Land and the Transition from a Dual to a Modern Economy

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Abstract

Tenurial contracts in agriculture can be an initial source of wealth accumulation for dynasties of poor, credit-constrained individuals. The income from such contracts can be invested in education of offspring, who then can find work in the formal manufacturing sector. This process allows the economy to develop into a modern economy with a large manufacturing sector. An excessive number of poor individuals competing for scarce land, however, drives up the rental price of land, which then slows the process of accumulation and forces the economy to converge to a less efficient dual equilibrium. In such cases, a policy of land redistribution coupled with a temporary education subsidy may be needed to push the economy to a modern equilibrium.

Keywords: tenurial contracts, land reform, education, imperfect credit markets, migration.

JEL Classification: O14, O15, O16, Q15

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1 Introduction

Less developed countries often possess a dual economy with a large, backward agrarian sector and a small, modern manufacturing sector.\(^1\) During the process of development, economies feature a high level of growth in the industrial sector and an increase in the efficiency of the agrarian sector. This paper presents a theoretical model of land-driven wealth accumulation by credit-constrained dynasties that may assist in identifying the necessary conditions for transition or persistence of dualism.

Unlike most earlier work on dualism, our model emphasizes the role of the agricultural sector in driving economic transformation. Researchers have traditionally downplayed the role of the agrarian sector in the development process, perhaps because of the decline this sector experiences in the transition process.\(^2\) Our model suggests that despite this decline the agrarian sector can provide the engine for economic modernization.

We start with two observations. First, the seminal paper of Lewis (1954) on economic dualism emphasizes that the agrarian sector provides labor for the manufacturing sector as the economy transforms. Second, we note the general sentiment that jobs in the urban formal sector require education. Individuals barred by their lack of formal education must thus seek employment in the informal sector.\(^3\) We then incorporate this notion in a dual-economy model, where wealth accumulation by tenants in the agrarian sector plays a fundamental role in determining the level of human capital investment of individuals migrating to the urban sector.

We analyze a simple model with three sectors: an agrarian formal sector, a manufacturing formal sector, and a low-yielding informal sector. As manufacturing jobs require an initial human capital investment, poor individuals are excluded from this sector due to credit-market imperfections.\(^4\) Even so, some of the poor can still obtain income in the agrarian sector, since they can rent land through a tenurial contract, which, as in the case of sharecropping, does not unnecessarily

\(^1\) “A dual economy consists of two sectors: a small industrialized sector and an agricultural sector. The industrial sector [...] operates more or less like any modern industrial economy[...] Surrounding this sector is the much larger agricultural sector, where the modes of production are primitive and a vast majority of the population is very poor.” Basu (1997).

\(^2\) For a thorough discussion, see Binswanger et al. (1995).

\(^3\) Cole and Sanders (1985). See also Todaro and Smith (2003), eighth edition (p. 391) for a general discussion.

\(^4\) This assumption is possibly strong, but it simplifies the analysis. We could more realistically assume that uneducated individuals have only some probability \(p\) of producing in the manufacturing sector without qualitatively changing our final results, as long as \(p\) is sufficiently small.
require ex-ante payment.\textsuperscript{5} This income can then be invested in the training of offspring to give them the opportunity to migrate to the formal manufacturing sector. Poor individuals who fail to find employment in the agrarian sector can only find jobs in the informal sector.

The volume of human capital supply that can be supported by the agrarian sector crucially depends on the land rental price. If rents are high, tenants accumulate wealth slowly. This, in turn, diminishes migration of skilled individuals to the manufacturing sector. Hence, if rents are high enough, the economy will stagnate at a less efficient “dual” equilibrium. Low rents, in contrast, may serve to drive the economy to a “modern” equilibrium. The rental price is higher the greater the number of unskilled landless workers demanding land, given that the only alternative option for unskilled workers is the informal sector, and that landlords have more bargaining power. Thus, an initial large number of unskilled, landless laborers results in a self-sustaining, long-run dual equilibrium characterized by little migration of skilled workers and high levels of unemployment and poverty.

Although wealth accumulated through land tenancy drives the development process in our model, economic policy has only limited power to affect the terms of tenurial contracts, which are determined by conditions in the land rental market and landlords’ bargaining power. To move the economy from a dual to a modern equilibrium, policy intervention must be geared to reducing the bargaining strength of landlords. Under such a policy, the number of poor unskilled laborers should shrink, leading to a decrease in the demand for land and consequently to a reduction of rents.

We show that land redistribution may decrease the number of poor individuals sufficiently to trigger the transition to a modern equilibrium. However, in an economy with scarce land resources, redistribution may not be sufficient to affect the power relationship of landlords and tenants as the number of poor will remain high even after the reform. In this case, a one-shot policy of mass education must complement land reform to give poor people the option of working in the manufacturing sector. This policy also decreases land prices and puts in motion forces that push the economy toward a self-sustaining modern equilibrium.

The model also reveals that agrarian reform should not be evaluated only for its impact on agrarian sector productivity but also on the general equilibrium effect of fostering wealth accumulation by the poor. Thus, where land resources are scarce, the promotion of education may complement land reform. Without an additional emphasis on education, agrarian reform by

\textsuperscript{5}This occurs endogenously in our model since individuals can renege on their debts by running away before production takes place. This is possible for human capital, a mobile asset, but not for land.
itself may be insufficient to both increase agrarian productivity and propel a transition between equilibria.

These results seem to lend support to the widespread notion that land reform was the core factor in creating the economic successes of Japan, Korea, and Taiwan. On the other hand, it is well known that East Asian countries – Japan above all – complemented the shift from the land with policies of mass education. Fei, Ranis, and Kuo (1979), for example, report that the Taiwanese government, in addition to implementing an impressive policy of agrarian reform, made vigorous efforts to foster off-farm production so that workers from the agrarian sector would be absorbed by the formal manufacturing sector.

Our model adds an agrarian sector to an economy with credit constraints and non-convexity in production as analyzed by Banerjee and Newman (1993) and Galor and Zeira (1993). Without a sufficiently productive agrarian sector, the manufacturing sector disappears, trapping the entire economy in a poverty-trap equilibrium arising from credit market imperfections. Therefore, we show how the agrarian sector – and land tenurial contracts in particular – might overcome the initial investment barrier.

The features of this dual equilibrium are consistent with the dual-economy model pioneered by Lewis (1954). In accordance with Lewis’s analysis, development is defined as the path of an economy moving from a dual to a modern equilibrium. However, while the agrarian sector only supplies a general labor force to manufacturing in Lewis’s model, we give the agrarian sector an active role in determining the supply of skilled labor. Moene (1994), building on Lewis’ model, analyzes an economy where the effect of land redistribution on the manufacturing sector takes place through intersectorial migration. In Moene’s analysis, however, the only form of wealth considered is land, so the probability of the migrating individuals getting a job in the modern sector is exogenous. In line with models à la Lewis, Moene emphasizes the negative externalities of migration, such as urban unemployment and poverty. Our model finds that the migration of individuals with an initial skill endowment can have a positive effect on both sectors.

