Transition, agricultural decommercialisation, and their implications for quantitative modelling

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Abstract

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1. Introduction

The process of economic reforms and transformation in agriculture in Central and Eastern Europe has created a phenomenon unknown in recent years - subsistence agriculture. Its emergence and expansion has taken analysts of transition by surprise and was initially discarded as a temporary "side" effect of transition through its recognition as a major problem to agricultural development, and by defining it as an externality and an important barrier to "efficiency" in agriculture (OECD, 1999, Sarris et al., 1999). Subsistence may be considered as being a logical outcome of the worsened economic situation (Tho Seeth et al., 1998; Caskie, 2000), but in transition economies has, however, been defined (Kostov and Lingard, 2000) as compatible with the rationalising of economic behaviour not only with respect to individual utility functions but also at the aggregate economic level. This disagreement about the nature of subsistence farming in transition economies represents a gap in both our theoretical and empirical understanding; such a gap is popularly described as a problem. Indeed, the widespread phenomenon of subsistence agriculture in transition economies does represent a problem, because we lack proper understanding of it. To this end, an in-depth analysis is needed. The first step in any analysis consists of identification of its objectives. That is, we need to know what subsistence agriculture is.

Arguably the most widely-accepted interpretation of subsistence is expressed in Mosher (1970), who defines subsistence farmers as those who sell less than 50% of their production. The term "peasant" is sometimes used interchangeably, but it probably has a much wider application. Ellis (1993) defines as peasants those "households which derive their likelihood mainly from agriculture, utilise mainly family labour in farm production and are characterised by partial engagement in input and output markets which are often imperfect and incomplete". This definition clearly identifies the main elements of a comprehensive understanding of subsistence, incorporating insights from many different theoretical models of subsistence agriculture. These elements may be considered one by one. The first is that subsistence is defined as being located within the farming household. Using the household instead of the conventional farm as a basis for the theoretical models of subsistence agriculture places the problem in a broader context.

Subsistence is no longer only an agricultural phenomenon, but also a social one. The links to agriculture are not abolished, they are even emphasised, but they are understood within the framework of an integrated rural economy. The use of mainly family labour implies the existence of non-economic factors in the decision process. The partial engagement in output markets expresses the non-marketing nature of a considerable part of production as a main characteristic while the same, when applied in the case of input markets, describes the technological backwardness of subsistence production, which is one of the main sources of concern for economists.

The final statement about the imperfection and incompleteness of the markets identifies the constraining framework within which subsistence develops, which is also one of the reasons for its existence. If these markets were better developed, there

would probably be no subsistence. This provides a link between the problems of subsistence in developing and transition economies. These imperfect markets are the common reason, the common constraint. In developing economies, however, they are usually the hallmark of underdevelopment, while in transition economies the policy emphasis on industrial development in pre-transition years often assigns different dimensions to the subsistence problem. This industrialisation that is considered in some dualistic agriculture theories as an engine for agricultural commercialisation gave birth to intensive urbanisation and a radically different rurality in what are, today, transition economies. Furthermore, the collapse of the excessive industrial capacities at the beginning of transition can be identified as one of the reasons for subsistence expansion (Kostov, 1995).

Thus without rejecting the useful elements in the traditional theories of subsistence, we have to stress that this phenomenon assumes very different dimensions in transition when a comparison is made with the developing economies. An important advantage of subsistence agriculture in transition economies is that it can be analysed as a process. While in developing countries subsistence can be regarded as "given", that is it simply exists and has "always" existed, in the CEECs it is the transition process that has “given birth to” subsistence agriculture. Having both the cause and the result we are able to identify the *raison d'etre* for subsistence, and the factors that govern its expansion, as well as those which may well reverse the process.

2. Transition and emergence of subsistence agriculture

2.1 The institutional framework of transition

Under the planned economy, investments were centrally determined. Due to the emphasis on industrial development, the investments in agriculture have been neglected. This process of the decapitalisation of Bulgarian agriculture began in the 1970s (Creed, 1998). The relative unavailability of credit resources leads to reallocation of resources from the earlier to the later stages of production. Liberalisation created conditions for the intensification of the decapitalisation of agricultural production. We denote this process of the reallocation of production resources as the shortening of production in real time. The uncertainty generated by the initial reforms increased the importance of present relative to future consumption, setting in motion a further shortening. It is important to stress the link between the shortening of production and the propensity to consume. The shortening process effectively impinges on the later stages of production, the net effect of which is an increase of current relative to future consumption. Therefore this process takes place when there are expectations of a future fall in the consumption of the final products.

The key to understanding agricultural developments during transition is the institutional structure. At the beginning of transition managers were given autonomy. This is to be interpreted as a refusal of the State to engage in economic administration or at least to restrict its participation in the latter. However, it means the dismantlement of the established institutional order. The plan ceases to be the

main aim. Uncertainty increases and at the same time there are no mechanisms ready to cope with this situation. The result is that the intended spirit of enterpreneurship is constrained and the most reasonable way to behave is to do nothing. The expected price liberalisation was an important constraint to economic action. In contrast to Bulgaria, where the system of central planning was applied strictly and therefore the above was a really radical behavioural change, in Slovenia, due the limited scope of the central planning and the introduction of the self management socialism in the 1950s, the overall economic situation facilitated the reforms. In the case of Slovenia not only agriculture but the economy as a whole, had several decades to adopt institutional rules and arrangements that are appropriated to a system without central planning. As a result the institutional changes required to accomplish transition to a market economy were much more radical in Bulgaria than in Slovenia. The mechanisms to cope with the new market environment were virtually non-existent in Bulgarian economy, but have been established to a certain extent in Slovenia. Most of the discussed in Chapter 1 differences in the initial conditions and the consecutive development during transition in these two countries are direct result of their economic institutional structure.

