Manufacturing as an engine of growth

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Introduction

There is a long tradition in economics which argues that manufacturing industry has a critical role in growth, particularly at relatively low income per capita. This 'engine of growth argument' rests on several features of the sector

- Output per worker (productivity) is normally considerably higher than in agriculture or services (although not in mining) so that structural change in favour of manufacturing raises the overall productivity of an economy.
- Productivity growth in manufacturing has historically been more rapid than in other sectors due to greater technical change and learning effects
- Manufacturing is the sector where there is greater scope for specialisation as outputs grows
- Its linkages with other parts of the economy are greater than for any other aggregate sector
- As a key tradable sector manufacturing expansion allows access to the world market and faces better demand prospects there than primary exports.

The normal historical pattern has been that in poor countries the share of manufacturing in total economic activity is very low, but that as growth occurs and workers move out of agriculture it rises rapidly, but that once a threshold income level is passed the relative share of manufacturing starts to decline as demand shifts towards services.[1] Thus for example in 2005 manufacturing was 9% of GDP in Ghana, 30% of GDP in a middle income economy like Malaysia and averaged 16% in the OECD economies.[2] It is at the transition

[1] McKinsey (2012) suggests that the downturn starts at a GDP of approximately US$10,000 per capita in 1990 prices at PPP exchange rates or approximately $21,000 at current prices.
[2] Smirzai (2013 table 1.2)

from low to middle income status that the engine of growth effect can be expected to be greatest due to the greater scope for a productivity boost as workers shift out of agriculture.

Is manufacturing still special?

Recent experience has questioned some of these assumptions. Across all countries there is evidence that the relationship between a country's income per capita and the share of manufacturing in GDP has been weakening so that for a given level of income the manufacturing share predicted from cross-country analysis is lower than in earlier time periods. This is particularly the case where employment shares are concerned, with a weakening of relationship between employment and manufacturing growth and absolute declines in manufacturing employment in some high income economies. Furthermore there has been relatively rapid productivity growth in parts of the service sector and agriculture. Parts of services related to financial and professional services, retail and distribution have benefitted from the application computer-based technologies to sustain higher productivity levels and growth. Agricultural productivity growth has also been relatively rapid in a number of countries as labour has left the sector and new agricultural technologies have allowed output per worker to rise for those remaining. On the world market in the last decade the price of manufactures has declined relative to that of many primary commodities.

None the less recent empirical and theoretical work has confirmed the importance of manufacturing to economic growth particularly at lower income levels, where it can be an important source of employment at productivity levels well above those offered in the rest of the economy. At higher income levels it represents the key dynamic internationally traded activity.

Productivity catch-up greatest in manufacturing

Manufacturing appears to be the only sector where there is a systematic tendency for productivity to catch-up with international best practice independently of the policy environment in an economy. The implication is that once a manufacturing activity is established through a process of learning producers move towards international best practice productivity levels. This 'convergence' test is applied and is not found to operate for

non-manufacturing in the aggregate, although there is separate evidence that it may apply in parts of services.[3]

Export sophistication boosts economic growth

The structure of a country's exports has been shown to affect its growth performance (along with a range of other factors). Export sophistication has been measured by the productivity inherent in different goods. Manufactures are amongst the highest productivity goods and an increase in the share of manufactures in exports would normally be expected to raise the sophistication of the overall export basket. There is evidence that in the past higher export sophistication has had a positive impact on economic growth and this is one of the explanations for China's sustained high growth rates.[4] Manufactures also offer greater scope for transferability of skills, so that within manufacturing it is easier to branch out into the production of similar but differentiated products.

