9. Distribution of agricultural surplus and industrial takeoff*

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9.1. INTRODUCTION

This chapter analyses how the distribution of agricultural product between landlords and peasants affects both industrial takeoff and aggregate income through the demand side. Our contribution follows that part of the literature on structural change which investigates the link between inequality, industrialization and income and that focuses on the effects of income distribution on demand (see for instance Murphy et al., 1989; Baland and Ray, 1991; Eswaran and Kotwal, 1993; Matsuyama, 2002; Fiaschi and Signorino, 2003).[1] We follow the traditional modelling approach of this literature assuming a dual economy (see Rosenstein-Rodan, 1943; Lewis, 1954, 1967; Fleming, 1955). However, our model is built on that proposed by Murphy et al. (1989) in which industrialization is triggered by the domestic demand for manufactures.

The key assumptions in Murphy et al. (1989) are that i) individuals have hierarchical preferences, ii) industrial production shows increasing returns because of a fixed set up cost, and iii) a fraction of the labour force receives, besides wages, a share of profits and rents. Given i), ii) and iii), the distribution of shares affects the composition of demand which, in turn, affects the profitability of mass production. The conclusion is that industrialization requires a 'middle class as the source of the buying power for domestic manufactures' (Murphy et al., 1989, p. 538).

As in Bilancini and D'Alessandro (2005), we maintain the first two key assumptions of Murphy et al. (1989) while substituting the third with a functional division of property rights among social classes: land is owned by non-working landowners and each firm is owned by a single entrepreneur-capitalist. Hence, in our model there is no room for a middle class in the sense used by Murphy et al. (1989). In addition, we assume that the labour market for agricultural workers is non-competitive: peasants receive, as a whole, an exogenously given fraction of the agricultural product. This is our key assumption. We make it for two reasons. First, we find that a competitive job market for agricultural workers is a rather unrealistic hypothesis for non-industrial economies or economies in their early stage of industrialization (Lewis, 1954, 1967). Second, in order to apply comparative statics to the study of how distribution of agricultural product affects industrialization and aggregate income, we need an exogenous parameter that fully determines the distribution of agricultural product but does not directly affect industrialization and aggregate income.[2]

We find that the general result of Murphy et al. (1989) that a wide middle class is required for industrial takeoff is no longer true under our assumptions: industrialization can take place without a large group of land- and firm-owners, provided that peasants' share of agricultural product is large enough. The intuition of the result is the following. A large peasants' share induces high wages for both agricultural and manufacturing workers – the latter because workers of the manufacturing sector can always 'retreat' to the agricultural sector. This induces high prices of manufactures (because of a high labour cost) and reduces landlords' demand for manufactures (because of a smaller rent) but it also results in many workers demanding the same bundle of manufactures (because of hierarchical preferences). Thus, although a smaller variety of manufactured goods are demanded, for some of them the fixed start-up costs can be covered and industrialization is brought about.

Furthermore we find that, *ceteris paribus*, a larger peasants' share of agricultural product is always beneficial to aggregate income under industrialization while it can be either beneficial or detrimental when industrialization is absent. Under industrialization a greater buying power of workers translates into a greater demand for basic manufactures, fostering both industrialization and profits (greater profits induce a greater demand for basic manufactures and this further increases the benefits of mass production). Instead, when industrialization is absent a greater buying power of workers translates into a greater demand for agricultural products. In such a case, since agricultural production increases and manufacture production decreases, the effect on aggregate income depends on labour productivity in agriculture with respect to labour productivity in manufacture. In both cases we also have a relative-price effect due to the fact that a larger peasants' share makes manufactures more expensive in terms of food.