Economic transition is mostly about changing institutions. Its trademark is instability. The dismissal of the centrally-established plan is itself a major institutional change. The liberalisation of prices (and even recognition of the possibility of it) represents an official dismissal of the plan in the form in which it existed under the planned economy. It means that the State no longer holds the enforcement mechanism. In principle, the latter may exist only if the State has sufficient financial funds to maintain certain price levels or had developed mechanisms alternative to the central planning. Chapter 1 demonstrated that this was much more likely in Slovenia than in Bulgaria.Given the unstable macroeconomic situation which resulted from transition, households faced a high-risk environment. Their response to instability and uncertainty was to try to secure their basic food supply via subsistence production. Self-consumption can be considered a form of risk minimisation. Economic instability changes psychological attitudes and with the possibility of chronic food shortages, market stimuli lose their power. The dramatic macroeconomic changes promoted self-sufficiency as a high-order household priority, and changed relationships to the market. In order to explain the impact of the macroeconomic instability we have to look at the institutional basis of transition. Transition is mostly about changing old institutions and creating new ones. Institutions represent the "rules" that individuals follow to cope with uncertainty (O' Driscoll and Rizzo, 1996). On the one hand they have an informatory role, providing rules and routines that are proven to work in given situations. Faced with the uncertainty of the future, the individuals confine their behaviour within these rules. This helps to predict individual behaviour and to achieve a "pattern co-ordination", a notion which better reflects economic realities than the more familiar one of equilibrium. We do not "know" the future, but we can "imagine" it, or at least its typical features. Instability is a logical consequence of the destruction of the old established institutions. Rules for behaviour, prescribed by the institutions that were destroyed in transition, now cease to work. This increases uncertainty. This process is illustrated in Johnson et al. (1997) who emphasise the crucial role of the speed of

the reforms. In Bulgaria, reforms were slow and this has resulted in longer periods of economic instability. The process of destruction is necessary, because the system of the planned economy as analysed in Kornai (1980) or Earnhart (1999) is very different from our idea for a market economy. During this process of transformation small-scale agricultural production remained one of the few institutions individuals could rely on.

General economic development and the related income situation are only the visible side of the underlying changes in the institutional structure. It is clear that the institutional change is the essence of transition. Macroeconomic instability is a consequence of the selected sequence of reforms (i.e. institutional changes). At the aggregate level, the institutions represent the "means of orientation" (Lachmann, 1971) and changes to them impacts on the behaviour of economic agents. Institutions are to be interpreted as a social crystallisation of rule-following behaviour (Hayek, 1973). As such they provide a basis for pattern co-ordination (O'Driscoll and Rizzo, 1996). Therefore the process of institutional change necessarily brings instability in the economic behaviour observed, thus creating it at the aggregate level. There are two main sources of this instability related to the process of economic transition. The first is the impossibility to follow the rules of thumb prescribed by the institutions which have been destroyed. This is often described as a "vacuum" originating from the destruction of the old structures and the lack of new ones. The second, and arguably more important source of instability, is related to the informatory role of institutions. Hayek (1973) argues that outside the price system, the patterns of routine behaviour transfer information.

Except for the restrictions that they impose on individual behaviour, institutions are considered to convey knowledge. This is explained by postulating a Darwinian process that wipes out institutions with inferior survival abilities. Therefore the rules of thumb can be regarded as efficient adaptations to the environment. The latter idea about the nature of efficiency in the evolutionary processes has been extensively criticised in Hodgson (1993), but it can be readily replaced by the notion of workable adaptations. The nature of transition changes the environment. Therefore, even if the old institutions are still in place, the routines for action they prescribe may, and will, convey erroneous information which increases instability. One of the consequences of the latter is the greater chance of economic errors. These errors are translated into the transaction balances. Kessel and Alchian (1962) argue that transaction balances and ‘short-lived’ capital goods are complements, while transaction balances and ‘long-lived’ capital goods are substitutes. Therefore the effect of the economic volatility is the reduction of long-term capital. Insofar as the long-term capital is associated with the earlier stages of production, the above is an alternative representation of the shortening of production in real time, which when applied to aggregate agriculture contributes to its decommercialisation.

The influence of inflation is that only short-term finance is available. This further enhances the process of shortening. Inflation increases the preferability of current relative to future consumption of consumption goods, such as food, and therefore contributes to the shortening of agricultural production. In terms of agriculture the above process means a need for food at the present time, and due to the expected

future decline in food production, the danger of future food shortages. Both of the above give rise to a tendency towards household self-sufficiency. This tendency, however, may be expected to be of a relatively temporary duration, subject to the development of the new market institutions.

2.2. Environmental and behavioural entropy

The environment to which economic agents have to adapt is highly volatile. This high volatility implies higher environmental entropy. When this is the case behavioural entropy should decrease (Heiner, 1983). This restricts enterpreneurship, which is a high-entropy type of behaviour. The uncertainty means that even if there is enterpreneurship, the chances for reward will be relatively low.

Institutions are tools to cope with the uncertainty. In the context of Eastern European transition "gradual" reforms create constant instability. They do not allow for the establishment of new institutional arrangements. Even when the new institutions successfully adapt to the environment, new shocks disturb them and hinder the process of institutionalisation. This volatility does not allow for long-life capital goods. A characteristic of Bulgarian agriculture in transition is constituted by numerous export bans, which undoubtedly prohibit the creation of a market. The effect of these bans is weighted by expectations which, although during the first years may be for the lifting of a ban, will later change and production will consequently adjust to meet domestic consumption. This means that the engine for production growth in such a situation is the foreign market. If there are expectations for a growth of the market, which in terms of agriculture and the current situation means the external market, then there will be adjustments in the production process to meet this increased demand. The income-driven domestic market increase (or expectations of it) will have a similar effect in reversing the tendency towards shortening.