Growth accelerations and higher productivity have been associated with an increasing role for manufacturing

A shift in economic structure (whether in terms of share of value-added, employment or exports) in favour manufacturing has been found to be associated with more rapid economic growth. This has been evidenced for growth accelerations (periods of sustained GDP growth). In part this may be reflecting a shift towards greater export activity driven by manufactured exports. Also shifts in economic structure in favour of manufacturing have been associated with higher aggregate productivity growth in Asia and shifts against manufacturing have been associated with lower aggregate productivity growth in Africa and Latin America.[5] It should be noted that some empirical work also links the service sector share in GDP with growth accelerations, so the impact may not be unique to manufacturing.[6]

Kaldor's laws

[3] Rodrik (2012)
[4] For the empirical analysis, see Hausmann et al (2007) and for an explanation of the methodology, see Weiss (2010).
[5] See, Rodrik (2006), Hausmann et al (2005), ADB (2007) for growth accelerations and MacMillan and Rodrik (2011) for an analysis of productivity and structural change.
[6] See Smirzai (2013)

The most influential statement of the engine of growth case comes from the work of the eminent Cambridge economist Nicholas Kaldor nearly 50 years ago (Kaldor 1966, 1967). The theoretical case for the special role for manufacturing involves not just greater externalities than in other sectors but a focus on dynamic increasing returns in the sense of declining unit costs as output grows over time. There is a long tradition in economics that contrasts increasing returns (that is productivity growth) in manufacturing with diminishing returns in agriculture with services treated as an appendage of manufacturing. This is distinct from an argument about increasing returns in a static sense, where unit costs fall as plant scale is expanded. Static economies of scale are found in many lines of activity; plantation agriculture may have lower cost per unit of crop output than small-holder agriculture and supermarkets are likely to have lower costs per product sold than small family shops. Furthermore there will be a wide variation within manufacturing in the relation between higher output and decline in unit cost of production, with heavy capital-intensive activities showing the most scale effect.

The key focus here is a dynamic rather than a static relationship, with dynamic increasing returns referring to the tendency in manufacturing for the growth of output to be related systematically to the growth of productivity. Hence it is not the level of output that drives the decline in unit cost but its cumulative growth over time. The mechanisms underlying this process in manufacturing are learning by doing, technological imitation, adaptation and modification and the gains from increased specialisation as manufacturing is increasingly sub-divided into more specialised forms. Unlike static economies of scale these dynamic gains should not be reversible if output subsequently declines, since they have created a higher skill and technological base for the sector.

The concept of dynamic increasing returns links with the discussion of externalities and linkages since they will be part of the process of productivity improvement. The complex set of linkages between firms found in manufacturing provides the mechanism for productivity gains in response to growing output. Historically it is well documented that as the scale of the national market for manufactures grows it allows the establishment of increasing specialisation and differentiation between firms (the ‘roundaboutness of production’), as newly specialised supplier firms are established through backward linkages from existing firms. Today with the removal of many barriers to trade this process has been heightened

by the closer integration of most economies with the world market. The scale of the market is critical since as it expands with growth, so will the opportunities for specialisation. Some of the resulting productivity gains will be internal to firms, but others will spillover as benefits to other firms.

Kaldor stressed dynamic increasing returns as the explanation for why manufacturing (as opposed to agriculture or services) was the only sector for which output growth and productivity growth were related. Productivity growth could occur in agriculture or in services, for example, but in his view it was not related systematically to growth of output. For example, productivity growth in agriculture might be due to exogenous technical change in the form of new seed varieties or to the shift of workers off the land, not to the expansion of the sector itself and the increased specialisation and learning that this allows. As is discussed further below, more recent analyses have shown that these results showing increasing returns hold for a range of sectors, not just for manufacturing (see also Timmer et al in this volume).[7] However the Kaldor argument goes further by asserting that manufacturing growth raises not just productivity in manufacturing, but through externality and spillover effects raises overall productivity in the economy as labour is transferred from lower productivity activities into manufacturing and as manufacturing development stimulates improvements in the services that it uses. There is evidence linking manufacturing with overall GDP and productivity growth, however it appears that unlike the earlier view of Kaldor which saw services as a largely passive element in the economy, the modern service sector is also emerging as an engine of growth and drawing workers into technologically dynamic activities with the potential for productivity growth.

Kaldor's case was based on the relationship between output growth and productivity first established by the Dutch economist Jake Verdoorn and he put forward a simple empirical test (Kaldor 1966, 1967). He estimated two equations for a number of sectors from a sample of developed countries.

$$p_i = a_1 + b_1.q_i \quad (1)$$

$$e_i = a_2 + b_2.q_i \quad (2)$$

[7] See Pieper (2001) and the chapter by Timmer et al in this volume.

where *p, q* and *e* are labour productivity growth, output growth and employment growth respectively for sector *i*.