From these results it is straightforward to obtain a relationship between income inequality, aggregate income and industrialization. When income inequality is very high – which happens when peasants' share of agricultural product is very low – there is no industrialization and aggregate income is low. As income inequality decreases – which happens when peasants' share is greater – industrialization becomes more likely while aggregate income increases or decreases depending on the relative marginal productivity of labour in the two sectors and on the magnitude of the relative-price effect. Finally, when income inequality is low enough to trigger industrialization both the extent of industrialization and aggregate income show a negative relationship with income inequality.

The chapter is organized as follows. Section 9.2 presents the model; Section 9.3 provides the main results; Section 9.4 comments on the relationship between income and inequality; Section 9.5 contains a few concluding remarks.

9.2. THE MODEL

9.2.1. Commodities and Consumption Patterns

The economy we describe is constituted by two sectors: agriculture and manufacture. Agriculture produces a single homogeneous divisible good, named *food*, which is used as numeraire. In the other sector, there is instead a continuum of manufactured goods represented by the open interval $[0,\infty)\in\Re$. Each good is denoted by its distance q from the origin.

Individuals are assumed to follow the same consumption pattern. There is a subsistence level of food consumption $\bar{\omega}$ and a minimum amount of food z which is preferred to the consumption of any manufacture, where obviously $z>\bar{\omega}$. Beyond z any unit of income is spent to buy the manufactured goods following the order in which they are indexed.

Such a consumption pattern is intended as a simple way of introducing a common ranking of necessities: people first need to buy food up to the level z, then basic manufactures and durables which allow better life standards and, only after that, they buy luxuries. For simplicity, we assume that only one unit is bought of any manufactured good. In other terms, any individual with income $\omega\geq z$ uses his/her first z of income to purchase food and $(\omega-z)$ to purchase the manufactured goods. Any individual with $\omega<z$ consumes only food.[3]

It is worth pointing out the intuitive consequences of our assumptions. First, individuals are almost identical in terms of their consumption decisions and they only differ in income. Thus, landowners and their servants would consume the same if given the same income. Second, any increase in income above z results in an increase in consumption variety: richer people buy the same bundle as poorer people plus some other commodities.

9.2.2. The Agricultural Sector

Food is produced using land and labour. We abstract from land and assume it is always fully utilized in production. For the sake of simplicity, we also assume all workers have the same skills – that is labour is homogeneous.

Technology and incomes

Given the amount of land, labour has decreasing marginal productivity. Production is given by the function $F(L_F)$, with $F'>0$, $F''<0$, where L_F is the number of peasant workers.

The agricultural product is shared between peasants and landlords. The parameter λ represents the peasants' share. Therefore agricultural wages and rents are given by

$$w_F = \frac{\lambda F(L_F)}{L_F} \tag{9.1}$$

and

$$R = (1-\lambda)F(L_F), \tag{9.2}$$

where w_F is the income of peasants and R the total amount of rents.

The parameter λ is exogenous to the model. It may be thought of as reflecting institutional peculiarities due to the historical evolution of the country. It may also be interpreted as representing power relationships between landlords and peasants.[4]

Land ownership

Unlike Murphy et al. (1989), we assume that property rights of the land stock are equally distributed among M landowners. Therefore, the income of each landowner is equal to $r \equiv R/M$ and, hence, is negatively related to their number.[5] Although a non-uniform distribution of land property rights is the norm, our simplification works well as long as the average concentration is the relevant feature. In this sense, M should be interpreted as a rough index of land property concentration. Finally, we assume that landlords are always richer than peasants, $r \geq w_F$, which means that $\lambda \leq \lambda_{\max} \equiv L_F/(L_F+M)$.

9.2.3. The Manufacturing Sector

We consider a continuum of markets where each is infinitely small with respect to the entire economy. The number of workers employed in the manufacturing sector as a whole is denoted by L_M while the ruling wage is w_M.