The paper is organized as follows: We present the model in section 2. In section 3, the initial

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6See Biswanger et al. (1995); Fei, Ranis, and Kuo (1979) chapt. 2; Yasuba and Dhiravegin (1985), Ranis (1990) chapt. 8.

7Ranis (1990, chapt. 8), referring to East Asian economies, notes, “The absence of natural resources (...) is more likely to jolt the system into the realization that it has to rely on its human resources if it is to navigate successfully in the direction of modern growth.”

8For further reading, see Piketty (1997), where wealth constraints for poor individuals are generated by self-sustaining high interest rates, and Gathak and Joung (2000), who provide a simple, elegant model of inequality and occupational choice.
conditions for the two types of long-run equilibrium are determined and followed with an analysis of the effects of land redistribution and education policies. In section 4, we discuss assumptions in the model. The final section provides descriptive evidence consistent with the results.

2 The model

2.1 Technology and preferences

Consider an economy at a given time \( t_0 \) (we omit the time subscript throughout this section) with two sectors, manufacturing and agrarian, each producing a single good. There is an atomless measure of \( L < 1 \) plots of land used for producing in the agrarian sector.

According to the land ownership structure, we distinguish:

1. a mass \( l \leq L \) of owners, indexed by \( i \), each endowed with \( N_i \in \mathbb{N} \) single plots of land such that \( \int_0^L N_i di = L \);

2. a mass \( 1 - l \) of landless agents.

Every individual can work a single plot of land. Therefore, \( L - l \) is the total amount of land always supplied by landlords in the land rental market. A policy of land redistribution increases the number of owners \( l \).

Individuals’ initial endowments may consist of land and a quantity \( b_{-1} \) of the good. Thus, in addition to land ownership, individuals may differ according to their initial endowment of non-land wealth (or simply wealth henceforth). We further distinguish the landless into:

2a. \( \omega \) landless rich individuals with \( b_{-1} = \bar{b} \);

2b. \( 1 - \omega \) landless poor individuals with \( b_{-1} = 0 \).

Production in the manufacturing sector requires an investment of \( h \leq \bar{b} \) in a fixed level of human capital.\(^9\) Accordingly, a landless rich person always has the option of producing in the manufacturing sector, even in the absence of a credit market. Production in the agrarian sector requires no capital, just a plot of land.

\(^9\)We may also think of \( h \) as representing other types of investment such as business start-up costs.
The two sectors are otherwise symmetrical; therefore, using the index \( j = \{A, M\} \) to denote the agrarian and the manufacturing sector respectively, the final gross product is:

\[
q_j = \begin{cases} 
1 & \text{with probability } e, \\
0 & \text{with probability } 1 - e.
\end{cases}
\]  

(1)

Where \( e \) represents the unobservable effort intensity of work and all individuals are endowed with one unit of time/labor.10 Workers cannot split their time unit between the two sectors. The above output realizations are always observable and contractible.

In both sectors, the subjective cost of effort per time unit is represented by a function \( C(e) \), with \( C'(e) > 0 \) and \( C''(e) > 0 \). For simplicity, we assume the following functional form: \( C(e) = e^2/2a \), with \( a \in (0, 1) \).

Each individual can become a farmer in the formal agrarian sector (A-sector), move to the formal manufacturing sector (M-sector), or find a job in the informal sector. In the two formal sectors, the process of production takes two periods. The landless farmer rents a plot of land in the first period and produces in the second period by exerting effort \( e \). Symmetrically, an agent in the M-sector invests \( h \) in the first period and produces in the second. For the sake of simplicity, we normalize to zero the payoff in the low-yielding informal sector and assume no initial investment is needed.

Every individual’s life is divided into two periods. In the first, the individual splits his wealth between (period 1) consumption and investment; in the second, he provides effort, obtains a payoff for his activity, and splits his wealth into (period 2) consumption and a bequest.

We assume that the ex-ante utility function of consumption and bequests is represented by:11

\[
U(c_1, c_2, b) = c_1 + \frac{1}{\rho} \frac{E(c_2^{1-\beta}b^{\beta})}{\eta},
\]  

(2)

where \( \eta = \beta^\beta (1 - \beta)^{1-\beta} \) is a constant of normalization, and \( \rho \) is one plus the intertemporal discount rate. The arguments \( c_1, c_2 \) and \( b \), respectively, are the consumption in the two periods of the single good and the bequest of the individual to his offspring.

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10 We make a simplifying assumption here: because effort is unobservable, it rules out the possibility of organizing production in the agrarian sector by using fixed-wage labor. In the extended version of the model (available on the web as an annex of the paper), we show that allowing for the possibility of using hired labor does not qualitatively affect the results.

11 Preferences here are motivated by “impure altruism,” perhaps the most tractable of bequest motives. The formulation is common in the literature on endogenous wealth distribution (see e.g. Banerjee and Newman, 1993; Aghion and Bolton, 1997).
A landless individual willing to produce in the A-sector has to sign a tenurial contract with an owner and pay a price \( p \), determined in the land rental market. Likewise, an individual with no initial endowment in the M-sector has to borrow an amount \( h \) to invest in human capital.

In the following subsection, we describe the tenurial contract and the financing contract. In equilibrium, contractual terms depend on the initial wealth distribution \( \{l, \omega, L\}_{t_0} \) and generate different paths of accumulation and migration. It will be seen that long-run equilibria are fully determined by the initial conditions \( \{l, \omega, L\}_{t_0} \).

### 2.2 Contracts

Given the production function (1), both the tenurial contract in the A-sector and the financing contract in the M-sector can be described without loss of generality by the pair \((s_j, r_j)\) with \( j \in \{A, M\} \), where \( s_j \) and \( r_j \) represent respectively the contingent and the non-contingent components of the total payment. When positive, they indicate the payment from the tenant (borrower) to the owner (lender). Again, effort is not observable and every individual at the beginning of period 2 faces the same problem:

\[
\max_e (1 - s_j)e - \frac{e^2}{2a}.
\]

Thus, the optimal level of effort is \( e(s_j) = a(1 - s_j) \).

