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Skills, migration, and industrial structure in a dual economy

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Abstract

A comparative-static model describes the decline of manufacturing in the face of rising overseas employment through a mechanism other than the Dutch Disease. Instead it is competition for skilled labour and the relative ease in producing skills that affect the size of the manufacturing sector, including its employment of unskilled labour.

Keywords: deindustrialisation, manufacturing and services sector, migration, skills

JEL Codes: O14, O15

Beginning in the 1990s, the Philippine economy began to manifest novel—indeed somewhat paradoxical—characteristics from the viewpoint of standard development economics. These features include the following:

(a) A reversal of the large net resource-transfers of the 1980s from the debt hangover and the emergence of large net surpluses on primary account[2]. The latter is due mainly to large flows of overseas remittances from the exodus of a large part of the labour force. The same fact also implies that gross national income has exceeded gross domestic product on a regular basis since 1991;

(b) The rise of services since 1997 as the largest sector of the economy, in terms of share in both output and employment. This has occurred without the country experiencing an agriculture-to-industry transition; in recent years, low-productivity services have also been augmented by higher-skill services, notably outsourced business processes.

(c) The long-term stagnation of the manufacturing sector, particularly the manufactured-export sector, in relative terms of shares of both output and employment;

(d) The emergence of overseas remittances as the main factor in sustained current-account surpluses since 2002. The same fact implies that domestic saving now exceeds domestic investment, making the

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[2] "Net factor income from abroad" under the older nomenclature.

Philippines a net lender to other countries and imparting a stability to the external accounts unprecedented in the country's history;

(e) Despite the foregoing, the Philippines faces persistently low rates of investment and saving, which in turn leads to low trajectories of long-term growth; and therefore the persistence of the classic problems of development, namely, low productivity and incomes, high rates of poverty, high inequality, and the social costs these entail.

These trends constitute a puzzle and beg for an explanation, since they diverge from the well-documented East Asian success stories (from Japan to, most recently, China). The latter, by contrast, involved rapid transitions, usually involving a quantum rise in agricultural productivity after some agrarian reform or agricultural modernisation; an industrialisation based primarily on exports of labour-intensive manufactures; significant direct foreign investment; high rates of saving, investment, and growth that resulted in rapid reductions in levels of poverty over a relatively short historical period. These general features are well accepted, although the extent to which conscious industrial policy (i.e., promotion of selected industries by the state) played an indispensable role remains in dispute. To explain the Philippines' "deviant behaviour", several hypotheses have been advanced (see Williamson and de Dios [forthcoming] for a survey). These include the Dutch-Disease effects of chronic currency overvaluation stemming first from rapid debt-accumulation and then to overseas remittances (see, e.g., Fabella [2011]); perennial institutional uncertainty—dealing mainly with political stability and legitimacy stemming from corruption that led to fall-off in investment [de Dios 2009]—and finally liberalisation. Without prejudging the importance of each of the foregoing hypotheses, the present paper contributes to the discussion by proposing a fourth possible explanation of the deindustrialisation phenomenon: a mechanism that works through the supply of skills to manufacturing.

The next section discusses the empirical basis for the skill differences posited in the model. The model itself is explained and developed in Sections 2-4,while comparative-static results are presented in Sections 5-8. The final section discusses the relevance of the results in reconstructing the country's shifting industrial pattern.

1. Skill differences

Large differences in skill levels or educational attainment between workers deployed for overseas work and the rest of the labour force are a well-established feature of many labour markets where migration is prominent. The Philippines is no exception: Filipinos who are successfully recruited for jobs overseas are typically better educated than the average member of the labour force, a trend that has only been accentuated in recent years. Ducanes [2012] notes, for example, that 35 percent of overseas workers in 2007 were college graduates, compared with only 14 percent of the domestic labour force; moreover 82 percent of overseas workers had at least some college education, compared with only 27 percent of the general labour force. If anything, this

disparity has only become emphasised over two decades (Table 1). Contributing to this phenomenon is the policy of "quality-selective" immigration policies of many receiving countries.

