What Drives Structural Change in Different Stages of Development?*

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Abstract

This paper introduces a theory-based approach for exploring the predominant driver of structural change in the early and late stages of development. The results reveal that labor pull is a common driver in the early stages of development. The drivers in the late stages of development are more diverse, with labor pull remaining as the predominant driver in Asia but reallocation cost reduction becoming the main driver in most OECD and Latin American countries. Finally, there are few labor push driven structural changes after World War II. (JEL O11, O47, O57)

1. Introduction

The structural transformation of labor from the agricultural sector to other sectors is a pervasive phenomenon of modern economic development (as shown by Kuznets, 1966, 1973; Chenery and Syrquin, 1975; Timmer and De Vries, 2009). Yet, the literature has not reached a consensus on the predominant driver of this structural transformation. A better understanding about the process of this development is essential because the differences in sectoral employment shares across countries are related to cross-country income differences.[1] In this paper, we provide a theory-based approach

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[1] Restuccia et al. (2008) documented the fact that poor countries have larger shares of labor in the agricultural sector than rich countries despite the fact that their agricultural productivity is low. Moreover, there is a negative relationship between the share of employment in agriculture and GDP per worker relative to the U.S.

for identifying the historical determinants of the structural transformation after World War II (WWII).

The major debate in the literature is between the labor push hypothesis and the labor pull hypothesis. The labor push hypothesis emphasizes the importance of productivity growth in the agricultural sector in initiating the labor structural transformation (e.g., Rostow, 1960; Matsuyama, 1992; Gollin et al. 2002, 2007; Ngai and Pissarides, 2007, Chen and Liao 2012). On the other hand, the labor pull hypothesis emphasizes that the productivity growth of the non-agricultural sector initiates the labor movement (e.g., Lewis, 1954; Hansen and Prescott, 2002; Vollrath, 2009a). A detailed discussion can be found in Alvarez-Cuadrado and Poschke (2011).

In addition to labor pull and labor push, another hypothesis argues that the reduction in reallocation costs also contributes to labor structural transformation. For example, Hayashi and Prescott (2008) point out that in Japan the abolishment of the patriarchy system, which manifests as a reduction in reallocation costs, allows large amounts of labor to flow out of the agricultural sector, thus resulting in dramatic labor structural transformation.

Therefore, we bring together a two-sector model and a special type of shift analysis and propose an approach to differentiate the labor structural transformation driven by three different forces: labor push, labor pull, and reallocation cost reduction.[2] This model-based identification approach is necessary because in practice sectoral production efficiency/total factor productivity (TFP) is hard to measure if the reallocation of production factor (e.g., capital or labor) across sectors is allowed (to be discussed in detail in Section 4.2).

Our approach is composed of three parts. First, we separate out an element from the average labor productivity growth rate that is associated with labor structural change, i.e., the immediate jump effect and subsequent growth effect. This procedure adopts a special form of shift analysis used in the literature (Syrquin, 1984, 1986; Chenery and Syrquin, 1989; Ark, 1996; Maudos, Pastor and Serrano, 2008; Timmer and Vries, 2009; and McMillan and Rodrik, 2011, among others).[3]

Second, we set up a two-sector model similar to Hayashi and Prescott (2008) and show that different types of structural change drivers yield different signs for the subsequent growth effect.

[2] This study only focuses on identifying the driver of labor structural transformation from agriculture to non-agriculture. Despite the fact that labor structural transformation is not limited to movement from agriculture to non-agriculture and includes movement back to agriculture at certain points in time, such changes in direction do not last long during our sampled period. For example, in the Philippines, the data show an increase in the share of employment in agriculture during 1971-1973. Moreover, for some countries, such direction lasts a bit longer and occurs toward the beginning (e.g., India) or end (e.g., Peru) of the sampled period. Thus, we drop those periods. For example, for Peru, the employment share increased between 1991 and 1995. Thus, we chose for the period of study to end in 1991. In India, the employment share in agriculture rose between 1964 and 1974, and we chose for the period of study to begin in 1975 and last until 2004 (the last year the data are available).

[3] Our approach is different from theirs in that we decompose the actual average labor productivity growth rate rather than the approximation of average labor productivity growth rate, i.e., the changes in log of productivity.

Structural change driven by labor pull will yield a positive sign, and structural change driven by labor push/reallocation cost reduction will yield a negative sign. Therefore, we use the sign implied by the model to identify the period in which labor pull is the predominant driver of labor structural change. Of particular note, this model allows us to take into account the fact that labor pull/reallocation cost reduction causes structural change, both directly and indirectly, by raising agricultural productivity. We attribute the contribution of both channels to labor pull/reallocation cost reduction, instead of to labor push.

Finally, we examine the remaining period in which labor push/reallocation cost reduction is the main driver and further distinguish reallocation cost reduction driven structural change from these cases. Recall, labor push effects drive labor out of the agricultural sector when agricultural productivity rises because less labor is needed for producing food for subsistence. Accordingly, we characterize the dominance of this scenario by two necessary conditions: (1) positive agricultural productivity growth and (2) stationary agricultural output per capita. Accordingly, when either one of the two conditions does not hold, we can exclude the labor push scenario and claim that reallocation cost reduction is the main driver.

We apply this approach to the growth experience of 28 countries—ten Asian, nine Latin American, and nine Organisation for Economic Co-operation and Development (OECD) member countries—after WWII. Moreover, to address the main driver of different stages of development, we define two stages of development, early and late, for each country using the year in which the economy's agricultural employment share falls below 30 percent as the demarcation. Overall, five countries remained in the early stage of development throughout the time period under consideration, 10 countries remained in the late stage, and 13 countries transitioned from the early stage to the late stage.

We find evidence supporting the labor pull hypothesis. The general pattern is that labor pull is the predominant driver in the early stage of development and reallocation cost reduction is the predominant driver in the late stage. Although not all countries fit this scenario, we find those that experienced both early and late stages after WWII and had a change in the predominant driver usually underwent a transition from labor pull to reallocation cost reduction driven labor structural change. Moreover, for 16 out of 18 countries that experienced early stages, the labor structural change is mainly driven by labor pull. For 11 out of 17 non-Asian countries that experienced late stages—all Asian transition proceeded by labor pull—the labor structural change is mainly driven by reallocation cost reduction.

Our work contributes to the literature that systematically identifies the main driver of structural change. We provide a theory-based measurement for identifying the main driver, and it turns out that we support the labor pull hypothesis. Our work differs from the literature that explores the contribution of one driver to structural changes, e.g., Gollin et al. (2002), and Hayashi and Prescott (2008), because our model allows the co-existence of more than one driver. Moreover, our work differs from the studies that provide a theory-based measurement for identifying the main driver (e.g., Alvarez-Cuadrado and Poschke, 2011) in that a different measurement is developed and then applied to more countries.[4] Though both works support the labor pull hypothesis, our paper emphasizes that the structural change in the late stage is mostly driven by reallocation cost reduction rather than labor push.[5]

The above result leads to the policy recommendation that emphasizes the importance of non-agricultural productivity growth in development. Based on the growth experienced after WWII, the structural change proceeds with the labor pull effect, especially in the early stage of development. Moreover, our model shows that the labor structural transformation driven by labor push and labor reallocation cost reduction results in a negative subsequent growth effect, which cancels out the positive contribution of an immediate productivity jump due to structural change. Therefore, to pursue growth- enhancing labor structural change, engineering a labor pull effect is more effective than labor push and reallocation cost reduction. Moreover, as the need for producing enough food to sustain life is not a critical issue of modern economic development, reallocation cost reduction is more important than labor push in the growth process.

The remainder of this paper is organized as follows. Section I discusses the possible forces that drive the labor structural transformation. Section II shows the shift analysis we adopt and the model we use as the theoretical base for the observers. Section III discusses the identifying procedure. Section IV presents the data, and then discusses the results and policy implications. Section V offers concluding remarks.

[4] Alvarez-Cuadrado and Poschke (2011) studied the development experience of Belgium, Canada, Finland, France, Germany, Japan, the Netherlands, South Korea, Spain, Sweden, the United Kingdom, and the United States. Their identification strategy is based on the presumption that relative price is a good proxy for relative productivity. Then, the relative price is used for determining the relative importance of labor push and labor pull to economic development.

[5] Since the data characteristics for the labor push effect and reallocation cost reduction effect are similar—both experienced a rise in agricultural productivity and a fall in non-agricultural productivity—we can also view reallocation cost reduction as a broadly defined labor push. Then, our result is similar to Alvarez-Cuadrado and Poschke (2011) although we use different data.

2. The Three Drivers

There are three types of forces that are hypothesized to drive the movement of labor from agriculture to non-agriculture. The first is the labor push hypothesis. The basic assumption of the labor push hypothesis is that individuals need to resolve the "food problem," characterized by Schultz (1953) as the necessity of satisfying the basic need for food: hereafter the "food problem constraint." Then when agricultural productivity grows while the food problem constraint still binds, agricultural productivity growth pushes labor out of the agricultural sector. Research by Gollin et al. (2002, 2007) provides a theoretical foundation for this type of labor structural change. Accordingly, this type of development is characterized by rising agricultural productivity alongside stationary agricultural output per capita, and we use these two data characteristics as the necessary conditions for labor push.

The second is the labor pull hypothesis. The basic assumption of the labor pull hypothesis is that productivity growth in the non-agricultural sector triggers the movement of labor. This type of driver is characterized by Hansen and Prescott (2002). Accordingly, the necessary condition of this scenario is positive non-agricultural productivity growth.

The third hypothesis is reallocation cost reduction. The basic assumption of this mechanism is that the labor market is in equilibrium and that the marginal product of labor in agriculture equals the marginal product of labor in non-agriculture multiplied by a variable called reallocation cost. The reallocation cost can be viewed as the cost of acquiring new skills to work in the non-agricultural sector and the migration cost of moving from a rural to an urban environment, among others.[6] The work by Hayashi and Prescott (2008) characterized the effect of reducing reallocation costs in structural change in Japan after WWII. Given the parameter values, we can measure the reallocation cost. Therefore, from the trend of the imputed cost we can infer if there exists a reduction in reallocation costs.

3. The Framework

We first discuss the shift analysis adopted (Section 3.1). Then, we set up a two-sector model (Section 3.2) and discuss the model implications for the shift analysis results (Section 3.3).

[6] The reallocation cost can go both directions, but rising reallocation cost will deter labor movement out of the agricultural sector, or even create regress labor structural transformation. Therefore, this scenario is not our focus. Nevertheless, the basic assumption for the scenario of reallocation cost increase is the same as that for reallocation cost reduction except that now the cost increases. The reallocation cost increase can be viewed as the abstract of the rising cost for acquiring skills to stay in the non-agricultural sector, or the rising migration cost of moving from rural to urban areas to work in the non-agricultural sector, among others.

3.1. The Shift Analysis

We adopt a special form of shift analysis that decomposes the growth of average labor productivity (ALP), i.e., output per worker, and focus only on the productivity gain from labor reallocation. We decompose the average labor productivity growth as follows:

(1)
$$\frac{ALP_t^{agg}}{ALP_0^{agg}}-1=\left\{\left(\frac{L_0^a}{L_0^a+L_0^n}-\frac{L_t^a}{L_t^a+L_t^n}\right)\cdot\left[\frac{ALP_0^n}{ALP_0^{\text{agg}}}-\frac{ALP_0^a}{ALP_0^{\text{agg}}}\right]\right\}$$
$$+\left\{\left(\frac{L_0^a}{L_0^a+L_0^n}-\frac{L_t^a}{L_t^a+L_t^n}\right)\cdot\left[\frac{ALP_0^n}{ALP_0^{\text{agg}}}\left(\frac{ALP_t^n}{ALP_0^n}-1\right)-\frac{ALP_0^a}{ALP_0^{\text{agg}}}\left(\frac{ALP_t^a}{ALP_0^a}-1\right)\right]\right\}$$
$$+\left\{\mathrm{W}_0\left[\frac{ALP_t^a}{ALP_0^a}-1\right]+(1-\mathrm{W}_0)\cdot\left[\frac{ALP_t^n}{ALP_0^n}-1\right]\right\},$$

where $ALP_t^{agg}\,/\,ALP_t^a\,/\,ALP_t^n$ represents the aggregate/agricultural/non-agricultural ALP at date "t", and $L_t^{agg}\,/\,L_t^a\,/\,L_t^n$ represents the level of total/agricultural/non-agricultural employment at date "t". Moreover, we define

$$\mathrm{W}_0\equiv\frac{L_0^a}{L_0^a+L_0^n}\cdot\frac{ALP_0^a}{ALP_0^{agg}}.$$

Consequently,

$$1-\mathrm{W}_0=\frac{L_0^n}{L_0^a+L_0^n}\cdot\frac{ALP_0^n}{ALP_0^{agg}}.$$

The decomposition separates average labor productivity growth rates into three parts: the term in the first curly bracket represents the productivity gain from moving labor from a low productivity sector to a high productivity sector. In other words, the first part represents the immediate productivity jump due to moving labor to a more productive sector, hereafter the "immediate jump effect" from reallocation. The term in the second curly bracket represents the additional productivity gain from moving labor to a sector with higher productivity growth than the originated sector. In other words, the second part represents the subsequent productivity gain after the labor movement, hereafter, the "subsequent growth effect" from reallocation. Finally, the term in the third curly bracket represents the weighted average of sectoral productivity growth rates. In this paper, we focus only on the immediate jump effect and the subsequent growth effect because these two terms are associated with labor structural change.

