Threshold Externalities in Intermediates, Substitution Elasticities, and Manufacturing Wages*

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May 20, 2007

*Funding from the World Bank and the Helen and Roy Ryu Chair is acknowledged. The views expressed in the paper are entirely those of the authors. Responsibility for all remaining errors is ours. We are grateful for feedback on earlier versions of the paper from seminar participants at LACEA (RIN) meetings and University of Washington.

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Abstract: The objective of the paper is to investigate the empirical basis for a set of models of multiple equilibria based on increasing returns in intermediate goods. The premise of these models is that the main impediments to growth are due to thresholds arising from externalities or coordination problems in the production of intermediate goods. Before crossing such a threshold, the economy is trapped in one of many "poor" equilibria. Breaking the development trap requires crossing the threshold in order to move into one of the many "good" equilibria paths of growth. The logic of the models is compelling. Since empirical work preceding this theoretical development was not tightly linked with underlying models, there is a noticeable gap in the empirical literature. This paper takes a step in the direction of theory-based empirical investigation of these models. Data from UNIDO that is substantive in three dimensions — time, countries, and industries — are used to investigate whether variety in intermediates imposes threshold barriers, and whether breaking those barriers via increases in the variety of intermediates has the potential to increase manufacturing wages.

JEL Classification: O12, O14, C23.

Keywords: Intermediates; Variety; Multiple Equilibria; Fixed Effects. Gross Substitutes and Complements.

1. Introduction

The objective of this paper is to empirically consider evidence on multiple equilibria due to coordination failures. Specifically, the problem of development is supposed to be the coordination failure in the production of intermediate goods. The greater is the *variety* available in intermediate goods, the more superior are the final goods produced using those intermediate inputs. Thus, complementarities exist in intermediates production and must be overcome in order for a robust industrialization process to take root. Complementarities are the theme behind the theories of coordination failures put forth in the seminal papers of Rosenstein-Rodan (1943) and Hirschmann (1958). Their idea was that investments are not made because complementary investments are not forthcoming. Backwards and forward linkages, that are crucial to industrialization thus remain stunted, forestalling the process of industrialization before it even begins (Ray 2000). Absent such coordination failures, investments would beget other complementary investments, setting the economy on a new equilibrium growth path. Complementarities thus yield multiple equilibria. We build upon a simple theoretical model of complementarities in the production of intermediates, employing the Dixit-Stiglitz-Ethier (DSE) model of increasing returns in intermediate goods. This model is the workhorse for growth theories which emphasize intermediates. Weitzman (1994) demonstrates how the DSE framework facilitates models of growth based on increasing returns, as well as models of multiple equilibria.[1]

The empirical basis for theories featuring increasing returns in intermediate goods is not firmly established. The early study by Chenery et al. (1986) has been used as the motivation for the theoretical models, but that empirical evidence bears little connection with the later theoretical models of development and growth, notably Ciccone and Hall (1996), Ciccone and Matsuyama (1996), Faini (1984), Howitt (1999), Matsuyama (1991), Murphy, Shleifer, and Vishny (1989), Rodriguez-Clare (1996), and Rodrik (1996). This paper seeks to narrow that gap in the literature by establishing an empirical basis.

[1] Weitzman also shows the equivalence in the reduced forms from both, the DSE model as well as the model of Hotelling-Lancaster-Chamberlain model of differentiated products on a circle. So use of the reduced form from that model should also yield the same results.

In order to study this problem for a variety of countries and industries, a central task is to construct a theoretically sound measure of "variety" in intermediates that is widely applicable. Only a select set of studies has attempted to empirically establish a relationship between variety in intermediates and growth because measuring variety has proved elusive. A contribution of this paper is to compute an adequate proxy for variety in intermediate goods using easily available data for a range of middle-income, developing, and emerging countries. Feenstra et al. (1999) and Feenstra and Kee (2004) derive a carefully constructed measure of variety in intermediates. Their measure is attractive, for it takes into account increases in the number of inputs due to the introduction of new inputs, as well as changes in their values due to changing technology and relative input demand. The availability of data precludes the use of their demanding, though rigorous, measures at the scope of our study. We appeal to a special result that allows us to use more aggregate industry-level data in order to carry out our study at the breadth we desire. Data from UNIDO that are rich in three dimensions — time, countries and industries — are used to estimate the relationship between variety in intermediates and wage growth in manufacturing. As more detailed data emerge, it will be of interest to conduct our study using the Feenstra et al. (1999) and Feenstra-Kee (2004) measures to see if our results continue to hold.

The paper takes a step towards testing models in which multiple equilibria occur due to "threshold externalities". The focus in this paper is on externalities posed by the requirement of a threshold number of intermediates varieties before final goods of high quality may be produced. The testable implication of the model is a conditional prediction about the relationship between variety in intermediates and manufacturing wages. The relationship rests on conditions about whether primary inputs and intermediates are used as gross complements or gross substitutes in the production of final goods. One way of interpreting the results is that if the conditions on gross complementarity or gross substitutability are as indicated by the results, then the theory of coordination failures is validated. The findings in the paper also have an important bearing on the finding by Solow (1958) about the non-constancy of input shares in production functions. Thus, another way of interpreting the results is that if the theory of coordination failures is valid, then the empirical findings indicate whether primary inputs and intermediates are used as gross complements or gross substitutes in manufacturing. We find heterogeneity across regions in how inputs are combined in the manufacture of final goods. This result is new to the literature. We expect the answer to the question of why such heterogeneity exists in production to lie in the varaition in regulations and factor market rigidities across countries.

The paper proceeds as follows. Section 2 reviews theoretical models of multiple equilibria and their testable implications. Importantly, in this section we develop a simple theory-based measure of variety in intermediates. Sections 4 lays out the empirical methodology and discusses the data. The results are reported and analyzed in Section 4. Section 5 discusses policy implications of the findings. Section 6 concludes.

2. Theory

The Intermediates Sector

The basic DES model of "love of variety" in intermediates goods production is as follows. A final consumer good, C, is produced competitively using a production function $F = F(X, L)$, where L denotes labor and X a composite of different intermediate inputs. X is produced using a symmetric CES production function,

$$X = \left[\sum_{i}^{n} x_i^{1-1/\sigma} \right]^{\sigma/(\sigma-1)}, \tag{1}$$

with $\sigma > 1$, where σ is the partial elasticity of substitution between any pair of input varieties. $\sigma > 1$ implies that no input is essential while each is equally useful. A useful parameterization is in terms of κ, where $\kappa = 1 - (1/\sigma)$, so that $\sigma > 1$ implies $\kappa \in (0, 1)$. Then the production of the composite intermediate good is given by

$$X = \left[\sum_{i}^{n} x_i^{\kappa} \right]^{1/\kappa}. \tag{2}$$

Let M be the total quantity of intermediate goods used in production of a final good, $M = \sum_{i=1}^{n} x_i$. Suppose each input variety x_i is produced using one unit of labor. Since each input variety enters symmetrically into production, it is efficient to produce using the same quantity of each variety, $x_i = x$. Then $M = nx$ and

$$X = (nx^{\kappa})^{1/\kappa} = Mn^{(1-\kappa)/\kappa}. \tag{3}$$

Since $\kappa \in (0,1)$, productivity in the intermediate sector increases with n.[2] Ethier (1982) ascribes this source of increasing returns to specialization in production.

In order to derive the equilibrium number of varieties, we make the standard assumption of Bertrand competition, so that profit maximizing price P is a mark up over marginal cost as the ratio P/MC=$1/\kappa$. The poorer the substitutability between intermediate varieties (greater $1/\kappa$), the higher the markup. Suppose production of any intermediate variety requires a fixed cost of one unit of labor plus a marginal cost of one unit of labor. With labor earning a wage equal to w, MC=w, and the profit to a producer from producing x units of the intermediate variety is $x(w/\kappa - w) - w$. With free entry this equals zero, so that the profit maximizing output of any variety is:[3]

$$x = \frac{\kappa}{1-\kappa} \tag{4}$$

Since the output of each intermediate variety is fixed, the size of the intermediates goods sector depends on equilibrium number of varieties n. n is determined by the full employment condition, and the division of labor into the amount used directly in production and the amount used in the intermediate goods sector. The shares of labor used directly in the production of finished good C and in the intermediate goods sector are straightforward to determine once the specific

[2] In term of the parameterization in (1), $M = nx$ and $X = (nx^{1-1/\sigma})^{\sigma/(\sigma-1)} = Mn^{1/(\sigma-1)}$. Since $\sigma > 1$, the productivity of intermediate goods increases with n.

[3] More generally, if production of intermediate varieties have a fixed cost f, then profit maximizing output is at $x = f.\kappa/(1-\kappa)$.

form of the CRS production function for C is given.

Final Goods Production: Measuring variety

In this section we construct a theory-based measure of variety in intermediates that is simple enough to measure using widely available data. Assume that the final good F is sold in competitive markets and uses a CES production function to combine the composite intermediate input (X) with labor (L) as

$$F = \left[\gamma X^{\frac{e-1}{e}} + (1-\gamma) L^{\frac{e-1}{e}}\right]^{\frac{e}{e-1}}, \tag{5}$$

where γ is a share-parameter, and $e > 0$ is the elasticity of substitution between the two factors. The production function is linear if $e = \infty$, Cobb-Douglas is $e = 1$, and Leontief when $e = 0$. When $e > 1$ then X and L are *gross substitutes* in the production of F, implying that the demand for X increases with an increase in the price of factor L (holding constant X's own price and the quantity of L). When $e < 1$ then X and L are *gross complements*, in which case the demand for X moves inversely with the price of L.

The relative marginal product of the factors is

$$\frac{MP_X}{MP_L} = \frac{1-\gamma}{\gamma}\left(\frac{X}{L}\right)^{-\frac{1}{e}}. \tag{6}$$

so that the ratio of their total products is

$$\frac{MP_X \cdot X}{MP_L \cdot L} = \frac{1-\gamma}{\gamma}\left(\frac{X}{L}\right)^{\frac{e-1}{e}}. \tag{7}$$

Denoting the price of L by p_L and of X by p_X, the linear homogeneity of production implies that $\frac{MP_X}{MP_L} = \frac{p_X}{p_L}$. Substituting into (7), the share of X in total (gross) output relative to the share of L is given by

$$\frac{p_X \cdot X}{p_L \cdot L} = \frac{1-\gamma}{\gamma} \left(\frac{X}{L}\right)^{\frac{e-1}{e}}. \tag{8}$$

Note that this relative share is decreasing or increasing in the relative price p_X/p_L depending on whether $e > 1$ (L and K are gross substitutes) or $e < 1$ (L and K are gross complements), respectively. The relative share is independent of the price ratio if $e = 1$ (Cobb Douglas).[4]

In order to link this result with variety in intermediates we use the result (Ciccone and Matsuyama 1996) that the price p_X of the composite intermediate input X and the price of labor p_L is determined by the number of intermediate varieties n as:

$$\frac{p_X}{p_L} = n^{\frac{1}{1-\sigma}}, \text{ or } n = \left(\frac{p_X}{p_L}\right)^{1-\sigma}, \tag{10}$$

where $\sigma > 1$ is the elasticity of substitution among symmetric intermediate varieties in (1).

The main result (Ciccone and Matsuyama 1996) is that the relative share is increasing in n if $e > 1$ (L and K are gross substitutes) and decreasing in n if $e < 1$ (L and K are gross complements). The relative share is independent of the price ratio if $e = 1$ (Cobb Douglas). [5] Denote by α the share of the intermediate input X in (gross) output of F. Then, since the two shares exhaust total product, α is also increasing, decreasing or independent of the price ratio p_X/p_L, respectively, as $e > 1$, $e < 1$, or $e = 1$. We have thus established a (conditional) relationship between n and α.