Therefore, the contingent component \( s_j \) is always distortionary and agents will always prefer a contract with \( s_j = 0 \) for any given price \( p \), human capital \( h \), and interest rate. However, the non-contingent component, \( r_j \), which is independent of the final outcome, depends only on the individual’s initial wealth and is subject to the following constraint:

\[
r_j \leq b_{-1,i} + N_ip, \tag{4}
\]

where \( b_{-1,i} = 0 \) if the individual \( i \) is poor, and \( N_i = 0 \) if the individual \( i \) is landless.\(^{12}\) A landless individual with zero wealth and no land must accept a distortionary contract. In this case, the higher the value of \( p \), the less efficient the contract. Therefore, the initial distribution of wealth determines the structure of contracts and the efficiency of production (directly, because \( s_j > 0 \), and indirectly, through the market equilibrium price, \( p \)). Given this general framework, we can now separately analyze the financing contract and the tenurial contract.

\(^{12}\)If the individual is a poor landlord willing to produce in the M-sector, he can borrow \( r \) by entitling the lender to appropriate output from the A-sector. Although this is an ex-post payment, it is not contingent on the agent’s effort.
Financing contracts in the M-sector

For simplicity, we suppose a perfectly competitive and infinitely elastic credit supply. Accordingly, all loans must yield the same expected return, which in turn must equal the individual intertemporal discount factor $\rho$.\(^{13}\) However, after investing in human capital, individuals have an opportunity to renege on their loan by “running away” before production in the M-sector takes place. We further suppose that they can produce in a new location with zero probability of being caught and pursued.

As a result, no contract with $s_M > 0$ is enforceable as individuals cannot commit to paying back their loan contingent on their outcome in the M-sector. Therefore, $r_M = h$ for all individuals in the M-sector, who then employ a first-best level of effort, $e = a$, obtaining a level of gross surplus $V^M = a/2\rho$.\(^{14}\)

Landlords have sole access to the financing market in the M-sector as only they can enter into a contract entitling the lender to appropriate the entire revenue from the A-sector. This contract is enforceable because land can be used as a collateral and seized if the borrower defaults. The possibility of default ex ante is the key difference between the A-sector and the M-sector. This is clearly ruled out in the A-sector by the non-mobile nature of land.

Finally, if $p$ is the first-period value of land, a landlord with bequest $b_{-1} = 0$ can obtain a loan only if:

\[ N_i p \geq h. \tag{5} \]

Otherwise, even a landlord has incentive to default, since the value of his land used as a collateral is strictly lower than the amount of the loan to be repaid.

Tenurial contracts

If a landless individual decides to produce in the A-sector, he faces the constraint $r_A \leq b_{-1}$ (we hereafter omit the subscript $j$ as $r$ and $s$ always refer to the A-sector). Given that $p$ is the first-period land rental,

\[ \frac{e(s)s}{\rho} + r = p. \tag{6} \]

As land in this model only serves as an input in agricultural production, its selling price must equal its rental price. Therefore, the selling contract may be thought of as a special form of the

\(^{13}\)We can imagine, for example, that rich landlords also act as competitive capital suppliers, or that we are in a small open economy and individuals can borrow from the rest of the world.

\(^{14}\)Obtained by substituting $e = a$ in production function (1) and in the effort-cost function $e^2/2a$. 
tenurial contract, where \( s = 0 \) and \( r = p \). As a result, a landless individual can become an owner only with an endowment of \( b_{-1} \geq p \).\(^{15}\)

Recalling that the first-period cost of investing in human capital is \( h \) and the landlords’ opportunity cost of producing in the A-sector is \( p \), landlords will supply all the land and become absentee when \( p > h \). Similarly, the \( \omega \) landless rich opt for the M-sector when \( p \geq h \).\(^{16}\) As a result, only the \( 1 - \omega - l \) individuals lacking another high-yielding outside option are willing to work in the A-sector for \( p \geq h \).

However, an equilibrium with \( p > h \) is possible only if the highest amount the poor can pay, \( \bar{p} \), is at least \( h \). The level of \( \bar{p} \) is determined as:

\[
\bar{p} = \max_{s} \frac{e(s)s}{\rho}.
\]  

(7)

Using the expression \( e(s) = (1 - s)a \), \( s = 1/2 \) and the suboptimal level of effort \( e = a/2 \). Substituting these values in (7), we calculate the maximum rental price for a poor tenant as \( \bar{p} = \frac{a}{4\rho} \). If \( \bar{p} < h \), nobody is willing to pay \( p > h \) and every individual will strictly prefer the A-sector since the M-sector is not sufficiently productive (i.e. \( h \) is too high). To rule out this trivial outcome, we assume that \( h < \bar{p} \), or:

\[
h < \frac{a}{4\rho}.
\]  

(8)

In the following section, the equilibrium land prices, \( p^* \), are derived as a function of the wealth distribution vector \( \{\omega, l, L\} \). Taking into account the mechanism of intergenerational wealth transmission determined by the utility function (2), we determine the long-run equilibrium as a function of the initial conditions \( \{\omega, l, L\}_{t_0} \).

\(^{15}\)We rule out the possibility of buying land using the land itself as collateral. The literature generally agrees that farmers acquire land with their savings rather than loans (see Binswanger et al., 1995, pp. 2705-2712). This is because land needs to be used as a collateral for acquiring physical capital. To endogenize this pattern in the model, one could introduce physical capital into the A-sector.

\(^{16}\)We assume here that the rich landless have a weak preference for the manufacturing sector.
3 Equilibrium analysis

3.1 Static equilibria

The equilibrium land price, \( p^* \), is determined by conditions in the land market. Taking into account the outside options of rich individuals and landlords, we obtain the land supply schedule (solid lines in Figure 1):

\[
L - l \quad \text{if } p < h, \\
\{L; L - l\} \quad \text{if } p = h, \\
L \quad \text{if } p > h.
\]  
(9)

Given that the final outcome is the same for the two sectors, when the price of land is higher than the cost of investing in human capital \( h \), landlords will prefer to offer all land for rent and produce in the manufacturing sector. It is important to note that landlords are never wealth constrained as the value of each plot of land, when they opt for the M-sector, is \( p h \).

The demand for land (dashed lines in Figure 1) would thus be:

\[
1 - l \quad \text{if } p < h, \\
1 - l - \omega \quad \text{if } \bar{p} \geq p \geq h, \\
0 \quad \text{if } p > \bar{p}.
\]  
(10)

The \( \omega \) landless rich will prefer the M-sector when \( p \geq h \). As a result, only the \( 1 - \omega - l \) poor individuals whose only outside option is the informal sector will agree to work in the A-sector when \( p \geq h \). Moreover, as we saw in the previous section, the poor landless cannot pay a price higher than \( \bar{p} \).