The informational role of institutions aimed at reducing uncertainty can be alternatively expressed as reducing the environmental entropy. Routinised behaviour therefore reduces behavioural entropy. An important study by Heiner (1983) reveals that although in general behavioural and environmental entropy are positively correlated, increasing the latter beyond a certain limit leads to a decline in behavioural entropy. Subsistence economic behaviour, due to its short production cycle in real time, is more predictable than commercial, which means that high volatility in the economic and social environment would lead to augmentation of the relative importance of subsistence agriculture.

2.3. Hierarchies

Simon (1981) notes that individual plans and perceptions are hierarchical and we can conclude that this also applies to institutions. Economic transition has to do with

change in the higher-ranking institutions. This change brings about greater instability, because it affects the most typical features of economic events. It disturbs the established pattern of co-ordination. Subsistence agriculture is situated at lower levels in the hierarchy of the institutions. Following Langlois (1986), who suggests that when actions are co-ordinated at a higher level in the hierarchy agents use the energy released to examine possible behavioural changes at the lower levels in the same hierarchy, we can now explain subsistence endurance. Firstly, the macroeconomic parameters reflect the volatility borne by the most fundamental institutions, that is to say those which are high in the hierarchy. Here, the apparent stability does not imply that all the institutional arrangements required are in place and working. Institutional change is a much wider process. We note that many of the new institutions were created during economic turmoil. When the environmental entropy decreases, these institutions have to adapt further to this new environment. Does this mean that, whilst establishing stability high in the institutional hierarchy frees up energy to be utilised at the lower levels, the subsistence structure will be changed? The answer is yes, but only in principle. Self-sufficiency is evidently ranked lower than general consumption behaviour. This means that changes in subsistence can take place on condition that a stable and co-ordinated consumption pattern is obtained. A common measure for consumption volatility is demand price elasticity. When referring to subsistence, we are interested in the price elasticity of food consumption. When incomes are low, these elasticities (and therefore food consumption volatility) are higher and there is little energy to be applied to changing self-sufficiency. The income situation therefore is an important determinant of subsistence agriculture, because it describes its institutional environment.

The subsistence type of behaviour, however not only means "consume what you have produced", but also "produce what you want to consume". That is, it has to be placed within the institutional environment of overall food production. It consists of agricultural production and food-processing. It is well-known that in general, agricultural production is relatively price-inelastic. Food-processing however depends on both domestic and external demand for its products and is much more volatile. Consequently production for food-processing is of a different kind to that aimed at immediate consumption. It assumes different planning. The existence of subsistence restricts the domestic market for the products of food-processing. Therefore the external markets are the key to change in subsistence farming when it is regarded from its production side.

Another difference between the incomes situation and external markets is that while the former acts directly and is therefore easier to observe, the latter have much more subtle and indirect influence. We may see that the increase in the external market for raw agricultural products would also contribute to commercialisation of agriculture, inasmuch as this increase is greater than the ensuing increase in domestic production. This means that the relatively inelastic production cannot meet the higher demand and some of the production aimed at self-sufficiency might have to be reallocated towards the market. If this growth is expected to be irreversible, then some resources would be moved from the later to the earlier stages of production. In other words this would lead to "expanding" production in real time. The effect of this would be increased future production and consumption. In relation to subsistence

consumption, this process may restore, if needed, the original level of consumption, part of which may be "sacrificed" to launch the process of resource reallocation.

2.4. Roundaboutness and its link to the process of shortening

We can express the effect of shortening alternatively, as diminishing the roundaboutness of production. This will be true only if more roundabout production techniques are superior to the less roundabout ones. This is generally the case with subsistence and commercial agriculture. Therefore, for the rest of this discussion, we can view diminishing roundaboutness as synonymous with the shortening of production. This equivalency may be used to apply the neo-Austrian production theory to our problems, because the latter explicitly deals with the problems of roundaboutness. That is, while we have hitherto expressed ourselves in relative terms, we can now establish some of the results in absolute terms which are more easily understandable. Institutional instability leads to dramatic increase in the relative preference of current to future consumption, in the sense that it augments the value of the discounting factor by which future consumption is weighted. This makes current consumption increasingly more desirable. Coupled with the ensuing process of shortening of production in real time this results in a relative decrease in both future production and consumption. Subsistence behaviour, therefore, can be regarded as an insurance against the expected fall in consumption. Let us consider the moment in which this future becomes present. *Ceteris paribus* at this moment, the individual would be faced with lower consumption. He or she would, however, have a relatively high propensity to consume (inherited from the previous period). If the expectations for the effect of the decreased roundaboutness have been properly computed, then the choice of the subsistence type of economic behaviour would help individuals to increase their consumption, in contrast to that of market-driven behaviour. That is, subsistence has a function of maintaining consumption at a higher level than otherwise and thus offsets some of the effects of the decreased roundaboutness of agricultural production on it. In doing so, it further restricts future consumption of commercial production and contributes to the deepening of the shortening process. For a fuller understanding of the dynamics of subsistence it will be useful to consider how the vicious circle just described can be broken. In the simple model above, the variable that would affect the dynamics is the propensity to consume. In the case of a fall in uncertainty, the propensity to consume will decline. The latter however may not be sufficient to reverse the process. In order to increase the roundaboutness some current consumption has to be "sacrificed". This must be accompanied by expectations of a future rise in consumption. Under consumption here we understand both domestic and external demand for the final products. This is the case of even distribution of the effects on overall agriculture. If this was the case, however, there would have been no need to consider subsistence agriculture separately from commercial agriculture. The immediate response of subsistence farms to the changed demand would be more flexible; what is needed is a simple reallocation of part of their own consumption to the market. This is a reference to unexpected changes in demand. In principle such a reallocation would represent a

shift in the propensity to consume if higher demand is expected. In a world of uncertainty and ignorance, however, such expectations first have to be formed. In this regard, the immediate reaction of subsistence agriculture to changes in production would not necessary involve expectational elements. If the new higher demand stays at this level for a sufficient time, the temporary character of the change in the propensity to consume may be obliterated and therefore the current "sacrificed" consumption may lead to increased roundaboutness.

