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ABSTRACT

One of the most debated questions in economy is the disparity of wealth between countries. Take the poorest country for example; it is income per capita is about 15 times less than that of the world's richest country. Reasons have been argued and some point to a delayed start of industrialization, which's innately a slow process, as to why the poor countries are in their current state.

Keywords: Angecha, Economic efficiency, Frontier, Households', Wheat production

INTRODUCTION

In this paper we present a structural transformation model providing a theory as to why industrialization is a slow and tedious process and why different countries begin it at different rates. Agricultural growth being a central key in this model, a concept that has been around in traditional literature.

LITERATURE REVIEW

We have built on the works of as well as to make our model. We have made an explicit section for agriculture, in the one-sector neoclassical growth model. Within the model, there is a concurrent transformation of structure with development, as the role of agriculture declines. Eventually the model becomes identical to the standard one-sector neoclassical growth model as the share of agriculture's employment reduces to zero.

Each period contains a unit of time endowed upon an infinitely lived representative family. the period utility can be for an agricultural good or a non-agricultural good. The utility function is assumed to stone-geary variety in order to create a structural transformation [1]. There should be an assumption from a technical point of view, that there is a consumption of small endowment of non-agricultural good which prevents lowering of instantaneous utility when there is a slight increase in c, however it is ignored for simplicity and the following extreme functional form is adopted.

$$(1) \quad U(c_t, a_t) = \begin{cases} \log(c_t) + \bar{a} & \text{if } a_t \geq \bar{a} \\ a_t & \text{if } a_t < \bar{a}. \end{cases}$$

The following gives lifetime ability:

$$(2) \qquad \sum_{t=0}^{\infty} \beta^t U(c_t, a_t).$$

The concept is that, once ā in the (per capita) output is reached in agricultural sector, the rest of labor will leave agriculture sector, regardless of the condition of non-agricultural sector. On a broader view, the labor available for agriculture is influenced by the condition of non-agricultural sector. However our focus here is to demonstrate that the condition of agriculture greatly impacts labor available for non-agricultural sector, this effect is studied.

The non-agricultural sector uses capital (Kmt) and labor (Nmt) to produce its output (Ymt):

$$(3) \quad Y_{mt} = A_m[K_{mt}^{\theta}((1+\gamma_m)^t N_{mt})^{1-\theta} + \alpha N_{mt}].$$

In above equation Total-Factor-Productivity (TFP) is Am, the constant rate of exogenous technological change is Ym. With the exception of of α Nmt term, this is a standard production function. The term allows the accumulation of capital for an economy with no physical capital. in the work to follow, α will be made a small number.

The parameter Am is affected by institutions and specific policies that influence non-agriculture sector and is country-specific. However, α and Ym are assumed identical worldwide. Useful knowledge is often discovered in rich countries due to research and development, and poor countries are often not encouraging new ideas, and from such a perspective an exogenous technological change is a reasonable assumption.

The main difference is that exogenous technological change can influence modern technology. Utilizing traditional technology, an ā unit of agricultural good can be produced in one unit of time. This value is not intrinsically special, and slightly higher or lower values would alter our results by much. Non the less endogenous fertility models, theorize that economizes who have yet to start industrialization will have output per capita close to subsistence levels, making values close to ā reasonable [2].

The agricultural TFP is influenced by institutions within a country and its policy, similar to non-agricultural TFP parameter. Other factors like land quantity and quality per person and climate also influence it. There may be climate specific technological innovations that may not work elsewhere, contributing to the large policy-independent disparity of productivity levels across different countries. The resource constraint on agriculture is only at ≤ Yat since the output from the agriculture sector is only used for consumption.

The main focus here is too see how the resulting dynamic allocations are affected by different values of TFP parameters Aa and Am, to grasp the economies competitive equilibrium. Two simple steps are needed for solving the competitive equilibrium. Allocating labors to the sectors in each period is the first step. Setting suggests until Aa(2 + Ya)t ≥ ā all labor will allocated to agriculture. Upon fulfilling this, there will be a shift to modern technology from traditional technology in agriculture with a resultant out flow of labor from agriculture at a rate.

