Dani RODRIK

STRUCTURAL TRANSFORMATION

AND

ECONOMIC DEVELOPMENT

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This is the preliminary draft of a paper to be delivered as the Merih Celasun Memorial Lecture at TEPAV, Ankara, on December 22, 2010. The work reported here draws heavily from joint work with Margaret McMillan on "Globalization and Structural Transformation" (McMillan and Rodrik 2010). I thank Iñigo Verduzco for excellent research assistance, and the International Food Policy Research Institute (IFPRI) for research support.

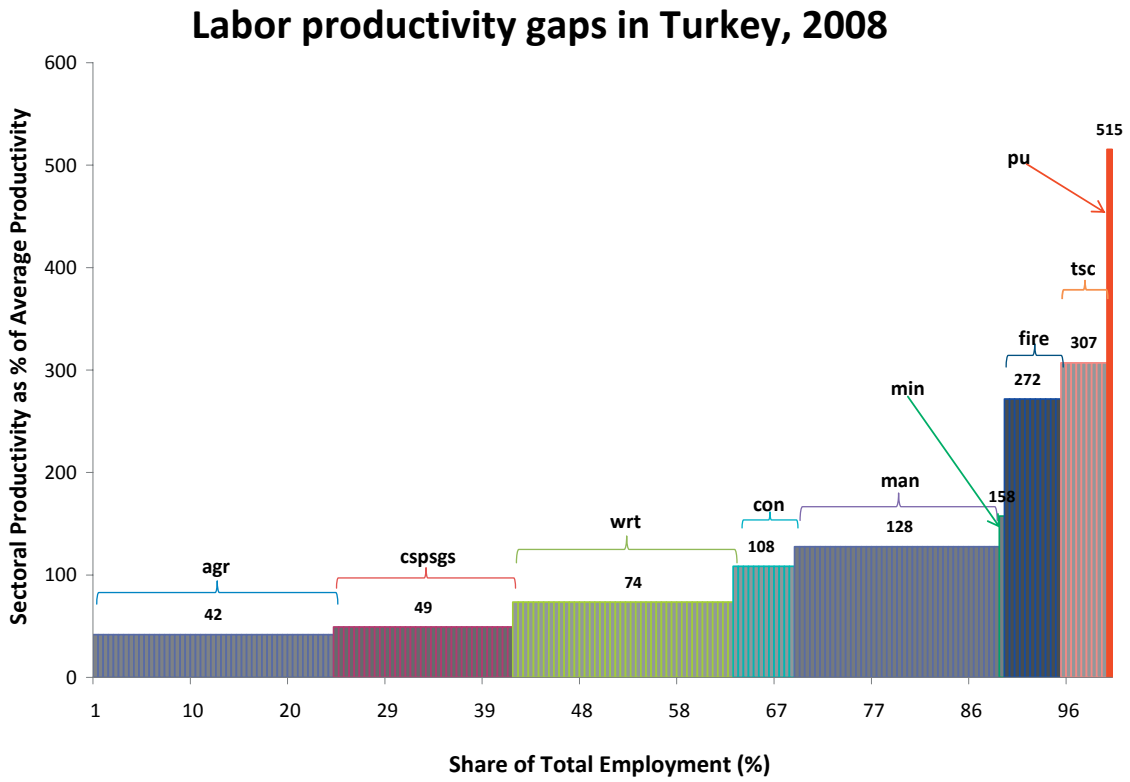
Dani RODRIK

Introduction

All serious development economists are structuralists. By this, I don't mean that they think price elasticities tend to be zero, incentives have little effect on behavior or that markets almost always fail. I mean that they understand the structure of economic activity is substantially different in developing countries and that the process of development cannot be analyzed usefully without taking that structure into account. Developing countries are not just scaled-down versions of advanced countries. They are both quantitatively and qualitatively different.

Much of growth theory – both of the traditional and the new kind – ignores the presence of large productivity gaps between existing activities in the economy. As the dual-economy models have emphasized from W. Arthur Lewis on, in a typical developing economy growth takes place through the movement of labor from low-productivity activities to high productivity activities. Hence a key determinant of economic success is the degree to which the environment is conducive to rapid structural change. Structural change determines not only the pace of economic growth but also the evolution of income distribution. These points were repeatedly underscored by the late Merih Celasun, who undertook some of the earliest and best work on the process of structural change in Turkey (Celasun 1983).

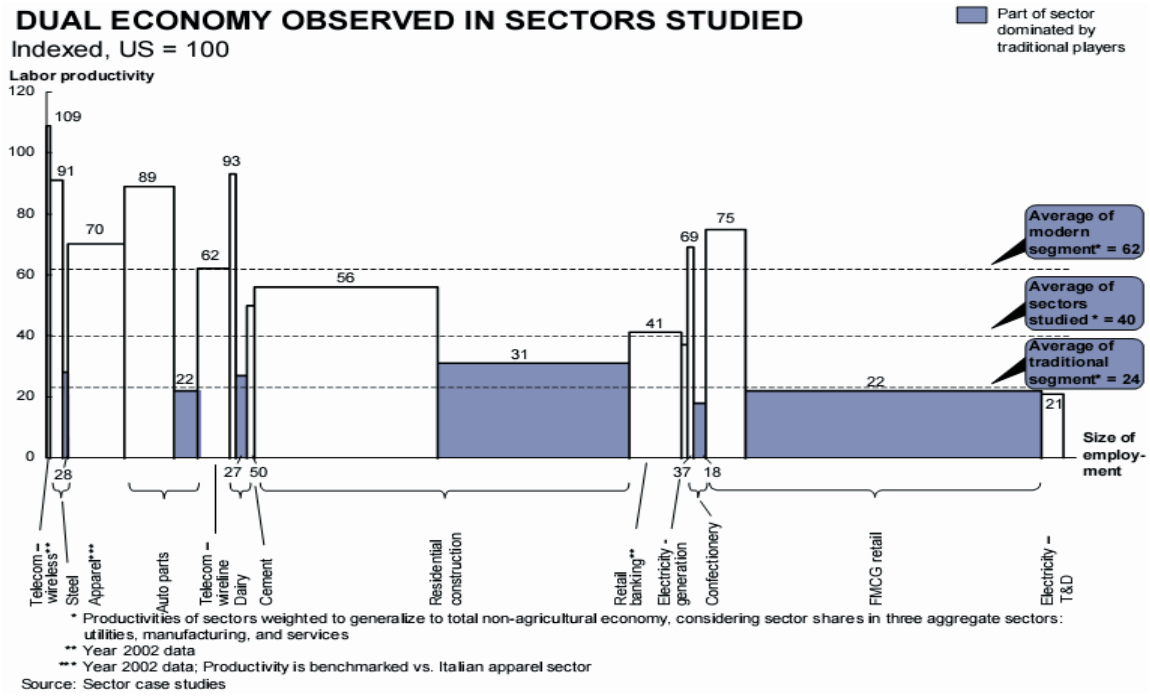
We can observe the productivity gaps in the Turkish economy by comparing value added per employee across different sectors, as is done in Figure 1. What stands out immediately is the huge dispersion, with agriculture ("agr," which still generates nearly a quarter of employment) at one end and public utilities ("pu") at the other. Since public utilities are a highly capital intensive sector that doesn't generate a lot of employment, perhaps a more relevant comparison is between agriculture and manufacturing. As the chart shows, average productivity in manufacturing exceeds that in agriculture by a factor of three. Besides agriculture, other sectors with lower-than-average productivity are community, personal, and government services ("cspsgs") and wholesale and retail trade ("wrt"), two sectors which are characterized by substantial informality. Getting labor to move from one of these sectors to manufacturing or any of the other high-productivity sectors would provide a significant boost to real incomes.



Source: TUIK and author's calculations.