(1) is the relation established by Verdoorn, which has been found to hold for many branches of activity. Since by definition growth of output is the sum of growth of productivity and the growth of the number of workers ($q_i = p_i + e_i$) it is possible for spurious correlations to be found between *q* and *p*, when changes in *e* are small. Hence Kaldor's additional requirement to demonstrate the existence of dynamic increasing returns is that (2) is also statistically significant with a coefficient b_2 of less than unity. This implies that the growth of employment is less than the growth of output, so by definition there will be a productivity gain.[8]

Kaldor's Laws and Empirical tests

The analysis in this tradition focuses on establishing empirical regularities or 'stylized facts' relating to the role of manufacturing in development. The empirical focus is on testing what have termed Kaldor's laws (Felipe 2010:85). These can be summarised as follows:

Law 1 - *the faster the growth of manufacturing output the faster the growth of GDP*

Law 2 - *a strong positive relation between the growth of manufacturing output and the growth of manufacturing productivity*

Law 3 - *the faster manufacturing grows the faster productivity outside manufacturing will increase.*

Evidence in support of these propositions for developed economies was found in Cripps and Tarling (1973) and in Kaldor's original analysis (Kaldor 1966, 1967). More recent work has focused on how far these relationships still hold in the era of a more open global economy and how far their strength varies with stage of development or country income level.

[8] Kaldor's original test was simplified in focusing only on labour productivity and can be modified by introducing a capital input and setting the analysis in a production function framework; see McCombie et al (2002).

The impact of growth in manufacturing on the rest of the economy (Law 1) can be tested simply by regressing growth of GDP on growth of manufacturing value-added and comparing the results with similar analyses for services and agriculture. For example, Dasgupta and Singh (2006) report this test for 50 developing countries for which data are available 1990-2000. The coefficients on each sector's growth are positive and statistically significant. However, whilst the equations for manufacturing and services are robust statistically, but that for agriculture does not pass all the necessary diagnostic tests, so less confidence can be placed on the link between agriculture growth and GDP growth. In these equations the lower the coefficient on the sector growth variable the higher is the impact of the sector on GDP, since a lower rate of sector growth will be required to generate a given change in GDP. The coefficient for manufacturing (of 0.47) is below that for services (of 0.58). (Not clear)

This analysis may be misleading as by using growth of GDP as the dependent variable part of GDP will be used to explain change in all GDP. Felipe et al (2007) avoid this problem by setting GDP net of the sector whose impact is being tested as the dependent variable and also apply more sophisticated econometric techniques in a panel data analysis for 17 Asian economies 1980-2004. Unlike the previous result they find that whilst each major sector has a significant impact on GDP growth (net of its own value added) the impact of industry is greatest, followed by services and then manufacturing.[9] They stress that by this test it is industry and services which have played the greatest engine of growth role over the period for the 17 countries covered.

These analyses are of limited value however since they do not control fully for the influence of other variables on growth, the development stage of an economy and the difference between time periods. These problems are addressed more fully by Smirzai and Verspagen (2011) who create a model to explain growth in 89 countries (developed and developing) 1950-2005 over different time periods where

$$gGDPcap_t = f(ManufShare, ServShare, RelGDP, Z) \quad (3)$$

where $gGDPcap_t$ is per capita GDP growth over period t, ManufShare is the share of manufacturing in GDP at the start of period t, ServShare is the same for services, RelGDP is

[9] Industry here includes mining, public utilities and manufacturing.

country GDP per capita divided by the US figure at the start of the period to capture a convergence effect and Z is a vector of control variables for each country expected to explain growth. Z includes variables relating to education (Edu), population, climate and openness to trade. The differential impact of a change in sector share in GDP on growth depending on a country's stage of development is captured by including interaction terms that separately interact ManufShare with RelGDP and Edu. The expectation is that the sign on the former will be negative (so a growing manufacturing will have a greater GDP growth effect at lower income levels) and on the latter is positive (so GDP growth will respond more strongly the better educated is the workforce).

