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STRUCTURAL TRANSFORMATION AND ECONOMIC GROWTH

Statement of problem. The one–sector growth model has become the workhorse of modern macroeconomics that is used for measuring aggregate economic activity and for addressing a wide range of important positive and normative issues. The popularity of the one–sector growth model is at least partly due to the fact that it captures in a minimalist fashion the essence of modern economic growth, which Kuznets (1973) in his Nobel prize lecture described as the sustained increase in productivity and living standards. By virtue of being a minimalist structure, the one–sector growth model necessarily abstracts from several features of the process of economic growth. One of the most important ones is structural transformation, that is, the reallocation of economic activity across agriculture, manufacturing and services.

Kuznets listed structural transformation as one of the six main features of modern economic growth. Structural transformation has also received a lot of attention in the policy debate of developed countries where various observers have claimed that the sectoral reallocation of economic activity is inefficient, and calls for government intervention. Understanding whether structural transformation arises as an efficient equilibrium outcome requires enriching the one– sector growth model to incorporate multiple sectors [1]. More generally, this raises the question whether incorporating multiple sectors will sharpen or expand the insights that can be obtained from the one–sector growth model. Several researchers have recently begun to tackle these questions, and the objective of this chapter is to synthesize and evaluate their efforts.

Description of main material. The term „structural transformation" has been used regularly in the economic literature over several decades. However, different meanings have been given to this concept. It will be used in this work to refer to a process in which the relative importance of different sectors and activities within a national economy changes, in terms of both composition and factor utilization, with a relative decline of low-productivity agriculture and low value added extractive activities and a relative rise of manufacturing and high-productivity services. This process also involves upgrading within sectors as production becomes more skill-, technology- and capital-intensive. Moreover, the sectoral shifts also tend to increase the predominance of sectors and activities with a higher growth potential, both in terms of income elasticity of demand, the presence of increasing returns to scale and the potential of technological progress.

Structural transformation occurs through factor accumulation, factor reallocation and innovation, which refers to the introduction of products and processes which are new to a national economy. In dynamic economies undergoing structural transformation, there is a continual process of creative destruction, as some activities wither away whilst others mushroom. In general, structural transformation is also associated with changes in the form of integration into the global economy, in terms of both export and import composition, and also the increasing urbanization of the population [2].

A first step in the broad line of research on structural transformation is to develop extensions of the one-sector growth model that are consistent with the „stylized facts" of structural transformation. Accordingly, we begin this chapter by presenting the stylized facts of structural transformation and then we develop a multi–sector extension of the growth model that serves as a natural benchmark model to address the issue of structural transformation. Given the prominent role attributed to theories of balanced growth in the literature using the one-sector growth model, we start by asking whether it is possible to simultaneously deliver structural transformation and balanced growth. Recent work has identified several versions of the growth model that achieve this, and we present the results of this work in the context of our benchmark multi-sector model.

It turns out that the conditions under which one can simultaneously generate balanced growth and structural transformation are rather strict, and that under these conditions the multi-sector model is not able to account for the broad set of empirical regularities that characterize structural transformation. We therefore argue that the literature on structural transformation has possibly placed too much attention on requiring exact balanced growth, and that it would be better served by settling for approximate balanced growth instead. Put somewhat differently, we think that progress in building better models of structural transformation will come from focusing on the forces behind structural transformation without insisting on exact balanced growth.

As mentioned before, structural transformation is defined as the reallocation of economic activity across three broad sectors (agriculture, manufacturing, and services) that accompanies the process of modern economic growth. Carnai (2005) and Restuccia et al. (2006) argue that the proximate cause of much of the large differences in living standards across countries is attributable to two simple facts [3]:

– developing countries are much less productive in agriculture relative to developed countries;

– developing countries devote much more of their labor to agriculture than do developed countries.

These two facts suggest that in order to understand why developing countries are so poor it is of first-order

importance to understand the forces that shape the allocation of resources between agriculture and the other sectors. A version of the growth model extended to incorporate structural transformation is the natural framework to be used in this context.