[4] To see this, take the log of both sides and differentiate with respect to $\ln(p_X/p_L)$:

$$\frac{\partial \ln \frac{p_X \cdot X}{p_L \cdot L}}{\partial \ln \frac{p_X}{p_L}} = \left(\frac{e-1}{e}\right) \frac{\partial \ln \frac{X}{L}}{\partial \ln \frac{p_X}{p_L}} = \left(\frac{e-1}{e}\right) \cdot (-e) = 1 - e. \tag{9}$$

[5] Taking logs of both sides of (8), the chain rule yields:

$$\frac{\partial \ln \frac{p_X \cdot X}{p_L \cdot L}}{\partial \ln n} = \frac{\partial \ln \frac{p_X \cdot X}{p_L \cdot L}}{\partial \ln \frac{p_X}{p_L}} \cdot \frac{\partial \ln \frac{p_X}{p_L}}{\partial \ln n} = (1-e) \cdot \frac{\partial \ln \frac{p_X}{p_L}}{\partial \ln n} \tag{11}$$

From (10), $\cdot \frac{\partial \ln \frac{p_X}{p_L}}{\partial \ln n} < 0$ since $\sigma > 1$. This proves the result.

Proposition 1

The share of intermediates in the production of the final good α is a function of n. The function $\alpha(n)$

- increases with n if and only if X and L are gross substitutes ($e > 1$),
- decreases with n if and only if X and L are gross substitutes ($e < 1$),
- is independent of n if and only if the production of F is Cobb-Douglas $e = 1$.

Since (10) defines a continuous monotonically increasing function, the result is both necessary and sufficient. This will be useful in the subsequent empirical work.[6] Since the empirics are carried out in terms of the share of value added to gross output, or $(1 - \alpha)$, we restate the proposition in terms of the share of the primary factor:

Corollary 1

The share of the primary factor L in the production of the final good $1 - \alpha$ is a function of n. This function

- decreases with n if and only if X and L are gross substitutes ($e > 1$),
- increases with n if and only if X and L are gross substitutes ($e < 1$),
- is independent of n if and only if the production of F is Cobb-Douglas $e = 1$.

We note that while labor is the only primary factor in the model, it is straightforward to incorporate a composite labor-capital bundle so long as intermediate varieties are also produced using a similar bundle.

Our result is much simpler than the one proposed in Feenstra et al. (1999), and certainly less perfect. They measure variety using the CES structure of production of intermediates goods

[6]In Ciccone and Matsuyama (1999) feedbacks from final goods can make the relationship between n and the factor share complex. In particular, if e is large (L and X exhibit high degree of gross substitutability) then the intermediates varieties can become Hicks-Allen complements in the production of the composite input X, i.e. σ can becomes less than unity. In that case, inferring whether the industry combines factors as gross substitutes or gross complements, as we will do below, is not possible.

(X), while we measure it at the level of final goods (F). Their measure requires highly disaggregated data, while our measure is motivated by a the use of more easily available aggregate gross output and value added data, so that panel data on many countries may be used in the empirical analysis. Their measure is realistic in that it does not require that the inputs x_i enter symmetrically into the production of the intermediate good X while ours requires that simplifying assumption. For this last reason, their measure is certainly preferable to ours were detailed data available to implement its use widely. But constructing the Feenstra et al. measure imposes unrealistic demands on the data at the scope of our study. We therefore proceed with the use of our measure. Our objective is to empirically examine the threshold effects model due to Rodrik (1997). It highlights multiple equilibria due to threshold effects in intermediates goods production.

Threshold Externalities: Intermediates and Coordination Failures

We consider a simpler version of Rodrik's (1997) model to establish the externality problem. Suppose that each differentiated intermediate variety is produced by a single firm. Entry is free, and therefore the price in the intermediate sector just covers cost. Two technologies are available for the production of the final good F. A low-priced "low-tech" good and a higher priced "high-tech" good. A threshold number of intermediates, n^*, must be available before the cost of the finished good falls sufficiently for production of the high-tech good to be feasible. The low-tech good, which uses labor but no intermediates, sells at the world price equal to 1 while the high-tech good, which combines labor with the intermediate input, sells at a price greater than 1. The low-tech good has unit isocost $\theta(w)$ while the high-tech good has unit isocost $\phi(w; n)$ ¡ $\theta(w)$.

When production in the high-tech sector requires more varieties than are currently produced, $n_{\max} < n^*$varieties, the result is a full employment equilibrium in which only the low-tech good is produced. In such an equilibrium the manufacturing wage is low. One reason for why $n_{\max}$ may be too small is that the unit cost of producing each intermediate variety is high.[7]

[7]This, in turn, may be due a variety of factors, for example, low skill levels or financial constraints that lead to low levels of productivity. In Rodrik's model skills play an important role, but from which we abstract in favor of a more generic exposition that focuses on the coordination failure that lies at the heart of multiple equilibira. We also note that this model is easily extended to include capital as another

The complementarity problem is as follows. Coordination failure among producers of intermediates varieties occurs when they are unsure of the existence of enough other producers like themselves that enable the high-tech sector to industrialize. The coordination problem may be exacerbated (as in Rodrik's model) by the requirement that the high-tech good also requires more skills and inhibits intermediates producers from going into production. Government policy of concerted industrialization in the high-tech sector signaled by subsidies or infrastructure development can provide the impetus to solve the coordination failure problem by convincing potential intermediates producers that the well-publicized forthcoming demand for the high-tech final good would cause other intermediates producers to also enter. Due to increasing returns to scale, an increase in n shifts the high-tech isocost curve outwards. The use of a larger number of intermediate varieties leads to greater productivity, permitting higher factor payments to labor. From the individual entrepreneur's perspective, however, the entry of a new intermediate good creates social benefits that are not entirely internal to the initiating firm, but are provided equally among the n incumbents.

Thus, two equilibria are possible. If intermediate production makes avaliable only $n < n^*$ varieties, the small degree of specialization in intermediate good production permits realization of only a small portion of the potential economies of scale, leaving the economy with a low-tech isocost and in a low-tech equilibrium. However, if the costs of coordinating simultaneous entry can be overcome so that the maximum number of varieties is produced, $n_{\max} > n^*$, high-tech isocost can lead to a high income equilibrium. Rodrik's theory leads to the following proposition.[8]

primary input.

[8]We note that in Ciccone and Matsuyama (1996, 1999) multiple equilibria emerge from a different mechanism. Feedbacks from final goods into the production of intermediates are explicitly modeled. Intermediate input varieties x_i's can switch from being Hicks-Allen complements to substitutes and conversely, depending on the elasticity of substitution (e) of X and L in final good production. If e is large, then it is possible for intermediate inputs to be Hicks-Allen complements. A high e can therefore lead to the existence of both, pessimistic and optimistic equilibria, due to coordination failures. The relationship between factor share and the number of varieties is no longer monotonic and factor shares may not be used to test their theory.

Proposition 2

Wage increases with n but beyond a threshold level n^*.

Proposition 2 presents us with a simple testable implication of the threshold externality model, where the externality arises due to IRS in intermediates and coordination failure among intermediates producers. They combine to yield in multiple equilibria. Proposition 2 appears to be unconditionally testable, but it is not. The validity of our model of threshold externalities, according to Corollary 1, may be established conditionally on the elasticity of substitution, since our empirical measure of n (using observable data on value added and gross output) are conditional on the elasticity of substitution between labor and the intermediate input in the production of the final good. That is, the (intertemporal) variation in the share of the primary factor (e.g. labor) in the production of the final good may be used to infer whether n has increased or decreased conditionally on the elasticity of substitution between the primary factor and the intermediate input. We now turn to the (conditional) empirical implementation of Hypothesis 2.

3. Empirical Methodology and Data

Empirical Methodology

We estimate three classes of econometric models using panel data across countries indexed by c, industries indexed by i and time indexed by t. The first set consist of baseline models featuring a smooth relationship between (log of) wages, $\ln(w)$, and variety in intermediates, n

$$\ln w_{it} = \beta_1 n_{it} + \text{industry fixed effects} + \epsilon_{it}, \tag{12}$$

where ϵ_{it} is a homoskedastic error term, but which may posses a time-series structure. This is unlike the relationship postulated by multiple equilibria models. A smooth relationship would be the case if there were no threshold externalities, so that marginal increments to intermediate varieties would still shift out the isoquant and marginally increment wages. Another source for such a relationship is made clear in way in the description in Feenstra et. al (1999) about how new inputs expand the dimensionality of the input space, which leads to greater productivity via increasing returns in the production of the intermediate good allow. The lower cost of the intermediates good may then be passed on to primary factors in the production of the final good.

The second class of models postulates a threshold effect on wages beyond a level of n. This model gets closer to the idea of threshold effects in the multiple equilibria models, but features only two possible equilibria, one where wages respond positively to changes in the n but beyond threshold level n^*, and one in which there is no such threshold effect ($n^* = 0$). The nonlinear model is specified as

$$\ln w_{it} = \beta_1(\max\{0, n_{it} - \beta_2\}) + \text{industry fixed effects} + \epsilon_{it}, \tag{13}$$

where $\beta_2 \equiv n^*$ is the threshold parameter and β_1 the slope parameter. If $\beta_2 = 0$ then the model reduces to (12).

The third class of models comes closest to (conditionally) testing Proposition 2 about models of multiple equilibria advanced by Ciccone and Matsuyama, and Rodrik. It is specified as a pair of equations

$$\ln w_{it} = \beta_1 n_{it} + \beta_2(n_{it} \times I_{it}^{+}) + \text{industry fixed effects} + \epsilon_{it}, \tag{14}$$

$$\ln w_{it} = \beta_1 n_{it} + \beta_2(n_{it} \times I_{it}^{-}) + \text{industry fixed effects} + \epsilon_{it}. \tag{15}$$

In (14) and (15)the variable I_{it}^{+} takes the value one if industry i was experiencing a positive transition in n during period t. The terminology and measurement borrows from Rodrik (1999) in which "investment" transitions are measured analogously. The beginning of a period of a positive $n-$transition is identified as the year T at which the 5-year lagged moving average of n

is exceeded by each of the (five) 3-year moving averages taken over the eight years beginning in $T+1$. If T is identified as the beginning of an $n-$transition then $I_{it}^{+}=1$ for $t=T,T+1,\ldots,T+5$. Otherwise $I_{it}^{+}=0$. For any industry i, multiple positive transition periods are possible which do not necessarily overlap. I_{it}^{-} is defined analogously for negative transitions, that is, during which n is falling.

While the hypotheses in Propositions 1 and 2 are stated as conditional (on elasticity of substitution) hypotheses, they allow the theory to be falsified. The theory may be rejected for a specific country when the estimates indicate that the country (industry) employs a production function in which L and X are simultaneously gross complements and gross substitutes. There are caveats to this method of rejecting the hypothesis which we detail in the discussion of the results.

Data

We use data from the World Bank Trade and Production Database compiled by Nicita and Olarreaga (2001). The source of the production component of this database is UNIDO's manufacturing database. We use wage and output data on 37 countries: three developed Asian countries (Japan, Korea, Taiwan), twelve low and moderate income Asian countries (Bangladesh, China, Egypt, Indonesia, India, Sri Lanka, Malaysia, Nepal, Pakistan, Phillipines, Thailand, Turkey), twelve Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Trinidad/Tobago, Uruguay, Venezuela), five low and middle income African countries (Cameroon, Ethiopia, Kenya, Morocco, Malawi), and five emerging countries (Hungary, Latvia, Poland, Romania, South Africa). For each country, wage and output data are available (incompletely) for 28 ISIC 3-digit industries over the 1976-1999 period. The data are quite incomplete for many developing countries. The most glaring deficiencies are in the data for Brazil and China.

Annual industry wage is computed by dividing industry payroll by industry employment (UNIDO's definitions of the variables are provided in the Data Appendix). The models that we estimate are log linear so that deflating the wage rate by some constant exchange rate makes no difference to the results. Since the models are estimated using fixed effects, and since exchange rates are country- and time-specific (not industry-specific) their use would make the results no different. This also avoids the many measurement issues with using market exchange rates to deflate wages. We have therefore chosen to simply use the nominal wage.