Table 1. Distribution of overseas workers and the domestic labour force by educational attainment (1989 and 2007, in percent)

	1989		2007	
	Overseas workers	Domestic labour force	Overseas workers	Domestic labour force
Non-high school graduate	16.5	63.4	11.6	47.8
High school graduate	29.2	17.0	26.2	25.3
College undergraduate	30.2	9.2	27.2	12.8
College graduate	23.8	10.3	35.0	14.0
No information	0.4	0.0	-	-
Total	100.0	100.0	100.0	100.0

Source: Ducanes [2012, Table 1.1] derived from the *Family Income and Expenditure Surveys*(National Statistical Coordination Board).

In the event, in a country that allows overseas migration for its nationals, a worker's decision to acquire skills or education will naturally be influenced by the income prospects of overseas employment, in addition to the possibility of employment in one or another sector of the domestic economy. Skills are required for entry into a high-productivity domestic sector (e.g., telecommunications, business-process outsourcing) or work overseas. By contrast, no skills are required in the domestic low-productivity sectors like agriculture or lower-end services (e.g., domestic retail and small-scale transport).

Looking at the domestic labour force, on the other hand, it is also evident that skill and education levels are highest for the services sector, where some 24percent of those employed in 2010 had college degrees or higher; this is to be compared with only 11 percent and 2.2 percent in industry and agriculture, respectively. If anything, however, these figures are understated to the extent the sectors are heterogeneous. The services sector, in particular, contains significant segments (e.g., retail trade and personal services) that are associated with low productivity and low educational levels, so that the gap between the modern services sector alone and the rest of the economy would be even larger than what is suggested by Tables 2 and 3.

Table 2. Educational attainment of the domestic labour force by branch of industry (1988 and 2010, in percent)

	1988		2010	
	Zero years of college	At least some years of college	Zero years of college	At least some years of college
Agriculture	92.3	7.7	95.3	4.7
Industry	73.9	26.1	80.7	19.3
Services	57.5	42.5	64.7	35.3

Source: Computed from the Labour Force Surveys (National Statistical Coordination Board).

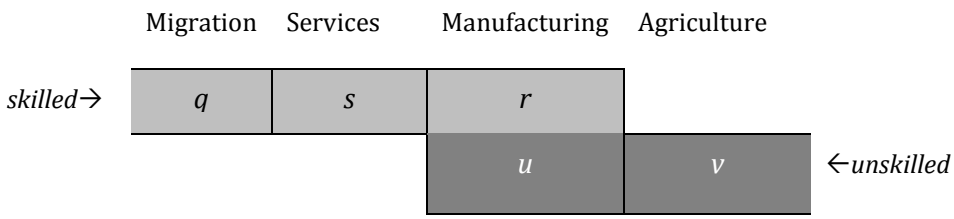
Table 3. Educational attainment of the domestic labour force by branch of industry
(1988 and 2010, in percent)

	1988			2010		
	Agriculture	Industry	Services	Agriculture	Industry	Services
Non-high school graduate	79.6	45.1	37.5	74.4	39.0	29.3
High school graduate	13.6	31.6	25.3	18.0	34.8	28.2
College undergraduate	4.8	13.1	15.3	5.5	15.4	18.4
College graduate or higher	1.9	10.1	21.4	2.2	10.7	24.0
No information	0.0	0.1	0.5	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Labour Force Surveys (National Statistical Coordination Board).

This broad skills pattern is now used in the conceptual model described below, which posits that the both new services sector (e.g., business-process outsourcing) and overseas migrant sector draw exclusively from the most skilled sector of the labour force. On the other hand, agriculture[3] uses only the least- or unskilled parts of the labour force. The distinctive characteristic of the manufacturing (or more broadly industrial) sector, however, is that it is a hybrid: it uses a combination of skilled and unskilled labour. This scheme is shown in Figure 1 below (the letters refer to variable names used in the next section).

Figure 1.



We want to inquire into how such a hybrid sector as manufacturing is affected when exogenous changes in employment and productivity occur in the nonhybrid sectors (services and agriculture). This will be done in the following sections.

