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The Speed of Structural Convergence in the Manufacturing Industries of Newly Industrializing Economies

Berhanu Abegaz*
College of William and Mary

College of William and Mary
Department of Economics
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Abstract

We seek to identify the determinants of the speed of convergence in the structures of manufacturing to their steady-state levels as developing economies become fully industrialized. Applying a two-stage sequential estimation procedure to data on three-digit manufacturing industries for 45 mostly middle-income countries, we find empirical support for the hypothesis that production efficiency is a major determinant of inter-branch output share adjustment. This finding applies to many but not all industries. One implication for latecomers is that industrial policy must aim at rapid diffusion of core technologies to facilitate the acquisition of industrial capabilities in a diversified basket of exportables.

JEL Codes: F14, L6, O14, O33, O57

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Berhanu Abegaz
Department of Economics
College of William and Mary
Williamsburg, VA 23187-8795
bxabeg@wm.edu

1. INTRODUCTION

A remarkably robust stylized fact of development is that, as developing economies emerge out of mass poverty, their product space is upgraded and diversified (Imbs and Wacziarg, 2003; Hausmann and Klinger, 2007). This paper asks whether such rapidly industrializing countries become more similar in the production structures of their manufacturing industries and, if so, what factors drive the speed of structural convergence. The evidence provided here establishes the existence of convergence and underscores the important role of supply-side factors in influencing the speed of structural adjustment.

The interplay between improvements in economic well-being and changes in the structure of economic activity, though under-researched, has a long pedigree in economics. This is in large part because economic growth is closely, perhaps endogenously, associated with structural change. One notable result is that production and export structures assume alternating forms of specialization and diversification with increases in per capita income.

Empirical studies of older vintage have looked at structural change at two distinct levels. The first level pertains to inter-sectoral change of the Clark-Kuznets variety that involves a sequential shift in economic activity at the one-digit ISIC[1] level from agriculture to industry and then to services. In this case, causality runs from changes in income to changes in production structure.

The second level involves intra-sectoral change within manufacturing industry involving shifts at the two-digit ISIC or higher levels which are often linked to changes in the composition of demand, productivity and factor endowments. These dynamics entail significant shifts from low-technology activities toward high-technology production, employment, and trade in the course of industrialization.

A succinct summary of the stylized facts concerning the process of production diversification, technological deepening and growth is provided by UNIDO (2005, p. xvii) in its recent report on the dynamics of capacity building as latecomers catch up with leaders:

> As poor countries get richer, sectoral production and employment become less concentrated and more diversified. This pattern lasts until fairly late in the development process. Then, incentives to specialize take over as the major force. Beyond a few specialized, export-oriented activities, a similar pattern can be expected in the allocation of resources to technological effort where technological learning tends first to spread across a broad range of activities, to become increasingly specialized and differentiated as the economy attains higher levels of development.

[1] ISIC = international system of industrial classification.

The manufacturing sectors of two countries are said to structurally converge if comparability in the economy-wide shares of manufacturing is accompanied by a growing resemblance in the sectoral composition of output or factor use. Structural factors, therefore, have significant implications for theoretical and policy debates concerning the nature of changes in growth, trade and the industrial organization in the course of development. If structural convergence is discernible for rapidly catching-up economies, then, the inevitable follow-up task is to provide a persuasive account of the factors that drive inter-industry differences in the speed of convergence.

The rest of the paper is organized as follows. The existence of the phenomenon of convergence is explored in section 2. The theoretical basis for the working hypothesis concerning the speed of convergence is presented in section 3. The two-stage empirical framework and the models employed to estimate the influences of industry characteristics on the direction and the speed of convergence are presented in section 4. The empirical findings and their possible policy implications are taken up in section 5. Section 6 presents concluding thoughts. The sources of the data and the necessary adjustments are briefly explained in the appendix.

2. DIRECTION OF STRUCTURAL CONVERGENCE

As noted earlier, the need to account for the remarkable postwar success of a number of middle-income countries in diversifying and technologically upgrading their industrial bases has rekindled interest in the possibility of convergence in the structures of manufacturing between successful industrializers and latecomers (Aiginger, 1999; Amsden, 2001; Nolan and Pack, 2003). More specifically, the question is *whether* and *how* the industrial structures of successful latecomers progressively become intersectorally thick and fat-tailed much like those of mature industrial economies. This question has three dimensions: directionality, determinants of directionality, and determinants of speed. We explore the first and the last dimensions in this paper.

A natural starting point for empirical investigation is the well-established historical fact that, in the industrialized market economies, the production structure of manufacturing is generally diversified and relatively stable at least between technological revolutions. For the many waves of catching-up economies, on the other hand, manufacturing tends to be narrowly concentrated and in continual flux. The contrast between relative stability and specialization in mature but non-deindustrializing economies and rapid diversification in successfully developing economies raises the intriguing possibility of structural convergence (Abegaz, 2002; Imbs and Wacziarg, 2003)[2].

[2] The special case of the centrally planned economies is worth noting here. Compared to their market-oriented

These observations have led, among other things, to a reconceptualization of the concern of the older, and in some ways fuzzier, literature on *structural change* in production, trade, employment, or sources of growth (see Syrquin, 1988, for a review of the literature on the subject). Recasting this line of research in terms of *structural convergence* has, in fact, been done at two distinct levels of aggregation.

Much of the extant empirical literature on the subject has focused on Solow-type convergence in 'level variables'—notably in sectoral labor productivity or in real per capita income—between leaders (countries or regions) and laggards (see Wolff, 1997). Although aggregate endogenous growth models, which eschew compositional shifts, have led to a dampening of interest in structural analysis, the two-way causality between aggregate economic growth and structural change is beginning to receive the attention it deserves (see, for example, Timmer and Szirmai, 2000; Peneder, 2003; Montobbio and Rampa, 2005).

The second strand of empirical work is on convergence in 'structural variables.' In its weak version, structural convergence refers to rising similarity in the inter-branch composition of industrial output, trade, or employment between countries grouped by level of industrial sophistication (Baumol, Nelson and Wolff, 1994). This conceptualization confronts directly the longstanding question of whether, say, the distribution of output among the manufacturing industries of a typical late-industrializer progressively resembles the structure of the manufacturing sector of a randomly picked mature industrial economy.

Benefiting from the robust empirical support for the Clark-Kuznets conjecture at the one-digit level (see, for example, Branson, *et al.*, 1998; Kuznets, 1966), the directionality of structural shifts in developing economies has been the subject of two waves of disaggregated analysis. One strand focused on structural change in manufacturing at the two-digit ISIC level. Chenery and associates (Chenery and Syrquin, 1986; Syrquin and Chenery, 1989) demonstrated the existence of discernible empirical regularities in the evolution of industrial structures in the course of economic development.

