence agriculture in transition. To do this we first consider the microeconomic foundations and explanations of subsistence agriculture. Then argument about the macroeconomic stabilising role of

[4] Beckmann and Pavel (2000) model this shift in terms of agricultural opportunities only and the decrease in the share of subsistence agriculture they obtain is much smaller than in Mishev et. al. (2002) who express the latter in terms of a general income indicator.

subsistence agriculture is presented. The latter will then be reconsidered in a more dynamic framework.

2. Micro-models of subsistence agriculture

We consider two basic models explaining the self-sufficient orientation of poor, small-scale farmers. The first is based on the transaction cost concept. De Janvry and Sadoulet (1994, p.141) demonstrate that the existence of transaction costs implies a price band determined by the effective price received for items sold and the effective price for items purchased. There might exist a range of products and factors for which equilibrium between supply and demand occurs within this price band. In this case, the equilibrium (shadow) price is higher than the sale price and lower than the purchase price, with the result that neither sale nor purchase are desired, and there is self-sufficiency in this commodity or factor. Thus a commodity is not by its nature a tradable or non-tradable one, and a farm is then defined as subsistence- or market-oriented by externally determined prices and transaction costs specific to each decision unit. Löfgren and Robinson (1999, 2003) adopt the same framework and argue that production and consumption decisions should be viewed as non-separable. The rationale behind this is: when transaction costs are small and thus the above band is narrow, shadow prices can be reasonably approximated by market prices. In this case production and consumption can be regarded as separable. When the price band due to transaction costs widens however, these decisions become interrelated and thus non-separable.

The other explanation builds on the finding of extreme risk aversion of poor farmers. The transaction cost model only considers the price risk, while risk-based explanations of subsistence behaviour consider a much wider range of risks. When survival of the household is at stake and subsistence production offers an effective protection, the degree of risk aversion will increase and thus poor farmers cannot be considered risk neutral but rather risk averse (Brüntrup and Heidhues, 2002). This result would not differ when one replaces survival by any other serious consequence deemed unacceptable by the decision makers (hunger periods, the sale of (productive or other) assets). Risk aversion elicitation tests and experiments repeatedly show that risk aversion increases with the level of risk involved, and that for extreme probabilities and outcomes people do not classify decisions according to utility theory (Binswanger 1980, Tversky and Kahnemann 1982, Brüntrup 1997). Moreover, Kostov and Lingard (2003) argue that that it is the (deemed) importance of the consequences rather that the magnitude of the probabilities that determine whether a rational economic

agent should employ risk avoidance strategies. For a more comprehensive review of alternative theories and views on risk coping strategies see Hazell and Norton (1986), Upton (1987), Brüntrup and Heidhues (2002), Kostov and Lingard (2003).

The non-separability of production and consumption is an important characteristic of farm household models. It is a direct consequence from the existence of transaction costs that create a gap between purchase and selling price. Nevertheless the notion of non-separability is only true ex-ante. To clarify this one has to take into account that the decision making process of farmers is extended over a long period of time often characterised by high risk and uncertainty. One may distinguish two distinct decisions of farmers. The first is, as suggested by Löfgren and Robinson (1999, 2003), the decision whether to buy or to produce[5]. This ex-ante with regard to the production process decision is non-separable. Once production is available however, at some later stage, the farmer has to decide whether to sell it or to keep it for own consumption. At this stage it is too late to change the choice made ex-ante, and in this case the decision whether to sell or hold onto the produce is separable with regard to the production choice (Mishev and Kostov, 2002)[6]. We get into a situation where decisions are non-separable ex-ante (i.e. at the first stage) but separable ex-post. Confusing the decisions made at one of these stages may lead to contradictory results and recommendations and it is necessary to specify which of these two decisions is being considered. Hence the separability of production and consumption decisions becomes a matter of analytical focus. When the aim is to build a simulation model of small scale farming, one needs to model them as non-separable. The reason for this is that simulation models (unless stochastic) need to conflate the above two decisions into one using either the assumption of perfect foresight or some other form of expectational dynamics. Note that whatever form of expectational dynamics is specified for empirical purposes it will need to hold also at the second stage (i.e. when the production is available). These models do not consider the second stage of the decision process, but this is a necessary feature of such models. Otherwise their functionality would be impaired. In this case from the pair of decisions produce/buy and sell/consume one gets to the conflated decision problem produce / consume.

When the emphasis is on obtaining a descriptive explanation of a phenomenon however, the assumptions employed need not be so restrictive. In this case one may wish to consider the above two-stage decision process. In order to do so we basically combine the transaction cost

[5] Strictly speaking Löfgren and Robinson (1999, 2003) speak about the decision to produce or to consume, as do Mishev and Kostov (2002). Nevertheless a careful analysis of their statements reveals that they actually refer to the two distinct stages of the decision process discussed here.

[6] See the previous note.

and the risk aversion models. The role of risk aversion is in modifying the expectational element of the model. When the perceived consequences of unfavourable outcomes are serious as is the case with poor farmers, the risk aversion increases. In practical terms this means that decisions at the first stage will be aimed at risk avoidance. This may take place via diversification. For example Rosenzweig and Binswanger (1993) found that in riskier environments, portfolio assets less sensitive to weather but less profitable were chosen. On the other hand diversification may be a means to maximize use of all resources available to the household (Ellis, 1988; Reardon et al., 1992; Valdivia et al., 1996) and thus reduce risk exposure. Farm households regularly save and build assets for various reasons, which is another form of risk coping strategy (Rutherford 2000).

When diversification opportunities such as alternative employment and incomes, as well as asset building possibilities[7], are restricted, the strategy would imply making full use of the available production potential. The latter means that the decision whether to produce or consume may be predetermined in favour of production (Kostov and Lingard, 2002), because producing maximises the survival capacity of small farmers in highly uncertain environments. It can be shown that in this case the price elasticity of production decreases (De Janvry et al., 2003; Key et al., 1999; Kostov, 2002). The extent to which the price elasticity will decrease and even the sign of this price elasticity, depend on the motives for producing. Ozanne (1999) shows that there are two conflicting models about the production response of subsistence farmers. When their primary motive is to secure their consumption, they will try to sell the marketable surplus. In this case a better harvest will result (*ceteris paribus*) in higher aggregate marketable surplus and thus a lower price. If however the main motivation of subsistence farmers is to produce for sale, then consumption becomes the residual term. In the latter case the marketed quantities will generally be positively correlated to price. These two types of motivation defined by Kostov and Lingard (2002) as respectively *subsistence* and *market* orientation denote qualitatively different modes of behaviour. Note that if we denote by P_B, P_S, and P_E the purchase, sale and the expected shadow prices ($P_B > P_S$), then the above two motivations can be cast in the transaction cost framework and correspondingly expressed as $P_B > P_E > P_S$, and $P_E > P_B$. The latter means that the *subsistence* orientation means that farmers expect *ex-ante* to be self-sufficient in this product, and similarly the *market* orientation represents an expectation about full market participation. The content of the orientation concept is however much richer. In addition to the expectation element, it has a