2. Production sectors

We represent a domestic economy with three sectors distinguished by skill requirements, as suggested by the data. A modern services sector uses only skilled labour s to produce output Y according to the function F (assumed twice-differentiable and concave):

$$Y_1 = F(s;K), \text{ with } F'(s;K) > 0,\ F''(s;K) < 0, F'_K(s;K) > 0.$$

[3] As already noted, unskilled labour is also used by the low-productivity services sector, but we henceforth designate that combined sector as "agriculture", for brevity.

where the derivatives are understood as referring to the variable factor *s*. In the Philippines this is typified by the business-process outsourcing sector, which typically requires highly educated labours. *K* is a shift-parameter (e.g., capital or technology) that raises the marginal product of *s*. Another source of demand for skilled labour is industry—the focus of our inquiry—where output Y_2 is produced using both skilled labour *r* and unskilled labour *u* according to the production function:

$$Y_2 = G(r, u)$$

where *G* is a well-behaved production function that is homogeneous of degree one. Linear homogeneity allows one to write the marginal products of skilled and unskilled labour, respectively, as:

(1) $g'(r/u)$ and $g(r/u) - (r/u)g'(r/u)$, with $g'(r/u) > 0, g'' < 0$

where *g* is the per-capita production function derived from $Y_2/u = G(r/u, 1) = g(r/u)$. Skilled labour may also be deployed for overseas work in the exogenously fixed amount *q* set by immigration quotas of the receiving countries. As already explained, the fact that immigration draws from the highly skilled pool is partly due to the selective immigration policies of destination countries. Denoting the total skilled labour force by *n*, therefore, we have:

(2) $n = s + r + q$.

The total pool of unskilled labour is divided between a part *u* that is engaged in industry and a part *v* that is in low-productivity self-employment, including retail trade, personal services, and so on. Production in the subsistence sector takes place using only unskilled labour according to the concave function *H*:

$$Y_3 = H(v;Z), \text{ with } H'(v;Z) > 0, H''(v;Z) < 0; \; H'_Z(v; Z) > 0.$$

Here, again, *K* is a shift parameter representing capital or technology that raises the marginal product of *v*, and the derivatives are defined with respect to *v*.

The total labour force *N*, which is fixed and inelastic, is then fully accounted for:

(3) $N = n + u + v = (s + r + q) + u + v$.

Equilibrium in each labour market requires that each category must be paid the same domestic wage, so that for skilled workers:

(4) $F'(s; K) = g'(r/u) = w_S$,

while for the unskilled,

(5) $H'(v, Z) = g(r/u) - (r/u)g'(r/u) = w_U$.

Sector-output prices here have provisionally all been set equal to one to reduce notation. This also highlights the subject of this paper, which is the reallocation of labour across sectors, rather than terms-of-trade effects as in the Dutch Disease literature.

3. Skills-acquisition

An important feature of this description is the allocation of the labour force N between skilled and unskilled workers, which is not fixed but endogenous, so that n itself is a variable.

The expected wage for a skilled worker is $hw_S + (1 - h)W$, where h and $(1 - h)$ are respectively the probabilities of being employed at home and overseas, assuming a worker possesses higher skill qualifications, W is the exogenous foreign wage, and $w_S$is the domestic wage for skilled persons.

The cost of acquiring skills or education is negatively related to abilities. Let the labour force be distributed in the interval $[0, N]$ in decreasing order of its members' possession of ability. The cost to the kth worker of acquiring the required skill is $c(k)$, where the worker's ability is already implied by his position on the interval. As a result we have $c(k_1)>c(k_2)$, for $k_1>k_2$, and we can write the cost-function for skilled labour as:

$$c(n),\ n\in [0, N],\ c'(n)> 0.$$

Here "cost" is comprehensive and includes both financial costs (out-of-pocket and implicit) and psychic costs. This depiction is similar in spirit to the modelling by Beine, Docquier, and Rapoport [2003], except for the fact that they consider home wages that are constant.

Note that the elasticity of c is:

$$\varepsilon(n) = c'(n)(n/c(n))> 0 \qquad (6)$$

A higher elasticity implies sharply increasing costs for any proportional increase in would-be skilled workers and is therefore associated with a system that has greater difficulty turning out skills. (Conversely, a smaller ε indicates a system that produces skilled workers more easily.)