Technology and markets
Each commodity q is produced with the same cost structure. Two technologies are available. The first, labelled *traditional technology* or TT, requires α units of labour in order to produce one unit of output. This represents the case in which commodities are produced by artisans who, at the same time, organize production and work like other wage-paid labourers. For this reason, the number of workers in TT markets also includes artisans. The second, labelled *industrial technology* or IT, requires k units of labour to start up plus β units of labour per unit of output produced, with $0<\beta<\alpha$. This represents the case where a former artisan becomes an entrepreneur exploiting the benefits of mass production.

Furthermore, we assume $(k+1)>(\alpha-\beta)$ which means that the amount $(\alpha-\beta)$ of labour saved by producing one unit of output using IT is less than the fixed amount k needed to introduce the IT plus the unit of labour provided by the artisan. Clearly, this is the only interesting case because if $(k+1)\leq(\alpha-\beta)$ then IT never requires more units of labour with respect to TT and, hence, it is always preferred by artisans. Lastly, we denote by E the number of entrepreneurs.

Notice that TT shows constant returns to scale while IT shows increasing returns. The difference between these two technologies represents the economic advantage of industrialization.

Competition and income
A group of competing artisans is assumed to operate in each market q of the economy. Given a wage w_M, any amount of commodities can be produced and sold at the unit price αw_M. Artisans compete among each other so that no profits are earned using TT. Besides, in each market there exists one and only one artisan who knows IT. If she decides to be an entrepreneur she can become a monopolist by slightly undercutting the price αw_M. To simplify the analysis we assume that in such a case nobody buys goods produced with TT such that the profits of the monopolist of market q are equal to

$$\pi(q)=[(\alpha-\beta)D_q-k]w_M \tag{9.3}$$

where D_q is the demand faced by market q.

9.2.4. Population and Labour Market

The distribution of agricultural product and agricultural employment determines w_F. We assume perfect mobility of labour among sectors and markets such that $w_F=w_M=w$. The active population is denoted by L and each worker either supplies inelastically one unit of labour or becomes an entrepreneur. The total supply of labour is hence equal to $L-E$. Finally, the population is assumed to be fixed and equal to $N = L + M$ where $L = L_F + L_M + E$.

9.3. ANALYSIS

9.3.1. Industrialization

In the context of this model industrialization means the adoption of IT in place of TT. We assume that IT is adopted whenever it is not disadvantageous. This assumption grants the existence of a unique equilibrium.[6] Therefore, the artisan producing the q-th commodity who knows IT adopts the new technology and becomes an entrepreneur if and only if profits $\pi(q)$ are no lower than the best alternative, that is the ruling wage w. The Equation (9.3) yields that IT is adopted to produce the q-th commodity if and only if $D_q \geq \rho \equiv (k+1)/(\alpha - \beta)$.

Suppose that the agricultural sector is in equilibrium. Denote with Ω_m the total expenditure in manufactures and with ω the income of a generic individual. Since every consumer who has already bought z units of food spends their remaining income to get a unit of each manufacture in the specified order, the demand D_q faced by a generic market q is determined by the number of individuals who earn enough income to buy at least commodity q, namely those whose income satisfies $(\omega - z)/\alpha w > q$.

To keep the analysis interesting we assume that the number of landowners is not sufficient to generate a level of demand for basic manufactures which triggers industrialization, namely we assume that $M < \rho$. As a consequence, the threshold ρ cannot be reached without workers' demand for manufactures. This implies that $w \geq z$ is a necessary condition for industrialization.[7] Since workers' demand is essential for the industrial takeoff, then industrialization is viable only if agricultural technology is productive enough to obtain $r > w > z$. We further impose that $F(L_F) > zN$ to have the previous condition satisfied.[8]

Whenever $w > z$ workers demand manufactures and industrialization may take place. If $(M+L) > \rho$ then some markets industrialize and entrepreneurs make positive profits. The extra earnings obtained by entrepreneurs start a multiplicative process of demand for manufactures. New demand generates new profits and new profits generate new demand. Such a feedback process can take place several times but it converges in the limit because in each round the amount of new profits diminishes as only a fraction of the new demand becomes new profits – the remaining part going to cover production costs.

