THE TWO WAVES OF SERVICE SECTOR GROWTH

Barry Eichengreen
Poonam Gupta

The Two Waves of Service Sector Growth
Barry Eichengreen and Poonam Gupta
NBER Working Paper No. 14968
May 2009
JEL No. O0,O1,O10

ABSTRACT

The positive association between the service sector share of output and per capita income is one of the best-known regularities in all of growth and development economics. Yet there is less than complete agreement on the nature of that association. Here we identify two waves of service sector growth, a first wave in countries with relatively low levels of per capita GDP and a second wave in countries with higher per capita incomes. The first wave appears to be made up primarily of traditional services, the second wave of modern (financial, communication, computer, technical, legal, advertising and business) services that are receptive to the application of information technologies and increasingly tradable across borders. In addition, there is evidence of the second wave occurring at lower income levels after 1990. But this change in the second wave is not equally evident in all economies: it is most apparent in democracies, in countries that are open to trade, and in those that are relatively close to the major global financial centers. This points to both political and economic conditions that can help countries capitalize on the opportunities afforded by an increasingly globalized post-industrial economy.

Barry Eichengreen
Department of Economics
University of California, Berkeley
549 Evans Hall 3880
Berkeley, CA 94720-3880
and NBER
eichengr@econ.Berkeley.edu

Poonam Gupta
Indian Council for Research
  on International Economic Policy
Core 6A, Fourth Floor
India Habitat Center
Lodhi Road
New Delhi, India
pgupta@icrier.res.in

1. Introduction

The positive association between the service sector share of GDP and per capita income is one of the best-known regularities in all of growth and development economics. Or so one might think. In fact, far less is known about this regularity than commonly asserted. The pioneers of the literature on structural change, such as Fisher (1939) and Clark (1940), emphasized the shift from agriculture to industry in the course of economic growth; they in fact said little about the share of services. Kuznets (1953) concluded that the share of services in national product did not vary significantly with per capita income.[2] Chenery (1960), when regressing the share of services on per capita income, found an insignificant coefficient on the latter, concluding that the relationship between services and per capita income is not uniform across countries. Chenery and Syrquin (1975) regressed the service-sector share of output on per capita income and per capita income squared, concluding that the relationship was concave to the origin – that it rose with per capita incomes but at a decelerating rate. Kongsamut, Rebelo and Xie (1999) found, in contrast, the share of services in output to be linear in per capita income. Evidently, the stylized fact is less than clear.[3]

Moreover, the world has changed since most of these authors wrote. The application of information and communications technology to the production of services has thrown into doubt the presumption that their cost necessarily rises faster than that of manufactures. It has allowed services that once had to be produced locally to be sourced

---

[2] Kuznets considered transport services separately.

[3] In two recent papers Buera and Kaboski (2008, 2009) find the relationship between the share of services in GDP and log per capita income to be linear. They also find threshold effects at per capita income levels of US $7,100 and $9,200, above which the linear relationship between the services share in GDP and log per capita income is steeper.

at long distances and traded across borders. The traditional services that once dominated – lodging, meal preparation, housecleaning, beauty and barber shops – have been increasingly supplemented by modern banking, insurance, computing, communication, and business services. It would be surprising if the association of the service-sector share of GDP and per capita income had remained the same in the face of these developments.

In this paper we therefore seek to provide new evidence about how the relative size of the service sector evolves over the growth process. We establish three facts.

First, there are two waves of service sector growth. The service sector share of output already begins to rise at relatively modest incomes but at a decelerating rate as growth proceeds, until it levels out at roughly US $1800 per capita income (in year 2000 US purchasing-power-parity dollars); this is the first wave. At roughly US $4000 per capita income the share of the service sector then begins to rise again in a second wave, before eventually leveling off a second time.

Second, there was an upward shift in the second wave of service-sector growth after 1990. That is to say, the second wave starts at lower levels of income after 1990 than before.

Third, this two-wave pattern and specifically the greater importance of the second wave in medium-to-high-income countries is most evident in democracies, in countries that are close to major financial centers, and in economies that are relatively open to trade (both in general and in services in particular). Intuitively, the increase in the service-sector share at all levels of income but especially the second wave at higher income levels reflects increased scope for producing and exporting modern (financial, communications, computing, legal, technical and business) services in which medium-to-

3

high-income countries specialize. And it appears that democracies, perhaps because they have a lesser tendency to suppress the diffusion of information and communications technologies; countries close to major financial centers, which have a comparative advantage in the provision of financial services; and countries open to trade, which are in a position to specialize and export those services in which they have a comparative advantage, are in the best position to capitalize on the opportunities afforded by these subsectors.

In Section 2 we establish the relationship between the service-share of output and per capita income in a large cross section of countries starting in 1950. Section 3 examines what economic variables explain, in a proximate sense, the patterns we observe. Section 4 then considers some individual country experiences in more detail. In Section 5 we analyze a much more limited sample of countries for which it is possible to empirically distinguish between traditional and modern services directly. Section 6, finally, concludes.

2. Relationship Between Log Per Capita Income and the Services Share in GDP

Our data on the shares of agriculture, industry and services in GDP covering the period 1950-2005 come from the World Bank's *World Development Indicators (WDI)* and Mitchell (various years). These are available for some 60 countries until the first half of the 1960s, some 70 countries until 1980, and more than 80 countries since. Data on per capita income are from *WDI* and Maddison (2003); information on trade openness, urbanization, literacy, age dependency, and trade in services are drawn from *WDI*. Data on geographical variables, such as latitude, and land in topical area are obtained from

Gallup, Sachs and Mellinger (1999). Data on democracy are drawn from the Policy IV database and on distance from CEPII. Complete data sources and summary statistics are provided in Appendix Tables A1 and A2.

We use lowess plots to explore the relationship between per capita income and share of services in GDP. These locally-weighted regressions use a function that attaches less weight to points far from the mean. We examine this relationship separately for the 1951-1969, 1970-1989, and 1990-2005 periods.[4]

The relationship looks like a cubic or quartic.[5] We therefore estimate a quartic relationship between the share of services in GDP and per capita income. If the cubic (or logistic) fits the data better, we would expect the coefficient on per capita income raised to the fourth power to go to zero.

The regression framework is given by equation 1. The dependent variable is service sector output as a percentage of GDP, where (as throughout) i refers to country and t to year. Regressors include the four powers of log per capita income. All regressions include country fixed effects. In subsequent regressions we include different intercepts for different time periods, different slopes of per capita income terms in different time periods; and various explanatory variables which can explain the patterns of services sector growth.

---

[4] Figure 1for example shows the Lowess plot for the default options in Stata 9.0 which include a bandwidth of .8 (which means that in each regression 80 percent of the observations are included) and a Tricube Weighting scheme (which means that the observations farther away from the mean get a lower weight). Results are robust to changing the weighing scheme including to a rectangular weighting scheme (in which all observations get equal weights) and to changing the band width.

[5] The quartic term is not very evident visually, but it is problematic to assume that the share of services rises at an accelerating pace as incomes rise (the implication of a cubic), since that share of bounded by 100 per cent. We show below that statistical evidence of the quartic term, which would cause the share of the service sector to grow more slowly at relatively high incomes, is stronger than the corresponding visual evidence in Figure 1.

$$\frac{Ser_{it}}{GDP_{it}} = \text{Constant} + \sum_i \theta_i D_i + \alpha_1 Y_{it} + \alpha_2 Y_{it}^2 + \alpha_3 Y_{it}^3 + \alpha_4 Y_{it}^4 + \varepsilon_{it} \qquad (1)$$

Results are in Table 1. In all cases we obtain support for the hypothesis of a quartic relationship. In Column 1 we estimate a quartic with a common intercept for all years. In Column II we allow the intercept to differ in 1970-1989 and 1990-2005. In Column III we allow the coefficients on log per capita income (PCY) terms to differ in the different periods. In Column IV we do the same but combine the 1950-69 and 1970-89 subperiods.[6] We illustrate these relationships by plotting in Figure 2 the predicted values corresponding to the coefficient estimates in column III. The corresponding estimated relationship between the service sector's share and per capita income when the period 1950-1989 is clubbed together (as in column IV of Table 1) is Figure 3.

This pattern is robust to changes in sample and specification, as shown in Table 2. We exclude low income countries.[7] We estimate the relationship assuming random instead of fixed effects. We include individual year fixed effects rather than just distinguishing two or three time periods. In each case the quartic relationship between log per capita income and the share of the service sector continues to hold, as does evidence of a more pronounced second wave (larger cubic and quartic terms) after 1989.

In Table 3 we calculate the slope of services as a share in GDP with respect to per capita income based on the coefficients in column IV, Table 1, at different income levels.

---

[6] The reason for doing so is that the coefficients on the per capita income variables in 1970-1989 are statistically indistinguishable from those for 1950-1969. There the dummy variable for 1970-1989 (not interacted) remains significant, but the dummy variable for the 1990-2005 subperiod (not interacted) goes to zero, while the big and statistically significant coefficients on the post-1990 shifters are on the cubic and quartic terms. The coefficient on per capita income squared after 1990 is also statistically significant, but it is small relative to that on per capita income squared over the entire period.

[7] Specifically we drop observations with per capita income in the bottom 10 percent, which corresponds to observations below log per capita income level 6.65 or income level of 770 year 2000 US purchasing-power-parity dollars. Examples of countries below this threshold are Tanzania, Malawi, Madagascar, Uganda and Rwanda.

The slopes indicate that in 1950-1989 the service sector's share of GDP first rose with per capita income before stabilizing at middle incomes. Note that a log per capita GDP of 7.5, where this stagnation sets in, is approximately 1800 U.S. year 2000 purchasing-power-parity dollars. Then at still higher income levels the service sector's share of GDP starts rising again. Here a log per capita income of 8.25, where this second wave of service-sector growth becomes apparent, corresponds to approximately US $3825. Since we detect this pattern in the data for 1950-1989, it does not appear that the second wave of service sector growth is exclusively a post-1990s phenomenon.[8]

Figures 4 and 5 provide analogous evidence for industry and agriculture. In Figure 4 we estimate the relationship for industry separately for 1950-1969, 1970-1989 and 1990-2005. The message of Figure 4 is that the share of industry in GDP peaks out, after which it begins to fall, at both lower levels of GDP and a lower share of industry in national income after 1989. That of Figure 5 is that the share of agriculture in GDP declines gradually with per capita income. There is also a suggestion that the pace of decline in agriculture's share has slowed at least modestly over time.

3. Correlates of Service Sector Growth

The pattern of coefficients when we estimate the quartic relationship suggests that there are two waves of service sector growth: a first wave as a country moves from low to middle income, and a second wave as it moves from middle to high income.

---

[8] Starting in the 1990s, it would appear, the relationship became steeper everywhere other than high income levels – that is, at log per capita incomes above 8.75 (a log per capita income of 8.75 corresponds to approximately $6300 U.S., the per capita income of Brazil, Turkey and Mexico). In addition, unlike in the earlier period, the slope remains significantly positive – that is, the service sector continues to expand with growth – in middle- as well as low- and high-income countries after 1990. A further difference of note is that service-sector growth seems to slow faster at very high incomes after 1990 than before.

The other interesting result is that the cubic and quartic terms in per capita income kick in at lower income levels in the post-1990 period (as is apparent visually in Figure 3). In contrast, the coefficient on the linear term is insignificant and the coefficient on the squared term for the post 1990 period, while significant, is small compared to the squared term for the whole period. This suggests that countries are experiencing the first wave of service sector growth more or less as they did in earlier years, but that they are now beginning to experience the second wave at earlier stages of economic development.

To understand where and why, we first identify correlates which when interacted with the four terms in per capita income reduce or eliminate the significance of all four per capita income terms. These are the factors that appear to be associated with our two waves. The variables we consider as potential correlates include the size of the economy (GDP), openness to trade (as measured by the trade-to-GDP ratio), openness to trade in services (as measured by trade-in-services-to-GDP ratio); and vector of demographic, geographical and political variables (including democracy, latitude, share of land area in the tropics, the dependency ratio (both youth and old age), and proximity to the major economic and financial centers).[9] Some of these explanatory variables are highly correlated with each other and with per capita income, as shown in Table 4. The overall trade and trade in services ratios are highly correlated, for example. Latitude and area in the tropics are obviously correlated. For this reason we do not always include all potential explanatory variables in all equations.

---

[9] Data on trade in services begins only around 1970 for some countries in our sample. Availability improves over the years and by 1975 data are available for about half the countries, and by 1980 for 80 percent of the countries in the sample; therefore regressions including this variable have been estimated on fewer observations. The remaining variables are either time invariant or vary little. The geographical variables are, of course, time invariant, while democracy, age dependency, and literacy vary over time but show considerable persistence.