[7] Kostov (2002) argues that while uncertainty encourages asset building, it discourages the use of available assets for consumption purposes, thus anchoring consumption to the current level of production.

component of uncertain anticipation. Let us first assume that orientation can be expressed in terms of expectations only. Then even if expectations are not assumed to be self-fulfilling, the market orientation of subsistence farmers becomes dubious if they consistently fail to market their produce, since it assumes the lack of learning. How can one assert that subsistence farmer is market oriented if he/she does not sell in several successive years? Why are the expectations not modified accordingly? The uncertain anticipation element means that farmers do not simply expect whether they will be self-sufficient in this product or sell, but also that they are prepared for a surprising change in the environment. Their environment is viewed as uncertain and in the case of market orientation, they organise their production decisions in such a way that if an opportunity to sell arises, they are prepared to do so. Similarly in the case of subsistence orientation, the provision of basic food security is the major concern, and they anticipate shocks that may endanger the latter. Therefore it is the anticipation of market or subsistence situation, which defines the orientation of subsistence farmers, while the expectations may be for subsistence. Unfortunately the transaction cost paradigm is static and does not account for such a distinction. If one adopts the concept of dynamic transaction costs (Langlois, 1992), which involves "costs of persuading, negotiating, coordinating with and teaching" other market participants with relation to change (Langlois, 1992), then one may define orientation in terms of expectations with regard to dynamic transaction costs. Unlike conventional transaction costs, which are static in the sense that they are measures against the status quo, dynamic transaction costs are evaluated only against the benchmark of a change. The orientation is a dynamic concept, because it measures the *ex-ante* response of subsistence farmers to change. With a view to possible agricultural commercialisation, subsistence oriented farmers are not prepared for arising market opportunities, while market oriented ones are. This can lead to two different modes of commercialisation. Market oriented subsistence farmers are ready to become truly commercial farmers, whilst the only way out of subsistence for subsistence oriented farmers is exit from agriculture.

Kostov and Lingard (2002) argue that orientation is product specific and is relatively stable over time, although in the case of Bulgarian agriculture they consider, farmers are mainly market oriented. It is nevertheless important to distinguish between the orientation concept and actual market participation, which is the focus of the transaction cost model. The hypothesised relative stability of the orientation of poor farmers may be justified by their extreme risk aversion. The latter may be derived from the two-stage decision process extended in time. When poor farmers fail to sell a significant part of their production, they

restrict their cash receipts. With limited resources, their risk aversion increases (because they have less assets to overcome emergencies). In this way the highly uncertain environment holds subsistence farmers in a poverty trap.

One is tempted to transfer what development economics has established for subsistence farming in developing countries to countries in transition. This would however be hindered by an impediment, namely an assertion that the small-scale private agriculture, described nowadays as subsistence, has been the sector of the centrally planned economy, most closely identified as a market one (Kornai, 1992). Kostov and Lingard (2002) develop the latter thesis in detail for Bulgaria. In terms of the two-stage decision process discussed, this means that while the poor farmers in developing countries are predominantly subsistence oriented, they are mainly market oriented in transition countries. This assertion needs to be interpreted with caution since the orientation appears to be product dependent. A formal mathematical representation of the two-stage decision making process of subsistence farmers is presented in Appendix 1.

3. A conceptual model of the effects of subsistence agriculture.

The micro-economic justification for subsistence behaviour can now be considered a stylised fact in development economics. The macro-economic repercussions of this micro-economic phenomenon are much less clear and are increasingly the focus of economic policy (Timmer, 1997). An efficiency argument with regard to subsistence agriculture has recently emerged. At this end "…we will argue that, although subsistence agriculture may at first sight appear to be an impediment for economic growth, it often is the only way for rural people to survive under extremely difficult conditions, such as inefficient input, output, credit and labour markets, risks and uncertainties. Under such conditions subsistence agriculture should not only be considered as a passive adaptation, it can even play an important role in stabilizing fragile economies." (Brüntrup and Heidhues, 2002: 2). Kostov and Lingard (2002) argue that even if the small-scale subsistence and semi-subsistence farms exhibit lower technical efficiency, the aggregate effects of their existence, when compared to a totally commercial agriculture, are positive both in terms of production and consumption. We investigate whether and under what circumstances such positive production and consumption effects might arise.

Let P_0 be the minimum price that covers the costs of a commercial farm. It is possible in principle under low incomes to get the situation represented in figure 1 by S_0 and D_0. S_0 is the hypothetical supply curve under conditions of full employment of all resources and a totally

commercial agriculture. With price below P_0 there is no (commercial) production (if $P < P_0$ then $S_0 = 0$). That is, the supply curve is discontinued (it consist of OQ_0 and S_0). In the case of low incomes, it is possible that the demand curve (D_0) passes through the discontinuity. There can thus be no equilibrium in this case. The necessary (though not sufficient) preconditions for existence of such a discontinuity, in addition to low incomes, are full employment of the available resources, totally commercial production (i.e. self-sufficient production is ruled out) and non-negative profits. They ensure that S_0 may be discontinued at P_0. Such a situation is hypothetical, because it is impossible to ensure combination of these conditions. Since the process of 'eliminating' the hypothetical discontinuity in the production function may give rise to multiple equilibria, we may compare the set of equilibria, ensuing from a totally commercial agriculture to the equivalent set in the case where there is subsistence agriculture.

Insert Figure 1.

The standard approach to achieving equilibrium in the case of discontinuities in the production possibilities frontier and a demand curve passing through this discontinuity is by quantity rationing (Heal, 1969) or price discrimination (Edlin et al., 1998). Let us first consider the case of quantity rationing. Quantity rationing of supply can help us to reach almost any point on the demand curve in the discontinuity (in this case all points where the price exceeds the minimum price P_0) and thus achieve an equilibrium. The role of quantity rationing in this case is to shift supply curves into the discontinuity region. We note that quantity rationing of supply will be caused by competitive market forces. This will lead to less than full employment of the resources available in the agricultural sector.

The essential difference of this type of adjustment is that the act of quantity rationing represents a significant structural change in production. Supply is being adjusted not to price signals, but to quantity information about demand. The importance of this quantity information is not simply reminiscent of some comparison between market mechanism and central planning. Both price and quantity information are needed and essential in a real economy (see Kornai (1971) on the complex informational structure of the economic systems). What equilibrium economics does is to rule out the quantity information by assuming away non-convexities and thus conflating the needed information into the price signal. Furthermore, this multidimensional signal is demoted to a single price vector.