We use Proposition 1 to operationalize the measurement of n in the econometric models. Thus, the factor share of primary inputs, computed as the ratio of value added to gross output, measures n. In the data, value added is the payment to labor and capital, while in the theory (eq. (9)) it is payments to labor. The theory applies equally to a composite labor-capital bundle so long as intermediate varieties are also produced using the same bundle. We proceed on that assumption.[9] This facilitates the use of the primary factor share to measure variety even in Rodrik's model which features both labor and capital in production. The share of primary inputs is measured by dividing industry value added by industry gross output. The data appendix provides a detailed description of what UNIDO includes and does not include in its definition of output. Even though accounting conventions vary across countries,[10] within any country the same method is used to measure value added and gross output. Therefore, the value added to gross output ratio is a good approximation of what it would have been had accounting conventions been uniform across countries.

[9] Another way of viewing production of the final good with labor and capital is as in Acemoglu (2002).

$$F = \left[\gamma(A_X X)^{\frac{e-1}{e}} + (1-\gamma)(A_C C)^{\frac{e-1}{e}}\right]^{\frac{e}{e-1}}, \quad (16)$$

where C is a composite labor-capital unit input bundle, and A_X and A_C are separate technology terms. Exogenous or technological changes in the productivity of the primary input bundle (e.g. increases in skill, better machines) influence the relative marginal products through A_C while technological change in the intermediates sector influences relative marginal products through A_X. The relative marginal product of the factors now becomes

$$\frac{MP_X}{MP_L} = \frac{1-\gamma}{\gamma}\left(\frac{A_X}{A_L}\right)^{\frac{e-1}{e}}\left(\frac{X}{L}\right)^{-\frac{1}{e}}. \quad (17)$$

If $e > 1$ then an increase in A_X relative to A_C will increase the marginal product of X, but if $e < 1$, an increase in A_X increases marginal product of the primary input C relative to the marginal productivity of X. This formulation can lead to a better understanding of the results that we get.

[10] For example, both value added and gross output may be measured at market prices or at cost, with indirect taxes or without, and so on.

4 . Empirical Results

Table 1 indicates descriptive statistics for log wage, viewed as industry panels for each country. For example, there are 28 $i-$panels with 494 observations for Japan. The within, between and overall means and standards deviations (within and between means are 0) are reported. If wages were sticky, with few instances of short-run deviations from a steady state, then the overall variance would be dominated by the cross-industry or between-variation. This is not the case. The within-variation in the data (wage) was significant during the 24-year period in almost all countries. In order to exploit the significant within-variation we use fixed effects regressions in all the models.[11]

Table 2 shows descriptive statistics for the issue variable, the share of primary factors in total output measured as the ratio of value added to gross output. Contrary to our prior beliefs, the data indicate that there is wide intertemporal variation in this share even for a specific country-industry pair. We consider an increase in the ratio by 0.1 to be economically significant, indicating a substantial increase in the share of the primary factors. We will investigate regression models featuring "transition episodes in which there were sustained increases and decreases in this share. Appendix Table A1 arranges the VA/GO ratio for each industry sorted by the range over the period for which data was available for each country. Though ranges above 0.40 are exceptional, for the majority of countries the VA/GO ratio have a range in excess of 0.10. The share of output going to primary factors has thus varied considerably over the 24-year period. Research undertaken in recent years into the question of whether factor shares are constant over time also indicates that factor shares vary considerably (Solow 1958, Ruiz 2005, Takeuchi 2004, Jones 2005, Young 2004).

[11]The Hausman tests rejects the equivalence of fixed and random effects in almost all the models. In order to control for the considerable heterogeneity across countries, this encourages fixed effects estimation. The set of random effects results are also available from the authors.

Smooth relationship between n and wage

Estimates of the parameters from models (12) and (16) are presented in Table 3. While the multiple equilibria models imply discontinuities and jumps in the relationship between n and wage, the models with jumps subsume as a special case the continuous model. Therefore, even though the smooth models are atheoretical, they serve two purposes. First, they provide a baseline set of results with which to compare the models with jumps. Second, and equally importantly, they indicate which fixed effects specification is appropriate for the data.

The one-way fixed effects model produces estimates that are substantially different from those that account for time series structure in the wage data. The first two columns, labeled "M1: Country FE display the coefficient on the primary factor share from a one-way fixed effects model, together with their t-statistics. A green-shaded t-statistic indicates that as the VA/GO ratio increases, so does wage. Orange-shaded values indicates the opposite. The estimates indicate, for example, that in Argentinian manufacturing an increase in the VA/GO ratio of 0.10 leads to a 13% decline in the annual wage, all else held constant. The three other models reported in the table all control for a specific or general time series structure. Model M2 includes year fixed effects, Model M3 is the same as Model M1 but corrects for an AR1 process in log wage, and Model M4 is the same as Model M3 but also includes year fixed effects. A striking feature is that the models that admit time series structures have similar results, and they are quite different from the results in Model M1 which does not incorporate any time series structure. For this reason, the models discussed below all incorporate a time series structure. In the nonlinear threshold models, year-fixed effects are included, while the jump-models are estimated as a dynamic panel.

Although the results in Table 3 are atheoretical, they are robust across the models and worth discussing to provide the flavor for the conditional inferences they provide. The green shaded values correspond to coefficients that come from, on average, production functions in which L and X are gross complements. If the t-value is statistically insignificant, then we infer that manufacturing technology is, on average Cobb-Douglas. Thus, among the Latin American countries in the sample, Brazil, Chile, Ecuador, Guatemala, and Venezuela use Cobb-Douglas production in manufacturing, if we assume that the theory applies even to continuous changes in VA/GO (and therefore n).

Threshold Effects: Single discontinuity

Table 4 presents results from the threshold nonlinear panel model in (13). The model is estimated for each industry with country panels, but the sample is broken down by a more homogeneous grouping of countries into four sub-samples - Africa, Asia, Emerging, and Latin America. This enables unmasking of heterogeneous relationships among the regions. The nonlinearity in the model arises from a specific kind of threshold effect, measured by the threshold parameter β_2. Beyond a value of VA/GO equal to β_2, the log wage begins to be (smoothly) influenced by the VA/GO ratio. Since it is not straightforward to estimate the nonlinear model with a specific time-series structure (say, AR1), explicit year fixed effects take account of unspecified time series structures in the data.

If the coefficient β_2 is estimated to be statistically insignificant from zero then it implies the same smooth relationship between VA/GO and wage as did the estimates in Table 3, and it is not possible to use Proposition 2 to infer about the elasticity of substitution between the primary factor and the intermediate input. Where this coefficient is statistically significantly different from zero, it indicates a threshold-type discontinuity in the relationship. The estimates on β_1 then indicate whether the production in the industry (on average, for the group of countries) combines L and X as gross complements (GC), gross substitutes (GS) or neither (CD, or Cobb-Douglas).

Only in a few instances does this model allow clear-cut inferences about the elasticity of substitution conditional on (the relationship between n and wages in) Proposition 2. Where this conditional inference is possible, African, Asian and Latin American countries appear to combine L and X as gross substitutes or use Cobb-Douglas technology in most manufacturing industries; Emerging countries rely on technologies with gross complementarity between L and X.

A message from the nonlinear model is the heterogeneity in responses across regions. For rubber goods (including tires), an increase of 0.10 in the VA/GO ratio increases wage in this sector by 37.4% in Asia, but decreases wage by 9.9% in emerging countries (beyond the threshold of .35) and by 40.5% in Latin America. Unlike this single discontinuity model, the next model allows us to infer about the elasticity of substitution more generally.

Multiple equilibria: Many discontinuities

We now examine the results from models that come closest to testing Proposition 2 about multiple equilibria. All models are estimated as dynamic panel estimators that account for the time series structures in the evolution of wages. Thus, we employ the Arellano-Bond method which estimates the model in first differences and includes the lagged dependent variable as a regressor. The first difference wipes out the fixed effects, so this is a fixed effects estimator with an AR1 error structure. The lagged dependent variable and a constant are included but not reported. They are both generally highly statistically significant. The chi-squared statistic measures of fit are reported and indicate that all models have statistically significantly explanatory power.

Table 5 presents estimates from an industry panel perspective. Two equations are estimated, one where the VA/GO ratio is interacted by the variable I^+ which indicates years when the country experienced sustained increases in this ratio, and a second model where the VA/GO ratio is interacted by the variable I^- indicating years of negative transition in the VA/GO ratio. In Table 5 the coefficient β_2 indicates how manufacturing wage in a country responds to such sustained increases and decreases in the share of primary inputs, beyond the impact that the level of the VA/GO ratio linearly has on wages. Thus, for South Korea (KOR) there is no particular relationship between the primary input share and annual wages (β_1, is statistically insignificant). However, the coefficient of 0.40 on β_2 indicates that during a sustained positive transition (measuring a sustained increase in the number of varieties n), the wage rate jumps by 4.0% over. This 4% increase is both a statistically and economically significant magnitude.

The statistical significance of a positive β_2 may be taken as (conditional) evidence of the empirical validity of the theory (Proposition 2) – surges in the number of varieties of intermediates n can help economies break out of low-wage equilibria. This evidence in favor of the theory is of course conditional on L and X being GS or GC as implied by the estimates. Conversely, given the theory is accurate, we may infer whether the two factors are GS, GC or CD. The estimates indicate, for example, that in South Korea's manufacturing production function labor and intermediates are gross complements. Negative transitions corroborate this inference. During sustained decreases in VA/GO the sign on β_2 is reversed and is statistically significant, indicating that manufacturing wage fell in South Korea. This, combined with the increase in wages during positive transitions, we infer to be strong evidence that South Korea's manufacturing on average exhibits gross complementarity between primary inputs and intermediate inputs. Conversely, given the gross complementarity between X and L in South Korea's manufacturing the theory of multiple equilibrium in borne out.

Consider Taiwan's estimates on β_2. The two positive coefficients (0.11 during positive transitions and 0.12 during negative transitions) are at odds because the former implies that labor and X are gross complements whereas the latter implies they are gross substitutes. We take this to be evidence against the theory (the last column is thus marked "X"). There is, however, a caveat to this rejection, if we imagine that manufacturers are able to switch to technology in which the elasticity of substitution changes from less than unity to more than unity in little time. If so, since phases of positive and negative transitions do not necessarily overlap, the Taiwan result need not imply the rejection of the theory. If such a switch is not possible within a year or two, then the common sign on β_2 rejects the theory. Quite surprisingly there are only few instances of possible rejections – Taiwan, Hungary and Uruguay.

For a number of countries β_1 is estimated to be statistically insignificant during both positive and negative transitions, while β_2 is estimated to be statistically and economically significant. This is perfectly consistent with the theory because multiple equilibria do not imply a smooth relationship between wage and input shares, but rather discrete changes which are measured in the econometric model by β_2. We take the evidence from either positive or negative transitions as indicating whether the two factors are GC, GS, or CD. For example, Egypt's evidence from negative transitions is by itself sufficient for that inference.

In sum, twelve of the thirty seven countries use Cobb-Douglas technology in manufacturing. Thirteen use technology that combines L and K as gross complements, and five as gross substitutes. For three countries the theory is rejected. Due to lack of data or the absence of transitions, no inference is possible for the remaining four countries. Three of the five African countries, five of the twelve Asian countries and four of the twelve Latin American countries use Cobb-Douglas technology manufacturing. A surprisingly large number of countries use production functions that combines L and X as gross complements – four in Latin America, two of the developed countries, and four Asian countries.[12]

In Table 6 we attempt to take account of heterogeneity in production across industries by estimating the multiple equilibria for each industry for four regions (Asia, Africa, Emerging and Latin America). Taking account of the heterogeneity across regions presents a more complete picture of the variety of production techniques used in manufacturing across the world. Cobb-Douglas technology is widespread in the Asian, Latin American and Emerging sub-samples. It appears that manufacturing in the less advanced world uses technology with fairly constant factor shares. Perhaps the absence of technological shocks, or their relative closedness until recently is responsible for his finding. With the recent wave of liberalization that expose their industries to outside shocks, it remains to be seen whether the same inferences continue to hold. Where CES production functions with non-unitary substitution elasticities are in evidence, they generally combine L and X as gross complements and only in a few industries is there evidence of gross substitutability.