8

We use a general to specific approach. We start with a very general specification and then drop variables with insignificant coefficients. In this way we obtain a parsimonious specification.

In these parsimonious regressions the coefficients of the per capita income terms are not significantly different from zero—implying that the two waves of service sector growth are being driven by the factors included in the parsimonious regressions. We have estimated these regressions first including total trade, and then including trade in services. We first report results for total trade in Table 5.

In Column I we include all of the potential explanatory variables interacted with the four per capita income terms. In Column II we drop the variables interacting urban population with per capita income; in Column III we drop the terms interacting governance with per capita income; in Column IV we drop the terms interacting age dependency with per capita income; and in Column V we drop the terms interacting area outside the tropics with per capita income.

While more urban countries have larger service sectors, the four powers of urbanization are generally insignificant; urbanization does not appear to be explaining the two-wave pattern in other words. In contrast, in countries more open to trade, more democratic, and closer to the major financial centers, the four powers of per capita income tend to be insignificantly different from zero in most specifications.[10] Some specifications also suggest a role for physical geography (share of land area in outside the tropics). Importantly, the four powers of per capita income are now insignificantly

---

[10] This last result is not driven by Western Europe and Canada. When we drop these countries from the sample, the terms involving minimum distance still have significant coefficients. Note that the significance of the trade variable is evident only in the more parsimonious specifications.

different from zero.[11] It would appear that these variables suffice to explain the two wave pattern.

In order to interpret the coefficients, we calculate the slope of our dependent variable with respect to income at various income levels and at various values of the explanatory variables. For example, taking the coefficients in Column V in Table 5, we can compute the slopes at three sets of values for trade, distance from the major financial center and democracy: low, medium and high (respectively values at the bottom quartile, median and the top quartile of these variables). Estimated slopes for the low, medium and high values of these variables at various income levels are presented in Table 6.

At low values of trade, democracy and proximity, we do not see a second wave of service sector growth – that is to say, the services share does not begin increasing again with per capita income above middle income levels. In contrast, at high values of these three variables we see the slope again becoming positive at higher income levels. This supports our conclusion that the second wave of service sector growth is observed in countries which are more open, more democratic and closer to the major global financial centers.

These results withstand a number of robustness checks. We include year dummies rather than the dummies for 1970-1989 and 1990-2005; cluster the standard errors by country and alternatively by year (to allow for standard errors to be correlated across years within each country and to allow the standard errors to be correlated across countries in each year). We also add back in the variables dropped in the earlier stages (urbanization, age dependency or governance), interacting them with the four powers of

---

[11] They remain statistically significant as a group, which is telling us that per capita income still matters for the size of the service sector (richer countries have larger service sector shares), but no longer for the two-wave pattern.

per capita income. When we include these in our parsimonious specification, the coefficients of these variables remain insignificant, and their inclusion does not affect the coefficients on the trade, democracy and proximity-to-financial-center terms.[12]

Table 7 substitutes trade in services for total trade.[13] Trade in services is significant in all specifications. Otherwise the results are essentially the same as before, except that there is less support for the importance of climate. We conclude that openness to trade in services, democracy and proximity to the major financial centers are drivers of the two-wave pattern.

Next we ask whether any of the variables considered so far can explain the shift in the relationship in the services/GDP ratio since 1990. The equations in Table 8 now include all four terms in PCY; these four terms interacted with the post 1990 dummy; dummies for 1970-1989 and for 1990-2005; other potential explanatory variables interacted with PCY terms; and the latter interacted with the post 1990 dummy.

In Column I of Table 8 (which reproduces Column IV of Table 1 as a benchmark), the coefficients on per capita income interacted with the post-1989 dummy are all significant. In Column II we include additional variables affecting the size of the service sector: GDP, urban population, trade, democracy. The coefficients on per capita income and interaction with the dummy variable for the post-1990 period do not change. This means that these variables by themselves cannot explain the post-1989 shift in the pattern of service sector growth.

In column III we add variables explaining the two wave pattern of growth: democracy, trade and proximity to financial centers interacted with the powers of per

---

[12] Or the coefficients on the powers of per capita income.
[13] The general-to-specific procedure and the sequence in which we dropped insignificant variables remain the same.

capita income. These variables seem to explain the first as well as the second wave of service sector growth in pre-1990 period but not subsequently.

In column IV we interact trade, democracy, and proximity with per capita income as well with as the post-1990 dummy. Now the coefficients of the per capita income terms interacted with post 1990s dummy are no longer significantly different from zero. In column V we drop trade interacted with per capita income terms and the post-1989 dummy, since the coefficients on the trade variables were insignificant in column IV.

The results suggest that democracy, proximity to major financial centers and trade openness explain the post-1990 shift in the share of services in GDP, in that they make the significance of the per-capita-income-post-1990 interaction go to zero.

We can again calculate the slope of the share of services in GDP with respect to per capita income at various income levels in the pre- and post-1990 periods for different values of the explanatory variables, as in Table 9. We continue to see in Columns I-IV our two-wave pattern of service sector growth, with a second wave at middle and high incomes only in countries with relatively high levels of trade, democracy, and proximity to the major financial centers. These variables also seem to be associated with the shift in services income relationship after 1989, although that shift now does not seem especially pronounced.

When we include trade, democracy, and proximity interacted with per capita income, as well as per capita income and the post 1990s dummy, we can explain the shift in the services/GDP ratio since 1990s better (slopes not shown in Table 9). Finally, in order to improve the fit of the regression, we drop the interaction of trade and the post 1990s dummy, thus allowing for the possibility that trade did not have a differential

impact on the services and per capita income relationship post 1990s. The slopes calculated using this specification are reported in Columns V-VIII in Table 9. Now the second wave occurs only in countries with relatively high levels of trade, democracy, and proximity to the major financial centers; and the post-1990 shift is more pronounced in countries with these features.

4. Country-Specific Experience

We now examine how growth of the service sector in individual countries compares with the typical pattern in different sub-periods.[14] The data for the United States are highlighted in Figure 6. The size of the service sector is more or less in line with the international norm in the 1970s and 1980s. In the 1990s it then grows significantly larger than predicted for a high income country. In other words, the U.S. observations lie entirely above the two-standard-error bands. This story is well known: it reflects the productivity-enhancing restructuring of retail, wholesale and financial services, enabled by the application of new information technology; in part it reflects rapid deregulation and ultimately unsustainable growth of the financial services industry.

Japan was known in the third quarter of the 20th century for having a manufacturing-heavy economy. In Figure 7 we see that the service share of GDP was not, in fact, atypical in the 1960s. The period when the service-sector share is smaller than expected was the 1970s and 1980s (mainly the early 1970s and late 1980s). There was then convergence to the international norm after 1990, with relatively rapid growth in the output shares of business, health and social services.

---

[14] The typical pattern is given in Figure 3 above, where we plot the predicted services/share in different time periods and along with their two standard error bands.

13

In contrast, Germany, another traditionally manufacturing-heavy country, shows

evidence in Figure 8 of having had an unusually low service-sector share in the 1950s

and 1960s, the decades of the manufacturing *Wirtschaftswunder*. This anomaly

disappeared in the 1970s and 1980s. In recent years the service sector grew unusually

rapidly by international standards, perhaps reflecting deindustrialization in the new

eastern *lander*.[15] By the end of the sample period there is some sign of a service-sector

share slightly higher than expected.

Figure 9 for the UK suggests that the service sector share was typical for a

country with its per capita GDP from the 1950s through the 1980s, notwithstanding the

debate over the country's deindustrialization (which would lead one to expect a service

sector significantly larger than the international norm). Then in the 1990s the service

sector becomes unusually large by the standards of that international norm. Interestingly,

unusually large subsectors include not only financial services but also retail trade, legal,

technical, legal and other community, social and personal services.[16]

Finally, Figure 10 considers a late-developing middle-income country, Korea. The

fact that Korea has a relatively underdeveloped service sector characterized by low

productivity is well known: OECD (2008) observes that the productivity gap vis-à-vis

other OECD countries is much larger for services than manufacturing, a problem that can

be ascribed in large part to restrictive regulations designed to protect small and medium-

sized enterprises from domestic and foreign competition. Figure 10 suggests that the

problem of a stunted service sector is relatively recent. It was barely visible in the 1970s

and 1980s but emerges clearly in the 1990s,when the typical relationship between the

---

[15] Which is of course not included in the data for the earlier period.
[16] According to the EU KLEMS data base, described further below.

service-sector share of output and per capita income shifts up but Korea lags behind. This may reflect in part Korea's lack of proximity to the major global financial centers, New York and London, and difficulty of establishing itself as a financial hub for Northeast Asia.

5. Traditional and Modern Services

Direct evidence on the composition of service sector production at different income levels can be constructed mainly for high-income countries on the basis of data provided by the EU KLEMS project for the period 1970-2005. Data limitations limit the analysis: we cannot analyze the compositional sources of the pre/post-1970 shift, for example, or examine what has been going on in low-income countries.

The EU KLEMS release of 2008 spans the period 1970-2005 for the 15 founding (pre-2004) EU member states and for the US, South Korea, Japan and Australia. Series from 1995 onwards are available for the new EU member states which joined the EU on 1 May 2004. Industries are classified according to the European NACE Revision 1 classification, but the level of detail varies across countries, industries and variables owing to differences in national statistical procedure. We do not include the new member states in our analysis and also drop Luxembourg and Portugal.[17] Thus we consider Australia, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Netherlands, Spain, Sweden, United Kingdom, and United States in the

---

[17] Where there are data-availability problems.

disaggregated analysis. We calculate the share of different services in GDP using value

added at current prices in local currency for various service industries and total GDP.[18]

We distinguish three groups of services according to whether their shares of GDP

have fallen, risen slowly, or risen rapidly over time. First are traditional services: retail

and wholesale trade, transport and storage, public administration and defense. Their share

in GDP has fallen noticeably over time. The second group is a hybrid of traditional and

modern services consumed mainly by households: education; health and social work;

hotels and restaurants; and other community, social and personal services. Their shares

all show a tendency to rise slowly with time. The third group is modern services

consumed by both the household and corporate sectors: financial intermediation,

computer services, business services, communication, and legal and technical services.

We refer to them as modern because their share in GDP was only 7 per cent in 1970 but

has since risen to more than 15 percent. Details on these three groups are in Table 10.

The quartic relationship between the share of services in GDP and per capita

income is again evident in this smaller sample, although it is not as pronounced as in the

larger sample of low- and middle- as well as high-income countries.[19] Figures 12-14

show the fitted values for our three groups. That the GDP share of services such as public

administration and defense, retail trade, wholesale trade and transport and storage (Group

---

[18] We also use the data on total factor productivity from the EU KLEMS. Certain services that were very small or did not seem to be following any specific pattern of growth are excluded. One sector which is relatively large that we did not include is real estate activities (8 percent). Real estate services seem to be quite volatile and do not fit any neat pattern of growth. This could be due to the fact that valuation of these services changes with real estate prices and these are not adequately accounted for in the real prices. We also test the robustness of results to including these services in different groups, where they seem to be fitting e.g. activities related to financial intermediation in group III with financial intermediation; sale, maintenance and repair of motor in Group I with retail trade; and private households with personal services in group II. The results are robust.
[19] There are also some signs of a shift in the relationship after 1990, but this too is small in comparison with the larger sample of countries.

I) declines steadily as countries move from middle- to high-income status, consistent with a low income elasticity of demand for these services, is not in conflict with the existence of a hump-shaped pattern, since here we do not observe the share of Group I in low-income countries.

As shown in Figure 13, the share of Group II services grows faster than the rest of the economy all through the middle- and high-income range. This behavior is consistent with a high income elasticity of demand.

Finally, we see an increase in the GDP share of Group III over the entire range of middle- and high-income levels. The share of these activities increases particularly rapidly at high incomes, with no sign (in contrast to Group II) of that share growing more slowly at the high end, indicating very high income elasticities of demand and/or the greater tradability and therefore capacity to export these services. Although we do not observe the share of such modern services in low income countries it seems safe to conjecture that the importance of Group III rises steadily with per capita income.

Having considered demand, we look also at some potential determinants of the supply of these services. Productivity growth was highest, not surprisingly, in the Group III modern services (Table 11). Interestingly, however, productivity increases have also been relatively rapid within traditional services (Group I), some of which (retailing, wholesaling) have made extensive use of new information technologies. This reinforces the presumption that insofar as the share of output accounted for by Group I has declined, this reflects relatively low income elasticities of demand. It is in Group II, the hybrid cases, where the cost disease appears to be most serious. Suggestively, Group II ranks lowest in terms of the penetration/application of new information technology. It also has

17

the lowest international tradability, suggesting that limits on international competition and on the ability to specialize contribute to this problem.[20]

6. Conclusion

We have provided new evidence and analysis of the share of services in GDP in the course of economic development. We identify two waves of service sector growth, a first wave in countries with relatively low levels of per capita GDP and a second wave in countries with higher per capita incomes. The first wave appears to be made up primarily of traditional services, the second wave of modern (financial, communication, computer, technical, legal, advertising and business) services that are receptive to the application of new information technology and increasingly tradable across borders.