In the next two sections we apply comparative statics to study the effects of changes in λ. We first investigate what happens for $w<z$ and then for $w\geq z$. These two cases differ not only in the presence or absence of mass production, but also in the effects, in equilibrium, of an increase in λ. Since the agricultural sector is in equilibrium when $F(L_F)=\min\{w, z\}L+zM$ – where the LHS and the RHS are, respectively, food supply and demand – then, for $z\geq w$, the demand for food is independent of w and, hence, food production is constant. Instead, for $z<w$, food production depends on w and, hence, the relative size of the two sectors depends on w. We call the former case industrial equilibrium and the latter traditional equilibrium.

9.3.2. Traditional Equilibrium

For $w<z$ a larger w implies a greater food production and consequently a shift of workers from manufacturing to the agricultural sector. Let L_F^* be the equilibrium number of peasants working in the agricultural sector. We define the implicit function of level of L_F^* which is induced by a given share λ as

$$\phi(L_F^*, \lambda)\equiv F(L_F^*)-wL-zM=0 \tag{9.4}$$

By applying the implicit differentiation theorem we obtain

$$\frac{\mathrm{d}L_F^*}{\mathrm{d}\lambda}=\frac{FL_F^*L}{F'L_F^{*\,2}+\lambda L(F-F'L_F^*)} \tag{9.5}$$

where we set $F\equiv F(L_F^*)$ to simplify notation. Since the production function of food is concave we obtain $(F-F'L_F^*)>0$ and hence $\mathrm{d}L_F^*/\mathrm{d}\lambda>0$. From (9.1) and (9.5) the effect of a greater share λ on the equilibrium wage w^* becomes

$$\frac{\mathrm{d}w^*}{\mathrm{d}\lambda}=\frac{F}{L_F^*}-\lambda\frac{F-F'L_F^*}{L_F^{*\,2}}\frac{\mathrm{d}L_F^*}{\mathrm{d}\lambda}=\frac{F}{L_F^*}\left[1-\frac{\lambda L(F-F'L_F^*)}{F'L_F^{*\,2}+\lambda L(F-F'L_F^*)}\right] \tag{9.6}$$

Inspection of the terms in the RHS of (9.6) clearly shows that $dw^*/d\lambda>0$. This means that a greater peasants' share of agricultural product implies a greater equilibrium wage even though agricultural productivity declines due to the greater number of agricultural workers. Let us define $\lambda_{\min}$ as the level of λ for which $w^*=\overline{\omega}$ and λ_z the level of λ for which $w^*=z$.[9]

More people working in the agricultural sector means, in equilibrium, less people working in manufacturing. Of course, this may affect both the distribution of income and its aggregate value. In a traditional (non-industrial) equilibrium the aggregate income of the economy is equal to

$$Y^* = R^* + w^* L = F + w^* L_M^* . \tag{9.7}$$

where stars denote equilibrium values. Differentiating (income) with respect to λ and given that $L_M^* = L - L_F^*$ we get

$$\frac{\mathrm{d}Y^*}{\mathrm{d}\lambda} = F'^* \frac{\mathrm{d}L_F^*}{\mathrm{d}\lambda} + L_M^* \frac{\mathrm{d}w^*}{\mathrm{d}\lambda}. \tag{9.8}$$

The sign of (9.8) depends on the two terms. The first, $(F'^*)\mathrm{d}L_F^*/\mathrm{d}\lambda$, represents the gain/loss of the shift of workers from manufacturing to agriculture. The factor in parenthesis is the difference between agricultural and manufacturing productivity valued in terms of food while the derivative represents the marginal change in the number of agricultural workers. The second term, $L_M^*(\mathrm{d}w^*/\mathrm{d}\lambda)$, captures the marginal change in value of manufacture production due to the rise in the price of manufactures – since w^* is greater, relative prices change in favour of manufactures.