The key to meeting future expected higher demand is, however, in increased roundaboutness. This is a process of the reallocation of resources, mainly capital, from later to earlier stages of production. The capital accumulation on commercial farms, however, largely exceeds that on subsistence farms. Consequently the changes in the roundaboutness of commercial agriculture would be much easier and greater than those in the subsistence sector. We note the asymmetry in the changes in roundaboutness; while a decrease may be achieved by dispersing capital resources, the augmentation assumes capital accumulation and it is therefore a generally slower process. This differential approach is helpful in understanding the sources of subsistence. The genesis and expansion of current subsistence farming took place in conditions of decreasing demand for consumption and the roundaboutness of agricultural production. In general, commercial farmers reduce the roundaboutness of their production slowly in accordance with the useful economic life of their assets. The process of disinvestment in agriculture, however, began long before transition took place. The liquidation of the former co-operatives in Bulgaria additionally contributed to the faster decline in roundaboutness, while in Slovenia this was partially offset by the initial structure of agriculture. Less roundaboutness and more labour-intensive technologies simply mean more subsistence.

It may now be appropriate to discuss the meaning that we have attached to the term "shortening of production in real time". First of all, it is clear that this cannot be interpreted in the context of calendar time since, in the case of agricultural production, it always takes the same amount of the latter. In subjective terms real time is understood as a flow of events. One of the main differences between the real and Newtonian concepts of time is that the former allows for novelty and surprises. Moreover, time is identified with this element of surprise. When we say shortening, however, we do not mean that the number of unexpected events during the process of production will be lower. One can easily conclude from the above discussion and the greater uncertainty associated with this process that the opposite will normally be the case. The term "shortening" rather reflects that those events which would affect the typical features of the economic behaviour are less likely to occur. In other words, the importance of rule-following behaviour has been increased in response to the lower subjective probability of deviation from the adopted rules. This understanding brings together the production process and the environment inasmuch as it shows the combined effects of their interactions, which cannot be regarded separately.

The issue of capital accumulation and amortisation is important to the future development of agriculture. Traditionally, capital production models include production of capital goods as a separate phase of the production process. We can regard monetary funds as a universal liquid form of capital. This means that when

capital is exogenised from the production process money can, and should be, interpreted as capital. Accumulating money is simply another form of capital accumulation. New capital can be brought into the production by substitution for available monetary funds, which is similar to the familiar substitution of specific capital. Loans can also be used to introduce new capital but they have to be ensured by collateral. Here, loans can be regarded as an inter-temporal substitution for specific capital. Subsistence agriculture is particularly deprived of accumulated capital. This suggests that the process of commercialisation would require the engagement of agricultural capital resources from outside. An example may be for an individual to use his own house as collateral. The latter cannot happen unless some prerequisites have been met. The first is that relative stability has to be achieved in the domain of prime use of these assets. The uncertainty (both general and specific) to the domains of prime use (e.g. housing) and transfer (that is agriculture) of the asset must be sufficiently low. Expectations about an increase in the consumption of the final produced goods have to exist.

2.5. Subsistence agriculture - what defines it?

At the beginning of this chapter we stated that the phenomenon of subsistence is a surprise. It has been demonstrated that subsistence is a logical outcome of transition. The process of economic reforms has its peculiarities in every country in transition. These particularities have influenced the character and the relative size of subsistence in these countries. The countries considered in this study, Bulgaria and Slovenia, represent the two extremes in terms of the nature of economic reforms, and correspondingly they account for two very different types of subsistence agriculture. The main reason for its existence and endurance is, however, the process of transition; the drastic institutional changes have given rise to subsistence agriculture. For this reason it cannot be regarded as a phenomenon that is temporary and one of "inefficiency" (Sarris et al., 1999, OECD, 1999). Subsistence is simply the reaction of an agricultural economy to abrupt institutional changes. As such it cannot be regarded as surprise; it is the only possible outcome. The supporters of the "efficiency" argument may recall another example of dramatic institutional change, in which subsistence expansion was disallowed - namely the collectivisation of agriculture in Soviet Russia in the 1920s - and remember the outcome of this experience, i.e. famine. The experience of some Central European countries, such as Poland and Hungary, was also characterised by food shortage problems in the early stages of transition.

Subsistence has to be explicitly modelled and its considerable effects on overall agriculture deserve our attention. The main focus of attention in modelling subsistence agriculture has to be on its interactions with the commercial sector. It has been shown that the expansion of subsistence took place as a result of the economic developments of commercial agriculture. The key for the desirable commercialisation of subsistence farming is therefore in its relationships with commercial agriculture. We have outlined the most important factors likely to

influence this process. The first is the income situation. Income impacts not only on domestic demand for agricultural products, but also on institutional development.

The other factor of agricultural commercialisation is that of the external markets for agricultural and food products. This is important to a traditional agricultural exporter such as Bulgaria, but may be ignored in some other countries. The importance of external markets helps us to interpret the economic role of subsistence, as outlined in Kostov (2001) and Kostov and Lingard (2000). Subsistence evidently contributes to the maintenance of total food consumption at a higher level when a comparison is made with entirely commercialised agriculture. The effects on production of subsistence, on the other hand, seem to be negative. This is the reason why it is classified by many as abnormal and "inefficient". The net effects of subsistence are therefore to reduce production and to increase consumption. This means that without subsistence, *ceteris paribus*, consumption should decrease and production would have to increase, thus leading to an agricultural surplus. This surplus has to be cleared via exports, because the assumption *ceteris paribus* as above fixes domestic demand. This is possible only if there is unrestricted foreign market access. The latter is, however, questionable where the typical products of subsistence agriculture are concerned. Subsistence farming, therefore, can be seen as restricting this potential surplus of agricultural production and stabilising the domestic market. The only other alternative to this "market clearing" role of subsistence is to abandon agricultural land. In the case of no subsistence, prices would decline further and it would be impossible for many farms to stay in business. The result of their closure would be a considerable amount of abandoned land. The latter suggests that the overall effect of subsistence agriculture is positive even with regard to production. We cannot mechanically compare the current dualistic structure with an entirely commercial agriculture by simply substituting commercial for subsistence farms. The proper comparison would have to include only viable commercial farms. With regard to this, subsistence agriculture is an alternative to abandoning land, rather than to commercial farming, and therefore cannot be defined as economically "inefficient" at aggregate level. As for the efficiency of these farms at individual level, Sarris et al. (1999) report that the average age of small-scale farmers in Bulgaria is 62 years. This means that most of the current subsistence farmers are pensioners; that is, they are the people less likely to find alternative employment. In other words the opportunity cost of their labour employed in subsistence production is virtually zero. Bearing in mind that labour is often the only input in this type of production, any meaningful calculations should show that in economic terms these subsistence farmers will always be efficient. The only other alternative to subsistence production is leisure, which cannot be a reality unless there is sufficient income. The above renders meaningless any utility-maximising labour reallocations between subsistence farming and some alternative employment, suggested in Beckmann and Pavel (2000) as a basis for modelling the interactions between subsistence sector and the rest of economy.