There is evidence of an increase in the share of services in GDP at all levels of income after 1970 and, in addition, of a further increase in the share of services in countries with relatively high per capita incomes – in other words, of the second wave occurring at lower income levels than before. But this change in the second wave is not equally evident in all countries: it is most apparent in countries that are open to trade, that are democratic, and that are relatively close to the major global financial centers. This points to both political and economic conditions that can help countries capitalize on the

---

[20] The indicator of tradability is constructed using data in Jensen and Kletzer (2005). Since Jensen and Kletzer work with the NAICS (North American Industrial classification system), we map their classification into our NACE (European Classification of Economics Activities). Jensen and Kletzer calculate the Gini Coefficient for the geographical dispersion of each activity and use it to identify tradable and non tradable services. The underlying idea is that the services which are tradable can be geographically concentrated in order to reap the economies of scale. The mapping was quite clear for all of our services except for Transport and storage. Two different NAICS codes are assigned to these activities, each with a different degree of tradability. Hence we leave this cell blank. Another case where the tradability was not clear is the wholesale trade. For this service category Jensen and Kletzer find it to be having an almost equal score for tradability and non tradability. Indicators for information and communication technology (ICT) industries has been constructed using the data in van Ark, Inklaar and McGucken (2005).

18

opportunities afforded by an increasingly globalized post-industrial economy.

References

Buera, Francisco J. and Joseph P. Kaboski (2008), "Scale and Origins of Structural Change," unpublished manuscript.

Buera, Francisco J. and Joseph P. Kaboski (2009), "The Rise of the Services Economy," NBER Working paper 14822.

CEPII database, 2008, http://www.cepii.fr/anglaisgraph/bdd/bdd.htm.

Chenery, Hollis (1960), "Patterns of Industrial Growth," *American Economic Review* 50, pp 624-654.

Chenery, Hollis and Moshe Syrquin (1975), *Patterns of Development, 1957-1970*, Oxford: Oxford University Press.

Clark, Colin (1940), The Conditions of Economic Progress, London: Macmillan.

EU KLEMS Database (2007), EU LEMS Growth and Productivity Accounts, http://www.euklems.net.

Fisher, A.G.B. (1939), "Primary, Secondary and Tertiary Production," *Economic Record* 15, pp.24-38.

Gallup, John Luke and Jeffrey D. Sachs, and Andrew Mellinger (1999), "Geography and Economic Development." CID Working Paper No. 1, Center for International Development, Harvard University.

Jensen, Bradford J. and Lori G. Kletzer, 2005, "Tradable Services: Understanding the Scope and Impact of Services Outsourcing," Institute for International Economics Working Paper No. 05-9.

Kongsamut, Piyabha, Sergio Rebelo and Danyang Xie (1999), "Beyond Balanced Growth," NBER Working Paper 6159.

Kuznets, Simon (1957), "Quantitative Aspects of the Economic Growth of Nations: II, Industrial Distribution of National Product and Labor Force," *Economic Development and Cultural Change, Vol. 5, No. 4,* (supplement), pp.1-111.

Kuznets, Simon (1973), "Modern Economic Growth: Findings and Reflections," *American Economic Review* 63, pp. 247-258.

Maddison, Angus (2003), "Historical Statistics for the World Economy: 1-2003 AD, downloaded from http://www.ggdc.net

Mitchell B. R. (1982), *International Historical Statistics-Asia and Africa*, New York: New York University Press

Mitchell B. R. (1992), *International Historical Statistics-Europe 1750-1988*, New York: Stockton Press.

Mitchell B. R. (1993), *International Historical Statistics-The Americas*, New York: Stockton Press.

OECD (2008), *Korea Economic Survey*, Paris: OECD.

Polity (various years), *Polity IV Data Base: Political Regime Characteristics and transitions, 1800-2007*.

Van Ark, Bart, Robert Inklaar and Robert H. McGuckin, 2003. "ICT and Productivity in Europe and the United States: Where Do the Differences Come From?" Economics Program Working Papers 03-05, Washington, D.C.: The Conference Board

World Bank (various years), *World Development Indicators,* Washington, D.C.: World Bank.

Table A 1: Data Sources and Construction of Variables

	Sources	Definitions
Sectoral shares in GDP (agriculture, industry and services)	WDI, Mitchell (various editions)	Shares of agriculture, industry and services in GDP (in percent)
Per capita income	Maddison, WDI	Per capita income in 2000 PPP US $, Maddison and WDI
GDP	Maddison, WDI	GDP in 2000 PPP US $, Maddison and WDI
Trade/GDP	WDI, Mitchell, Penn World Tables	(Export + Import of goods and services)/GDP, in percent
Trade in services	WDI	(Export + Import of services)/GDP, in percent
Distance	CEPII	Great Circle distance between capital cities and either the US or the UK, whichever is smaller, in Kilometer
Latitude	Gallup, Sachs and Mellinger	latitude
Urban Population	WDI	Urban population (% of total Population)
Age dependency	WDI	Share of dependents to working-age population
Non tropical area	Gallup, Sachs and Mellinger	Percentage of land outside the tropics.
Governance	World Bank, Aggregate Governance Indicators 1996-2007	The average of governance indicators measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes.
Democracy	Polity IV	Institutionalized Democracy Score, takes values between 0 and 10

Appendix Table A 2: Summary Statistics

Variable	Number of Observations	Mean	Std. Dev.	Min	Max
Services/GDP (in percent)	3950	50.2	11.1	18.4	77
Log Per Capita Income	3937	8.1	1.1	5.8	10.3
Log GDP	3877	10.6	1.92	5.37	15.9
Trade (percent of GDP)	3838	56.5	33.3	2.7	251.1
Urban Population(percent of total)	3415	49.1	24.1	2.4	97.3
Democracy	3674	5.31	4.3	0	10
Trade in Services (percent of GDP)	2358	14.5	9.5	0	82.8
Distance from Major Financial centers	3931	5118	3689	0	15958
Governance	3950	0.23	0.99	-1.45	1.95
Non tropical area (Share of total area)	3850	0.55	0.47	0	1
Latitude	3950	27.7	17.2	1.2	63.5
Age dependency (share of working population)	3415	0.74	0.20	0.39	1.13

Figure 1: Lowess Plot of the Relationship between Log Per Capita Income and Services/GDP
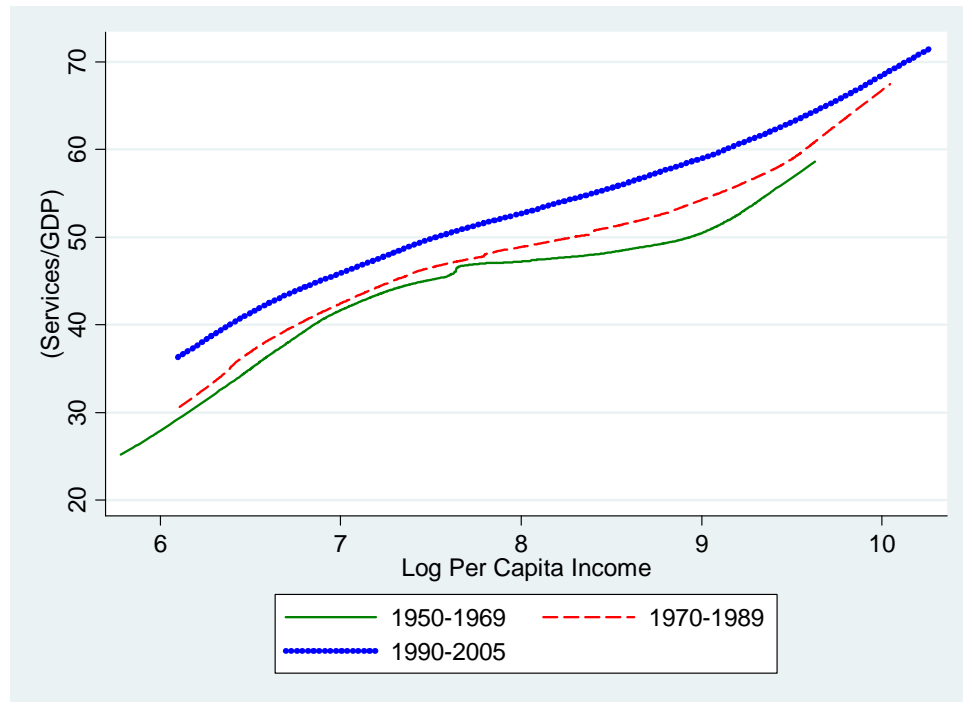
Figure 2: Log Per Capita Income and Services/GDP
Based on Quartic Function Estimation
(Different Slopes in the Three Subperiods)
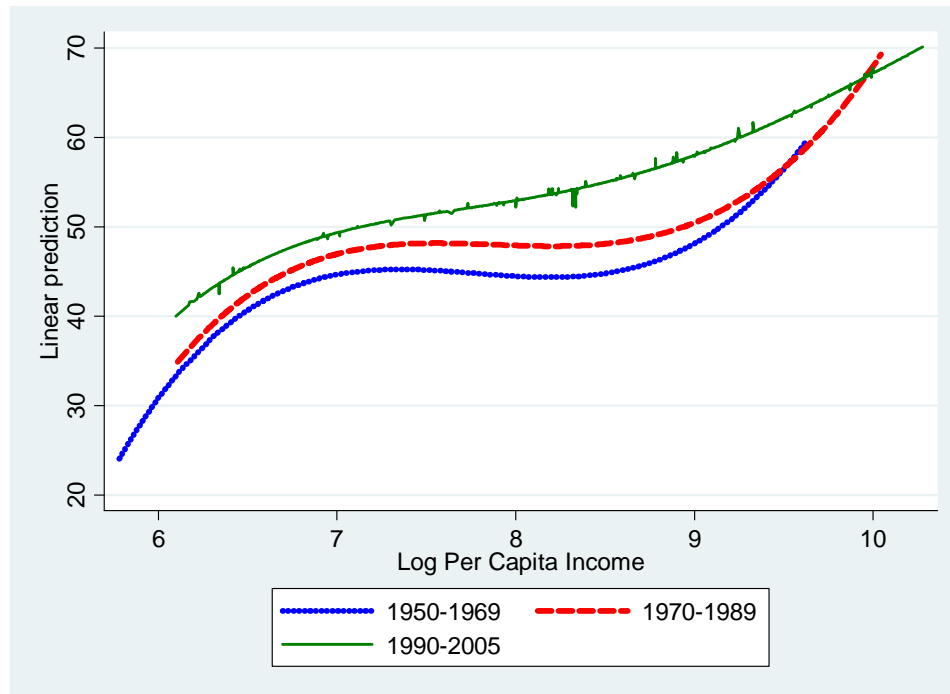
Note: Based on regression in Column III, Table 1.

Figure 3: Log Per Capita Income and Services/GDP, Quartic Estimation (Different Slopes in 1950-1989 and 1990-2005)
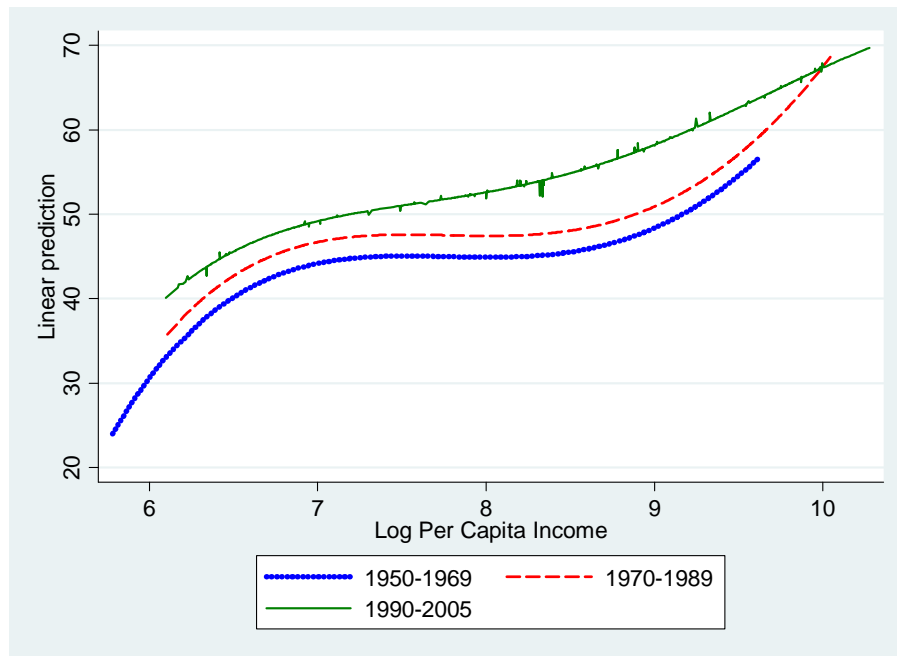
Note: Based on regression in Column IV, Table 1.