From land supply (9), land demand (10) and using Figure 1, we derive the two possible equilibria and state the following:

**Proposition 1** When there is excess demand for land, \( L < 1 - \omega - l \), the economy is in a Dual Equilibrium. When \( L > 1 - \omega - l \), the economy is in a Modern Equilibrium.

We now characterize tenurial contracts in these equilibria and their efficiency. In the dual equilibrium, hereafter \( E^d \) (Figure 1a), the land price is \( \bar{p} \), because landlords hold all bargaining power over the poor landless. This situation arises when there is excess land demand and the individuals demanding land only have the zero outside option of the informal sector. Therefore, landlords only offer a contract with \( r = 0 \) and \( s = 1/2 \), resulting in an inefficiently low level of tenant effort, \( e = a/2 \). While landlords have all the bargaining power, they nevertheless cannot
extract the entire surplus from the tenants because they cannot observe effort $e$ and tenants have limited liability. This short-run imperfection has a positive impact on long-run efficiency as it allows poor dynasties to accumulate wealth and escape the poverty trap. When $s > 0$, the tenurial contract is a rental contract with delayed payment. For simplicity, we call this a “sharecropping contract,” even if sharecropping contracts are in fact only a subset of this class of contracts.\(^{17}\)

In the dual equilibrium, $E^d$, only poor individuals work in the agrarian sector and all landlords are absentee, so the entire sector is organized through tenancies with $r = 0$ and $s = 1/2$, i.e. with sharecropping contracts. Note that in $E^d$ there is no land sale market: rich individuals are willing to pay the entire amount $p \geq a/4\rho$ only if they become farmers (obtaining the total expected surplus $a/2\rho$), but given that $p \geq a/4\rho > h$, they strictly prefer the M-sector. On the other hand, the poor, who would like to buy land, are credit rationed and unable to borrow the amount they need.\(^{18}\)

When the economy is in modern equilibrium $E^m$ (Figure 1b), the rental price is $h$. In this case, some landlords will prefer to work as owner-farmers, since the two sectors offer similar opportunities at this price. Furthermore, whenever $L - l > 1 - \omega - l$, there is always more land than poor individuals, and there will necessarily be some landless rich individuals who choose to produce in the A-sector.\(^{19}\) Since they can pay the entire price, $p$, ex ante, we will have $r = h$, and so they can become owners. In this case, some rich individuals will buy land. Thus, there will be a new mass of owners, $l'$, and a new mass of landless rich, $\omega : l' - l = \omega - \omega'$, such that $L - l' = 1 - \omega' - l'$ or $L = 1 - \omega'$.

We next consider the contract offered to the poor workers in $E^m$. Given that $r = 0$ and substituting the effort function $e(s) = a(1 - s)$ in (6), we solve for $s$ to obtain:

$$s = \frac{a - \sqrt{a(a - 4\rho h)}}{2a},$$

which, given assumption (8), is always well defined.

Finally, substituting expressions (11) in $e(s)$, and defining $d \equiv \sqrt{a(a - 4\rho h)}$, we have:

$$e = \frac{a + d}{2},$$

\(^{17}\)The two-state production function does not allow specific distinction between types of tenurial contract, whose analysis is beyond the scope of this paper.

\(^{18}\)This aspect of a dual equilibrium provides an alternative explanation for the lack of a sale market in traditional economies (see Biswanger et al. (1995, chapt. 42, pp. 2705-2712) for discussion.

\(^{19}\)The land price can never fall below $h$, otherwise everybody would strictly prefer the A-sector, creating excess demand.
where \( d \) is a positive number. Therefore, the effort of the tenant in the modern equilibrium is higher than in the dual equilibrium since tenants have to pay a smaller \( s \).

Equilibrium \( E^m \) dominates equilibrium \( E^d \) in terms of aggregate production. In the A-sector, this is true because in \( E^d \) all \( L \) individuals acting in this sector are sharecroppers with \( e = a/2 \). In contrast, in \( E^m \) only a fraction \( 1 - \omega - l < L \) are tenants, exert a level of effort \( e > a/2 \). All other \( L - (1 - \omega - l) \) farmers are owners, who produce at the first-best level of effort (equal to \( a \)). The M-sector in \( E^m \) is larger than in \( E^d \), where there is a mass \( 1 - \omega - l - L \) individuals in the informal sector.

Notably, while there are only sharecroppers in \( E^d \), in \( E^m \) there is normally a mix of owner-farmers and sharecroppers. In other words, sharecropping is closely associated with the dual equilibrium; its importance decreases as the economy modernizes.

### 3.2 Dynamics and long-run equilibria

In this subsection, we determine the conditions under which the economy can move from a dual to a modern equilibrium. As we now understand how wealth distribution \( \{l, \omega, L\} \) determines a static equilibrium, we analyze how the process of wealth accumulation can change wealth distribution and how the final equilibrium depends on the initial conditions \( \{l, \omega, L\}_{t_0} \). In the next subsection, we will show when agrarian reform and education policies, by changing \( \{l, \omega, L\}_{t_0} \), determine the transition to a modern equilibrium.

Suppose that the economy described above is replicated indefinitely through time, with every agent giving birth to a single individual so that the population is stable. From the utility function (2), we can see that at time \( t - 1 \) every individual leaves \( b_{t-1} \) to his offspring. This represents the initial endowment of generation \( t \). Given \( b_{t-1} \) and knowing the equilibrium rental price, \( p^* \), an individual selects a sector and a level of investment in the first period of his life. In the second period, an individual produces and bequeaths to his offspring a fraction \( 1 - \beta \) of his income.

Therefore, the intergenerational evolution of endowment for a dynasty is determined by the dynamic equation

\[
b_t = (1 - \beta)q_j(b_{t-1}, p^*).
\]

Recalling the production function (1), production \( q_j \) is a stochastic variable and (13) is a Markov process.

As shown earlier, the equilibrium land price, \( p^* \), depends on supply and demand for land and, consequently, on wealth distribution at time \( t \). Therefore, the process of wealth accumulation is not stationary. Thus, it is not possible to use the standard technique of relying on a transition matrix (which here would change with \( t \)) to find the limit distribution of wealth. Instead, we
characterize the dynamics at $t$ by supposing that at $t - 1$ the economy is in one of the two equilibria and then determine whether the dynamics support a steady-state path.

Given that the interest rate is $\rho$, an individual is indifferent as to consuming in period 1 or postponing consumption until the next period. Consequently, the level of bequests is dependent only on the outcome of production. A successful tenant in the dual equilibrium obtains half of the final output, and so the tenant’s minimum bequest is $(1 - \beta)/2$.