Dehez and Dreze (1988) present a mathematical analysis of the equilibrating forces in an economy based on information about quantities. Their lemma 2 states that in a convex economy, competitive prices may be retrieved from voluntary trading by lowering output prices. In other words, price adjustments are sufficient to clear the market in the convex case. In the non-convex case, this is no longer possible. Quantity cannot be fixed in this case and market stability would require economic agents to decide on both prices and quantities produced. Since they present their argument for an arbitrary pricing rule, one would expect that in the non-convex case the relative excess supply associated with prices would prevail. To put it explicitly, while in the convex case, prices can be adjusted to given quantities or alternatively quantities can be changed to meet given prices, thus creating a duality between the price and quantity selection problems, this is no longer true for a non-convex economy. The optimisation problem becomes self-dual in the sense that it requires prices and quantities to be adjusted simultaneously.

Supply quantity rationing takes place in agriculture via the exit of commercial farms. This will shift the supply curve leftwards. S_1 represents this shifted supply curve, which crosses the demand curve and allows an equilibrium. We assume this happens at the minimum admissible price P_0. Note that this price level need not imply zero profits. If the farms are heterogeneous, some of them will be profitable if this price just covers average costs. Moreover, one does not need to be restrictive in specifying this price level with regard to costs only, it may also include some minimal profit margin. The situation depicted by S_1 above, assumes homogeneous farms in terms of production functions. If this is not the case, then less efficient farms will be those to exit and the slope of the real supply curve S_1 will be lower than that of S_0 (instead of being the same as assumed on the graph). Such a case is represented by S'_1. The quantity of consumption in this equilibrium will be Q_1.

The effect of the other mechanism for reaching equilibrium, that is the price discrimination, is similar. The case of pure price discrimination (when they is no quantity rationing) will be to shift the demand curve to the right and hopefully to achieve an equilibrium solution. In contrast to the quantity rationing mechanism, however, this is no longer guaranteed, since the extent to which this shift may take place is limited by the structure of demand. When most demand is represented by low income consumers, the scope of application of this mechanism is limited. For this reason we focus primarily on quantity rationing. A more detailed analysis of the effects of price discrimination is presented in Appendix 2. The effect of price discrimination combined with quantity rationing will be to alleviate the losses associated with

the non-full employment of production resources since it will allow for greater quantities to be sold.

Let us now consider the possibility for subsistence and semi-subsistence production. Furthermore we assume that subsistence production is less efficient than commercial in that it will produce less output with the same resources. This assumption is questionable, but if subsistence production is more efficient than commercial, the argument that it can create positive effects at the sectoral level become trivial. The influence of this assumption on the argument is minimal and will be outlined where appropriate. This assumption is more innocuous that it looks because the main property of subsistence production used in the following analysis is that of retaining part of the production for own consumption.

In line with the above argument, the supply curve (represented on Figure 1 by S_2) will bridge the discontinuity. At price P_0, supply will be lower than that in the fully commercial case (because of the superior technical efficiency of commercial farms) but with further price increases it will move closer to S_0 in line with agricultural commercialisation. If subsistence is assumed to be technically more efficient than commercial, then S_2 would have been presented to the right of S_0.

S_2 will be greater than the equilibrium supply S'_1, because subsistence will employ resources that commercial farming cannot at this price level. Such an explanation raises questions about whether these resources can have alternative use outside agriculture. The two main production resources used in small-scale subsistence agriculture are land and labour. Non-agricultural use of land, if there are such possibilities, is almost always more profitable than agricultural and usually there are restrictions on the latter. Moreover, these will apply to the same extent in both cases compared here, namely totally commercial, and subsistence agriculture. The issue with alternative use of labour is more complicated. It is nevertheless clear that the lack of alternative employment and income opportunities (outside agriculture) is one of the main sources of subsistence farming (Kostov and Lingard, 2002). Moreover, collapse of non-agricultural activities created the current income problems in rural areas in transition (Kostov et al., 1996). Therefore since the alternative use of these resources is limited we assume it away.

The intersection of S_2 and D_0 however, is not an equilibrium. Some of the production of the semi-subsistence sector is not marketed. Therefore S_2 is a production curve, that consists of market supply and subsistence consumption. The market supply curve is presented on the graph by S_M. A point of consideration is that the market price P_M is smaller than P_0, thus

apparently implying production with negative profits. This need not be the case. The market supply represents formally sold production, while the subsistence consumption comprises alongside own consumption transfers to friends and family, for which transaction costs are lower. This means that the differentiation between market and subsistence consumption is an expression of price discrimination and cannot be directly compared to the single price P_0.

The horizontal difference between the curves S_2 and S_M is production consumed within the subsistence sector. We also have to account for this subsistence consumption in demand, because this will shift the (market) demand curve leftwards. The market demand D_M is this shifted demand curve. The horizontal shift in the demand curve is smaller than the difference between the total production curve S_2 and the marketed supply S_M, because it is 'cheaper' to consume own production than to buy it from the market. The opportunity cost of consuming own production is lower that the market price. While in the transaction cost model this is the definition of subsistence (de Janvry and Sadoulet, 1994), or a consequence of the 'non-separability' of production and consumption choices (Löfgren and Robinson, 1999), in the framework of the two stage decision process proposed in this paper, production costs are 'sunk' costs at the second stage. If one takes poverty as a characteristic of countries with widespread subsistence farming, then the opportunity cost of consuming own production may be low. As Kostov and Lingard (2002: 89) put it "the opportunity cost of the labour of a rural pensioner is zero", meaning that for many of these people there is little chance of finding alternative employment or income sources. The total demand with no subsistence at the new equilibrium price P_M (denoted by point B) is less that the subsistence production at the same price (point C).

Owing to the difference between the shift of the supply and demand curves, the equilibrium price with subsistence (i.e. P_M) is greater than the intersection of the total production curve and the unshifted demand curve (that is of S_2 and D_0). The quantity of consumption in this new equilibrium is greater than the quantity Q_1 in the fully commercial equilibrium. We can decompose the excess into the following components.

The first is the difference between the commercial consumption ($Q_M - Q_1$) in the cases of subsistence and commercial only eqilibria. The other component is the excess consumption borne by existing subsistence (the difference in the shift of the demand and supply). On the graph this additional consumption contribution of subsistence agriculture is represented by the horizontal difference between S_2 and D_0) at price P_M, that is the segment BC. The segment AB, on the other hand represents the additional consumption gain, due to the lower, than in

the fully commercial equilibrium, clearing price. The total gain in consumption and production is expressed by Q_2, which is the quantity at point C (it follows from the equilibrium condition that this quantity, which is total production at price P_M, is the actually consumed quantity). Since this quantity exceeds both demand at this price which would have been without subsistence (represented by D_0) and the quantity that would have been consumed if all the production in subsistence agriculture had been marketed (that is the intersection of the total production curve S_2 and the demand D_0), there are positive impacts of subsistence agriculture. Since the segment AC (i.e. $Q_2 - Q_M$) is the difference at the clearing price between total production and marketed production, which is bigger than the corresponding difference between the market demand curve and demand which would have existed without subsistence, the effect of subsistence agriculture can be expressed by a fictional aggregate consumption curve which is the sum of market and subsistence consumption. In order to get this curve one needs to add non-marketed production to the market demand. It is clear that this aggregate consumption curve would lie beyond (to the right of) the reference demand without subsistence (D_0). This displacement of aggregate consumption (which at the equilibrium price is the segment BC) to the right, illustrates the positive consumption effects of subsistence.