In conclusion, the result of a greater peasants' share of agricultural product depends on both the productivity and the relative size of the two sectors. From Equations (9.5), (9.6) and (9.8) we get the following condition

$$\frac{\mathrm{d}Y^*}{\mathrm{d}\lambda} \gtrless 0 \Leftrightarrow \lambda \gtrless \tilde{\lambda} \equiv \frac{F'L_F^*}{LF}(2L - L_F^*) \Leftrightarrow w^* \gtrless F' + \frac{L_M^*}{L}F' \tag{9.9}$$

Since w^* increases in λ and both F' and L_M^* decrease in λ, then there exists at most only one peasants' share of agricultural product for which $\mathrm{d}Y^*/\mathrm{d}\lambda = 0$. We denote such a share with $\tilde{\lambda}$. Therefore, from (9.9) we see that, for $\bar{\omega} \le w < z$, there are three possible kinds of relationships between λ and Y^*. First, if agricultural productivity is so low that $\bar{\omega} \ge F' + L_M F'/L$, then $\mathrm{d}Y^*/\mathrm{d}\lambda$ is negative. Second, if agricultural productivity is so high that $z \le F' + L_M F'/L$, then $\mathrm{d}Y^*/\mathrm{d}\lambda$ is positive. Finally, if agricultural productivity is neither so high as in the first case nor so low as in the second one, then there exists a certain level of peasants' share of agricultural product $\tilde{\lambda}$ such that for $\lambda_{\min} \le \lambda < \tilde{\lambda}$ we have $\mathrm{d}Y^*/\mathrm{d}\lambda > 0$ while for $\tilde{\lambda} < \lambda < \lambda_z$ we obtain $\mathrm{d}Y^*/\mathrm{d}\lambda < 0$. In the latter case the relationship between λ and Y^* is inverted u-shaped in the interval $[\lambda_{\min}, \lambda_z]$.

9.3.3. Industrial Equilibrium

For $\lambda_z \le \lambda < \lambda_{\max}$ the demand for food – and, hence, food production – is independent of the value of λ. This gives rise to a linear and positive relationship between λ and w^* because the negative effect on w^* due to the reduction of agricultural productivity – which exists for $\lambda_{\min} \le \lambda < \lambda_z$ – is now absent.

Furthermore, for $\lambda_z \leq \lambda < \lambda_{max}$ we may have industrialization. In particular, both aggregate income and the extent of industrialization turn out to depend positively on the share λ. Since workers spend $(w^* - z)$ in manufactures. they consume commodities in $[0, Q_L]$, where Q_L is $(w^* - z)/\alpha w^*$. Since $r^* > w^*$ then also $Q_R > Q_L$, where Q_R is $(r^* - z)/\alpha w^*$ (recall that, by assumption, landowners are always richer than workers and hence they consume a greater variety of commodities). Therefore, markets in $[0, Q_L]$ face a demand equal to $(L+M)$. If the domestic market for manufactures is large enough, namely if $(L+M) \geq \rho$, then the Q_L artisans in $[0, Q_L]$ who know IT choose to become entrepreneurs and adopt mass production technology. In addition, if such entrepreneurs earn more than w^* then they spend the surplus to w^* to buy commodities produced in markets beyond Q_L. In such a case some markets beyond Q_L face their demand plus that of landowners (see Figure 9.1).

