Determinants of Labor Productivity: An Empirical Investigation of Productivity Divergence

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Abstract:

This paper investigates the determinants of labor productivity growth using a cross country panel data set of 45 countries for the period of 1980-2005. The results reveal the positive and significant role of education, ICT investment, financial depth and FDI for labor productivity growth. However, increase in labor force participation, employment in agriculture sector and price volatility impacts the productivity growth negatively. On the basis of long term structural determinants, we find that divergence in labor productivity across different income groups and regions can be explained by diversity in ICT investment, human capital, financial depth and employment distribution in different sectors.

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I: Introduction:

This study intends to identify the potential determinants of labor productivity for developing and emerging economies belonging to different income groups. There are studies in literature which focused on the same question (Bourles et al 2007, Belorgey et al, 2006 and Gust and Marquez 2004),But these studies mainly investigate the impact of information and communication technology development for productivity growth for the panel of highly developed economies. Their main aim is to explain the productivity differential between Europe and US. Moreover most of above mentioned studies covered the period of 1992-2001. There are various countries specific case studies exploring the determinant of labor productivity growth in a particular country (Dixon and Macdonald 1992, Brandolini et al 2001 and Rice et al 2006).Our focus is not just on the role of ICT for labor productivity growth but also on other socio economic indicators which are essential for labor productivity growth. Moreover we are interested in exploring the factors behind the productivity differential across different groups of countries and regions in the world.

In this study we use the cross country panel of 45 countries to find out the determinants of labor productivity (output per worker) during the time period of 1980-2005. Our hypothesis is that different explanatory variables behave in a different manner for the economies belonging to different income groups. To empirically test this hypothesis we applied the cross country fixed effects panel estimation approach on annual data for the period of 1980-2005.

We find that the increase in labor force participation rate impacts the labor productivity growth negatively and confirms the diminishing returns. There is presence of conditional "convergence" in our sample countries. We also find that role of ICT investment in labor productivity growth is positive and significant in short run as well as in long run. Empirical analysis by different income groups showed that in lower and middle income

2

economies the impact of urbanization is positive while it is not significant for high income group economies. Similarly, impact of openness and gross capital formation is not same for all income groups. Long term structural analysis of determinants of apparent labor productivity levels in 2005, emphasize on the role of human capital, financial sector development, stable macroeconomic indicators, ICT investment and employment distribution in different sectors of the economy.

Our findings suggest that factors which are mainly responsible for poor labor productivity performance in developing and lower income economies of south Asia and Africa are high share of employment in agriculture sector, low ICT expenditure, low level of education, high inflation rate and low financial development.

Our findings confirm that labor productivity diversity between Europe and USA can be explained by low ICT investment, education level and financial depth in Europe as compared to US. The comparison between Europe and Eastern European countries show that low level of labor productivity in Eastern Europe is explained by low level of ICT investment, high share of agricultural employment; high inflation and low level of financial depth and FDI as compared to European economies.

This paper will proceed in a following manner. Section II discusses the labor productivity growth across countries and regions during the period of 1980-2005. Empirical estimation of potential determinant of labor productivity growth is examined in section III. Section IV is about the estimation of long run structural determinants of labor productivity level in 2005. In section V, we apply the findings of our long run determinants of labor productivity to figure out the factors responsible for differential in labor productivity across regions. Finally the last section presents summary of findings and suggests policy measures to boost the labor productivity in low income developing economies.

II: Examining Labor Productivity across Regions:

In this section, we present the labor productivity growth across different regions for the period of 1980-2005. There is a divergence in productivity growth among different regions of the world. Although the productivity growth varies across different regions, but within the regions, there is reasonable diversity with regard to productivity growth. In *South America*, Chile showed impressive and consistent increase in labor productivity. Peru also performed well but Ecuador performance remained poor and its productivity level in 2005 is lower than in 1980s. Other economies like Brazil, Colombia have seen slight increase in productivity over the last decade. In south east and East Asian region, all selected economies registered increase in productivity level during 1990s.