Importantly, the results may be interpreted as supporting the theory of threshold externalities conditionally. If the evidence about GS, GC and CD technologies is accurate, then in those

[12] As a sensitivity analysis of the possible endogeneity of VA/GO, we instrumented it using the United States capital-labor ratio, it's inverse, and their squared terms. The first stage-f statistics are high, attesting to the adequacy of those instruments. Since they are U.S. variables, we are confident about their exogeneity. The results in Table 5 are remarkably robust to these instruments.

instances the evidence affirms the theory of multiple equilibria due to coordination failures. The evidence in this paper about the type of technology used in manufacturing, at least for developed countries, is corroborated by a set of recent studies of the non-constancy of factor shares over time. Ruiz (2005), Young (2005) Takeuchi (2005) and Jones (2002) find that in a range of developed countries (Spain, US, Japan) the elasticity of substitution between labor and capital is less than 1. That is, they are gross complements. Whether this is evidence of short-run inflexibility in responding to changes in factor prices or whether the inputs are actually complements is at odds with the long run view in which factors should be gross substitutes. Modern manufacturing plants, like Intel's fabrication units appear to be the exception, not the rule. Even in these integrated fabrication plants, the reason for flexibility is not necessarily to enable the factor mix to change in response to a change in factor prices (in fact the factor mixes may be quite rigid in the short run) but rather to ensure that the fixed cost of setting up the plant covers more than one technological change. They enable long-run substitutability but are not necessarily designed to do so in the short-run. In our view, the main reason for gross complementarity between L and X is that changing the factor mix is costly in the short-run.

The results have specific policy implications. Costly policies such as subsidizing the production of intermediate varieties, targeting a wage floor, or subsidizing foreign investment need not be directed at industries using Cobb-Douglas technology since they do not benefit from "solving coordination failure problems. The first policy implication is therefore that identifying CD industries makes policy less expensive. The second policy implication is that identifying technology in an industry as GC or GS can help in designing the right policy to overcome the coordination failure. This is especially important if the policy is designed to also encourage technological progress that influences the productivity of X and L.

5. Conclusion

We conclude with directions for future research. Theoretical extensions that incorporate technical change (Acemoglu 2002) can produce a richer variety of results conditional on gross complementarity and substitutability of factors. How does biased technical change influence equilibria? Does intermediate variety aggravate the difference between "good' and "bad" equilibria when biased technical change is introduced into the models? These are empirically relevant questions that theory can and should address.

Empirically, this exploratory study provides a framework for more formal (conditional) testing of other models in which intermediates variety play a crucial role in development. Rodriguez-Clare (1996) formalizes the notion of backward and forward linkages first put forth by Hirschmann (1958). Multinationals are vehicles, Rodriguez-Clare postulates, through which such linkages are generated. Intuitively, if intermediates are only locally produced, a new final goods firm (e.g. a multinational) that increases the demand for inputs helps to induce a larger variety of intermediates. This generates a positive externality to other final goods producers, thus providing a backward linkage effect. With a greater variety in intermediates now available, more complex final goods that more intensively use the specialized inputs now begin to appear, creating a forward linkage. A proposition is that an increase in the number of multinational firms (M) increases n and wage if the multinationals have a high "linkage" effect (the linkage coefficient of a firm is defined to be the amount of employment generated in the intermediates goods sector per unit of labor hired directly by the firm to produce the final good). Smarzynska-Javorcik (2004) finds strong evidence in favor of such linkages in Lithuanian manufacturing data.

Ciccone and Hall (1996) and Howitt (1999) propose relationships between growth and variety in intermediates, although not with multiple equilibria. Ciccone and Hall (1996) find that higher density (persons per square mile) is strongly associated with greater productivity across counties, contradicting the notion that congestion should cause productivity to decline. The primary reason, they postulate, is that increasing returns in intermediates is strong enough to overcome the congestion effect – congestion of workers on fixed land is overcome by the effect of intermediates in final goods production (and lower substitutability among intermediate varieties).

Howitt (1999) models a separate mechanism through which variety in intermediates determines wage growth via the Aghion-Howitt (1992) model of creative destruction. The extension is based on Young's (1998) idea of horizontal and vertical innovations. Vertical innovations create more improved versions of existing varieties, so that an incumbent monopolist is replaced by the innovator, at least until the next innovation in that variety. Horizontal innovations increase the number of varieties, so that the innovator creates a new monopoly, at least until the first innovation in that variety comes along. These models *do* present alternative mechanisms that generate growth through increasing variety, and since they allow testing of models against well specified alternatives, future research should perform these tests.

Structural testing of those theories will be greatly facilitated by using the primary factor input shares to measure variety in intermediates, as proposed in this paper.

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Data Appendix

The UNIDO defines their variables as follows (our acronyms in parentheses):

(1) Number of persons engaged and number of employees (NE):
The number of persons engaged is defined as the total number of persons who worked in or for the establishment during the reference year. However, homeworkers are excluded. The concept covers working proprietors, active business partners and unpaid family workers as well as employees. The figures reported refer normally to the average number of persons engaged during the reference year, obtained as the sum of the "average number of employees" during the year and the total number of other persons engaged measured for a single period of the year. The category "employees" is intended to include all persons engaged other than working proprietors, active business partners and unpaid family workers.

(2) Annual Wages and salaries (PAY):
Wages and salaries include all payments in cash or in kind paid to "employees" during the reference year in relation to work done for the establishment. Payments include: (a) direct wages and salaries; (b) remuneration for time not worked; (c) bonuses and gratuities; (d) housing allowances and family allowances paid directly by the employer; and (e) payments in kind. Excluded are employers' contributions in respect of their employees paid to social security, pension and insurance schemes, as well as the benefits received by employees under these schemes and severance and termination pay.

(3) Gross Output (GO):
The measure of output normally reported is the census concept which covers only activities of an industrial nature. The value of census output in the case of estimates compiled on a production basis comprises: (a) the value of all products of the establishment; (b) the net change between the beginning and the end of the reference period in the value of work in progress and stocks of goods to be shipped in the same condition as received; (c) the value of industrial work done or

industrial services rendered to others; (d) the value of goods shipped in the same condition as received less the amount paid for these goods; and (e) the value of fixed assets produced during the period by the unit for its own use. In the case of estimates compiled on a shipment basis, the net change in the value of stocks of finished goods between the beginning and the end of the reference period is also included. Gross output is equivalent to census output plus the revenue from activities of a non-industrial nature. Valuation may be in factor cost, excluding all indirect taxes falling on production and including all current subsidies received in support of production activity, or in producers' prices, including all indirect taxes and excluding all subsidies.

(4) Value added (VA):

The measure of value added normally reported is the census concept, which is defined as the value of census output less the value of census input, which covers: (a) value of materials and supplies for production (including cost of all fuel and purchased electricity); and (b) cost of industrial services received (mainly payments for contract and commission work and repair and maintenance work). If input estimates are compiled on a "received" rather than on a "consumed" basis, the result needs to be adjusted for the net change between the beginning and the end of the period in the value of stocks of materials, fuel and other supplies. Total value added is the national accounting concept. It is ideally represented by the contribution of the establishments in each branch of activity to the gross domestic product. For the measure of total value added, the cost of non-industrial services is deducted from and the receipts for non-industrial services are added to census value added. The estimates, whether in terms of census value added or total value added, may be gross of depreciation and other provisions for capital consumption. The valuation may be in factor cost or in producers' prices, depending on the treatment of indirect taxes and subsidies.

In the paper, wages are calculated as $w = \text{PAY}/\text{NE}$, and the share of primary inputs in gross output as $1 - \alpha = \text{VA}/\text{GO}$.

Table 1: Descriptive statistics for **log(wage)**

Industry Panels: Unbalanced, 1976-2000, 28 ISIC 3 digit industries

				Within			Between			Overall					
Region	Country	ccode		Max	Min	sd	Max	Min	sd	Max	Min	sd	Mean	panels	N
DEV	Japan	JPN	12	3.56	1.62	0.43	2.91	2.26	0.12	3.43	1.31	0.45	2.69	28	494
DEV	Korea	KOR	13	3.08	-0.09	0.78	2.41	1.44	0.24	3.36	-0.14	0.81	1.82	28	689
DEV	Taiwan	TWN	18	2.99	0.03	0.77	2.10	1.33	0.21	3.39	-0.08	0.80	1.69	28	585
EME	Hungary	HUN	20	1.92	0.08	0.41	1.94	0.55	0.27	2.17	0.05	0.46	0.90	28	683
EME	Latvia	LVA	21	1.06	0.63	0.08	1.57	0.27	0.30	1.64	0.25	0.28	0.88	20	64
EME	Poland	POL	22	2.42	0.03	0.52	1.11	0.57	0.14	2.52	-0.01	0.53	0.86	28	672
EME	Romania	ROM	23	0.68	-0.36	0.31	0.44	-0.16	0.17	0.85	-0.58	0.35	0.09	13	51
EME	South Afric	ZAF	24	2.53	0.85	0.32	2.29	1.10	0.35	2.93	0.59	0.47	1.83	28	652
LATIN	Argentina	ARG	25	3.44	-1.37	0.58	2.38	1.32	0.29	3.35	-1.22	0.65	1.91	28	324
LATIN	Bolivia	BOL	26	2.86	-0.69	0.47	1.95	-0.16	0.41	3.14	-1.57	0.62	0.72	28	651
LATIN	Brazil	BRA	27	2.39	1.67	0.18	2.53	1.36	0.39	2.84	1.11	0.42	2.00	13	65
LATIN	Chile	CHL	28	2.69	0.48	0.48	2.48	1.17	0.38	3.17	0.13	0.61	1.75	28	694
LATIN	Colombia	COL	29	1.90	0.12	0.34	1.86	0.53	0.30	2.35	-0.22	0.45	1.08	28	697
LATIN	Costa Rica	CRI	30	2.18	0.00	0.31	1.97	0.64	0.32	2.46	-0.33	0.44	1.21	28	447
LATIN	Ecuador	ECU	31	2.26	-0.33	0.41	2.23	0.42	0.42	3.09	-0.67	0.57	1.20	28	666
LATIN	Guatemala	GTM	32	1.52	-0.08	0.29	2.06	0.20	0.42	2.45	-0.20	0.50	0.80	28	364
LATIN	Mexico	MEX	33	2.44	0.52	0.34	2.08	1.14	0.26	2.63	0.60	0.42	1.62	28	599
LATIN	Trinidad/To	TTO	34	2.95	0.37	0.48	2.68	0.66	0.46	3.27	-0.19	0.64	1.81	24	376
LATIN	Uruguay	URY	35	2.93	-0.19	0.53	2.12	0.74	0.38	3.25	-0.51	0.63	1.42	28	612
LATIN	Venezuela	VEN	36	2.75	0.63	0.43	2.60	1.36	0.31	3.25	0.46	0.52	1.85	28	612
ASIA	Bangladesh	BGD	37	0.43	-1.43	0.31	0.86	-1.18	0.40	1.47	-1.86	0.51	-0.49	28	505
ASIA	China	CHN	38	-0.53	-1.26	0.13	-0.57	-0.99	0.09	-0.40	-1.33	0.16	-0.83	26	183
ASIA	Egypt	EGY	39	1.74	-1.07	0.44	1.50	0.16	0.27	2.36	-1.04	0.51	0.78	28	630
ASIA	Indonesia	IDN	40	0.92	-1.09	0.30	0.75	-0.78	0.40	1.45	-1.43	0.48	-0.06	28	622
ASIA	India	IND	41	0.78	-0.86	0.23	1.02	-1.11	0.44	1.57	-1.50	0.49	0.06	28	700
ASIA	Sri Lanka	LKA	42	0.72	-1.31	0.35	0.28	-1.31	0.36	1.15	-1.60	0.49	-0.30	28	449
ASIA	Malaysia	MYS	43	2.17	0.08	0.41	2.45	0.64	0.39	2.89	-0.42	0.56	1.15	28	672
ASIA	Nepal	NPL	44	-0.45	-1.44	0.17	-0.40	-1.61	0.23	-0.26	-1.72	0.28	-0.80	25	187
ASIA	Pakistan	PAK	45	2.04	-4.13	0.42	1.02	-0.21	0.29	2.04	-4.12	0.51	0.30	28	493
ASIA	Phillipines	PHL	46	1.75	-0.51	0.45	2.11	-0.18	0.45	3.07	-1.06	0.63	0.54	28	616
ASIA	Thailand	THA	47	2.27	-1.46	0.56	2.60	0.00	0.47	3.05	-1.40	0.70	0.71	28	318
ASIA	Turkey	TUR	48	2.96	0.64	0.47	2.38	0.94	0.36	3.32	0.15	0.59	1.61	28	700
AFRICA	Cameroon	CMR	49	2.57	0.52	0.40	2.32	0.59	0.45	2.94	-0.22	0.58	1.60	25	410
AFRICA	Ethiopia	ETH	50	0.92	-0.54	0.33	0.65	-0.46	0.27	1.37	-0.76	0.42	0.06	22	234
AFRICA	Kenya	KEN	51	2.27	-0.40	0.29	1.94	-0.04	0.44	2.86	-0.70	0.52	0.67	25	593
AFRICA	Morocco	MAR	52	2.65	0.44	0.27	2.10	-0.60	0.54	2.89	-0.60	0.47	1.40	28	388
AFRICA	Malawi	MWI	53	3.44	-1.59	0.48	1.12	-0.76	0.46	3.19	-1.57	0.65	0.27	20	248