3.2. The Model

Now we set up a two-sector model similar to Hayashi and Prescott (2008) and then discuss the model implications of the results of the shift analysis.

The model economy is comprised of an agricultural and a non-agricultural sector, a representative family, and firms in a perfect foresight environment. The agricultural sector adopts a decreasing return to scale production technology and the non-agricultural sector adopts a constant return to scale production technology[7]

(2) $$Y_t^a = A_t^a \left(s_t^L L_t\right)^{\theta},$$

(3) $$Y_t^n = A_t^n \left(K_t\right)^{1-\alpha} \left[\left(1 - s_t^L\right) L_t\right]^{\alpha},$$

where Y_t^i is output at time t for agriculture (i=a) and non-agriculture (i=n). A_t^i is the production efficiency/total factor productivity (TFP) at time t for each sector, L_t^i is labor in each sector at time t, and K_t is capital used in the non-agricultural sector at time t. The parameters θ and α are the labor shares of agricultural and non-agricultural productions, respectively. The labor share of agricultural production is set to $\theta<1$ because we abstract from the contribution of land to agricultural production. s_t^L is the percentage of labor allocated to the agricultural sector. Furthermore, we assume that when the period begins (i.e., t = initial), the average labor productivity in non-agriculture is greater than or equal to that in the agricultural sector; that is,

$$\frac{Y_{initial}^a}{L_{initial}^a} \le \frac{Y_{initial}^n}{L_{initial}^n}.$$

The infinitely-lived representative family chooses labor allocation across sectors while facing a reallocation cost when allocating labor to the non-agricultural sector.[8] The family size (N) evolves over time such that

[7] We also consider the model with capital in both agricultural and non-agricultural sectors. The corresponding propositions and model implications—about how the immediate jump effect and subsequent growth effect change when labor push, labor pull, or reallocation cost reduction is the dominant driver—remain the same. See Technical Appendix A.

[8] This model differs from that in Hayashi and Prescott in two ways. First, their model assumes that the choice of labor in agriculture is subject to the patriarchal system so that the level of employment in agriculture is fixed and thus laborers are unable to move out of the agricultural sector. By contrast, our model assumes two frictions that confine workers to the agricultural sector: (1) the economy has to produce enough agricultural

$$N_{t+1} = (1+n)N_t ,$$

where *n* is the population growth rate.

The utility function for the family is as follows:

$$\sum_{t=0}^{\infty} \beta^t N_t u(c_t^a, c_t^n) = \sum_{t=0}^{\infty} \beta^t N_t \left[\log(c_t^a - \bar{c}) + \phi \log(c_t^n)\right], \tag{4}$$

where c_t^i is per capita consumption of agricultural (i=a) and non-agricultural (i=n) goods in period t, respectively, and $\bar{c}$ is the subsistence level of agricultural goods. The household takes L_t as given and chooses s_t^L. β is the discount factor. The budget constraint for each period t is

$$p_t N_t c_t^a + N_t c_t^n + N_{t+1} k_{t+1} - (1-\delta)k_t = w_t^a \cdot s_t^L \cdot L_t + w_t^n \cdot (1-\chi_t) \cdot \left(1 - s_t^L\right) \cdot L_t + r_t N_t k_t + \pi_t , \tag{5}$$

where δ is the depreciation rate, π_t is profit, k_t is capital per capita, and χ_t is the cost of working in the non-agricultural sector at date t, which is exogenously given and is less than or equal to 1. Higher χ_t implies higher costs for acquiring a job in the non-agricultural sector. Finally, p_t is the relative price of the agricultural good to the non-agricultural good.

The family chooses the allocation of labor across sectors based on the following rule:

$$s_t^L L_t = \begin{cases} \left(\dfrac{N_t \bar{c}}{A_t^a}\right)^{\frac{1}{\theta}} & if \ \dfrac{w_t^a}{w_t^n \cdot (1-\chi_t)} < 1, \\ L_t & if \ \dfrac{w_t^a}{w_t^n \cdot (1-\chi_t)} > 1, \\ \in [\left(\dfrac{N_t \bar{c}}{A_t^a}\right)^{\frac{1}{\theta}}, L_t] & if \ \dfrac{w_t^a}{w_t^n \cdot (1-\chi_t)} = 1. \end{cases} \tag{6}$$

where w_t^i i={a, n} for {agriculture, non-agriculture}, equals the marginal product of labor of each sector in equilibrium:

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output to sustain the food needs of the economy; (2) there is a cost for labor to move to the non-agricultural sector. Second, their model takes into account the financial intermediation cost. We abstract from such financial frictions for simplification since our focus is on the forces that drive the labor reallocation.

(7) Agriculture: $w_t^a = \theta p_t A_t^a \left(s_t^L L_t\right)^{\theta-1} = \theta p_t \frac{Y_t^a}{s_t^L L_t}$,

(8) Non-agriculture: $w_t^n = \alpha A_t^n \left(K_t\right)^{1-\alpha} \left[(1-s_t^L)L_t\right]^{\alpha-1} = \alpha \frac{Y_t^n}{L_t^n}$.

This model implies that the sectoral reallocation from agriculture to non-agriculture is due to sectoral productivity growth, i.e., labor push or labor pull, or is due to the elimination of the barrier for labor reallocation, which is characterized by a reallocation cost reduction.[9]

The above setup has two features. First, we allow the household to produce agricultural goods greater than or equal to the subsistence level. Second, we take into consideration the fact that not all the labor structural change resulting from agricultural productivity increase attributes to labor push. The labor pull effect and reallocation cost reduction also indirectly raise agricultural productivity. We attribute the structural change driven by these indirect effects to the contribution of labor pull/reallocation cost reduction.[10] Therefore, we restrict the labor push scenario to the case where the wage rates (net of reallocation cost) across sectors are not equal. In other words, we only impose the condition that the wage rates (net of relocation cost) across sectors are equal under labor pull and reallocation cost reduction scenarios.

3.3. The Propositions

Now we move on to discuss the model implications for shift analysis. In particular, we focus on the effects of labor push, labor pull, and reallocation cost reduction on the immediate jump effect and the subsequent growth effect.

The labor push hypothesis suggests that agricultural productivity growth can release labor to the non-agricultural sector. This scenario assumes that the food problem constraint is binding such that workers stay in the agricultural sector despite the fact that agricultural wages are lower than non-agricultural wages (net of reallocation costs). Consequently, higher agricultural productivity allows the family to allocate more labor to the non-agricultural sector while still producing enough agricultural output to satisfy food needs. Such labor movement raises the number of non-agricultural

[9] We preclude the scenario that the agricultural wage is greater than the non-agricultural wage net of reallocation cost. This scenario would imply that all workers are in the agricultural sector, which is counterfactual.

[10] Labor pull and reallocation cost reduction scenarios also raise the average agricultural productivity. Therefore, in the data it is hard to tell whether the agricultural productivity growth is the consequence of labor push, labor pull, or reallocation cost reduction.

workers and reduces the marginal product of non-agricultural labor.[11] Holding all other things constant, such structural changes result in an increase in the agricultural average labor productivity ($\frac{\partial ALP^a}{\partial A^a} > 0$) and a decrease in the non-agricultural average labor productivity ($\frac{\partial ALP^n}{\partial A^a} < 0$). This leads to the first proposition.

Proposition 1: *Labor push driven labor structural transformation (from agriculture to non-agriculture) results in a positive immediate jump effect and negative subsequent growth effect.*

The immediate jump effect is positive because we assume that non-agricultural productivity is higher than agricultural productivity in the initial year. The subsequent growth effect is negative because in this scenario non-agricultural productivity growth (<0) is smaller than agricultural productivity growth (>0).

Next, for the scenarios other than labor push, i.e., labor pull and reallocation cost reduction, we assume that the food problem constraint is not binding so that workers can move freely across sectors to equilibrate agricultural wages to non-agricultural wages net of reallocation costs. Accordingly, the labor choice condition and the firm's first order condition on labor choices suggest the following condition holds:

(9) $$\theta \frac{q_t Y_t^a}{s_t^L L_t} = \alpha(1-\chi_t)\frac{Y_t^n}{\left(1-s_t^L\right)L_t}.$$

The labor pull hypothesis suggests that non-agricultural productivity growth can attract more workers to the non-agricultural sector. Consequently, higher non-agricultural productivity triggers labor movement from agriculture to non-agriculture to restore the equilibrium suggested by Eq. (9), thus raising the number of non-agricultural employees and reducing the number of agricultural employees. Such structural change results in an increase in the average labor productivity of both sectors (i.e., $\frac{\partial ALP^a}{\partial A^n} > 0$; $\frac{\partial ALP^n}{\partial A^n} > 0$). This leads to the second proposition.

[11] If the food problem constraint is not binding, and agricultural wages equal non-agricultural wages net of reallocation costs, higher agricultural productivity causes labor structural transformation from non-agriculture to agriculture. Under this scenario, there is a negative subsequent growth effect and a negative immediate jump effect.

Proposition 2: *Labor pull driven labor structural transformation (from agriculture to non-agriculture) results in a positive immediate jump effect and a positive subsequent growth effect.*

Again, the immediate jump effect is positive because we assume that non-agricultural productivity is higher than agricultural productivity in the initial year. The subsequent growth effect is positive for the following reason. Productivity growth in the non-agricultural sector attracts laborers moving out of the agricultural sector, thus raising the marginal product of labor. Since Eq. (9) has to hold in equilibrium, in the long run the productivity growth of both sectors has to be equal in equilibrium. Because the initial productivity in the non-agricultural sector is higher than in the agricultural sector, similar productivity growth implies that the productivity increase of the non-agricultural sector is also higher than that of the agricultural sector. Therefore, the subsequent growth effect is positive.

The labor structural change driven by reallocation cost reduction assumes that the cost of acquiring jobs in the non-agricultural sector falls, as if the barriers to reallocation were lowered. Consequently, the family allocates more labor to the non-agricultural sector. Again, this scenario assumes that the food problem constraint is not binding so that workers can freely move across sectors to equilibrate agricultural wages to non-agricultural wages net of reallocation costs. Consequently, a lower reallocation cost raises agricultural productivity ($-\frac{\partial ALP^a}{\partial \chi} > 0$) due to workers flowing out of the sector and reduces the non-agricultural sector ($-\frac{\partial ALP^n}{\partial \chi} < 0$) due to more workers flowing into the sector. This leads to the third proposition.

Proposition 3: *Reallocation cost reduction driven labor structural transformation from agriculture to non-agriculture results in a positive immediate jump effect but a negative subsequent growth effect.*[12]

Of particular note, the data characteristics of reallocation cost reduction driven labor structural change are similar to those of labor push. Under both of these scenarios, the productivity growth of

[12] On the contrary, increases in the reallocation cost (e.g., an increase in the skill requirement of the non-agricultural sector) forces workers to move out of the non-agricultural sector. Accordingly, non-agricultural productivity increases, the number of workers in the agricultural sector increases, and agricultural productivity falls. Assuming that the initial non-agricultural productivity is higher than the initial agricultural productivity, the subsequent growth effect and the pure productivity jump is negative since the changes in the share of labor in agriculture is negative. Therefore, proposition 3 does not imply that rising reallocation costs result in a positive productivity gain from reallocation.

the agricultural sector rises and that of the non-agricultural sector falls. The difference is that labor push is in effect only when the food problem constraint binds.

4. The Identifying Approach

Based on the model's propositions, we provide three guidelines for identifying the predominant driver of labor structural transformation (Section 4.1) and discuss the procedure for identifying the driver of the structural change (Section 4.2).

4.1. The Guidelines

Now we provide guidelines for examining the existence of labor push, labor pull, and reallocation cost reduction and for pinning down the main driver. The guidelines are summarized in Table 1.

Positive average labor productivity growth in agriculture does not necessarily imply the existence of labor push. This is because labor moving out of the agricultural sector due to other forces also raises the marginal product of labor, thus increasing the average labor productivity of the agricultural sector. Nevertheless, a negative growth rate of agricultural labor productivity precludes the existence of a labor push effect. This is a sufficient condition to rule out a labor push effect. This is because under the scenario that the economy still faces a food problem constraint, if there is no agricultural productivity growth, laborers have to stay in the agricultural sector to provide enough food to sustain life.

Next, we address the scenarios other than labor push. Recall, for scenarios other than labor push, Eq. (9) has to hold. Consequently, the factors that cause any variables in this equilibrium condition to change result in labor structural change.

When labor moves toward the non-agricultural sector while there is no non-agricultural productivity growth, such movement results in lower non-agricultural productivity. Therefore, when the economy experiences labor movement from agriculture to non-agriculture, positive productivity growth of the non-agricultural sector is the sufficient condition for labor pull to exist.

Finally, since we can compute the reallocation cost over time given all the parameters and the average labor productivity of agriculture and non-agriculture, we can observe the evolution of reallocation costs and verify if there is any cost reduction. Therefore, we have Guideline 1.

Guideline 1 (existence check): *When the agricultural share of employment falls, negative growth in agricultural average labor productivity precludes the existence of labor push. Positive growth in non-agricultural average labor productivity is associated with the existence of labor pull. Finally, a downward trend of the reallocation cost implies the existence of reallocation cost reduction.*

Next, we combine the model proposition with the result of the shift analysis and propose Guideline 2 for checking the dominance of either labor pull or labor push/reallocation cost reduction.