In *East Asia*; all economies in region were more or less on equal growth path until 1993, after that China productivity growth increased more rapidly than other economies. Korea also performed well but rapid increase in China's productivity can be attributed to catching up with other economies in the region as China has lower initial productivity level in the region. In south East Asia, there has been an upward trend in productivity since 1990 but that was at moderate pace .i.e. slower than other Asian sub region and more than from developing economies see figure P1 in appendix.

South Asian region has seen improvement in terms of productivity growth since 1990. The productivity levels vary considerably between countries. India has managed to increase its output very fast compared to Pakistan, Sri Lanka and Bangladesh .India manage to increase output produced by per person employed by more than 75 percent during 1990-2005. Pakistan and Sri Lanka started well in early 1990s but than in late 1990s entered into period of productivity decline. Pakistan revived again but Sri Lanka's productivity has stagnated since 1998. Bangladesh showed slow and gradual increase in labor productivity during the same time period.

In *Middle East and North Africa*, labor productivity in selected economies showed mixed trends. There has been steady upward trend in Egypt and Tunisia, a declining trend in Syria since 1998 and volatile pattern in Morocco. *Africa* is the only region that had seen decrease in labor productivity since 1990. Productivity level in 2005 is lower than in 1980. Only Tanzania, Nigeria and South Africa showed slight increase in productivity level after 2001.

III: Empirical Estimation:

To find out the main determinant of labor productivity in developing and emerging economies during 1980-2005, we estimated the following model for a cross country panel of 45 countries belonging to different income group economies see table A1 for sample countries list.

$$LP_{i,t} = \alpha_i + \beta_1 Part_{it} + \beta_2 ipey_{it} + \beta_3 ICT_{it} + \beta_4 Inf_{it} + \beta_5 GCF_{it} + \beta_6 FDI_{it} + \beta_7 Urb_{it} + \partial_{it} + \varepsilon_{it}$$

Where i represent country and t is time period. LP denotes the labor productivity growth, measured as GDP per employed person; Part is change in labor force participation measured as ratio of employed labor force to total population. , ipey is an initial level of labor productivity in an economy. ICT is information and communication technology expenditure as percentage of GDP, Inf is inflation rate, GCF is gross capital formation, FDI is foreign direct investment and Urb is percentage of urban population in total population. ∂_{it} is country specific fixed effects. These fixed effects allows for different labor market institutions and cultural and social norms across countries. The detailed description and source of data set is presented in table A2 in appendix. Descriptive statistics of data by income group and correlation matrix between different explanatory variables is also presented in table A3 and A4 in appendix.

We estimated this model by using fixed effects panel approach and results are presented in table 1. In first column, we look at the impact of increase in labor force participation rate on labor productivity. The impact is significant and negative as expected as it reflects

the entry of unskilled and inexperienced labors in the workforce. In model 2, we introduced more explanatory variables in our estimated model which can affect the labor productivity growth. The inclusion of these explanatory variables for testing their impact on labor productivity growth is justified in literature by Levine and Renelt (1992), Mankiv et al (1992) and Barro and Sala-i-Martin (1995).

We find that initial labor productivity variable is significant and negative which reflects the conditional convergence in per capita productivity growth in our sample countries. The impact of urbanization, foreign direct investment and gross capital formation is positive and significant. The high level of urbanization in an economy reflects that employed people are more engaged in non farm activities. Most probably they are working in services or industrial sectors which are suppose to be sectors with high labor productivity as compared to agriculture sector (high underemployment in agriculture). We will check the impact of employment in different sectors on labor productivity in next section of this paper. Inflation rate coefficient is negative and significant as price volatility in an economy leads to low investment and economic growth.

The role of ICT for labor productivity growth is captured by the ICT expenditure as percentage of GDP. The data for this variable is not available for all economies in our sample and is available from 2000 onward. As a result one can notice the significant change in number of observations in model 3. The impact of ICT is positive and significant[1] .This finding is in consonance with previous studies findings (Oliner and Sichel 2002, Roeger 2001 and Gust and Marquez 2004). In the last specification in model 4, we exclude the variable of gross capital formation from the model as it may also include the investment on ICT. The results remain the same.

