Unconditional Convergence of Labor Productivity in the Service Sector

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Abstract

Using disaggregated service sector data for 101 countries, we find unconditional convergence in labor productivity for the service sector. The aggregate service sector yields a large unconditional convergence coefficient of -0.028, while for individual sub-sectors we find a similar presence of unconditional convergence. Since the service sector, as part of the "modern" sector now also faces international competition, unconditional convergence in labor productivity in this sector is not totally unwarranted. Given Rodrik's (2013) recent findings of unconditional convergence in labor productivity in the manufacturing sector and the observed failure of unconditional convergence of per capita GDP, our findings of unconditional convergence in the service sector suggest that we need to look carefully at methodological issues such as "aggregation bias" and the huge divergence of other sectors such as the agricultural sector as a potential solution to this anomaly.

JEL Codes: O40, O14.

Keywords: Unconditional convergence; Labor productivity; Service sector.

1. Introduction

The service sector currently contributes more than 60 percent of the world's production and employment (WTO, 2014). The service sector's share in international trade is around 20 percent (WTO, 2014). Although this share in international trade may seem modest as compared to its contribution to production and employment, the service sector has increasingly become internationally mobile (WTO, 2013). Many services that had been considered domestic activities have now become internationally tradable (WTO, 2014). For example, the outsourcing of labor-intensive services has received a great deal of attention from both academics and policy makers (Liu and Trefler, 2008). Increasingly, banking, medical services, entertainment and sports activities have been globalized. This trend toward the internationalization of services is expected to grow with the rise in electronic transmission technologies. Consequently, the Uruguay Round of trade negotiations that took place between 1986 and 1993 resulted in the adoption of the General Agreement of Trade in Services (GATS) in 1995 (see WTO 2013, 2014).

With the increase in the tradability of the services sector, firms engaged in providing services face intense competition not only from their domestic rivals but also from foreign firms. As the service industry becomes more globalized, industries even in low-income countries strive to emulate their foreign counterparts. In addition, multinational companies are setting standards of quality for the industry as they compete with local companies. Faced with competition from both domestic and foreign firms, domestic service providers in low-income countries must improve their efficiency. As a result, we find an increase in productivity in the service sector not just in developed countries but also in developing countries. We may also expect a diffusion of technologies in the service sector across countries through international trade and the international standardization of service provisions. For example, in the financial sector, we can observe remarkable similarities between

firms in both low- and high-income countries in both organizational structure and work environments (Konan and Maskus, 2006). Taking these factors into account, it is imperative to examine the ways in which labor productivity is catching up in service sectors across countries. This paper represents an attempt to assess this trend.

The neoclassical growth model predicts that poor economies grow faster than rich economies[1] if they have similar preferences and technologies. A poor country with a lower capital or income will grow faster than a rich country due to the presence of diminishing returns to capital (Barro and Sala-I-Martin, 2004). Access to foreign capital, foreign technology and foreign markets in a globalized economy could make this convergence a reality.

However, most empirical studies find no such convergence for all countries with the exception of a group of countries that have similar structural variables (see, among others, Barro et al. (1991); Barro and Sala-I-Martin (1992); Mankiw et al. (1992); Sala-I-Martin (1996a, 1996b); Young et al. (2008); Higgins et al. (2006); and Barro (2012)). This has prompted researchers to focus on theories of conditional convergence where convergence depends on structural variables and endogenous technological change (Acemoglu, 2009; Durlauf et al, 2005).

Baumol (1986), however, reported unconditional convergence[2] in GDP per labor hour only among developed countries. Similarly, Barro et al. (1991) and Barro and Sala-I-Martin (1992) find unconditional convergence for the US States and European countries, but find no evidence of unconditional convergence for a cross-section of countries that includes developing countries.

[1]The idea that poor economies grow faster than rich economies is called β (beta) convergence whereas σ (sigma) convergence indicates that the dispersion of real per capital income among countries falls over time.
[2] The literature distinguishes between unconditional convergence and conditional convergence. Conditional convergence is what the neoclassical theory predicts for economies having similar structural parameters with the only difference being initial capital. Unconditional convergence does not depend on any factor.

Early studies in the convergence literature focus more on aggregate variables such as convergence in per capita real GDP. Currently, researchers have been examining the presence or absence of convergence in a context of differing levels of aggregation of national accounts and productivity. Freeman and Yerger's (2001) study focuses on labor productivity in the manufacturing sector in OECD countries. They find unconditional convergence for the pre-1970 data and an absence of convergence for the post-1970 data. Rodrik (2013), using data from 118 countries, finds unconditional convergence in labor productivity in the manufacturing sector. Similarly, Inklaar (2014) finds stronger convergence in manufacturing sectors using disaggregated data. The study also finds rapid convergence in labor productivity in the manufacturing sectors of emerging market economies.

Rodrik (2013) suggests that competition and diffusion of technologies in manufacturing are the main reasons behind this convergence. One would then expect that the robust presence of competition and diffusion of technologies in the any other sector might also lead to convergence in labor productivity in that sector. In order to test this conjecture one has to find detailed data for that sector for a large number of countries and for a longer span of time. Although the size of the service sector in almost every country in the world has increased and international trade in services is growing at a rapid rate along with the diffusion of technology in this sector, we have not found, to the best of our knowledge, that there are any studies that deal with this issue using a large dataset for a large number of countries. The unavailability of detailed data for the service sectors of a large number of countries has been the main cause of this gap in the literature. Generally, researchers have been able to obtain sectoral data for a few rich countries but only sporadic data for other countries. We have overcome this challenge by meticulously compiling internationally comparable data for the service sector's labor productivity as a whole and also for 12 sub-sectors

of the service sectors of 101 countries. The value-added data were collected from the National Accounts Official Country Data (United Nations Statistics Division) and the employment data were collected from International Labor Organization Statistics (ILOSTAT). The painstaking matching of these data from two different sources has provided us with a consistent dataset for the service sector and its sub-sectors. This dataset has allowed us to examine whether labor productivity in the service sector exhibits unconditional convergence or not. This paper is an attempt to fill this gap in the literature.

There have been a few studies of per capita output convergence using sectoral data, but these studies are mainly concerned with developed countries. Bernard and Jones (1996) decompose aggregate productivity into industry-level productivities, splitting the economy into six sectors. They find that the service sector exhibits convergence in 14 OECD countries. The service sector accounts for a third of the aggregate productivity convergence observed among the 14 OECD countries. However, Bernard and Jones (1996) do not find evidence of convergence in the manufacturing sectors of OECD countries. Contrary to the findings of Bernard and Jones (1996), Madsen and Timol (2011) find both absolute and conditional β convergence in manufacturing for 19 OECD countries. The Madsen and Timol (2011) study reports convergence for both manufacturing and total factor productivity.

Taking into account both the service and manufacturing sectors, Sondermann (2013) finds no convergence in real labor productivity in the majority of sectors within both the service and manufacturing sectors in Euro areas. A few sub-sectors in both manufacturing and service show evidence of convergence. On the other hand, by selecting only three manufacturing sectors in both US and non-US firms, Fung (2005) finds statistically significant conditional convergence and weak absolute convergence (statistically significant at 10% but only over a longer period of time).

In a recent paper, Rodrik (2013) goes even further in the disaggregation of the manufacturing sector by considering two-digit and four-digit ISIC classifications of industries within the manufacturing sector. He finds that countries that lag behind other countries in labor productivity in the manufacturing sector tend to grow more rapidly. He concludes that the manufacturing sector exhibits a strong unconditional convergence. He argues that the manufacturing sector inherently exhibits unconditional convergence since this sector is modern and tradable.

In this paper we investigate through the use of disaggregated data whether the service sector exhibits unconditional convergence. We use sub-sector-level disaggregated data based on the International Standard Industry Classification (ISIC), using ISIC revision 2 and ISIC revision 3 classifications of the service sector for a large number of countries. Our main result is based on 101 countries, representing 12 sub-sectors of the service sector during the 1971 - 2012 period. Following the estimation technique suggested by Rodrik (2013), we find a highly significant unconditional convergence coefficient for the service sector. This suggests that countries starting from conditions of low initial labor productivity in the service sector grow faster than countries with higher initial labor productivity in that sector.

We also find the presence of absolute convergence for individual sub-sectors. We interpret the results for individual sub-sectors as follows: A higher convergence coefficient for a sub-sector implies that this sub-sector faces more competition, that the service it provides are more tradable and that a greater degree of technological diffusion is taking place in this sub-sector.

This paper proceeds as follows: Section 2 presents a brief theoretical background of the convergence literature. In Section 3, we describe the methods we used to compile a compatible data set for value added and employment that we used to calculate labor productivity in the service

sector. Section 4 formally presents the study's empirical specifications, and we present our results in Section 5. In Section 6 we discuss the results, concentrating specifically on 12 individual sub-sectors within the service sector. We discuss sigma convergence in Section 7, and in Section 8 we discuss the issues related to non-convergence in the aggregate variable along with the presence of unconditional convergence in specific sectors such as the manufacturing (Rodrik, 2013) and service sectors. Section 9 presents some concluding remarks.