We draw a change in the supply and production curves at the minimum admissible price for commercial production, because of the possibility at this price for upward entry of fully commercial farms. The net effect of subsistence on the value of the marketed production is $P_MQ_M - P_0Q_1$ and the net value effect on total production (market and subsistence) is $P_MQ_2 - P_0Q_1$. Whether these are negative or positive depends on the characteristics of subsistence and commercial farms (the difference in their technical efficiency represented by the different slopes of the corresponding supply curves) and the excess supply with full resource employment ($Q_0 - Q_1$). We speculate that while the former is likely to be negative, the latter may be positive.

Another important result of the economic literature is that existing non-convexities in production sets can alternatively lead to multiple equilibria which nevertheless may all be inefficient in a Pareto sense (Guesnerie, 1975). Our analysis presents an illustration of this which is represented by the superiority of the subsistence equilibrium over the fully commercial one. The multiplicity of the equilibria follows from the possibility to get commercial equilibrium with appropriate rationing at any price $P > P_0$.[8] It is however clear

[8] Similarly there is multiplicity of subsistence equilibria.

that all these feasible commercial equilibria are Pareto dominated by the subsistence equilibrium and thus are inefficient.

We note that subsistence basically can be viewed as a combination of the two main mechanisms for achieving equilibrium with non-convex production sets, namely rationing and price discrimination. Rationing is expressed by the withdrawal of some production from the market for own consumption. This restricts the potential fall in prices. Price discrimination is expressed in the two different modes of consumption: market and subsistence. While market consumption is determined by prevailing market prices, subsistence consumption is more dependent on quantity variables, such as relative availability of production surplus (which changes according to price signals and the orientation of subsistence producers). The size of the production surplus defines the shadow price of own production. Nevertheless, this leads to effects similar to pure price discrimination, because aggregate consumption can be regarded as a sum of two separate components, market and subsistence, which are determined by different prices.

Comparing subsistence with commercial agriculture only on the basis of their relative technical efficiency, that is the difference between their respective production curves (S_0 - S_2) does not take into account demand. Furthermore such a comparison is a direct result from the assumption about which of the two sub-sectors is characterised by greater technical efficiency. We have to compare the equilibria resulting from commercial only and semi-subsistence agriculture. The production effect is Q_2 - Q_1, and accounts for subsistence using resources unwanted by the commercial sector. If one wants to compare the full employment totally commercial state with a subsistence agriculture, this comparison will depend on the prevailing market price. If this price is below the minimum admissible commercial price P_0, the production effect of subsistence would be positive because there will be zero production in the totally commercial case. If the price is P_0, the production effect of subsistence will be negative (if it is assumed to be less efficient than commercial, but positive otherwise), but because the effective demand will be only Q_1, the consumption effect of subsistence will again be positive.

Subsistence agriculture introduces a fundamental non-convexity into production possibility sets (expressed in the change of the production curve at P_0). Since aggregate consumption is a sum of market demand and subsistence consumption, this non-convexity carries over to the consumption analysis. The introduction of non-convexities may in principle impede the achievement of equilibrium. It should however be clear, that non-convexities in this case stem

from the entry of fully commercial farms employing different technologies, but is not a consequence of the subsistence sector itself. A subsistence type agricultural economy is the only existing agricultural system that resembles the neo-classical economics image of the market. It is a non-convex system by definition.

Since the possibility of existence of efficient equilibria is affected by the initial endowments (Brown and Heal, 1979) we have taken into account different possibilities about the point of departure in terms of initial conditions. We have to distinguish two separate cases in analysis of the effects of subsistence agriculture. The first is when the demand curve passes through the discontinuity in the supply curve. In this case, the existence of subsistence practices facilitates the achievement of an equilibrium. Moreover, this equilibrium dominates the one of a fully commercial agricultural production in a Pareto sense. The position of the demand curve depends on the income and employment situation in a given country.

In the second case, when the demand curve crosses the commercial supply curve (that is, on the graph, the demand curve is shifted rightwards), we deduce that the effects of subsistence agriculture will be negative if it is technically less efficient than commercial agriculture, but positive if it is more efficient. We illustrate only the former case. There is an efficiency production loss (S_0 - S_2) and the totally commercial equilibrium will Pareto-dominate the one in which there is subsistence production, because both production and consumption will be greater in the fully commercial equilibrium alongside a lower market price. This case is presented in Figure 2.

Insert Figure 2.

The above figure illustrates the possibility of a superior (in Pareto sense) commercial only equilibrium. Unlike the illustrated case which preserves the slope of the shifted demand curve, the shift of the latter which assumes improved incomes will lead to a change in its slope, making it steeper, and will reduce the superiority of the commercial equilibrium. With a steeper demand curve (that is less price sensitive demand) the fully commercial equilibrium point, corresponding to the illustrated subsistence equilibrium, will be to the left of the current one, because the new steeper (less price sensitive) demand would cross the commercial supply curve at a point that has both lower quantity and price than depicted. That is if we denote by P_3 and Q_3 the price and quantity characterising this equilibrium by Q'_2 the aggregate consumption in the subsistence equilibrium corresponding to the new steeper demand curve,

and assuming that the market clearing price and quantity in the subsistence case remain the same, then $Q_1>Q_3>Q'_2$ and $P_3<P_1<P_M$.

This leads to the following generalisation. The subsistence phenomenon is mainly due to insufficient effective demand. Under these circumstances the effects of subsistence on production and consumption are positive. The derivation of such positive effects depends exclusively on subsistence withdrawing some production from the market, and not on assumptions about whether it is more or less efficient than the commercial sector in technical terms. The assumption about full employment of the available resources is not critical. It was used to depict a hypothetical situation, which was shown to be untenable since it could not yield an equilibrium. The totally commercial agriculture and the subsistence equilibria, compared to deduce the effects of subsistence agriculture, are both characterised by less than full employment in the case of insufficient effective demand (i.e. where the mechanisms of quantity rationing and price discrimination are necessary to lead to an equilibrium). When this is not the case however (i.e. when the equlibrium price exceeds P_0), the full employment possibility cannot be ruled out. In this case the relative technical efficiency of subsistence farmers will be the main factor determining whether its effects are positive or negative.