To test whether these explanatory variables behave differently for the economies at different stage of economic development, we re-estimate the same model but now for economies belonging to different income groups see table 2. We find that the impact of

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[1] We are used other ICT indicators (Hardware investment, software investment) in place of ICT expenditure to check the robustness of its role. The results remain the same.

increase in labor force participation is negative and significant for all income groups. One thing to note is that as we move from high income group to low income group economies the absolute value of LFPR coefficient become large. This indicates the high level of productivity loss with more participation in low income economies as compared to highly developed countries. It is may be because of low level of skill and education, and more employment in agriculture sector in low income developing countries as compared to high income economies.

Table 1: Determinants of Labor Productivity (1980-2005)

Dependent variable is growth in Labor Productivity(GDP/Employed)				
	Model 1	Model 2	Model 3	Model 4
Change in LFPR	-0.705***	-0.695***	-0.570***	-0.537***
	(0.056)	(0.107)	(0.076)	(0.078)
Initial level of Prod	-0.02	-0.150***	-0.310*	-0.390**
	(0.035)	(0.052)	(0.176)	(0.179)
Inflation		-0.002***	-0.040**	-0.054***
		(0.00)	(0.019)	(0.019)
Openness		0.02	0.018	0.133***
		(0.032)	(0.059)	(0.051)
Gross Capital Formation		0.223***	0.351***	
		(0.048)	(0.100)	
ICT expenditure			0.837***	0.999***
			(0.276)	(0.281)
Foreign Direct Investment		0.066		
		(0.047)		
Urbanization		0.148***		
		(0.045)		
Constant	2.025***	-9.431***	-3.328	1.246
	(0.623)	(1.989)	(4.261)	(4.178)
Hausman Test		50.82	28.89	
P – value		0.00	0.001	
Number of Countries	45	45	40	40
Number of observations	1170	1076	231	231
R^2	0.127	0.225	0.318	0.272

Robust standard errors are presented in parenthesis below the coefficient values.
*** represent statistical significant at 1 percent, ** significance at 5 percent and * at 10 percent.

The coefficient of initial level of labor productivity is negative and significant in all income groups, showing convergence within these groups. Inflation rate impact is

negative and significant in all income groups. Gross Capital formation is positive for high income economies but not significant while for rest of all three income groups its coefficient value is positive and significant. Openness which is measured as imports of goods and services as percentage of GDP has different impact for economies belonging to different income groups. Its effect is positive for high and upper middle income economies but is significant only for upper middle income economies. However for lower middle income and lower income economies the impact is negative and is significant only for lower income economies. This negative effect in low and developing economies may be explained by the large share of consumer's goods in their imports contrary to capital and investment goods. FDI impact is positive and significant in all income groups except lower middle income economies. The coefficient value is the highest in low income economies as compared to other groups.

Table 2: Determinants of Labor Productivity (1980-2005)

Dependent variable is growth in Labor Productivity (GDP/Employed)				
	High Income Economies	Upper Middle Income Economies	Lower Middle Income Economies	Lower Income Economies
Change in LFPR	-0.350***	-0.599**	-0.887***	-1.601**
	(0.09)	(0.206)	(0.127)	(0.512)
Initial level of Prod	-0.161**	-0.590**	-0.508***	-1.274***
	(0.055)	(0.196)	(0.165)	(0.252)
Inflation	-0.207***	-0.002	-0.002***	-0.029
	(0.046)	(0.001)	(0.00)	(0.026)
Gross Capital Formation	0.05	0.219	0.260***	0.269**
	(0.077)	(0.121)	(0.077)	(0.08)
Openness	0.039	0.134*	-0.028	-0.138**
	(0.026)	(0.068)	(0.058)	(0.051)
Foreign Direct Investment	0.017	0.383**	0.121	0.491***
	(0.013)	(0.149)	(0.286)	(0.087)
Urbanization	0.05	0.108	0.226***	0.267**
	(0.048)	(0.119)	(0.054)	(0.108)
Constant	2.685	-5.798	-8.292**	-4.205*
	(3.251)	(7.114)	(3.452)	(2.132)
Number of Countries	13	10	14	8
Number of observations	328	228	338	182
R^2	0.232	0.263	0.357	0.363

Robust standard errors are presented in parenthesis below the coefficient values.
*** represent statistical significant at 1 percent, ** significance at 5 percent and * at 10 percent.