The other strand of empirical work, at the three-digit ISIC level, has supplied more than tentative answers to questions regarding the directionality of convergence. There is some evidential support for the claim that technological diffusion, rising per capita income and expanding world trade have resulted in increased homogenization of industrial structures across all but the poorest countries. This is the case despite significant inter-country variations in histories, factor endowments, financial systems, and industrial policies. This finding is, of course, not inconsistent with the observation that global integration of the less industrialized economies, given the multiplicity of initial conditions, can and does result in greater specialization at the level of specific products (Cimoli, Dosi, Nelson and Stiglitz, 2006).

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counterparts at similar levels of income per head, socialist economies tended to be over-industrialized and over-diversified. Post-socialist transition has inevitably led to massive disorganization of industry, deindustrialization where products are no longer marketable, and greater specializations toward areas of comparative advantage.

Broadly speaking, the evidence suggests that industrial deepening—whether market-induced or policy-induced or both—entails share losses for light and selected heavy manufacturing, and share gains for engineering and consumer durables. While semi-industrial economies have managed to shift into petrochemical and engineering industries, the least industrialized boast a broad spectrum of non-traditional manufacturing (Abegaz, 2002; Amsden, 2001; Forstner and Balance, 1990; Syrquin and Chenery, 1989; Chenery and Syrquin, 1986; UNIDO, 1979; 2004). In light of this, the primary distinction of theoretical and policy interest is understandably turning to market- and policy-induced firm responses to technological gaps across clusters of manufacturing industries (see UNIDO, 2002; OECD, 1996; Cimoli, Dosi, Nelson and Stiglitz, 2006, for a review).

If weak convergence in levels is discernible from the historical data, the next task for researchers is to identify and empirically assess the factors that govern the *speed* of structural convergence. Using three-digit panel data for a representative sample of 45 twentieth-century industrializers spanning four continents, this paper seeks an answer for the question of what drives inter-branch variations in the rate of convergence to the long-term or steady-state output mix.

3. SPEED OF STRUCTURAL CONVERGENCE

Directional changes in the output share of an industry over time, relative to total manufacturing, are driven by differential changes in supply, demand, or both. The observed data obviously reflects the joint influences of supply and demand.

Analysis of the 'directionality' of convergence presupposes the existence of easily identifiable end points—share floors for losers and share ceilings for gainers. The end points of convergence, theoretically speaking, are the steady-state output shares that would prevail in the long run.[3]

The 'speed' of convergence, on the other hand, pertains to the efficiency with which structural changes or transitional dynamics take place toward the steady state levels. The rate of convergence is then understood here as the pace of output-share adjustments as an industry sector gropes toward its long-term share level.

[3] From the standpoint of economic theory, it would be desirable if the empirical work is informed by a clear-cut identification of the "optimal" structure to which those manufacturing industries away from their steady states would converge. However, given that the stringent conditions under which the theorems of welfare economics rarely hold in an environment of rapid industrialization, empirical work on convergence in level variables (such as labor productivity) typically relies for a yardstick on either the average level in a reference group of mature economies or one taken from a canonical economy (typically, the United States). We explore the usefulness of the former in the empirical sections of the paper.

Differences in the speed of adjustment can be studied at two levels: at the level of industries over time for a given country, and at the level of industries across countries. The first type produces inter-country comparisons of efficiency in industrial adjustment based on time series data. The second type, the main concern in this paper, yields industry-specific measures of speed for a group of late industrializers, especially if it is based on a panel of cross-section and time series data.

(a) Theory

Aiginger (1999; 2001) makes the candid observation that the lack coherent theory has impeded progress in the academic research on convergence of industry structure. However, there are well established theoretical considerations from the economics of demand, supply and trade to serve as building blocks of a usable framework.

Structural adjustment, economic theory suggests, is endogenous to long-run growth and development. This is so because microeconomic changes in supply and demand have differential effects across industry sectors. Existing economic structure, being generally slow-changing in nature, also exerts lingering influences on future growth prospects (Kuznets, 1966; Adelman, 2001; Hagemann, 2003; Weil, 2005). For a given final demand (external as well as internal), there are three explanations for changes in industrial structure: neoclassical, institutional, and evolutionary.

According to the theory of factor proportions, given the same technology, prices and tastes, investment in physical capital and education have predictable effects on the structure of production in that countries tend to produce or export relatively more of those manufactures that intensively utilize their most abundant factor supplies (Reeve, 2006). In this model, technology, prices and tastes are given. That means, if factor endowments and technological change are endogenous, the factor supplies theory of comparative advantage cannot address the issue of convergence. To the extent convergence in institutions and policies is a slow process, structural variations are likely to persist across countries or industries.

The institutionalist explanation, on the other hand, posits that industry structure reflects the presence of mostly idiosyncratic institutions and embedded policies that reflected the power of vested interests. From a political economy perspective, this means that regulatory regimes, unionization, labor and environmental standards, tax treatment, credit subsidies, and trade policy explain industry structure.

The third explanation is neo-technological and suggests that, in the developed economies, the emergence of technical and product standards leads to the establishment of a new "industry" as well as associated market and non-market institutions (or selection environment) that regularize the interactions among key actors (firms, suppliers, and customers). In developing countries, the diffusion of mature products and standardized processes allow for the establishment of low-technology and then mid-technology industries (Nelson, 2005).

A number of reasons can be adduced for this pattern of evolution. Marginal returns are lower in high capital-intensity industries than in low capital-intensity industries. The rate of technological progress is higher in follower industries since the cost of advanced technology rises with the level of technological sophistication already achieved. Latecomers need not reinvent the wheel or repeat the mistakes of industrial leaders. Finally, late adopters of a technology are less likely to be burdened by inertial institutional lock-ins that thwart the adaptability of institutions to ever-changing circumstances (Tybout, 2000; Ruttan, 2001).

The relationship between income and technological sophistication on the one hand and structural change on the other hand may then be conceptualized as a bi-directional relationship:

$$\{ y \} \qquad \leftarrow A \rightarrow \qquad \{ I \} \qquad \leftarrow B \rightarrow \qquad \{ SC \} \tag{1}$$

where y = per capita income, I = industrial development as indexed by industrial value added as a fraction of GDP, and SC = structural change/convergence.

The link [A] captures the relationship between real per capita income and industrial development. For industrializing economies, the share of industrial value added in national output rises steadily and then falls at higher per capita income levels after which time modern services begin to take the lead.

The link [B], that between industrial development and structural change (and hence structural convergence), may be summed up in terms of the three theoretical dimensions noted above (Wacziarg, 2001; Imbs and Wacziarg, 2003; Aiginger, 1999; 2001; Reeve, 2006; Rodrik, 2007):

i. *Demand-side effects,* i.e., convergence of incomes among countries, by homogenizing preferences via Engel effects, induce convergence in the structures of industrial output.

ii. *Supply-side effects*, i.e., convergence of inter-sectoral productivities of labor across countries as technological diffusion, via product and process innovations, shapes demand (lower prices and fungible consumer taste), and allocational efficiency improves. This effect is accentuated by economies of scale and economies of scope which together induce greater similarities in output structure especially if technological lock-ins resulting from complementarities or agglomeration are absent.

iii. *Trade effects,* i.e., greater similarity in relative factor abundance (due to dynamic comparative advantage) may complement Ricardian productivity-led convergence to induce rising homogeneity in product mixes. One manifestation is the growing importance of intra-industry trade among high-income economies.