Figure 1

Similar productivity gaps exist within sectors as well. In particular, larger firms tend to have much higher productivity levels than the smaller, informal firms with which they often compete. When the McKinsey Global Institute undertook a study of productivity in Turkey some years back, this duality was one of the most striking findings it uncovered (Figure 2). For example, in auto parts modern firms had reached 89 percent of the productivity of firms in the United States, while what MGI called "traditional" firms operated at only 22 percent – a four-fold difference. In many other manufacturing and service industries, there were similar gaps as well.



Source: McKinsey Global Institute (2003)

Figure 2

The productivity gaps shown in the last two figures refer to differences in average labor productivity. When markets work well and structural constraints don't bind, it is productivities at the margin that should be equalized. Under a simple Cobb-Douglas production function specification, the marginal productivity of labor is the average productivity multiplied by the labor share. So if labor shares differ greatly across economic activities comparing average labor productivities can be misleading. The fact that average productivity in public utilities is so high (Figure 1), for example, may simply indicate that the labor share of value added in this capital-intensive sector is quite small. But in the case of other sectors it is not clear that there is an obvious and significant bias. Once the share of land is taken into account, for example, it is not obvious that the labor share in agriculture is significantly lower than in manufacturing (Mundlak et al., 2008). So the three-fold difference in average labor productivities between manufacturing and agriculture does point to large gaps in marginal productivity.

That such intersectoral productivity gaps are a feature of underdevelopment can be seen by observing that they tend to diminish as a result of sustained economic growth. Figure 3 uses data from a broad range of countries to show how productivity gaps (measured by the coefficient of variation of the log of sectoral labor productivities) decline over the course of development. (All data here, unless otherwise identified, come from the Timmer and de Vries, 2009, dataset). The countries in the sample range on the income scale from the United States to India. The relationship between the size of intersectoral productivity gaps and per-capital income is negative and statistically highly significant. One way to interpret this is to note that the movement of labor from low-productivity to high-productivity activities would be accompanied, under diminishing marginal products, with convergence in economy-wide marginal labor productivities. In other words, structural change produces – or has the potential to produce – productivity convergence both within the economy and with richer economies.

In this lecture, I wish to analyze the contribution of broad patterns of structural change to overall economic growth in a cross-section of countries, including Turkey. My focus is not on reallocation within manufacturing, on which a number of important and interesting studies have appeared of late (e.g., Hsieh and Klenow 2009). As insightful as these studies are, they may sometimes be also misleading to the extent that they leave out of the analysis the dynamics of labor flows in and out of manufacturing. For example, what looks like impressive productivity performance within manufacturing may take on a somewhat different interpretation if the productivity gains come at the expense of labor flowing out of manufacturing into less productive sectors. The focus in this analysis is squarely on the general equilibrium of the whole economy.

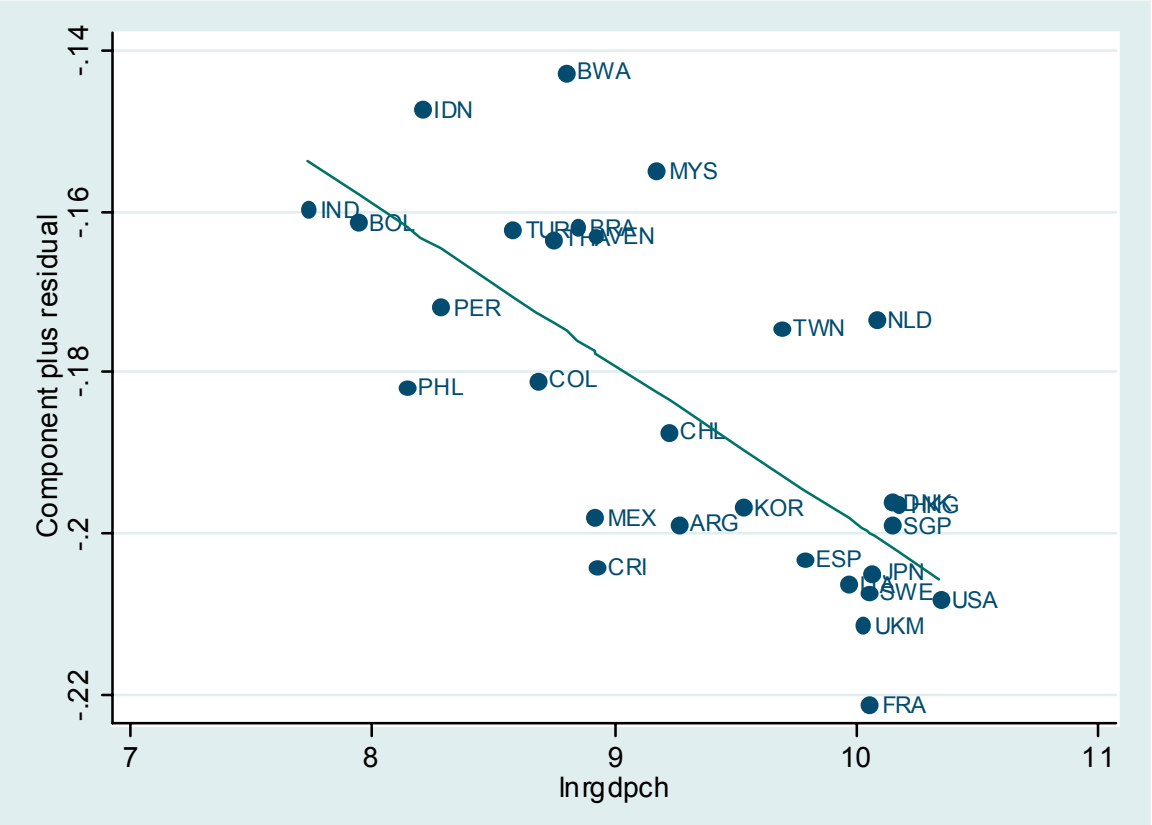


Figure 3:

Coefficient of variation of (log) sectoral labor productivity against per-capita income

A comparative look at structural change

Labor productivity growth can be achieved in one of two ways. First, productivity can grow within existing economic activities through capital accumulation or technological change. Second, labor can move from low-productivity to high-productivity activities, increasing overall labor productivity in the economy. This can be expressed using the following decomposition:

(1) $$\Delta P_t = \sum_{i=n} \theta_{i,t-k} \Delta p_{i,t} + \sum_{i=n} p_{i,t} \Delta \theta_{i,t}$$

where P_t and $p_{i,t}$ refer to economy-wide and sectoral labor productivity levels, respectively, and $\theta_{i,t}$ is the share of employment in sector i. The Δ operator denotes the change in productivity or employment shares between t-k and t. The first term in the decomposition is the weighted sum of productivity growth within individual sectors, where the weights are the employment share of each sector at the beginning of the time period. I will call this the "within" component of productivity growth. The second term captures the productivity effect of labor re-allocations across different sectors. It is essentially the inner product of productivity levels (at the end of the time period) with the change in employment shares across sectors. When changes in employment shares are positively correlated with productivity levels, this term will be positive. Structural change will increase economy-wide productivity growth. I will call this second term the "structural change" term.

The analysis is carried out using labor productivity and employment data from Timmer and de Vries (2009), converted to common units at PPP dollar exchange rates. The economy is divided into 9 sectors, as shown in Table 1. The Timmer and de Vries data set covers 27 countries: nine from Latin America, nine from developing Asia, and nine high-income countries. (More details on the data and methods can be found in McMillan and Rodrik, forthcoming.) This data set does not include Turkey, so I have supplemented it with data from the Turkish Statistical Institute.