The third factor that would influence the likely agricultural commercialisation is the process of capital accumulation. Capital accumulation as a basis for the production process is often neglected in economic analysis. The role of money as a universal form of capital relates the likely commercialisation to the income situation. In the

interaction between subsistence and commercial agriculture simulated in the N-ESIM (see Chapter 8), the emphasis is on the influence of income on domestic consumption. Here, we have in mind mainly the stabilising role of income on the institutional structure. That is, the role of income for capital accumulation and thus for production growth is related to general economic development. Similarly the substitution between different kinds of specific capital that contributes to the accumulation of agricultural capital can be viewed as another facet of the same process. N-ESIM implicitly incorporates the impact of the capital accumulation into the GDP-dependent technological progress.

3. Modeling subsistence - do we need a different model?

It has been asserted that explicit modelling of subsistence agriculture is needed to achieve efficient forecasts for future agricultural performance. However it is not clear under what circumstances ignoring the underlying dualistic structure of agriculture would have a serious impact on the forecasting capabilities of the constructed models, or when this effect would be negligibly small. It is intuitively clear that the size of subsistence has a significant effect on the performance of conventional economic models. But this is obviously insufficient. N-ESIM provides some quantitative results that are referred to as effects of subsistence on total agriculture. These effects are, however, estimated by comparison of the current dualistic agriculture with a hypothetical agriculture to which only the behavioural characteristics of current commercial agriculture are attributed. The effect of ignoring subsistence agriculture in a conventional modelling exercise will be rather different. In this case the pooled data for total agriculture will be used to estimate the characteristics of the system. For simplicity let these characteristics be the elasticities. The normal non-dualistic model will have elasticities that are a weighted average of the elasticities of the subsistence and commercial sectors. Therefore it is not clear whether this pooled data model with combined elasticities could provide at least a reasonable approximation at aggregate level to the true underlying processes. Why should this type of model not produce reasonable forecasts for total production? This is not a question without importance. The only reasonable way to make a general assessment of the effect of different factors on the performance of conventional non-dualistic agricultural models is by simulation. A Monte-Carlo type of simulation study on this topic is presented in Kostov (2001). This study is conditioned by the current size of subsistence agriculture in Bulgaria. Some conditions are listed under which ignoring subsistence will not lead to serious consequences for the efficiency of the estimated parameters and the forecasting capabilities in the case of constant elasticities, such as those employed in N-ESIM; however, they are restrictive and inappropriate for most countries in transition. These conditions can be summarised as follows:

- Sufficient length of the data period. In an empirical modelling exercise functional parameters cannot be considered as given or known; they have to be estimated and the quality of the estimates will influence the performance of the model. The cost of

ignoring subsistence can be partially offset by increasing the length of the data set by up to three times.

- Stable relationships between subsistence and commercial agriculture. It is difficult to provide a formal definition of this requirement. It means that the interactions between subsistence and commercial agriculture should be free of structural breaks or can be approximated from the data. The latter means that the process of transformation of subsistence into commercial has to be correlated with some of the parameters used to identify the model.

- Stable prices. Relative price changes have to be small; under constant elasticities production functions they have to be below 10 %. While this is usually the case in developed countries, transition countries were subjected to massive price changes, especially at the beginning of transition.

The last two conditions have to hold simultaneously in the time periods used for both estimation and forecasting in order for the conventional models to provide reasonable approximations of the performance of the total agricultural economy. In other words periods of drastic price changes have to be excluded from the data set used for estimation. Unfortunately all the above are violated in most countries in transition. Particularly in the case of Bulgaria, it is not possible to construct a non-dualistic model with satisfactory performance. This is not to say that such a model cannot exist. Its parameters, however, should be guessed at, rather than estimated.

The above suggests that in the case of Bulgaria, modelling subsistence is a necessary prerequisite for a meaningful policy analysis. For Slovenia however, the answer cannot be so definite. It is true that Slovenian agriculture exhibits significant subsistence patterns. The less radical nature of the changes in Slovenian agriculture, suggest that the existing structural breaks could be approximated from the available data. Moreover our discussion of the process of shortening showed that while in Bulgaria and some other countries it led to a vicious circle that created subsistence agriculture, it had much more limited effects in countries like Slovenia, where institutional changes have been smaller and less radical. This difference in the initial conditions explains the difference in the final outcome. Bulgaria is net exporter of agricultural products while Slovenia is a net importer. Since the effects of shortening as can be mitigated by imports, which change the size of domestic market and thus influence both commercial and subsistence agriculture, there are more possibilities to resolve the problem of subsistence behaviour in Slovenia than there are in Bulgaria.