The joint effects of the foregoing factors have been the subject of two interesting lines of recent empirical research. One line of research has established an inverted-U pattern of diversification in production and exports. Wacziarg (2001), for example, provides evidence for the idea that convergence in relative factor abundance (employment) induces convergence in sectoral structure which is not inconsistent with the Heckscher-Ohlin-Samuelson model of trade. Imbs and Wacziarg (2003) identify, at the three-digit ISIC level, distinct stages of structural transformation whereby sectoral diversification increases with per capita up to a certain threshold (Ireland's level of income) beyond which specialization in more advanced products becomes the predominant trend. This finding of nonlinearity in the industrialization process clearly goes against the traditional conception of static comparative advantage which overemphasizes the virtues of specialization for developing countries regardless of income level.

Applying the idea of development as discovery and using network analysis, related research by Hausmann and associates also shows that the discovery of new exportables peaks at the middle-income level and then declines subsequently (Klinger and Lederman, 2004), and that the ability of industrializing economies to upgrade their export mix is shaped by the degree of relatedness of the products they are already able to produce. This would imply that the density or dispersion of the product space shapes the prospects for further structural convergence and economic growth (Hausmann and Klinger, 2006; 2007).

If sectoral concentration of economic activity falls and then rises with per capita income, and given the stylized fact that the share of industry in national output inevitably rises and then falls with per capita income, it must then follow that the pattern of sectoral diversification rises with industrial deepening. That means, one can speak of an income dependent "normal" or "optimal" structure which may, in turn, shape the prospects for income growth via demand expansion and export competitiveness—perhaps with a lag (Aiginger, 2001, p.14).

Even when research interest is not on disaggregating the sources of structural change (demand structure, productivity, or factor abundance), a valid econometric specification of the determinants of industry structure must be clear about the assumed steady-state distribution of shares. In a world where countries are identical in endowments and access to technology, the steady-state distribution of the shares of each branch of manufacturing in one country would be the same since income and productivity will also converge. If large structural differences persist despite convergence in productivity or endowments, then either the assumptions do not hold or that other confounding factors (such as agglomeration economies and path-dependence of technological diffusion) must be operative.

The bottom line is that the nature of technology, inter-sectoral linkages, institutional and organizational forms, openness to international trade and investment, and industrial policy are among the major candidates that would shape firm behavior and the optimality of the industrial structure. Changes in industrial structure are ultimately driven by the interplay of technological and market opportunities which vary across branches, and differing institutional and entrepreneurial capabilities facing developing-country firms to creatively assimilate imported technology (UNIDO, 1979; 2002; 2004; Evenson and Westphal, 1995; Chandler, 1990; Lall, 1997; Amsden, 2001).

Although the readily available data do not allow us to disentangle demand-side convergence and supply-side convergence, the drivers of differential share adjustment can be readily identified. Share growth, for example, is bound to be rapid for industries facing growing and broadly-based demand—domestic as well as export. This is attributable to several factors, including external economies that arise as a larger industry permits falling input costs, pecuniary economies emanating from scale economies and longer production runs, and non-production forms of innovation involving such high-value activities as design and distribution (Noland and Pack, 2003; Giuliani, *et al.*, 2005).

Share gainers are also likely to be those industries with high supply elasticity. The supply-side mechanism captures the effects of such factors as technological externalities that arise from interactions between domestic suppliers and buyers, technological externalities from trade especially as inter-industry trade gives way to intra-industry trade, benefits from static scale economies in industries with low fixed costs, and gains from dynamic scale economies in the form of long-term learning. By the same token, share losers tend to be industries with low capital and skill intensities resulting in low rates of firm entry, and those with high rates of protection or bias against exports (Pack, 1988; Noland and Pack, 2003; Montobbio and Rampa, 2005).

(b) Hypothesis

While the foregoing theoretical considerations speak to the question of the direction of structural change, namely, the possibility of structural convergence, they do not directly address the issue of speed of convergence. However, there are two implications of the analysis that are pertinent to speed. Firstly, regardless of whether countries gravitate toward a global or a club steady state, it must be the case that those economies that are further away from their steady state structure are bound to converge at a higher speed than those closer to it. Secondly, the forces that drive the direction of structural convergence must also be among the major factors that determine the speed of convergence.

In light of these considerations, and the scope of the data at our disposal, we propose to examine, if not definitively test, the following hypothesis:

> *The speed of convergence of developing-country manufacturing industries to their long-term steady--state output shares is driven primarily by technical and financial efficiency, and the degree of openness to international trade. More specifically, share gains (losses) are accelerated (mitigated) by low unit cost, profitability, and*

trade turnover, but moderated by strong backward linkages with input-supplying industries.

The hypothesis captures strong claims concerning the joint effects of demand and supply (cost and profitability) and openness to trade on structural change with a bias toward supply-side capability. It should be noted, however, that disaggregating the separate effects of these factors goes beyond the scope of this paper since it requires data on sector-specific consumption, productivity and trade intensity.

4. METHODOLOGY AND ESTIMATION ISSUES

An outright panel econometric approach is ill-suited for the problem at hand because of the difficulty of finding a robust measure of the speed of convergence. A new approach is needed that melds the effects of initial shares and a realistic trajectory of adjustment. A methodological innovation employed here for testing the foregoing hypothesis is the use of a sequential, two-stage framework of estimation.

In the first stage, we posit a purely statistical logistic path of compositional change at the meso-economic level. Using panel data (country years), we estimate industry-specific and country-specific slope parameters (betas) for the logistic model—a flexible form that has been applied to a variety of economic relationships (the nutrition curve, the efficiency-wage curve, etc.). These betas, which capture inter-branch heterogeneity, provide the needed parameters whose signs (positive, negative or zero) define the *direction* of convergence. Just as importantly, the size of the beta parameters provides a reasonable index of the *speed* of convergence toward the target or long-term share level.

In the second stage, we regress the cross-sectional vector of estimated beta parameters on the mean values (over years of observation) of a number of economically justifiable explanatory variables that vary by industry and country. This approach, in effect, treats the speed parameters as random draws from a common distribution that depends primarily on inter-country differences in industry characteristics.