Figure 4 : Lowess Plot for Log Per Capita Income and Share of Industry in GDP
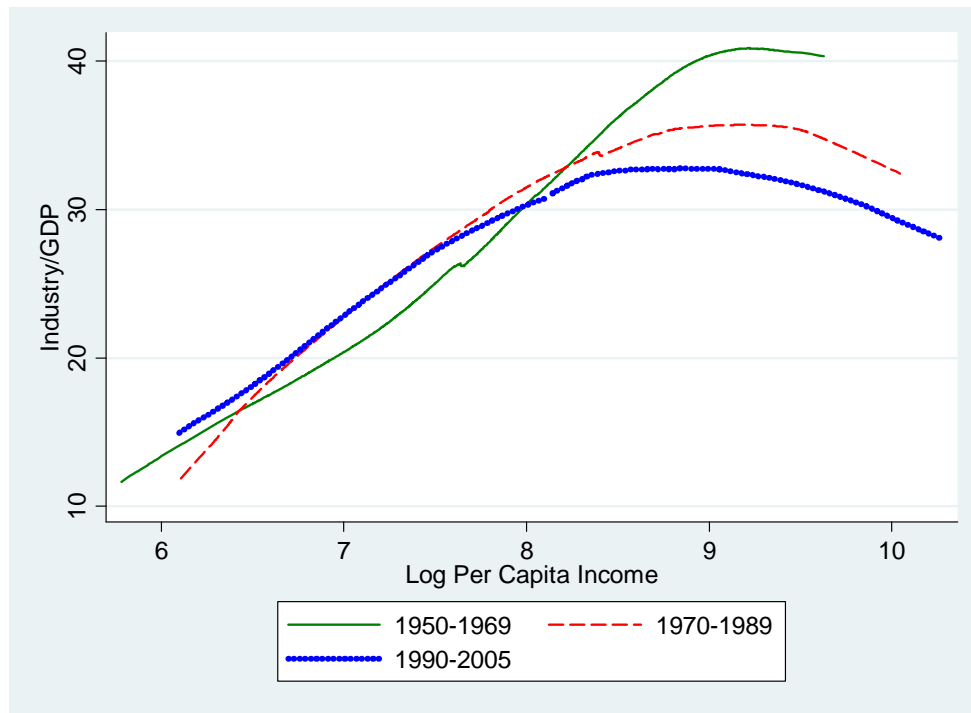
Figure 5 : Lowess Plot for Log Per Capita Income and Share of Agriculture in GDP
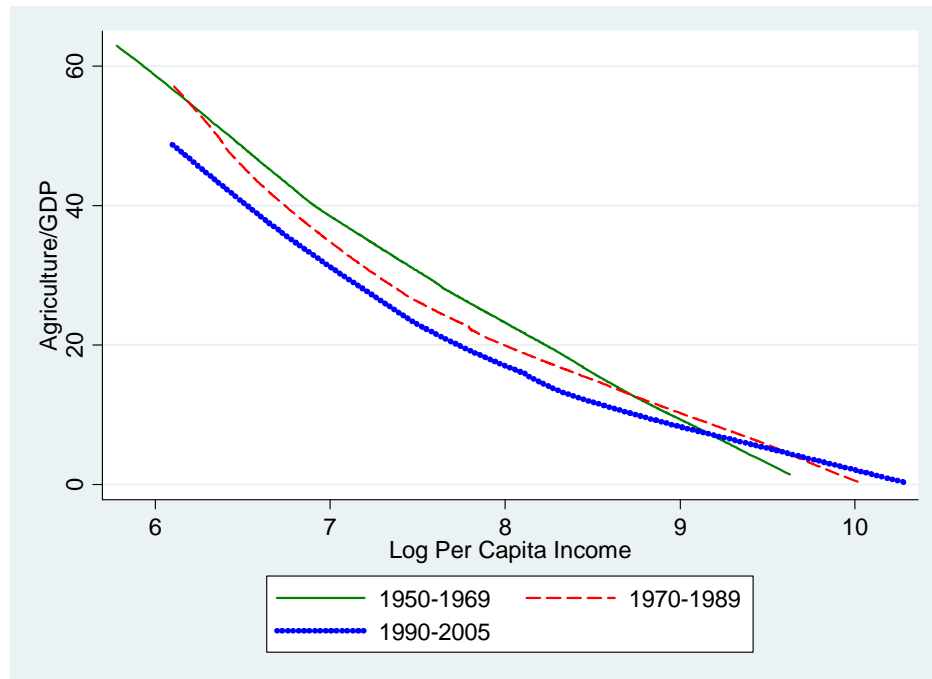
Figure 6: Service Sector Share Per Capita Income, United States
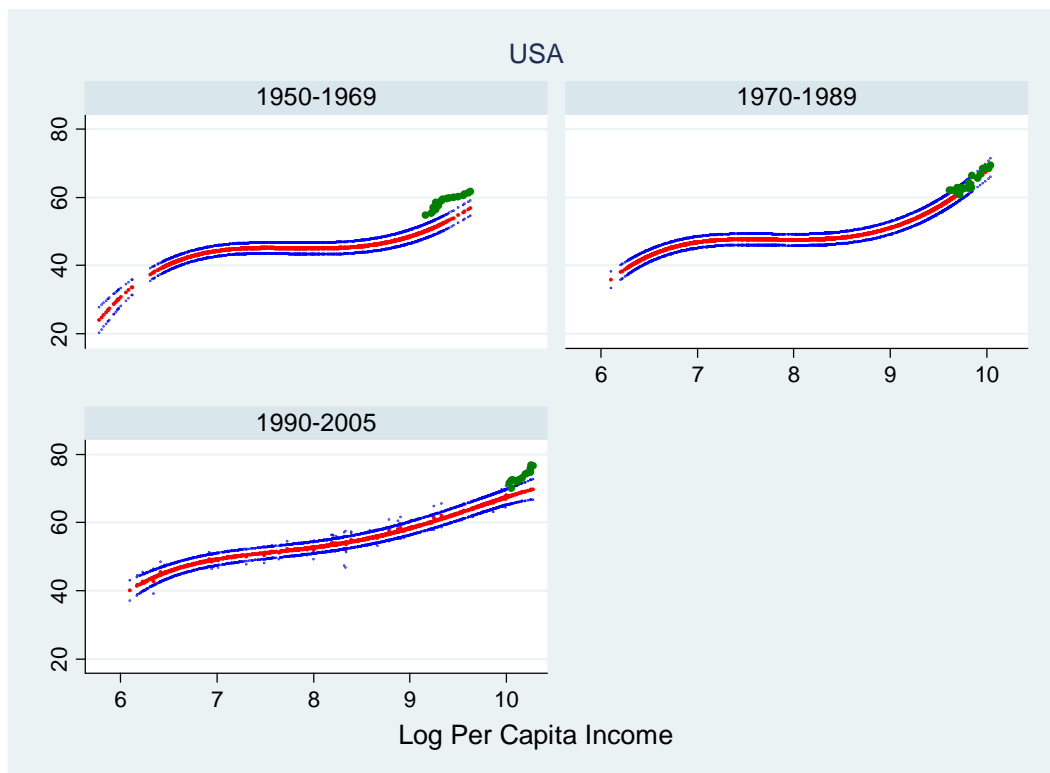
Note: The figure shows the estimated relationship and the two standard error bands for three sub periods based on the regression in Column IV, Table 1.

Figure 7: Service Sector Share and Per Capita Income, Japan
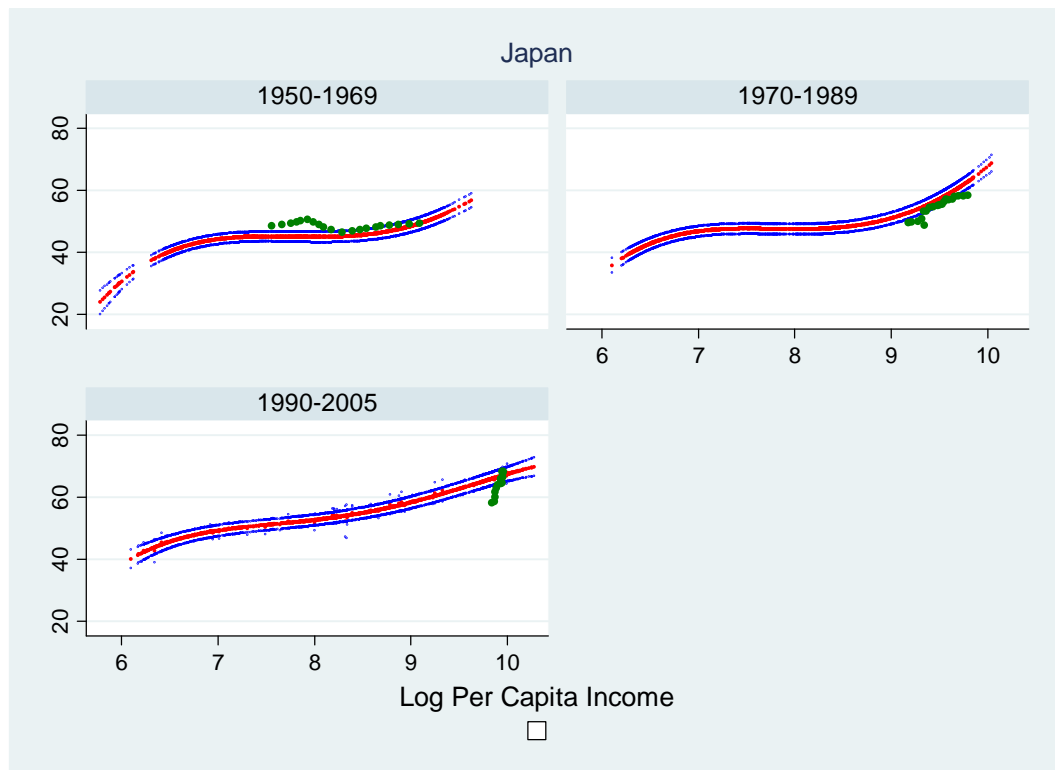
Note: The figure shows the estimated relationship and the two standard error bands for three sub periods based on the regression in Column IV, Table 1.

Figure 8: Service Sector Share and Per Capita Income, Germany
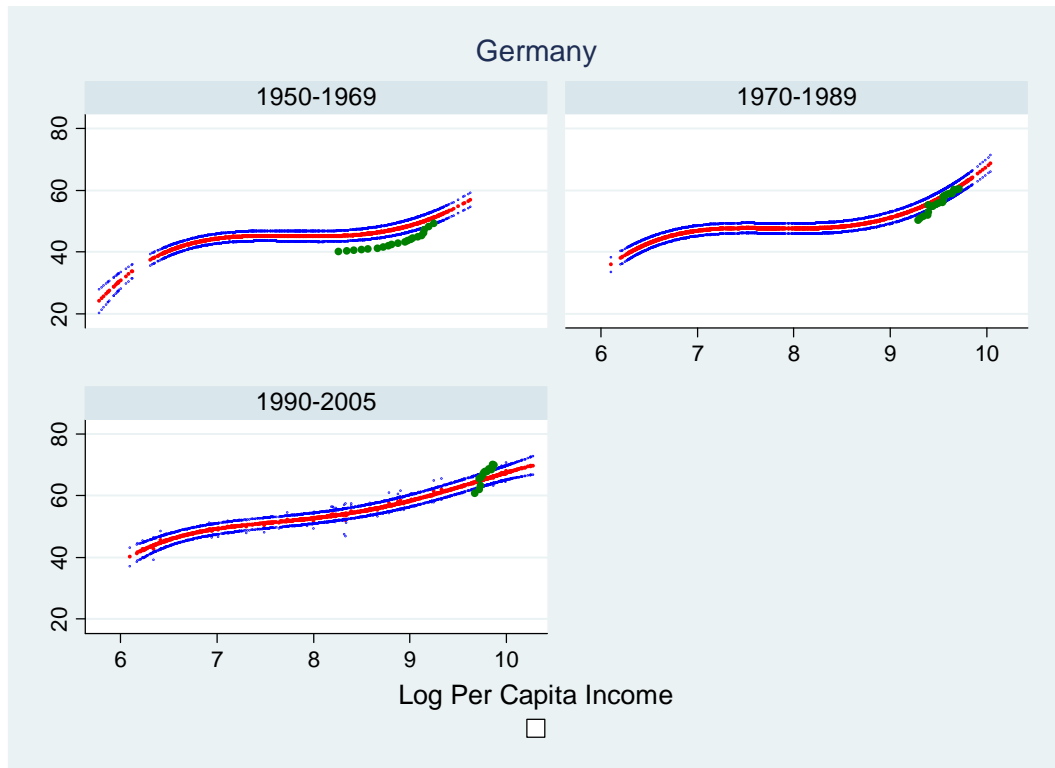
Note: The figure shows the estimated relationship and the two standard error bands for three sub periods based on the regression in Column IV, Table 1.