Guideline 2 (dominance check): *The subsequent growth effect is positive when labor pull is the dominant force driving structural transformation; this effect is negative when reallocation cost/labor push effect is the dominant driver.*

This guideline is based on propositions 1-3. As labor pull is the dominant force driving labor structural change, the effect of labor pull on structural change is the strongest, thus resulting in a positive immediate jump effect and a positive subsequent growth effect. On the contrary, when labor push/reallocation cost reduction is the dominant force driving labor structural change, the effect of labor push/reallocation cost reduction on structural change is the strongest, thus resulting in a positive immediate jump effect and a negative subsequent growth effect. Thus, the sign of the subsequent growth effect is used for distinguishing the structural change mainly driven by labor pull from that mainly driven by labor push/reallocation cost reduction.

Finally, to distinguish the structural change mainly driven by reallocation cost reduction (i.e., to exclude the labor push scenario), we propose Guideline 3. For labor push to exist, the food problem constraint has to bind such that the economy retains high agricultural employment while the agricultural wage is less than the non-agricultural wage net of reallocation cost. Then, when agricultural productivity rises, workers are released to the non-agricultural sector.[13] This leads to the third guideline:

Guideline 3 (labor push check): *The existence of a binding food problem constraint and positive agricultural productivity growth is the necessary condition for labor push to function. Accordingly, one can exclude the labor push scenario when agricultural output per head is non-stable (i.e., not a mean reversion process) or the agricultural output growth is non-positive.*

[13] If the food problem constraint is not binding and Eq. (9) holds, rising agricultural productivity results in regressive labor structural change.

The logic behind this check is that for the case in which the food problem persists, we observe positive agricultural productivity growth while agricultural output per capita is stationary. If agricultural output per capita rises over time, this scenario implies that the food problem constraint is no longer binding in the late stage. By contrast, if agricultural output per capita declines over time, this scenario implies that the food problem constraint does not bind in the early stage.

4.2. The Procedure

Now we discuss the procedure used for identifying the driver of structural change and the statistical method used in each procedure. The complete procedure for identifying the main driver of reallocation takes three steps.

First, we define the period studied. We only focus on the period that the economy experiences a declining share of labor in agriculture because the focal point of this paper is labor structural transformation from the agricultural sector to the non-agricultural sector. Therefore, we drop the periods during which the upward trend is sustained, that is, when Hodrick-Prescott filtered data show an upward trend.[14] Moreover, we also define the early and the late stage of development. We set a demarcation point between the early and late stages of development so that we can study the sequence of different predominant drivers in development. The demarcation point for each country is chosen based on the share of employment in agriculture. We define the period in which that share is greater than 30 percent to be the early stage of development and the period in which that share is less than 30 percent to be the late stage.[15]

Second, we examine the existence of different drivers. We implement the standard KPSS test (with intercept only) on the time series of reallocation costs to verify whether the path is stationary.[16] For the test, we choose the critical value according to Table 1 in Kwiatkowski, Phillips, Schmidt, and Shin (1992). Then, we focus on those periods in which the reallocation costs are non-stationary and regress the path of reallocation costs on time. This step verifies whether the reallocation costs increase or decrease when they are not stationary. Finally, we can simply examine the existence of

[14] For the Hodrick-Prescott filter, a smoothing parameter of 100 is used.

[15] We choose 30 percent as the threshold because the average share for the OECD countries in 1950 (excluding the U.K. and the U.S.) in the Groningen Growth and Development Centre (GGDC) dataset equals 27 percent when excluding Italy (due to lack of data in 1950) and equals 32 percent when using 1951 data for Italy. We also investigate the robustness of the empirical results when setting the demarcation point at 20 percent and 40 percent. See Technical Appendix B.

[16] The null hypothesis for the test is that the series is stationary. We adopt the KPSS test with intercept only because it is a residual-based test for nonstationarity. To control for serial correlation, the Newey and West's (1994) data-dependent method is used to determine the bandwidth of the long-run variance.

labor pull and the absence of labor push by the signs of the non-agricultural and agricultural productivity growth rates.

Third, we apply the dominance check and labor push check to pin down the main driver. The dominance check identifies whether labor pull or labor push/reallocation cost reduction is the predominant driver of the labor structural transformation. We examine the sign of the subsequent growth effect: a positive subsequent growth effect implies that labor pull dominates all other effects, whereas a negative subsequent growth effect implies that labor push/reallocation cost plays a dominant role.

To complete this step, we also implement the labor push check to identify reallocation cost reduction effects for those periods where the labor push/reallocation cost reduction effect is the predominant driver. To implement the labor push check, we first look for the existence of the food problem by checking two necessary conditions of labor push: positive agricultural productivity growth and stationary agricultural output per capita. To validate the first condition, we examine the sign of the agricultural growth rate.

Furthermore, to verify the second condition, we use the standard KPSS with intercept only to test for stationarity. The null hypothesis is that the path is stationary. The cases for which we reject the null hypothesis are classified as reallocation cost reduction driven structural change. This conclusion is based on the assumption that for labor push to dominate reallocation cost reduction in driving the structural change, the data characteristics should be consistent with the basic assumption of labor push. Recall, labor push assumes that workers stay in agriculture to produce enough food to satisfy subsistence needs, which should be roughly constant. Therefore, we argue that this data characteristic implies that the per capita agricultural output level should stay at a relatively stable level (i.e., a mean reversion process). Violating such data characteristics excludes the possibility that labor push is the main driver of the structural change. Nevertheless, fulfilling the necessary conditions does not guarantee that the labor push effect dominates.

This identification strategy improved the procedure adopted in Alvarez-Cuadrado and Poschke (2011). Our work examines the variable that directly associates with productivity changes of each sector, i.e., subsequent growth effect. Therefore, the assumption that relative price (price of manufactures to agricultural goods) is a good proxy for relative productivity is not necessary in our framework.[17] Moreover, we allow both technological regress and improvement. Moreover, our

[17] Though using relative price as a measurement for relative productivity is common in the literature (see Greenwood et al. (1997), Ngai and Pissarides (2007), and Alvarez-Cuadrado and Poschke (2011), among others), the price of agricultural goods may easily change due to factors

identification steps can be statistically verified. Consequently, we can quantitatively and qualitatively identify the dominance of labor pull, reallocation cost reduction, and labor push/reallocation cost reduction

Of a particular note, this model-based identification approach is necessary when we treat sectoral TFP as an exogenous variable. When TFP is exogenously given and the labor choice (between agricultural activity and non-agricultural activity) is subject to the relative productivity across sectors, any TFP change in one sector (e.g., the non-agricultural TFP) affects the chosen labor force of all the sectors (e.g., the agricultural sector and the non-agricultural sector). Therefore, under a two-sector framework (e.g., agriculture and non-agriculture), the measured TFP in data of a sector is a function of the other sector' actual TFP and we cannot correctly separate the agricultural TFP and the non-agricultural TFP in data. Accordingly, we cannot infer the relative impact of the sectoral TFP changes (i.e., labor push or labor pull) simply by comparing the computed times series for the agricultural TFP and the non-agricultural TFP.

5. The Data and the Results

We first introduce the data used and the parameters chosen (Section 5.1). Then, we examine the main driver of structural change in different stages of development (Section 5.2). Finally, we discuss the results and policy implications (Section 5.3).

5.1. Data and Parameters

The data used are mainly obtained from the ten-sector database of the Groningen Growth and Development Centre (GGDC) as of June 2007 (Timmer and de Vries, 2007), and then supplemented with the data from the Penn World Table 7.0.

From the GGDC, we obtain the data for sectoral output, i.e., constant price GDP, and sectoral number of employees, and then we compute the output per worker as the average labor productivity. We use all the data in the dataset. There are ten Asian countries (Hong Kong, Indonesia, India, Japan, South Korea, Malaysia, the Philippines, Singapore, Thailand, Taiwan), nine Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, and Venezuela), and nine OECD countries (W. Germany, Denmark, Spain, France, Italy, the Netherlands, Sweden, the United

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other than technological improvement. For example, in a bad harvest year, the price of the agricultural product increases and drives down the relative price falls. Accordingly, their logic implies that labor pull is the main driver of structural change in that year, which is not true.

Kingdom, and the United States.) From the Penn World Table, we obtain the data for the total population so that we can compute the agricultural output per capita.

Moreover, our study focuses on the periods where the share of agricultural employment declines. We find that most economies have experienced a declining share of labor in agriculture. The exceptions are India during 1960-1974, and Peru after 1991. Therefore, we only focus on the period between 1975 and 2004 for India; and for Peru, we focus on the period 1960-1991.

Finally, for the imputed time series of reallocation costs, we adopt the capital share estimated in Valentiniyi and Herrendorf (2008). Thus, we set the labor share of the agricultural sector equal to 0.46 and that of the non-agricultural sector equal to 0.67.[18] This choice of the parameter values does not affect the trend but only the level of the imputed reallocation cost.

5.2. The Results

We now implement the identification procedure by taking the following three steps: (i) determining the early and the late stages; (ii) undertaking an existence check; and (iii) pinning down the main driver.

(i) The First Step: Determining the Early and the Late Stages

We set the demarcation point for the early and late stages of development based on the share of employment in agriculture. We use the year that the share becomes less than 30 percent as the demarcation point for separating the early and late stage of development. We define the period that the share is greater than 30 percent as the early stage of development and the period that that share is less than 30 percent as the late stage. Overall, over the years for which we have data, five countries (four Asian countries and one Latin American country) remained in the early stage of development, and ten countries (two Asian countries, one Latin American country, and seven OECD countries) remained in the late stage of development. For the remaining 14 countries, the period studied covers both the early and late stage of development. We summarize the period studied in Table 2, columns (a) and (e).

(ii) The Second Step: the Existence Check

[18] In Table 2 of Valentiniyi and Herrendorf (2008), they report that the capital shares for agriculture and non-agriculture are 0.54 and 0.33, respectively.

We examine the sign of the non-agricultural productivity growth to identify the existence of the labor pull effect (based on Guideline 1). See columns (b) and (f) in Table 2. As can be seen, the labor pull effect exists in most countries, except for Brazil in 1986-2003, Bolivia in 1950-2003, Mexico in 1979-2005, Peru in 1960-1991, and Venezuela in 1965-2005.

Next, we examine the sign of the agricultural productivity growth rate. We find that the agricultural productivity growth in Chile in 1950-1961 is negative. Thus, we preclude the existence of labor push for Chile in this period. This is the only case with a negative agricultural productivity growth rate.

Moreover, we explore the evolution of reallocation costs. We compute the reallocation costs of all the countries based on the assumption that Eq. (9) holds. The imputed reallocation costs suggest that in general the declines of the reallocation costs in Asia are smaller than those of the Latin American and OECD countries. See Fig 1.

We also examine the stationarity and the trend of the reallocation cost for each sub-period. See columns (d) and (h) in Table 2. As can be seen, the time series is stationary in the early stage of development for South Korea, Taiwan, and Thailand, and in the late stage of development for Colombia, Japan, Malaysia, and Singapore. Moreover, for the non-stationary cases, most of the reallocation cost shows a significant downward trend. There are few exceptions: Hong Kong (1974-2005), India (1975-2004), Taiwan (1991-2005), and Chile (1950-1961). Based on the existence check, reallocation cost reduction cannot be the dominant driver for these countries during the specified period.

(iii) The Third Step: Determining the Predominant Driver

We first implement the dominance check for the early and late stage of development to identify whether labor pull or labor push/reallocation cost reduction is the predominant driver of the labor structural transformation. Then, we implement the labor push check to distinguish the reallocation cost reduction effect from the labor push/reallocation cost reduction scenario.

We find that there is no definite driver for the early and the late stage of development. For some countries, i.e., all of the Asian countries, Colombia, W. Germany, and the Netherlands, the subsequent growth effect has been positive throughout the entire period. Based on the dominance check, the positive subsequent growth implies that the labor pull effect persists for these countries throughout the early and late stage of development (for those countries that transition from the early stage to the late stage). On the contrary, for most Latin American and OECD countries that experienced a fall in the share of employment from above 30 percent to less than 30 percent, the predominant driver of the labor structural transformation is first labor pull and then reallocation cost reduction/labor push. For these countries, the subsequent growth effect was positive in the early stage of development and turns negative in the late stage of development. See columns (c) and (g) in Table 3.

To further distinguish the reallocation cost reduction effect from the labor push effect/reallocation cost reduction joint scenario, we implement the labor push check for the periods in which the labor pull effect is not the main driver. Recall, we verify the labor push effect by examining the two necessary conditions: positive agricultural productivity growth and stationary agricultural output per capita. The time series for the agricultural output per capita for all the countries are shown in Fig. 2. We find that all of the countries have positive agricultural productivity growth during the sampled period, except for Chile (1950-1961). Moreover, the statistical results regarding the evolution of agricultural output per capita show that except for Argentina (1950-2005), Bolivia (1950-2001), and Sweden (1960-2005), we reject the hypothesis that the time series is stationary.[19] See columns (d) and (h) in Table 3. Based on Guideline 3, we conclude that reallocation cost reduction is the main driver for most labor push/reallocation cost reduction driven structural change.