A worker indexed, say, by n_k has a choice whether to acquire skills at the cost $c(n_k)$ and earn the expected skilled wage $hw_S + (1 - h)W$ in the skilled sector (including the possibility of earning the foreign wage W), or to refrain from doing so. If no other considerations come into play, skills will be acquired by all workers $z$for whom the expected skilled wage exceeds the cost, i.e., for whom the following holds: $(1 - h)w_S + hW - c(n_k)> 0$, or alternatively $(1 - h)w_S + hW>c(n_k)$. For given h, therefore, the dividing line between those who do and who do not acquire skills is given by n^* in the following:

$$(1 - h)w_S + hW = c(n^*),$$

where all workers indexed $n_k \leq n^*$ acquire skills while for all indexed $n_k > n^*$ choose not to do so.

The probability h is itself endogenous, however. First, the number of overseas workers is determined by a quota, q. The remainder of the skilled workers, namely, $(n - q)$, earn the domestic skilled wage w_S. One may therefore take the probability of earning a domestic skilled wage as $(n - q)/n = (1 - h)$ and of the foreign wage W as $(q/n) = h$, which allows one to write the equilibrium condition determining n as:

$$(7)\ \left(\frac{n-q}{n}\right) w_S + \left(\frac{q}{n}\right) W - c(n) = 0$$

4. Labour market-clearing

Using equations (1)-(6) allows one to describe the equilibrium in all labour markets by the following system (8):

$$(8)\begin{cases} \left(\frac{s}{n}\right) F'(s;K) + \left(\frac{r}{n}\right) g'(r/u) + \left(\frac{q}{n}\right) W - c(n) = 0 \\ F'(s;K) - g'(r/u) = 0 \\ g(r/u) - \left(\frac{r}{u}\right) g'(r/u) - H'(v;Z) = 0 \\ q + r + s - n = 0 \\ n + u + v - N = 0 \end{cases}$$

If a solution exists, these five equations can be used to find n, r, s, u, and v. The first equation proceeds from (7) and describes equilibrium in workers' expectations between the expected benefits from obtaining training and its costs; the second requires equality between skilled-labour wages across all sectors, as defined by (4); the third does the same for unskilled-labour wages as in (5); and the last two are market-clearing conditions for skilled and unskilled labour from respectively, using (3).

The dimension of system(8)can be reduced by using the second equation in the first and expressing other variables in terms of n, s, and u:

$$(9)\begin{cases} \left(\frac{n-q}{n}\right) F'(s;K) + \left(\frac{q}{n}\right) W - c(n) = 0 \\ F'(s;K) - g'((n-q-s)/u) = 0 \\ g((n-q-s)/u) - \left(\frac{n-q-s}{u}\right) g'((n-q-s)/u) - H'(N-n-u;Z) = 0 \end{cases}$$

If a solution exists, system (9)can be used to determinen^0, s^0, and u^0. Solutions for v and r are then obtained as $v^0 = N - n^0 - u^0$ and $r^0 = n^0 - q - s^0$.

5. An increase in migration opportunities

A central issue of interest is whether and how greater outmigration affects the allocation of labour across industries. On one hand, a higher migration quota directly draws from and therefore reduces the current supply of skilled labour; on the other hand, it also raises expected returns from skills-acquisition and therefore also increases the supply. It remains to be seen what the net effect is and what conditions influence it.

It is first of all straightforward to determine that the Jacobian determinant of the above system is

$$(10) \quad \Delta = -\left(\left(\frac{q}{n^2}\right)(W - F') + c'(n)\right)A + \left(1 - \frac{r}{u}\right)B < 0,$$

where $A = [(r^2/u^3)(F''g'') + F''H'' + g''H''/u] > 0$ and $B = ((n - q)/n)(F''g''H'')/u < 0$ and of course $r = n - q - s$. The first term is negative, since $W - F' > 0$ in fact and by assumption. On the other hand, the second term is also negative, since it is almost true in typical manufacturing industries in developing countries thatunskilled workers outnumber the skilled, i.e., $r/u < 1$.

From the above one is able to determine:

$$(11) \; \partial n/\partial q = \frac{-\left(\frac{W-F'}{n}\right)A + \left(1 - \frac{r}{u}\right)B}{-\left(\frac{q}{n^2}(W - F') + c'(n)\right)A + \left(1 - \frac{r}{u}\right)B} > 0.$$

For the same reasons that $\Delta < 0$, the numerator of the above is also negative, which leads to the positive derivative. An increase in the migration quota, therefore, unambiguously increases the pool of skilled labour.