Table 2: Descriptive statistics for VA/GO (=value added/gross output)
Industry Panels: Unbalanced, 1976-2000, 28 ISIC 3 digit industries

			Overall			
Region	Country	ccode	Max	Min	sd	Mean
DEV	Japan	JPN	0.62	0.09	0.10	0.40
DEV	Korea	KOR	0.79	0.11	0.12	0.42
DEV	Taiwan	TWN	0.92	0.10	0.14	0.35
EME	Hungary	HUN	0.66	0.05	0.11	0.31
EME	Latvia	LVA	0.63	0.23	0.09	0.41
EME	Poland	POL	0.95	0.06	0.14	0.43
EME	Romania	ROM	0.66	0.09	0.11	0.34
EME	South Afr	ZAF	0.85	0.12	0.13	0.39
LATIN	Argentina	ARG	0.86	0.01	0.15	0.48
LATIN	Bolivia	BOL	0.86	0.05	0.15	0.42
LATIN	Brazil	BRA	0.77	0.41	0.09	0.61
LATIN	Chile	CHL	0.90	0.14	0.12	0.50
LATIN	Colombia	COL	0.79	0.06	0.11	0.46
LATIN	Costa Ric	CRI	0.95	0.09	0.10	0.36
LATIN	Ecuador	ECU	0.90	0.06	0.13	0.36
LATIN	Guatemal	GTM	0.94	0.06	0.15	0.47
LATIN	Mexico	MEX	0.80	0.07	0.12	0.44
LATIN	Trinidad/T	TTO	0.87	0.10	0.14	0.40
LATIN	Uruguay	URY	0.88	0.06	0.13	0.47
LATIN	Venezuela	VEN	0.97	0.15	0.13	0.47
ASIA	Banglades	BGD	0.83	0.00	0.16	0.38
ASIA	China	CHN	0.65	0.11	0.11	0.36
ASIA	Egypt	EGY	0.72	0.01	0.11	0.30
ASIA	Indonesia	IDN	0.99	0.05	0.10	0.36
ASIA	India	IND	0.38	0.03	0.06	0.21
ASIA	Sri Lanka	LKA	0.96	0.04	0.16	0.45
ASIA	Malaysia	MYS	0.60	0.04	0.10	0.34
ASIA	Nepal	NPL	0.77	0.02	0.14	0.40
ASIA	Pakistan	PAK	0.85	0.00	0.15	0.37
ASIA	Phillipines	PHL	0.70	0.01	0.12	0.36
ASIA	Thailand	THA	0.99	0.03	0.17	0.39
ASIA	Turkey	TUR	0.72	0.11	0.11	0.41
AFRICA	Cameroon	CMR	0.87	0.01	0.14	0.38
AFRICA	Ethiopia	ETH	0.85	0.16	0.14	0.49
AFRICA	Kenya	KEN	0.94	0.00	0.15	0.25
AFRICA	Morocco	MAR	0.93	0.10	0.10	0.31
AFRICA	Malawi	MWI	0.83	0.01	0.15	0.31

Table 3: Estimates on **VA/GO.** Baseline models. By Country. Industry Fixed-Effects.
Dependent variable: **log(wage)**

			M1: country FE		**M2:** M1+year FE		**M3:** M1+AR1		**M4:** M2+AR1	
region	country	ccode	est	*t*	est	*t*	est	*t*	est	*t*
LAT	Argentina	ARG	-1.30	**-2.33**	2.24	**3.12**	0.80	**1.99**	1.68	**7.30**
LAT	Bolivia	BOL	1.25	**5.03**	0.36	**2.06**	1.08	**6.06**	0.10	0.84
LAT	Brazil	BRA	-1.83	**-4.95**	0.10	0.24	0.09	0.46	0.78	**2.26**
LAT	Chile	CHL	-1.55	**-4.85**	0.20	**1.75**	0.08	0.53	-0.05	-0.58
LAT	Colombia	COL	1.39	**4.56**	0.25	**2.87**	0.59	**4.87**	0.26	**3.38**
LAT	Costa Rica	CRI	1.00	**2.44**	0.27	**2.73**	0.23	1.21	0.12	1.00
LAT	Ecuador	ECU	0.17	1.06	0.33	**2.33**	0.21	**1.71**	0.17	**2.10**
LAT	Guatemala	GTM	0.62	**2.63**	-0.21	**-1.76**	0.05	0.30	0.04	0.51
LAT	Mexico	MEX	0.03	0.08	0.67	**3.28**	0.41	**2.20**	0.78	**7.61**
LAT	Trinidad	TTO	0.96	**3.05**	0.60	**3.05**	0.39	**1.88**	0.22	1.35
LAT	Uruguay	URY	0.25	0.76	0.72	**2.77**	1.75	**11.24**	1.04	**10.32**
LAT	Venezuela	VEN	1.97	**6.71**	0.18	1.22	-0.05	-0.27	0.01	0.14
EME	Hungary	HUN	0.22	0.88	-0.02	-0.20	0.14	0.95	0.11	1.15
EME	Latvia	LVA	-0.38	-1.39	0.27	1.08	0.92	**2.96**	0.55	**1.79**
EME	Poland	POL	-2.03	**-8.03**	0.18	**2.41**	0.06	0.71	0.02	0.71
EME	Romania	ROM	2.19	**2.42**	0.20	1.10	1.29	1.58	0.51	**2.13**
EME	South Africa	ZAF	-0.01	-0.06	0.03	0.28	-0.16	-1.44	0.05	0.99
DEV	Japan	JPN	7.09	**7.06**	-1.66	**-4.27**	4.43	**9.26**	-0.14	-0.77
DEV	Korea	KOR	11.08	**24.80**	0.12	1.00	0.14	0.64	0.00	0.00
DEV	Taiwan	TWN	0.93	1.67	0.08	**2.19**	0.03	0.31	0.01	0.16
ASA	Bangladesh	BGD	0.22	1.10	0.11	0.61	0.02	0.19	0.06	0.52
ASA	China	CHN	1.68	**9.24**	0.10	1.23	0.08	0.32	0.03	0.29
ASA	Egypt	EGY	0.14	0.61	-0.07	-0.71	-0.08	-0.64	-0.13	-1.67
ASA	Indonesia	IDN	0.22	1.20	0.20	**1.72**	0.02	0.15	-0.05	-0.54
ASA	India	IND	-1.04	**-3.69**	0.39	**2.58**	-0.04	-0.27	0.25	**2.06**
ASA	Sri Lanka	LKA	0.52	**2.34**	0.03	0.23	-0.06	-0.62	-0.03	-0.25
ASA	Malaysia	MYS	-0.42	-1.14	0.30	**1.86**	0.26	**1.73**	0.21	**1.80**
ASA	Nepal	NPL	0.44	1.42	0.09	0.47	-0.57	**-3.30**	0.09	0.58
ASA	Pakistan	PAK	1.25	**1.87**	1.94	**3.59**	1.19	**6.63**	1.14	**6.82**
ASA	Phillipines	PHL	2.56	**12.24**	0.30	**3.57**	0.09	1.08	0.20	**2.50**
ASA	Thailand	THA	1.09	**3.50**	0.49	1.67	0.59	**3.02**	0.43	**2.08**
ASA	Turkey	TUR	1.64	**4.46**	0.04	0.42	0.28	1.54	-0.11	-1.17
AFR	Cameroon	CMR	-1.14	**-6.03**	-0.35	**-2.63**	0.02	0.20	0.07	0.98
AFR	Ethiopia	ETH	0.35	0.80	0.16	0.96	-0.19	-1.10	-0.03	-0.21
AFR	Kenya	KEN	0.33	**2.54**	0.13	1.30	0.28	**2.78**	0.22	**2.97**
AFR	Morocco	MAR	0.90	**5.13**	0.32	**2.14**	1.10	**7.34**	0.41	**2.71**
AFR	Malawi	MWI	-0.36	-1.40	-0.28	-0.96	-0.06	-0.30	0.06	0.31

Notes:
1. See Table 1 for sample size. Measures of fit available from authors.
2. Green (+) and Orange (-) shaded cells imply statistical significance at 5%.