2. Theoretical Framework

The standard neoclassical growth model has served as the cornerstone of the literature on absolute and conditional convergence. Mankiw et al. (1992), Sala-I-Martin (1996b), Barro and Sala-I-Martin (1992, 2006) and Islam (1995, 2003), among others, have discussed the link between the neoclassical growth model and convergence. In order to test for unconditional convergence, researchers generally try to estimate the following equation (see Sala-I-Martin (1996b)):

$$\frac{1}{T}\left[ln\left(y_{i,t+T}\right) - ln(y_{i,t})\right] = \alpha + \beta ln(y_{i,t}) + \varepsilon_{i,t} \quad \ldots\ldots (1)$$

Where y is the per capita income of a country.

The left side of Equation 1 represents the average annual growth rate in y between period $t+T$ and t. On the right side of the equation $y_{i,t}$ represents the initial per capita income. This means that the growth rates of per capita income of a number of countries are regressed on the initial income of those countries. A negative coefficient of β implies unconditional convergence. Equation (1) is a univariate regression in which we do not include any other regressors such as steady-state income or other structural variables. This is also known as β –convergence (for further discussion, see Sala-I-Martin (1996b) and Barro and Sala-I-Martin (2004)). This indicates that

poor economies grow faster than rich economies and also that a large absolute value of β suggests a faster rate of convergence. Unconditional convergence in a cross-section of countries also indicates that countries converge toward the same steady-state value.

The existing empirical literature on growth and convergence yields results that suggest an absence of unconditional convergence of per capita income across countries (see Islam, 2003 and Sala-I-Martin, 1996a). However, the lack of empirical evidence for unconditional convergence among countries is generally to be seen in studies that consider aggregate variables in an economy, usually GDP per capita.

3. Data

In order to calculate sectoral and sub-sectoral labor productivity it was necessary for us to acquire data on employment and value added in each sub-sector of the service sector. Labor productivity was calculated as value added per worker in each sub-sector. The employment data were collected from the ILOSTAT database while the value added data were taken from the National Accounts Official Country Data gathered by the United Nations Statistics Division (UNSD). The sectoral classification of the service sector is based on International Standard Industrial Classification (ISIC revisions 2 and 3), depending on the availability of data in the UN National Accounts Official Country data repository. The value added data is expressed in terms of the current price of the various national currencies. We used the average annual exchange rate to convert these national currencies to the US dollar using exchange rate data collected from the International Financial Statistics of the IMF.

One of the main challenges of this study was the compilation of a comprehensive dataset for disaggregated service sectors for a large number of countries. For most developing countries,

especially for countries in Africa, we did not have access to readily available disaggregated data for the service sector. In the absence of such data for the service sector, we matched the employment data from the ILOSTAT with the UN data for value added based on the ISIC (revisions 2 or 3) classifications to compute labor productivity[3].

The main challenge in matching the employment data from ILOSTAT to the value added data from UNSD emanates from the fact that the data available from the two organizations is arranged according to different and/or multiple ISIC industry classifications. Even within both the value added and the employment data repositories a country may be represented by a sporadic data series for both value added and employment using different ISIC classification methods. The United Nations National Accounts Official Country value added data repository for the service sector uses 13 different types of time series data. For most countries, the national data set consists of two to five separate kinds of time series data. Having multiple types of time series data for most countries is mainly due to their having adopted a variety of data collection methodologies (using either 1969, 1993 or/and the latest 2008 System of National Account (SNA)). According to the description of the data from the UNSD, a country can also have different types of time series data if it uses a variety of currencies, if its fiscal years are subject to change, or when there has been a significant change in the way the country compiles its data.

On the other hand, the employment data from ILOSTAT is based on different revised industry classifications of ISIC (revisions 1, 2, 3 or 4). Because both the employment data from ILOSTAT and the value added data from UNSD contain duplications for most countries, there are many fragmented times series data for many countries in both employment and value added. In general,

[3] Detailed discussions about matching these two datasets are available upon request.

we obtained data for the period 1971 – 2012. In order to have a large and consistent dataset we followed the strategy adopted by Rodrik (2013) which is discussed in detail in the next section. A list of countries and a list of sectors are given in the appendix.

4. Empirical Specification

Following the existing literature and Rodrik (2013) more specifically, we estimated equation (1) where $y_{i,t}$ is the value added per worker for country i at time t to obtain the unconditional convergence coefficients of the service sector in the aggregate and also in its sub-sectors. This entails regressing the decadal growth rate (a ten-year compounded growth rate of labor productivity) of disaggregated service sector data on the initial value added per worker without adding any other explanatory variable. Moreover, following Rodrik (2013) we also estimated the convergence coefficients using the sub-sectoral fixed effect and period fixed effects in the baseline estimation.

In addition, we examined whether the service sector exhibits conditional convergence by introducing country-specific fixed effects, and thus we estimated the following equation:

$$g_{ijt} = -\beta \ln v_{ijt} + D_{it} + D_j + \varepsilon_{ijt} \qquad (2)$$

where g_{ijt} is the nominal growth rate of labor productivity in sub sector i, country j at t time period; v represents the initial level of labor productivity; D_j is the country-specific fixed effect, D_{it} is a set of sub-sector multiplied by time fixed effects and ε_{ijt} is the error term for sub-sector i, country j at t time period[4]. Rodrik (2013) discusses in detail why in Equation (2) the nominal

[4] The main result is based on current price value added. We also find a similar estimated result for value added in constant price (using 2005 as the base year) using the consumer price index from the World Bank's World Development Indicators. The result is not reported but we find a highly significant coefficient of -0.019.

growth rate of labor productivity yields the appropriate unconditional convergence coefficients. Since the error term can be related to sub-sectors within the same country, we used a standard error clustered on countries that takes into account the non-independence of the error terms. We also present standard errors clustered on the sub-sectoral level as a robustness check.

Even though the variable on the left side of the regression equation uses a nominal growth rate of labor productivity, it is derived from the real growth rate of labor productivity. The real growth rate of labor productivity represents the difference between the nominal growth rate of labor productivity and the increase in the industry-level deflator. In addition, the real growth rate of labor productivity in a sub-sector is a function of both the difference between its initial level of labor productivity and its frontier technology and country-specific conditions. Using the two definitions for real growth rate of labor productivity in a sub-sector, we can write the nominal growth rate of labor productivity in the left side of equation (2) as a function of the initial level of labor productivity, its sub-sector level deflator and its frontier technology. The industry and time interaction variable D_{it} captures both the industry deflator and the sub-sector's frontier technology (see Rodrik, 2013).

We estimate equation (2) using a number of cross-sectional and panel data estimation techniques. Our estimation technique follows the strategy adopted by Rodrik (2013) for the manufacturing sector. Accordingly, we estimate coefficients in each case for both unconditional and conditional convergence.

Our baseline result is based on cross-sectional data due to the availability of a larger data set. What we refer as the baseline estimation takes into account only the recent available data for growth and initial labor productivity in the service sector for industries and countries that have this

data. We adopted this strategy so that we could expand the sample size. For example, considering only the period between1995 and 2005, we found only 44 countries that had data for both value added and employment. Instead of limiting ourselves to a specific time period, when choosing recent data from a country's available data we increased the sample size to 101 countries covering the period between 1971 and 2012. The baseline data set is available on and after 1990 for most industries and countries. The baseline estimation does not specify any explicit time period, but only that the available data be recent[5]. On the other hand, we also considered estimations for the period on or after 1990. Given that almost all of the available baseline estimation data is for years on or after 1990, we expected that the two results (from the baseline and the post-1990 period) would be very similar.

We also considered estimation based on cross-sectional data of countries for the period 1995 to 2005, but this method gave us the smallest data coverage, representing only 44 countries. Moreover, we also adopted panel data estimation techniques for a panel dataset consisting of three decades (1975-1985, 1985-1995 and 1995-2005). This panel estimation included 59 countries.

5. Empirical Results

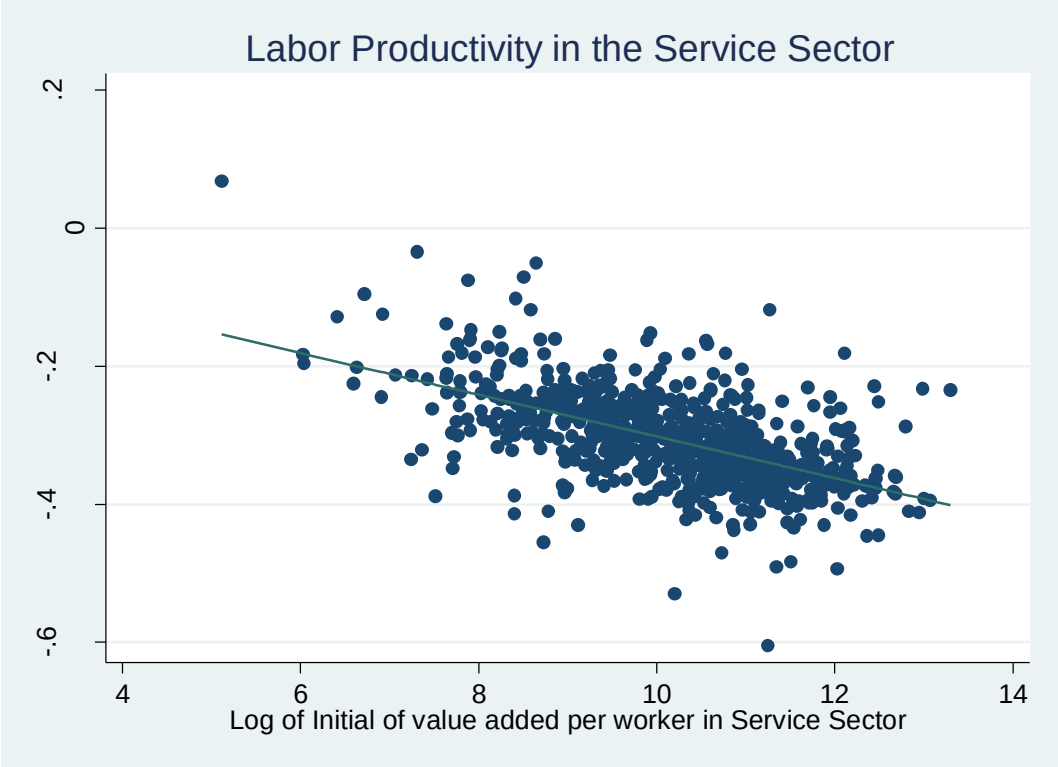
5.a Main Results

Figure 1 shows the relationship between initial labor productivity and its growth rate over a ten-year period. Each point in the graph represents a particular service industry in a particular country.