As a result, we conclude that labor pull is the predominant driver of the labor structural change in all Asian countries and Colombia for the whole sample period, some Latin American countries (Brazil, Chile, Costa Rica, Mexico, and Venezuela) in the early stage, Italy and Spain in their early stage; and W. Germany and the Netherlands over the whole sampled period (which is considered to be only the late stage). Moreover, we reject the hypothesis that labor push is the predominant driver except in Bolivia during 1950-2001, Argentina during 1950-2005, and Sweden during 1960-2005. Finally, reallocation cost reduction is the predominant driver of the structural change in Brazil during 1986-2005, Chile during 1962-2005, Costa Rica during 1989-2005, Mexico during 1979-2005, Venezuela during 1965-2005, and most OECD countries. We summarize these results in Table 3, columns (b) and (f).

The results here are consistent with the results in the existence check. For example, the existence check precludes the existence of labor push and reallocation cost reduction in Chile from 1950 to 1961, and it turns out that the dominance check suggests that the structural change in this period is

[19] For the Philippines from 1971 to 2005, we cannot reject the hypothesis that its agricultural output per head is stationary. Since fulfilling this necessary condition does not imply that labor push is the main driver, and the dominance check already shows that the labor pull effect is the main driver, we classify this case as labor pull driven structural change. Therefore, we do not discuss this case here.

mainly driven by labor pull. Moreover, the existence check precludes the existence of a labor pull effect in Bolivia in 1950-2001, Brazil in 1986-2005, Mexico in 1979-2005, Peru 1960-1991, and Venezuela in 1965-2005. The dominance check confirms that labor pull is not the main driver in these countries during the specified period. Finally, we find that there is no indication of reallocation cost reduction in Japan 1963-2003, S. Korea 1963-1982, Malaysia 1989-2005, Singapore 1970-2005, Taiwan 1963-1975, Thailand 1960-2005, and Colombia 1991-2005 or even indication of reallocation cost increase in Hong Kong 1974-2005, India 1975-2004, and Taiwan 1976-2005. In these countries, the labor pull effect is the main driver.

5.3. Discussion and Policy Implications

The results of the analysis suggest that there is no definite predominant driver of structural change in different stages of development. For example, the labor pull effect has been the predominant driver of structural change throughout the early and late stage of development in Asia. By contrast, for most Latin American and OECD countries, reallocation cost reduction becomes the main driver of structural change.

However, we do find that labor pull first and then reallocation cost reduction is the pattern for countries that experienced a different main driver in their early and late stage of development. Therefore, we conclude that generally the labor structural transformation after WWII was first driven by labor pull in the early stage of development.

This result, together with the model propositions, leads to two policy implications. The growth of the non-agricultural sector, which generates the labor pull effect, is critical to the structural change in the early stage of development. Recall from the propositions that only the labor pull driven labor structural change generates a positive subsequent growth effect, thus adding to rather than canceling out the positive immediate productivity jump due to the shift of labor from a low productivity to a high productivity sector. Accordingly, policies that enhance non-agricultural productivity growth are more effective in engineering growth enhancing labor structural transformation rather than policies that attempt to enhance agricultural productivity or reduce labor barriers for reallocation. Such non-agricultural productivity growth enhancing policies are more likely to allow underdeveloped countries to growth fast.

Moreover, the food problem is not a critical constraint of modern economic development. From the development experience after WWII, we find that in general, reallocation cost reduction is the main driver of structural change rather than labor push when labor pull is no longer the main driver.

Therefore, reducing the barriers to labor movement or other reallocation costs for structural change from agriculture to non-agriculture is of secondary importance.

6. Concluding Remarks

We introduced a theory-based approach for identifying the main driver of labor structural transformation in different stages of development. We have found that all three drivers exist simultaneously in most countries. Furthermore, we have found that labor pull driven structural change is the typical main driver of the structural change for countries that experienced an early stage of development after WWII. Then, the structural change proceeds primarily through the labor pull effect in Asia, and through reallocation cost reduction in most Latin American and OECD countries. This result suggests that in general the main initial driver of the labor structural change (of noticeable growth experiences) after WWII is labor pull.

Since the model suggests that labor pull driven labor structural change is the most effective in generating productivity gains from reallocation, a natural next step is to understand how to enhance non-agricultural productivity growth such that we can induce growth enhancing structural change for less developed countries. We leave this interesting topic for future research.

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TABLE 1—SUMMARY FOR GUIDELINES AND PROPOSITIONS

Panel A. Summary for Guideline 1: existence check

Drivers	Agr. ALP growth rate	Non-agr. ALP growth rate	Reallocation cost
Labor push	>0	Any	Any
Labor pull	Any	>0	Any
Reallocation cost reduction	Any	Any	Downward trend

Panel B. Summary for Propositions 1-3 and Guidelines 2 and 3: (dominance check* and labor push check**)

Drivers	Food problem constraint**	Immediate jump effect	Subsequent growth effect*
Labor push	Binds	Positive	Negative
Labor pull	Does not bind	Positive	Positive
Reallocation cost reduction	Does not bind	Positive	Negative

TABLE 2—SUB-PERIOD CHARACTERISTICS AND EXISTENCE CHECK

	Early period (agr. share >30%)	Non-agr growth rate	Agr. growth rate	Reallocation cost (first year=100)	Late period (agr. share <30%)	Non-agr growth rate	Agr growth rate	Reallocation cost (first year=100)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Hong Kong	-	-	-	-	1974 to 2005	3.55%	0.40%	**2.327*** **
India	1975 to 2004	3.14%	0.79%	**0.374*** **	-	-	-	-
Indonesia	1971 to 2005	2.27%	2.36%	-0.157***	-	-	-	-
Japan	1953 to 1962	3.62%	7.77%	-1.031***	1963 to 2003	3.05%	2.36%	**Stable**
S. Korea	1963 to 1982	2.12%	3.78%	**Stable**	1983 to 2005	3.57%	5.41%	-0.715***
Malaysia	1975 to 1988	2.35%	4.04%	-0.927***	1989 to 2005	3.60%	3.34%	**Stable**
Philippines	1971 to 2005	0.58%	0.62%	-0.395***	-	-	-	-
Singapore	-	-	-	-	1970 to 2005	3.69%	1.93%	**Stable**
Taiwan	1963 to 1975	4.31%	4.47%	**Stable**	1976 to 2005	3.97%	3.90%	**0.125*** **
Thailand	1960 to 2005	2.33%	2.76%	**Stable**	-	-	-	-
Argentina	-	-	-	-	1950 to 2005	0.41%	2.93%	-0.862***
Bolivia	1950 to 2001	**-0.65%**	2.01%	-0.432***	2002 to 2003	**-9.89%**	9.78%	-^
Brazil	1950 to 1985	2.23%	2.51%	-0.036*	1986 to 2005	**-1.05%**	3.98%	-0.979***
Chile	1950 to 1961	2.20%	**-0.90%**	**0.422*** **	1962 to 2005	1.03%	4.57%	-0.963***
Colombia	1950 to 1990	1.16%	2.26%	-0.290***	1991 to 2005	0.56%	0.13%	**Stable**
Costa Rica	1950 to 1988	1.46%	2.05%	-0.327***	1989 to 2005	0.27%	3.09%	-1.351***
Mexico	1950 to 1978	1.76%	2.72%	-0.100***	1979 to 2005	**-0.57%**	1.58%	-0.450***
Peru	1960 to 1991	**-1.28%**	0.56%	-0.164***	-	-	-	-
Venezuela	1950 to 1964	1.81%	5.31%	-0.200***	1965 to 2005	**-1.74%**	1.91%	-0.620***
Denmark	-	-	-	-	1950 to 2005	1.90%	5.52%	-1.247***
France	-	-	-	-	1954 to 2005	2.33%	4.99%	-1.131***
W. Germany	-	-	-	-	1950 to 1991	2.92%	5.80%	-0.483***
Italy	1951 to 1962	3.05%	6.70%	-0.287***	1963 to 2005	1.62%	5.76%	-1.128***
Netherlands	-	-	-	-	1956 to 2005	5.27%	5.05%	-1.953***
Spain	1956 to 1964	4.11%	4.90%	-^	1965 to 2005	1.56%	5.10%	-1.618***
Sweden	-	-	-	-	1960 to 2005	2.29%	4.22%	-1.170***
U.K.	-	-	-	-	1950 to 2005	1.71%	3.80%	-1.252***
U.S.	-	-	-	-	1950 to 2005	1.43%	3.54%	-0.991***

Notes:

1. For the items denoted by a caret "^", we do not have results for the statistical test because the period is too short to generate an outcome.

2. A negative agricultural productivity growth rate precludes the existence of labor push (highlighted in bold).

3. A negative non-agricultural productivity growth rate precludes the existence of labor pull (highlighted in bold).

4. A stable or upward trend (a positive coefficient for trend) of reallocation costs precludes the existence of a reallocation cost reduction (highlighted in bold).

TABLE 3—IDENTIFICATION RESULTS

	Early period (agr. share >30%)	Main driver	Subsequent growth effect	Agr. output per head	Late period (agr. share <30%)	Main driver	Subsequent growth effect	Agr. output Per head
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Hong Kong	-	-	-	-	1974 to 2005	labor pull	0.10%	0.568**
India	1975 to 2004	labor pull	0.62%	0.684**	-	-	-	-
Indonesia	1971 to 2005	labor pull	0.72%	0.663**	-	-	-	-
Japan	1953 to 1962	labor pull	0.20%	-	1963 to 2003	labor pull	0.56%	0.738**
Korea	1963 to 1982	labor pull	0.41%	0.475**	1983 to 2005	labor pull	0.21%	0.68**
Malaysia	1975 to 1988	labor pull	0.10%	0.509**	1989 to 2005	labor pull	0.30%	0.448*
Philippines	1971 to 2005	labor pull	0.05%	**Stable**	-	-	-	-
Singapore	-	-	-	-	1970 to 2005	labor pull	0.09%	0.66**
Taiwan	1963 to 1975	labor pull	0.91%	0.376*	1976 to 2005	labor pull	0.77%	0.539**
Thailand	1960 to 2005	labor pull	1.43%	0.872***	-	-	-	-
Argentina	-	-	-	-	1950 to 2005	push/ c. reduction	**-0.23%**	**Stable**
Bolivia	1950 to 2001	push/c. reduction	**-0.84%**	**Stable**	2002 to 2003	-	**-0.44%**	-^
Brazil	1950 to 1985	labor pull	0.93%	0.67**	1986 to 2005	cost reduction	**-0.25%**	0.553**
Chile	1950 to 1961	labor pull	0.04%	0.441*	1962 to 2005	cost reduction	**-0.11%**	0.764***
Colombia	1950 to 1990	labor pull	0.07%	0.719**	1991 to 2005	labor pull	0.02%	0.414*
Costa Rica	1950 to 1988	labor pull	0.31%	0.541**	1989 to 2005	c. reduction	**-0.17%**	0.603**
Mexico	1950 to 1978	labor pull	0.54%	0.466**	1979 to 2005	c. reduction	**-0.17%**	0.498**
Peru	1960 to 1991	c. reduction	**-0.53%**	0.669**	-	-	-	-
Venezuela	1950 to 1964	labor pull	0.29%	0.484**	1965 to 2005	c. reduction	**-0.48%**	0.491**
Denmark	-	-	-	-	1950 to 2005	c. reduction	**-0.25%**	0.804***
France	-	-	-	-	1954 to 2005	c. reduction	**-0.06%**	0.876***
W. Germany	-	-	-	-	1950 to 1991	labor pull	0.35%	0.746***
Italy	1951 to 1962	labor pull	0.60%	0.496**	1963 to 2005	c. reduction	**-0.18%**	0.765***
Netherlands	-	-	-	-	1956 to 2005	labor pull	0.03%	0.917***
Spain	1956 to 1964	labor pull	0.37%	-^	1965 to 2005	c. reduction	**-0.18%**	0.751***
Sweden	-	-	-	-	1960 to 2005	Push/c. reduction	**-0.10%**	**Stable**
U.K.	-	-	-	-	1950 to 2005	c. reduction	**-0.03%**	0.853***
U.S.	-	-	-	-	1950 to 2005	c. reduction	**-0.05%**	0.601**

Notes:

1. labor pull: labor pull is the main driver; c. reduction: reallocation cost reduction is the main driver; push/c. reduction: reject the scenario that labor pull is the main driver but cannot reject the scenario that labor push is the main driver.
2. For the caret "^", we do not have results for the statistical test because the period is too short to generate an outcome.
3. A positive subsequent growth effect implies that the structural change is mainly driven by labor pull; a negative subsequent growth effect (highlighted in bold) implies that the structural change is mainly driven by labor push/reallocation cost reduction.
4. Non-stable agricultural (agr.) output per head or non-positive agricultural productivity growth (see columns (c) and (g) in Table 2) for the labor push/reallocation cost reduction scenario implies that reallocation cost reduction is the main driver.