Work by Gollin, Parente, and Rogerson (2002, 2007) illustrates how low agricultural productivity can be the source of large cross-country differences in aggregate productivity. For ease of exposition we focus on the simpler presentation in the 2002 paper, which uses a two-sector version of our benchmark model, with the two sectors being agriculture and non-agriculture. They assume that the population is constant and normalize it to one. Preferences are such that there is a subsistence level c_a of agricultural consumption at which individuals are also satiated. The non–agricultural production function is essentially a Cobb-Douglas production function in capital and labor. In contrast, there are two agricultural production functions: a traditional and a modern one. Both agricultural production functions are linear in labor, though the analysis would be unaffected by assuming a fixed quantity of land and decreasing returns to scale in labor. The traditional production is assumed to be the same across countries and to be sufficiently productive to exactly meet subsistence agricultural needs when all labor is allocated to it. The modern production function has a country-specific total factor productivity parameter and it is the only production function that is subject to technological progress. In this model, only the agricultural technology with the larger productivity will be used in equilibrium. Initially this is the traditional technology. Since the modern technology is subject to technological progress, at some point the modern technology will replace the traditional technology as the only technology that will be used. The somewhat extreme structure of the model then yields a very simple solution method for determining the equilibrium. Total food production must be. As long as the traditional technology is used, this means that all labor will be in agriculture. When the modern technology starts to dominate the traditional technology, labor will start to flow from agriculture to non-agriculture. With the time series for labor allocations determined, the remainder of the model becomes a standard growth model with an exogenously given process for labor. The growth rate of labor in the non-agricultural sector is completely determined by the exogenous growth rate of labor productivity in the modern agricultural sector. Since all countries have the same output of agriculture, cross-country differences in aggregate output are entirely driven by differences in non-agricultural output.

Several implications follow. First, countries that use the modern technology in agriculture but have low productivity in it will have to devote more labor to agriculture. This leads to less labor, and capital, in non-agriculture, and hence to less aggregate output. Given the observed differences in the amount of labor that is devoted to agriculture, show that this mechanism can account for a large part of the cross-country differences in aggregate output. This is interesting because in their model the only difference across countries is the level of productivity of agriculture.

Second, assuming that productivity growth rates are constant over time, the model necessarily implies that transition dynamics will be long-lived, thereby addressing a point emphasized by King and Rrebelo (1993) that in a standard one-sector growth model transition to the steady state capital level is rapid. This point does not carry over to the two-sector model because labor allocated to the non-agricultural sector only slowly converges to its asymptotic level. Third, the model implies that (in a closed economy setting) advances in agricultural productivity are a precondition for growth. This view was a central argument of Schultz (1953), and figured prominently in later contributions by Johnston and Mellor (1961), Johnston and Kilby (1975), Timmer (1988), and Yang and Zhu (2009), among others. More recently, it has taken a central state in the writing of non-economists such as Diamond (1997).

Laitner (2000) considers a similar framework as Gollin et al. (2002) but focuses on a different issue. He notes that in the time series data there is evidence of an increase in savings rates early in the industrialization process. Whereas some have argued that the increase in savings rate is the driving force behind the industrialization process, Laitner shows that, in a model of structural transformation, this apparent increase in savings rate is simply an artifact of how NIPA measures saving. Early in the development process most labor is employed in agriculture, and so most savings take the form of realized capital gains in the value of land, which is not recorded as savings by the NIPA. As labor moves out of agriculture and agriculture becomes a smaller part of aggregate output, this issue becomes less important quantitatively [4]. Laitner argues that viewed from the perspective of his model of structural transformation, one should not attach any significance to the apparent increase in savings rates that occur in the early stages of development.