We also have applied the dynamic panel GMM model to capture the impact of any endogeneity and measurement error in the model. The results remain very similar. We choose to go further in our analysis with the fixed effects panel model because otherwise it would not be possible to do analysis by income groups because of small sample size in different categories.

IV: Log Run/Structural Determinants of Productivity:

This section focuses on the analysis of determinants of labor productivity levels in 2005. It is a static model which pays attention on the long run determinants of labor productivity. The method used here is OLS regression on productivity level of a given particular year and does not include the time dimension. If we take the values of all the determinants in the same year they may create simultaneity bias as its possible that they are reflecting the country's level of development in that particular year (Belgory et al 2004). To deal with this issue, where suitable, we take the long run averages of the explanatory variables. So our model for estimation will become like this

$$LP_{i2005} = \alpha_0 + \beta_1 * L_i + \beta_2 * E_i + \beta_3 * HC_i + \beta_4 * ICT_i + \varepsilon$$

Where i is number of countries, LP is the labor productivity (GDP/Employed) level in 2005, E is the vector of determinants related to labor markets which include labor participation and employment in different sectors of the economy, E is vector of economic explanatory variables which include inflation and foreign direct investment and financial depth which is measured as ratio of public credit to private as percentage of GDP , HC is human capital which is measured by the average years of schooling for the population 15 years old and above and ICT is software investment and its data is taken from Jorgensen data set.

The estimation results for the factors responsible for labor productivity level in 2005 are presented in table 3. This table explains the structural factors which are responsible for

the difference in productivity level among 40 countries belonging to different income groups and regions in the world. Results in table 2 shows the labor market indicators are very important in determining the difference in labor productivity *.Labor force participation rate* impact is negative as we already found in panel analysis. Moreover, the high share of *employment in agriculture* is responsible for low level of labor productivity. Negative impact of agricultural employment on labor productivity explains the low level labor productivity in case of most developing and low income economies from South Asia and Africa. Industrial's employment impact is positive but not significant and high *employment in services* sector leads to high productivity, as an implication of this finding we can see that in most developed economies and European region, services sector is responsible for more than 2/3rd of total employment.

Impact of *education* is positive and significant and explains reasonable share of differences in productivity between high income economies and low income economies. A country's economic indicators emerge as significant determinants of labor productivity; *inflation* has negative impact on productivity as it raises the uncertainty level in economy and which hinders investment, *financial depth* has positive and significant impact on labor productivity as it promotes efficient allocation of financial resources in productive channels, and *foreign direct investment* measured by net inflows of foreign capital has positive significant impact on productivity level. As FDI has not only direct effects through inflow of capital but also has spillover by bringing modern technology and providing training to domestic labor force in host country.

Impact of average ICT spending measured by average software investment during 1990-2005, is positive and significant. We also used average per capita ICT expenditure and hardware investment as a proxy for contribution made by ICT, results remain the same. ICT role in labor productivity is significant and positive and is responsible for productivity differences across countries.

Table 3: Labor Productivity in 2005

Dependent variable is GDP per employed person in 2005

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Labor force Participation Rate						
(2005)	0.516***	-0.265***	-0.223***	0.079	-0.346**	-0.403***
	(0.063)	(0.071)	(0.090)	(0.190)	(0.142)	(0.075)
Inflation						
(average of 1995-2005)		-0.103	-0.093	-0.083	-0.12*	-0.055
		(0.065)	(0.072)	(0.079)	(0.07)	(0.068)
Financial depth						
(avg of 1995-2005)		0.137***	0.119***	0.084**	0.116***	0.134***
		(0.038)	(0.036)	(0.037)	(0.045)	(0.042)
Education						
(Avg of 1970-2000)		4.037***	3.65***	2.750***	3.198***	2.642***
		(0.691)	(0.741)	(0.822)	(0.972	(0.798)
Foreign direct Investment						
(Avg 1995-2005)		0.652*	0.853***	0.707*	0.808***	0.701**
		(0.343)	(0.302)	(0.356)	(0.325)	(0.33)
ICT expenditure						
software investment						
(Average 2000-2005)			0.027**	0.028***	0.031***	0.025**
			(0.011)	(0.01)	(0.012)	(0.01)
Agriculture Emp share						
(Avg 1995-2005)				-0.214**		
				(0.10)		
Industry Emp share						
(Avg 1995-2005)					0.376	
					(0.38)	
Services Emp share						
(Avg 1995-2005)						0.247**
						(0.094)
N	45	41	36	36	36	36
R-Square	0.64	0.90	0.91	0.92	0.91	0.92

Robust standard errors are presented in parenthesis below the coefficient values.
*** represent statistical significant at 1 percent, ** significance at 5 percent and * at 10 percent.