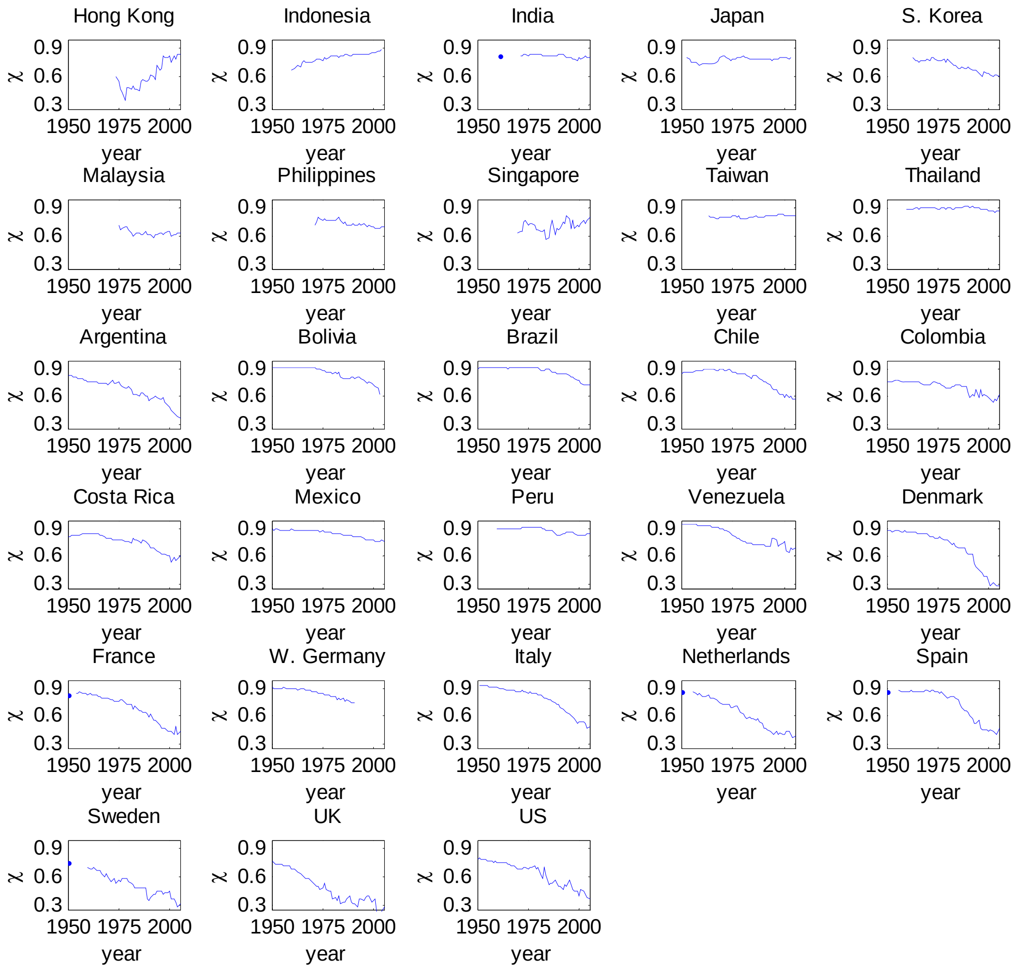

FIGURE 1. THE IMPUTED REALLOCATION COST (χ)

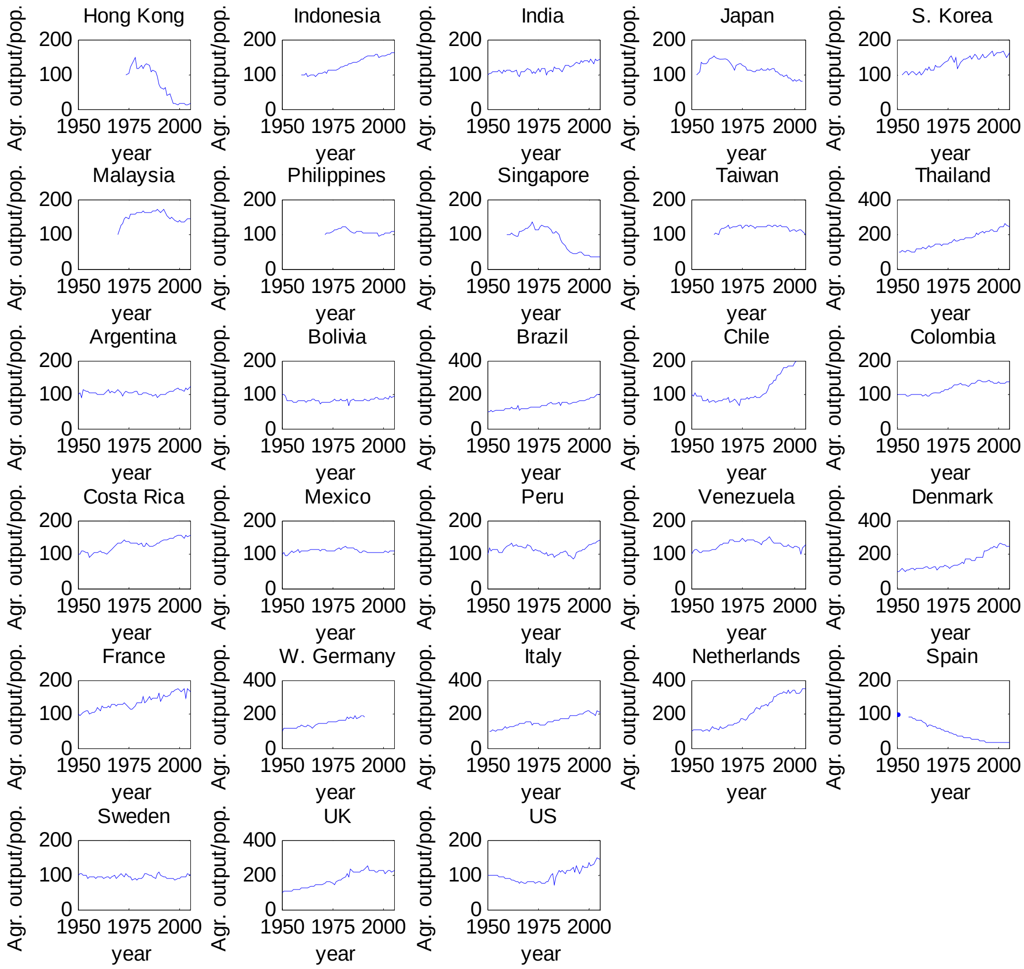

FIGURE 2. AGRICULTURAL OUTPUT PER CAPITA[20]

[20] All of the values are normalized to 100 in the first year that the data are available.

TECHNICAL APPENDIX A: THE MODEL WITH CAPITAL IN BOTH SECTORS.

Now we consider the extended model in which both the agricultural and non-agricultural sectors adopt the production technology using both capital and labor as inputs. Overall, the propositions and the identification rules for labor push, labor pull, and reallocation cost reduction are the same as those derived based on the model in which agricultural production technology uses only labor as the input.

We highlight the equations that are different under the model with capital in both sectors from that with capital only in non-agricultural production in Section A.1. Then, we discuss how labor push, labor pull, and reallocation cost reduction affect the subsequent growth effect in Sections A.2 to A.4. The results are summarized in Table A.1.

A.1. The Model

The production functions for Eqs. (2) and (3) become:

(A.1) $$Y_t^a = A_t^a \left[s_t^K K_t \right]^{1-\theta} \left[\left(s_t^L L_t \right) \right]^{\theta},$$

(A.2) $$Y_t^n = A_t^n \left[\left(1 - s_t^K \right) K_t \right]^{1-\alpha} \left[\left(1 - s_t^L \right) L_t \right]^{\alpha},$$

where s_t^K is the percentage of capital used in agricultural production. Accordingly, $1 - s_t^K$ is the percentage of capital used in non-agricultural production. s_t^K is chosen to equate the marginal product of capital across sectors and follows Eq. (A.3):

(A.3) $$(1-\theta) \frac{q_t Y_t^a}{s_t^k K_t} = (1-\alpha) \frac{Y_t^n}{(1-s_t^k) K_t}.$$

Similar to the main text, the family chooses the allocation of labor across sectors based on the following rule:

(A.4) $$s_t^L = \begin{cases} \left[\dfrac{N_t\bar{c}}{A_t^a\left(s_t^K K_t\right)^{1-\theta}\left(L_t\right)^{\theta}}\right]^{\frac{1}{\theta}} & if \dfrac{w_t^a}{w_t^n\cdot(1-\chi_t)} < 1, \\ 1 & if \dfrac{w_t^a}{w_t^n\cdot(1-\chi_t)} > 1, \\ \in [\left[\dfrac{N_t\bar{c}}{A_t^a\left(s_t^K K_t\right)^{1-\theta}\left(L_t\right)^{\theta}}\right]^{\frac{1}{\theta}},1] & if \dfrac{w_t^a}{w_t^n\cdot(1-\chi_t)} = 1, \end{cases}$$

where w_t^i, i={a, n} for {agriculture, non-agriculture}, equals the marginal product of labor of each sector in equilibrium. Similar to the discussion in the main text, we consider three scenarios: labor push, labor pull, and reallocation cost reduction.

In addition to the assumption that initial non-agricultural productivity is higher than initial agricultural productivity, we make two additional assumptions: First, capital is not confined to the agricultural sector in order to resolve the food problem characterized by Schultz (1953). Therefore, s_t^K is chosen based on Eq. (A.3) for all three scenarios. Second, the absolute value of the productivity (point) elasticity of s_t^K is smaller than that of s_t^L. That is, $\left|\frac{A_t^n}{s_t^K}\frac{\partial s_t^K}{\partial A_t^n}\right| < \left|\frac{A_t^n}{s_t^L}\frac{\partial s_t^L}{\partial A_t^n}\right|$, which implies the following:

$$\left|\frac{1}{s_t^K}\frac{\partial s_t^K}{\partial A_t^n}\right| < \left|\frac{1}{s_t^L}\frac{\partial s_t^L}{\partial A_t^n}\right|.$$

Next, based on Eqs. (A.1) and (A.2), the average labor productivity for the agricultural and non-agricultural sectors are as follows:

(A.5) $$ALP_t^a = \frac{A_t^a\left[s_t^K K_t\right]^{1-\theta}\left[\left(s_t^L L_t\right)\right]^{\theta}}{s_t^L L_t} = \frac{A_t^a\left[s_t^K K_t\right]^{1-\theta}}{\left(s_t^L L_t\right)^{1-\theta}} = \frac{A_t^a K_t^{\,1-\theta}}{\left[\left(L_t\right)\right]^{1-\theta}}\left[s_t^K\right]^{1-\theta} s_t^{L\,\theta-1},$$

(A.6) $$ALP_t^n = \frac{A_t^n\left[(1-s_t^K)K_t\right]^{1-\alpha}\left[\left((1-s_t^L)L_t\right)\right]^{\alpha}}{\left(1-s_t^L\right)L_t} = \frac{A_t^n\left[(1-s_t^K)K_t\right]^{1-\alpha}}{\left[(1-s_t^L)L_t\right]^{1-\alpha}}$$

$$= \frac{A_t^n K_t^{\,1-\alpha}}{\left[\left(L_t\right)\right]^{1-\alpha}}\left[1-s_t^K\right]^{1-\alpha}\left[1-s_t^L\right]^{\alpha-1}.$$

Finally, combining Eqs. (A.1) to (A.3), we obtain

$$(1-\theta)\frac{q_t A_t^a \left[s_t^K K_t\right]^{1-\theta}\left[\left(s_t^L L_t\right)\right]^{\theta}}{s_t^K K_t} = (1-\alpha)\frac{A_t^n \left[\left(1-s_t^K\right)K_t\right]^{1-\alpha}\left[\left(1-s_t^L\right)L_t\right]^{\alpha}}{(1-s_t^K)K_t}$$, which implies

(A.7) $$(1-\theta)q_t A_t^a \left[s_t^L \frac{L_t}{K_t}\right]^{\theta}\left(s_t^K\right)^{-\theta} = (1-\alpha)A_t^n\left[\left(1-s_t^L\right)\frac{L_t}{K_t}\right]^{\alpha}\left[\left(1-s_t^K\right)\right]^{-\alpha}.$$

Thus, we obtain the relationship between productivity (of the agriculture and non-agriculture sectors) and the percentage of capital used in the agricultural sector as follows.

For $\Delta \equiv \frac{(1-\alpha)\left[\left(1-s_t^L\right)\frac{L_t}{K_t}\right]^{\alpha}}{(1-\theta)q_t\left[s_t^L \frac{L_t}{K_t}\right]^{\theta}}$, we rearrange Eq. (A.7) and obtain:

either $A_t^a = \Delta A_t^n \frac{\left[\left(1-s_t^K\right)\right]^{-\alpha}}{\left(s_t^K\right)^{-\theta}}$ or $A_t^n = \frac{1}{\Delta} A_t^a \frac{\left(s_t^K\right)^{-\theta}}{\left[\left(1-s_t^K\right)\right]^{-\alpha}}$.

Therefore,

$$\frac{\partial A_t^a}{\partial s_t^K} = \Delta A_t^n\left\{-\alpha\left(1-s_t^K\right)^{-\alpha-1}(-1)\left(s_t^K\right)^{\theta} + \left(1-s_t^K\right)^{-\alpha}(\theta)\left(s_t^K\right)^{\theta-1}\right\} > 0,$$

$$\frac{\partial A_t^n}{\partial s_t^K} = \frac{1}{\Delta} A_t^a\left\{(-\theta)\left(s_t^K\right)^{-\theta-1}\left(1-s_t^K\right)^{\alpha} + \alpha\left(s_t^K\right)^{-\theta}\left(1-s_t^L\right)^{\alpha-1}(-1)\right\} < 0.$$

The above results together with the fact that $\frac{\partial s_t^K}{\partial A_t^a} = \frac{1}{\frac{\partial A_t^a}{\partial s_t^K}}$ and $\frac{\partial s_t^K}{\partial A_t^n} = \frac{1}{\frac{\partial A_t^n}{\partial s_t^K}}$ suggest that $\frac{\partial s_t^K}{\partial A_t^a} > 0$ and $\frac{\partial s_t^K}{\partial A_t^n} < 0$.