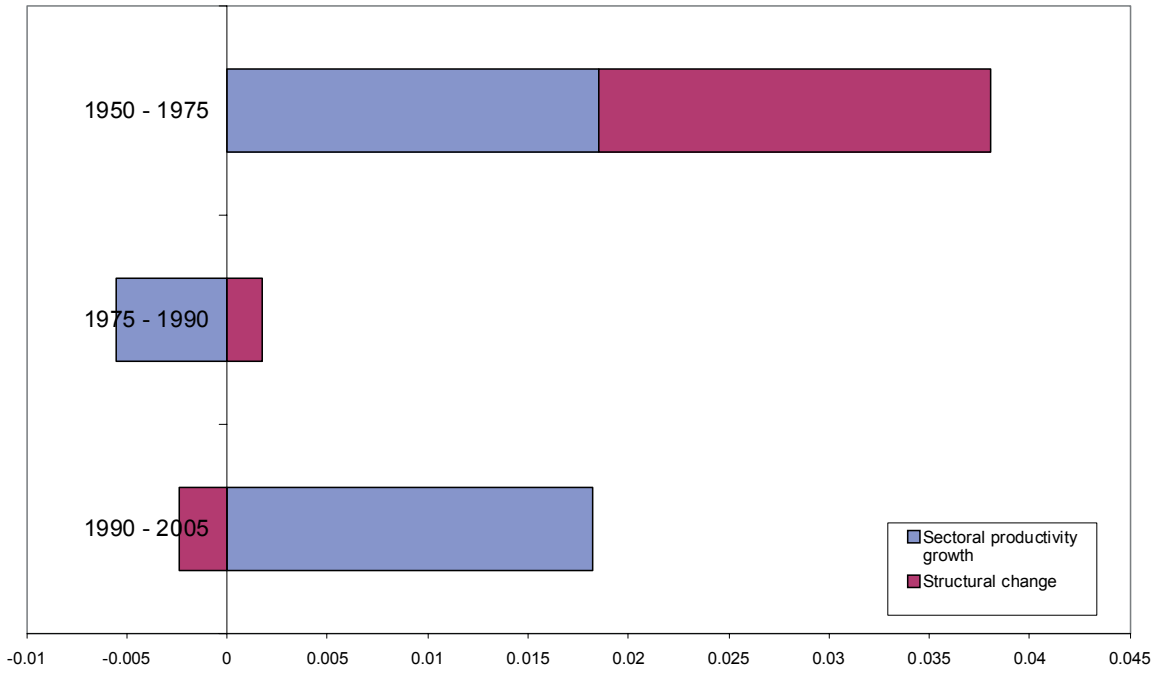
Table 1:
Sectoral Disaggregation

	Sector	Full name
1	AGR	Agriculture
2	MIN	Mining
3	MAN	Manufacturing
4	PU	Public utilities
5	CON	Construction
6	WRT	Wholesale & retail trade
7	TSC	Transport & communication
8	FIRE	Finance & business services
9	CSPSGS	Government & public services

The decomposition above clarifies how partial analyses of productivity performance within individual sectors (e.g., manufacturing) can be misleading when there are large differences in labor productivities ($p_{i,t}$) across economic activities. In particular, a high rate of productivity growth within an industry can have quite ambiguous implications for overall economic performance if the industry's share of employment shrinks rather than expands. If the displaced labor ends up in activities with lower productivity, economy-wide growth will suffer and may even turn negative.

Consider the experience of Latin America since the 1950s. When the Inter-American Development Bank recently analyzed the pattern of productivity change in the continent, using the same Timmer and de Vries data and a very similar decomposition, it uncovered a striking result, depicted in Figure 4. Between 1950 and 1975, Latin America experienced rapid (labor) productivity growth of almost 4 percent per annum, roughly half of which was accounted for by structural change. Then the region went into a debt crisis and experienced a "lost decade," with productivity growth in the negative territory between 1975 and 1990. Latin America returned to growth after 1990, but productivity growth never regained the levels seen before 1975. This is due entirely to the fact that the contribution of structural change has now turned negative. The "within" component of productivity growth is virtually identical in the two periods 1950-1975 and 1990-2005 (at 1.8 percent per annum). But the structural change component went from 2 percent during 1950-1975 to -0.2 percent in 1990-2005, an astounding reversal in the course of a few decades.

Productivity decomposition in Latin America across different periods (annual growth rates)



Source: Pages et al., 2010.

Şekil 4:

This is all the more surprising in light of the commonly accepted view that Latin America's policies and institutions improved significantly as a result of the reforms of the late 1980s and early 1990s. Argentina, Brazil, Mexico, Chile, Colombia, and most of the other economies got rid of high inflation, brought fiscal deficits under control, turned over monetary policy to independent central banks, eliminated financial repression, opened up their economies to international trade and capital flows, privatized state enterprises, reduced red tape and most subsidies, and gave markets freer rein in general. Those countries which had become dictatorships during the 1970s experienced democratic transitions, while others significantly improved governance as well. Compared to the macroeconomic populism and protectionist, import-substitution policies that had prevailed until the end of the 1970s, this new economic environment was expected to yield significantly enhanced productivity performance.

The sheer scale of this reversal in the contribution of structural change has been masked by microeconomic studies that record significant productivity gains for individual plants or industries, and further, find these gains to be strongly related to post-1990 policy reforms. In particular, study after study has shown that the intensified competition brought about by trade liberalization has forced manufacturing industries to become more productive (see for example Pavcnik 2000, Paus et al. 2003, Cavalcanti Ferreira and Rossi 2003, Fernandes 2007, and Esclava et al. 2009). A key mechanism that these studies document is what's called "industry rationalization:" the least productive firms exit the industry, and remaining firms shed "excess labor."

The question left unanswered is what happens to the workers that are thereby displaced. In economies which don't exhibit large inter-sectoral productivity gaps, labor displacement would not have important implications for economy-wide productivity. Clearly, this is not the case in Latin America. The evidence in Figure 4 suggests instead that displaced workers may have ended up in less productive activities. In other words, rationalization of manufacturing industries may have come at the expense of inducing growth-reducing structural change.

Figure 4 provides interesting new insight on what has held Latin American productivity growth back in recent years, despite apparent technological progress in many of the advanced sectors of the region's economies. But it also raises a number of questions. In particular, was this experience a general one across all developing countries (including Turkey), and what explains it? If there are significant differences across countries in this respect, what are the drivers of these differences?

First, let us take a broad comparative look. Figure 5 compares Latin America's (LAC) post-1990 performance to two other groups, Asian countries (ASIA) and high-income countries (HI). We note that these decompositions are not identical to those undertaken in Pages et al. (2010), but they yield similar results.[1] In particular, the structural change term is still negative for Latin America (and in fact larger in absolute value). High-income countries have a small (and slightly negative) structural change component. This is largely as expected, since productivity gaps become less important over the course of economic development, as discussed previously.

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[1] We fixed some data discrepancies and used a 9-sector disaggregation to compute the decomposition rather than IDB's 3-sector disaggregation. See McMillan and Rodrik (forthcoming) for more details.