[5] Baseline data sets include available data for the 10-year period for each country. For example, if we assume that we have available data for country A for the period 1981- 2012 and also for country B, we have data available for 1995-2007. In our baseline dataset we include data for the period 2002-2012 for country A and data for the period 1997-2007 for country B. Accordingly, from the 101 countries in the study, Burundi's recent available data is for the period 1979- 1989 whereas for Brazil it is for 2002- 2012.

We included 101 countries and 12 sub-sectors in the study. If all of the 101 countries had data for all 12 sub-sectors, we would end up with 1212 data points. However, not all countries in the study had data for all 12 sub-sectors. One of the main reasons for this is the mismatch between industry classification in employment data and value added data, as is discussed in the description of data section. Here, we have 809 data points.

Figure 1: Relationship between Growth of Labor Productivity and Initial Value Added per Worker in the Service Sector



The data points in Figure 1 show the relationship between the growth in labor productivity in the service sub-sectors and the initial productivity. The graph is a component-plus-residual plot (a.k.a. partial residual plot). It examines whether a nonlinear relationship exists between the two variables. The diagram illustrates a linear relationship between growth of labor productivity and

initial value added per worker in the service sub-sectors. We can see a downwardly sloping line showing the negative relationship between growth and initial labor productivity in disaggregated services industries. Countries with lower initial labor productivity grow at a faster rate than countries that have higher initial value added per worker. Also, Figure 2 shows the convergence results for the service sector in aggregate.

Figure 2: Unconditional Convergence in Aggregate Service Sector

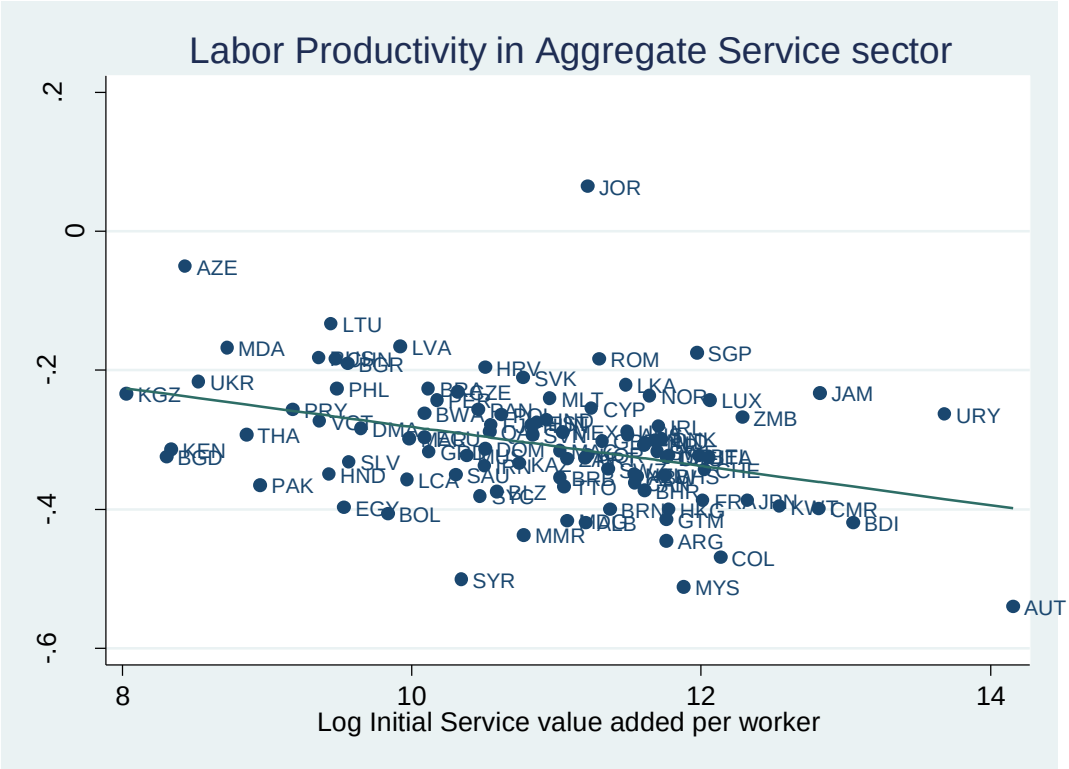


Table 1 presents the regression results from the estimation of Equation (2). The dependent variable is the compound annual growth rate and the explanatory variables are the initial levels of labor productivity (in natural log) which serve as a base, along with the fixed effects for industry, period, period-industry and country. In each case, we ran a regression with and without the country fixed effect. The coefficient estimate of initial labor productivity without the country fixed effect yields

results indicating unconditional convergence while the same estimate made with the country fixed effect yields results indicating conditional convergence.

Regarding the labor productivity of the aggregate service sector, we obtain a negative and highly significant coefficient for the initial level of labor productivity under varying assumptions about the country fixed effect, various time spans and different estimation techniques. The baseline specification takes into account the fixed effects of industry, year and country along with the interaction between year and industry. We find a highly significant coefficient of -0.03 for the initial level of labor productivity of the service sector (Column 1), suggesting the presence of unconditional convergence.

The negative and highly significant coefficients suggest that countries starting from low initial labor productivity in the service sector grow faster than countries with higher initial labor productivity in that sector. The coefficient estimate for the conditional convergence is also negative and significant (column 2). Moreover, the conditional convergence coefficient is higher in magnitude (-0.042) than that for unconditional convergence (-0.03). Rodrik (2013) found similar results for the manufacturing sector.

Table 1: Unconditional and Conditional Convergences of Labor Productivity in the Service Sector
Dependent Variable: growth rate of labor productivity

	Baseline		Baseline, only post-1990 data		Cross section, 1995-2005		Panel	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Initial Productivity	-0.030***	-0.042***	-0.030***	-0.042***	-0.024**	-0.034***	-0.017*	-0.027**
	(0.005)	(0.007)	(0.005)	(0.007)	(0.011)	(0.011)	(0.010)	(0.010)
Country fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period*Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of countries	101	101	100	100	44	44	59	59
Number of observations	809	809	804	804	373	373	474	474

Estimates for unconditional convergence are shown in bold and italic.
* p<0.1, ** p<0.05, *** p<0.01

The baseline estimation for all countries represents only the recent data for their growth and initial labor productivity. An estimation using different time periods also yields similar results. The results for the post-1990 years reported in column 3 and for the cross-sectional data reported in column 5 in Table 1 also yield negative and highly significant convergence coefficients. Although smaller in absolute magnitude, the panel data that takes three decades into consideration also results in negative and significant coefficients representing the presence of both conditional and unconditional convergence.

Barro (2012) argues that the inclusion of country fixed effects in regression analyses results in a significantly higher and misleading convergence rate. On the other hand, Islam (2003) advocates for the use of panel data model in convergence literature, among which is the use of a least square with dummy variables. Islam (2003) argues that the use of a panel model helps to correct for omitted variable bias by capturing country-specific characteristics in the form of individual effects. To see how the convergence coefficient varies with the introduction of fixed effects, we ran a regression that involved no fixed effects and subsequently added the industry, period, period-industry, and country fixed effects. The results are reported in Table 2.

Table 2: Comparison of Results Using Different Fixed Effects
Dependent Variable: growth of labor productivity

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	No fixed effects	Only Period effect	Period, Industry Effect	Period, Industry, period * industry	All fixed effects included
Log Initial Productivity	-0.030***	-0.024***	-0.025***	-0.029***	-0.030***	-0.042***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.007)
Country fixed effects	No	No	No	No	No	Yes
Industry fixed effects	Yes	No	No	Yes	Yes	Yes
Period fixed effects	Yes	No	Yes	Yes	Yes	Yes
Period X Industry fixed effects	Yes	No	No	No	Yes	Yes
Number of countries	101	101	101	101	101	101
Number of observations	809	809	809	809	809	809

* p<0.1, ** p<0.05, *** p<0.01

The results reported in Table 2 confirm the findings of Barro (2012) that the inclusion of fixed effects increases the absolute magnitude of the coefficient of the initial labor productivity. The convergence coefficient with no fixed effects was 0.024 (in absolute value) whereas when all period, industry-country and industry-period fixed effects are included, we obtain a coefficient of 0.042 (absolute value). However, unlike Barro (2012) where the inclusion of country fixed effects gives statistically insignificant results, the inclusion of country fixed effects does not affect the statistical significance of our results. Overall, our model estimation with or without fixed effects yields a large negative and highly significant convergence coefficient.