A.2. Scenario 1 (labor push): When $w_t^a < w_t^n(1-\chi_t)$

The equilibrium conditions for the labor push scenario suggests the following:

$$s_t^L = \left\{ \frac{N_t \bar{c}}{A_t^a \left[s_t^K K_t \right]^{1-\theta} L_t^{\theta}} \right\}^{\frac{1}{\theta}}, \text{ which implies that } s_t^L = \left\{ \frac{N_t \bar{c}}{\left[s_t^K K_t \right]^{1-\theta} L_t^{\theta}} \right\}^{\frac{1}{\theta}} \cdot \left(A_t^a \right)^{-\frac{1}{\theta}}.$$

Then, $\dfrac{\partial s_t^L}{\partial A_t^a} = \left\{ \dfrac{N_t \bar{c}}{\left[s_t^K K_t \right]^{1-\theta} L_t^{\theta}} \right\}^{\frac{1}{\theta}} \cdot \left(-\dfrac{1}{\theta} \right) \left(A_t^a \right)^{-\frac{1}{\theta}-1} < 0$.

From Eq.(A.5), we obtain

$$\frac{\partial ALP_t^a}{\partial A_t^a} = \frac{K_t^{1-\theta}}{\left[(L_t) \right]^{1-\theta}} \left[s_t^K \right]^{1-\theta} \left(s_t^L \right)^{\theta-1} + \frac{A_t^a K_t^{1-\theta}}{\left[(L_t) \right]^{1-\theta}} \left\{ (1-\theta) \left(s_t^K \right)^{-\theta} \left(s_t^L \right)^{\theta-1} \frac{\partial s_t^K}{\partial A_t^a} + (\theta-1) \left[s_t^K \right]^{1-\theta} s_t^{L\,\theta-2} \frac{\partial s_t^L}{\partial A_t^a} \right\}$$

$$= \frac{K_t^{1-\theta}}{\left[(L_t) \right]^{1-\theta}} \left[s_t^K \right]^{1-\theta} s_t^{L\,\theta-1} \left\{ 1 + A_t^a (1-\theta) \left\{ \frac{1}{s_t^K} \frac{\partial s_t^K}{\partial A_t^a} - \frac{1}{s_t^L} \frac{\partial s_t^L}{\partial A_t^a} \right\} \right\}$$

Since $\dfrac{\partial s_t^K}{\partial A_t^a} > 0$, $\dfrac{\partial s_t^L}{\partial A_t^a} < 0$, we obtain $\dfrac{\partial ALP_t^a}{\partial A_t^a} > 0$.

Also, from Eq. (A.6), we obtain

$$\frac{\partial ALP_t^n}{\partial A_t^a} = \frac{A_t^n K_t^{1-\alpha}}{\left[(L_t) \right]^{1-\alpha}} \left\{ -(1-\alpha) \left[1-s_t^K \right]^{-\alpha} \left[1-s_t^L \right]^{\alpha-1} \frac{\partial s_t^K}{\partial A_t^a} - (\alpha-1) \left[1-s_t^K \right]^{1-\alpha} \left[1-s_t^L \right]^{\alpha-2} \frac{\partial s_t^L}{\partial A_t^a} \right\},$$

$$= \frac{A_t^n K_t^{1-\alpha}}{\left[(L_t) \right]^{1-\alpha}} \left[1-s_t^K \right]^{1-\alpha} \left[1-s_t^L \right]^{\alpha-1} (1-\alpha) \left\{ \frac{1}{1-s_t^L} \frac{\partial s_t^L}{\partial A_t^a} - \frac{1}{1-s_t^K} \frac{\partial s_t^K}{\partial A_t^a} \right\}.$$

Since $\dfrac{\partial s_t^K}{\partial A_t^a} > 0$, $\dfrac{\partial s_t^L}{\partial A_t^a} < 0$, we obtain $\dfrac{\partial ALP_t^n}{\partial A_t^a} < 0$.

Accordingly, for the scenario where the percentage of labor in the agricultural sector falls and initial non-agricultural productivity is higher than initial agricultural productivity, we show that the subsequent growth effect is negative:

$$\left\{ \left(\frac{L_0^a}{L_0^a + L_0^n} - \frac{L_t^a}{L_t^a + L_t^n} \right) \cdot \left[\frac{ALP_0^n}{ALP_0^{\text{agg}}} \left(\frac{ALP_t^n}{ALP_0^n} - 1 \right) - \frac{ALP_0^a}{ALP_0^{\text{agg}}} \left(\frac{ALP_t^a}{ALP_0^a} - 1 \right) \right] \right\} < 0.$$

A.3. Scenario 2 (labor pull): When $w_t^a = w_t^n(1-\chi_t)$

The equilibrium conditions for the labor push scenario suggest the following:

(A.8) $$\theta \frac{q_t Y_t^a}{s_t^L L_t} = (1-\chi_t)\alpha \frac{Y_t^n}{(1-s_t^L)L_t}.$$

Combining Eqs. (A.1), (A.2) and (A.8), we obtain

(A.9) $$\theta \frac{q_t A_t^a \left[s_t^K K_t\right]^{1-\theta}\left[\left(s_t^L L_t\right)\right]^{\theta}}{s_t^L L_t} = (1-\chi_t)\alpha \frac{A_t^n \left[\left(1-s_t^K\right)K_t\right]^{1-\alpha}\left[\left(1-s_t^L\right)L_t\right]^{\alpha}}{(1-s_t^L)L_t},$$

$$\theta q_t A_t^a \left[s_t^K \frac{K_t}{L_t}\right]^{1-\theta}\left(s_t^L\right)^{\theta-1} = (1-\chi_t)\alpha A_t^n \left[\left(1-s_t^K\right)\frac{K_t}{L_t}\right]^{1-\alpha}\left[\left(1-s_t^L\right)\right]^{\alpha-1}.$$

Then, for $\Omega \equiv \dfrac{\theta q_t A_t^a \left[s_t^K \frac{K_t}{L_t}\right]^{1-\theta}}{(1-\chi_t)\alpha\left[\left(1-s_t^K\right)\frac{K_t}{L_t}\right]^{1-\alpha}}$, $A_t^n = \Omega \dfrac{\left(s_t^L\right)^{\theta-1}}{\left[\left(1-s_t^L\right)\right]^{\alpha-1}}$.

Thus,

$$\frac{\partial A_t^n}{\partial s_t^L} = \Omega\left\{(\theta-1)\left(s_t^L\right)^{\theta-2}\left(1-s_t^L\right)^{1-\alpha} + (1-\alpha)\left(s_t^L\right)^{\theta-1}\left(1-s_t^L\right)^{-\alpha}(-1)\right\} < 0.$$

From the above results, together with the fact that $\dfrac{\partial s_t^L}{\partial A_t^n} = \dfrac{1}{\frac{\partial A_t^n}{\partial s_t^L}}$, we obtain $\dfrac{\partial s_t^L}{\partial A_t^n} < 0$.

Then, based on the average productivity for agriculture defined in Eq. (A.5), we obtain

$$\frac{\partial ALP_t^a}{\partial A_t^n} = \frac{A_t^a K_t^{\,1-\theta}}{\left[\left(L_t\right)\right]^{1-\theta}}\left\{(1-\theta)\left[s_t^K\right]^{-\theta}\left[s_t^L\right]^{\theta-1}\frac{\partial s_t^K}{\partial A_t^n} + (\theta-1)\left[s_t^K\right]^{1-\theta}\left[s_t^L\right]^{\theta-2}\frac{\partial s_t^L}{\partial A_t^n}\right\}$$

$$= \frac{A_t^a K_t^{\,1-\theta}}{\left[\left(L_t\right)\right]^{1-\theta}}\left[s_t^K\right]^{1-\theta}\left[s_t^L\right]^{\theta-1}(1-\theta)\left\{\frac{1}{s_t^K}\frac{\partial s_t^K}{\partial A_t^n} - \frac{1}{s_t^L}\frac{\partial s_t^L}{\partial A_t^n}\right\}.$$

Since we know from above that $\frac{\partial s_t^K}{\partial A_t^n} < 0$, $\frac{\partial s_t^L}{\partial A_t^n} < 0$, and $\left|\frac{1}{s_t^K}\frac{\partial s_t^K}{\partial A_t^n}\right| < \left|\frac{1}{s_t^L}\frac{\partial s_t^L}{\partial A_t^n}\right|$ (assumed), we obtain that $\frac{\partial ALP_t^a}{\partial A_t^n}$ >0.

Next, based on the average productivity for non-agriculture defined in Eq. (A.6), we obtain

$$\begin{aligned}\frac{\partial ALP_t^n}{\partial A_t^n} &= \frac{K_t^{1-\alpha}}{[(L_t)]^{1-\alpha}}\left[1-s_t^K\right]^{1-\alpha}\left[1-s_t^L\right]^{\alpha-1} \\ &+ \frac{A_t^n K_t^{1-\alpha}}{[(L_t)]^{1-\alpha}}\left\{(1-\alpha)\left(1-s_t^K\right)^{-\alpha}\left(1-s_t^L\right)^{\alpha-1}\frac{\partial s_t^K}{\partial A_t^n}(-1)+(\alpha-1)\left[1-s_t^K\right]^{1-\alpha}\left(1-s_t^L\right)^{\alpha-2}\frac{\partial s_t^L}{\partial A_t^n}(-1)\right\} \\ &= \frac{K_t^{1-\alpha}}{[(L_t)]^{1-\alpha}}\left(1-s_t^K\right)^{1-\alpha}\left(1-s_t^L\right)^{\alpha-1}\left\{1+A_t^n(1-\alpha)\left\{\frac{1}{1-s_t^L}\frac{\partial s_t^L}{\partial A_t^n}-\frac{1}{1-s_t^K}\frac{\partial s_t^K}{\partial A_t^n}\right\}\right\}.\end{aligned}$$

Consequently, the results can be either positive or negative:

$$\begin{cases}\frac{\partial ALP_t^n}{\partial A_t^n} \le 0 \quad if \quad \frac{1}{1-s_t^L}\frac{\partial s_t^L}{\partial A_t^n}+\frac{1}{A_t^n(1-\alpha)} \le \frac{1}{1-s_t^K}\frac{\partial s_t^K}{\partial A_t^n}, \\ \frac{\partial ALP_t^n}{\partial A_t^n} > 0 \quad if \quad \frac{1}{1-s_t^L}\frac{\partial s_t^L}{\partial A_t^n}+\frac{1}{A_t^n(1-\alpha)} > \frac{1}{1-s_t^K}\frac{\partial s_t^K}{\partial A_t^n}.\end{cases}$$

Nevertheless, from Eq. (A.8), we know $\theta ALP^a = (1-\chi_t)\alpha ALP^n$ must always hold. Therefore, all other things being equal, the percentage changes of ALP^a due to changes in non-agricultural productivity has to be the same as that of ALP^n. Since the change in ALP^a is positive (i.e., $\frac{\partial ALP_t^a}{\partial A_t^n}$ >0), it follows that $\frac{\partial ALP_t^n}{\partial A_t^n}$ has to be positive. Moreover, $\left(\frac{ALP_t^a}{ALP_0^a}-1\right)$ and $\left(\frac{ALP_t^n}{ALP_0^n}-1\right)$ are the same.

Together with the assumption that initial average labor productivity in agriculture is lower than that in non-agriculture, we obtain a positive subsequent growth effect, under the scenario that the percentage of labor in the agricultural sector falls:

$$\left\{\left(\frac{L_0^a}{L_0^a+L_0^n}-\frac{L_t^a}{L_t^a+L_t^n}\right)\cdot\left[\frac{ALP_0^n}{ALP_0^{\text{agg}}}\left(\frac{ALP_t^n}{ALP_0^n}-1\right)-\frac{ALP_0^a}{ALP_0^{\text{agg}}}\left(\frac{ALP_t^a}{ALP_0^a}-1\right)\right]\right\} > 0.$$

A.4. Scenario 3 (Reallocation cost reduction): When $w_t^a = w_t^n(1-\chi_t)$

We obtain Eq. (A.10) by rearranging Eq. (A.9):

$$(1-\chi_t) = \frac{\theta q_t A_t^a \left[s_t^K \frac{K_t}{L_t} \right]^{1-\theta} \left(s_t^L \right)^{\theta-1}}{\alpha A_t^n \left[\left(1-s_t^K\right) \frac{K_t}{L_t} \right]^{1-\alpha} \left[\left(1-s_t^L\right) \right]^{\alpha-1}}. \tag{A.10}$$

Accordingly,

for $\Gamma \equiv \dfrac{\theta q_t A_t^a \left[\frac{K_t}{L_t} \right]^{1-\theta}}{\alpha A_t^n \left[\left(1-s_t^K\right) \frac{K_t}{L_t} \right]^{1-\alpha}} \dfrac{\left(s_t^K\right)^{1-\theta}}{\left(1-s_t^K\right)^{1-\alpha}}$, $\chi_t = 1 - \Gamma \cdot \left(s_t^L\right)^{\theta-1} \left[\left(1-s_t^L\right)\right]^{1-\alpha}$.