More striking and important is the difference with Asia, where the structural change component is decidedly positive. When countries are ranked by the contribution of the "within" component, five Latin American countries are in the top ten. But in the ranking by the "structural change" component, only two Latin American countries (Costa Rica and Mexico) make the top ten, and are ranked ninth and tenth respectively (see the Appendix for the rankings). Indeed, the bulk of the difference in productivity performance between Asia and Latin America is accounted for by the difference in the contribution of structural change.[2]

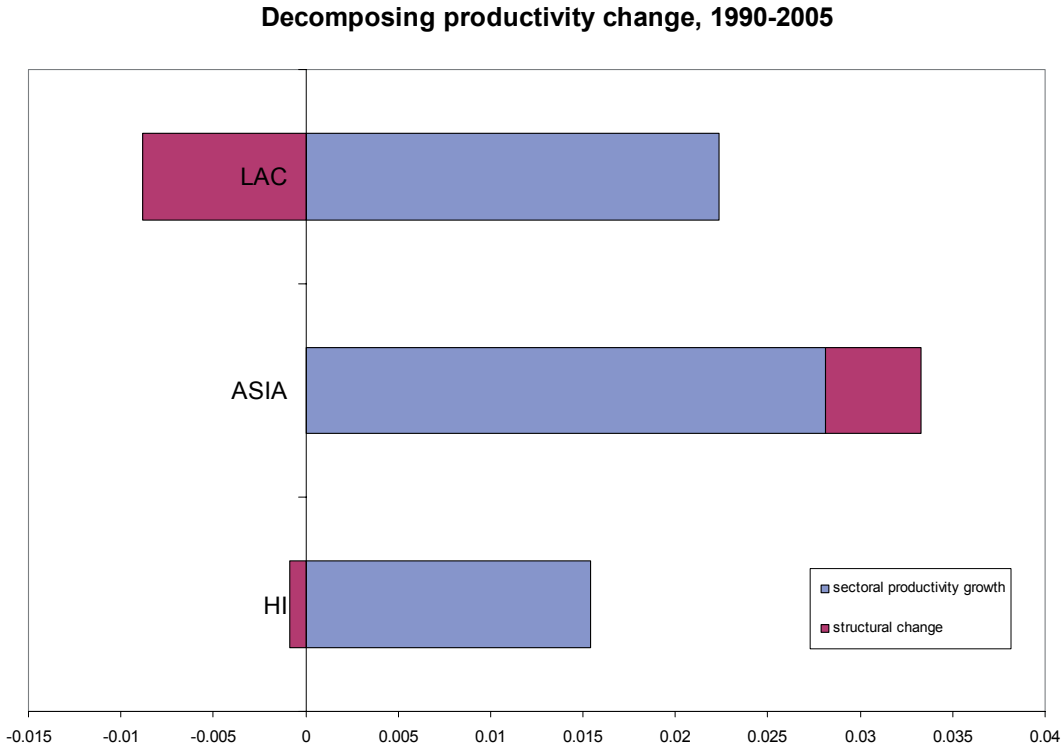


Figure 5:

A comparison of different groups of countries

To put some numbers on this last point, consider that Asia's labor productivity growth outperformed Latin America's during 1990-2005 by around 2 percentage points (Table 2). Of this, 0.6 percentage points (or 30%) is accounted for by differences in the "within" component, and a full 1.4 percentage points (70%) by differences in the contribution of structural change. Once again, we reach a striking conclusion with respect to the importance of structural change in explaining differences in the patterns of growth. We saw above that the decline in the contribution of structural change was a key factor behind the deterioration of Latin American productivity growth since the 1960s. We now see that the same factor accounts for the lion's share of Latin America's under-performance relative to Asia.

[2] *Note that regional averages are based on unweighted country data. For averages weighted by country GDPs, see Figure A.1 in the Appendix. Weighted data show a very slight positive term for Latin America, but once again there is a very large difference with Asia where the structural term is many times larger.*

Table 2:
Decomposing the difference between Latin America and Asia

1990-2005	overall productivity growth	"within" component	Structural change
ASIA	% 3,33	% 2,81	% 0,52
LAC	% 1,35	% 2,24	% -0,88
Difference	% 1,98	% 0,57	% 1,40

We can gain further insight into these results by comparing specific countries. The next four figures (Figs. 6-9) show sectoral detail for two Latin American and two Asian countries. For each country, we plot the (end-period) relative productivity of sectors ($p_{i,t}$) against the change in their employment share ($\Delta\theta_{i,t}$) between 1990 and 2005. As noted above, a negative structural change term implies that the correlation between these two is negative and the regression line of the scatter plot will have a negative slope. The employment share of each of the sectors is indicated by the size of the bubble representing the sector.

Argentina shows a particularly clear-cut case of growth-reducing structural change (Figure 6). The sector with the largest relative loss in employment is manufacturing, which also happens to be the largest sector among those that are more productive than the average. Most of this reduction in manufacturing employment took place during the 1990s, under the Argentine experiment with hyper-openness. Even though the decline in manufacturing was halted and partially reversed during the recovery from the financial crisis of 20010-2002, this was not enough to change the overall picture for the 1990-2005 period. By contrast, the sector experiencing the largest employment gain is community, personal, and government services, which has a high level of informality and is among the least productive. Hence the sharply negative slope of the Argentine scatter plot.

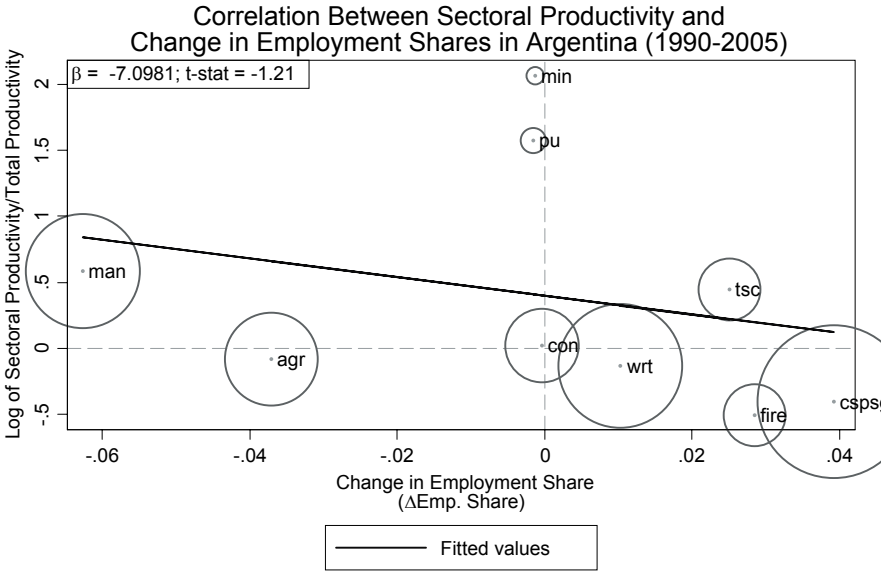


Figure 6: Argentina

*Note: Size of circle represents employment share in 1990
**Note: β denotes coeff. of independent variable in regression equation:
ln(p/P) =α + βΔEmp. Share
Source: Author's calculations with data from Timmer and de Vries (2007)

Brazil shows a somewhat more mixed picture (Figure 7). The collapse in manufacturing employment (relatively speaking) was not as drastic as in Argentina, and it was somewhat counterbalanced by the even larger contraction in agriculture, a significantly below-average productivity sector. On the other hand, the most rapidly expanding sectors were again relatively unproductive non-tradable sectors such as personal and community services and wholesale and retail trade. On balance, the Brazilian slope is slightly negative, indicating a small growth-reducing role for structural change.