5.b Robustness Check

We checked the robustness of our results by estimating convergence coefficients using a different set of countries, different periods and other varying characteristics of country groups; all of these results are reported in Table 3. We found the convergence coefficients to be negative and highly significant in all these cases. First, we checked to see if our results were driven by a few countries and/or sub-sectors. In column 2 we report the results obtained when we excluded countries with fewer than five and ten sub-sectors respectively out of a total of twelve service industries within the service sector. When we excluded countries with fewer than ten industries (39 countries included), the coefficient estimate was higher than was the case when we excluded countries with fewer than five sectors (83 countries included).

In column (4) of Table 3 we report the results obtained when we excluded observations involving the lowest and largest 10% growth of value added. This gives the lowest absolute converge coefficient of -0.019, which is smaller but still highly significant. On the other hand, when we excluded the lowest and highest 10% values for initial labor productivity, we obtained a higher

and more highly significant convergence coefficient. We obtained similar results when we considered only countries with a labor productivity that occupied the bottom half of the dataset or when we considered only countries with a level of labor productivity that occupied the top half of the dataset. We also obtained results very similar to the baseline estimate (-0.032) when we excluded high-income OECD countries (Column 7).

Rodrik (2013) shows that the global estimate for the convergence coefficient is a weighted average of industry-by-industry convergence coefficients. We report a weighted regression result that includes value added as a weight. Column (8) shows the weighted regression result. This result (-0.031) is also very similar to our baseline estimates.

These baseline results may have been susceptible to endogeneity and error in measurement. According to Davidson and MacKinnon (2004), measurement error in a variable and the issue of endogeneity are the two main causes for correlations between regressors and error terms. To deal with this potential endogeneity we also made use of instrumental variable (IV) estimation methods to check for robustness (column 9, Table 3).

Table 3: Robustness Tests

	(1) Baseline	(2) Excluding countries which have fewer than 5 industries included	(3) Excluding countries which have fewer than 10 industries included	(4) Excluding observations with the highest and lowest 10% values for growth	(5) Subsample including labor productivity in the bottom half of the sample	(6) Subsample including labor productivity in the top half of the sample
Log Initial Productivity	-0.030***	-0.035***	-0.047***	-0.019***	-0.044***	-0.049***
	(0.005)	(0.006)	(0.007)	(0.006)	(0.011)	(0.006)
Country fixed effects	No	No	No	No	No	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Period X Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of countries	101	83	39	95	83	84
Number of observations	809	723	441	629	323	486

* p<0.1, ** p<0.05, *** p<0.01

Table 3: Robustness Tests (Cont'd)

	(7) Excluding high Income OECD countries	(8) Weighted regression results: ln(value added) weights	(9) IV results with 3-year lagged initial productivity as instrument	(10) Rescaled labor productivity growth (adjusted for real exchange rate appreciation)	(11) Standard errors clustered by industry	(12) Country fixed effects with no industry controls	(13) Testing for non-linearity by labor productivity quartiles
Log Initial Productivity	-0.032***	-0.031***	-0.021***	-0.035***	-0.030***	-0.021***	
	(0.008)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	
Log initial productivity, 1st quartile							-0.036***
							(0.011)
Log initial productivity, 2nd quartile							-0.036***
							(0.010)
Log initial productivity, 3rd quartile							-0.036***
							(0.009)
Log initial productivity, 4th quartile							-0.033***
							(0.009)
Country fixed effects	No	No	No	No	No	Yes	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	No	Yes
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period*Industry fixed effects	Yes	Yes	Yes	Yes	Yes	No	Yes
Number of countries	73	101	65	96	14	101	101
Number of observations	507	809	466	774	809	809	809

* p<0.1, ** p<0.05, *** p<0.01

Barro (2012) argues in favor of the use of lagged independent values as an instrument in cross-country regressions to deal with the endogeneity issue. He explains that in the presence of a country fixed effect, using instruments that do not vary over time (such as ethnolinguistic fractionalization, population density and settler mortality at the time of colonial settlement or the form of legal origin) does not improve the estimates. In accordance with Barro's (2012) suggestions, we used the lag in initial labor productivity as an instrument for initial labor productivity. To determine the lag size, we employed the robust Durbin-Wu-Hausman (DHW) test to determine whether the instrumental variable is endogenous (Cameron and Trivedi, 2010). For a three-year lag we found that the test statistics failed to reject the null hypothesis that a three-year lag in labor productivity is an exogenous variable. With further diagnosis we found the correlation between a three-year lag in labor productivity and initial labor productivity to be 0.94 whereas the correlation between the error term and initial labor productivity had been reduced from -0.13 in the baseline estimate to 0.06 when we used the three-year lag in labor productivity.

The IV estimation gives us a highly significant convergence coefficient of -0.021 (column 9). However, the size of the convergence coefficient is smaller than the baseline estimate of -0.03 and is closer to what the literature calls the "iron law of convergence" where countries diminish the gap in levels of per capita income at a rate of around 2% per year (see Barro, 2012).

The baseline result could also have been biased upward due to the use of the US dollar in the value added calculation. According to Rodrik (2013), estimating value added for industries using the US dollar can be misleading for countries that experience sustained movement in the real exchange rate that is not reflected in the nominal exchange rate. He argues that the convergence coefficient can be biased upward if low-income countries with low productivity experience an appreciation of the real exchange rate due to rising domestic costs of production with no corresponding

depreciation of the domestic currency. To account for a possible movement in real exchange rates, column (10) presents a recalculated growth obtained by adjusting growth in value added by taking into account the rate of appreciation (or depreciation) of the real exchange rate. The change in real exchange rate takes into account changes in both the nominal exchange rate and in price levels. To calculate the change in price level we considered price change in the US and price change in the home country (using CPI). The robustness estimation result obtained when accounting for the change in the real exchange rate also gives a highly significant and negative unconditional convergence coefficient of -0.035.

The last three columns of Table 3 also give results consistent with the baseline estimation. The first of the three results considers standard error clustered by industry rather than by country as it is in the baseline. We also considered country fixed effects but excluded the industry fixed effect. The last column follows Rodrik (2013) in testing non-linearity by introducing quartile coefficients. The estimated quartile coefficients are very similar in magnitude and statistically significant in that the case for the non-linearity of the β coefficient is not found.

6. Individual Sub-Sectors of the Service Sector

In the context of unconditional convergence in the manufacturing sector, Rodrik (2013) suggests that unconditional convergence is plausible since a tremendous increase in international trade in the manufacturing sector has resulted in increased competition, and thus efficiency upgrades in the production process everywhere in the world seem very reasonable. It is interesting to note that the service sector is also comprised of a number of sub-sectors with various levels of exposure to the world trade in services (UNCTAD, 2014) and that these sub-sectors consequently face varying levels of competition. A disaggregated analysis would allow us to apprise which sectors have been facing stronger competition as compared to other sectors. Labor productivity in a sub-sector that faces stiff competition would converge at a faster rate than a sub-sector that faces no or very little competition. These convergence results would therefore also shed light on the levels of competition faced by an individual sub-sector of the service sector.

Table 4 shows the unconditional convergence estimates without adding any fixed effects for industries in the service sector. The 12 columns represent various industries in the service sector. The last column represents the aggregate service sector.

All of the unconditional convergence coefficients among all the individual industries are negative with the exception of two industries that have an insignificant coefficient, whereas the remaining 10 industries have significant coefficients. This suggests that unconditional convergence exists for individual sub-sectors within the service sector.

Table 4: Absolute Convergence Coefficient by Industry

	(1) Electricity, Gas and Water	(2) Construction	(3) Transport, Storage and Communication	(4) Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	(5) Hotels and restaurants	(6) Financial intermediation
Log Initial Labor Productivity	-0.017**	-0.009	-0.024***	-0.033***	-0.024*	-0.033***
	(0.007)	(0.008)	(0.008)	(0.011)	(0.013)	(0.013)
Number of Countries	85	101	95	54	55	59

* p<0.1, ** p<0.05, *** p<0.01

	(7) Real estate, renting and business activities	(8) Public administration and defence; compulsory social security	(9) Education	(10) Health and social work	(11) Other community, social and personal service activities	(12) Private households with employed persons	(13) All Service
Log Initial Labor Productivity	-0.036***	-0.025***	-0.041***	-0.049***	-0.054***	-0.009	-0.028***
	(0.007)	(0.007)	(0.006)	(0.008)	(0.015)	(0.014)	(0.008)
Number of Countries	52	59	49	50	50	25	101

* p<0.1, ** p<0.05, *** p<0.01

The lowest (absolute value) significant convergence coefficient is for "Electricity, gas and water" while the highest is for "Other community, social and personal service activities." All the other sub-sectors yield significant coefficients with the smallest (in absolute value) being -0.025. The results show that both the individual and aggregate service sectors exhibit unconditional convergence.