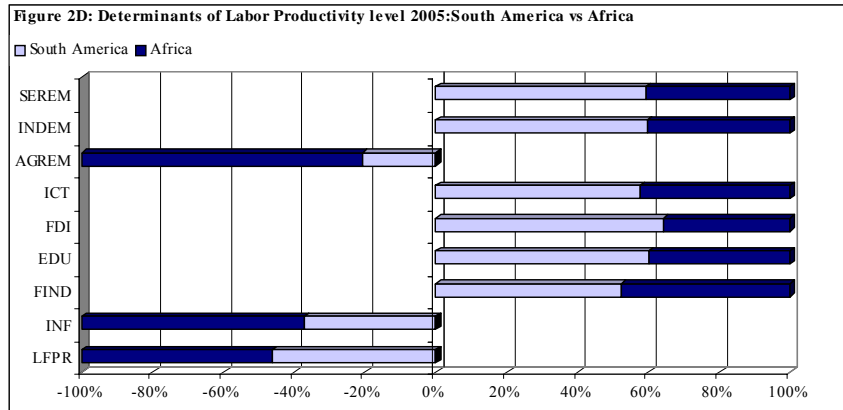**V: Explanation of Productivity disparity across Different Income Groups and Regions based on our Analysis:**
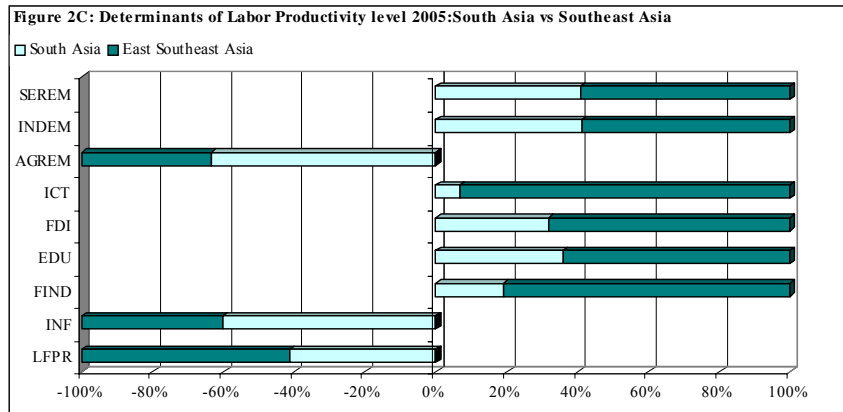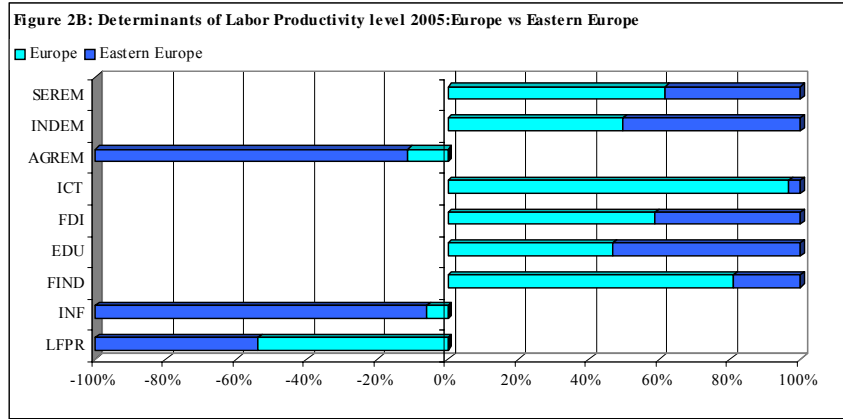
On the basis of findings of long term determinants of apparent labor productivity level in 2005, we evaluate the basis of productivity differences among the economies belonging to different income groups. Comparison is presented in figure 1 below. We find that LFPR's impact on productivity is negative for all income groups. Volatility in price level hurt labor productivity in all economies but upper middle income economies and lower income economies really suffered from this as compared other income groups. The major productivity difference between high income economies group and other economies is explained by the significant role played by ICT investment. Similarly the lowest productivity in low income economies is explained by the highest share of agriculture sector in total employment. Low level of education, financial depth and foreign direct investment are other factors which contribute towards lower labor productivity performance of low income economies see figure 1.