The initial results show manufacturing share in GDP to be statistically and positive significant imply higher growth over a five year period the higher is the initial manufacturing share. The service sector share however is insignificant (Not clear). The impact of manufacturing share on growth is only modest (between 0.5% and 1.0% for a 10% rise in manufacturing's share in GDP). This is a linear specification, however, so that the growth impact of a given rise in manufacturing share is the same for all levels of share. The interaction terms are designed to allow for non-linear effects. The coefficient on the interaction of Manufshare and RelGDP is negative as expected and significant suggesting that manufacturing's growth impact is greater in lower income economies. Again as expected the sign on the interaction between Manufshare and Edu is positive and significant so that a better educated workforce creates a bigger impact from manufacturing on growth. Hence the engine of growth case for manufacturing is strongest in countries with low incomes, but where a minimum threshold of human capital has been passed. Once different time periods are controlled for however the picture changes and in the post 1990 period, since here a positive direct impact of manufacturing on growth is found only in the poorest economies.[10] For the earlier period 1950-70 when manufacturing's growth effect is stronger that of services is also significant. However the interaction of manufacturing with income and education remains significant in all periods. The authors conclude that 'since 1990 manufacturing is becoming a somewhat more difficult route to growth'. Hence a given marginal impact on growth from manufacturing requires more education attainment post 1990 and the bonus of catching up

[10] These are defined as those where RelGDP is below 0.2 (that is countries with less than 20% of US GDP per capita.

at a given relative low income levels becomes weaker. None the less despite these changing conditions there is support for what the authors term 'an extended engine of growth hypothesis' where impact is conditional on relative income and human capital.

Law 2 relates to productivity growth within a sector. Many tests have been carried out on the Verdoorn relation between output growth and productivity growth. Kaldor (1975) himself found that whilst equation (1) generally holds for all sectors equations (1) and (2) together only hold for manufacturing as a sector and not for the non-manufacturing sectors of the economy. His second law requires that (2) is significant with the coefficient $b_2 < 1$ the requirement for dynamic increasing returns in the sector. Unlike Kaldor's analysis for developed economies, Pieper (2003) finds in a detailed analysis across 30 developing countries that there is clear regularity across sectors with the majority (not just manufacturing) showing evidence of increasing returns.

An alternative test highlighted in Rodrik (2012) relates to productivity convergence in a sector to see whether within a sector there is a natural tendency for catch-up productivity growth either unconditionally (that is regardless of country or sector characteristics) or conditional on specific features of the country or sector. Evidence of convergence can be interpreted as support for the learning mechanism in the engine of growth case.

Across countries unconditional convergence is formulated as:

$$cg_{ij} = \alpha + \beta \ln y_{ij} + \varepsilon \qquad (4)$$

Where cg is the compound rate of growth of labour productivity for sector j in country i, y is the initial level of labour productivity for the sector and ε is the stochastic term.

For unconditional convergence to hold, β should be negative and significant. Similarly conditional convergence, controlling for features of an economy, is tested by an equation of the form:

$$cg_{ij} = \alpha + \beta_1 \ln y_{ij} + \mu Z_i + \varepsilon \qquad (5)$$

where Z_i is a set of country specific controls. Conditional convergence requires that β_1 be negative and significant.

Rodrik (2012) conducts this analysis at a disaggregate level within manufacturing alone showing considerable scope for both types of convergence with the conditional coefficient typically double that of the unconditional, as country-specific conditions play a large role. The implication is that within manufacturing catch-up and learning effects are strong. However this tells us nothing about how far these effects are unique to manufacturing and below we extend this analysis by considering how far such effects operate in other sectors. Our focus is not on intra manufacturing differences, but on whether manufacturing is different from other sectors in terms of convergence potential.