Figure 3 depicts a component-plus-residual plot similar to that presented in Figure 1 for four selected sub-sectors of the service sector. The sub-sectors are (1) Wholesale and retail trade; Repair of motor vehicles, motorcycles and personal and household goods (ISIC-revision 3-G), (2) Transport, storage and communication (ISIC- revision 3-I), (3) Hotels and restaurants (ISIC-revision 3-H), and (4) Financial intermediation (ISIC- revision 3-J). We observe a linear and downwardly sloping relationship between the growth in labor productivity in each of the sub-sectors and in initial labor productivity. This suggests that, even in each individual sub-sector, labor productivity in countries with lower initial labor productivity in these four sub-sectors grows faster than in countries with higher initial labor productivity in these sub-sectors.

In sum, we can argue that unconditional convergence in the service sector is not implausible since the observed increased labor mobility between the manufacturing and the service sectors (Menezes-Filho et al., 2011) would tend to equate the labor productivities of both of the sectors in line with predictions concerning factor price equalization in dynamic Heckscher-Ohlin models. More international trade in manufacturing and increasing international trade in services would suggest that factor prices (here seen in terms of labor productivity) would tend to approach each other over time.

Table 5. Sigma Convergence

Industry	Baseline				1995-2005			
	Number of countries	Sigma in Base Year	Sigma in Recent Year	Difference	Number of countries	Sigma in 1995	Sigma in 2005	Difference
Electricity, gas and water	85	1.255	1.634	0.379	41	0.983	1.065	0.082
Construction	101	1.21	1.388	0.178	43	1.062	1.08	0.018
Transport, storage and communication	95	1.019	1.146	0.127	43	0.81	0.9	0.09
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	54	0.883	0.96	0.077	27	0.898	0.928	0.03
Hotels and restaurants	55	0.915	0.845	-0.07	26	1.019	0.819	-0.2
Financial intermediation	59	0.977	0.848	-0.129	28	1.019	0.819	-0.2
Real estate, renting and business activities	52	1.054	0.934	-0.12	27	0.894	0.809	-0.085
Public administration and defence; compulsory social security	59	1.029	0.992	-0.037	30	0.886	0.781	-0.105
Education	49	1.239	1.015	-0.224	26	0.917	0.814	-0.103
Health and social work	50	1.333	0.957	-0.376	26	0.88	0.826	-0.054
Other community, social and personal service activities	50	1.332	1.071	-0.261	26	0.914	0.772	-0.142
Private households with employed persons	25	1.382	1.568	0.186	14	1.353	1.867	0.514
Total Service	102	1.173	1.306	0.133	44	1.058	1.026	-0.032

7. Sigma Convergence

When the dispersion of countries' income levels falls over time, the countries are said to attain σ-convergence (Sala-I-Martin, 1996b). The dispersion is measured through the standard deviation of the log income; in our case this is the log of labor productivity. To examine the dispersion over time we first considered the 1995-2005 decade for which we had data for a large number of countries. However, not even this 1995-2005 data gave us a large overall representation of countries. It is for this reason that we adopted the strategy used in the baseline estimation of the β convergence.

In Table 5 we report the standard deviation of the log of labor productivity using cross-sectional data. The results show that for both the baseline and the 1995-2005 decade more than half of the industries in the service sector experienced a fall in the dispersion of labor productivity. For the baseline, 7 of the 12 sub-sectors of the service sector exhibit a falling trend in the variation of labor productivity. For the 1995-2005 period, 8 of the 12 industries show a decline in the dispersion of labor productivity.

Among the seven industries that show a falling trend in dispersion during the baseline period, all seven yield similar results for the period. We plot the kernel density distribution of labor productivity in the aggregate service sector and two individual sub-sectors (financial intermediation (ISIC- revision 3-J) and real estate, renting and business activities (ISIC- revision 3-K) for the years 1995 and 2005 in Figures 4 and 5. We observe that the variation in labor productivity (in natural log) was larger in 1995 than in 2005 for both the aggregate sector and the two sub-sectors. This supports the suggestions of sigma convergence illustrated in Table 5.

8. Sectoral Convergence Versus Aggregate Non-Convergence

The extant literature provides a few possible explanations for the observed lack of unconditional convergence in per capita GDP. Rodrik (2013) finds unconditional convergence for labor productivity in the manufacturing sector; however, he finds no sign of unconditional convergence for the non-manufacturing sector. Consequently, Rodrik (2013) argues that the unconditional convergence in manufacturing does not translate to aggregate convergence mainly because the employment share of manufacturing is small for poor countries.

In this paper, we report the presence of unconditional convergence in labor productivity in the service sector. Our results cast doubt on Rodrik's (2013) conjecture about the possible reasons for the existence of sectoral unconditional convergence along with aggregate non-convergence, as the service sector is already very large and its share is increasing both in terms of output and employment. In Figures 6.a and 6.b and in Tables 6 and 7 we show the importance of the service sector across countries at varying levels of development. Figures 6. a and 6. b show a significant rise in the share of the service sector in terms of both GDP and total employment for all income groups (low-, middle- or high-income).

Figures 6.a and 6.b show the distribution of the share of the service sector in relation to GDP between 1995 and 2005 for 213 countries grouped into three income levels in accordance with the World Bank's income group classification. We find that the share of value added in the service sector is growing for countries from all income groups. It is not just the value added share that is growing; in Figure 6.b we also see that the share of the service sector in total employment is also increasing for all low-, middle- and high- income groups. When we examine individual countries, taking five countries each from the three income groups (see Table 6.a), we find that the share of

the service sector in relation to GDP is growing for almost all of the different kinds of countries represented in the sample. The significance of the service sector is more pronounced when we examine its share in total employment. All of the countries in our sample (Table 6.b) have experienced a huge growth in employment in the service sector in recent decades.

On the other hand, the share of industry (manufacturing) in relation to GDP does not show a clear trend for low- and middle-income countries, while for high-income countries a falling trend in the share of manufacturing in relation to GDP is observed. We observe in Figure 7.a that the share of industry in relation to GDP for high-income countries shows a clear falling trend between 1995 and 2005. The industry sector does not show a clear rising or falling trend for low- and middle-income countries. Figure 7.b vividly demonstrates that, for countries in the three income groups in all 213 countries, the share of the industry sector declined noticeably between 1995 and 2005 for high-and middle-income countries, while the same phenomenon occurred between 1996 and 2006 in low-income countries.

Therefore, given that we find unconditional convergence in the service sector while Rodrik (2013) found the same for the manufacturing sector, we argue that the lack of convergence in the aggregate per capita GDP should not be attributed to the small share occupied by the manufacturing sector in the economies of poor countries as suggested by Rodrik (2013). Rodrik's (2013) division of economies into manufacturing and nonmanufacturing sectors combines the agriculture sector with the service sector as "nonmanufacturing" sectors. However, we find that there is a large and growing service sector within this "nonmanufacturing" sector classification in which we also find unconditional convergence. Consequently, we argue that the lack of unconditional convergence in per capita GDP is not due to the fact that the manufacturing sector is small in poor countries.

One might argue that the observed convergence of the labor productivity in the service sector in this paper may be the result of the broad convergence in the aggregate labor productivity in the post-1990 period (Dervis, 2012) as the service sector comprises more than 50 percent of total output for most of the countries during this period. Using data from Penn World Table 8 we estimated convergence coefficient for the real aggregate output per worker by matching countries and time periods included in our study and we found no convergence[6]. Thus we argue that our results for service sectors are not the manifestations of the behavior of the aggregate labor productivity.

In order to reconcile the presence of unconditional convergence in the manufacturing and service sectors and the non-convergence of aggregate output per capita, it is necessary to examine a number of factors, including trends in agricultural labor productivity, "aggregation bias" and the relationship between output per capita and output per worker. Restucciaa et al. (2008) show that the high share of employment in agriculture combined with low productivity in the agriculture sector explains the difference in aggregate productivity across countries. Similarly, Lagakos et al. (2013) find that the difference in cross-country labor productivity is larger in the agriculture sector than in the non-agriculture sector. Gollin et al. (2014) find that this agricultural productivity gap across countries is not an artifact of data measurement error.

In the context of individual commodity prices and aggregate price indices, researchers have shown the existence of an "aggregation bias" which yields smaller rates of convergence for the aggregate consumer price index (CPI) to the level of long-run purchasing power parity (PPP) whereas larger rates of convergence are observed for individual price series (Imbs et al., 2005, 2005b). Further

[6] We found insignificant β coefficient of -0.005 with standard error 0.005.

research on this trend in this context may yield valuable information. Also, the changes in labor force participation rates for male and female workers at different time periods in different countries may introduce a wedge between per capita GDP and labor productivity (Teignier and Cuberes, 2014) which could be manifested itself in the form of the anomaly we observe here.

9. Conclusions

In the present age of increased international trade in services and intense competition within the service sector from firms both at home and abroad, it is imperative to examine what is happening to labor productivity in this sector. This paper is an attempt to understand the dynamics of labor productivity in the service sector by estimating the rate of convergence using a very disaggregated dataset. Using value added and employment data based on industry classification for the service sector (ISIC revisions 2 and 3) for a large number of countries, we find robust unconditional convergence in labor productivity in the service sector.