Figure 9: Service Sector Share and Per Capita Income, United Kingdom
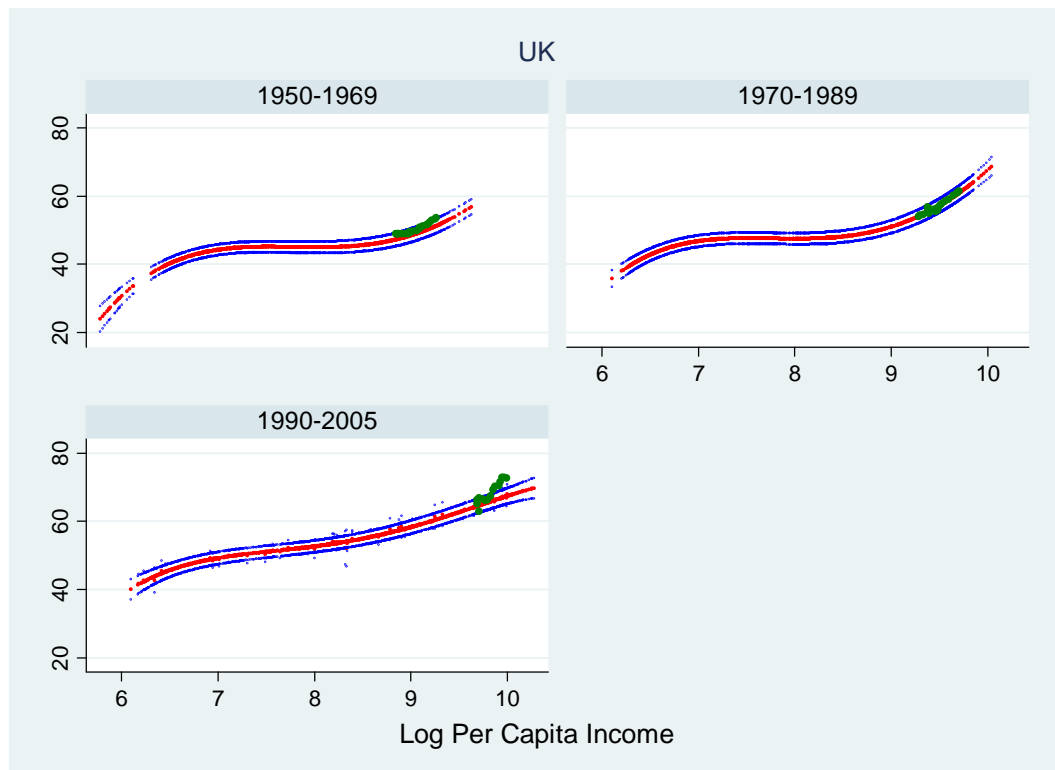
Note: The figure shows the estimated relationship and the two standard error bands for three sub periods based on the regression in Column IV, Table 1.

Figure 10: Service Sector Share and Per Capita Income, South Korea

Note: The figure shows the estimated relationship and the two standard error bands for three sub periods based on the regression in Column IV, Table 1.

Chart 11: Estimated Relationship between the Share of the Services and Per Capita Income for the EU KLEMS Sample
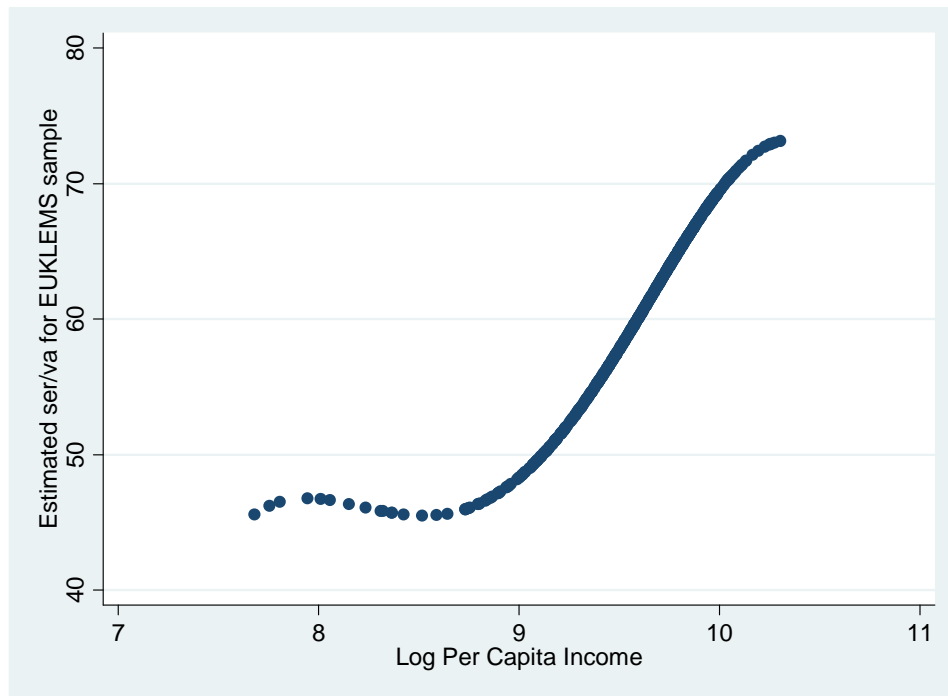
Note: The figure shows the estimated quartic relationship between services/GDP and log per capita income for the sample included in the EUKLEMS database.

Figure 12: Estimated Relationship Between the Share of Group I Services and Per Capita Income
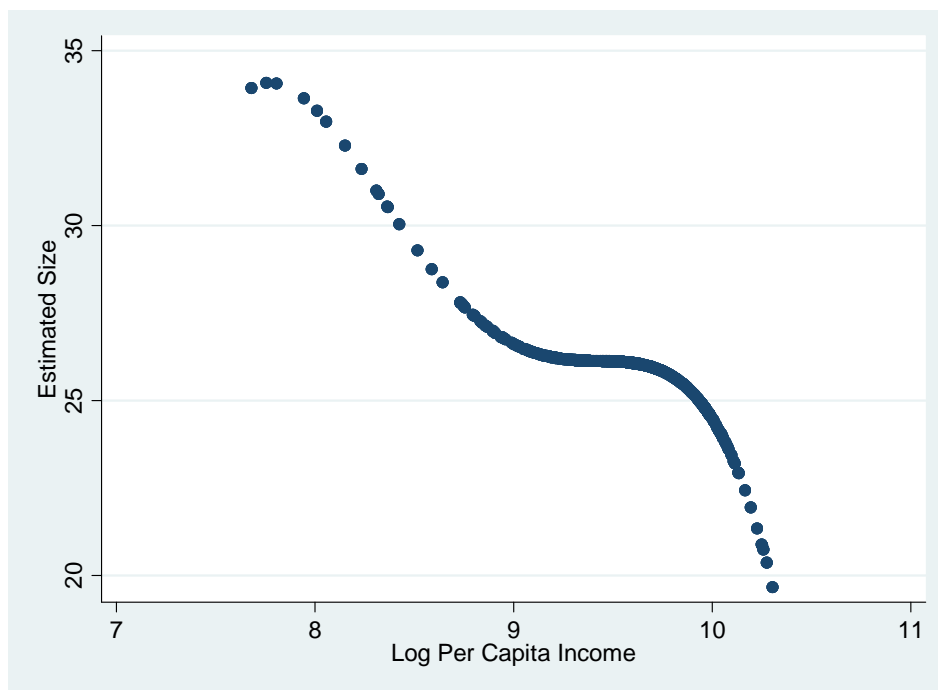
Note: Group I includes public administration and defense, retail trade, wholesale trade, and transport and storage. The estimated values are based on a regression of share of services in GDP for activities belonging to this group on four terms of per capita income and country-service fixed effects.

Figure 13: Estimated Relationship Between the Share of Group II Services and Per Capita Income
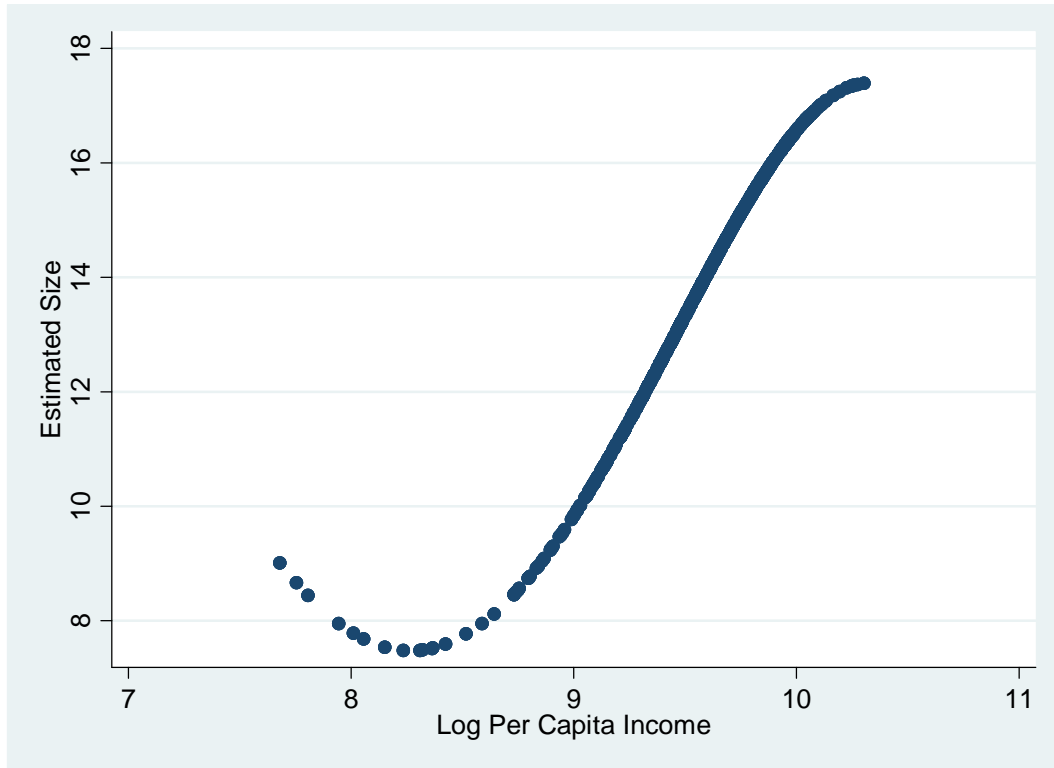
Note: Group II includes education, hotels and restaurants, Health and social work, and other community social and personal services. The estimated values are based on a regression of share of services in GDP for activities belonging to this group on four terms of per capita income and country-service fixed effects.

Figure 14: Estimated Relationship Between the Share of Group III Services and Per Capita Income
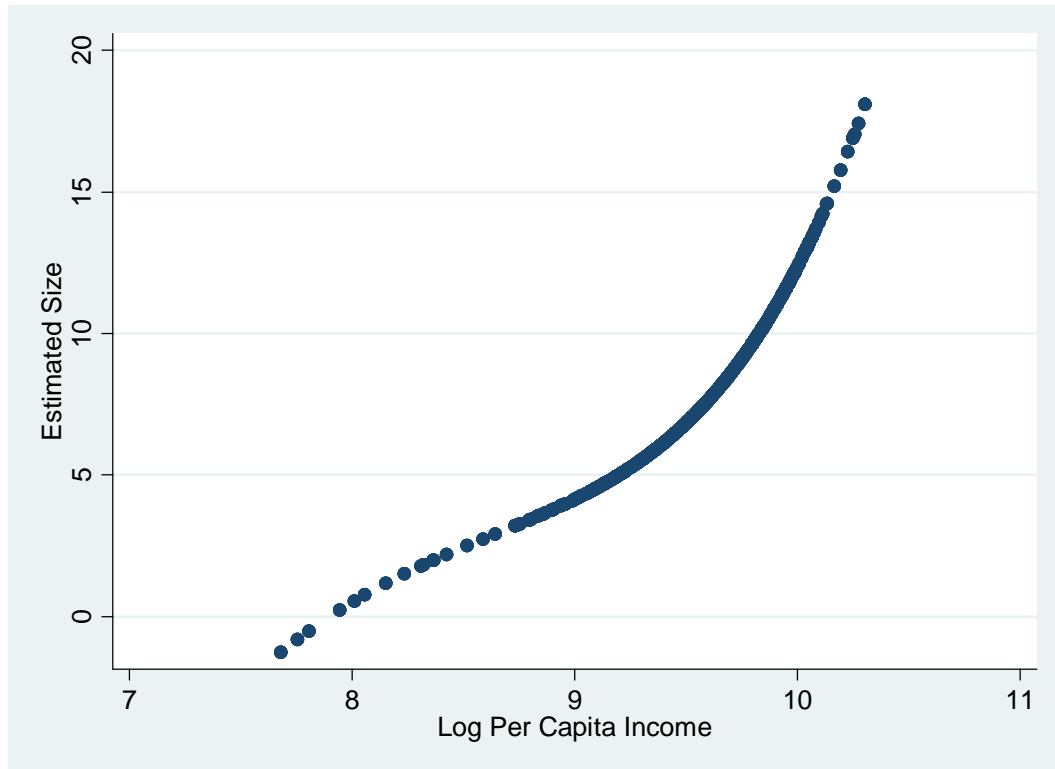
Note: Group III includes computer, legal, technical and advertising, financial intermediation, other business services and post and telecommunication. The estimated values are based on a regression of share of services in GDP for activities belonging to this group on four terms of Per capita income and country-service fixed effects.