The third Law relates to the impact of manufacturing on productivity elsewhere in the economy. The basic test here first used by Cripps and Tarling (1973) for developed economies uses a regression model to explain overall labour productivity growth in an economy by the growth of manufacturing value added and the growth of employment outside manufacturing. If the Law holds overall productivity growth in an economy is associated positively with the growth of manufacturing and negatively with the size of non-manufacturing employment. Thus:

$$g(VA/L)_t = a + b_1(gVAm) + b_2(gLn) + e \qquad (6)$$

Where g is growth, VA is value-added, L is employment, m refers to manufacturing and n is non-manufacturing and t refers to the aggregate economy. Cripps and Tarling (1973) found b_1 to be positive and significant for manufacturing, with b_2 negative for non-manufacturing sectors.

Dasgupta and Singh (2006) repeated this analysis across a sample of 48 developing economies but re-specified (6) by replacing non-manufacturing employment with agricultural employment (Lag). This is on the grounds that agriculture is the main decreasing returns low productivity sector in low income countries and that its release of labour to manufacturing raises overall productivity. They found b_1 to be positive and significant for manufacturing, with b_2 negative for agricultural employment. However when service value added is included instead of manufacturing a similar result, with b_1 significant is also obtained, casting doubt on the uniqueness of manufacturing.

More disaggregate analysis

In this chapter we extend these earlier results by conducting more disaggregate tests on Laws 2 and 3. Our analysis is based principally on sectoral data on value-added and employment for a sample of 38 developed and developing countries drawn from the Groningen Growth and Development Centre database and extended by Rodrik and MacMillan (2011). The dataset is further complemented by data from the World Development Indicators and the Penn World Tables (2011) with institutional variables taken from Kaufmann and Kraay (2011). This dataset provides time series data on value added and corresponding labour productivity for a number of sectors including agriculture, mining, manufacturing, public utilities, construction, wholesale and retail trade, transport and communication services, as well as finance and business services for 38 countries over the period 1990-2005. The dataset relates to the relevant time series data for the following group of countries:

High Income: United States, France, Netherlands, Italy, Sweden, Japan, United Kingdom, Spain and Denmark. **Asia:** Hong Kong, Singapore, Taiwan, South Korea, Malaysia, Thailand, Indonesia, Philippines, China and India. **Middle East:** Turkey. **Latin America:** Argentina, Chile, Mexico, Venezuela, Costa Rica, Colombia, Peru, Brazil and Bolivia. **Africa:** South Africa, Mauritius, Nigeria, Senegal, Kenya, Ghana, Zambia, Ethiopia and Malawi.

Complementary data, such as PPP (constant 2000 US$) values of GDP per capita, GDP per capita growth and measures of openness were added from Penn World Tables website.[11] Data for the institutional quality measures are taken from Kaufman et al (2011).[12] We test for regional effects with separate regional dummies. In common with most empirical research in this area, and in order to remove short term disturbances as well as business cycle from the data, we have converted the time series data on variables into 5-year period averages covering 1991-95, 1996-2000 and 2001-05.

We first consider the evidence on convergence in labour productivity to firstly check whether there is evidence of convergence within manufacturing from our dataset and

[11] http://pwt.econ.upenn.edu/php_site/pwt_index.php
[12] Downloadable from the World Bank's Worldwide Governance Indicators (WGI) project website http://info.worldbank.org/governance/wgi/index.asp

secondly how far this is replicated within other sectors. Table 1 below presents the result of testing for productivity convergence in different sectors. The analysis applies both equations (4) and (5) to test for unconditional and conditional convergence, respectively.

(Table 1)

Unconditional convergence is not confirmed for any of the productive sectors for the whole dataset, as there is no statistically significance relationship between the sectoral growth of labour productivity and its initial level and the signs of the parameter estimate for agriculture and manufacturing are positive, which goes against convergence. It is only confirmed for construction and weakly for transport and communications. If we exclude African countries on the grounds that their relatively weak economic performance in manufacturing makes them special cases, there is now some support weak support with negative coefficients on initial productivity for manufacturing, mining and public utilities. There is no evidence that unconditional convergence is stronger in manufacturing than in the other two sectors, as might be expected from the engine of growth hypothesis since the coefficient on the parameter initial productivity is lower than in mining and public utilities.