In this volume we interpret modelling as a tool that should support and complement policy analysis. For the latter, one needs to know what policy makers need a model for. Models, as succinctly put in the previous chapters, are not crystal balls, but imperfect tools that should provide guidance in assisting policy makers to decide on the likely effects of alternative policy options. The future accession to the EU has been asserted as a major priority for both Bulgaria and Slovenia and has been allocated special attention in the context of the present project. The existing gap between Bulgarian agriculture and this of the EU is much wider than the one between Slovenia and the EU. Consequently much greater changes are necessary in the case of Bulgaria. The impact of the existing subsistence agriculture is much more

likely to be of a concern and as the simulation results demonstrate, would be much greater in the case of such significant changes and thus need to be analysed. The significance of agriculture for the overall economy in terms of GDP and employment is much greater in Bulgaria than in Slovenia. This leads to a different policy relevance of the agricultural sector. It justifies different policy approach to agriculture in these two countries and thus different policy objectives and requirements to the quantitative models. The problems of subsistence agriculture may be ignored in countries like Slovenia not only because of their smaller impact, but also because of the associations with the less developed countries that this term invokes. In countries like Bulgaria, on the other hand, where agriculture is considered to be an important sector, this becomes an important issue.and policy makers are not able to avoid it.

4. How to model dualistic agriculture: the block diagonal representation

Hitherto we have presented the problem of subsistence agriculture within the overall framework of economic transition. This view of subsistence allows us to understand the driving forces of its emergence, expansion and endurance, and therefore to identify the likely factors that could reverse this process. The need for explicit modelling of subsistence and its relationships to commercial agriculture were emphasised. Nonetheless, the need for such modelling and the identification of the main factors influencing subsistence does not mean that we should proceed headlong into a modelling exercise. What we need to know is how exactly to represent the dualistic agricultural structure. A reliable basis for doing this is the block-diagonal representation of a dualistic agricultural economy, as defined in Kostov (2001) and implemented in Kostov and Lingard (2000). The basic idea behind the derivation of the block diagonal representation is the different economic behaviour of subsistence and commercial farming, stressed by Mishev (1997), the effect of which can be seen in the elasticity estimates, presented in Mishev et al. (1996). The likely interactions between subsistence and commercial farming cannot be ignored, particularly when subsistence and commercial production are often combined in the same production unit. Here we present only the case of production, consumption being susceptible to similar treatment. Given these considerations the "true" process governing a dualistic economy can, in terms of its production side, be represented as:

$$p(t+1)=\begin{pmatrix} p_c(t+1) \\ p_s(t+1) \end{pmatrix} = x(t) * p(t) = \begin{bmatrix} X_A(t) & X_B(t) \\ X_C(t) & X_D(t) \end{bmatrix} * \begin{pmatrix} p_c(t) \\ p_s(t) \end{pmatrix} \qquad (1)$$

where p stands for production, subscripts c and s denote its commercial and subsistence counterparts correspondingly, t is a time index and the matrix X is used to represent any admissible functional form. In the general case X is a matrix of

functionals, rather than parameters. The above representation reflects the understanding that subsistence and commercial production are intrinsically different, although they are linked and interact between themselves. It can easily be seen that this representation creates enormous computational problems, since it represents a four-fold increase in the number of parameters required for constructing a model, compared to the conventional case in which the difference between subsistence and commercial production is ignored. This seemingly insurmountable difficulty can be eliminated by using the block-diagonal representation. It has been proved that the above can be alternatively represented as:

$$p_c(t+1) = A(t)p_c(t) \tag{2}$$

$$p_s(t+1) = D(t)p_s(t) \tag{3}$$

where $A(t)$ and $D(t)$ are simple combinations of the original elements of the functional matrix $X(t)$. What this suggests is that one can model a dualistic agriculture as having seemingly separate models for the subsistence and commercial sectors. The denomination block-diagonal comes from the fact that the above simply states that there exists an equivalent representation of the matrix $X(t)$ which is block diagonal with respect to the division of agriculture into subsistence and commercial. This allows for estimation of the parameters, contained in $A(t)$ and $D(t)$. Notably, the only additional information required is that concerning the share of subsistence or commercial in total agricultural production for each product. Otherwise this alternative representation does not impose any additional data requirements, compared to the conventional case of an entirely commercial agriculture. However, the dependence of $A(t)$ and $D(t)$ on the elements of the original matrix $X(t)$ means that some restrictions have to be imposed when the parameters of the functions employed in $A(t)$ and $D(t)$ are estimated. The block-diagonal representation allows this to be done automatically during the modelling process, by including these restrictions in the following analytical form, expressed in terms of the elements of $X(t)$:

$$X_C(t)p_c(t) = X_B(t)p_s(t) \tag{4}$$

The block-diagonal representation of a dualistic agricultural economy, is contained in equation (2), (3) and (4).

Let us now consider (4). Remembering the structure of $X(t)$, its left-hand side represents the contribution of the commercial sector in the period t to the subsistence sector in the subsequent period. That is, it represents the effect of commercial on subsistence agriculture. Similarly the right-hand side gives the effect of subsistence on commercial agriculture; that is, (4) requires these effects to be equal. At first sight this sounds nonsense, because we are speaking here about production and this seems

to be fulfilled only in the case of no interactions between subsistence and commercial agriculture. Nevertheless, the block-diagonal representation can still be applied. What is required is to express production in such units of measurement that (4) will be automatically satisfied. Such a unit for crop production is the land area. It is clear that the net effect of subsistence on commercial agriculture expressed in land redistributed from subsistence into commercial use meets the requirement imposed by (4). The amount of land that leaves the subsistence sector exactly matches the amount of land that enters commercial agriculture. Similarly the livestock sector can be expressed in terms of the number of animals. After basing the modelling on such appropriate units of measurement, different yield and productivity functions can be applied to the results in order to arrive at the aggregate production result. This requires that data about the land used under different crops and the number of animals have to be made available. Now we can similarly model the consumption of agricultural products, basing it on appropriate consumption units. The product "populations" employed in N-ESIM in Chapter 8 have precisely this role.