(a) Direction of Structural Convergence

The standard logistic (SL), in a continuous form, is an ideal statistical model for capturing structural convergence (Cramer, 1991; Clark, *et al.*, 1991; Abegaz, 2002).[4] First, it constrains the estimated share (S*) in

[4] The standard, continuous logistic model takes the form: $S_{jct} = C_j / [1 + \exp(-Z_{jct})]$ $(0 < S < 1)$ where S = output share of a branch in total manufacturing value-added, C = the share ceiling which for simplicity is given its maximum value of 1, and Z_{jct} = relevant explanatory variables. The subscripts *j, c* and *t* index industries, countries, and years, respectively. The logistic distribution belongs to a class of differential equations. The logistic curve is symmetric around the midpoint (S = 1/2). The symmetry around the inflection point implies that most pronounced structural changes occur at the intermediate level of industrialization. Furthermore, S is also constrained to the range $0 \leq S \leq C \leq 1$. The parameter C may then be given the interpretation of being a long-run equilibrium share ceiling (for sunrise industries) or share floor (for sunset industries). The slope of the curve is governed by the proportionality parameter, β. Since we apply the

the range, $0 \leq S^* \leq 1$. Second, the slope of the curve is such that change is proportional to the share already achieved (S^*) and the distance ($1 - S^*$) from the maximum share ceiling or share floor. Third, symmetry around the inflection point implies that the most pronounced structural change is likely to occur at the intermediate stage of industrialization to which most of the countries in our sample belong. Fourth, it allows for different industries to converge to their respective steady state share ceilings or share floors.

Since the logistic distribution is intrinsically nonlinear in its parameters, it is usually estimated after a logit transformation. The dependent variable then takes the form of the log of the ratio of the share already attained to the additional share to be attained until the gap between current and long-run shares are closed. The *logit* regressions by country and industry are specified as:

$$L_{jct} = \alpha_{jc} + \beta_{jc} I_{ct} + \delta_{jc} P_{ct} + \theta_{jc} O_{ct} + \varepsilon_{jct} \qquad (2)$$

where $L = \log [S_{jct}/(1-S_{jct})]$ is the logit with S being the output share of an industry in total manufacturing value added (MVA). Specified as such, the logit function is basically the log of the ratio of the industry share to one (the theoretical maximum possible share) minus the same share (the log-odds ratio) which is regressed on economy-wide country characteristics.

The coefficient $\boldsymbol{\beta}$ is a vector of slope parameters, and $\boldsymbol{\alpha}$ is a vector of intercept parameters. The above formulation assumes that $\varepsilon \sim N(0, \sigma^2)$. The panel subscripts ***j, c,*** and ***t*** index 28 three-digit manufacturing industries, 45 countries, and up to 35 years of observation, respectively.

The SL model accommodates any number of conditioning variables that can be justified by economic theory (Cramer, 1991). Due to data constraints, we are limited to the following regressors for the estimation in the first stage:

I = MVA/GDP,

P = labor force (in millions), and

O = trade turnover [(imports + exports)/GDP].

The variable I, industrial value added, is an index of industrial development. Since countries differ greatly in size, industrial output is normalized by GDP.

Since the role of markets needs to be taken into account, we include proxies for market size and openness. P is the commonly used measure of country size or resource endowment. The variable O is the volume of

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theoretical maximum ceiling of 1 in constructing the logit, a conservative estimate of beta is obtained. Note also that $\partial S/\partial Z = \beta S(1\text{-}S)$. The position of the curve is determined by the parameter β along with C. The sum of the S's from estimated logistic regressions, evaluated at the mean values of the independent variables, must then equal 1.

trade turnover normalized by GDP. It serves as a good proxy for the degree of exposure to global competition.

The theoretical expectations for the signs of the coefficients of I, conditional on inter-country differences in size and openness, are as follows. For a *share-gaining* branch, $\beta > 0$, and its size measures the speed of convergence to its long run share ceiling. For a *share-losing branch*, it is necessary but not sufficient that $\beta < 0$. Its size measures the speed of convergence to a lower asymptote or long-run share floor. Finally, for a *share-maintaining* branch, $\beta = 0$.

Beta is a reasonable measure of convergence for at least three interrelated reasons. First, it captures the effect of changes in industry share of GDP on a branch's share within manufacturing.[5] Secondly, it enables us to test whether these changes vary systematically by the level of technological sophistication or factor intensity of industries. Thirdly, it is a continuous index as shown in Figures 1 and 2.

[Figures 1 and 2 about here]

As noted above, structural convergence presupposes the existence of universal factors strong enough to ensure regularity in the growth elasticities of sectoral output. Since we control for country size (scale) and degree of international integration (openness), beta in effect captures the influences of such variables as factor endowments, technological diffusion, changes in domestic and export demand, and industrial policy.

Rapid structural convergence, then, presupposes two things. First, those branches of manufacturing with markedly different factor contents or demand elasticities have 'opposite signs' for non-zero betas (i.e., losers for industrial leaders are gainers for followers). Second, branches that account for significant proportions of MVA have non-zero betas, i.e., they are not share maintainers.

Since regressions that take the form of equation (2) contain systematic and non-systematic heteroskedasticity, we estimated the model using weighted least squares (WLS) with White's estimator of variance. Controlling for size differences across countries (P and O) also mitigates the potential problems with heteroskedasticity. Regarding stationarity, unit-root tests showed that the independent variables are stationary for almost all industries. Where there is non-stationarity, cointegration was rarely detected. For the few cointegrated equations, estimation was based on first differences.

Another potential econometric concern with the sequential approach adopted here is the impact of any imprecision with which the betas may be estimated in stage one on the realism of parameter estimates in stage

[5] The marginal effect of I (and each explanatory variable) on S is $\partial S/\partial I = \beta S_m(1-S_m)$ where S_m represents the sample mean of S. That means, β has an inverted-U distribution—rising initially from near zero in a proto-industrial setting, peaking at the highest stage of industrial intensity, and then settling to near zero in a post-industrial setting. The speed of convergence is, then, shaped by two key parameters as shown in Figure 1 and Figure 2: the share ceiling or floor (which compresses or relaxes the S-curve) and beta (which is a measure of the proportionate rate of growth of shares). The observed industry share for a sample of semi-industrialized and fully industrialized countries around 1990 ranged from 0.3% (Petroleum/Coal Products) to 12.3% (Food Products). This means, the logit falls in the range: $0.03 < L < 0.42$ (see Table 2, last column).

two. To mitigate this, we excluded betas whose estimates were based on fewer than seven observations and where all logit regressions for which the F-statistic is insignificant. Out of 1,289 industry regressions, 832 (or 65%) were accepted—an average of 18 industry branches per country and 20 years of observations per industry[6].

In interpreting the results, one should be mindful of the fact that the explanatory variables in the logit regressions of stage one are country specific whereas the explanatory variables in the beta regressions of stage 2 are industry specific as well as country specific. This procedure ensures that consistent estimates of the parameters are obtained for the determinants of the speed of structural adjustment (Greene, 2000). A similar procedure was employed by other industry studies (Wachter, 1979; Clark, *et al.*, 1991). Just as importantly, this approach has the virtue of generating statistical results that can be given straightforward economic interpretations.