Once we apply a version of equation (4) the picture changes. We apply only one control variable, the composite institutional quality measure, on the grounds that this correlated with other plausible controls. For the full dataset the sign on initial labour productivity is now always negative and is significant in public utilities, construction and transport and communications and in the aggregate. When we exclude African countries, however conditional convergence is confirmed strongly for manufacturing and in the aggregate. It is also found in public utilities. In the non-African sample once we control for institutional quality convergence is faster and more significant in manufacturing than in public utilities. With the institutional control the relationship is insignificant for mining and agriculture, although the sign on the parameter estimate for initial productivity is negative. For services there is no evidence of convergence apart from transport and communications. Thus outside Africa, where it is well known that in many places manufacturing has regressed in

recent decades, catch-up productivity growth is found in manufacturing, but not in most of services.[13]

We also test for Law 3 by applying a version of equation (6) to our data with our results given in table 2. We apply both an OLS and fixed panel approach across countries and following Dasgupta and Singh (2006) specify equation (6) using agricultural sector employment, but also include non-manufacturing in the aggregate as an alternative. We find that sector growth in manufacturing is strongly and positively associated with total productivity growth and that agricultural employment growth is negatively associated with total productivity growth. However, we find that manufacturing is not unique in this respect. When we add a series of other sector variables separately to replace the manufacturing variable all three services branches included (financial services, transport and communications and wholesale and retail trade) appear to be performing similarly to manufacturing, as is construction. Mining and public utilities are the sectors where there is no significant, positive relation between their value-added growth and overall productivity growth. These results are consistent using both OLS and panel data.

Conclusions

Evidence on productivity growth and some of the tests reported here tend to suggest that the uniqueness of manufacturing as a source of learning and productivity dynamism is perhaps less strong than was once thought. Attention is now focussed increasingly on services particularly those knowledge-intensive elements. This is likely to be due on part to the somewhat arbitrary distinction between a service and a manufacturing activity and the fact that some activities previously done in-house by manufacturers may now be outsourced to specialist suppliers who are recorded under services. However it is clear that whilst some service activities in low and middle income countries, such as retail and wholesale trade and public bureaucracies, have low productivity, new dynamic elements of services are emerging, such as business and computer-based services, telecommunications and tourism. One interpretation of the results obtained from applying equation (6) is that these latter dynamic elements are starting to dominate and that service sector as a whole is

[13] This replicates the result of Rodrik (2012) who looked at convergence within branches of manufacturing.

behaving in way similar to manufacturing and thus offering higher productivity employment to that available in agriculture. This argument is now particularly relevant in the context of India where service sector growth is seen as a key feature of recent development[14]. However it is worth stressing that our convergence analysis only finds evidence of convergence in labour productivity within one of the three service categories that we work with. Further the fact that manufacturing is not unique in offering higher productivity employment to that available in agriculture should perhaps be unsurprising. What matters in terms of strategy is the growth and employment potential a sector offers and in many lower income economies shifting labour resources into manufacturing continues to greater growth potential than elsewhere in the economy. Our broad conclusion is that at a certain development level the engine of growth case remains valid, even if it is obvious that growth opportunities outside manufacturing should not be neglected.

[14] The evidence on service productivity growth in the chapter by Timmer et al in this volume supports this view.

Table (1): Testing for convergence[15]

Independent variables:	**Dependent variable: Cumulative sectoral growth**								
	cgagr	**cgmin**	**cgman**	**cgpu**	**cgcon**	**cgwrt**	**cgtcs**	**cgfin**	**cgsum**
				All countries included					
Initial level of sectoral labour productivity	0.14	-1.23	0.92	-2.43***	-2.20**	0.28	-1.21*	-0.75	0.07
				All countries, adding institutional proxy					
Initial level of sectoral labour productivity	-0.06	-1.11	-0.89	-3.64***	-3.24***	-0.69	-2.30**	-0.76	-0.35
Institute	0.14	-0.22	0.93***	1.09*	0.61	0.5	0.56*	0.02	0.26
				All countries excluding those in Africa					