In general, IT may be adopted also in markets beyond Q_L. This happens if and only if the sum of the demand of entrepreneurs and landowners is at least ρ. Here we assume that this is never the case – that is that $(E+M) < \rho$ – because we want to focus on the role played by the distribution of agricultural product and not on that played by the concentration of land property rights.[10] Under our assumptions, $(E+M) < \rho$ can be written as $M < \rho - [F^* - z(L_F^* + M)]/(\alpha F)$ which highlights the crucial role of both land ownership concentration and productivity. In particular, this shows that assuming $(E+M) < \rho$ amounts to assuming that, for the given production technology, the number of landowners is too small to sustain industrialization without the demand of workers.[11]

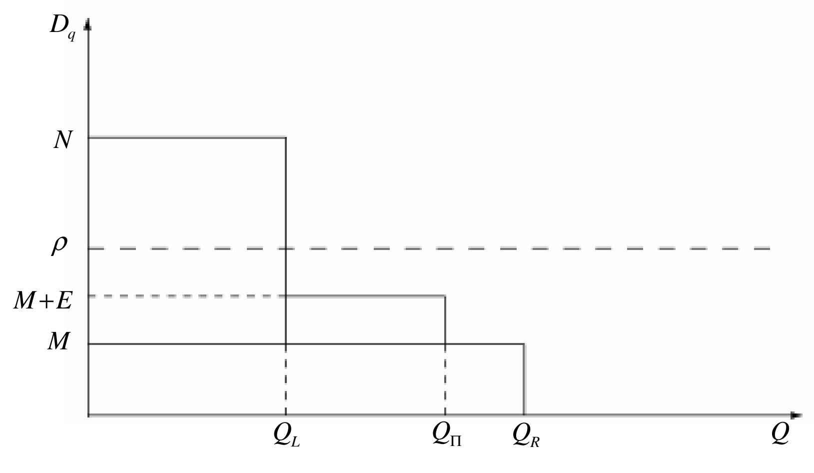

Figure 9.1. Manufacturing sector, w ≥ z.

Under the stated assumptions, all entrepreneurs earn the same amount of income which is equal to

$$\pi = w^{*}\left[(\alpha-\beta)N-k\right] = \lambda\frac{F}{L_F^{*}}\left[(\alpha-\beta)N-k\right] \tag{9.10}$$

From (9.10) we see that individual profits are linearly increasing in λ.[12] Hence, aggregate profits increase in λ for two reasons: because there are more entrepreneurs earning profits and because each entrepreneur earns more profits. Indeed, when we turn to the formula for aggregate profits, the positive relationship between the latter and the peasants' share of agricultural product is evident

$$\Pi \equiv \pi Q_L = \frac{(\alpha-\beta)(N-\rho)}{\alpha}\left(\lambda\frac{F}{L_F^{*}} - z\right) \tag{9.11}$$

Taking into account (9.11) we obtain that the equilibrium level of aggregate income is equal to

$$Y^{*} = F(L_F^{*}) + w^{*}L_M^{*} + \Pi =$$

$$= F(L_F^{*}) + \lambda\frac{F}{L_F^{*}}\left[L_M^{*} + \frac{(\alpha-\beta)(N-\rho)}{\alpha}\right] - z\frac{(\alpha-\beta)(N-\rho)}{\alpha} \tag{9.12}$$

From (9.11) we see that the relationship between λ and Y^{*} is linear and positive. Moreover, from the terms inside the square brackets, we can identify two ways through which λ positively affects Y^{*}. The first is a relative-price effect and depends on the size of the manufacturing sector which is captured by the factor L_M^{*}. A larger peasants' share of agricultural product increases wages and hence increases the relative price of manufactures in terms of food. The second is a real effect and depends on the extent of industrialization – the number of goods produced with IT – which is captured by the factor $(\alpha-\beta)(N-\rho)/\alpha$. Higher wages increase the variety of manufactured goods demanded by both agricultural and manufacturing workers, making mass production profitable in more markets; this, in turn, allows greater exploitation of increasing-return technology.

Finally, note that. since aggregate income depends positively on λ, the maximum level of Y^{*} is attained, in the limit, when λ approaches $\lambda_{\max}$, that is, when w approaches r.