We are interested in an economy where the agrarian sector is potentially able to generate a sufficiently high level of wealth accumulation to fuel transition to the modern equilibrium. Accordingly, we suppose that

$$\frac{1 - \beta}{2} \geq h,$$

so that the next generations of successful tenants can always invest in human capital. We discuss below the implications of (14) and the reasons this may not be satisfied.

First, consider a scenario where the economy is in equilibrium $E_d$. Accordingly, at time $t_0$, we have

$$1 - \omega_{t_0} - l > L,$$  \hspace{1cm} (15)

where we have omitted the subscript on $l$ given that there is no land market in this equilibrium.

We next determine whether (15) holds for all $t > t_0$. From the earlier analysis, we know that in the dual equilibrium, $E_d$, all individuals always prefer the M-sector. Therefore, the $l$ landlords (who are never wealth constrained because the value of each plot of land $p \geq h$) and the $\omega$ landless rich (whose bequest is $b_{-1} \geq h$) choose the M-sector. As a result, only the $L$ landless poor produce in the A-sector. Hence, the choice of the landless depends on their initial endowment, which in turn is determined by the previous generation’s bequest. Accordingly, the following difference equation describes the dynamics for the mass of landless rich individuals under equilibrium $E_d$:

$$\omega_t = \frac{a}{2} L + a\omega_{t-1}.  \hspace{1cm} (16)$$

The first term of (16) represents the next generation of successful tenants migrating from the A-sector; the second term of (16) represents the offspring of the successful landless individuals in the M-sector, who received a bequest $(1 - \beta)$ and are not wealth constrained. All unsuccessful landless individuals and the $1 - \omega_{t_0} - L$ individuals in the informal sector obtain zero wealth.

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20Suppose there are transaction costs (arbitrarily small) in the credit market for a landless individual, so that he strictly prefers to consume in his first period of life all the wealth he does not invest.

21Recall that the level of tenant’s effort (and thus his probability of being successful) is $a/2$, while the effort of individuals in the M-sector is $a$.  

13
and leave no bequest at \( t_0 + 1 \). The same reasoning can be repeated for all \( t > t_0 \) as long as \( 1 - \omega_t - \lambda > L \).

Now consider an economy in equilibrium \( E^m \) at \( t_0 \), with \( 1 - l - \omega_{t_0} < L \leq 1 - \omega_{t_0} \). All individuals with zero wealth will be able to find a plot of land at a price \( p^* = h \). We saw earlier that the tenant’s effort is now \( e = \frac{1}{2}(a + d) \). Accordingly, we have the following difference equation for the mass of landless rich individuals:

\[
\omega_t = \frac{1}{2}(a + d)(1 - l - \omega_{t-1}) + a\omega_{t-1}. \tag{17}
\]

Therefore, solving equations (16) and (17) recursively, we derive the poor’s land demand as \( 1 - \omega_t - \lambda \) at any time \( t \). Comparing this with \( L \), we can determine whether (15) is satisfied at \( t \) and in the long run. Accordingly, we state:

**Proposition 2** Given an initial distribution of land and wealth \((L, l, \omega_{t_0})\): (i) The economy always reaches a modern equilibrium for each \( \omega_{t_0} \) when \( L > \frac{2(1 - a)(1 - l)}{2 - a} \); (ii) when the land endowment is lower, \( \frac{2(1 - a)(1 - l)}{2 - a} > L > \frac{2(1 - a)(1 - l)}{2 - a + d} \), the economy can only reach a modern equilibrium when the initial number of poor is sufficiently low, i.e. if \( L > 1 - l - \omega_{t_0} \); and (iii) when \( L < \frac{2(1 - a)(1 - l)}{2 - a + d} \), a dual equilibrium is the only possible outcome.

**Proof.** See Appendix.

This proposition is graphically illustrated in Figure 2, which depicts the various regions of area \((L, l)\) where the two equilibria hold. The black area above line \( bb' \) represents the set of values of \( l \) and \( L \) such that the economy is in \( E^m \) independent of the initial distribution of wealth \( \omega_{t_0} \) (scenario (i) of Proposition 2). The area below \( aa' \) represents the set \((L, l)\) such that the economy will never reach \( E^d \) (scenario (iii)). In the area between \( aa' \) and \( bb' \) both equilibria are possible (scenario (ii)), and the long-run equilibrium depends on \( \omega_{t_0} \). For every \((L, l)\) belonging to this intermediate area, the economy is initially in a dual state (the white area below the dashed line) and remains there in the long run. Similarly, in the gray area above the dashed line the outcome is \( E^m \) in both the short and long run.

Intuitively, tenurial contracts with a high rental price in a dual economy only allow a small number of individuals to migrate to the M-sector. Hence, where land is rather scarce and there is substantial unemployment, migration is in itself insufficient to lower the land price and sustain the

\[22\text{Since } L \leq 1 - \omega_{t_0}, \text{ there is no land market. If } L > 1 - \omega_{t_0} \text{ some rich individuals will become owners so that } L = 1 - \omega_{t_0}.\]
transition to a modern equilibrium. Indeed, when the economy is in the modern equilibrium with a low rental price, the probability of success is higher (since \( d > 0 \)) and the mass of individuals migrating to the M-sector is higher. Land demand remains sufficiently low to restrain the rental price and sustain the modern equilibrium as a steady state.

3.3 Land redistribution and education policies

A policy of land redistribution at time \( t_0 \) increases \( l \), while a policy of education increases \( \omega_{t_0} \). Figure 2 suggests that for quantities of land \( L < a' \) and \( L > b \), both policies are ineffective in generating a change in the equilibrium. The agrarian sector is either too small \( (L < a') \) to generate this change or the quantity of land is sufficiently large \( (L > b) \) to always allow wealth accumulation sufficient to modernize the economy.

More interesting is the analysis of policies in the intermediate case \( a' < L < b \). We start by considering an economy with land \( L_1 \) such that \( b' < L_1 < b \). Figure 3 shows the effect of land redistribution from \( l \) to \( l' \) in this economy. This policy should generate a transition from the dual to the modern economy (an equilibrium above line \( bb' \)) over the long run. However, from Figure 4 we see that in an economy with less land, i.e. with a land endowment \( L_2 < b' \), a policy of land redistribution that increases \( l \) to \( l' \) is insufficient to push the economy to equilibrium \( E^m \). Instead, the economy sticks at a dual equilibrium at new point \( (l', L_2) \). Not only is \( L_2 \) below the dashed line representing \( 1 - l' - \omega_{t_0} \), but beneficiaries of the reform also have incentive to rent out their expensive land. A policy of education that increases \( \omega_{t_0} \) to \( \omega'_{t_0} \), so that \( L_2 > 1 - l' - \omega'_{t_0} \), is thus required to push through the transition to \( E^m \).