It is useful to ask, however, whether and when the higher quota induces an increase in the skilled-labour pool in excess of the change in quota itself, i.e., not only whether $\partial n/\partial q$is positive but whether it is greater than unity. From (11)one sees this depends entirely on whether

$$(12) \left(\frac{W - F'}{n}\right) < \left(\frac{q}{n^2}(W - F') - c'(n)\right),$$

whichafter some rewriting and using (6) yields

$$\left(\frac{n - q}{n}\right)\frac{(W - F')}{c(n)} < \frac{c'(n)n}{c'(n)}$$

$$(13) \left(\frac{n - q}{n}\right)\rho < \varepsilon(n),$$

where $\rho = (W - F')/c(n)$ is the migration premium for an investment in skills, while η, as before, is the cost-elasticity of skills. The inequality (12) says that an increase in migration quotas calls forth more a *less* than one-for-one supply of the skilled if (a) the migration premium is low; (b) the cost-elasticity of skills is high (i.e., additional skill labourers are difficult to develop); and (c) the number of migrants is already "large" relative to the skilled labour force. Condition (13) also proves significant in subsequent results.

It is important to recall that "cost" here refers not only to the financial cost but also the psychic cost of additional trainees. If, on the other hand—as seems true for the Philippines—there is a bottleneck in the supply of suitable additional candidates for skilled work, then the cost-elasticity may in fact be high and the condition may not be fulfilled. In that case, $\partial n/\partial q < 1$, with consequences to be discussed in the following section.

6. Effects on industrial structure

It remains to see what the system implies for employment in the various sectors when migration opportunities expand exogenously. First, the effect on services-sector employment is determined in a straightforward manner:

$$(14) \quad \partial s/\partial q = \frac{-g''H''\left(1+\frac{r}{u}\right)\left(\left(\frac{W-F'}{n}\right)-\left(\frac{q}{n^2}(W-F')-c'(n)\right)\right)}{\Delta}$$

$$= \frac{-g''H''\left(1+\frac{r}{u}\right)\left[\left(\frac{n-q}{n}\rho-\varepsilon\right)\right]}{\Delta}$$

The last equation has been rewritten following(12) and (13). Recalling that $\Delta < 0$, it follows that

$$(15) \quad \text{sgn}(\partial s/\partial q) = \text{sgn}\left(\frac{n-q}{n}\rho-\varepsilon\right).$$

That is, the employment of skilled workers in the services sector expands, remains the same, or contracts with migration opportunities, under the same conditions that the latter affects the pool of skilled labour by more than one-to-one. The factors are, to wit: a higher migration premium, a lower existing stock of migrants, and a low cost-elasticity of skills. The hopeful scenario where brighter prospects of overseas employment induce a supply of skilled labour that helps expand services now appears to depend crucially on the ease or difficulty with which an economy produces skilled labour. Indeed, if condition (13)holds, the expansion of overseas employment may actually represent a penalty to the services sector.

The impact of a higher $q$on unskilled labour employed in manufacturing is given by the following:

$$(16)\ \partial u/\partial q = \frac{\left(F''H'' + \frac{g''H''}{u}\right)c(n)n(\rho(n+q)+\varepsilon) - \frac{2F'g'H'}{u}\left(\frac{n-q}{n}\right)}{\Delta} + \frac{\frac{F'g'r}{u^2}\left(\frac{n-q}{n}\rho - \varepsilon\right)}{\Delta}$$

Upon inspection, it a sufficient condition for a positive numerator (and therefore a negative derivative) is the fulfilment of condition (13) in the last term. The difficulty in producing skilled labour in response to increased migration actually has a latent knock-on effect on the employment of the unskilled and the size of the manufacturing sector.

The effect on the employment of skilled labour in manufacturing *r* can be intuitively deduced by remembering that services-sector employment shrinks if (13)is fulfilled. This implies that wages for the same skilled labour rise not only in services but also in manufacturing, which in turn is associated with a fall in r/u, the skilled-unskilled labour mix. It has already been shown, however, that *u* falls when (13) holds. A fall in r/u, combined, with a fall in *u* can only mean that *r* falls proportionately even more than *u*. Hence *r* falls.

Finally it remains to consider what happens to subsistence-sector employment *v*. The fall in r/u implies a fall in the marginal product (and therefore wages) of unskilled labour in manufacturing, which must be reflected in an equivalent fall in wages in the subsistence sector. The can occur only if *v* expands.