9.4. INCOME AND INEQUALITY

Since workers and peasants are the poorest income group in society, the relationship that exists between the peasants' share of agricultural product and aggregate income induces a qualitatively similar relationship between the degree of income equality and aggregate income. Figure 9.2 shows that the equilibrium income Y^* changes as a function of the share λ in the case where $\lambda_{\min} < \tilde{\lambda} < \lambda_z$. The case where $\bar{\omega} \geq F' + L_M F'/L$ and where $z \leq F' + L_M F'/L$ differ in that, in the region $[\lambda_{\min}, \lambda_z]$, Y^* is, respectively, decreasing and increasing.

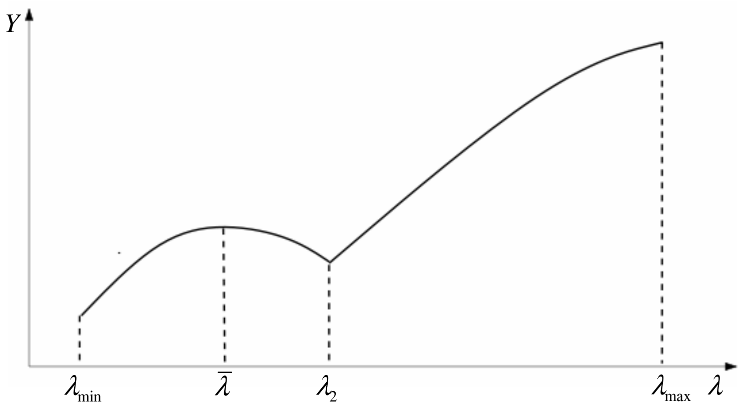

Figure 9.2. Income and distribution of agricultural product

Therefore, another prediction of this model is that, *ceteris paribus*, more equality is beneficial to aggregate income under industrialization while it may or may not be such when industrialization is absent. Note that the interpretation that a greater λ produces a greater income equality is justified. It is obviously correct in a traditional equilibrium because there are only two income groups – peasants and landowners – and a greater λ means a redistribution in favour of the poorest one. We also find it correct in an industrial equilibrium because the largest income group is, realistically, by far that of peasants and workers. Hence, although a greater λ increases the income of entrepreneurs possibly beyond that of landowners, the fact the number of peasants and workers is much larger than that of entrepreneurs and landowners makes it very unlikely that a larger λ increases inequality.

9.5. CONCLUDING REMARKS

In this chapter we studied how the distribution of agricultural product between peasants and landlords affects aggregate income and industrialization. Our focus was on the demand side and, in particular, on the role played by income distribution in shaping the domestic demand for manufactures. To do this we developed a modified version of the model in Murphy et al. (1989). There are two main differences between the latter and our model. The first is that we assume a functional distribution of both property rights and income. The second, which is actually our key assumption, is that the agricultural sector is non-competitive (Lewis, 1954 and 1967).

We showed that, under our assumptions, contrary to what was found by Murphy et al. (1989), industrialization can be sustained without the emergence of a middle class. If the peasants' share of agricultural product is large enough then the income of both peasants and workers is sufficient to produce a domestic demand for manufactures which sustains the industrial takeoff. Moreover, under industrialization we obtain that the larger the peasants' share the better for both industrialization and income. The reason for this result is the following. Since industrialization has both increasing returns to scale and a fixed start-up cost, mass production is made more profitable by redistributing income in favour of the largest social group because it concentrates demand for manufactures in a smaller number of markets. Realistically, peasants and workers constitute the largest group in society and, hence, redistributing income from landlords to peasants and workers increases the exploitation of increasing returns, fostering both industrialization and income.

In the absence of industrialization, however, the effect of a larger peasants' share is ambiguous. Indeed, in such a case there are no increasing returns to exploit since only landlords consume manufactures which are produced with a constant-return technology. Since the income of peasants and workers is low, redistributing the agricultural product in favour of peasants results only in a greater demand for food and a lower demand for manufactures. Hence, the agricultural sector expands while the manufacturing sector shrinks, the actual effect on aggregate income depending on the productivity of agricultural labour with respect to that of manufacturing labour.