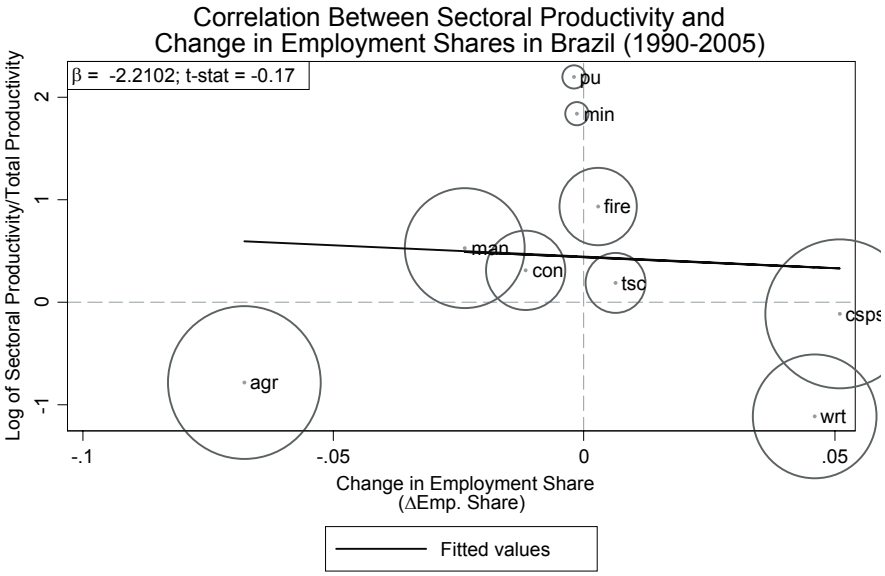
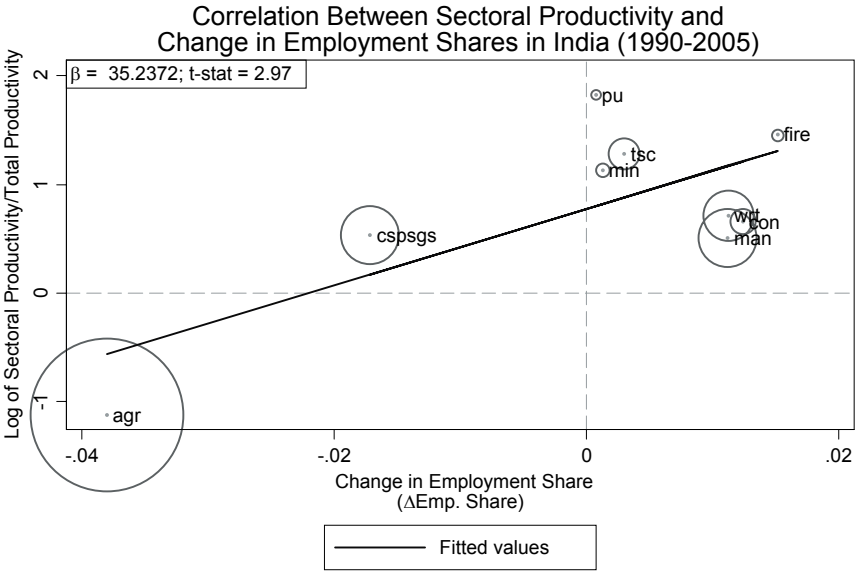


Figure 7: Brazil

*Note: Size of circle represents employment share in 1990
**Note: β denotes coeff. of independent variable in regression equation:
ln(p/P) =α + βΔEmp. Share
Source: Author's calculations with data from Timmer and de Vries (2007)

Compare these cases to India, which has experienced significant growth-enhancing structural change since 1990. As Figure 8 shows, labor has moved predominantly from very low-productivity agriculture to modern sectors of the economy, including notably manufacturing. India is the poorest country in our sample, so its experience need not be representative. But another Asian country, Thailand, shows very much the same pattern (Figure 9). In fact, the magnitude of structural change in Thailand has been phenomenal, with agriculture's employment share declining by some 20 percentage points and manufacturing experiencing significant gains.



*Note: Size of circle represents employment share in 1990
**Note: β denotes coeff. of independent variable in regression equation:
ln(p/P) = α + βΔEmp. Share
Source: Author's calculations with data from Timmer and de Vries (2007)

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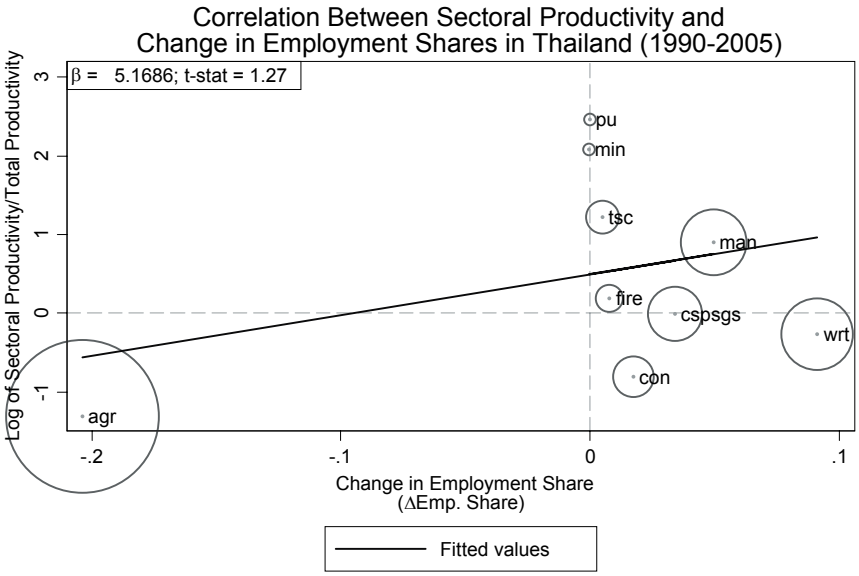
Hindistan



*Note: Size of circle represents employment share in 1990
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ln(p/P) = α + βΔEmp. Share
Source: Author's calculations with data from Timmer and de Vries (2007)

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Not all Asian countries have this kind of pattern. South Korea and Singapore, in particular, look more like Latin American countries in that high-productivity manufacturing sectors have shrunk in favor of some relatively lower-productivity service activities. But in both of these cases, very rapid "within" productivity growth has more than offset the negative contribution from structural change. That has not happened in Latin America.

How does Turkey fare in comparison? The answer is not that badly at all.[3] Even though Turkey has followed many of the same policies that Latin America adopted in the 1990s (freer trade and capital mobility in particular), it has experienced a substantial amount of growth-enhancing structural change. The decomposition for Turkey is shown in Figure 10 for two periods, 1990-2005 and 1999-2008. The first of these corresponds to the period covered by the other countries in the sample, while the latter covers the last decade. In both periods, the contribution of structural change has been significant: 1.4 (45%) and 2.0 (38%) percent respectively. These numbers are among the highest recorded for the sample of countries covered here (see Table A.2 in the Appendix).