The block-diagonal representation allows us to resolve the computational problems posed by considering subsistence as a separate part of total agriculture. However, it has another important characteristic; it is relatively straightforward to demonstrate that it is not unique. That is, many different alternative block-diagonal representations can be found, based on the same original $X(t)$ matrix. This representation can, of course, be specified more fully in order to guarantee its uniqueness, but we do not consider this necessary. When modelling subsistence and commercial sectors, the parameters of a functional representation of the process of transformation of resources between them have to be estimated. An important property of the block diagonal representation is that it allows for a trade-off between the parameters of the production function and the above-mentioned transformation function. To clarify what is in mind, if we bias the transformation function because of the omission of important determinants of the latter, this bias may be fully offset by the bias that will be introduced by these determinants in production function. Since it is very difficult to distinguish the effects of the same factors on production and transformation functions, this allows for efficient estimation of the aggregate effects. In other words, although when applying the block-diagonal representation one cannot be sure whether the effects calculated from production and transformation functions are the true ones, their sum in both the subsistence and commercial sectors will be correctly specified. There is nothing to be gained by the imposition of uniqueness on the block-diagonal representation. If we were able to do so, any error in estimating parameters would be magnified. It may be admitted that we are generally not able to observe the separate effects of production and transformation functions, only the result of their combined action. Therefore it is advantageous to "bias" these by allowing flexibility in the adopted representation.

N-ESIM can be viewed as a practical implementation of the principle of block diagonal representation. N-ESIM utilises constant elasticities functions to represent the production and consumption components of agriculture. These constant elasticity functions are the production functions in subsistence and commercial sectors. The shifters applied to the subsistence sector define the transformation function. Crop

production is modelled on the basis of land area. This allows the result of the transformation function, applied to subsistence agriculture, simply to be transferred to the commercial sector. Therefore crop production is represented via area/price elasticities, which reflect the area re-allocation between the different products within the subsistence or commercial sectors and product-specific shifters which give the effects of the transformation process. Different yield functions for subsistence and commercial farming, applied to the results of this land re-allocation, give the total production effect. Crops are therefore modelled according to the block-diagonal representation.

An invariable measure of livestock production is the number of animals, which allows the same approach to be applied to livestock production. N-ESIM does not use the number of animals. Nevertheless, one can regard N-ESIM as compatible to the block-diagonal representation in terms of livestock production, because of the implicit inclusion of the number of animals via the feed ratios. This is, however, achieved by an additional adjustment in feed ratios.

Consumption is modelled similarly, based on "consumption units". While subsistence consumption is equal to subsistence production, commercial consumption is determined in terms of the division of the total population into "commercial" and "subsistence". The above division is carried out separately for each product, according to the size of subsistence. Commercial consumption for a given product is therefore obtained by applying consumption elasticities to the "product population".

The transformation process drives resources in and out of the subsistence sector, thereby changing its size. In terms of consumption, this means change in the product specific "populations"; that is, the transformation of some production from subsistence into commercial use drives some people out of the subsistence sector and enlarges product markets. The income-related "shifters" used in N-ESIM to simulate this process work in a similar way to that of constant elasticities. An alternative approach is applied in Kostov and Lingard (2000) and Kostov (2001), which employ non-linear flexible elasticities of substitution that can be expressed as quadratic functions of the share of subsistence. The results obtained using both these approaches are similar in the short- and medium-term.

In order to better explain the block-diagonal representation, it may be useful to demonstrate not only how it may but also how it should not be applied. As an example for the latter we can take the approach developed in Beckmann and Pavel (2000). They use a combination of CGE and a household model. In a few words, this approach consists of simulating the "market" for household labour which can be used either in subsistence production or in an alternative employment. The relative wage determines the "optimal" reallocation of labour. The labour input in subsistence defines the volume of subsistence production. On the other hand, there is a "market" for food, where households decide whether to buy food, or to produce it themselves, market food and own consumption being regarded as imperfect substitutes for one another. An objection was made earlier to the idea of a "market" for labour, because it is precisely the lack of such alternative employment opportunities that is one of the main factors for the current existence of subsistence farming. Otherwise, using

labour in such a way meets the requirements of the block-diagonal representation. Therefore such mechanisms may be employed in formal modelling for simulating the effects of employment opportunities. It is the simulated "market" for food which raises objections. To recap, N-ESIM virtually simulates the following choice - to sell or to consume available production. The latter is more realistic, because the former ignores the budget restriction. Market food cannot be substituted for subsistence unless a household has sufficient income to buy it. Here the effects of income on the transformation can clearly be seen. The block-diagonal representation explains why, in such a "market" for food, subsistence and market food are imperfect substitutes for each other. This is so because in this case (4) cannot be expressed in a satisfactory way by any units of measurement for food, since none can be found for it; thus there is no possibility of direct construction of a block-diagonal representation of consumption. Stating that, for example, 1 unit of a given market food equals 1.2 units of the same type subsistence food can resolve the problem for only one period. Even without invoking particulars of the block-diagonal representation, it should be clear that the transformation effects, which are represented in this case by the "market" for food, are dependent on the size of the subsistence sector. Therefore the "ratio" of imperfect substitution is variable. Although by employing flexible functional forms one can achieve an effect similar to the block diagonal representation, there is no recipe for how this can be done and no criteria against which to check whether the estimated parameters approximate reasonably well to the true underlying process.