The second step involves finding the optimal allocation of labor across the time path. This similar to applying an exogenous time profile of labor input to the neoclassical growth model to solve the transitional dynamics, the labor input is represented by Nmt. eventually Nmt will approach 1 and Nat approaches 0 as the technology is increased in agriculture by a rate of Ya. thus, this model becomes similar to the standard model of one-sector neoclassical growth.

Numerical experiments

The united Kingdom's development in the last 11 years is broadly captured in the provided benchmark specification. The time period's length is one year. We normalize the values of Am and Aa to 1 while avoiding the loss of generality. The output growth rate (per capita) is assigned Ym asymptotically for this economy. The report by Angus Maddison (1995) states the per capita output growth rate in the past 100 years for United Kingdom has been around 10.3 % per year, thus we assign Ym a value of 0.013. The parameter for capital share is set to 0.50, similar to Parente and Prescott. We have set α to 0.0001 and δ to 0.065. The parameters for ā and Ya are set to 35 percent and 5 percent respectively to make the model matches the agricultural employment shares of U.K. in 1800 and 1950. To make the asymptotic annual interest rate 5 percent, we chose β. At this calibration, 1720 represents the first year where resources were moved out of agriculture in United Kingdom (Figures 1 and 2).

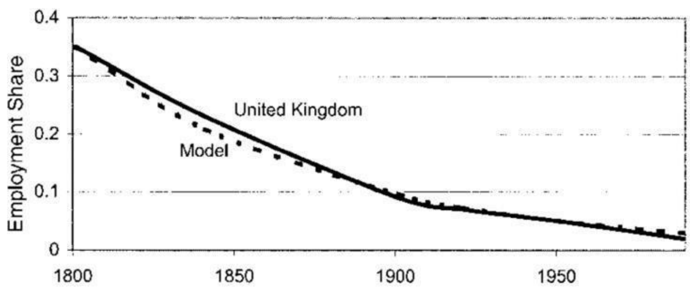

Figure 1: Share of employment in agriculture.

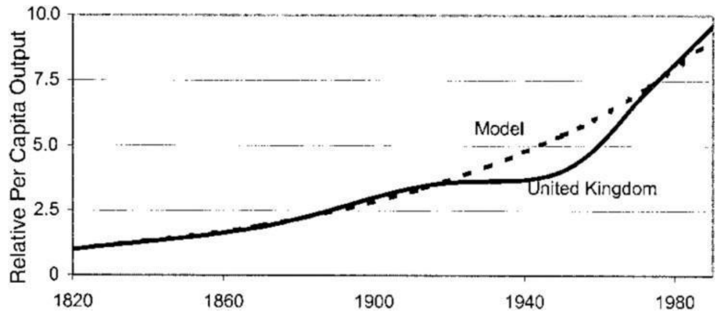

Figure 2: Comparison of per capita output (relative to 1820).

The model provides a result that is quite close to growth and development experience of U.K. in the last 250 years, despite its simplicity. Data taken from regarding employment share and output per capita of U.K. in 1820 level is compared to the resultant time series provided by the model.

The differences between cross-country productivity and its implications is studied to further understand the evolution economic structure and income differences across countries. As stated, these productivity difference will be used in a simple form to study the cross-country differences, encompassing within it other dimensions like regulations, taxation, collective bargaining institutions and others, property right enforcement and climate and soil conditions [3]. It is important to remember that Aa and Am in the benchmark economy were normalized (Figure 3).

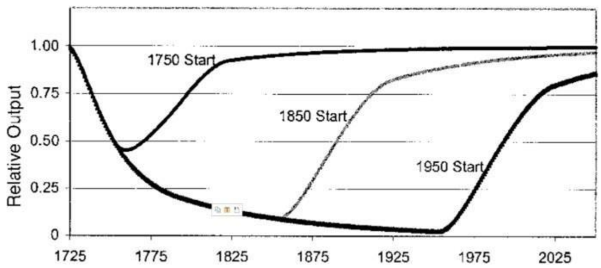

Figure 3: Relative input in different industrialization dates.

Keeping Am 1 for all economies, in Figure 3 we demonstrate different output paths for different economies that have started industrialization in years 1750, 1850 and 1950. Within the benchmark economy, year-2000 prices are used to calculate the relative income for economy. The Aa of a country that has begun industrialization in 1859 is 0.19 and a per capita income that is 9.4 percent of the leader. The employment share of agriculture in this country drops to 15 percent from 100 percent by year 2000. However, a country starting industrialization in 1950 has an Aa of 0.05 and a per capita income that is 2.5 percent of the leader. Agriculture’s employment share only decreases to 50 percent by 2000. Similar values can be seen in poor countries across the world that has started industrialization in second half of 20th century. Hence, through this model, we solidify the idea that poor countries are countries with low agricultural productivity.