Alternatively, for $\Lambda \equiv \dfrac{\theta q_t A_t^a \left[\frac{K_t}{L_t} \right]^{1-\theta}}{\alpha A_t^n \left[\left(1-s_t^K\right) \frac{K_t}{L_t} \right]^{1-\alpha}} \dfrac{\left(s_t^L\right)^{\theta-1}}{\left[\left(1-s_t^L\right)\right]^{\alpha-1}}$,

$$\chi_t = 1 - \Lambda \cdot \left(s_t^K\right)^{1-\theta} \left[\left(1-s_t^K\right)\right]^{\alpha-1}.$$

Therefore,

$$\frac{\partial \chi_t}{\partial s_t^K} = -\Lambda \left\{ (1-\theta)\left(s_t^K\right)^{-\theta} \left(1-s_t^K\right)^{\alpha-1} + (\alpha-1)\left(s_t^K\right)^{1-\theta} \left(1-s_t^K\right)^{\alpha-2} (-1) \right\} < 0.$$

$$\frac{\partial \chi_t}{\partial s_t^L} = -\Gamma \left\{ (\theta-1)\left(s_t^L\right)^{\theta-2} \left(1-s_t^L\right)^{1-\alpha} + (1-\alpha)\left(s_t^L\right)^{\theta-1} \left(1-s_t^L\right)^{-\alpha} (-1) \right\} > 0,$$

The above results together with the fact that $\frac{\partial s_t^K}{\partial \chi_t} = \frac{1}{\frac{\partial \chi_t}{\partial s_t^K}}$ and $\frac{\partial s_t^L}{\partial \chi_t} = \frac{1}{\frac{\partial \chi_t}{\partial s_t^L}}$, suggest that $\frac{\partial s_t^K}{\partial \chi_t} < 0$ and $\frac{\partial s_t^L}{\partial \chi_t} > 0$.

Based on the average labor productivity for agriculture defined in Eq. (A.5), we obtain

$$\frac{\partial ALP_t^a}{\partial \chi_t} = \frac{A_t^a K_t^{1-\theta}}{[(L_t)]^{1-\theta}} \left\{ (1-\theta)\left[s_t^K\right]^{-\theta}\left[s_t^L\right]^{\theta-1} \frac{\partial s_t^K}{\partial \chi_t} + (\theta-1)\left[s_t^K\right]^{1-\theta}\left[s_t^L\right]^{\theta-2} \frac{\partial s_t^L}{\partial \chi} \right\}.$$

Together with the fact that $\frac{\partial s_t^K}{\partial \chi_t} < 0$ and $\frac{\partial s_t^L}{\partial \chi_t} > 0$, it follows that $\frac{\partial ALP_t^a}{\partial \chi_t}$ <0.

Next, based on the average labor productivity for non-agriculture defined in Eq. (A.6), we obtain

$$\frac{\partial ALP_t^n}{\partial \chi_t} = \frac{A_t^n K_t^{1-\alpha}}{[(L_t)]^{1-\alpha}} \left\{ (1-\alpha)\left[1-s_t^K\right]^{-\alpha}\left[1-s_t^L\right]^{\alpha-1} \frac{\partial s_t^K}{\partial \chi_t}(-1) + (\alpha-1)\left[1-s_t^K\right]^{1-\alpha}\left[1-s_t^L\right]^{\alpha-2} \frac{\partial s_t^L}{\partial \chi}(-1) \right\}.$$

Again, since $\frac{\partial s_t^K}{\partial \chi_t} < 0$ and $\frac{\partial s_t^L}{\partial \chi_t} > 0$, we have $\frac{\partial ALP_t^n}{\partial \chi_t}$ >0.

Therefore, for the scenario in which the reallocation cost (χ_t) falls, we focus on the results:

$$-\frac{\partial ALP_t^a}{\partial \chi_t} > 0, \quad -\frac{\partial ALP_t^n}{\partial \chi_t} < 0.$$

Accordingly, for the scenario that the percentage of labor in the agricultural sector falls, we obtain a negative subsequent growth effect:

$$\left\{ \left(\frac{L_0^a}{L_0^a + L_0^n} - \frac{L_t^a}{L_t^a + L_t^n}\right) \cdot \left[\frac{ALP_0^n}{ALP_0^{\text{agg}}}\left(\frac{ALP_t^n}{ALP_0^n} - 1\right) - \frac{ALP_0^a}{ALP_0^{\text{agg}}}\left(\frac{ALP_t^a}{ALP_0^a} - 1\right) \right] \right\} < 0.$$

TABLE A.1: SUMMARY OF MODEL PROPERTIES (MODEL WITH CAPITAL IN BOTH AGR AND NON-AGR.)

SCENARIO 1: LABOR PUSH				
$\frac{\partial s_t^K}{\partial A_t^a}$	$\frac{\partial s_t^L}{\partial A_t^a}$	$\frac{\partial ALP_t^a}{\partial A_t^a}$	$\frac{\partial ALP_t^n}{\partial A_t^a}$	Subsequent growth effect
>0	<0	>0	<0	<0
SCENARIO 2: LABOR PULL				
$\frac{\partial s_t^K}{\partial A_t^n}$	$\frac{\partial s_t^L}{\partial A_t^n}$	$\frac{\partial ALP_t^a}{\partial A_t^n}$	$\frac{\partial ALP_t^n}{\partial A_t^n}$	Subsequent growth effect
<0	<0	>0	>0	>0
SCENARIO 3: REALLOCATION COST REDUCTION				
$\frac{\partial s_t^K}{\partial \chi_t}$	$\frac{\partial s_t^L}{\partial \chi_t}$	$-\frac{\partial ALP_t^a}{\partial \chi_t}$	$-\frac{\partial ALP_t^n}{\partial \chi_t}$	Subsequent growth effect
<0	>0	>0	<0	<0

TECHNICAL APPENDIX B:

SENSITIVITY ANALYSIS FOR DIFFERENT DEMARCATION FOR EARLY AND LATE PERIODS

We repeat the exercise in Section 5.2 but choose different demarcation points for the early and late stages of development. In Section B.1, we explore the results based on a demarcation in which the percentage of labor in the agricultural sector falls from above 20% to below 20%. In Section B.2, we explore the results based on a demarcation in which the percentage of labor in the agricultural sector falls from above 40% to below 40%. Overall, the general results remain similar to those of the baseline case despite changes in county-specific characteristics. We still find that in the early stage, labor pull is a common driver; whereas in the late stage, labor pull remains the predominant driver in Asia but reallocation cost reduction becomes the main driver in most OECD and Latin American countries.

B.1. Demarcation at 20%

When we choose the demarcation point to be the point at which the percentage of labor in agricultural falls from above 20% to below 20%, the early and late periods of development are defined differently. Since it takes a longer time for the percentage of labor in agriculture to fall to 20% than to 30% (the baseline case), the early stage becomes longer and the late stage becomes shorter than in the baseline case.

We then conduct the existence check, the dominance check, and the labor push check and find the results similar. The results are summarized in Tables B.1 and B.2. For most countries, more than one driver exists simultaneously. Furthermore, although more OECD countries experienced early stages of development under this scenario, labor pull remains the main driver for all of the Asian and OECD countries. Moreover, the main driver for the late stage remains the same as in the baseline case for all of the Asian and OECD countries despite the fact that the late periods are defined differently.

However, the main driver changes for a few Latin American countries. For example, in Venezuela, when the early period extended until 1973 (instead of 1964 in the baseline case), reallocation cost reduction becomes the main driver. Moreover, in Costa Rica, when the late period is shortened to 1999-2005 due to the different demarcation point, the main driver becomes undetermined between labor push and reallocation cost reduction. Finally, in Mexico, when the late period is shortened to 1996-2005, labor pull becomes the main driver.

The results here remain consistent with the baseline case that the general pattern of development after WWII supports the labor pull hypothesis. Among the 22 countries that experienced early stages of development after WWII, the labor structural change of 18 countries is mainly driven by labor pull. Then, in the late stage, labor pull remains the main driver of structural change in all Asian countries that experienced a late stage, whereas reallocation cost reduction is the main driver for 9 out of 15 Latin American and OECD countries that experienced a late stage.

B.2. Demarcation at 40%

When we choose the demarcation point to be when the percentage of labor in agricultural falls from above 40% to below 40%, the early and late periods of development are defined differently. Since it takes a shorter time for the percentage of labor in agriculture to fall to 40% than to 30%, the early stage becomes shorter and the late stage becomes longer than in the baseline case.

As with the baseline case, we conduct the existence check, the dominance check, and then the labor push check and find similar results. The results are summarized in Tables B.3 and B.4. Again, we find that more than one driver exists simultaneously for most countries. Moreover, for all the Asian and OECD countries except Japan in the early stage, labor pull remains the main driver, as indicated in the baseline case. For Japan, where 1953-1955 is defined as the early stage, we find that the contribution of labor pull is dominated by that of labor push/reallocation cost reduction. Hayashi and Prescott (2008) suggest that the abolishment of the patriarchal system, which is reflected as a form of reallocation cost reduction, significantly contributes to the labor structural change right after WWII. This effect together with high agricultural productivity growth—the annual agricultural productivity in Japan is more than 15%— suggests that the contribution of labor pull to structural change is relatively weak during this period. Our result is consistent with this conclusion.

The results for some Latin American countries are different from the baseline case. For Colombia, when we take the years from 1976 onward as the late stage, reallocation cost reduction rather than labor pull (which is the main driver during 1991-2005) becomes the main driver. It suggests that when the late stage is lengthened, the contribution of the reallocation cost reduction is revealed. For Peru, the new demarcation point allows Peru to have both early and late stages of development and we find that labor pull is the main driver in the early stage; in the late stage, we find that labor push/reallocation cost reduction is the main driver. For Mexico and Venezuela, the main driver becomes undetermined between labor push and reallocation cost reduction. However, we still clearly exclude the labor pull effect.

In sum, the results here remain consistent with the baseline case that the general pattern of development after WWII supports the labor pull hypothesis. Among the 16 countries that experienced an early stage of development after WWII, the labor structural changes of 14 are mainly driven by labor pull. Then, in the late stage, labor pull remains the main driver of the structural change in Asian countries that experienced a late stage, whereas reallocation cost reduction is the main driver for 11 out of the 18 Latin American and OECD countries that experienced a late stage.

TABLE B.1—SUB-PERIOD CHARACTERISTICS AND EXISTENCE CHECK (DEMARCATION POINT: 20%)

	Early period (agr. share >20%)	Non-agr growth rate	Agr. growth rate	Reallocation cost (first year=100)	Late period (agr. share <20%)	Non-agr growth rate	Agr. growth rate	Reallocation cost (first year=100)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Hong Kong	-	-	-	-	1974 to 2005	3.55%	0.40%	**2.327*** **
India	1975 to 2004	2.27%	2.36%	**0.374*** **	-	-	-	-
Indonesia	1971 to 2005	3.14%	0.79%	-0.157***	-	-	-	-
Japan	1953 to 1969	5.05%	5.57%	**Stable**	1970 to 2003	2.19%	2.51%	**Stable**
S. Korea	1963 to 1988	2.76%	4.78%	-0.436***	1989 to 2005	3.49%	5.27%	-0.776***
Malaysia	1975 to 1993	2.80%	4.42%	-0.737***	1994 to 2005	3.17%	2.69%	**Stable**
Philippines	1971 to 2005	0.58%	0.62%	-0.395***	-	-	-	-
Singapore	-	-	-	-	1970 to 2005	3.69%	1.93%	**Stable**
Taiwan	1963 to 1979	4.46%	5.69%	**Stable**	1980 to 2005	4.04%	3.24%	**0.166*** **
Thailand	1960 to 2005	2.33%	2.76%	**Stable**	-	-	-	-
Argentina	1950 to 1965	0.41%	2.93%	-0.710***	1966 to 2005	0.41%	2.93%	-1.095***
Bolivia	1950 to 2003	**-0.82%**	2.23%	-0.476***	-	-	-	-
Brazil	1950 to 2000	1.23%	3.05%	-0.242***	2001 to 2005	**-0.81%**	1.02%	**Stable**
Chile	1950 to 1988	0.93%	1.73%	-0.205***	1989 to 2005	2.11%	6.70%	-1.595***
Colombia	1950 to 2005	0.81%	1.73%	-0.503***	-	-	-	-
Costa Rica	1950 to 1998	1.10%	2.66%	-0.518***	1999 to 2005	0.25%	0.70%	**Stable**
Mexico	1950 to 1995	0.48%	2.04%	-0.229***	1996 to 2005	1.42%	2.64%	-0.229***
Peru	1960 to 1991	**-1.28%**	0.56%	-0.164***	-	-	-	-
Venezuela	1950 to 1973	0.41%	5.26%	-0.361***	1974 to 2005	**-1.50%**	0.99%	-0.418***
Denmark	1950 to 1958	1.91%	4.32%	-0.298**	1959 to 2005	1.83%	5.95%	-1.534***
France	1954 to 1962	3.92%	5.26%	**Stable**	1963 to 2005	2.01%	5.02%	-1.311***
W. Germany	1950 to 1952	5.00%	11.73%	**Stable**	1953 to 1991	2.76%	5.55%	-0.512***
Italy	1951 to 1971	3.30%	7.24%	-0.393***	1972 to 2005	1.11%	5.66%	-1.408***
Netherlands	-	-	-	-	1956 to 2005	5.27%	5.05%	-1.953***
Spain	1956 to 1975	4.10%	4.42%	**0.033**	1976 to 2005	0.65%	5.22%	-2.058***
Sweden	-	-	-	-	1960 to 2005	2.29%	4.22%	-1.170***
U.K.	-	-	-	-	1950 to 2005	1.71%	3.80%	-1.252***
U.S.	-	-	-	-	1950 to 2005	1.43%	3.54%	-0.991***

Notes:

1. A negative agricultural productivity growth rate precludes the existence of labor push (highlighted in bold).

2. A negative non-agricultural productivity growth rate precludes the existence of labor pull (highlighted in bold).

3. A stable or upward trend (a positive coefficient for trend) of reallocation costs precludes the existence of a reallocation cost reduction (highlighted in bold).