[15] See appendix 1 below for variables definition

Initial level of sectoral labour productivity	-0.27	-1.69*	-1.18*	-1.46*	-0.62	0.24	-0.23	-0.20	-0.81**
All countries excluding those in Africa, adding institutional proxy									
Initial level of sectoral labour productivity	-1.00	-1.2	-3.06***	-2.16*	-0.86	-1.17	-1.04	-0.19	-1.90***
Institution	0.44	-0.58	0.84***	0.41	0.11	0.62**	0.36	0.00	0.54***

legend: * p<0.05; ** p<0.01; *** p<0.001

Table (2): Role of sectoral growth or output in overall GDP per capita growth

Dependent variable is the GDP per capita growth

Testing role of sectoral growth:

Independent variables	**Agr.**	**Min**	**Man.**	**PU**	**Con.**	**WRT**	**TCS**	**Fin.**
Rlks	0.199***	0.216***	0.229***	0.214***	0.230***	0.218***	0.212***	0.219***
Rlpseg	0.083*	0.082*	0.096*	0.082*	0.080*	0.081*	0.088*	0.086*
lgdp1in5y	-0.600***	-0.629***	-0.632***	-0.628***	-0.624***	-0.644***	-0.644***	-0.637***
Sectoral growth	0.005*	0.000	-0.003	0.000	-0.001	-0.002	-0.002	-0.001
Year								
2000	0.069***	0.071***	0.071***	0.070***	0.069***	0.072***	0.074***	0.070***
2005	0.131***	0.135***	0.136***	0.136***	0.136***	0.141***	0.141***	0.139***
Constant	4.705***	4.946***	4.917***	4.942***	4.893***	5.076***	5.068***	5.000**
R-squared	0.82	0.80	0.81	0.80	0.81	0.81	0.81	0.83
No of observations	98	98	98	98	98	98	98	98
No of countries	36	36	36	36	36	36	36	36

Testing the role of cumulative sector output per worker

Independent variables	Agr.	Min	Man.	PU	Con.	WRT	TCS	Fin.
Rlks	0.22***	0.21***	0.21***	0.21***	0.21***	0.20***	0.20***	0.23***
Rlpseg	0.08*	0.09*	0.08	0.09*	0.12**	0.09*	0.03	0.13*
lgdp1in5y	-0.64***	-0.64***	-0.72***	-0.67***	-0.64***	-0.67***	-0.71***	-0.62***
Sectoral output	1.29	-0.01	1.62*	0.14	1.46**	2.64	2.23***	0.02
Square of sectoral output	-3.61	0.00	-2.38*	-0.04	-2.45**	-7.55	-3.23***	0.13
Year								
2000	0.07***	0.07***	0.07***	0.07***	0.07***	0.07***	0.06***	0.07***
2005	0.13***	0.13***	0.13***	0.12***	0.14***	0.15***	0.12***	0.14***
Constant	4.99***	5.01***	5.53***	5.20***	4.80***	5.10***	5.56***	4.73***
R-squared	0.81	0.81	0.82	0.81	0.84	0.82	0.84	0.82
No of observations	98	98	98	98	98	98	98	98
No of countries	36	36	36	36	36	36	36	36

legend: * p<0.05; ** p<0.01; *** p<0.001

Appendix 1: Variables definition: Sectoral growth indicators

Cgagr	**Cumulative growth of Agriculture labour productivity, constant 2000 PPP dollars**
Cgcon	**Cumulative growth of Construction labour productivity, constant 2000 PPP dollars**
Cgfin	**Cumulative growth of Finance and business services labour productivity, constant 2000 PPP dollars**
Cgman	**Cumulative growth of Manufacturing labour productivity, constant 2000 PPP dollars**
Cgmin	**Cumulative growth of Mining labour productivity, constant 2000 PPP dollars**
Cgpu	**Cumulative growth of Public utilities labour productivity, constant 2000 PPP dollars**
Cgsum	**Cumulative growth of Total labour productivity, constant 2000 PPP dollars**
Cgtcs	**Cumulative growth of Transport and communication labour productivity, constant 2000 PPP dollars**
Cgwrt	**Cumulative growth of Retail and wholesale trade labour productivity, constant 2000 PPP dollars**