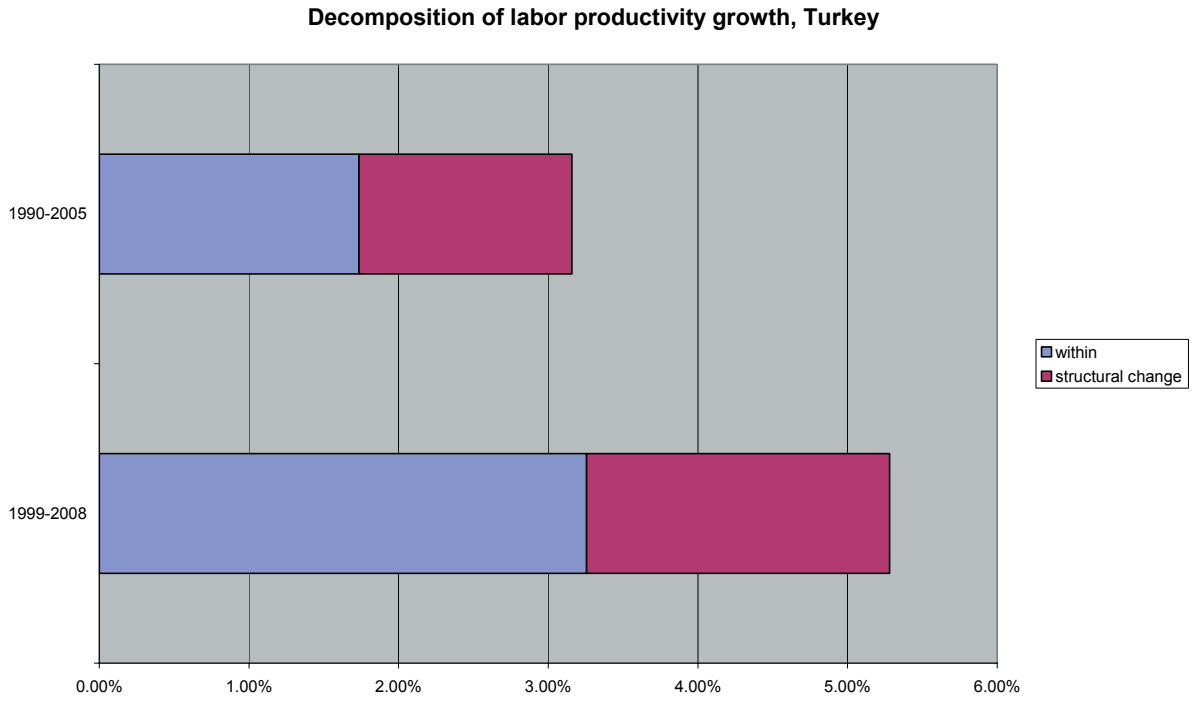
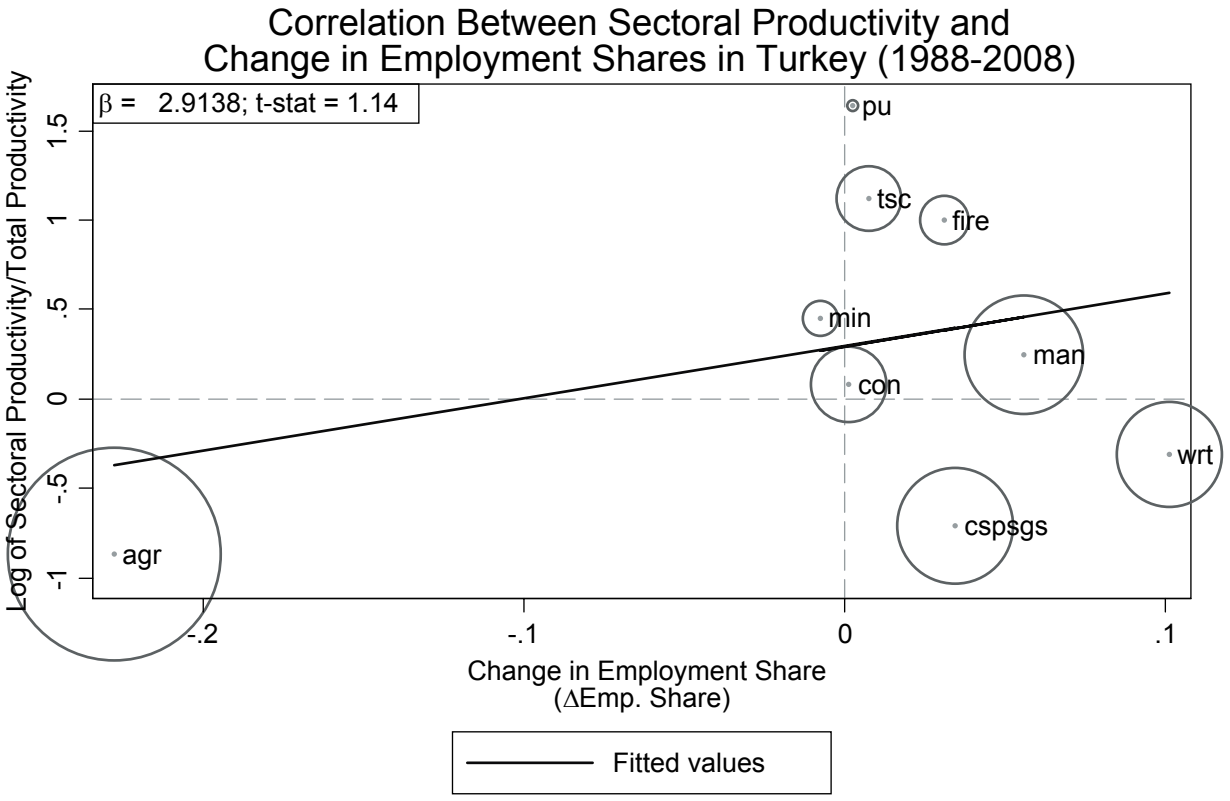


Figure 10

The bubble graph for Turkey shows the sectoral detail (Figure 11). As in Thailand and India, the Turkish story is mainly one of labor movement out of agriculture into other, more productive areas of the economy. Unlike what has happened in Latin America, manufacturing has continued to absorb an increasing share of the economy's labor force. On the other hand, some low-productivity service industries have also expanded (community and personal services and wholesale and retail trade).

[3] *See Altug et al. (2006) for a long-term perspective on productivity growth in Turkey, which also includes an agriculture-industry decomposition along the lines undertaken her.*



*Note: Size of circle represents employment share in 1988
**Note: β denotes coeff. of independent variable in regression equation:
$\ln(p/P) = \alpha + \beta \Delta$Emp. Share
Source: Authors' calculations with data from the Turkish Statistical Institute

Figure 11:
Sectoral detail for Turkey

Explaining Differences Across Countries

What explains the variety in performance that we observe in our sample of countries? There are four types of explanations that come to mind. First, richer countries may have less room for productivity-enhancing structural change, since their inter-sectoral productivity gaps are smaller to begin with. Second, countries where labor markets are more rigid – where labor hiring or firing restrictions are more binding in particular – may find it more difficult and costly to experience rapid structural change. Third, countries with a comparative advantage in resource or primary sectors may have a more difficult time moving labor from such sectors to more productive and dynamic sectors such as manufacturing. Fourth, trade/industrial/currency policies may play a role insofar as they discourage new tradable activities and expose manufacturing industries to import competition too early and excessively. I provide some preliminary evidence on each of these potential determinants.

There are suggestions in the data that all but the first of these forces may be at work in explaining the differences between the Latin American versus Asian patterns. Differences in levels of development do not seem to play a role because the Asian countries in our sample are on average richer than Latin American countries to begin with. So everything else equal, we would expect less productivity-enhancing structural change in Asia, not more. Furthermore, the dispersion in inter-sectoral productivity levels is virtually identical in the two regions. So the reasons for differences between the two regions must be sought elsewhere, in the other three types of explanations.

I have regressed the contribution of structural change for each country on proxies for comparative advantage, trade/currency practices, and labor market regulations. For comparative advantage, I use the share of a country's exports that is raw materials. For trade/currency practices, I use a measure of the undervaluation of a country's currency, based on a comparison of price levels across countries (after adjusting for the Balassa-Samuelson effect; see Rodrik 2008). And for labor market policies, I use the employment rigidity index from the World Bank's World Development Indicators data base. I find that all three of these enter the regression with the expected sign and are statistically significant. I have also tried various other specifications and included a range of additional variables, including demographic indicators, a dummy for Latin American countries, and tariff levels. But none of these additional regressors have turned out to be significant. The export-structure variable and the undervaluation index remain consistently significant, while the labor market rigidity index drifts in and out of significance depending on the specification.

Figures 12-14 display the partial correlation plots associated with this regression. The structural change component of labor productivity growth is sharply decreasing in the raw materials share of exports and rising in the level of undervaluation. These two relationships are estimated quite tightly (with robust t-statistics above 3), as can be seen from the figures. In other words, countries that are in the best position to exploit structural change for growth are those that tend to export manufactured products and have competitive exchange rates. Asian countries have benefited on both accounts, while Latin American countries have been disadvantaged. As Figure 14 reveals,

the relationship with the rigidity of employment index is not as strong (the coefficient estimate is barely significant around the 90% threshold). But there is some suggestion in the data that countries that make it harder for enterprises to hire and fire workers may pay a penalty in terms of the contribution of structural change to productivity growth.