We extend the recent empirical literature on sectoral convergence with results from the often-excluded service sector. Using the same empirical techniques as Rodrik (2013) we also examine the presence or absence of unconditional convergence in the individual sub-sectors of the service sector. Labor productivity in individual sub-sectors such as education, financial intermediation, real estate renting and business services, wholesale and retail trade, hotels and restaurants also yield a robust unconditional convergence. Since competition both at home and abroad and the diffusion of technology are considered the main channels through which unconditional convergence of labor productivity is brought about, we can indirectly measure the extent of these forces by examining the rates of convergences within the individual sub-sectors. According to our

results, the health and social work sub-sector faces more competition and is more receptive to new technology than those sectors concerned with electricity, gas and water services.

The robust presence of unconditional convergence in the service sector revealed here and Rodrik's (2013) similar finding for the manufacturing sector along with the observed lack of convergence of aggregate per capita GDP indicate that a closer look at both labor productivity in agriculture and the role played by aggregation as they are discussed in the convergence literature is warranted. Lagakos and Waugh (2013) have made an important contribution to this needed research.

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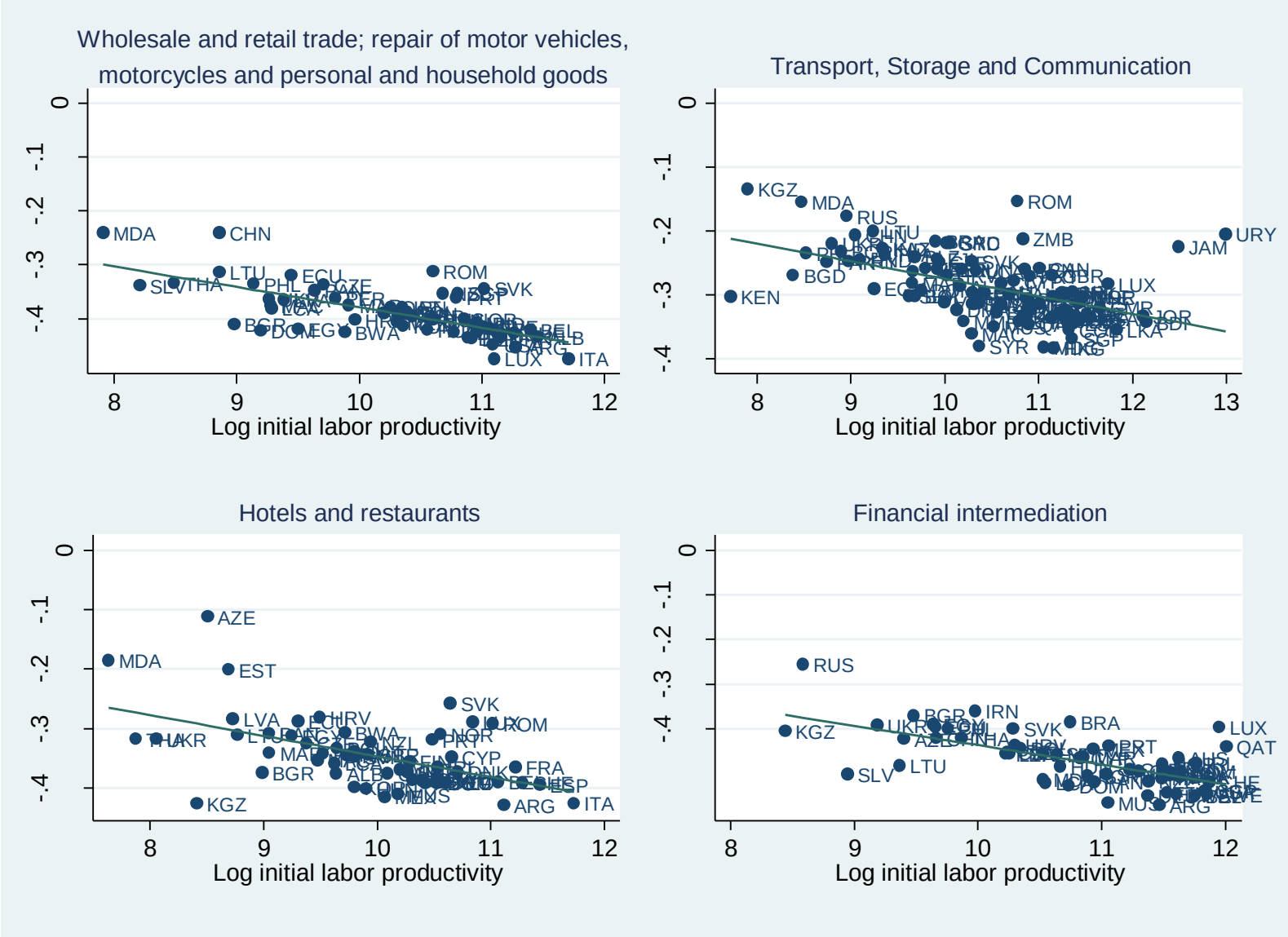

Figure 3: Relationship Between Growth of Labor Productivity and Initial Value Added per Worker in Specific Sub-sectors

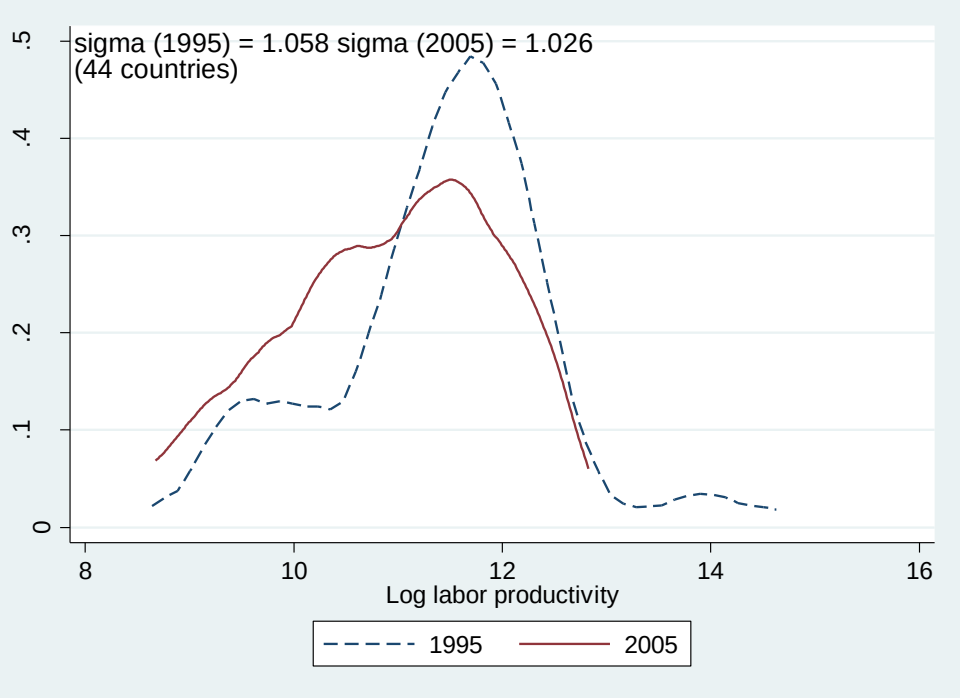

Figure 4. Sigma Convergence Aggregate Service Sector

ISIC-3 J: Financial intermediation ISIC-3 K: Real estate, renting and business activities

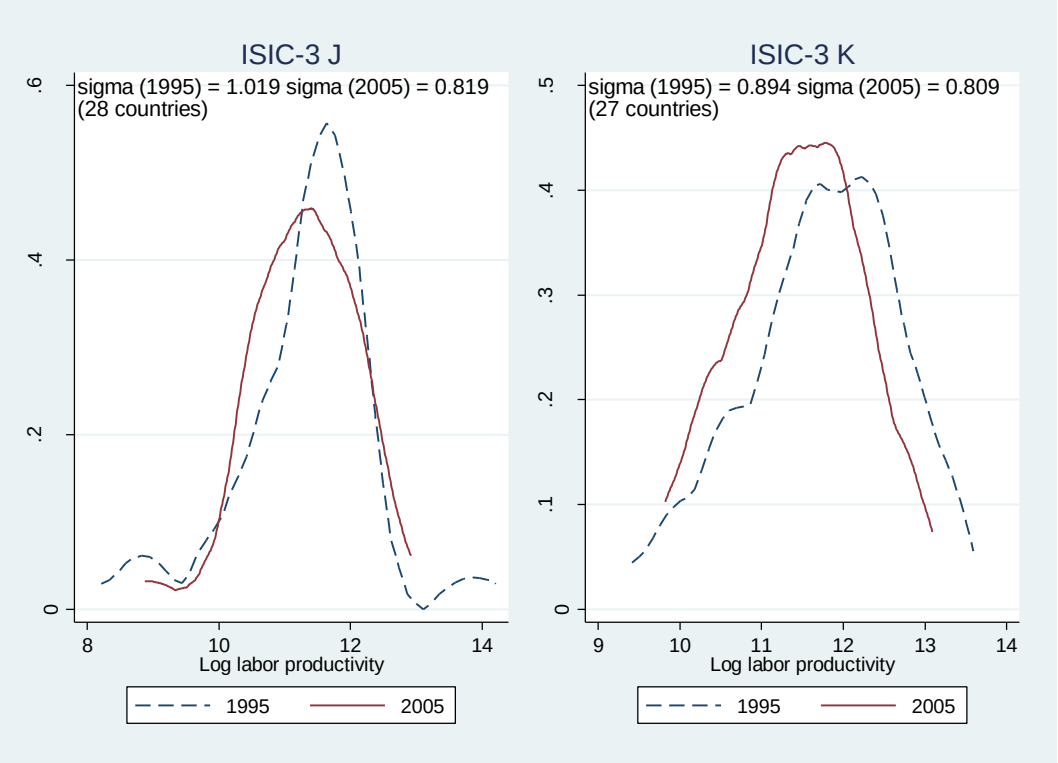

Figure 5. Sigma Convergence in Specific Sectors

Table 6.a Sectoral Value Added (% of GDP)