4 Discussion: low-accumulation in the agrarian sector

Having considered the scenario where assumption (14) holds, i.e. where tenants can potentially accumulate a sufficient level of wealth to support a transition, we now briefly analyze cases where accumulation in the agrarian sector is insufficient.

Suppose that the production for each plot of land is \( y < 1 \). In the modern equilibrium, the land price is: \( p(y) = \max \left\{ \frac{ay^2}{2\rho} - \left( \frac{a}{2\rho} - h \right), 0 \right\} \) and the level of accumulation is \( (1-\beta) \frac{1}{2} (y + \frac{\sqrt{-4p(y)\rho + ay^2}}{\sqrt{a}}) \).
which is increasing in \( y \) for \( p(y) \geq 0 \).

If \( y \) is so low that \( \left(1 - \beta\right)\frac{1}{2} \left(y + \frac{\sqrt{2a - 4h\rho - ay^2}}{\sqrt{a}}\right) < h \), then the next generation of tenants will be unable to migrate to the M-sector. This implies that a modern long-run equilibrium is not possible because the \( 1 - \alpha \) unsuccessful workers in the M-sector cannot be replaced by new migration from the agrarian sector.

This effect of a low level of \( y \) on the modern equilibrium emphasizes the importance of the agrarian sector as the engine of modernization. A tax \( \tau \) on the agrarian sector such that \( y = 1 - \tau \) can have an analogous effect of impeding skilled migration, and thus can reduce the size of the manufacturing sector. Moreover, a poorly designed agrarian reform will produce the same effect. Say, for example, a measure is introduced to redistribute land among a large number of poor individuals, whereby land is divided into smaller plots each yielding \( y < 1 \). If \( \left(1 - \beta\right)y + \frac{ya}{2p} < h \), the dynasties of the new small owners will never be able to migrate to the M-sector, causing it to eventually collapse. In this last example, the model exhibits behavior similar to that found in the models of Galor and Zeira (1993) and Banerjee and Newman (1993), where credit constraints generate a poverty trap for the entire economy.

5 Some empirical evidence

Japan, Taiwan, and South Korea are countries where agrarian reform has generally been considered successful. We will see that the initial distribution of wealth was in these countries more egalitarian and characterized by less poverty than in economies where the outcome of reform has usually been considered unsatisfactory. We will then present data consistent with the idea that Japan, Taiwan, and Korea went through a transition from a dual to a modern equilibrium, and compare these three countries with the Philippines, where an agrarian reform of comparable magnitude failed to achieve this transition. We will argue the failure in the Philippines may be due to the high level of poverty that generates the excess demand for land, or equivalently, the

\[ \frac{(1 - \beta)}{2} \left(1 - \frac{\sqrt{ay}}{\sqrt{2a - 4h\rho - ay^2}}\right) \geq 0 \]

for \( ay^2 < \frac{a}{2p} - \frac{a}{2p} - h \geq 0 \).

If the economy is initially in a dual equilibrium it will clearly never change its status as low accumulation precludes any migration by the landless.

\[ 23 \text{The derivative of this expression is} \]

\[ \frac{(1 - \beta)}{2} \left(1 - \frac{\sqrt{ay}}{\sqrt{2a - 4h\rho - ay^2}}\right) \geq 0 \]

\[ 24 \text{If the economy is initially in a dual equilibrium it will clearly never change its status as low accumulation precludes any migration by the landless.} \]
excess supply of agrarian labor.\textsuperscript{25}

The idea that more egalitarian land distribution can improve efficiency in the agrarian sector has large support in the economic literature. We note here two pieces of empirical evidence:

(a) In developing countries, in particular, the data show that smaller, family-owned farms generally perform better than large haciendas, which suggests decreasing returns to scale in agriculture.\textsuperscript{26}

(b) The coefficients of land concentration tend to be significant and negatively correlated to growth rates (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Deininger and Squire, 1998). The model can explain why in spite of (a) and (b) a policy of land redistribution may fail to improve agrarian production and foster development. In particular, by highlighting the complementarity between land and wealth redistribution, it predicts that an agrarian reform is more likely to fail in economies characterized by a large number of poor individuals.

This complementarity is consistent with the fact that the Gini coefficients of wealth and land concentration are both significant in their negative relationship with growth rates.\textsuperscript{27} Moreover, in Table 1, note that Japan, Taiwan and Korea – countries usually praised for their successful agrarian reform and their impressive level of growth after WW2 – are economies characterized by a comparatively lower number of individuals in the lowest income quintile than countries that have had less success at agrarian reform.\textsuperscript{28}

\textbf{INSERT TABLE 1 HERE}

In the dual equilibrium, owners always have an incentive to leave the agrarian sector. Hence, when agrarian reform fails to modernize the economy, we would expect those who obtained land because of the reform to abandon the agricultural sector and rent out or sell their land. Deininger, Olineto, and Maertens (2000) study the beneficiaries and non-beneficiaries of agrarian reform in five villages in the Philippines during a three-generation period. They find that the land reform had a large impact in terms of years of schooling for beneficiaries. Hayami and Kichuchi (2000), in a study based on a Filipino village in the 1970s, provide several anecdotal cases suggesting

\textsuperscript{25}As it is possible to see by extending the model to allow for hired labor, cf. note 10.
\textsuperscript{26}See Banerjee (1999) for an overview.
\textsuperscript{27}In Deininger and Squire (1998), who built the most reliable and complete dataset, the coefficients are -0.025 for the income Gini and -0.037 for the land Gini. The two coefficients are significant at the 5% and 10% levels respectively.
\textsuperscript{28}See e.g. de Janvry and Sadoulet (1989), Kay (1982), and Oshima (1985), as well as the descriptive evidence presented below for the Philippines.
that a major effect of land reform in the Philippines has been a higher level of human capital accumulation that has allowed the younger individuals to leave agriculture to find off-farm employment.