Table 4: Fixed effects estimates of Slope and Threshold coefficient. By industry and region.
Nonlinear Panel Model: ln(wage)=β1(max(0, vago-β2)) + fixed effects

	AFRICA					ASIA					EMERGING					LATIN AMERICA					
isic	β1	*t*	β2	*t*	S/C	β1	*t*	β2	*t*	S/C	β1	*t*	β2	*t*	S/C	β1	*t*	β2	*t*	S/C	isic
FOO	-1.20	**-2.65**	0.22	1.51		2.50	**4.76**	0.00	0.00		-0.18	-0.30	0.00	0.00		1.21	**2.99**	0.00	0.00		FOO
BEV	-1.30	-1.66	0.47	**4.66**	CD	1.42	**2.68**	0.53	**8.19**	GS	-0.40	-1.10	0.00	0.00		1.01	**2.72**	0.00	0.00		BEV
TOB	-1.34	-1.69	0.22	0.75		0.89	**2.76**	0.00	0.00		0.11	0.23	0.14	0.10		0.49	1.59	0.29	1.02		TOB
TXT	0.58	1.10	0.14	0.30		2.96	**7.29**	0.00	0.00		-0.76	-1.38	0.00	0.00		1.17	**2.51**	0.22	1.43		TXT
APP	-4.19	**-2.29**	0.41	**8.27**	GS	1.66	**2.65**	0.29	**6.90**	GS	-1.18	-1.56	0.40	**4.10**	CD	1.57	**3.30**	0.27	1.48		APP
LEA	-0.15	-0.32	0.00	0.00		0.79	**3.20**	0.00	0.00		-0.95	**-1.98**	0.00	0.00		0.68	1.31	0.00	0.00		LEA
SHO	0.85	1.34	0.00	0.00		0.72	**1.96**	0.00	0.00		-0.83	**-2.39**	0.00	0.00		0.92	**1.84**	0.00	0.00		SHO
WOD	-1.03	**-2.25**	0.00	0.00		0.83	**2.90**	0.00	0.00		-2.35	**-2.84**	0.00	0.00		-0.23	-0.65	0.00	0.00		WOD
FUR	0.73	**1.84**	0.00	0.00		1.18	**3.12**	0.18	0.91		-2.59	**-3.24**	0.00	0.00		1.28	**3.27**	0.30	1.70		FUR
PAP	-0.90	-0.75	0.29	**1.80**	CD	0.92	**1.91**	0.28	**3.66**	GS	-4.56	**-4.07**	0.00	0.00		1.29	**3.39**	0.10	0.47		PAP
PRN	-0.47	-0.79	0.29	0.99		1.58	**2.58**	0.54	**6.54**	GS	-0.54	-0.92	0.00	0.00		0.92	**2.53**	0.00	0.00		PRN
ICM	1.18	**2.85**	0.09	0.49		0.94	**2.31**	0.30	**3.98**	GS	-0.01	-0.02	0.00	0.00		-2.27	-1.07	0.56	**7.25**	CD	ICM
OCM	0.41	1.16	0.06	0.19		1.18	**3.67**	0.00	0.00		-0.71	-1.36	0.34	**1.77**	CD	0.16	0.45	0.00	0.00		OCM
PET	.		.			-0.22	-1.01	0.00			-0.18	-0.55	0.00	0.00		0.53	**1.95**	0.00	0.00		PET
OPT	.		.			1.05	**2.76**	0.00	0.00		-0.82	-0.91	0.00	0.00		1.33	**3.06**	0.21	**1.90**	GS	OPT
RUB	-0.10	-0.16	0.15	0.05		3.74	**3.51**	0.40	**16.48**	GS	-4.99	**-4.13**	0.35	**12.35**	GC	-4.05	-1.53	0.56	**15.01**	CD	RUB
PLA	0.48	0.85	0.21	0.56		1.69	**4.43**	0.00	0.00		-4.34	**-3.02**	0.35	**11.53**	GC	1.72	**4.57**	0.00	0.00		PLA
POT	-1.14	**-3.40**	0.00	0.00		0.45	1.65	0.18	0.29		-0.96	**-2.18**	0.00	0.00		1.57	**5.32**	0.00	0.00		POT
GLA	-1.15	**-2.58**	0.00	0.00		1.51	**4.88**	0.00	0.00		-0.13	-0.42	0.00	0.00		-1.07	-0.88	0.59	**6.94**	CD	GLA
OMN	0.55	1.08	0.25	1.20		0.34	1.09	0.00			-1.10	**-2.18**	0.00	0.00		0.14	0.32	0.00	0.00		OMN
I&S	-0.38	-0.64	0.00	0.00		1.71	**4.24**	0.00	0.00		-1.76	**-1.96**	0.38	**4.98**	GC	0.71	**1.82**	0.00	0.00		I&S
NFM	-0.63	-1.21	0.00	0.00		1.17	**3.13**	0.21	**3.54**	GS	0.74	**1.88**	0.09	0.52		0.08	0.25	0.00	0.00		NFM
FAB	-1.34	**-1.88**	0.26	**2.90**	GS	2.91	**3.07**	0.42	**14.53**	GS	-2.30	**-3.07**	0.00	0.00		-0.33	-1.05	0.00	0.00		FAB
MCH	3.85	**3.33**	0.29	**5.94**	GC	1.71	1.51	0.48	**7.00**	CD	-1.17	**-2.47**	0.00	0.00		-0.92	**-1.98**	0.29	1.18		MCH
ELE	0.53	1.64	0.00	0.00		0.98	**2.29**	0.29	**4.79**	GS	-2.76	**-4.84**	0.00	0.00		-0.13	-0.37	0.00	0.00		ELE
AUT	-0.14	-0.29	0.10	0.09		0.05	0.14	0.00			-2.69	**-3.96**	0.22	**4.28**	GC	0.08	0.28	0.00	0.00		AUT
PRO	0.17	0.24	0.00	0.00		0.57	**2.36**	0.00	0.00		-2.29	**-5.11**	0.34	**1.89**	GC	-0.36	-0.71	0.41	1.31		PRO
OTH	0.11	0.18	0.00	0.00		0.06	0.20	0.00			-0.18	-0.58	0.00	0.00		-0.01	-0.02	0.00	0.00		OTH

Notes:

1. Measures of fit available from the author (*R* -squared exceeds .95 generally)

2. GS indicates indicate that primary factors and composite intermediate good (X) are Gross Substitutes Complements (ε>1);
GC indicates indicate that they are Gross Complements (ε>1), and CD indicates that they are Cobb Douglas (ε=1).

3. If there are no threshold effects (β2=0) then we cannot infer about the elasticity of substitution.

Table 5: Dynamic panel estimates for models of *n* -Transitions. By country.

Positive Transitions: $\ln(wage(i,t)) = \beta 1\ VA/GO(i,t) + \beta 2\ [VA/GO(i,t) \times I^{+}(i,t)]$ + fixed effects

Negative Transitions: $\ln(wage(i,t)) = \beta 1\ VA/GO(i,t) + \beta 2\ [VA/GO(i,t) \times I^{-}(i,t)]$ + fixed effects

	POSITIVE TRANSITIONS						NEGATIVE TRANSITIONS						
ccode	β1	t	β2	t	χ2	ccode	β1	t	β2	t	χ2	n	S/C
JPN	5.02	**4.26**	0.24	**3.01**	356.2	JPN	5.68	**4.03**	-0.11	**-1.97**	359.1	291	**GC**
KOR	-0.36	-0.82	0.40	**8.56**	5849.5	KOR	0.12	0.30	-0.38	**-5.17**	8042.1	519	**GC**
TWN	-0.20	**-1.82**	0.11	**2.48**	1388.8	TWN	-0.21	**-1.95**	0.12	**3.03**	1612.1	417	**X**
HUN	0.35	1.14	0.18	**3.33**	372.1	HUN	0.39	1.62	0.22	**4.19**	576.9	519	**X**
POL	-0.25	**-1.90**	-0.10	-1.30	1746.2	POL	-0.35	**-2.69**	0.11	**2.39**	1802.4	487	**GS**
ZAF	-0.38	**-1.90**	0.19	**4.97**	2605.9	ZAF	-0.18	-1.10	-0.25	**-4.36**	1486.4	484	**GC**
ARG	0.11	0.20	0.00	0.02	334.1	ARG	0.07	0.14	0.10	0.94	465.4	213	**CD**
BOL	1.18	**3.01**	-0.10	-0.61	91.8	BOL	1.54	**3.78**	-0.58	**-4.40**	89.9	492	**GC**
CHL	-0.05	-0.27	0.23	**8.53**	1989.8	CHL	0.08	0.44	-0.22	**-3.57**	3794.0	526	**GC**
COL	0.50	**1.93**	0.17	**4.63**	4072.8	COL	0.62	**2.69**	-0.15	**-2.31**	3242.0	529	**GC**
CRI	0.21	1.65	0.12	**2.14**	8.9	CRI	0.28	**2.13**	-0.15	**-1.71**	11.3	387	**GC**
ECU	0.48	**2.09**	0.22	**1.70**	116.2	ECU	0.53	**2.04**	0.11	0.67	65.2	496	**GC**
GTM	-0.22	-1.10	0.00	0.03	152.1	GTM	-0.15	-0.75	-0.07	-1.16	151.6	196	**CD**
MEX	0.70	1.17	-0.03	-0.39	1275.4	MEX	0.73	1.25	-0.08	-1.15	974.4	469	**CD**
TTO	-0.06	-0.22	0.04	0.49	18.1	TTO	-0.03	-0.11	0.01	0.05	18.9	222	**CD**
URY	2.14	**7.32**	-0.28	**-3.10**	398.6	URY	2.14	**6.51**	-0.16	**-1.91**	419.9	434	**X**
VEN	0.11	0.47	0.09	1.32	79.9	VEN	0.23	0.89	-0.28	**-2.96**	78.3	440	**GC**
BGD	0.16	0.74	-0.20	-1.23	15.9	BGD	0.10	0.57	-0.13	-1.31	15.1	291	**CD**
EGY	0.13	0.55	-0.07	-0.66	1758.0	EGY	0.19	0.78	-0.28	**-2.71**	1675.6	456	**GC**
IDN	0.29	1.68	-0.03	-0.29	214.4	IDN	0.19	0.94	0.27	**3.09**	257.7	441	**GS**
IND	0.03	0.17	-0.09	-1.23	448.5	IND	0.03	0.14	-0.02	-0.32	478.4	532	**CD**
LKA	-0.05	-0.36	-0.15	-1.01	116.0	LKA	-0.09	-0.62	0.04	0.35	79.3	336	**CD**
MYS	-0.23	-1.03	0.17	**5.13**	236.8	MYS	-0.06	-0.27	-0.08	**-1.77**	306.3	504	**GC**
NPL	0.16	1.62	-0.13	**-2.53**	11.2	NPL	-0.33	-1.54	0.48	**1.99**	5.3	76	**GS**
PAK	0.29	1.48	-0.01	-0.22	22.0	PAK	0.28	1.56	0.02	0.22	23.4	308	**CD**
PHL	0.12	0.69	0.04	0.90	184.4	PHL	0.17	1.12	-0.08	-1.43	156.0	448	**CD**
THA	0.03	0.06	0.94	**1.82**	3.8	THA	0.70	1.15	-0.98	**-2.35**	6.2	51	**GC**
TUR	0.66	**1.88**	0.34	**5.38**	986.0	TUR	0.98	**3.12**	-0.45	**-5.47**	1048.8	532	**GC**
CMR	0.35	**2.19**	-0.50	**-4.58**	33.4	CMR	0.10	0.67	0.18	0.67	25.5	214	**GS**
ETH	-0.53	**-2.53**	-0.18	**-2.05**	221.2	ETH	-0.55	**-2.45**	-0.10	-1.29	132.4	185	**GS**
KEN	0.23	**2.25**	0.11	1.35	170.4	KEN	0.30	**2.55**	-0.15	-1.36	185.2	415	**CD**
MAR	0.23	0.97	0.03	0.31	21.3	MAR	0.23	1.02	-0.11	-1.13	24.0	204	**CD**
MWI	-0.11	-0.32	-0.15	-0.57	63.3	MWI	-0.22	-0.54	0.16	0.71	65.6	167	**CD**

Notes:

1. Arellano-Bond coefficients: differenced regressors and lagged dependent variables..
2. Lagged dependent variable and constant not reported. Generally highly statistically significant.
3. Green shaded cells indicate L and X are gross complements (GC) during positive transitions and gross substitutes (GS) during negative transitions. Orange shaded cells, indicate the converse of green shaded cells. CD indicates Cobb-Douglas production.
4. No estimates possible for CHN, LVA, ROM, BRA due to lack of adequate data.