Figure 15: Estimates Shares for Group III Subsectors
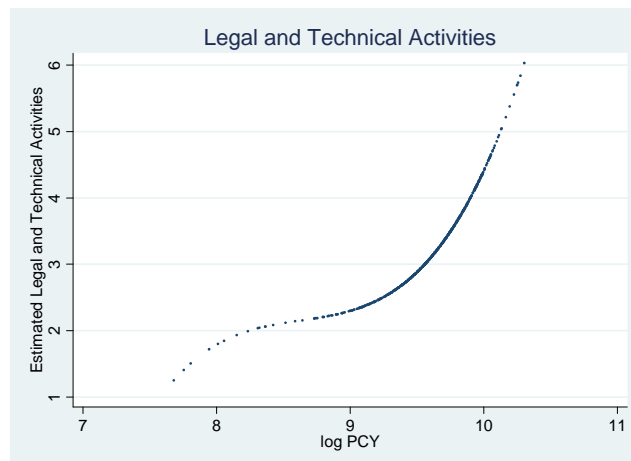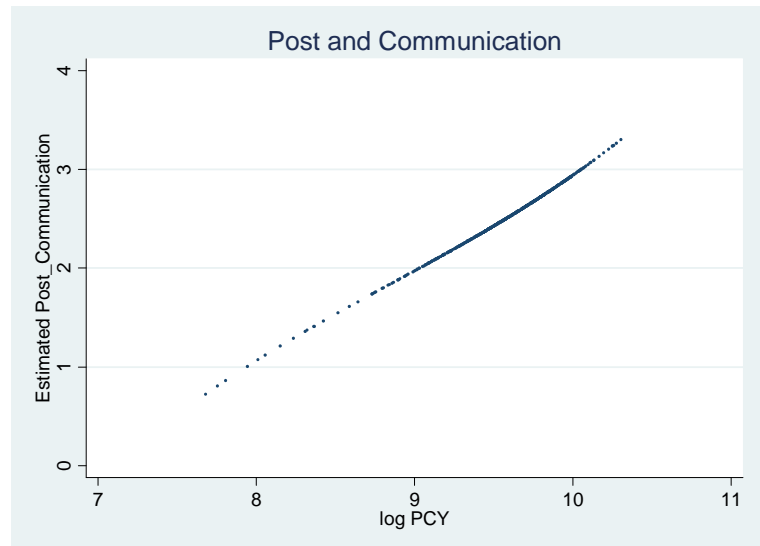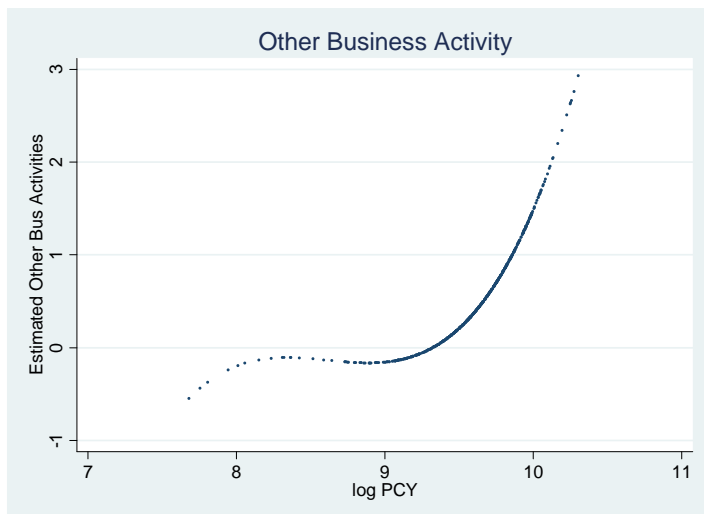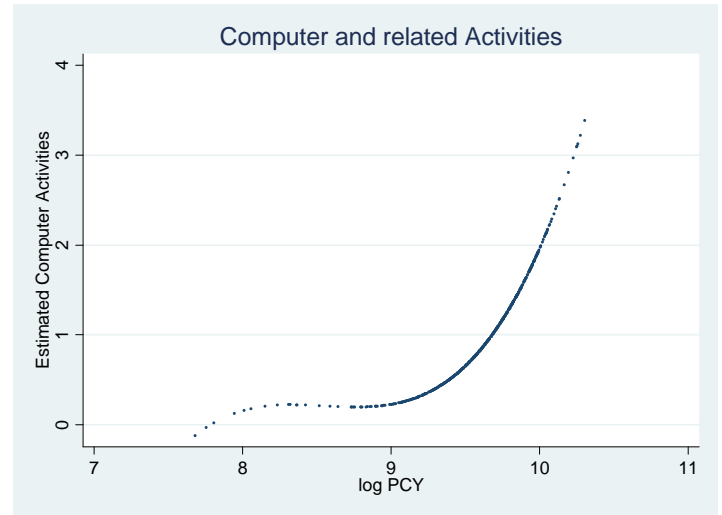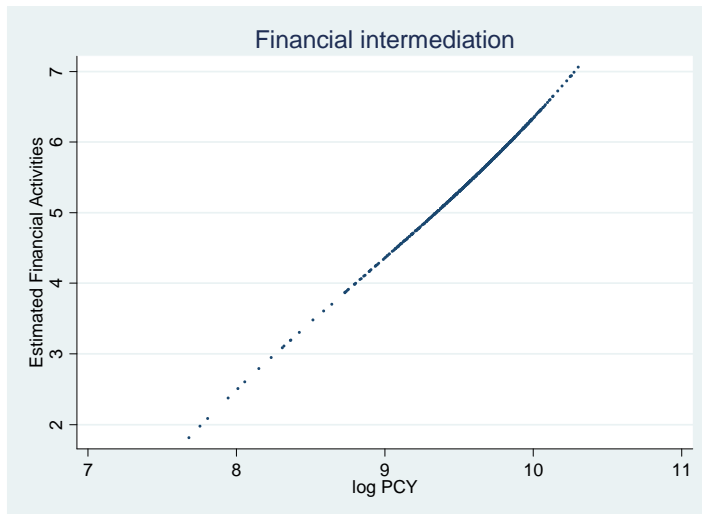
Table 1: Quartic Relationship Between Log Per Capita Income and Share of Services in GDP
[Dependent Variable: Services/GDP (in percent)]

	I	II	III	IV
Log Per Capita Income	1,000.6***	1,518.2***	661.2**	830.3***
	[5.64]	[8.09]	[2.30]	[4.02]
Log Per Capita Income, squared	-171.6***	-271.1***	-94.3*	-132.9***
	[5.17]	[7.75]	[1.66]	[3.40]
Log Per Capita Income, cube	12.9***	21.2***	5.2	9.05***
	[4.69]	[7.37]	[1.05]	[2.77]
Log Per Capita Income, quartic	-0.35***	-0.61***	-0.07	-0.22**
	[4.16]	[6.95]	[0.47]	[2.11]
Dummy for 1970-1989		2.41***	83.8	2.5***
		[10.36]	[0.12]	[10.66]
Dummy for 1990-2005		6.9***	88.26	48.2
		[21.96]	[0.68]	[0.39]
Log Per Capita Income *dummy-1970-1989			-32.71	
			[0.09]	
Log Per Capita Income squared*dummy-1970-1989			3.47	
			[0.05]	
Log Per Capita Income, cube* dummy-1970-1989			0.03	
			[0.01]	
Log Per Capita Income, quartic* dummy-1970-1989			-0.01	
			[0.08]	
Log Per Capita Income *dummy-1990-2005			49.18	46.46
			[0.79]	[0.76]
Log Per Capita Income, squared*dummy-1990-2005			-28.58**	-22.72*
			[2.21]	[1.93]
Log Per Capita Income, cube* dummy-1990-2005			4.15***	3.13***
			[3.19]	[3.00]
Log Per Capita Income, quartic* dummy-1990-2005			-0.19***	-0.14***
			[3.79]	[3.88]
Country Fixed effects	yes	yes	yes	yes
Observations	3937	3937	3937	3937
Number of Countries	91	91	91	91
R-squared	0.81	0.84	0.84	0.84

Note: Robust t statistics are in parentheses. *, **, *** indicate coefficient is significant at 10, 5, and 1 percent levels respectively. Column 1 shows the quartic relationship with a common intercept for all years. Column II allows the intercepts to differ in 1970-1989 and in 1990-2005. Column III allows the coefficients on log per capita income terms to differ in 1950-69, 1970-1989 and 1990-2005 subperiods. Column IV allows the coefficients on log per capita income terms to differ in 1950-89, and 1990-2005 subperiods.
Source: see text.

Table 2: Relationship Between Log Per Capita Income and Services/GDP:
Robustness Checks
[Dependent Variable: Services/GDP (in percent)]

	I	II	III	IV
Dummy for 1970-1989	2.53***	2.54***	2.40***	
	[10.66]	[10.46]	[10.25]	
Dummy for 1990-2005	48.23	201.22	50.11	
	[0.39]	[1.44]	[0.41]	
Log Per Capita Income	830.3***	2,641.4***	785.4***	1,194.5***
	[4.02]	[7.47]	[3.89]	[5.18]
Log Per Capita Income, squared	-132.9***	-458.6***	-123.9***	-204.3***
	[3.40]	[7.05]	[3.24]	[4.70]
Log Per Capita Income,cube	9.05***	34.95***	8.27***	15.17***
	[2.77]	[6.60]	[2.59]	[4.20]
Log Per Capita Income, quartic	-0.22**	-0.98***	-0.19*	-0.41***
	[2.11]	[6.12]	[1.91]	[3.67]
Log Per Capita Income *dummy-1990-2005	46.46	8.15	47.24	37.28
	[0.76]	[0.13]	[0.78]	[0.63]
Log Per Capita Income squared*dummy-1990-2005	-22.7*	-21.7*	-23.2**	-20.1*
	[1.93]	[1.76]	[2.00]	[1.75]
Log Per Capita Income, cube* dummy-1990-2005	3.13***	3.46***	3.19***	2.84***
	[3.00]	[3.13]	[3.11]	[2.78]
Log Per Capita Income,quartic* dummy-1990-2005	-0.14***	-0.16***	-0.14***	-0.13***
	[3.88]	[4.12]	[4.01]	[3.62]
Country Fixed Effects	Yes	Yes	RE	Yes
Observations	3937	3544	3937	3937
Number of Countries	91	87	91	91
R-squared	0.84	0.85		0.86

Note: Robust t statistics in parentheses. *, **, *** indicate coefficient is significant at 10, 5, and 1 percent levels respectively. Column I shows the base specification (same as in Column IV, Table1). Column II drops the observations with log income levels below 6.65, income level below $770. Column III is Random effects specification. Column IV includes annual dummies rather than dummies for different time periods.

Source: see text.

Table 3: Estimated Slope at Different Income Levels
(Base Specification, Column I, Table 2)

Log Per Capita Income	I Slope Pre 1990	II Slope post 1990
6.5	12.7***	10.6***
6.75	7.8***	7.0***
7	4.1***	4.8***
7.25	1.6***	*3.6****
7.5	0.1	*3****
7.75	-0.4	*3.1****
8	-0.07	*3.6****
8.25	1.1**	*4.5****
8.5	3.0***	*5.6****
8.75	5.6***	*6.7****
9	8.7***	*7.9****
9.25	12.3***	*8.8****

***, **, * indicates slope is significant at 1 percent level, 5 percent level, and 10 percent levels respectively. The slopes in bold in Column II are significantly different from the slope in pre 1990s period at 1 percent level of significance.