Our results may also be interpreted in terms of inequality and income. In the absence of industrialization, income inequality may be, depending on technology, either beneficial or detrimental to aggregate income. However, if peasants and workers earn enough to buy manufactured goods, then inequality becomes unambiguously detrimental to aggregate income because it reduces the exploitation of benefits of mass production.

A few final remarks on the nature of these results are worth making. In our analysis there is no dynamics and all findings come from a comparative statics exercise. Therefore, this study does not offer any reliable prediction about the impact of *changes* in the distribution of agricultural product. Indeed, our comparative statics is better interpreted as related to a cross-country analysis than one pertaining to a single country over time. Nevertheless, we think that our findings tell us something important. If a country is in an early stage of industrialization then we expect that, *ceteris paribus*, countries where peasants get a larger share of agricultural product – and, hence, in which wages are higher – can sustain a larger industrial sector.

NOTES

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1. Zweimüller (2001) and Mani (2001) sought to consider explicitly the growth process by investigating how hierarchical demand influences technological progress.
2. For example, assuming a competitive job market for agricultural workers and using agricultural productivity for comparative statics would not work well because the distributional effect would be partly obscured by the productivity gain/loss.
3. This is a behavioural particularization of the hypothesis of hierarchical preferences. It can be rationalized, for instance, by means of the following utility function

$$U = \begin{cases} c & \text{if } c \leq \overline{\varpi} \\ \overline{\varpi} + \int_0^{q_0} \min\{1, \; x(q)\}\mathrm{d}q & \text{if } c > \overline{\varpi} \end{cases}$$

   where q_0 is the lower bound of the set of non-consumed commodities, that is for every $q \in [0, \; q_0)$ commodity q is consumed.
4. The present formalization is not necessarily inconsistent with a competitive agricultural market. If the production function has constant elasticity – that is all the homogeneous functions with degree of homogeneity equal to $k < 1$ – and λ is equal to the elasticity of $F(L_F)$ with respect to L_F, then we have $w_F = F'(L_F)$.
5. Murphy et al. (1989) do not consider the existence of landowners as individuals: in their model, agricultural production – like industrial production – is organized by firms which divide their profits among a certain number of shareholders.
6. See Bilancini and D'Alessandro (2005) for a formal proof of this statement.
7. Notice that, under our hypothesis, a greater income of landowners is of no help at all because it would only result in a greater variety of demand for manufactured goods (leaving unaffected the demand for each kind of previously demanded manufacture). Instead, what can make the difference is the concentration of land ownership – that is the number of landowners. The latter issue is analysed in our companion paper (Bilancini and D'Alessandro, 2005).

8. Of course, if agricultural productivity is so low that there is no distribution of agricultural product that may sustain industrialization then there is not much to be studied.
9. From Equation (9.1), $\lambda_{\min} = (\varpi L_F^*)/F$ and $\lambda_z = (zL_F^*)/F$.
10. The issue of land ownership concentration is investigated in detail in Bilancini and D'Alessandro (2005) where the effects of different levels of M are analysed taking into account their impact on entrepreneurs' demand.
11. Notice that $E = Q_L \geq \rho$ is impossible as

$$\frac{w^* - z}{\alpha w^*} = \frac{1}{\alpha} - \frac{z}{\alpha w^*} < \frac{k+1}{\alpha - \beta} = \rho.$$

Intuitively, the number of manufactured goods demanded by workers cannot be greater than $1/\alpha$ since this would be the case when all workers' income is spent in manufactured goods.
12. Individual profits are the same for all entrepreneurs because, under $M + E < \rho$, demand is the same for every market in $[0, Q_L]$. However, individual profits may be either lower than individual rents (as depicted in Figure 9.1) or greater than them. In particular, individual profits and individual rents are the same when $\lambda = L_F / \{L_F + M[(\alpha+\beta)N - k]\}$.

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