The narrative thus far can be summarised as follows. Greater overseas employment opportunities are a drain on the existing pool of the skilled. Because of inelastic supply, however, the number of skilled workers rises by less than what the higher outmigration requires. This depletes the supply of skilled labour available to the domestic services industry, as well as to manufacturing. Skilled-labour wages rise as employment is cut down in both domestic sectors. Despite a degree of substitutability between skilled and unskilled labour, there is a knock-on effect on unskilled labour in manufacturing. This is partly the depletion of available skilled workers (owing to the increase in skilled labour force).

The foregoing discussion allows one to make the following:

> **Claim 1**. If condition (13) holds, then an increase in migration opportunities *q* is associated with the following:(i) a fall in services-sector employment *s*; (ii) a fall in both skilled and unskilled employment in manufacturing (*r* and *u*); (iii) a fall in the skilled-unskilled labour ratio (r/u) in manufacturing; (iv) a rise in subsistence-sector employment, *v*; and (v) a wider differential between the wages of skilled and unskilled labour.

7. New investment in the services sector

The next event to analyse is a rise in investment specific to the services sector. A major development for the Philippines was the new investment in services in the late 1990s associated with a deregulation of the telecommunications industry and motivated by new developments in information and communications technology. One might then ask how this affects the other sectors. To begin with, it is easily verified that the general-equilibrium production effect of the investment on own-sector employment is positive:

$$(17)\partial s/\partial K = \frac{1}{\Delta}\left[-F'_K \frac{g''H''}{u}\left(\frac{n-q}{n}\right)\left(1+\frac{r}{u}\right) + F'_K\left(\frac{q}{n^2}+c'(n)\right)\left(\frac{r^2}{u^3}g'' + H''\right)\right]$$

The expression in brackets is negative, so the derivative is unqualifiedly positive (again remembering $\Delta < 0$). The increase in the marginal product of skilled labour in services raises wages, which must be matched by the other user of skilled labour, manufacturing.

It is less straightforward to pin down the effect on the employment of unskilled labour in industry:

$$(18)\partial u/\partial K = \frac{1}{\Delta}\left[-F'_K \frac{g''r}{u^2}\left(\frac{q(W-F')}{n^2}+c'(n)\right) + \left(\frac{n-q}{n}F'_K H''\right)\left(\frac{g''}{u}-F''\right)\right].$$

Since the first term of the expression in square brackets is positive, and since $H'' < 0$, it suffices that $(g''/u) - F'' < 0$ for the entire bracketed expression to be positive. If so then an increase in services-sector employment causes a fall in unskilled employment in industry. The quantities g''/u and F'' are the slopes (evaluated at equilibrium) of the marginal product curves of skilled labour in the industry and service sectors, respectively. The sufficient condition is then really a requirement that the demand curve for skilled labour in the industry sector be steeper than that in services. This can be alternatively expressed in terms of elasticities:

$$(19)\left(\frac{g''}{u}-F''\right) < 0 \rightarrow (r\eta_r - s\eta_s) < 0,$$

where the ηs are the elasticities of labour demand in the two sectors, i.e., $\eta_s = |(g'/g'')(u/r)|$ and $\eta_r = |F'/F''s|$, and we have used the fact that $g' = F'$ in equilibrium.[4] It will be noted that $r\eta_r - s\eta_s$ is simply the *ex-ante* difference between the absolute changes in skilled employment in the industry and services sectors resulting from a one-percent change in wages. The rough interpretation of (19) is that the higher skilled wage caused by new investment in services fails to draw out a great deal of skilled labour from industry. This therefore requires an increase in supply through the conversion of more

[4] Rewrite $(g''/u) - F'' < 0$ as $|g''/u| > |F''|$; then $|rg''/ug'|(g'/r) > |F''s/F'|(F'/s)$; $(1/\eta_r)(g'/r) > (1/\eta_s)(F'/s)$, or $(1/\eta_r)(1/r) > (1/\eta_s)(1/s)$, since $F' = g'$. This leads to $\eta_r r < \eta_s s$, as given in the text.

unskilled into skilled workers. That in turn pulls up the wages of unskilled labour for industry and therefore reduces the employment of the unskilled even in the subsistence sector.