Source: see text.

Table 4 : Correlation Matrix

	PCY	GDP	Trade	Urban Pop	Democracy	Trade, Services	Proximity Financial Centers	Governance	Non Tropical Area	Latitude
Log PCY	1									
Log GDP	0.64*	1								
Trade	0.18*	-0.28*	1							
Urban Population	0.86*	0.54*	0.14*	1						
Democracy	0.66*	0.45*	0.09*	0.58*	1					
Trade in Services	0.01	-0.43*	0.73*	0.03	-0.05	1				
Proximity Major Financial Centers	0.41*	0.21*	0.11*	0.39*	0.32*	0.15*	1			
Governance	0.78*	0.49*	0.11*	0.67*	0.65*	0.05*	0.36*	1		
Non Tropical Area	0.61*	0.54*	-0.03	0.59*	0.37*	-0.02	0.42*	0.69*	1	
Latitude	0.71*	0.47*	0.09*	0.63*	0.51*	0.02	0.53*	0.79*	0.88*	1
Age Dependency	-0.79*	-0.66*	-0.15*	-0.71*	-0.62*	0.04	-0.31*	-0.72*	-0.64*	-0.69*

* Indicates the correlation coefficient is significant at 1 percent level of significance.
Source: see text.

Table 5: Explaining the Pattern of Service Sector Growth
[Dependent Variable: Services/GDP (in percent)]

	I	II	III	IV	V
Dummy for 1970-1989	-0.02	0.21	-0.09	-0.01	-0.12
	[0.05]	[0.73]	[0.31]	[0.02]	[0.43]
Dummy for 1990-2005	2.78***	3.08***	2.85***	3.12***	2.76***
	[5.93]	[6.68]	[6.16]	[6.87]	[6.16]
Log Per Capita Income (PCY)	336.3	-1,932.9*	-1,059.1	-583.1	620.2
	[0.29]	[1.75]	[1.07]	[0.59]	[0.69]
Log Per Capita Income, square	31.9	496.2**	332.4*	210.1	-41.3
	[0.14]	[2.34]	[1.73]	[1.13]	[0.24]
Log Per Capita Income, cube	-9.95	-51.4***	-37.8**	-25.48	-2.56
	[0.52]	[2.81]	[2.26]	[1.62]	[0.18]
Log Per Capita Income, quartic	0.52	1.89***	1.46***	1.03**	0.26
	[0.85]	[3.18]	[2.67]	[2.07]	[0.56]
Log GDP	2.61***	1.55**	1.62**	1.68**	1.61**
	[3.30]	[2.21]	[2.29]	[2.36]	[2.30]
Trade (% of GDP)	-4.54	-20.08	-13.38	-22.3	-39.42**
	[0.21]	[0.98]	[0.69]	[1.22]	[2.31]
Urban Population (% of total Population)	17.93	0.14***	0.15***	0.15***	0.16***
	[0.53]	[4.89]	[5.26]	[5.25]	[5.79]
Trade *Log PCY	4.92	12.41	9.11	13.54	21.65***
	[0.46]	[1.24]	[0.96]	[1.51]	[2.59]
Trade*log PCY squared	-1.37	-2.71	-2.11	-2.92*	-4.35***
	[0.71]	[1.49]	[1.22]	[1.79]	[2.85]
Trade*log PCY cube	0.15	0.25*	0.2	0.27**	0.38***
	[0.95]	[1.73]	[1.46]	[2.05]	[3.10]
Trade*log PCY quartic	-0.01	-0.01*	-0.01*	-0.01**	-0.01***
	[1.18]	[1.95]	[1.70]	[2.29]	[3.32]
Democracy	-662**	-522**	-637***	-571***	-561***
	[2.47]	[2.16]	[3.21]	[3.15]	[3.67]
Democracy* log PCY	342.5**	267.2**	331.5***	298.1***	292.8***
	[2.46]	[2.13]	[3.23]	[3.17]	[3.69]
Democracy*log PCY square	-65.9**	-50.8**	-64.2***	-57.96***	-56.95***
	[2.44]	[2.09]	[3.23]	[3.19]	[3.70]
Democracy*log PCY cube	5.59**	4.25**	5.48***	4.97***	4.89***
	[2.41]	[2.04]	[3.21]	[3.19]	[3.68]
Democracy*log PCY quartic	-0.18**	-0.13**	-0.17***	-0.16***	-0.16***
	[2.37]	[1.98]	[3.18]	[3.17]	[3.65]
Proximity*PCY	0.45***	0.50***	0.49***	0.54***	0.57***
	[5.34]	[6.37]	[6.37]	[7.06]	[8.03]
Proximity*PCY square	-0.08***	-0.09***	-0.09***	-0.10***	-0.10***
	[5.35]	[6.34]	[6.36]	[7.08]	[8.18]
Proximity*PCY cube	0.01***	0.01***	0.01***	0.01***	0.01***
	[5.36]	[6.31]	[6.34]	[7.09]	[8.33]
Proximity*PCY quartic	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	[5.37]	[6.28]	[6.32]	[7.10]	[8.47]
Nontropical area* PCY	2,492.6***	2,819.9***	1,455.8*	769.04	

43

	I	II	III	IV	V
	[2.88]	[3.37]	[1.82]	[0.96]	
Nontropical area* PCY squared	-498.3***	-566.7***	-307.9**	-175.9	
	[3.03]	[3.57]	[2.02]	[1.16]	
Nontropical area* PCY cube	43.71***	50.0***	28.28**	17.16	
	[3.16]	[3.74]	[2.20]	[1.35]	
Nontropical area* PCY quartic	-1.42***	-1.64***	-0.96**	-0.61	
	[3.26]	[3.89]	[2.36]	[1.53]	
Urban Population*PCY	-13.28				
	[0.80]				
Urban Population*PCY square	3.26				
	[1.06]				
Urban Population*PCY cube	-0.33				
	[1.32]				
Urban Population*PCY quartic	0.01				
	[1.58]				
Governance*PCY	75.54	-410.04			
	[0.14]	[0.87]			
Governance*PCY square	-21.1	66.32			
	[0.22]	[0.76]			
Governance*PCY cube	2.34	-4.61			
	[0.29]	[0.65]			
Governance*PCY quartic	-0.09	0.11			
	[0.38]	[0.52]			
Age Dependency Ratio*PCY	135.9	194.1*	193.9*		
	[1.25]	[1.80]	[1.76]		
Age Dependency Ratio*PCY square	-42.84	-63.63	-64.65		
	[1.07]	[1.60]	[1.58]		
Age Dependency Ratio*PCY cube	4.46	6.89	7.14		
	[0.91]	[1.41]	[1.43]		
Age Dependency Ratio*PCY quartic	-0.15	-0.25	-0.26		
	[0.77]	[1.25]	[1.29]		
Observations	3062	3062	3062	3062	3139
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Countries	80	80	80	80	83
R-squared	0.89	0.89	0.89	0.89	0.88

Note: Robust t statistics are in parentheses. *, **, *** indicate coefficient is significant at 10, 5, and 1 percent levels respectively. Column I includes all of the potential explanatory variables interacted with the four per capita income terms. Column II drops the variables interacting urban population with per capita income. Column III drops the terms interacting governance with per capita income. Column IV drops the terms interacting age dependency with per capita income. Column V drops the terms interacting area outside the tropics with per capita income.
Source: See text.

Table 6: Slope of Services/GDP with respect to Per Capita Income at Different Income Levels and Values of the Explanatory Variables

Log Per Capita Income	I Bottom Quartile values of Trade, proximity and democracy	II Median values of Trade, proximity and democracy	III Top Quartile Values of Trade, Proximity and Democracy
6.75	5.9***	13***	17.2***
7	5.6***	7.6**	7.6***
7.25	3.46*	3.1***	1.8
7.5	0.29	0.14	-0.9
7.75	-3.2	-1.5	-1.2
8	-6.4**	-1.8	0.37
8.25	-8.5***	-1	3.2
8.5	-8.8***	-7.7	6.5*
8.75	-6.7**	3.4**	9.8***
9	-1.4	6.8***	12.3***

Note: Slopes based on coefficients in Column V, Table 6. ***, **, * indicate that a slope is significantly different from zero at the 1, 5 and 10 percent levels, respectively.
Source: see text.

Table 7: Explaining the Pattern of Service Sector Growth II
[Dependent Variable: Services/GDP (in percent)]

	I	II	III	IV	V
Dummy for 1970-1989	0.33	0.67	0.08	0.29	0.18
	[0.48]	[0.93]	[0.11]	[0.40]	[0.25]
Dummy for 1990-2005	2.22***	2.61***	1.95**	2.41***	2.15**
	[2.77]	[3.16]	[2.39]	[2.89]	[2.57]
Log Per Capita Income	28.05	-519.1	384.6	1,334.7	2,093.8
	[0.01]	[0.31]	[0.26]	[0.98]	[1.63]
Log Per Capita Income, square	62.22	204.01	28.96	-155.96	-310.9
	[0.17]	[0.65]	[0.10]	[0.60]	[1.26]
Log Per Capita Income, cube	-10.32	-25.28	-10.23	4.95	18.98
	[0.33]	[0.94]	[0.43]	[0.22]	[0.90]
Log Per Capita Income, quartic	0.47	1.03	0.54	0.1	-0.38
	[0.48]	[1.19]	[0.72]	[0.14]	[0.56]
Log GDP	1.47	1	0.66	0.6	0.81
	[1.11]	[0.87]	[0.58]	[0.56]	[0.75]
Trade (% of GDP)	0.18*	0.14	0.15	0.16*	0.18*
	[1.90]	[1.47]	[1.56]	[1.68]	[1.95]
Urban Population (% of total Population)	-61.32	0.22***	0.24***	0.28***	0.30***
	[0.96]	[4.93]	[6.00]	[7.05]	[7.48]
Democracy	-240	-406	-660**	-610**	-562**
	[0.55]	[1.05]	[2.25]	[2.23]	[2.27]
Trade *Log PCY	-0.02**	-0.02	-0.02	-0.02*	-0.02**
	[2.01]	[1.52]	[1.63]	[1.71]	[2.10]
Trade in Services*Log PCY	3.86***	3.64***	4.12***	3.37***	3.50***
	[2.94]	[2.85]	[3.18]	[2.78]	[3.08]
Trade in Services*PCY square	-1.48***	-1.40***	-1.57***	-1.29***	-1.35***
	[3.09]	[3.00]	[3.34]	[2.93]	[3.25]
Trade in Services*PCY cube	0.19***	0.18***	0.20***	0.16***	0.17***
	[3.24]	[3.15]	[3.50]	[3.07]	[3.42]
Trade in Services*PCY quartic	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	[3.38]	[3.29]	[3.66]	[3.20]	[3.58]
Democracy	-240	-406	-660**	-610**	-562**
	[0.55]	[1.05]	[2.25]	[2.23]	[2.27]
Democracy* log PCY	133.8	219.42	352.74**	328.91**	303.09**
	[0.59]	[1.10]	[2.34]	[2.34]	[2.38]
Democracy*log PCY square	-27.21	-43.65	-69.77**	-65.60**	-60.48**
	[0.63]	[1.15]	[2.41]	[2.43]	[2.46]
Democracy*log PCY cube	2.4	3.8	6.06**	5.74**	5.30**
	[0.65]	[1.18]	[2.47]	[2.50]	[2.51]
Democracy*log PCY quartic	-0.08	-0.12	-0.20**	-0.19**	-0.17**
	[0.66]	[1.19]	[2.50]	[2.55]	[2.54]
Proximity*PCY	0.77***	0.76***	0.77***	0.86***	0.87***
	[5.58]	[6.15]	[6.59]	[7.43]	[7.42]
Proximity*PCY square	-0.14***	-0.14***	-0.14***	-0.16***	-0.16***
	[5.70]	[6.24]	[6.70]	[7.57]	[7.58]
Proximity*PCY cube	0.01***	0.01***	0.01***	0.01***	0.01***
	[5.80]	[6.32]	[6.79]	[7.69]	[7.72]

	I	II	III	IV	V
Proximity*PCY quartic	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	[5.88]	[6.37]	[6.86]	[7.78]	[7.84]
Nontropical area* PCY	663.7	1,356.52	331.15	-385.27	
	[0.49]	[1.07]	[0.28]	[0.33]	
Nontropical area* PCY square	-142.56	-279.08	-85.07	47.37	
	[0.56]	[1.16]	[0.38]	[0.22]	
Nontropical area* PCY cube	13.4	25.18	8.93	-1.78	
	[0.64]	[1.25]	[0.48]	[0.10]	
Nontropical area* PCY quartic	-0.47	-0.84	-0.33	-0.01	
	[0.71]	[1.34]	[0.58]	[0.02]	
Urban Population*PCY	28.76				
	[0.92]				
Urban Population*PCY square	-4.97				
	[0.87]				
Urban Population*PCY cube	0.38				
	[0.82]				
Urban Population*PCY quartic	-0.01				
	[0.76]				
Governance*PCY	-111.58	44.19			
	[0.14]	[0.06]			
Governance*PCY square	4.77	-22.78			
	[0.03]	[0.17]			
Governance*PCY cube	0.96	3.09			
	[0.08]	[0.29]			
Governance*PCY quartic	-0.07	-0.13			
	[0.21]	[0.41]			
Age Dependency Ratio*PCY	11.73	62.12	29.76		
	[0.06]	[0.37]	[0.19]		
Age Dependency Ratio*PCY square	5.86	-11.73	-0.84		
	[0.09]	[0.19]	[0.01]		
Age Dependency Ratio*PCY cube	-1.86	0.15	-1.07		
	[0.23]	[0.02]	[0.15]		
Age Dependency Ratio*PCY quartic	0.12	0.04	0.09		
	[0.36]	[0.14]	[0.31]		
Observations	2147	2147	2147	2147	2209
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Countries	80	80	80	80	83
R-squared	0.90	0.90	0.90	0.90	0.89

Note: Robust t statistics in parentheses. *, **, *** indicate coefficient is significant at 10, 5, and 1 percent levels respectively. Column I includes all of the potential explanatory variables interacted with the four per capita income terms. Column II drops the variables interacting urban population with per capita income. Column III drops the terms interacting governance with per capita income. Column IV drops the terms interacting age dependency with per capita income. Column V drops the terms interacting area outside the tropics with per capita income.
Source: see text.