The results for the first-stage, the directionality of structural change, are shown in Table 1. Two patterns are worth noting.

First, most industries are not adjusting in the sense that their output shares are not changing in a statistically measurable way. This suggests that structural change is a slow process for middle-income countries that have completed the easy phases of industrialization, import-substituting or export-promoting, but find it tough-going as they intensify the diversification drive by mastering ever more advanced technologies. Second, among share adjusters, the proportions of share gainers and share losers are comparable with a slight edge for the former.

[Table 1 about here]

A potential objection to this approach relates to the possibility of a simultaneity bias from the probable two-way causality between share growth (beta) and changes in the level of industrialization. However, this potential problem is not worrisome here since beta is estimated with the index of industrial depth (I) as an exogenous variable in the regressions of stage one. A related issue is the direction of causality between structural change and hence growth. Structural change, say in favor of progressive industries, would certainly boost productivity and growth. Rapid growth, by increasing the availability and allocational efficiency of investment, also facilitates structural change in favor of sunrise industries. In any case, the direction of causality is not a concern here since our interest is limited to identifying and measuring the correlates of share changes.

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[6] If we had no missing data, the corresponding numbers would have been 28 branches per country for 45 countries and 35 years per industry for 35 years bringing the total number of observations to 44,100 (instead of the actual 16,200). Since we used up the time-series dimension of the panel data in the estimation of the logit, the purely cross-sectional data for the speed regressions have a maximum of 27 country-specific observations per industry (see Table 1).

With a reasonable measure of the directionality of convergence in hand, we can now take up two interesting follow up questions. The first deals with the determinants of an industry's share status over time (gainer, loser, or maintainer). This issue deserves a full and separate treatment in its own right since the asymmetrical experiences of gainers and losers must be explored separately using probit models and the like. The second issue, the one we take up next, deals with the rate at which industry shares converge.

(b) Speed of Structural Convergence

Let us recall the hypothesis about supply-side factors as the primary determinants of the speed of convergence of developing-country manufacturing industries to their long-term output shares. That is, share gains (losses) are accelerated (mitigated) by low unit cost, profitability, and trade turnover, but moderated by strong backward linkages with input-supplying industries. If, as shown in the stage one regressions, structural convergence is discernible from the data, searching for an explanation is in order.

We employ a linear regression model which is estimated by applying OLS to the now purely cross-sectional data on industry-level and country-level observations. The regressions take the form:

$$ß_{cj} = a_j + b_j(OS)_{cj} + c_j(B)_{cj} + d_j(ULC)_{cj} + f_j(O)_c + e_{cj} \quad (3)$$

where ß = estimated betas (based on equation 2) with countries (c) and sectors (j) as the units of observation. One may argue that, while ß is a good index of the transitional dynamics, the true adjustment speed is the marginal effect of I on S: $\partial S/\partial I = ß\, S^*(1-S^*)$ where S* is the steady state share. It turns out that using this measure of speed as the dependent variable yields virtually identical regression estimates as (3) in terms of signs. The coefficient estimates are obviously smaller for the former.

The regressors in (3) are defined as follows:

OS = period-mean value of non-wage value added as % branch value added [(V-W)*100/V],

B = period-mean value of purchased inputs as % of branch gross output (G), calculated as [(G-V)*100/G),

O = period-mean value of country-specific trade openness as measured by the turnover rate, calculated as [(exports + imports)/gross output], and

ULC = period-mean unit labor cost defined as wages (W) per dollar of value added (V) or (W/V).

Operating surplus (OS) is a proxy for gross profitability reflecting the balance between sales revenue and wage bill. It captures the effects of both capital intensity and gross margins.[7] The latter may partly reflect the effects of market imperfections. B is a measure of the degree of an industry's dependence on other branches for intermediate inputs (backward linkages). The openness measure, O, captures the branch's exposure to international competition both as an importer and exporter. It is virtually uncorrelated with any of the other independent variables. Finally, ULC measures the costs of labor, the largest component of cost save for the most capital-intensive branches. While OS and ULC are negatively correlated, it is not high. In sum, the linear regression model provides a measure of the transitional dynamics as share gains or share losses relate to changes in an industry's unit labor cost (ratio of wage bill and value added), gross profitability (operating surplus), global trade exposure (trade turnover) and inter-sectoral linkage (importance of purchased inputs).

The theoretical expectations for the parameter values that underlie our working hypothesis are as follows. Increases in operating surplus have a positive impact on share adjustment ($b > 0$). On the other hand, strong backward linkages would be expected to have a dampening effect on convergence speed ($c < 0$) regardless of directionality. The rationale is that the more an industry is dependent on others for key complementary inputs, the more susceptible it would be to supply-side bottlenecks. Low ULC theoretically favors higher share adjustment ($d < 0$). Finally, trade intensity may have short-term adverse effects as an infant industry learns to compete, but it is likely to boost share growth should the branch benefit from international competition ($f > 0$). **O**, it should be noted, is a measure of country-level rather than industry-level openness.

5. RESULTS

(a) Determinants of the Speed of Convergence

Our working hypothesis invokes financial efficiency, openness, and production linkage as the independent variables for inter-industry differences in the speed of adjustment to the long-term share ceiling or share floor. Table 2 reports the results of the OLS regressions. Judging from the values of the F and R^2 statistics, the linear model provides a good explanation for convergence speed for only 8 branches of manufacturing which nonetheless account for one-third and half of MVA in the low-income economies and middle-income economies in the sample, respectively. The supply-side variables seem to have little or no explanatory power when it comes to the capital goods and consumer-durables sectors.

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[7] The standard accounting identity for a constant-returns-to-scale technology (assuming competitive factor markets) can be expressed in per capita terms as: $V/L = (W/L)(K/L) = w + rK/L$. For given the wage rate (w) and rate of profit (r), labor productivity and the capital-labor ratio (as well as capital productivity, V/K) are positively related. The wage-share of value added (W/V), which reflects skill intensity or the contribution of human capital, is not always complementary to physical capital (Bhalla, 1985).

[Table 2 about here]

Contrary to the hypothesized claims, the variables B (backward linkage) and O (trade turnover) have statistically insignificant coefficients and are, therefore, omitted from Table 2 to enhance readability. B affects only two industries, boosting the rate of convergence for pottery/china and dampening it for non-ferrous metals. OS (operating surplus) and ULC (unit labor cost), both of which capture largely supply side forces, carry much of the explanatory power. We appended data on changes in output shares during the sample period in the last column of Table 2 in order to facilitate comparison between the rate of structural adjustment and the direction of adjustment.