Land sales or rental of agrarian reform beneficiaries have been quite widespread in Latin America countries, especially Columbia and Brazil (Binswanger and Deininger, 1999), where agrarian reform has been comparatively unsuccessful. In Mexico, it has been estimated that 70% of the redistributed land in Sonora and between 40% and 80% of redistributed land in Sinaloa has been illegally rented out to large landowners (de Janvry, 1981). Indeed, to avoid the ownership reconcentration, the law often prevents re-sales or sets ceilings on the amount of land that can be owned by a single individual.29

5.1 The dynamic transitions of Japan, Taiwan, and South Korea compared to the stagnation of the Philippines

Table 2 shows the transition of Japan, Taiwan and South Korea from an economy characterized by structural unemployment to one characterized by only frictional unemployment (full employment) and a small share of the labor force in agriculture. As we can see from the table and, as earlier noted by Oshima (1993), Japan achieved full employment in the early 1960s, Taiwan in the late 1960s, and South Korea in the late 1970s. It is useful to compare these three countries to the Philippines, an economy still characterized in 1995 by a large agrarian sector and structural unemployment compatible with a large informal sector.30 This observation is confirmed in the ILO Key Indicators of the Labour Market, where the size of the Philippines’ informal sector is estimated to be around 17.3% of total employment.31

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29 The tendency to become absentee when the demand for land is high has often been observed historically. For example, Barrington Moore (1966, chapt. 6) notes that in nineteenth-century India: “... the authors of the 1880 Famine Report took note of a tendency for many peasants to sublet their land (...). This evidence indicate once more the familiar cluster of features: a rising population, an increasing demand for land and the emergence of a class of petty landlord rentiers out of peasantry.”

30 As Lucas (1996) earlier noted, a comparison between Korea and the Philippines can be particularly illuminating, since in the 1960s their respective economies were comparable in many structural characteristics, e.g. growth rates, demographic density, and the sectorial structure of the economy. However, as Benabou (1996) observes, the Philippines of the 1960s was already characterized by a much more concentrated wealth distribution and a higher level of poverty.

31 There are no data on the informal sector for Korea or Taiwan where, as with most modern industrialized countries, this sector has virtually disappeared.
On the basis of the above analysis, one could conjecture that in those years Japan, Taiwan and South Korea went through a transition to a modern equilibrium. By contrast, the Philippines, twenty-five years after its agrarian reform was launched, continues to be mired in a dual equilibrium (unemployment has actually increased since 1995, due in part to the financial crises that swept the region). Table 2 also reveals that Japan, Taiwan and South Korea witnessed, as the model predicts, a burst in agrarian productivity following the transition to a modern equilibrium.

INSERT HERE TABLE 2

In the model, the transition from a dual to a modern economy is generated by the presence of a relatively low number of poor, such that $L > 1 - \omega - l$. We can argue that Korea (and earlier, Japan and Taiwan), unlike the Philippines, experienced at the same time a decrease in the number of wealth-constrained unskilled individuals and an increase in the supply of land.\(^{32}\) Comparing levels of government expenditure in education in Table 3, we see that in Korea in the early 1970s, before the country reached the modern equilibrium, education expenditures in absolute terms were almost four times higher than in the Philippines today – and almost twice in terms of share of GDP.\(^{33}\) This suggests a greater dedication on the part of the Korean government than the Philippines government to reducing the number of landless unskilled individuals (i.e. $1 - \omega - l$).

INSERT TABLE 3 HERE

On the land supply side, there is evidence that the introduction of multiple cropping in Japan, Taiwan, and Korea led to an increase in the labor/land ratio (Oshima, 1987 and 1992), and thus to an increase in $L$.\(^{34}\) Indeed, their respective levels of labor employment increased during and just after the agrarian reform.\(^{35}\) By contrast, in the Philippines we cannot observe a similar

\(^{32}\)The share of the population below the poverty line in the Philippines was 75% in 1961 and 67% in 1965. A comparable index for South Korea gives a figure of 41% (data from Oshima, 1993).

\(^{33}\)World Bank Development Indicators do not give data for Taiwan. For Japan observations on education spending start in the 1970s, when they are already ten times higher than for Korea.

\(^{34}\)In Japan, Taiwan, and Korea, farmers diversified their crops away from rice to production of higher value fruits, vegetables, and livestock, most of which were more labor intensive than rice production. This diversification in Monsoon Asia is extremely important since most of the new crops are produced in the slack season, drastically reducing seasonal unemployment.

\(^{35}\)In Taiwan, the average days worked per year on the farm rose from 143 days in the pre-1940 period to 189 days after 1956. Similarly, input labor in South Korea rose about 40% between 1950 and 1965.
rise in diversification after the late 1980s,\textsuperscript{36} when the Philippines had one of the fastest growing populations in Southeast Asia. This increased population density placed severe pressure on land resources (Putznel, 1992).

The model predicts a decline of the agrarian rental price during the transition. Unfortunately, there are few reliable time series data on land prices.\textsuperscript{37} Therefore, we rely on real agrarian wages as a proxy.\textsuperscript{38} Thus, high poverty, whether it translates into high demand for land or into high agrarian labor supply, always prevents transition to a modern equilibrium, and can cause the failure of agrarian reform. If this is so, we would expect to observe a surge in real agrarian wages during transition. Looking at Figure 5, this appears to indeed be the case for Korea, while in the Philippines there is no sign of a clear upward trend until comparatively recently.\textsuperscript{39}

\begin{center}
\textsc{INSERT FIGURE 5 HERE}
\end{center}

The ILO database has no data for Taiwan or Japan before 1960. From Figure 5, we observe that in Japan agrarian wages grew steadily throughout the 1960s and stabilized in the 1970s. This is consistent with the notion that Japan’s transition in the early 1960s was associated with a reduction in the agrarian-sector labor supply.

\section{Appendix}

\subsection{Proof of Proposition 2}

Solving (16) recursively, we have

\[ \omega_t = \frac{a L}{2 (1 - a)} + \left( \omega_0 - \frac{a L}{2 (1 - a)} \right) a^t. \]

We substitute this expression in \( 1 - l - \omega_t \), defining this function as

\[ F^d_t(l, L, \omega_0) = 1 - l - \frac{a L}{2 (1 - a)} - \left( \omega_0 - \frac{a L}{2 (1 - a)} \right) a^t, \] \hspace{1cm} (18)

\textsuperscript{36}The ratio of vegetable, fruit and livestock to cereal and root crops declined by ten percentage points in the Philippines between 1970 and 1985. In the same period, it increased by more than forty percentage points in South Korea.

\textsuperscript{37}Further, it would be necessary to disentangle the effect of supply and demand from the effect of technological improvements transition may have triggered.

\textsuperscript{38}In the extension of the model where we allow for hired labor (cf. note 10), we see that a large number of poor and wealth-constrained individuals also results in an excess supply of labor. As a result wages are too low to escape the poverty trap.