Country	Sector	**1995**	**2000**	**2005**	**2010**
Low Income Countries					
Bangladesh	Agriculture	26.4	25.5	20.1	18.6
	Industry	24.6	25.3	27.2	28.5
	Service	49.1	49.2	52.6	53.0
Burkina Faso	Agriculture	35.8	29.3	39.0	35.4
	Industry	21.5	24.7	18.0	23.0
	Service	42.6	46.1	43.0	41.7
Ethiopia	Agriculture	56.1	48.7	45.6	45.6
	Industry	10.0	12.4	13.1	10.4
	Service	33.8	38.8	41.3	44.0
The Gambia	Agriculture	21.4	24.5	27.1	29.0
	Industry	14.9	14.8	14.1	12.3
	Service	63.8	60.6	58.9	58.7
Nepal	Agriculture	41.8	40.8	36.3	36.5
	Industry	22.8	22.1	17.7	15.6
	Service	35.5	37.0	46.0	47.8
Middle Income Countries					
Argentina	Agriculture	4.9	4.3	8.4	8.2
	Industry	23.9	23.7	34.7	30.9
	Service	71.1	72.0	56.9	60.9
Botswana	Agriculture	4.9	3.0	2.0	3.2
	Industry	46.5	50.5	47.6	40.1
	Service	48.6	46.4	50.3	56.6
Brazil	Agriculture	5.8	5.6	5.7	5.3
	Industry	27.5	27.7	29.3	28.1
	Service	66.7	66.7	65.0	66.6
India	Agriculture	26.3	23.0	18.8	18.2
	Industry	27.4	26.0	28.1	27.2
	Service	46.3	51.0	53.1	54.6
Mongolia	Agriculture	34.4	30.9	22.1	16.2
	Industry	34.7	25.0	36.2	37.5
	Service	31.0	44.1	41.7	46.3
High Income Countries					
Belgium	Agriculture	1.5	1.3	0.8	0.8
	Industry	28.5	27.2	24.4	22.5
	Service	70.1	71.5	74.9	76.7
Germany	Agriculture	1.1	1.1	0.8	0.8
	Industry	32.3	30.5	29.3	30.2
	Service	66.6	68.4	69.9	69.0
Russian Federation	Agriculture	7.2	6.4	5.0	3.9
	Industry	37.0	37.9	38.1	34.7
	Service	55.9	55.6	57.0	61.4
United Kingdom	Agriculture	1.6	0.9	0.6	0.7
	Industry	30.3	26.8	23.6	21.5
	Service	68.2	72.3	75.8	77.8
United States	Agriculture	1.6	1.2	1.2	1.2
	Industry	26.3	23.4	22.2	19.8
	Service	72.1	75.4	76.6	79.0

Table 6.b Sectoral Employment (% of Total Employment)

Country	Sector	**1995**	**2000**	**2005**	**2010**
Low Income Countries					
Bangladesh	Agriculture	..	62.1	48.1	..
	Industry	..	10.3	14.5	..
	Service	..	23.5	37.4	..
Burkina Faso	Agriculture	..	..	84.8	..
	Industry	..	..	3.1	..
	Service	..	..	12.2	..
Ethiopia	Agriculture	..	..	79.3	..
	Industry	..	..	6.6	..
	Service	..	..	13.0	..
Middle Income Countries					
Argentina	Agriculture	0.6	0.7	1.1	1.3
	Industry	27.0	22.7	23.5	23.2
	Service	72.0	76.2	75.1	75.0
Botswana	Agriculture	..	19.7	..	..
	Industry	..	20.9	..	..
	Service	..	58.2	..	..
Brazil	Agriculture	26.1	..	20.5	..
	Industry	19.6	..	21.4	..
	Service	54.3	..	57.9	..
India	Agriculture	..	59.9	55.8	51.1
	Industry	..	16.0	19.0	22.4
	Service	..	24.0	25.2	26.6
Mongolia	Agriculture	46.1	48.6	39.9	33.0
	Industry	17.9	14.1	16.8	16.2
	Service	35.9	37.2	43.3	50.2
High Income Countries					
Belgium	Agriculture	2.7	1.9	2.0	1.4
	Industry	28.3	25.8	24.7	23.4
	Service	69.1	72.3	73.3	75.3
Germany	Agriculture	3.2	2.6	2.4	1.6
	Industry	36.0	33.5	29.8	28.4
	Service	60.8	63.8	67.8	70.0
Russian Federation	Agriculture	15.7	14.5	10.2	..
	Industry	34.0	28.4	29.8	..
	Service	50.0	57.1	60.0	..
United Kingdom	Agriculture	2.0	1.5	1.3	1.2
	Industry	27.3	25.1	22.2	19.1
	Service	70.2	73.1	76.3	78.9
United States	Agriculture	2.9	2.6	1.6	1.6
	Industry	24.3	23.2	20.6	16.7
	Service	72.9	74.3	77.8	81.2