4. Longer term effects of subsistence

The model of subsistence agriculture was shown to increase both aggregate production and consumption of agricultural products. In a country with a considerable agricultural sector and relatively low incomes, this would imply significant economy-wide effects. To demonstrate this we introduce another subsistence concept – subsistence consumption. We distinguish subsistence as a mode of consumption from the concept of subsistence as a mode of production. While the latter refers to retaining part of production for own consumption, the former denotes a standard of living that allows satisfaction of some minimum standard of consumption. Sharif (1986) provides a comprehensive overview of this concept.

Subsistence as a mode of consumption is defined with regard to some standard of material well-being. This is how subsistence is understood in classical economics (e.g. Smith, Malthus). In this meaning subsistence is “a material consumption basket that is necessary for people to make a living and to reproduce themselves” (Bruntrup and Heidhues, 2002). This subsistence level is higher than the sheer existence minimum (Sharif 1986). Hence the subsistence level is only vaguely defined as some kind of basic need or consumption basket

and this definition is temporally and spatially dependent. The use of subsistence as a mode of consumption is related to the concept of a poverty line used by the World Bank.
In order to show the importance of this concept we write the intertemporal individual utility functions in the following Stone-Geary type (following Steger, 2000):

$$U[c(t)]=\int_0^{\infty}\frac{[c(t)-\bar{c}]^{1-\theta}-1}{1-\theta}e^{-(\rho-a)t}dt \qquad (1)$$

where ***t*** is the time index, ***c*** is the chosen consumption path, $\bar{c}$ is the subsistence consumption level, ***θ*** is a preference parameter, ***ρ*** is an individual preference rate, ***a*** – the rate of population growth. The meaning of the utility function is that only levels of consumption exceeding the subsistence consumption level will generate welfare, i.e. we have a truncated utility function. This can be clearly seen, since if this is not the case i.e. if c<= $\bar{c}$ then the contributions that are integrated in (1) above are non-positive and therefore the final result (i.e. the utility) is non positive.

When the intertemporal Stone-Geary utility function (1) is twice differentiable, we may deduce the following intertemporal elasticity of substitution (for convenience we omit the time index).

$$\xi(c) = -\frac{U'(c)}{U''(c).c}=\frac{c-\bar{c}}{\theta.c} \qquad (2)$$

Equation (2) shows that when actual consumption exceeds the subsistence consumption level, the intertemporal elasticity of substitution is positive. The more consumption exceeds the subsistence level, the larger the elasticity of substitution becomes. Since a major role of agricultural production is provision of food, looking at the subsistence level of consumption is important. In the case of the wealthy nations, the subsistence consumption level is small compared to actual consumption and can be ignored. In the case of poorer nations however, there is a link between subsistence agriculture and poverty. The subsistence level of consumption can play a significant role, it will restrict the possibilities for intertemporal substitution, i.e. of savings which enable longer term growth. When consumption is below the subsistence level, then the elasticity of substitution is negative creating a ‘poverty trap’. Such

effects have been investigated in the economic growth literature (see for example Ben-David (1998) for the exogenous growth case and Steger (2000) for an endogenous growth model) and it was demonstrated that the subsistence level of consumption alone can in low-income countries lead to negative economic growth. Thus there may be a negative correlation between the level of subsistence and growth, but the subsistence level does not lead to negative growth per se.

Let us now look in more detail at the effects of subsistence agriculture. For this purpose we rewrite (2) as:

$$\xi(c) = \frac{1}{\theta}[1 - \frac{\bar{c}}{c}] \qquad (3)$$

Let us further assume that $\boldsymbol{c} > \bar{c}$, ruling out the extreme poverty case. In addition to the greater utility, which although directly derivable from (1), is obvious, we have the effects on the intertemporal elasticity of substitution. The positive aggregate consumption effects of subsistence agriculture can be expressed as decreasing the last term in the brackets and increasing (3). In the case of individuals who directly consume subsistence production from their own farms or by social transfers based on kinship links, this directly increases their individual consumption $\boldsymbol{c}$. In the case of individuals who depend mainly on the market, the price decreasing role of subsistence agriculture is the way in which their consumption increases. The individual share of the increase in the aggregate consumption Q_2-Q_1 (Figure 1) of any product of subsistence farming will be positive for every individual consumer and will increase everyone's individual utility, compared to a totally commercial agriculture. Furthermore, one would expect that due to the positive effects of subsistence on basic food products, individual consumers will be able to dedicate more of their income to other products. The immediate effects of subsistence agriculture on the food sector are likely to create spill-overs in other sectors. Such spill-overs are related to the choice to produce at the first stage of the decision process. With regard to this choice the alternative of buying the same product at a price that is higher than the shadow price is avoided and raises the possibility for spill-overs, by saving some monetary income that would have otherwise been spent on purchasing these products. It is important to distinguish between this choice and the choice whether to sell or consume the available production (i.e. the second stage choice). By definition, subsistence is determined by the shadow price in the band between effective

selling and buying prices however, the foregone monetary income is not able to provide the same level of utility as the consumption of this production. During the second stage both shadow price and selling price are already known and therefore the decision to forego or not the income from selling (part of the) production is optimal. The spill-overs will be greater where the role of agriculture in the national economy is greater, and where the social role of subsistence agriculture in creating a social security net for relatives living in urban areas is more strongly expressed. The existence of such positive spill-overs is dependent on the assumption that current consumption exceeds the subsistence level. The possibility for such spill-overs only arises if this is the case. Additionally, it is necessary that the conditions under which subsistence agriculture increases (with regard to totally commercial agriculture) production and consumption, to be met.

5. Conclusions and policy implications

The proposed two-stage decision process accommodates both the transaction cost and the risk aversion models of subsistence agriculture. The first stage in this process is characterised by the concept of orientation, while the second stage is an outcome of circumstances. Policies that modify these circumstances may lead to a shift away from subsistence. An example of such policies are those reducing transaction costs relevant to subsistence producers. The rationale behind these policies is to reduce the width of the transaction costs band (i.e. the band between selling and buying prices for agricultural products) and thus reducing the probability that the shadow price for these products is situated in that band. For analytical reasons we distinguish two types of reductions. The first is when the buying price is reduced, keeping the selling price at the same level. In this case the purchase price may become lower than the shadow price making purchase more desirable than production. This will transform current subsistence producers into net buyers of agricultural produce. The efficiency of such policies will depend on the availability of alternative income allowing subsistence farmers to move outside agriculture. In other words the reduction of the purchase price has to be accompanied by an increase in the shadow price. This would not only make such a shift more likely, but ensure that it is permanent. This corresponds to moving people out of subsistence agriculture to alternative non-agricultural employment, and is the most likely driving force for agricultural commercialisation. Such a development will also lead to an increase in the selling price because the withdrawal of resources from agriculture will increase their relative scarcity

and limit the potential for subsistence agriculture playing a stabilising role as shown in section 3.