\textsuperscript{39}The data used are the agrarian male daily wages from ILO Labor Market Key Indicators.
which represents the mass of the poor individuals (demanding land at time $t$) as a function of the initial conditions $(L, l, \omega_{t_0})$, given that for all periods $(t_0, t_0 + 1, \ldots, t - 1)$ the economy remains in dual equilibrium. Solving (17) recursively, we obtain:

$$\omega_t = \frac{(a + d) (1 - l)}{2 - a + d} + \left(\omega_{t_0} - \frac{(a + d) (1 - l)}{2 - a + d}\right) \left(\frac{a - d}{2}\right)^t,$$

and substituting in $1 - l - \omega_t$ as we did before, we can define the following dynamic function:

$$F^m_t(l, \omega_{t_0}) = 1 - l - \frac{(a + d) (1 - l)}{2 - a + d} - \left(\omega_{t_0} - \frac{(a + d) (1 - l)}{2 - a + d}\right) \left(\frac{a - d}{2}\right)^t,$$  \hspace{1cm} (19)

which determines the mass of the poor individuals (demanding land at time $t$) as a function of the initial conditions $(l, \omega_{t_0})$, given that for all periods $(t_0, t_0 + 1, \ldots, t - 1)$ the economy remains in a modern equilibrium. Accordingly, the economy will be in $E^d$ at time $t$ whenever $F^d_t(l, \omega_{t_0}) < L$.

From (19) we can see that $\lim_{t \to \infty} F^m_t(l, \omega_{t_0}) > L$ whenever $L > \frac{2(1 - a)(1 - l)}{2 - a + d}$ and from

$$\lim_{t \to \infty} F^d_t(L, l, \omega_{t_0}) > L$$

whenever $L > \frac{2(1 - a)(1 - l)}{2 - a}$. We note, however, that if the first condition is true, the second will also be true, given that $d > 0$. Moreover, if the initial condition is such that $L > 1 - l - \omega_{t_0}$ (modern equilibrium), given the strict monotonicity in $t$ of $F^m_t(l, \omega_{t_0})$ and given that $\lim_{t \to \infty} F^m_t(l, \omega_{t_0}) > L$, the equilibrium $E^m$ will hold for all $t > t_0$.

Next, we show that this is true also when $L < 1 - l - \omega_{t_0}$. In this case, we are in the dual equilibrium at time $t_0$, but there must be a time $t_n$ (given that $L > \frac{2(1 - a)(1 - l)}{2 - a}$) where $F^d_{t_n}(L, l, \omega_{t_0}) > L$ and $F^d_{t_n-1}(L, l, \omega_{t_0}) < L$. Therefore, at $t_n$ the economy will become modern and this will hold for all $t > t_n$.

For scenario (iii): Symmetrically, if $\lim_{t \to \infty} F^d_t(L, l, \omega_{t_0}) < L$ then $\lim_{t \to \infty} F^m_t(l, \omega_{t_0}) < L$. Therefore, if the economy starts in a dual equilibrium with $L < 1 - l - \omega_{t_0}$, then this equilibrium will not change over the long run, given that $L < \frac{2(1 - a)(1 - l)}{2 - a}$ and the strict monotonicity of $F^d_t(L, l, \omega_{t_0})$. If, on the contrary, $L > 1 - l - \omega_{t_0}$, given that $\lim_{t \to \infty} F^m_t(l, \omega_{t_0}) < L$, there must be a time $t_n$ where, $F^m_{t_n}(l, \omega_{t_0}) > L$ and $F^m_{t_n-1}(l, \omega_{t_0}) < L$. Therefore, at $t_n$ the economy will become dual and this will hold for all $t > t_n$.

For scenario (ii): In the case $\frac{2(1 - a)(1 - l)}{2 - a} > L > \frac{2(1 - a)(1 - l)}{2 - a + d}$, $\lim_{t \to \infty} F^m_t(l, \omega_{t_0}) > L$ and $\lim_{t \to \infty} F^d_t(L, l, \omega_{t_0}) < L$. Given the strict monotonicity of $F^m_t(l, \omega_{t_0})$ and $F^d_t(L, l, \omega_{t_0})$, the equilibrium will be the same as the one at $t_0$.

**References**


Table 1. Past agrarian reforms, wealth distribution, and growth

<table>
<thead>
<tr>
<th></th>
<th>% of redistributed land</th>
<th>Period</th>
<th>Last income Quintile</th>
<th>GDP1990/GDP1960</th>
</tr>
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<tbody>
<tr>
<td>Japan</td>
<td>33.3</td>
<td>1946-49</td>
<td>0.44 (1962)</td>
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</tr>
<tr>
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<td>1948-58</td>
<td>0.41 (1965)</td>
<td>7.4</td>
</tr>
<tr>
<td>Taiwan</td>
<td>26.9</td>
<td>1949-53</td>
<td>0.41 (1964)</td>
<td>6.4</td>
</tr>
<tr>
<td>Philippines</td>
<td>27.0</td>
<td>1972-97</td>
<td>0.53 (1971-88)</td>
<td>1.6</td>
</tr>
<tr>
<td>Mexico</td>
<td>13.5</td>
<td>1915-76</td>
<td>0.61 (1950-75)</td>
<td>2.1</td>
</tr>
<tr>
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<td>11.3</td>
<td>1964-94</td>
<td>0.62 (1960-89)</td>
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</tr>
<tr>
<td>Peru</td>
<td>28.1</td>
<td>1969-79</td>
<td>0.68 (1961)</td>
<td>1.1</td>
</tr>
</tbody>
</table>

40Elaborated from Deininger, Olinto, and Maertens (2001).
41Deininger-Squire dataset (high-quality dataset, except Peru). The indexes for the Philippines, Mexico, and Brazil are averages; more observations are available for the periods we are interested in, and there is little variation among them.
42Penn World Table (PPP 1985 $US).
Table 2: The transition in different countries (values in %)\(^{13}\)

<table>
<thead>
<tr>
<th>Year</th>
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<th></th>
<th>Taiwan</th>
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<tr>
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<td></td>
<td></td>
<td></td>
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</tr>
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<td>20</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>1975</td>
<td>1.9</td>
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<td></td>
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<td>1985</td>
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Table 2: (cont.)

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<td>12.4</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

\(^{13}\)Data: World Bank, Development Indicators, and ILO, Key Indicators of 2003 Labor Market, Oshima (1992).

\(^{14}\)Year 1979
Table 3. Government expenditure on secondary and tertiary education, per student\textsuperscript{45}

<table>
<thead>
<tr>
<th>Year</th>
<th>US$ 1985</th>
<th>% of GDP per capita</th>
<th>Year</th>
<th>US$ 1985</th>
<th>% of GDP per capita</th>
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<td>1985</td>
<td>1169</td>
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<td>1990</td>
<td>1300</td>
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</tbody>
</table>

\textsuperscript{45}From the World Bank’s World Development Indicators.

Figure 1: Equilibria in the land market
Figure 2: Initial wealth distribution leading to the two equilibria.

Figure 3: Land redistribution
Figure 4: Complementarity between land redistribution and education

Figure 5: Evolution of Agrarian Wages (Philippines 1974 = 1, Korea and Japan 1960 = 1)