TABLE B.2—IDENTIFICATION RESULTS (DEMARCATION POINT: 20%)

	Early period (agr. share >20%)	Main driver	Subsequent growth effect	Agr. output per head	Late period (agr. share <20%)	Main driver	Subsequent growth effect	Agr. output per head
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Hong Kong	-	-	-	-	1974 to 2005	labor pull	0.10%	0.568**
India	1975 to 2004	labor pull	0.72%	0.684**	-	-	-	-
Indonesia	1971 to 2005	labor pull	0.62%	0.663**	-	-	-	-
Japan	1953 to 1969	labor pull	1.02%	0.414*	1970 to 2003	labor pull	0.23%	0.588**
Korea	1963 to 1988	labor pull	0.60%	0.658**	1989 to 2005	labor pull	0.09%	0.443*
Malaysia	1975 to 1993	labor pull	0.21%	0.534**	1994 to 2005	labor pull	0.10%	**Stable**
Philippines	1971 to 2005	labor pull	0.05%	**Stable**	-	-	-	-
Singapore	-	-	-	-	1970 to 2005	labor pull	0.09%	0.660**
Taiwan	1963 to 1979	labor pull	1.13%	0.530**	1980 to 2005	labor pull	0.46%	0.556**
Thailand	1960 to 2005	labor pull	1.43%	0.872***	-	-	-	-
Argentina	1950 to 1965	push/c. reduction	**-0.23%**	**Stable**	1966 to 2005	push/c. reduction	**-0.23%**	**Stable**
Bolivia	1950 to 2003	push/c. reduction	**-1.15%**	**Stable**	-	-	-	-
Brazil	1950 to 2000	labor pull	0.37%	0.946***	2001 to 2005	c. reduction	**-0.00%**	0.497**
Chile	1950 to 1988	labor pull	0.07%	**Stable**	1989 to 2005	c. reduction	**-0.08%**	0.547**
Colombia	1950 to 2005	labor pull	0.02%	0.387*	-	-	-	-
Costa Rica	1950 to 1998	labor pull	0.01%	0.745*	1999 to 2005	push/c. reduction	**-0.00%**	**Stable**
Mexico	1950 to 1995	labor pull	0.02%	**Stable**	1996 to 2005	labor pull	0.03%	0.373*
Peru	1960 to 1991	c. reduction	**-0.53%**	0.669**	-	-	-	-
Venezuela	1950 to 1973	c. reduction	**-0.06%**	0.652**	1974 to 2005	c. reduction	**-0.16%**	0.627**
Denmark	1950 to 1958	labor pull	0.06%	0.497**	1959 to 2005	c. reduction	**-0.24%**	0.644**
France	1954 to 1962	labor pull	0.16%	0.557**	1963 to 2005	c. reduction	**-0.10%**	0.764***
W. Germany	1950 to 1952	labor pull	0.12%	0.500**	1953 to 1991	labor pull	0.25%	0.677**
Italy	1951 to 1971	labor pull	0.90%	0.624**	1972 to 2005	cost reduction	**-0.19%**	0.646**
Netherlands	-	-	-	-	1956 to 2005	labor pull	0.03%	0.917***
Spain	1956 to 1975	labor pull	0.80%	0.610**	1976 to 2005	c. reduction	**-0.26%**	0.688**
Sweden	-	-	-	-	1960 to 2005	push/c. reduction	**-0.10%**	**Stable**
U.K.	-	-	-	-	1950 to 2005	c. reduction	**-0.03%**	0.853***
U.S.	-	-	-	-	1950 to 2005	c. reduction	**-0.05%**	0.601**

Notes:

1. labor pull: labor pull is the main driver; cost reduction: reallocation cost reduction is the main driver; push/c. reduction: reject the scenario that labor pull is the main driver but cannot reject the scenario that labor push is the main driver.

2. A positive subsequent growth effect implies that the structural change is mainly driven by labor pull; a negative subsequent growth effect (highlighted in bold) implies that the structural change is mainly driven by labor push/reallocation cost reduction.

3. Non-stable agricultural (agr.) output per head or non-positive agricultural productivity growth (see columns (c) and (g) in Table B.1) for labor push/reallocation cost reduction scenario implies that reallocation cost reduction is the main driver.

TABLE B.3—SUB-PERIOD CHARACTERISTICS AND EXISTENCE CHECK (DEMARCATION POINT: 40%)

	Early period (agr. share >40%)	Non-agr growth rate	Agr. growth rate	Reallocation cost (first year=100)	Late period (agr. share <40%)	Non-agr growth rate	Agr. growth rate	Reallocation cost (first year=100)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Hong Kong	-	-	-	-	1974 to 2005	3.55%	0.40%	**2.327*** **
India	1975 to 2004	3.14%	0.79%	**0.374*** **	-	-	-	-
Indonesia	1971 to 2003	2.26%	2.23%	-0.155***	2004 to 2005	6.51%	**-0.47%**	-^
Japan	1953 to 1955	2.14%	17.31%	-3.694*	1956 to 2003	3.26%	2.84%	**0.151*** **
S. Korea	1963 to 1977	2.51%	4.07%	**Stable**	1978 to 2005	3.26%	5.74%	-0.820***
Malaysia	1975 to 1979	4.03%	4.29%	**0.462**	1980 to 2005	3.11%	3.38%	**Stable**
Philippines	1971 to 1996	0.20%	0.20%	-0.355***	1997 to 2005	1.61%	1.43%	**Stable**
Singapore	-	-	-	-	1970 to 2005	3.69%	1.93%	**Stable**
Taiwan	1963 to 1968	4.30%	8.84%	-0.933***	1969 to 2005	4.15%	3.83%	**0.097*** **
Thailand	1960 to 2003	2.35%	3.02%	**Stable**	2004 to 2005	2.29%	**-2.30%**	-^
Argentina	-	-	-	-	1950 to 2005	0.41%	2.93%	-0.855***
Bolivia	1950 to 1994	**-0.54%**	1.77%	-0.356***	1995 to 2003	**-2.47%**	4.79%	-1.841***
Brazil	1950 to 1975	2.97%	2.39%	**0.039*** **	1976 to 2005	**-0.73%**	3.77%	-0.774***
Chile	-	-	-	-	1950 to 2005	1.32%	3.32%	-0.648***
Colombia	1950 to 1975	1.91%	2.33%	-0.197***	1976 to 2005	**-0.07%**	1.27%	-0.774***
Costa Rica	1950 to 1971	2.94%	3.48%	**Stable**	1972 to 2005	**-0.05%**	1.85%	-0.918***
Mexico	1950 to 1971	2.64%	3.07%	-0.074***	1972 to 2005	**-0.51%**	1.62%	-0.431***
Peru	1960 to 1979	1.54%	0.99%	**0.130*** **	1980 to 1991	**-6.18%**	0.49%	-0.945***
Venezuela	1950 to 1953	1.60%	5.28%	**Stable**	1954 to 2005	**-0.99%**	2.64%	-0.632***
Denmark	-	-	-	-	1950 to 2005	1.90%	5.52%	-1.247***
France	-	-	-	-	1954 to 2005	2.33%	4.99%	-1.131***
W. Germany	-	-	-	-	1950 to 1991	2.92%	5.80%	-0.473***
Italy	1951 to 1955	2.28%	5.04%	**Stable**	1956 to 2005	1.93%	6.20%	-0.983***
Netherlands	-	-	-	-	1956 to 2005	5.27%	5.05%	-1.953***
Spain	-	-	-	-	1956 to 2005	1.98%	5.11%	-1.252***
Sweden	-	-	-	-	1960 to 2005	2.29%	4.22%	-1.170***
U.K.	-	-	-	-	1950 to 2005	1.71%	3.80%	-1.252***
U.S.	-	-	-	-	1950 to 2005	1.43%	3.54%	-0.978***

Notes:

1. For the items denoted by a caret "^", we do not have results for the statistical test because the period is too short to generate an outcome.

2. A negative agricultural productivity growth rate precludes the existence of labor push (highlighted in bold).

3. A negative non-agricultural productivity growth rate precludes the existence of labor pull (highlighted in bold).

4. A stable or upward trend (a positive coefficient for trend) of reallocation costs precludes the existence of a reallocation cost reduction (highlighted in bold).

TABLE B.4—IDENTIFICATION RESULTS (DEMARCATION POINT: 40%)

	Early period (agr. share >40%)	Main driver	Subsequent growth effect	Agr. output per head	Late period (agr. share <40%)	Main driver	Subsequent growth effect	Agr. output per head
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Hong Kong	-	-	-	-	1974 to 2005	labor pull	0.10%	0.568**
India	1975 to 2004	labor pull	0.62%	0.684**	-	-	-	-
Indonesia	1971 to 2003	labor pull	0.68%	0.717**	2004 to 2005	-	**-0.07%**	-^
Japan	1953 to 1955	push/c. reduction	**-0.09%**	**Stable**	1956 to 2003	labor pull	0.92%	0.815 ***
Korea	1963 to 1977	labor pull	0.42%	0.575**	1978 to 2005	labor pull	0.23%	0.575**
Malaysia	1975 to 1979	labor pull	0.15%	0.367*	1980 to 2005	labor pull	0.37%	0.577**
Philippines	1971 to 1996	labor pull	0.01%	**Stable**	1997 to 2005	labor pull	0.03%	0.422*
Singapore	-	-	-	-	1970 to 2005	labor pull	0.09%	0.660**
Taiwan	1963 to 1968	labor pull	0.27%	0.408**	1969 to 2005	labor pull	1.21%	0.495**
Thailand	1960 to 2003	labor pull	1.33%	0.849***	2004 to 2005	-	0.03%	-^
Argentina	-	-	-	-	1950 to 2005	push/c. reduction	**-0.23%**	**Stable**
Bolivia	1950 to 1994	push/c. reduction	**-0.54%**	**Stable**	1995 to 2003	c. reduction	**-0.71%**	0.500**
Brazil	1950 to 1975	labor pull	1.09%	0.645**	1976 to 2005	c. reduction	**-0.42%**	0.661**
Chile	-	-	-	-	1950 to 2005	c. reduction	**-0.00%**	0.707**
Colombia	1950 to 1975	labor pull	0.25%	0.513**	1976 to 2005	c. reduction	**-0.12%**	0.502**
Costa Rica	1950 to 1971	labor pull	0.50%	0.429**	1972 to 2005	c. reduction	**-0.21%**	0.455*
Mexico	1950 to 1971	labor pull	0.64%	0.509**	1972 to 2005	push/c. reduction	**-0.27%**	**Stable**
Peru	1960 to 1979	labor pull	0.33%	0.561**	1980 to 1991	push/c. reduction	**-0.87%**	**Stable**
Venezuela	1950 to 1953	labor pull	0.05%	**Stable**	1954 to 2005	push/c. reduction	**-0.51%**	**Stable**
Denmark	-	-	-	-	1950 to 2005	c. reduction	**-0.25%**	0.804***
France	-	-	-	-	1954 to 2005	c. reduction	**-0.06%**	0.876***
W. Germany	-	-	-	-	1950 to 1991	labor pull	0.35%	0.746***
Italy	1951 to 1955	labor pull	0.18%	**Stable**	1956 to 2005	c. reduction	**-0.15%**	0.889***
Netherlands	-	-	-	-	1956 to 2005	labor pull	0.03%	0.917***
Spain	-	-	-	-	1956 to 2005	c. reduction	**-0.12%**	0.906***
Sweden	-	-	-	-	1960 to 2005	push/c. reduction	**-0.10%**	**Stable**
U.K.	-	-	-	-	1950 to 2005	c. reduction	**-0.03%**	0.853***
U.S.	-	-	-	-	1950 to 2005	c. reduction	**-0.05%**	0.601**

Notes:

1. labor pull: labor pull is the main driver; c. reduction: reallocation cost reduction is the main driver; push/c. reduction: reject the scenario that labor pull is the main driver but cannot reject the scenario that labor push is the main driver.

2. For the caret "^", we do not have results for the statistical test because the period is too short to generate an outcome.

3. A positive subsequent growth effect implies that the structural change is mainly driven by labor pull; a negative subsequent growth effect (highlighted in bold) implies that the structural change is mainly driven by labor push/reallocation cost reduction.

4. Non-stable agricultural (agr.) output per head or non-positive agricultural productivity growth (see columns (c) and (g) in Table B.3) for labor push/reallocation cost reduction scenario implies that reallocation cost reduction is the main driver.