Table 6: Dynamic panel estimates for models of n-Transitions. By 3-digit ISIC Industry and Region

Positive Transitions: $\ln(wage(i,c)) = \beta1\ VA/GO(i,c) + \beta2\ [VA/GO(i,c) \times I+(i,c)]$ + fixed effects

Negative Transitions: $\ln(wage(i,c)) = \beta1\ VA/GO(i,c) + \beta2\ [VA/GO(i,c) \times I-(i,c)]$ + fixed effects

	ASIA					EMERGING					LATIN AMERICA				
	"+" Transition		"-" Transition			"+" Transition		"-" Transition			"+" Transition		"-" Transition		
isic	**β2**	**t**	**β2**	**t**	**S/C**	**β2**	**t**	**β2**	**t**	**S/C**	**β2**	**t**	**β2**	**t**	**S/C**
FOO	0.73	1.58	0.04	0.25	CD	0.09	0.15	-1.45	**-2.81**	GC	-0.14	-0.67	0.08	0.35	CD
BEV	1.13	**2.87**	-0.09	-0.62	GC	-0.16	-0.54	0.17	0.68	CD	-0.08	-0.69	0.16	1.59	CD
TOB	0.17	0.74	0.18	1.43	CD	-0.23	-1.41	0.24	1.66	CD	-0.06	-0.64	0.09	1.33	CD
TXT	0.30	1.03	0.06	0.30	CD	-0.09	-0.57	-0.19	-1.24	CD	0.11	1.33	0.07	0.48	CD
APP	0.80	**1.93**	0.08	0.73	GC	0.22	0.94	0.09	0.67	CD	0.35	1.65	-0.26	**-1.85**	GC
LEA	0.51	1.34	-0.04	-0.25	CD	0.20	0.37	0.53	**1.90**	GS	-0.20	-0.88	0.27	1.02	CD
SHO	-0.35	**-2.59**	0.05	0.33	GS	0.62	**1.79**	-0.10	-0.70	GC	0.38	**2.84**	0.08	0.40	GC
WOD	0.18	0.80	0.25	1.37	CD	-0.29	-1.14	0.22	1.41	CD	0.16	1.61	-0.27	**-2.83**	GC
FUR	0.13	0.43	-0.21	**-1.92**	GC	0.69	1.61	0.12	0.83	CD	-0.05	-0.13	0.10	0.38	CD
PAP	0.33	1.37	-0.42	**-4.09**	GC	-0.23	-1.31	-0.13	-1.11	CD	-0.15	-0.62	-0.09	-0.64	CD
PRN	0.38	1.30	0.00	-0.02	CD	-0.31	**-1.86**	0.05	0.31	GS	0.00	0.03	-0.06	-0.50	CD
ICM	0.18	0.70	0.18	0.84	CD	-0.35	-1.21	-0.02	-0.09	CD	0.15	0.99	-0.27	**-2.65**	GC
OCM	-0.07	-0.22	-0.21	-1.26	CD	-0.19	-0.93	0.05	0.30	CD	0.26	**3.00**	-0.19	-1.63	GC
PET	0.12	0.44	-0.34	-1.55	CD	-0.05	-0.26	0.39	1.21	CD	0.01	0.11	-0.23	-1.11	CD
OPT	0.28	1.35	-0.32	-0.96	CD	-0.32	-0.44	-0.39	-1.45	CD	0.22	1.55	0.48	**3.48**	GS
RUB	-0.18	-0.45	-0.13	-0.78	CD	0.37	**2.00**	0.02	0.06	GC	0.03	0.20	-0.04	-0.22	CD
PLA	1.38	**2.19**	0.20	0.56	GC	0.31	1.49	-0.11	-0.41	CD	-0.11	-0.41	0.29	1.27	CD
POT	0.17	0.91	0.12	**2.01**	GS	-0.07	-0.32	-0.27	-1.50	CD	0.07	0.92	0.15	**2.40**	GS
GLA	-0.01	-0.07	-0.10	-0.78	CD	0.00	-0.01	-0.17	-0.82	CD	0.18	**2.55**	-0.33	-1.30	GC
OMN	0.08	0.32	0.13	0.90	CD	-0.43	**-1.79**	-0.23	-0.84	GS	0.11	0.52	-0.03	-0.20	CD
I&S	0.37	0.75	-0.24	-0.89	CD	-0.02	-0.11	-0.11	-0.61	CD	-0.26	-1.22	-0.37	-1.43	CD
NFM	0.42	1.28	-0.18	-0.46	CD	0.50	1.32	-1.41	**-1.98**	GC	0.30	0.70	0.09	0.38	CD
FAB	0.45	1.21	-0.19	-1.66	CD	0.35	1.35	-0.07	-0.34	CD	-0.29	-1.47	-0.18	-0.89	CD
MCH	-0.13	-0.37	0.19	1.30	CD	0.25	**1.73**	-0.06	-0.50	GC	0.07	0.47	-0.23	-1.18	CD
ELE	0.17	0.57	-0.31	**-2.28**	GC	-0.11	-0.45	0.06	0.40	CD	0.24	1.56	0.16	1.43	CD
AUT	0.12	0.37	-0.38	-1.65	CD	0.11	0.30	-0.48	**-2.05**	GC	0.20	1.70	-0.36	**-1.79**	GC
PRO	-0.28	**-1.83**	-0.09	-0.49	GS	0.27	1.22	-0.44	**-1.79**	GC	0.11	0.32	-0.10	-0.71	CD
OTH	-0.13	-0.84	0.20	1.44	CD	-0.35	-1.26	-0.14	-0.36	CD	-0.02	-0.13	0.18	1.50	CD

Notes:

1. See notes to Table 5.

Table A1: Range of the Value Added/Gross Output (VA/GO) ratio

	311	311		313	313		314	314		321	321		322	322		323	323		324	324		331	331		332	332
	FOO	**FOO**		**BEV**	**BEV**		**TOB**	**TOB**		**TXT**	**TXT**		**APP**	**APP**		**LEA**	**LEA**		**SHO**	**SHO**		**WOD**	**WOD**		**FUR**	**FUR**
F	MWI	0.68	**A**	LKA	0.63	**F**	MAR	0.81	**F**	KEN	0.59	**F**	CMR	0.56	**F**	KEN	0.68	**A**	EGY	0.58	**A**	LKA	0.50	**F**	KEN	0.57
L	BOL	0.51	**F**	KEN	0.63	**E**	POL	0.68	**F**	MWI	0.50	**L**	BOL	0.39	**A**	THA	0.67	**L**	BOL	0.37	**F**	CMR	0.48	**F**	CMR	0.43
F	CMR	0.46	**L**	ECU	0.62	**A**	THA	0.66	**F**	CMR	0.50	**L**	ARG	0.37	**A**	EGY	0.51	**L**	ECU	0.35	**F**	MWI	0.44	**L**	ECU	0.40
L	ARG	0.39	**E**	LVA	0.52	**L**	ECU	0.63	**L**	ARG	0.44	**A**	LKA	0.34	**L**	URY	0.43	**L**	URY	0.35	**L**	MEX	0.43	**A**	BGD	0.38
L	MEX	0.38	**E**	POL	0.50	**F**	CMR	0.60	**E**	POL	0.40	**A**	THA	0.29	**A**	LKA	0.35	**F**	MWI	0.34	**A**	EGY	0.39	**D**	TWN	0.37
A	PAK	0.33	**F**	MAR	0.49	**A**	PHL	0.55	**L**	TTO	0.38	**A**	EGY	0.29	**L**	ARG	0.34	**A**	NPL	0.34	**L**	BOL	0.37	**E**	POL	0.33
E	POL	0.31	**F**	CMR	0.45	**L**	BOL	0.52	**L**	BOL	0.34	**E**	HUN	0.27	**F**	ETH	0.34	**A**	PHL	0.33	**A**	NPL	0.36	**A**	THA	0.32
A	EGY	0.23	**L**	URY	0.38	**F**	MWI	0.52	**A**	PAK	0.33	**E**	LVA	0.27	**A**	PHL	0.33	**L**	CRI	0.32	**A**	PAK	0.36	**A**	CHN	0.31
L	URY	0.22	**A**	THA	0.38	**L**	ARG	0.45	**L**	URY	0.27	**E**	POL	0.26	**E**	POL	0.30	**E**	POL	0.31	**L**	CHL	0.35	**L**	ARG	0.30
A	NPL	0.21	**F**	MWI	0.37	**A**	TUR	0.41	**L**	VEN	0.23	**A**	PAK	0.25	**L**	MEX	0.29	**L**	ARG	0.30	**L**	URY	0.34	**A**	EGY	0.30
E	HUN	0.19	**A**	EGY	0.36	**L**	CRI	0.41	**A**	EGY	0.23	**F**	KEN	0.25	**A**	IDN	0.28	**A**	BGD	0.30	**A**	BGD	0.31	**L**	CHL	0.29
A	PHL	0.19	**A**	PHL	0.34	**L**	MEX	0.39	**A**	LKA	0.23	**L**	GTM	0.24	**A**	PAK	0.25	**A**	LKA	0.29	**L**	VEN	0.30	**F**	MAR	0.29
A	LKA	0.17	**A**	BGD	0.33	**A**	IDN	0.38	**A**	PHL	0.22	**L**	URY	0.24	**E**	ZAF	0.23	**E**	ZAF	0.28	**E**	ZAF	0.30	**L**	BOL	0.28
L	GTM	0.17	**A**	NPL	0.32	**F**	ETH	0.36	**L**	ECU	0.21	**F**	MWI	0.23	**F**	CMR	0.22	**E**	HUN	0.27	**E**	POL	0.27	**A**	IDN	0.26
L	TTO	0.17	**A**	TUR	0.30	**L**	COL	0.34	**A**	CHN	0.21	**L**	ECU	0.22	**L**	VEN	0.22	**A**	IDN	0.26	**A**	THA	0.26	**L**	GTM	0.26
A	BGD	0.17	**L**	BOL	0.27	**E**	ROM	0.33	**A**	THA	0.21	**A**	PHL	0.21	**L**	ECU	0.21	**L**	CHL	0.26	**L**	ECU	0.25	**L**	URY	0.26
A	TUR	0.16	**L**	GTM	0.26	**L**	VEN	0.33	**L**	MEX	0.19	**L**	VEN	0.21	**L**	BOL	0.21	**D**	TWN	0.24	**L**	ARG	0.25	**A**	LKA	0.24
L	VEN	0.16	**A**	IDN	0.25	**L**	BRA	0.32	**L**	CHL	0.19	**L**	CRI	0.21	**E**	ROM	0.20	**A**	PAK	0.23	**L**	TTO	0.24	**A**	PHL	0.24
E	ROM	0.15	**A**	CHN	0.25	**A**	EGY	0.28	**E**	ZAF	0.18	**D**	KOR	0.20	**A**	NPL	0.19	**D**	KOR	0.21	**D**	KOR	0.23	**A**	TUR	0.24
E	ZAF	0.15	**A**	MYS	0.25	**A**	BGD	0.26	**A**	BGD	0.17	**L**	TTO	0.20	**L**	CHL	0.19	**F**	KEN	0.21	**F**	KEN	0.22	**L**	CRI	0.23
A	IDN	0.15	**E**	HUN	0.24	**A**	LKA	0.26	**D**	TWN	0.17	**F**	MAR	0.20	**A**	MYS	0.18	**L**	TTO	0.20	**L**	COL	0.21	**A**	PAK	0.22
F	KEN	0.15	**L**	ARG	0.24	**L**	URY	0.26	**L**	BRA	0.16	**A**	IDN	0.20	**L**	COL	0.18	**L**	MEX	0.17	**D**	TWN	0.20	**L**	TTO	0.22
A	CHN	0.14	**L**	VEN	0.20	**L**	TTO	0.25	**E**	ROM	0.15	**A**	BGD	0.20	**L**	GTM	0.18	**L**	GTM	0.17	**L**	GTM	0.20	**E**	ROM	0.19
L	ECU	0.14	**D**	KOR	0.20	**D**	TWN	0.25	**F**	ETH	0.15	**A**	IND	0.18	**D**	TWN	0.16	**F**	MAR	0.16	**A**	PHL	0.18	**F**	MWI	0.17

Note: **F**=Africa, **L**=Latin America, **A**=Asia, **D**=Developed, **E**=Emerging.