The results of the speed regressions, controlling for economy-wide openness and inter-industry linkage, may be summarized as follows. First, convergence speed is uniformly and positively correlated with cost-efficiency indicators (i.e., gross margins and unit labor cost). This fact holds across industry clusters. However, there seems to be no systematic correlation between the speed of adjustment and the technological sophistication of manufacturing industries.

Second, industries with good cost-efficiency indicators experience rapid share gains if they are moving toward their steady-state share ceilings (paper and products, leather and products, and industrial chemicals). Similarly, they experience slow share losses if they are moving toward their steady-state share floors (tobacco products). This is entirely consistent with theoretical expectations.

What appears to be a puzzle, at least at first blush, is the fact that there are share gainers for whom cost-efficiency is correlated negatively with adjustment speed (apparels and other manufacturing) or share losers for whom cost-efficiency is positively correlated with adjustment speed (food products and beverages). In other words, high cost-efficiency may actually accentuate share losses or decelerate share gains for some industries.

One possible explanation for this finding is that demand-side factors, which are not sufficiently accounted for in this model, may be the predominant drivers of the speed of share adjustment in some branches of manufacturing. Operating surplus only partially captures demand effects through output prices.

In conformity with the maintained hypothesis, the speed of convergence of many manufacturing industries to their long-term output shares is driven primarily by production efficiency in the course of industrialization. For many other branches, the supply-side explanation provides little traction. Needless to say, diversification trajectories and rates are driven by a complex set of technological and demand-side factors whose effects are not easily captured by simple regression models. One implication is that disaggregating the sources of structural transformation (production and export diversification) at various stages of industrial deepening is the next area of research on this subject (Wacziarg, 2001; Imbs and Wacziarg, 2003; Hausmann and Klinger, 2007).

The foregoing results should also be viewed with the usual caveats regarding the scope and quality of the data.[8] For one, the measures of efficiency used in this analysis are indirect although they are the most internationally comparable available. It would have been better to have data on sector-specific consumption, capital stock, the composition of industrial skills, and measures of forward linkages. Secondly, the sample excludes unregistered enterprises in the informal sector and the least industrialized countries for which structural change is likely to be minimal.

(b) Implications for Industrial Policy

Structural convergence has policy implications for hastening industrial deepening and diversification. Industrial policy ultimately involves distorting relative prices by consciously favoring some activities over others although sector-biased incentives are usually favored since they facilitate self-selection by firms. Sector-specific industrial policy is justifiable only if measured dynamic benefits outweigh the static costs (Rodrik, 2007). Given the heterogeneity of the product space, sensible policy intervention will have to be based on demonstrable necessity for effecting big jumps from the periphery of the product space to its dense core (Hausmann and Klinger, 2007).

One of the few "laws" of industrialization is the universality of infant-industry protection by latecomers that is intended to reshape comparative advantage (Cimoli, Dosi, Nelson and Stiglitz, 2006, p. 8): "A fundamental element in countries that successfully caught-up with the leaders during the 19th and 20th centuries was active government support of the catch-up process, involving various forms of protection and direct and indirect subsidy." Rodrik (2007, ch. 4) attributes this stance to two causes of market failures that impede growth-enhancing diversification: informational externalities and investment coordination.[9]

What differentiates policy success from policy failure then is the capacity of policymakers to tailor policy

[8] Aside from the need to recognize data limitations (not least of which the unavoidable omitted variable bias), one should be mindful of the equivalent of the proverbial caveat of the investment banker about drawing inferences about the future or picking winners based on analyses of historical data. As Branson, *et al.* (1998, p.33) rightly caution: "[T]he relevance of economic structure should not be interpreted as implying that countries with unfavorable economic structures have no way out of a vicious circle of underdevelopment. The world is changing continuously, and current or past patterns of development do not need to hold forever."

[9] Cimoli, Dosi, Nelson and Stiglitz (2006) distill the experiences of latecomers with industrial policy into four lessons: (i) public agencies play a central role in nurturing or complementing markets, (ii) incentives are often not enough; good policies are ones that help build up the capabilities of domestic industrial actors, (iii) capability building must go hand in hand with effective measures to stem over-protection that preserves inertia and rent seeking, and (iv) under-protection such as the overly harsh market discipline that accompanies willy-nilly trade liberalization risks wiping out infant learners prematurely. Rodrik (2007) distills these considerations into "design principles" for industrial policy which include the following: incentives should be provided by competent and autonomous agencies only to new activities (as opposed to industries); such activities must have significant spillovers and must be chosen so as to make discovery ongoing; and there should be clear benchmarks and criteria for success or failure.

to the circumstances and to enforce it dispassionately. The speed of structural adjustment is likely to be enhanced by a decidedly branch-neutral policy stance with respect to investment in infrastructural services, access to credit, and supply of key skills, trade, and regulatory environment that fosters competition (Tybout, 2000; Noland and Pack, 2003).

Students of industrial development recognize that competitive advantage, the rate at which firms in a developing economy upgrade their technological capability in a given industry or enter a new high value-added industry, is shaped by the incentives provided by existing market institutions and industrial policy (Ellison and Gereffi, 1990; World Bank, 1993; Amsden, 2001). The persistence of large gaps in technology between oligopolistic multinationals and late-moving firms has, for example, induced forward-looking industrial firms in developing countries to accelerate technological upgrading and organizational innovation in a number of ways.

One strategy is to exploit their (temporary) monopolistic positions as pioneers of new domestic industries or privileged access to government support to accumulate economic rent that can be used to finance large-scale investment. The downside is that the economic rent can as well be used unproductively if the prospects for the emergence of a competitive environment are dim.

A second strategy is to affiliate with ubiquitous diversified business groups--a coordinated domestic network of firms with complementary assets. This organizational innovation is designed to exploit scale, scope and learning economies in a selection environment where market failure is endemic (Chandler, 1990; Amsden, 2001; Abegaz, 2005; Khanna and Yafeh, 2007). Yet another strategy, favored by small- and medium-scale enterprises, is to latch on to the various niches in inter-sectoral domestic clusters or in sector-specific global value chains as stand-alone suppliers or as joint-venture partners (Evenson and Westphal, 1995; Puga and Venables, 1996; UNIDO, 2002; Gereffi, 1989; Giuliani, *et al.*, 2005).

It is in this context that we can better understand why latecomers that managed to develop buoyant industrial sectors, especially in East Asia, have historically provided selective support for national firms that are conditional on reciprocity on the part of the latter. Many of these unorthodox policies were intended to guarantee stable domestic demand (including guaranteed public procurement) for entrants into a high-risk but progressive new industrial activity, to aid promising upstarts with high technological spillovers, and to underwrite a good portion of the high cost of penetrating export markets in ways that build on competitiveness based on static comparative advantage.