The other analytical case in relation to the transaction cost reduction is when the selling price is increased, but the purchase price is kept at the same level. In this case the shadow price is likely to drop below the selling price thus making sale desirable and transforming subsistence farmers into commercial producers. This can be viewed as pure agricultural commercialisation in the sense that resources will be transformed from subsistence into commercial use (not necessary implying any change in the sense of production organisation). Since such a change implies that total consumption is more or less constant and the shadow price is stable, we may view it as a 'pure' transaction cost reduction in that reductions in market distortions allow agricultural producers to get a better price in the face of unchanged demand. Although the scope of the latter transformation is limited in comparison to the non-agricultural transformation, and further limited by the role of subsistence in employing production resources unwanted elsewhere, it should not be neglected.

It should be clear that the above distinction is based on analytical convenience. Any change will be a combination of the above two cases. What it shown is that the possibilities for agricultural commercialisation lie predominantly outside agriculture and the transaction costs story is better viewed as a symptom of a more general economic misbalances, rather than a primary cause for subsistence agriculture.

While the general picture of what causes subsistence and what can eliminate it is clear, what is much less clear is what might be the immediate reactions of subsistence farmers to economic measures and policies. These are not simply a matter of fine tuning of policies, but are important with respect to both policies aimed at restricting the extent of subsistence and policies designed to work within the framework of widespread subsistence agricultural production. It is for these purposes where the concept of orientation, linked to the first stage of the decision making process may be particularly useful. Orientation defines the price responsiveness of subsistence farmers. Market oriented subsistence farmers will react immediately to improved market conditions by reallocating part of their production from consumption to the market. Their first stage decision prepares them for such a possibility. Subsistence orientation is based on the premises that they will remain subsistence, and since orientation is a forward looking concept, the response of subsistence-oriented farmers will be slower and of smaller magnitude. The orientation of subsistence farmers is nevertheless a largely under-researched area. The claim that it is relatively stable (Kostov and Lingard, 2002) needs to be substantiated. Mishev and Kostov (2002) argue that due to differences in

their mindsets, young people are not likely to be engaged in future agricultural production, and although the average age of subsistence farmers is likely to decrease, they will remain mostly middle-aged. The age structure of subsistence farmers and their inability and unwillingness to unlearn already learned patterns of behaviour, may provide some justification for the relative stability of their orientation. Orientation is subject to evolution and needs to be studied. The market orientation of most subsistence farmers in transition countries may be subject to change, but until it is available, processes of agricultural commercialisation may be facilitated. In addition to the issue of orientation, the relation of the current level of consumption and the subsistence consumption level, need to be investigated to assess the longer-term effects of subsistence agriculture. Unlike some developing countries, it may not be unreasonable to assume that in most countries in transition current consumption exceeds the subsistence level. Under this assumption, the static longer-term effects of subsistence may be positive.