5. Form of the transformation function

The crucial point in modelling subsistence agriculture is the choice of transformation function. There do not appear to be any theoretical considerations that might be useful in selecting specific functional form. The block diagonal representation allows for the "incorrect" specification of the transformation function, provided that the source for this mis-specification is accounted for in production functions. The latter however is true only in the general case when no specific functional forms are specified. The act of choosing specific functional form for either production or transformation functions imposes certain restrictions on the general case. With regard to N-ESIM, using production functions with constant elasticities restricts their ability to account for eventual mis-specification in transformation function. N-ESIM uses elasticity-like income-related shifters, which are applied to the subsistence sector to yield the result of transformation function. The result of this specification is that the yield of the transformation function is proportionate to the size of subsistence farming. In other words, assuming constant growth, this specification would simulate a process of agricultural commercialisation with a decreasing rate of transformation. If this were not the case, however, the error that results from this mis-specification could not be accommodated by production (and consumption) functions, because of their characteristic of constant elasticity. Therefore it is important that transformation function is adequately chosen. Even if production and consumption functions are more flexible, it is desirable that the chosen

transformation function is specified in a way that better approximates to the "true" transformation process. It is worth noting that block-diagonal representation demonstrates the possibility of removal of mis-specifications in the transformation function, but does not indicate that this will be done.

The appropriateness of the selected transformation function is tested empirically in Kostov (2001). This test is formulated in terms of different specification of the transformation function, but nevertheless the main points of analysis are valid in terms of N-ESIM. The essence of this testing is in using product-specific neural network models to investigate the effect of income increase on the size of subsistence. Monthly household budget data on the share of household production in total consumption for a number of products characterising subsistence agriculture are de-seasonalised, and adjusted for structural breaks using unobserved components models estimated in state space form. The results of these adjustments are indices for subsistence. Income and other macroeconomic variables are used as inputs in neural network models to explain these indices. These are specified and trained on the available data. Finally the neural models are presented with data on income increase and retaining the other determinants as constant, they are used to calculate the response of subsistence. This response should be expected to have a negative relation to income and its magnitude to decrease with income increase. On the other hand however, it is very difficult to find appropriate proxies for foreign market access, particularly when the original data has a monthly basis. Owing to this the effect of foreign market access has not been accounted for. The latter means that, as expected, there would be a response of subsistence indices to income increase only in the case of products for which foreign market access is insignificant. Kostov (2001) provides a classification of the product structure of Bulgarian subsistence agriculture, arguing that it has a dualistic structure comprising products which are primarily aimed at self-sufficiency and products which are market oriented. Without entering into details we can exactly identify, through the latter group, the products that are traditionally exported and therefore subjected to the influence of foreign market access. For these market-oriented products (e.g. vegetables) the decline in exports over the period used for estimation means that ignoring the importance of external markets implicitly introduces a downward trend in neural models which appears to dominate the positive effects of the assumed income augmentation. Therefore the mixed results for these two groups of product confirm both the functional form selected for the transformation function and the effect of external markets. This is clearly demonstrated by accounting for external markets either through inclusion of such a trend variable or through construction of approximate export indices. The latter is, however, only useful for demonstration purposes.

The above suggests that a useful model of subsistence agriculture will have to endogenise foreign trade. This can be done by constructing artificial variables which represent the additional demand for exports. These can be used to simulate the development of foreign market opportunities. The quantities needed to satisfy this "export demand" have to be provided by additional transformation of subsistence into commercial production.

6. Conclusions

The emergence of subsistence farming during transition is not by chance. It is the transition from centrally planned to market economy that has created subsistence agriculture. Economic transition brought about major institutional changes in Eastern European economies and societies. The process of dramatic restructuring led to a breakdown in underlying institutions. When applied to agriculture, institutional instability and radical uncertainty drive it towards subsistence. This is a general process that impacts both large and small-scale farms. The final result of this dynamic process is the current subsistence agriculture. Since the reasons for existence and emergence of subsistence farming are by and large institutional, it cannot be regarded as a temporary problem. Institutional development is a long and difficult process.

It is useful to divide, for the purposes of analysis, agriculture into subsistence and commercial subsectors. These are in a continuous process of dynamic interaction. The main factors that influence subsistence in its interaction with commercial agriculture are income situation, external markets for agricultural and food products and capital accumulation. A major implication of the adopted institutional viewpoint is that identifying the factors that had influenced it is not sufficient. Institutional restructuring represents a change in the rules of economic behaviour. Consequently, the likely process of agricultural commercialisation cannot be a mirror image of the one we have identified as a source and raison d'être for subsistence agriculture. This will be a process of asymmetric adjustments, process we hope can be properly represented by the transformation mechanism in a modelling exercise.

Incomes, markets and capital accumulation are the keys to reversing the process of decommercialisation and achieving a more predictable agricultural situation. These are implementable in quantitative agricultural models. The results of such models should however be cautiously interpreted. All the above factors are complex and it is difficult to express them in a single number. Economic policies should focus not only on the quantitative side of the above factors, but also on their structural characteristics. Increasing the general income level for example will undoubtedly contribute to reducing subsistence type of behaviour, but income and employment opportunities in rural areas would be much more effective way to tackle the problem. We would like to stress that policies that impact on the above factors, induce structural changes. Income level, market opportunities and the constraints on capital accumulations are all determinants of the economic environment and behaviour. Their change is in fact a change in the "rules of the game", that is a deep institutional change. This is the essence of institutional change, not copying of laws and organisational structures.

Subsistence agriculture is a problem that deserves our attention. Economic policies implicitly include the conclusions and recommendation of standard economic models. Since the conditions under which conventional economic model may provide reliable representation for the total agriculture are too restrictive, subsistence agriculture requires a specific model. Otherwise, economic policies, based on the

results of such a model, will be ill-designed and destined to fail. The requirement for specific model of subsistence agriculture is a must for countries with considerable share of subsistence and major policy significance of agriculture in the economy, such as Bulgaria. For countries like Slovenia, the policy emphasis is away from subsistence and due to its smaller policy relevance and lower probability to considerably modify the effects from agricultural policies, the ‘demand’ for specific models of subsistence agriculture is virtually non-existent.

In pursuing a satisfactory solution to the problem of creating a reliable quantitative model of a dualistic agricultural economy, we have presented the main principles of a novel approach, namely the block-diagonal representation. That provides the means for effective modelling of a dualistic agriculture.

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