Our model of structural transformation allows for the possibility that different sectors have different levels as well as growth rates of labor productivity. Herrendorf and Valentinyi (2011) provide evidence from the 1996 Benchmark Study of the Penn World Tables on sectoral TFP differences across countries. They find that there are large sectoral TFP differences relative to the United States not only in agriculture, but also in manufacturing, and that the sectoral TFP differences in these two sectors are much larger than in the service sector. Aggregate labor productivity may then be affected by the sectoral composition of the economy. In particular, to the extent that different countries are at different stages of the process of structural transformation, sectoral reallocation associated with structural transformation could generate significant changes in aggregate productivity growth. In principle, episodes of acceleration or slowdown in aggregate productivity growth may occur even if in each country sectoral productivities are growing at constant rates [5].

In a recent paper, Duarte and Restuccia (2010) have investigated the importance of these effects in a sample of 29 countries for the period of 1956 – 2004. They employed a somewhat simplified version of our benchmark model in which labor is the only factor of production (and production functions are linear in labor).

They assumed that each sector's labor productivity grows at a constant rate, but that level and growth rates differ across economies as dictated by the data.

The preference structure of Duarte and Restuccia (2010) assumes a period utility function which is a two-period version of (1):

$$C_t = w\log(c_{at} - \overline{c_a}) + w_n \log(c_{nt})$$

– stands for non-agricultural consumption and it is a CES aggregator of manufactured goods and services. Preference parameters are calibrated so as to match the behavior of the economy and are assumed to be the same across countries. The initial productivity levels of all countries relative to the US are inferred from the model by requiring that the model match the observed employment shares in the initial period. Inputting the sectoral productivity growth rates from the data, Duarte and Restuccia (2010) then simulate the model and compute the implied series for aggregate labor productivity.

Even though their model assumes constant productivity growth rates at the sectoral level of each country, it generates large movements in relative aggregate productivity across countries over time. Key to this finding is that differences in the levels and growth rates of labor productivity between rich and poor countries are larger in agriculture and services than in manufacturing. This implies that during the process of structural transformation, the reallocation of labor from agriculture to manufacturing leads to a catch up of aggregate productivity relative to the USA, and the reallocation from manufacturing to services leads to a falling behind of aggregate productivity relative to the USA.

In related research, Bah and Brada (2009) study the countries from Central Europe which have recently entered the European Union. The point of departure of their analysis is the stylized fact that central planning during communist times resulted in „over-agrarianism" and „over-industrialization", and the neglect of service sector in these countries. Bah and Brada document that even today employment in the service sector is considerably smaller in Central Europe than in the core countries of the European Union. Moreover, they find that in all of these countries the service sector has lower TFP than the manufacturing sector. This implies that structural transformation into the service sector will lead to losses in GDP per capita, unless reforms are implemented that make the service sectors more productive.

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Мельник О. С. Структурні трансформації і економічне зростання

У статті розглянуто існуючу теоретичну основу структурної трансформації економіки як основу для досягнення нової якості економічного зростання. Процес структурних перетворень розглянуто в якості одного з основних факторів економічного розвитку країни. Економічне зростання може бути визначене, як зростаючий потенціал на основі розвитку технологій та інституціональних та ідеологічних змін, яких потребує економіка країни.

Ключові слова: структурна трансформація, розвинені країни, висока продуктивність послуг, інновації у промисловості.

Мельник Е. С. Структурные трансформации и экономический рост

В данной статье рассматривается существующая теоретическая основа структурной трансформации экономики как основа достижения нового качества экономического роста. Процесс структурных преобразований рассматривается в качестве одного из основных факторов экономического развития страны. Экономический рост может быть определен, как растущий потенциал на основе развития технологий и институциональных и идеологических изменений, которых требует экономика страны.

Ключевые слова: структурная трансформация, развитые страны, высокая производительность услуг, инновации в промышленности.

Melnyk O. S. Structural Transformation and Economic Growth

In this article, under review there are the theoretical basis of structural transformation of economy as basis of achievement of new quality of economic growth. In article process of structural transformations as one of the main facts of economic development of the country is considered. A country's economic growth may be defined as a long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands.

Key words: structural transformation, developed countries, high-productivity services, industrial innovation.

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