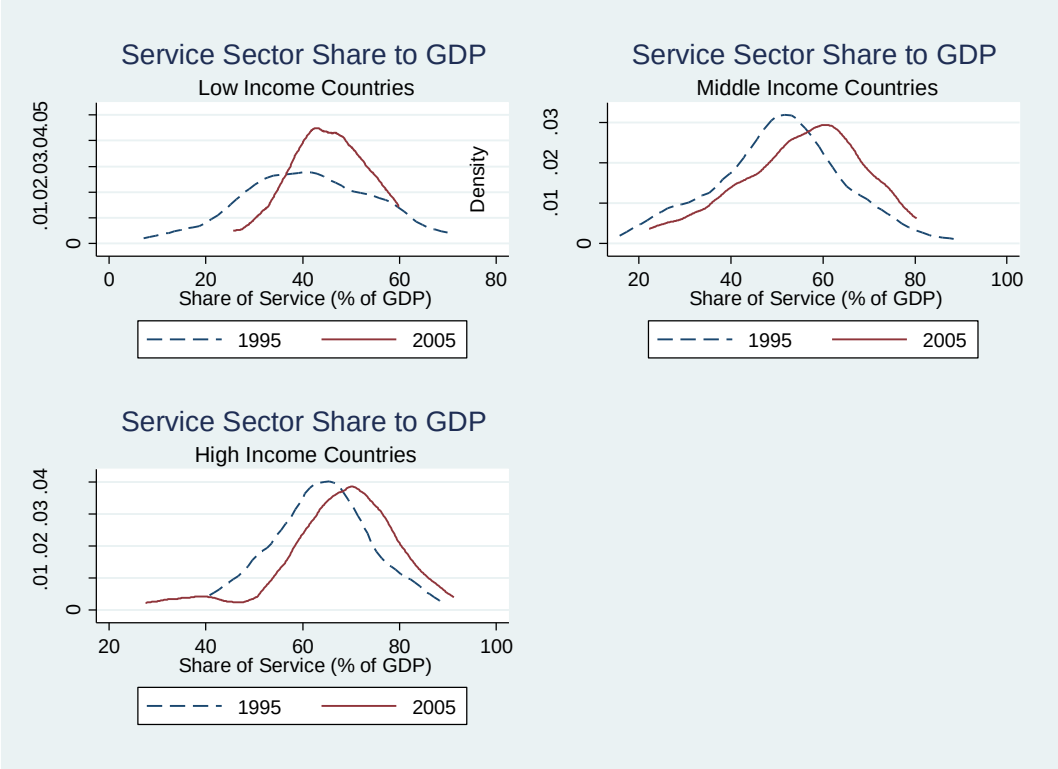

Figure 6.a Service Sector Share to GDP

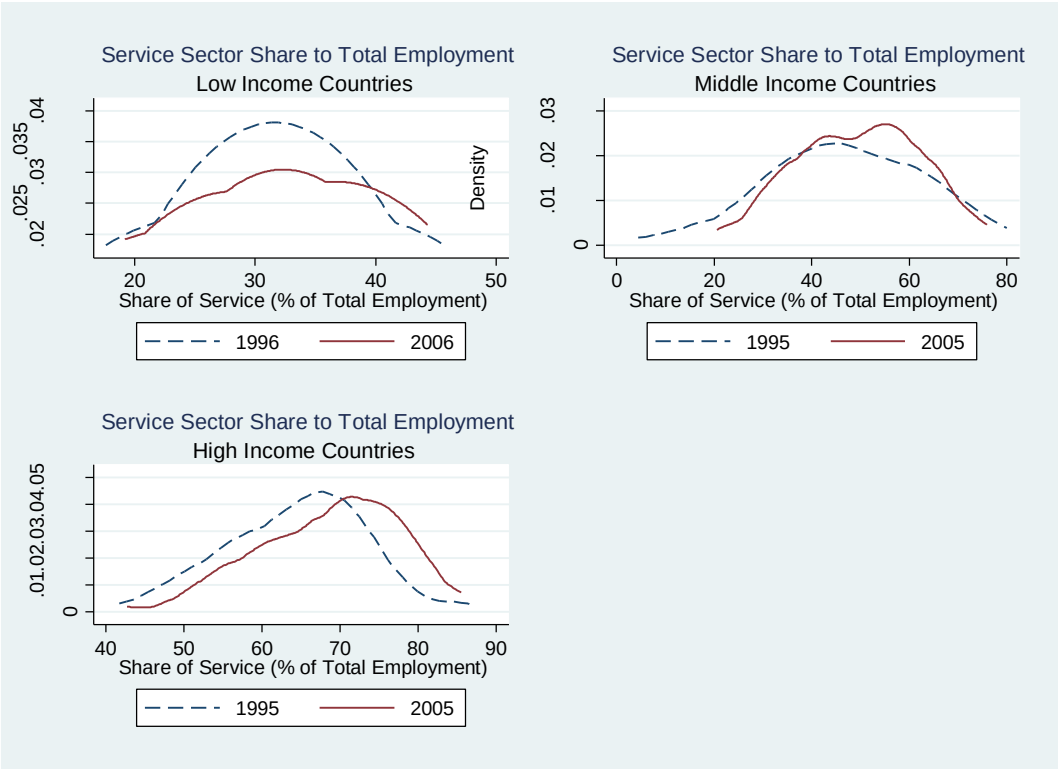

Figure 6.b Service sector share to total employment

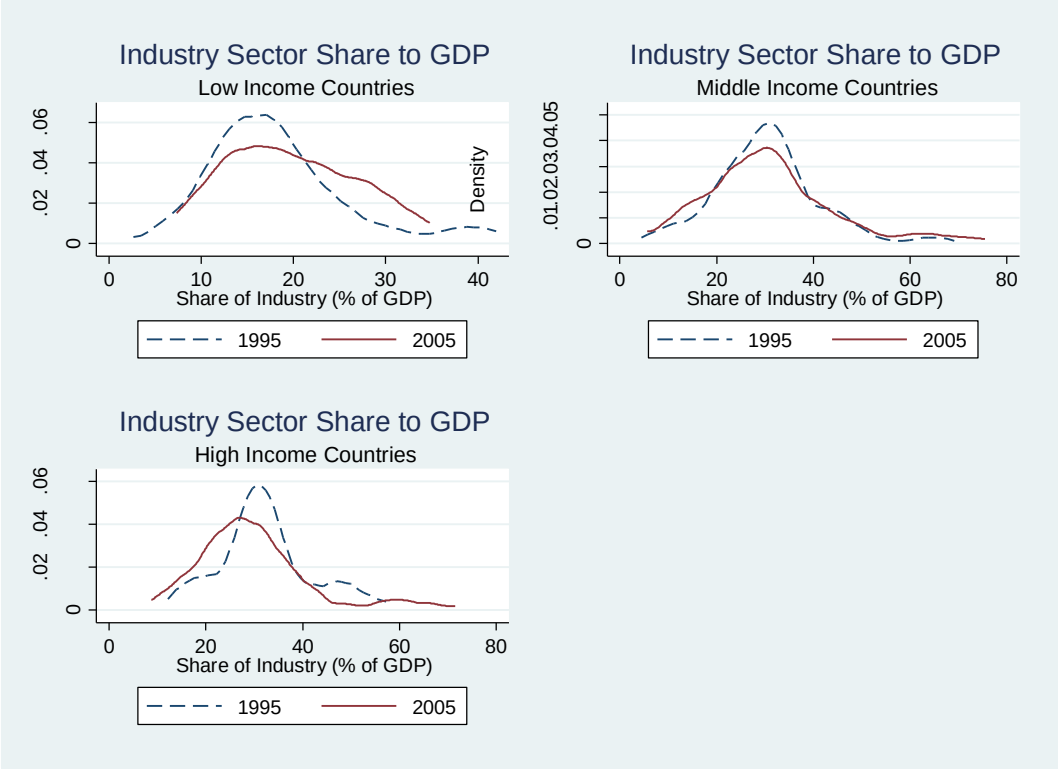

Figure 7.a Industry Sector Share to GDP

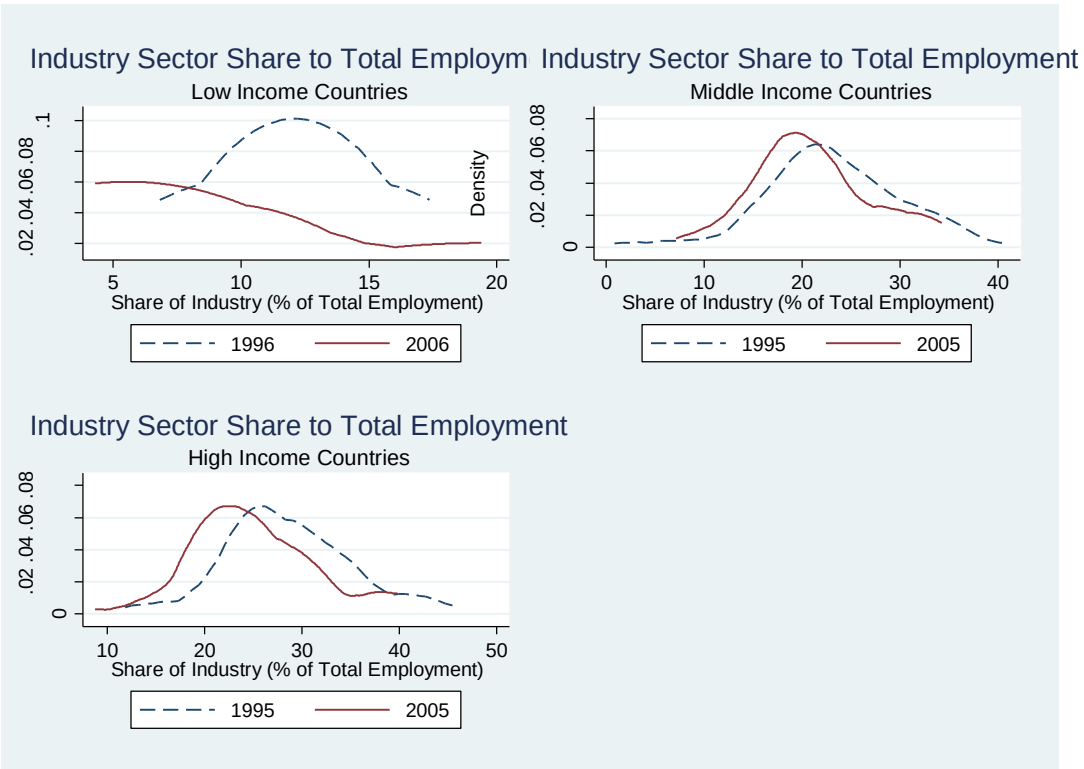

Figure 7.b Industry Sector Share to Total employment

Appendix Tables

Table 1: List of Countries

Albania	Dominican Republic	Malta	Swaziland
Argentina	Ecuador	Mauritius	Sweden
Aruba	Egypt	Mexico	Switzerland
Australia	El Salvador	Morocco	Syrian Arab Republic
Austria	Estonia	Myanmar	Thailand
Azerbaijan	Fiji	Netherlands	Trinidad and Tobago
Bahamas	Finland	New Zealand	Ukraine
Bahrain	France	Norway	United Kingdom
Bangladesh	Germany	Pakistan	United States
Barbados	Grenada	Panama	Uruguay
Belgium	Guatemala	Paraguay	Zambia
Belize	Honduras	Peru	
Bolivia	Hungary	Philippines	
Botswana	India	Poland	
Brazil	Iran	Portugal	
Brunei Darussalam	Ireland	Qatar	
Bulgaria	Israel	Republic of Korea	
Burundi	Italy	Republic of Moldova	
Cameroon	Jamaica	Romania	
Canada	Japan	Russian Federation	
China	Jordan	Saint Lucia	
China, Hong Kong Special Administrative Region	Kazakhstan	Saint Vincent and the Grenadines	
China, Macao Special Administrative Region	Kenya	Saudi Arabia	
Colombia	Kuwait	Seychelles	
Cote d'Ivoire	Kyrgyzstan	Singapore	
Croatia	Latvia	Slovakia	
Cyprus	Lithuania	Slovenia	
Czech Republic	Luxembourg	South Africa	
Denmark	Madagascar	Spain	
Dominica	Malaysia	Sri Lanka	

Table 2

List of Sub Sectors in Aggregated Service Sector

Electricity, Gas and Water
Construction
Transport, Storage and Communication
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
Hotels and restaurants
Financial intermediation
Real estate, renting and business activities
Public administration and defense; compulsory social security
Education
Health and social work
Other community, social and personal service activities
Private households with employed persons