If a higher *K* reduces unskilled employment in manufacturing, then *r* must also fall. The higher marginal product of skilled labour in services raises wages for skilled workers in manufacturing and therefore lowers the skilled-unskilled ratio (r/u) in that sector. But since we already know *u* falls, then *r* must fall by an even larger proportion.

Finally it is also possible to infer that *n* must increase, though by a smaller proportion than the increase in *s*, since part of the increase comes from the fall in *r*. The exact expression describing the resulting change in *n* is:

$$(20)\partial n/\partial K = -\frac{1}{\Delta}\left(\frac{n-q}{n}\right)\frac{F'_K g'' r^2}{u}\left(H'' + \frac{g''}{u^3}\left(1-\frac{1}{u}\right)\right).$$

This is positive given the sign conventions already established. Since the wages of unskilled labour rise, the marginal product of the subsistence must also have risen, which happens only if *v* falls. Summarising, we have:

$$\partial s/\partial K\,, \partial n/\partial K > 0;\ \partial r/\partial K, \partial u/\partial K < 0;\ \partial v/\partial K < 0,$$

And we are able to state the following:

> **Claim 2**. An exogenous increase in investment in the services-sector causes (i) an expansion of service-sector employment*s* and—if condition (19) is met—(ii) a reduction in skilled and unskilled employment in industry, *r* and *u*; (iii) a lower skilled-unskilled ratio r/u in manufacturing; (iv) an fall in subsistence-sector employment, *v*; and (v) a narrowing of the skilled- vs. unskilled-wage differential.

The second scenario potentially explains why a tradable sector such as new services can expand, even while another tradable sector such as manufacturing declines. It should be noted that such a differential trend will not be evident from a simple Dutch Disease analysis, which typically predicts a contraction in all tradable sectors.

8. A rise in subsistence-sector productivity

To complete the discussion, we analyse the effect of an exogenous increase in subsistence-sector productivity, say, through an increase in investment or improvement of technology in that sector. In reality, the aim is to analyse the effect of its opposite, i.e., a fall in productivity.

Formally, we inquire into the effect of a rise in *Z* on *n*, *s*, and *u*. Under the assumptions already made (remembering especially that $\Delta < 0$), the relevant results are the following:

$$(21)\ \frac{\partial n}{\partial Z} = \frac{H'_Z}{\Delta}\left(\left(\frac{n-q}{n}\right)\left(\frac{r}{u^2}\right)F''g''\right) < 0.$$

$$(22)\ \frac{\partial s}{\partial Z} = \frac{H'_Z}{\Delta}\left(q\left(\frac{W-F'}{n^2}\right)\left(\frac{r}{u^2}\right)g''\right) > 0.$$

$$(23)\ \frac{\partial u}{\partial Z} = \frac{H'_Z}{\Delta}\left(-q\left(\frac{W-F'}{n^2}\right)\left(F'' + \frac{g''}{u}\right) + \left(\frac{n-q}{n}\right)\frac{F''g''}{u}\right) < 0.$$

The above expressions predict a fall in the size of the skilled labour force *n*, a rise in employment in skilled services *s*, and a fall in unskilled labour employed in industry *u*. More plainly, the exogenous rise of marginal productivity in the subsistence sector draws in unskilled labour at the expense of industry. This causes industry to shed skilled labour *r* as well, which is partly released into services, lowering skilled wages in general. Lower skilled wages reduce the attractiveness of skills acquisition and reduce the pool of skilled labour more generally. This results in:

> **Claim 3.**An exogenous increase in marginal productivity in the subsistence sector will: (a) raise employment *v* in the subsistence sector; (b) reduce both skilled (*r*) and unskilled (*u*) employment in industry (and therefore shrinks industrial output as a whole); (c) lowers wages but raises employment (*s*) and output in the skilled-services sector; (d) causes industry to be more skill-intensive (i.e., raises r/u), and (d) reduces the supply of skilled labour *n* in general.

These results simply need to be reversed to describe a situation of declining agricultural productivity, the case that is potentially interesting in historical terms.

9. Analyses and preliminary conclusions

The foregoing comparative-statics provide a framework for possible explanation for the unusual changes in industrial structure that the Philippines experienced in the three decades 1980-2010.