Figure 3 can lead to a number of implications. First, the income differences across countries in 2000 should not be taken as a steady state, it would be misleading. Second, Parente and Prescott (1994) came to the conclusion that countries whom were able the achieve a specific level of income (e.g. 2000$), were able to double this level faster than countries whom achieved the specific level sooner in history. Meaning countries who start development late, will demonstrate a speedier development in comparison to early developers.

Third, the process of development is quite a slow one. In the model we have presented, labor transition from agriculture to non-agriculture sectors is a slow process. This considerable affects the rate of transition to steady state. It takes a country nearly 100 years to arrive at its steady-state relative output level. Thus, the model of one-sector neoclassical growth has much faster transition with its small capital stock in comparison. Fourth, a number of models suggest that agents can substitute for a lonely distorted sector. However, our model contradicts this, as it shows a distortion to any sector of agriculture will lead to more resource consumption, since the output of agriculture is mandatory for development and there is no substitution for its products in the economy.

All the results mentioned before come with the assumption that Am is 1, i.e. income different asymptotically disappear. Yet as mentioned earlier, the value of Am in different countries can be influenced by many factors [4]. Even if details are not included, the results will still be correct if industrializing countries keep having lower values of Am. taking a country with an Am value of 0.5 for example that has started industrialization in 1950, it will have an asymptotic relative income of 0.25, by 2000 the relative income would have decreased to 0.15, and its steady state value will not be reached till close to 2050.

Evidence

In order to provide the empirical support for our concept, that developed agriculture allows for labor and resources to be allocated to other sectors, and subsequently improve development, we will compare the predictions of our model with the state of different countries. It is clear the level of agriculture and its grow rates varies greatly between countries. United Nation's Food and Agriculture Organization (FAO) defined 62 countries in the period of 1960-1990 as developing countries recording all relevant data, which we studied. We found that there is a negative relation between agricultural productivity and its share of employment across the countries. Similar relation is in place when comparing the productivity of agriculture to non-agriculture sectors. Another finding was a positive relation between release of labor from agriculture and growth in the sectors productivity. A growth of food output per capita will give similar positive relation when regarded instead of agricultural productivity. These two findings support our model's mechanics.

From this, it is clear there will be great improvement in economy when labor is allocated to non-agriculture sectors due to sufficient production in agriculture. This is further substantiated by what is evident from the data that workers in non-agricultural sector in most poor countries have higher output than workers in agriculture sector, thus average productivity is increased. Take Malaysia or Korea in

1960 as an example, a worker moving into non-agriculture sector from agriculture would have tripled the worker's output, in Thailand the output would have increased 9 times.

We also note to properly understand GDP growth per worker in developing countries, a proper look at growth of agricultural productivity is quantitively necessary. To reach this finding, within the period 1960-1990, we dissected the growth of GDP per worker into three parts: growth within agriculture, which is growth in worker's output within agriculture plotted against the employment share of agriculture in the initial period. Growth within non-agriculture in a similar way, and lastly growth due to sectoral shifts, as the residual. The contribution of these three parts on average to GDP growth per worker was 54 percent, 17 percent and 29 percent, respectively [5]. From this analysis, we can conclude the growths of agricultural productivity with subsequent cross-sector movement of employment are crucial players in the growth of these countries' economy.

Conclusion

We have demonstrated that industrialization cannot be significantly delayed by low productivity of agriculture sector with our abstract model. The per capita incomes of countries with late industrialization, improper policies or poor agricultural technologies are considerably lower than leader countries. Therefore, industrialization can be hastened by developing the agriculture sector with subsequent improvement in the relative income of the country. No question that in the long run, improvement in non-agriculture sector is needed to raise a country's relative position to the leader, however in the short run, improvements in agriculture has a much a greater impact than similar improvement in non-agriculture. The main message from our analysis is that a proper understanding of the development process of poor countries mandates a deeper look at determinants of agricultural productivity.

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