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Figure 1

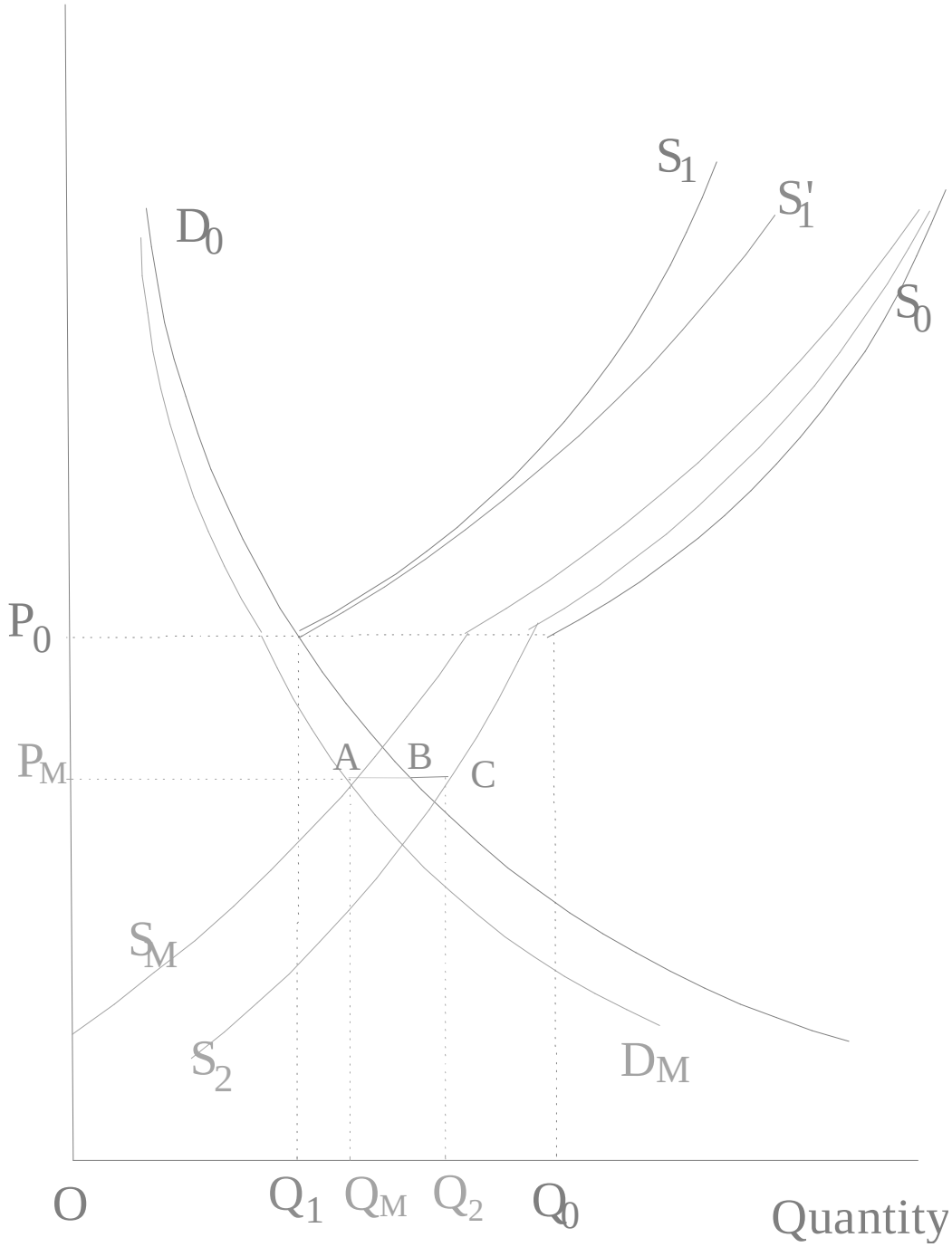


Figure 2

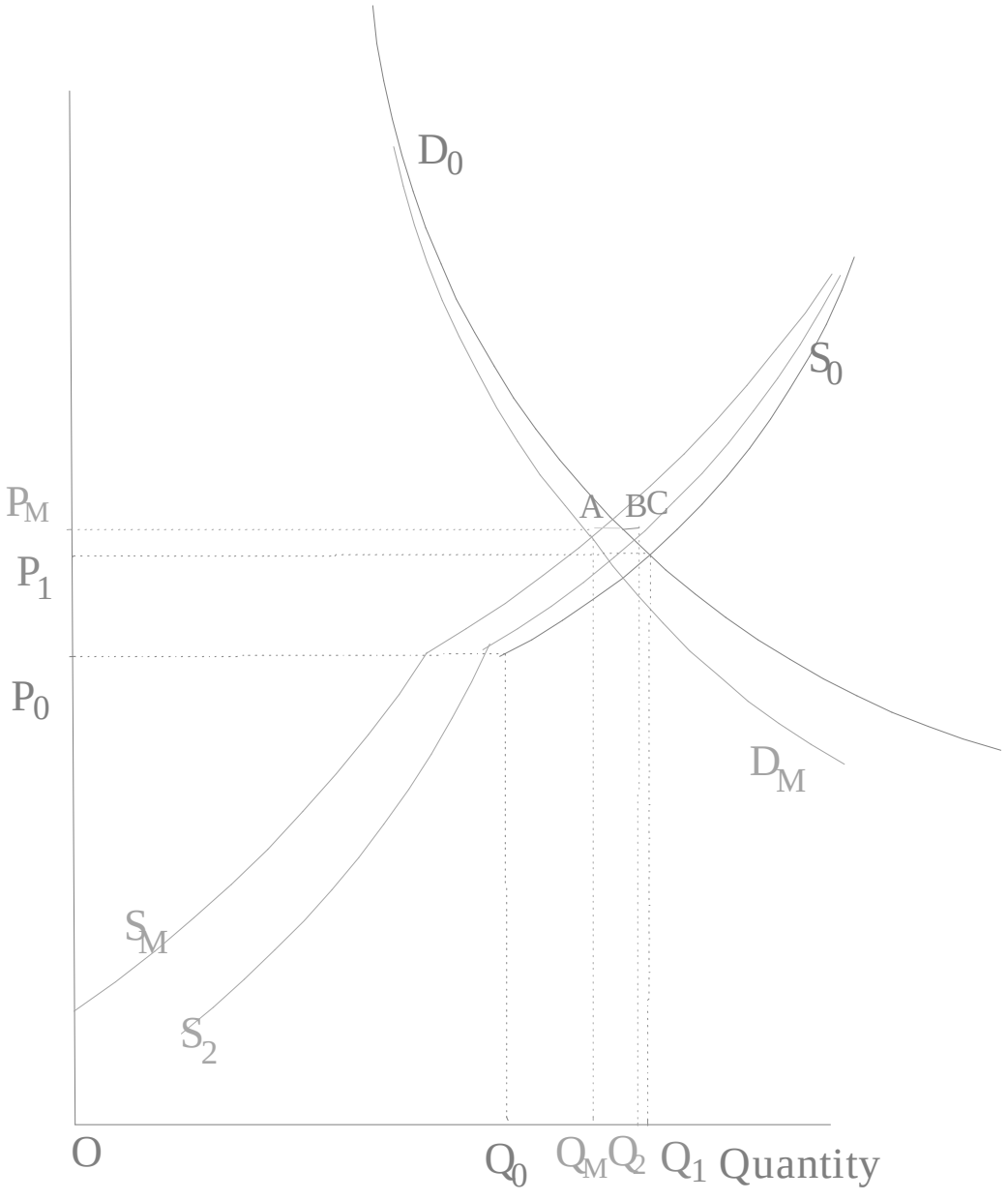
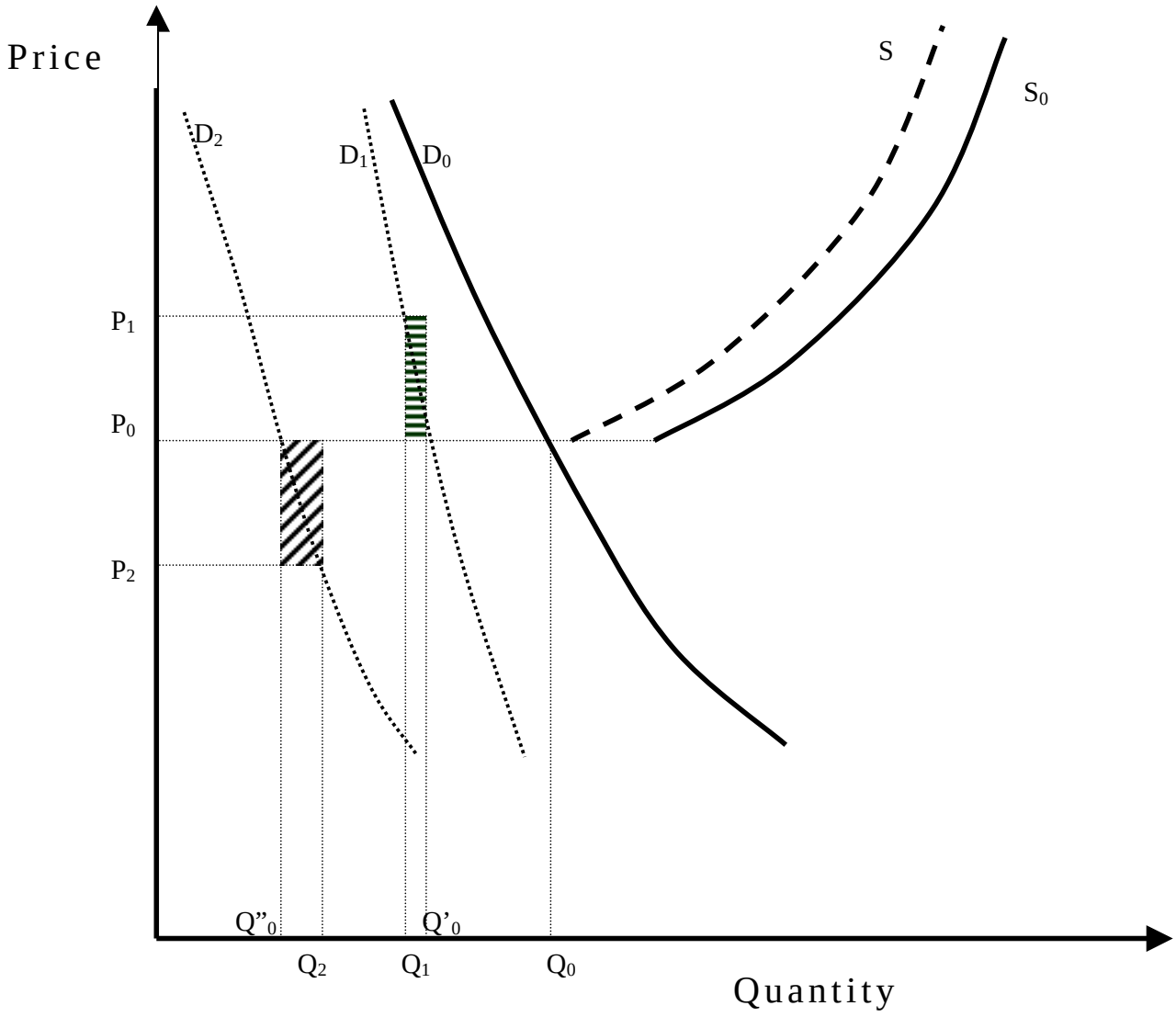