Others, such as South Africa and Brazil, have used resource-based industries as a springboard for building up more broadly-based industrial bases (World Bank, 1993; Lall, 1997; UNIDO, 2002a; Amsden, 2001; Noland and Pack, 2003; Rodrik, 2007; Cimoli, Dosi and Stiglitz, 2006). As the experience of South Africa suggests, this strategy may very well end up being self-limiting in the absence of a vigorous drive for domestic structural transformation to nurture a buoyant export capability (Hausmann and Klinger, 2006).

6. CONCLUSION

This paper subjects the concept of compositional shifts in the output of manufacturing industries to a novel empirical test in the hope of identifying the factors that might explain inter-industry differences in the rate of structural convergence. It provides a first-pass attempt extend the scope the existing literature on the historical patterns of industrialization that are characterized by a steady movement toward structural homogeneity in manufacturing between leaders and followers.

It has long been recognized that the interplay of changes in the structure of demand for manufactures and the trajectory of technological diffusion fundamentally shape the speed at which the profile of manufacturing evolves. The results reported here suggest that differences in intersectoral production efficiency boost the speed of share gain or share loss for many but certainly not most industries.

Structural change is clearly a joint product of nature (market) and nurture (industrial policy). A satisfactory empirical disentangling of the various supply-side and demand-side determinants of the speed of structural convergence in manufacturing awaits better models and data. So must robust estimates of steady-state shares at the country level.

Empirical explorations of the type offered here nonetheless help us to sharpen the focus of the search for better theory in an important facet of development that has yet to receive the serious research attention it deserves. A good understanding of the drivers and the trajectories of systematic structural adjustment is, after all, a key ingredient of sensible industrial policy.

APPENDIX 1:

DATA DEFINITIONS, SAMPLE CHARACTERISTICS AND ADJUSTMENT

The data for three-digit (ISIC) manufacturing consists of annualized observations. They are based on standardized surveys or censuses of establishments with at least five employees. Data on value-added (V), gross output (G), number of employees (L) and wages and salaries (W) by industry come from UNIDO's *Industrial Statistics Data Base* (2003). Economy-side data on GDP, deflators, and population and trade ratios were obtained from the World Bank's World *Development Indicators* (2005). The classification of industries by end use and factor intensity used in tables 2 and 3 is based on OECD (1996) and Abegaz (2002).

The sample is composed of diverse group of 45 late industrializers for 1963-97. It excludes the poorest (non-industrial) countries and the richest (industrial or deindustrializing) countries, but includes four formerly socialist countries. While a primary consideration for inclusion is significant industrial attainment, an attempt was made to ensure a regionally diversified sample. Although the socialist countries have among the highest level of industrialization (MVA/GDP) in the world, they are also broadly speaking latecomers and their manufacturing sectors have undergone major structural changes during the four decades covered by the sample.

The sample consists of 28 branches of manufacturing. It spans a maximum of 35 years although the coverage for the least industrialized is limited to the post-1970 period. The countries with the requisite data are: Argentina, Bangladesh, Brazil, Chile, China (PR), Colombia, Cote d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Ghana, Greece, Hong Kong, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Jordan, Kenya, South Korea, Malaysia, Mauritius, Nigeria, Pakistan, Philippines, Poland, Portugal, Puerto Rico, Singapore, South Africa, Spain, Syria, Tanzania, Thailand, Tunisia, Turkey, Uruguay, USSR, Venezuela, Zambia and Zimbabwe. While these countries achieved their industrial takeoff in the 20th century, some of them did the catching up in the early decades of the century (Hungary, Poland, Spain, S. Africa, and USSR).

The UNIDO database includes industry-specific observations for constructing the following variables: output per worker (productivity), average wage (skill-intensity), proportion of purchased inputs in gross output (inter-sectoral linkage), and non-wage value added (gross profitability). The last variable, of course, partly captures the influences of demand.

The definitions of the key variables are as follows (UNIDO, 2003, Annex 8):

Number of establishments: An "establishment" is ideally a unit that engages, under a single ownership or control, in one, or predominantly one, kind of activity at a single location.

Number of employees: 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, home workers 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.

Wages and salaries: 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.

Output: The measure of "gross" output normally reported is the census concept which covers only activities of an industrial nature which 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.

Value added: 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.

Gross fixed capital formation: Gross fixed capital formation refers to the value of purchases and own-account construction of fixed assets during the reference year less the value of corresponding sales. The fixed assets covered are those (whether new or used) with a productive life of one year or more. These assets, which are intended for the use of the establishment, include fixed assets made by the establishment's own labor force for its own use.

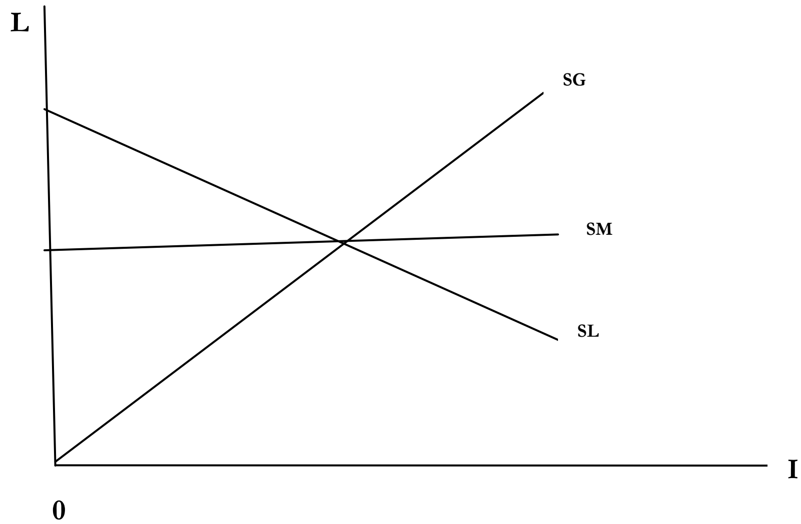

Figure 1. ***Logit*** *for share gainers (SG), share maintainers (SM) and share losers (SL)*

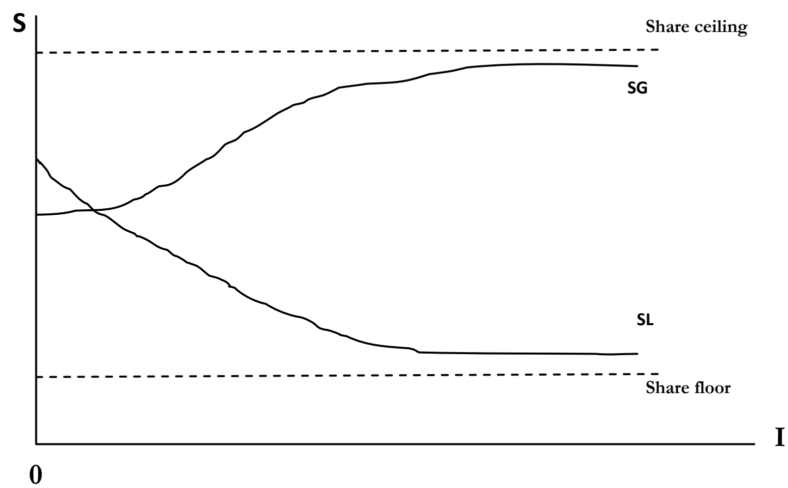

Figure 2. ***Logistic*** *paths of adjustment to share ceiling or share floor*

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Table 1. Directionality of convergence