Table A1 (contd.): Range of the Value Added/Gross Output (VA/GO) ratio

	341	341		342	342		351	351		352	352		353	353		354	354		355	355		356	356		361	361
	PAP	**PAP**		**PRN**	**PRN**		**ICM**	**ICM**		**OCM**	**OCM**		**PET**	**PET**		**OPT**	**OPT**		**RUB**	**RUB**		**PLA**	**PLA**		**POT**	**POT**
L	URY	0.45	**A**	THA	0.73	**F**	MWI	0.75	**E**	POL	0.62	**A**	THA	0.91	**A**	BGD	0.49	**L**	BOL	0.42	**F**	CMR	0.67	**L**	VEN	0.63
L	BOL	0.44	**A**	NPL	0.53	**F**	KEN	0.66	**F**	CMR	0.55	**L**	ECU	0.84	**L**	BOL	0.42	**E**	POL	0.41	**L**	ARG	0.63	**L**	CHL	0.62
A	LKA	0.42	**F**	CMR	0.52	**L**	BOL	0.53	**L**	ECU	0.53	**A**	BGD	0.82	**L**	GTM	0.41	**F**	MWI	0.41	**F**	KEN	0.55	**F**	KEN	0.61
F	ETH	0.38	**F**	MWI	0.49	**L**	ARG	0.41	**F**	MAR	0.52	**L**	ARG	0.73	**A**	TUR	0.36	**E**	ROM	0.38	**L**	URY	0.46	**L**	ECU	0.56
L	TTO	0.37	**D**	TWN	0.47	**F**	CMR	0.41	**F**	MWI	0.46	**L**	BOL	0.69	**A**	EGY	0.31	**L**	URY	0.33	**E**	LVA	0.39	**F**	CMR	0.53
F	CMR	0.36	**L**	GTM	0.42	**L**	TTO	0.40	**L**	MEX	0.45	**A**	IDN	0.68	**L**	CRI	0.31	**L**	ECU	0.32	**F**	MWI	0.36	**L**	TTO	0.49
L	ARG	0.36	**E**	POL	0.41	**A**	LKA	0.39	**L**	TTO	0.38	**L**	URY	0.67	**A**	PHL	0.28	**L**	ARG	0.31	**E**	POL	0.35	**E**	POL	0.44
A	NPL	0.30	**E**	ZAF	0.41	**A**	IDN	0.39	**L**	ARG	0.36	**L**	COL	0.59	**L**	URY	0.27	**A**	IDN	0.31	**A**	PAK	0.34	**L**	ARG	0.42
F	KEN	0.29	**L**	ARG	0.39	**A**	EGY	0.37	**A**	THA	0.36	**E**	HUN	0.50	**L**	MEX	0.26	**F**	KEN	0.30	**A**	LKA	0.32	**E**	ZAF	0.42
E	POL	0.29	**L**	URY	0.39	**E**	POL	0.31	**L**	BOL	0.31	**L**	VEN	0.47	**E**	ROM	0.25	**A**	EGY	0.29	**L**	TTO	0.30	**A**	IDN	0.41
L	VEN	0.29	**L**	BOL	0.36	**L**	CHL	0.30	**A**	PHL	0.31	**E**	POL	0.44	**A**	IDN	0.25	**F**	MAR	0.28	**A**	BGD	0.30	**A**	THA	0.39
F	MWI	0.28	**A**	PAK	0.33	**F**	MAR	0.29	**A**	LKA	0.28	**A**	CHN	0.29	**E**	POL	0.24	**A**	PHL	0.27	**L**	BOL	0.29	**L**	URY	0.38
A	CHN	0.28	**F**	MAR	0.31	**L**	GTM	0.29	**E**	ZAF	0.27	**D**	TWN	0.29	**L**	COL	0.24	**E**	LVA	0.26	**A**	EGY	0.26	**A**	EGY	0.36
F	MAR	0.25	**A**	EGY	0.30	**L**	ECU	0.28	**F**	KEN	0.25	**A**	PAK	0.28	**L**	ECU	0.24	**A**	CHN	0.26	**L**	CHL	0.26	**A**	PAK	0.35
D	TWN	0.24	**A**	LKA	0.30	**E**	HUN	0.26	**A**	TUR	0.22	**L**	MEX	0.27	**A**	PAK	0.24	**A**	BGD	0.25	**A**	THA	0.25	**E**	HUN	0.34
A	PHL	0.24	**E**	LVA	0.29	**A**	MYS	0.26	**L**	CHL	0.20	**A**	PHL	0.24	**A**	MYS	0.23	**L**	TTO	0.25	**A**	PHL	0.23	**A**	LKA	0.34
A	IDN	0.23	**L**	ECU	0.28	**A**	PHL	0.26	**L**	VEN	0.20	**A**	MYS	0.24	**A**	CHN	0.22	**A**	THA	0.25	**A**	IDN	0.22	**L**	BOL	0.31
L	ECU	0.23	**F**	KEN	0.27	**A**	THA	0.25	**E**	LVA	0.19	**L**	CRI	0.22	**L**	ARG	0.20	**A**	PAK	0.24	**L**	VEN	0.20	**A**	PHL	0.30
A	EGY	0.22	**E**	ROM	0.26	**E**	ZAF	0.24	**E**	HUN	0.18	**D**	KOR	0.22	**D**	KOR	0.17	**A**	NPL	0.23	**L**	MEX	0.19	**A**	BGD	0.28
A	PAK	0.20	**A**	IDN	0.24	**A**	TUR	0.24	**A**	IDN	0.17	**D**	JPN	0.19	**D**	TWN	0.14	**L**	GTM	0.21	**L**	MEX	0.19	**E**	ROM	0.27
E	HUN	0.19	**A**	TUR	0.23	**F**	ETH	0.24	**A**	CHN	0.17	**E**	LVA	0.16	**A**	IND	0.11	**L**	VEN	0.21	**A**	CHN	0.19	**A**	CHN	0.26
L	CHL	0.19	**L**	CHL	0.23	**D**	JPN	0.24	**A**	EGY	0.17	**E**	ZAF	0.13	**E**	ZAF	0.09	**E**	ZAF	0.19	**L**	ECU	0.19	**L**	GTM	0.26
E	LVA	0.18	**A**	BGD	0.22	**L**	CRI	0.22	**L**	GTM	0.16	**A**	IND	0.13	**F**	MAR	0.09	**A**	TUR	0.19	**D**	TWN	0.18	**L**	CRI	0.24
A	THA	0.18	**A**	PHL	0.22	**L**	VEN	0.20	**L**	COL	0.16	**E**	ROM	0.10				**D**	TWN	0.18	**E**	ZAF	0.18	**D**	KOR	0.21

Table A1 (contd.): Range of the Value Added/Gross Output (VA/GO) ratio

	362	362		369	369		371	371		372	372		381	381		382	382		383	383		384	384		385	385
	GLA	**GLA**		**OMN**	**OMN**		**I&S**	**I&S**		**NFM**	**NFM**		**FAB**	**FAB**		**MCH**	**MCH**		**ELE**	**ELE**		**AUT**	**AUT**		**PRO**	**PRO**
F	KEN	0.69	A	IDN	0.58	L	ARG	0.56	A	EGY	0.66	F	KEN	0.56	L	ECU	0.68	F	MWI	0.61	L	TTO	0.69	F	KEN	0.80
F	CMR	0.56	A	BGD	0.51	A	PAK	0.50	L	BOL	0.58	A	PAK	0.49	L	BOL	0.63	F	CMR	0.49	L	ARG	0.56	A	PAK	0.61
L	ECU	0.49	E	POL	0.48	A	LKA	0.49	F	CMR	0.49	L	MEX	0.45	A	THA	0.60	L	ARG	0.48	A	BGD	0.54	A	EGY	0.57
D	TWN	0.41	F	MWI	0.48	L	URY	0.48	E	LVA	0.45	L	URY	0.43	E	POL	0.51	A	LKA	0.45	L	ECU	0.46	A	THA	0.54
L	BOL	0.41	F	CMR	0.46	L	BOL	0.47	L	ECU	0.44	L	BOL	0.41	L	URY	0.49	F	KEN	0.44	L	BOL	0.45	L	BOL	0.52
F	ETH	0.39	A	PAK	0.34	F	CMR	0.37	A	PHL	0.43	F	MWI	0.39	F	KEN	0.43	L	BOL	0.42	F	CMR	0.44	L	CRI	0.51
A	THA	0.39	L	ARG	0.33	A	IDN	0.36	A	LKA	0.39	L	TTO	0.38	A	EGY	0.42	A	BGD	0.42	A	THA	0.44	A	PHL	0.47
E	POL	0.38	E	ZAF	0.30	L	CRI	0.34	E	POL	0.38	L	ARG	0.37	L	MEX	0.41	A	THA	0.38	L	CHL	0.44	A	BGD	0.44
F	MAR	0.37	D	HKG	0.29	L	ECU	0.31	L	GTM	0.38	A	EGY	0.33	L	ARG	0.40	L	ECU	0.37	F	MWI	0.43	A	IDN	0.43
A	PHL	0.36	F	KEN	0.27	A	TUR	0.31	A	THA	0.37	E	POL	0.32	F	ETH	0.34	E	POL	0.34	A	LKA	0.42	L	VEN	0.39
A	IDN	0.36	F	MAR	0.27	F	ETH	0.30	L	ARG	0.35	L	CHL	0.31	A	LKA	0.30	L	URY	0.28	L	URY	0.38	L	ECU	0.39
E	ZAF	0.31	A	LKA	0.27	A	PHL	0.29	L	VEN	0.33	A	THA	0.30	L	CHL	0.29	L	TTO	0.28	F	KEN	0.36	E	POL	0.36
A	CHN	0.31	A	EGY	0.27	A	EGY	0.28	A	PAK	0.33	D	TWN	0.27	L	GTM	0.27	E	ZAF	0.27	E	POL	0.35	E	ZAF	0.36
E	LVA	0.31	A	TUR	0.26	A	THA	0.28	L	URY	0.32	F	CMR	0.26	A	BGD	0.24	F	ETH	0.23	A	EGY	0.34	A	LKA	0.35
L	CRI	0.31	L	BOL	0.26	L	GTM	0.28	E	ZAF	0.32	L	ECU	0.24	A	IDN	0.24	A	EGY	0.22	A	PAK	0.30	A	CHN	0.33
L	GTM	0.27	L	ECU	0.26	E	HUN	0.28	F	MAR	0.31	E	LVA	0.24	A	PAK	0.23	L	CHL	0.20	F	MAR	0.30	L	GTM	0.30
L	URY	0.26	L	GTM	0.26	E	POL	0.27	A	MYS	0.26	A	CHN	0.20	A	PHL	0.22	E	HUN	0.20	A	IDN	0.29	E	LVA	0.29
L	CHL	0.26	A	PHL	0.26	E	ZAF	0.27	L	CHL	0.25	E	ZAF	0.19	E	ZAF	0.22	A	CHN	0.20	F	ETH	0.27	E	HUN	0.28
A	LKA	0.25	A	MYS	0.26	E	LVA	0.26	L	CRI	0.24	A	LKA	0.18	A	MYS	0.21	A	PHL	0.19	E	HUN	0.26	L	URY	0.28
L	ARG	0.24	A	CHN	0.24	L	VEN	0.23	L	COL	0.24	F	MAR	0.18	F	MAR	0.21	E	LVA	0.19	L	VEN	0.23	A	MYS	0.26
E	ROM	0.22	E	HUN	0.24	A	MYS	0.23	E	HUN	0.21	L	VEN	0.18	A	CHN	0.19	L	BRA	0.19	L	GTM	0.23	F	MAR	0.24
A	EGY	0.21	E	LVA	0.23	D	HKG	0.19	A	TUR	0.21	E	HUN	0.18	L	CRI	0.18	L	GTM	0.19	L	CRI	0.20	L	ARG	0.22
A	MYS	0.18	L	CRI	0.21	A	BGD	0.17	A	IND	0.21	A	IDN	0.17	D	TWN	0.18	A	IDN	0.18	A	CHN	0.20	L	CHL	0.22
L	MEX	0.18	L	MEX	0.21	L	CHL	0.17	L	MEX	0.18	A	NPL	0.16	E	HUN	0.17	L	VEN	0.18	A	MYS	0.19	D	TWN	0.22