Figure 3



Appendix 1
Mathematical representation of the two-stage decision model

In order to clarify the two-stage decision making approach we present the following simplified model. We assume that all farmers are rational optimisers (in terms of expected utility theory). The decision process can be presented as follows:
Stage one (given expected price P_S for the selling price and P_B for the purchase price) to decide on producing quantity Q_1 and buying quantity Q_2, may be represented as:

$$Q_1 = F(P_S, P_B) \quad (1.1)$$
$$Q_2 = G(P_S, P_B) \quad (1.2)$$

Where F(.) and G(.) are some functions.

Similarly the second stage decision is: given the available production and the price realisation R, decide to sell quantity Q_3 or to consume quantity Q_4. This translates into:

$$Q_3 = H(R_S, R_B) \quad (1.3)$$
$$Q_4 = E(R_S, R_B) \quad (1.4)$$

In empirical research the functional form for the functions F(.), G(.), H(.) and E(.) have to be decided by the researcher. An additional restriction for the sum of Q_3 and Q_4 will be necessary.
To illustrate the potential use of this model we employ the assumption of rationality and express it as:

$$R_S = P_S + e; \qquad e \sim N(0, \sigma_e^2) \quad (1.5)$$
$$R_S = P_B + u; \qquad u \sim N(0, \sigma_u^2) \quad (1.6)$$
$$Q_3 + Q_4 = Q_1 + v; \qquad v \sim N(0, \sigma_v^2) \quad (1.7)$$

(1.5) and (1.6) express the consistent price expectations, while (1.7) demonstrates that the quantity produced is consistent with the first level decision with allowance for yield effects (say because of weather) The last equation is simplistic, but we use it here for the sake of illustration.
Note that some of the above variables, in particular ones referring to the first stage decision are not directly observable. We nevertheless obtain a tractable model if we replace them with appropriate expressions containing observable (i.e. second stage) variables. Using (1.5), (1.6) and (1.7) to replace the expressions in (1.1) and (1.2) and introducing the actually bought quantity Q_5 we get:

$$Q_3 + Q_4 - v = F(R_S - e, R_B - u) \quad (1.8)$$
$$Q_5 + Q_4 = G(R_S - e, R_B - u) \quad (1.9)$$

The model then consists of equations (1.3), (1.4), (1.8) and (1.9) with the additional error terms e, u, v, specified in (1.5), (1.6) and (1.7) and can be used for two distinct purposes. One is to simulate the effect of the institutional environment (by randomly drawing the error terms from distributions with different variance levels). Alternatively one may wish to express the buying price in terms of the selling price and simulate the model in terms of transaction costs.

The other use of the model is to estimate the relationships embedded in it. This would involve representing it as a statistical model, which means introducing additional error terms for each equation. Since equations (1.8) and (1.9) already contain error terms, the model would contain four equations and seven error terms and cannot be estimated by standard maximum likelihood. It is nevertheless tractable for estimation purposes. Its estimation depends on the specification of the functions F(.), G(.), H(.) and E(.). Where these are linear, the model can be estimated by iterative generalised least squares techniques, like the various versions of the Expectation Maximisation algorithm. If these are non-linear, this may not be feasible, but multiple imputation methods (e.g. Markov Chain Monte Carlo or Importance Sampler) may be used instead.

Appendix 2
Price discrimination effects

The example of price discrimination is shown in Figure 2.1. Let us assume that there are two consumers(or types of consumers) and the quantities consumed are correspondingly Q'_0 and Q''_0. This implies that

$Q'_0 + Q''_0 = Q_0$

We can assume with no loss of generality that the first group of consumers are less price elastic than the second. This means that the slope of their demand curve D_1 will be steeper. In order to demonstrate the effect of price discrimination we assume that there is a production monopoly that allows producers to set two different prices for these two consumers. For simplicity let us further assume that the price differences are set with the same difference say ΔP with regard to the original price P_0. This means that if the new prices charged to the two consumers are correspondingly P_1 and P_2. then:

$$P_1 - P_0 = P_0 - P_2 = \Delta P$$

The price discrimination would be beneficial for producers if one can obtain a situation in which total revenues exceed their original level (at price P_0). To investigate this possibility we can set

$$\Delta_2 = Q_2 - Q''_0$$
$$\Delta_1 = Q'_0 - Q_1$$

The sum of the sales revenues under price discrimination are as follows

$$S = P_1Q_1 + P_2Q_2 = (P_0 + \Delta P)*(Q'_0 - \Delta_1) + (P_0 - \Delta P)*(Q''_0 + \Delta_2) \quad (2.1)$$

Setting $R = P_0Q_0 = P_0Q'_0 + P_0Q''_0$ and after some substitution and reworking we get:

$$S = R + \Delta P(Q_1 - Q_2) + P_0(\Delta_2 - \Delta_1) \quad (2.2)$$

It is clear that, in this example, price discrimination can increase sales revenues if

$$S - R = \Delta P(Q_1 - Q_2) + P_0(\Delta_2 - \Delta_1) > 0 \quad (2.3)$$

The latter holds if the price inelastic group of consumers account for a large part of total consumption. To see that let us rewrite (2.3) as (using that $\Delta P>0$):

$$(Q_1 - Q_2) > -P_0/\Delta P*(\Delta_2 - \Delta_1) \quad (2.4)$$

Since the RHS of (2.4) is negative the above inequality holds if the LHS is non-negative, i.e. if the consumption of the price inelastic group of consumers exceeds that of the other group, this is true. Even if the latter does not hold, if the difference between the quantities consumed by these two groups are relatively small, this may still be the case. In the latter case we need

$$|Q_1 - Q_2| < P_0/\Delta P*(\Delta_2 - \Delta_1), \quad (2.5)$$

where | .| stands for absolute value.

It follows from the above example that in order for price discrimination to bridge the discontinuity in the supply function, requires a considerable part of demand to be relatively price inelastic, i.e. to be backed up by well off consumers. The latter condition is difficult to maintain for poor countries and therefore price discrimination can only play auxiliary role. For this reason we do not analyse it in detail.