Table 8: Explaining the Post-1990 Shift
[Dependent Variable: Services/GDP (in percent)]

	I	II	III	IV	V
Log Per Capita Income	830.3***	698.4**	220.9	1,259.9	1,237.1
	[4.02]	[2.23]	[0.26]	[1.26]	[1.26]
Log Per Capita Income, square	-132.9***	-99.1*	33.7	-168.1	-166.9
	[3.40]	[1.69]	[0.21]	[0.88]	[0.89]
Log Per Capita Income,cube	9.05***	5.48	-8.84	8.78	8.92
	[2.77]	[1.13]	[0.65]	[0.54]	[0.56]
Log Per Capita Income, quartic	-0.22**	-0.08	0.454	-0.128	-0.139
	[2.11]	[0.56]	[1.06]	[0.25]	[0.28]
Log Per Capita Income*dummy-1990-2005	46.46	23.97	-21.55	-27.53	-32.88
	[0.76]	[0.39]	[0.37]	[0.50]	[0.60]
Log Per capita income square*dummy-1990-2005	-22.72*	-24.25**	-7.91	-5.06	0.54
	[1.93]	[2.05]	[0.71]	[0.32]	[0.04]
Log Per Capita Income Cube*dummy-1990-2005	3.13***	3.72***	1.7*	0.91	0.15
	[3.00]	[3.55]	[1.71]	[0.41]	[0.08]
Log Per Capita Income Quartic*dummy-1990-2005	-0.14***	-0.17***	-0.085**	-0.029	0.001
	[3.88]	[4.74]	[2.49]	[0.30]	[0.01]
Dummy for 1970-1989	2.53***	0.66**	-0.17	-0.31	-0.21
	[10.66]	[2.36]	[0.62]	[1.15]	[0.75]
Dummy for 1990-2005	48.23	148.05	157.7	197.1	145.5
	[0.39]	[1.18]	[1.32]	[1.24]	[1.03]
log GDP		2.76***	4.03***	4.89***	4.52***
		[3.59]	[5.25]	[6.27]	[5.89]
Trade/GDP		0.28***	-34.3**	-26.8	-27.6
		[5.55]	[2.04]	[1.27]	[1.63]
Trade*Post1990				19.41	
				[0.89]	
Democracy		0.30***	-592.3***	-399.3**	-395.9**
		[8.01]	[4.07]	[2.45]	[2.46]
Urban Population (% of total Population)		0.07***	0.13***	0.12***	0.13***
		[2.61]	[5.06]	[4.82]	[5.08]
Trade *Log PCY		-0.03***	19.2**	16.0	16.0*
		[5.91]	[2.34]	[1.51]	[1.94]
Trade*log PCY square			-3.91***	-3.42*	-3.36**
			[2.60]	[1.71]	[2.22]
Trade*log PCY cube			0.35***	0.31*	0.303**
			[2.85]	[1.89]	[2.48]
Trade*log PCY quartic			-0.011***	-0.010**	-0.010***
			[3.08]	[2.03]	[2.72]
Democracy* log PCY			308.9***	207.3**	205.6**
			[4.10]	[2.44]	[2.45]
Democracy*log PCY square			-59.9***	-39.8**	-39.5**
			[4.11]	[2.40]	[2.41]
Democracy*log PCY cube			5.14***	3.35**	3.33**
			[4.10]	[2.34]	[2.34]
Democracy*log PCY quartic			-0.16***	-0.104**	-0.10**
			[4.06]	[2.26]	[2.25]

	I	II	III	IV	V
Proximity*PCY			0.54***	0.55***	0.59***
			[7.86]	[5.86]	[6.30]
Proximity*PCY square			-0.099***	-0.10***	-0.11***
			[8.04]	[5.82]	[6.30]
Proximity*PCY cube			0.008***	0.008***	0.009***
			[8.21]	[5.79]	[6.30]
Proximity*PCY quartic			-0.000***	-0.000***	-0.000***
			[8.36]	[5.75]	[6.30]
Democracy*Per Capita Income*dummy-1990-2005				5.356	1.089
				[0.88]	[0.21]
Democracy*Per Capita Income square* dummy-1990-2005				-2.47	-0.89
				[1.07]	[0.46]
Democracy*Per Capita Income cube* dummy-1990-2005				0.36	0.17
				[1.24]	[0.71]
Democracy*Per Capita Income quartic* dummy-1990-2005				-0.017	-0.01
				[1.42]	[0.95]
Proximity*PCY* dummy-1990-2005				0.013***	0.008*
				[2.81]	[1.71]
Proximity*PCY square* dummy-1990-2005				-0.005***	-0.003*
				[2.78]	[1.70]
Proximity*PCY Cube*dummy-1990-2005				0.001***	0.000*
				[2.73]	[1.66]
Proximity*PCY Quartic*dummy-1990-2005				-0.000***	0
				[2.64]	[1.59]
Trade*log PCY* dummy-1990-2005				-10.33	
				[0.96]	
Trade*log PCY square* dummy-1990-2005				2.021	
				[1.02]	
Trade*log PCY cube* dummy-1990-2005				-0.173	
				[1.07]	
Trade*log PCY quartic* dummy-1990-2005				0.005	
				[1.11]	
Observations	3937	3139	3139	3139	3139
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Countries	91	83	83	83	83
R-squared	0.84	0.87	0.89	0.89	0.89

Note: Robust t statistics are in parentheses. *, **, *** indicate coefficient is significant at 10, 5, and 1 percent levels respectively. Column I reproduces Column IV of Table 1 as a benchmark. Column II includes GDP, urban population, trade, democracy. Column III includes democracy, trade, and proximity to financial centers, all interacted with the powers of per capita income. Column IV includes trade, democracy, and proximity interacted with per capita income as well with as post 1990 dummy. Column V drops trade interacted with per capita income terms and the post-1989 dummy.
Source: see text.

Table 9: Slope of Services/GDP at Different Per Capita Income Levels and for Different Values of the Explanatory Variables

	I	II	III	IV	V	VI	VII	VIII
	At Bottom Quartile Values of Trade, Democracy, Proximity		At Top Quartile Values of Trade, Democracy, Proximity		At Bottom Quartile Values of Trade, Democracy, Proximity		At Top Quartile Values of Trade, Democracy, Proximity	
	Slopes Based on Column III, Table 9				Based on Column V, Table 9			
Log Per Capita Income	Pre 1990	Post 1990	Pre 1990	Post 1990	Pre 1990	Post 1990	Pre 1990	Post 1990
6.5	2.5***	.36	23.9***	21.9***	.78	1.4	22.3***	25***
7	4***	**5.2*****	1.8	**2.9**	2.8	3.6	2.1	**7.4***
7.5	-2.2*	**1.2**	-6.3**	**-2.9**	-2.5	**-1.0**	-5.3	**1.3**
8	-9.9**	**-5.5*****	-4.9*	**.64**	-10.2**	**-7.0****	-4.1	**2.6**
8.5	-12.9***	**-9.2****	1.3	**5.0**	-15.2***	**-9.2****	1.6	**6.9***
9	-5.3	**-3.9**	7.9**	**9.3****	-12.5**	**-2.0**	7.7	**9.6****

*, **, *** indicate that the slopes are significant at 10, 5, and 1 percent levels respectively. Slopes in bold indicate that the slopes in post 1990 period are significantly different from the slopes in pre 1990 period.

Table 10: Size of Service Subsectors (percentage of GDP) in Different Years

	1970	1980	1990	2000	2005
Group I (Total)	22.3	22.4	21.6	20.8	20.7
Public administration and defense	6.24	6.9	6.5	6.1	6.1
	(1.7)	(1.7)	(1.4)	(1.3)	(1.4)
Wholesale trade	5.6	5.5	5.6	5.4	5.4
	(1.6)	(1.3)	(1.4)	(1.4)	(1.5)
Transport and Storage	5.5	5.2	4.9	4.8	4.8
	(1.2)	(.99)	(.93)	(1.1)	(1.2)
Retail Trade	5.0	4.8	4.6	4.5	4.4
	(.95)	(.90)	(1.06)	(.88)	(.92)
Group II (Total)	13.0	15.2	16.8	17.9	19.2
Health and Social Work	4.2	5.3	5.9	6.4	7.3
	(1.8)	(2.4)	(2.1)	(1.9)	(2.0)
Education	4.1	4.8	4.97	4.96	5.1
	(.92)	(1.15)	(.71)	(.75)	(.72)
Community, Social, Personal	2.4	2.7	3.3	3.5	3.7
	(.53)	(.59)	(.72)	(.71)	(.70)
Hotels and Restaurants	2.3	2.4	2.6	3.0	3.1
	(1.1)	(1.3)	(1.4)	(1.9)	(2.1)
Group III (Total)	7.3	9.6	12.0	14.6	15.1
Financial Intermediation	2.4	3.3	3.9	3.9	4.1
	(.81)	(.83)	(.82)	(.97)	(1.2)
Legal, Technical and Advertising	2.0	2.4	3.38	3.8	4.00
	(.83)	(1.2)	(1.5)	(1.9)	(1.9)
Post and Communication	1.8	1.98	2.2	2.46	2.4
	(.57)	(.43)	(.46)	(.47)	(.37)
Other Business Services	.90	1.4	1.7	2.7	2.8
	(.55)	(.99)	(.96)	(1.2)	(1.2)
Computer Services	.32	.53	.79	1.7	1.8
	(.27)	(.43)	(.45)	(.68)	(.69)

Note: Entry is average share of that service subsector in GDP in the EU KLEMS sample in the year indicated. Numbers in parentheses below each average are the standard deviations.

Table 11: Characteristics of Different Services

	Average annual productivity increase in 1990s (in percent)	Average annual productivity increase in1990-2005 (in percent)	ICT (Producing or Using)	Tradability
Group I				
Public Administration, Defense	0.11	0.31	0	NT
Retail Trade	1.71	1.17	1	NT
Transport and Storage	1.85	1.01	0	?
Wholesale Trade	1.54	1.88	1	?
Group II				
Education	0.13	-0.50	0	NT
Health, Social Work	-0.01	-0.53	0	NT
Hotels and Restaurants	-0.14	-1.00	0	NT
Other Community, Social and Personal Services	-0.71	-0.86	0	NT
Group III				
Post and Communication	3.13	7.17	1	T
Computer Services			1	T
Financial Intermediation			1	T
Legal, Technical, Advertising			1	T
Other Business Activities			0/1	T

Note: ICT equal to 0 implies that the service neither produces nor uses information and communication technology; and a 1 indicates that the service uses or produces information and communication technology. In the last column NT refers to non tradable services and T refers to tradable services. Productivity refers to total factor productivity and the average annual growth rates have been calculated using the data from EUKLEMS. The indicator of tradability has been constructed using the data in Jensen and Kletzer (2005). Indicators for information and communication technology (ICT) industries has been constructed using the data in van Ark, Inklaar and McGucken (2005). See Section 5 for further details.

Source: see text.