Overseas labour migration first became a major phenomenon in the mid- to late-1990s, after the worst of the debt and political crises of 1984-1986.[5] This can be represented in the model as an increase in *q*. As the preceding analysis shows (Claim 1), such an event has an adverse effect on the equilibrium size of employment of both the services and the industrial sectors, but increases the size of the subsistence sector, where the latter is understood as including not only agriculture but also the subsistence subsector of services. It is a stylised fact

[5]The earlier episode of workers' migration to the Middle East in the wake of the oil-price boom of the mid-1970s was a minor phenomenon by comparison.

of Philippine growth that this has indeed occurred; this part of the story is therefore adequately described by the model.

While the decline in industry is at least partly attributable to the foreign-exchange shortage caused by the debt crisis, which deprived industry of important inputs, it does not suffice to explain the shape of the industrial structure once the worst of that crisis had passed. That structure, once reconstituted, was decidedly nonindustrial. The analysis presented here suggests a channel distinct from the Dutch Disease, namely one that operates through the depletion of the skills base. With respect to manufacturing, the notion of "skilled" labour may be interpreted to include potential entrepreneurs[6], adding a broader dimension to the depletion of that supply through the overseas labour market.

The effects of an exogenous rise in productivity of the high-end services sector predicted by this model also conform closely with what is already known about the impact of liberalisation and massive investment in the telecommunications sector beginning in 1997. The model (Claim 2) predicts that the high-end services sector should expand at the expense of the industrial sector, as skilled workers are drawn out of the latter, and this is broadly what has occurred. A less obvious predicted impact, however, is the knock-on effect on the industrial sector, where the loss of skilled labour also leads to a shrinkage in the employment of the unskilled. The subsistence sector is ultimately affected as labour is drawn away from it. The picture is consistent with a decline in the employment shares of both industry and agriculture, at the expense of new services.

By contrast, the effects on industrial structure of a decline of productivity in the subsistence sector fail to align with the popular line of thinking on the matter. In this model, a fall in subsistence-sector productivity (i.e., working Claim 3 in reverse) is in fact expected to benefit *both* the industrial sector and the services sector. The model's mechanism works through lower wages in the subsistence sector, which draw more unskilled labour into industry. This threatens to raise the wages of skilled labour in both industry and services, increasing the pool of skilled workers overall. In effect, therefore, a decline in subsistence sector productivity is "friendly" to both industry and services. The model, therefore, fails to support a hypothesis where the decline of, say, agricultural productivity is a reason for de-industrialisation—in fact the opposite is the case. In this respect, the model's prediction is akin to the "price-scissors" model of industrialisation, where wages of agriculture are squeezed to benefit the modern sector. A possible direction to explore is the incorporation of a minimum wage, binding for industry but not for the subsistence sector. Then it is straightforward to see that a rise in this statutory wage (analogous to the rise in subsistence productivity discussed here) will obviously be detrimental to industry and services, as described above. A fall in the statutory wage, on the other hand, benefits both.

[6]I thank Jeff Ducanes for pointing out this possible interpretation.

What was presented above is a single-period model, whose interpretation requires one to assume that what one observes flows (or changes in flows) in the variables treated, e.g., in the size of the labour-force and its subdivisions, or in the size of the flow-demand from the overseas market. Alternatively, one may use the interpretation of different equilibria simultaneously attained by different economies. While this approach suffices for our purpose of indicating broad patterns and directions, it is not adapted to answering questions about the changes in stocks through time, e.g., changes in the size of the overseas labour force. A stock-approach is potentially important if one wanted to represent the effects through time of an increasing number of overseas workers deployed, which would then be reflected in increasing remittances. A second direction to explore is a multi-period (at least two periods) version of the preceding model. This is a necessary step if one wants to graft this model onto a "demand"-side model that represents the Dutch Disease phenomenon. A provisional approach to represent resource-pull effects of changes in output prices would be to insert output prices in the labour-market clearing conditions and then examine the effects of relative-price changes on labour-allocation.

We believe the model developed here represents the principal changes in Philippine industrial structure in the analytic detail merited by such an important historical shift. It suggests that the incorporation of the supply-side elements of skills-acquisition must be regarded as indispensable in future discussions of secular changes observed in Philippine industrial structure.

END

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