Code Industry	Total	Positive Beta	Negative Beta	Zero Beta	Steady-state S*(%)
CND:					
311 Food Products (LT)	30	5	3	22	12.0
313 Beverages (LT)	30	5	7	18	2.4
314 Tobacco (LT)	36	11	7	18	1.3
322 Apparel (LT)	26	7	5	14	2.6
324 Footwear (LT)	29	6	7	16	0.5
332 Furniture/Fixture (LT)	30	6	8	16	2.2
342 Printing/Publishing (LT)	31	6	6	19	6.3
361 Pottery/China (LT)	30	8	5	17	0.4
390 Other Manufacturing (MT)	31	6	2	23	1.1
RB:					
331 Wood/Cork (LT)	30	6	7	17	2.8
341 Paper & Products (LT)	30	10	5	15	4.8
353 Petroleum Refining (LT)	25	1	5	19	1.8
354 Petrol/Coal Products (LT)	20	5	3	12	0.3
371 Iron and Steel (LT)	23	4	2	17	3.9
372 Non-ferrous Metals (MT)	27	5	3	19	2.6
IS:					
321 Textiles (LT)	30	5	8	17	3.5
323 Leather/Fur (LT)	28	3	5	20	0.4
351 Industrial Chem. (MT)	30	6	5	19	5.0
352 Other Chemicals (MT)	31	10	6	15	3.9
355 Rubber Products (MT)	31	6	7	18	1.0
356 Plastic Products (MT)	31	12	6	13	2.5
362 Glass & Products (LT)	29	5	6	18	0.9
369 Non-metallic Prod. (LT)	31	8	4	19	3.1
381 Metal Products (LT)	31	5	5	21	7.0
KG/CD:					
382 NE Machinery (MT)	31	6	7	18	10.1
383 Electrical Machinery (HT)	31	9	5	17	7.9
384 Transport Equip. (MT)	31	3	8	20	8.5
385 Prof/Scientific Inst. (HT)	30	8	7	15	1.4
TOTAL (N):	823	177	154	492	
Mean	0.196	0.528	-0.515	0.000	
Standard Devaiation	0.626	0.537	1.056	0.000	

The distribution of statistically significant beta (ß) at the 10% level, based on equation (2). Zero Beta means a statistically insignificant estimate of beta. Classification based on OECD (1996).

S* is the average share for industrialized countries circa 1990 (Abegaz, 2005: Table 1) which may be used as a proxy for the steady-state level.

CND = consumer non-durables
IS = input supplies
LT = low technology
HT = high technology

RB = resource based
KG/CD = capital goods or consumer durables
MT = medium technology

Table 2. Speed of convergence

Code	Industry	Intercept	OS	ULC	N	R^2	F	ΔS(%)
CND:								
311	***Food Products (LT)***	***-0.473011***	***0.000497***	***0.368141***	***27***	***0.25***	***4.07***	***-1.80***
313	***Beverages (LT)***	***-0.620238***	***0.000643***	***0.435891***	***27***	***0.17***	***2.49***	***-1.70***
314	***Tobacco (LT)***	***2.369350***	***-0.002407***	***-2.266030***	***27***	***0.26***	***4.47***	***-0.60***
322	***Apparel (LT)***	***0.694944***	***-0.000727***	***-0.667618***	***26***	***0.27***	***4.51***	***1.40***
324	Footwear (LT)	0.718707	-0.000779	-0.530612	26	0.52	0.52	-0.10
332	Furniture/Fixture (LT)	1.341500	-0.001101	-1.417764	27	0.52	0.04	-1.00
342	Printing/Publishing (LT)	0.028232	-0.000008	-0.060072	27	0.02	0.31	0.70
361	Pottery/China (LT)	-0.142336	0.000146	0.220675	26	0.01	0.16	1.20
390	***Other Manufact.(MT)***	***2.146190***	***-0.002103***	***-2.198453***	***27***	***0.47***	***11.01***	***0.70***
RB:								
331	Wood/Cork (LT)	-0.205038	0.000180	0.228281	27	0.17	0.21	1.50
341	***Paper & Products***	***-1.357007***	***0.001380***	***1.323384***	***27***	***0.48***	***11.34***	***0.90***
353	Petroleum Refining (LT)	-2.938515	0.002884	3.051479	20	0.13	1.18	-1.40
354	Petrol./Coal Product (LT)	0.038547	-0.000085	0.042739	17	0.03	0.22	0.30
371	Iron and Steel (LT)	-1.386714	0.001364	1.339875	25	0.12	1.60	0.10
372	Non-ferrous Metals (MT)	0.250925	-0.000225	-0.258807	23	0.06	0.71	16.30
IS:								
321	Textiles (LT)	-0.251577	0.000333	0.222817	27	0.03	0.34	-9.60
323	***Leather/Fur (LT)***	***-1.525895***	***0.001528***	***1.540570***	***26***	***0.49***	***11.66***	***0.30***
351	***Industrial Chem. (MT)***	***-1.249516***	***0.001253***	***1.250490***	***26***	***0.33***	***5.93***	***9.20***
352	Other Chemicals (MT)	-0.224321	0.000206	0.204705	27	0.07	0.96	0.90
355	Rubber Products (MT)	-0.729470	0.000928	0.494019	27	0.11	1.48	-0.90
356	Plastic Products (MT)	-0.522670	0.000477	0.566495	27	0.11	1.46	0.40
362	Glass & Products (LT)	0.556849	-0.000350	-0.598448	26	0.01	0.07	0.10
369	Non-metallic Prod.(LT)	-0.118584	0.000083	0.150617	27	0.05	0.71	0.80
381	Metal Products (LT)	0.408761	-0.000396	-0.406387	27	1.01	1.34	-1.40
KG/CD:								
382	NE Machinery (MT)	-0.717222	0.000061	1.363153	27	0.09	1.19	4.70
383	Electrical Machinery (HT)	0.167210	-0.000177	-0.147257	26	0.09	0.89	7.00
384	Transport Equip. (MT)	-0.395565	0.000372	0.474301	27	0.11	1.39	3.30
385	Prof./Scient. Instr. (HT)	0.480393	-0.000366	-0.482701	26	0.01	0.11	2.40

Estimates of equation (3). The variables B and O are omitted because they contributed very little explanatory power.

Dependent variable = all estimated betas, equation (2). ***Bolded Cells*** = statistically significant at the 10% level.

N = number of countries per industry. ΔS = change in actual output share during 1970-1995 (sample average).