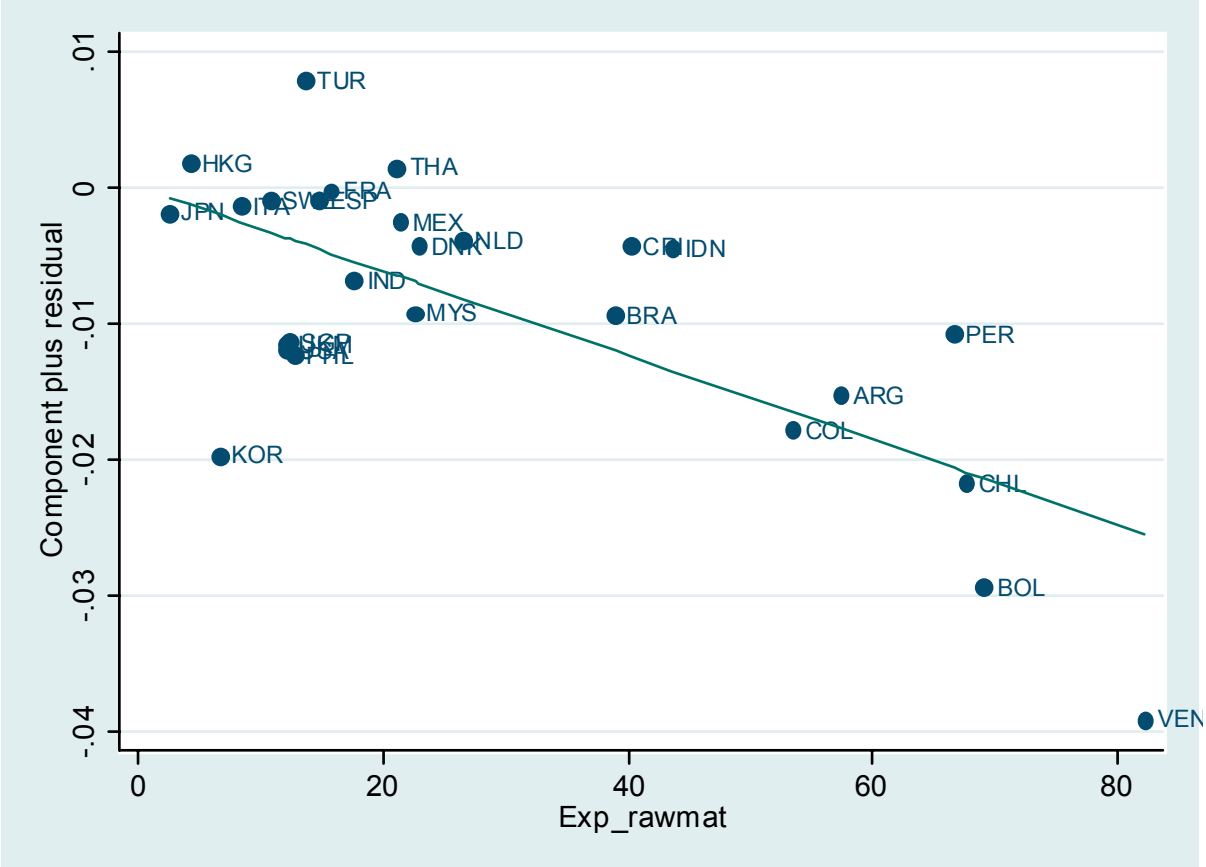


Figure 12:

The partial relationship between the raw materials share of exports and the structural change component

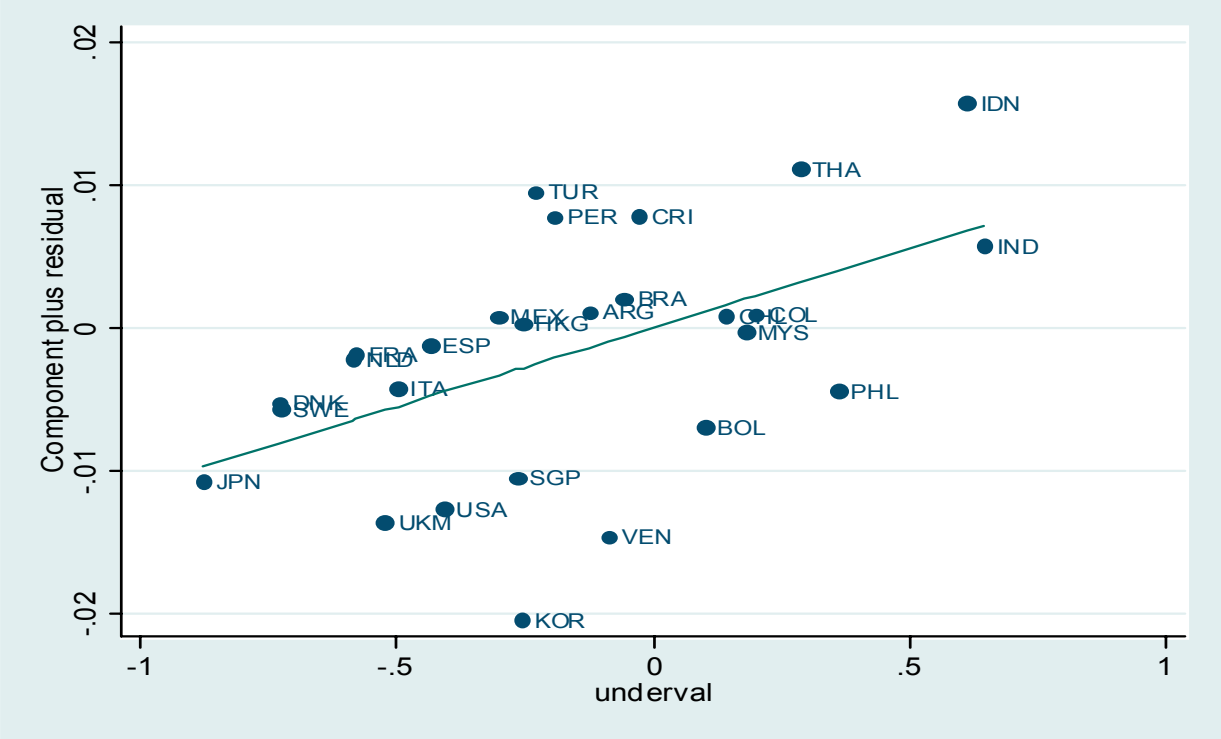


Figure 13:
The partial relationship between undervaluation and the structural change component

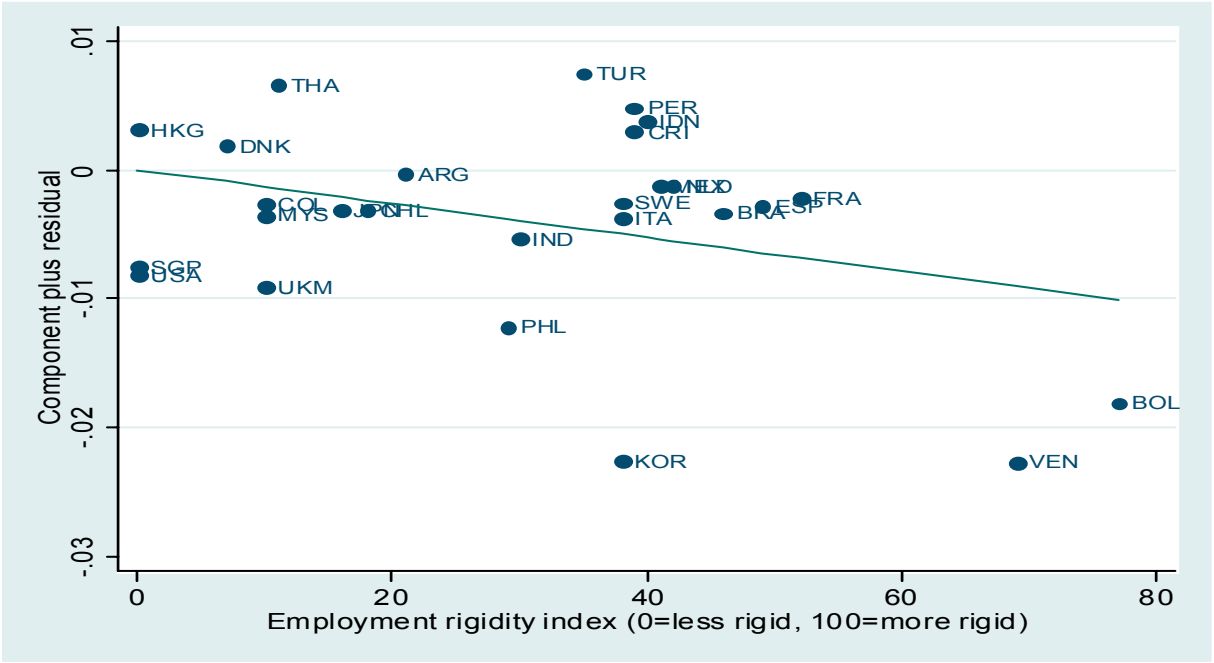


Figure 14:
The partial relationship between employment rigidity and the structural change component

Concluding comments

Large gaps in labor productivity between the traditional and modern parts of the economy are a fundamental reality of developing societies. In this lecture, I have documented these gaps, and emphasized that labor flows from low-productivity activities to high-productive activities are a key driver of development. The results show that the decline in Latin America's growth and its under-performance relative to Asia have a common cause: very poor performance in terms of structural change. Strikingly, since 1990 structural change has become growth-reducing in the representative Latin American country.

Turkey looks decidedly more Asian than Latin American in terms of the positive contribution that structural change has made to overall labor productivity growth. It is also encouraging that the structural change component has actually increased in size more recently (compare the 1990-2005 numbers to the 1999-2008 numbers in Figure 10), even though its share in overall growth has fallen somewhat.

It will be important for rapid, productivity-enhancing structural change to be sustained in order for Turkey to maintain its high rate of economic growth. This may become more difficult over time, however, as the rate at which manufacturing is expanding employment has slowed down and many of the services that are growing are not as productive. This is an important challenge that Turkish economic growth will face in coming years.

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Appendix

Figure A.1:

Productivity comparisons with weighted regional averages

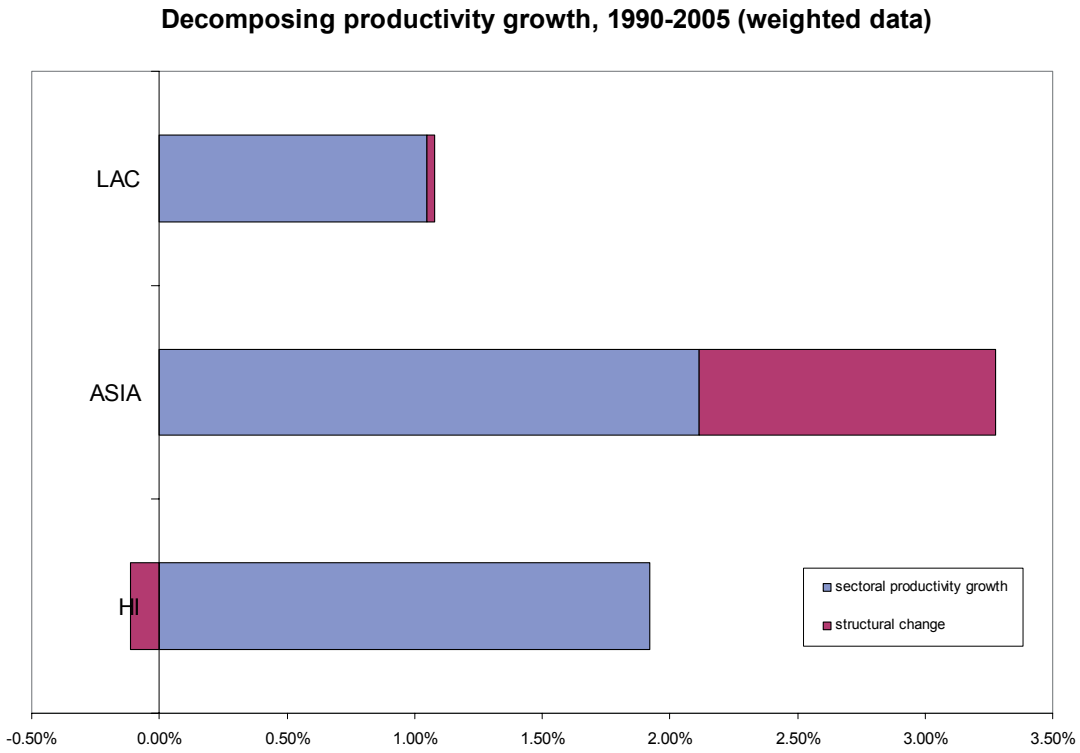

Table A.1:
Countries ranked by the contribution of the "within" component

Country	Region	Total	Within	Structural
KOR	ASIA	0.038972	0.052947	-0.013975
PER	LAC	0.034072	0.038536	-0.004465
CHL	LAC	0.029252	0.03G205	-0.008953
SGP	ASIA	0.037079	0.037853	-0.000775
MYS	ASIA	0.040816	0.035871	0.004946
TWN	ASIA	0.039907	0.03448	0.005427
BOL	LAC	0.008808	0.033657	-0.024849
IND	ASIA	0.042316	0.032409	0.009906
VEN	LAC	-0.003542	0.032048	-0.03559
ARG	LAC	0.023534	0.029429	-0.005896
HKG	ASIA	0.03272	0.020182	0.012538
TUR	TURKEV	0.031586	0.017353	0.014233
IDN	ASIA	0.027799	0.017228	0.010571
THA	ASIA	0.030511	0.013835	0.016676
CRI	LAC	0.0125	0.008725	0.003775
MEX	LAC	0.01067	0.008339	0.002331
PHL	ASIA	0.009455	0.00809	0.001365
BRA	LAC	0.004444	0.006957	-0.002513
COL	LAC	0.001849	0.00529	-0.00344
ETH	AFRIGA	0.018733	0.003935	0.014798

Table A.2:
Countries ranked by the contribution of the "structural change" component

Country	Region	Total	Within	Structural
THA	ASIA	0.030511	0.013835	0.016676
ETH	AFRIW	0.018733	0.003935	0.014798
TUR	TURKEV	0.031586	0.017353	0.014233
HKG	ASIA	0.03272	0.020182	0.012538
IDN	ASIA	0.027799	0.017228	0.010571
IND	ASIA	0.042316	0.032409	0.009906
TWN	ASIA	0.039907	0.03448	0.005427
MVS	ASIA	0.040816	0.035871	0.004946
CRI	LAC	0.0125	0.008725	0.003775
MEX	LAC	0.01067	0.008339	0.002331
PHL	ASIA	0.009455	0.00809	0.001365
SGP	ASIA	0.037079	0.037853	-0.000775
BRA	LAC	0.004444	0.006957	-0.002513
COL	LAC	0.001849	0.00529	-0.00344
PER	LAC	0.034072	0.038536	-0.004465
ARG	LAC	0.023534	0.029429	-0.005396
CHL	LAC	0.029252	0.038205	-0.008953
KOR	ASIA	0.038972	0.052947	-0.013975
BOL	LAC	0.008808	0.033657	-0.024849
VEN	LAC	-0.003542	0.032048	-0.03559