Figure 1: Determinant of Labor Productivity by Income Group in 2005
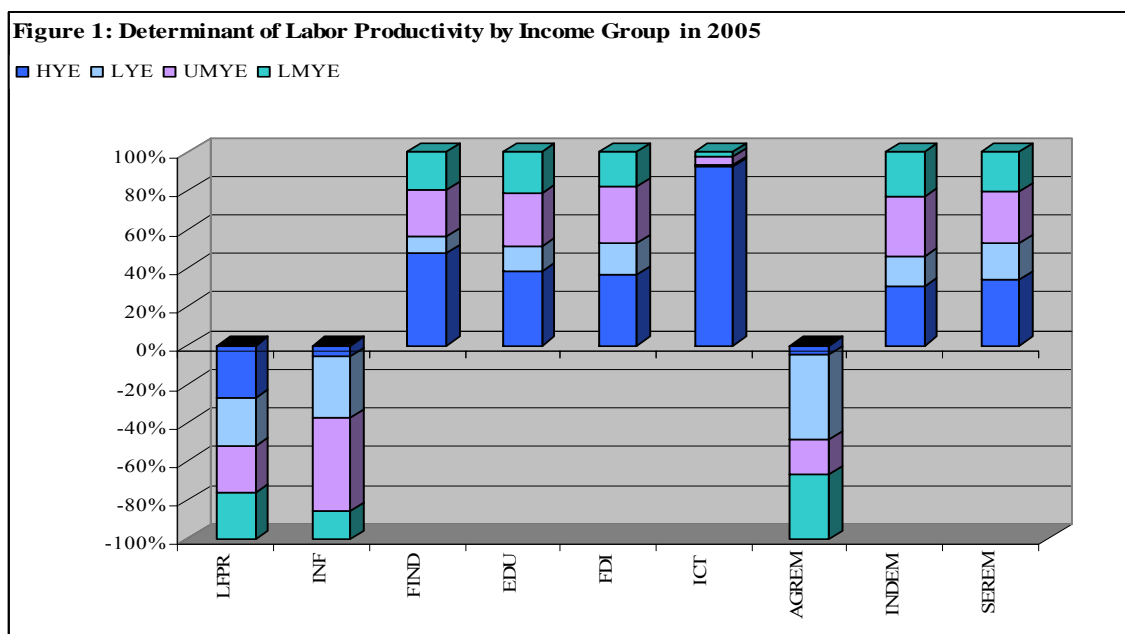
The regional level comparisons highlight some interesting facts further.

- The most discussed topic in literature is the difference in labor Productivity performance between United States and Europe (Netherlands, Spain, France, Belgium, Italy and United Kingdom). Our analysis of long term determinants of labor productivity shows that major contribution towards productivity difference between them is explained by the ICT investment. These findings are in consonance with findings in literature (Bart et al 2003, Belorgy et al 2006, and Jorgenson 2007). Financial depth, education and employment in different sectors are other important factors which explain the differences in labor productivity between United States and Europe see figure 2A.

- The comparison between Europe and Eastern European countries show that low level of labor productivity in Eastern Europe is explained by low level of ICT investment, high share of agricultural employment; high inflation and low level of financial depth and FDI as compared to European economies see Figure 2B. The education level in eastern economies is quite reasonable in Eastern Economies.

- From comparison perspective, another region of interest is the comparison of labor productivity performance of Eastern and Southeastern Asian economies with South Asia. The high growth in south eastern economies is often referred as "*Economic Miracle*" in literature (Krugman 1994, Bloom and Williamson 1998).In figure 2C, one can notice that in South Asian economies (Pakistan, India, Bangladesh and Sri Lanka), low labor productivity performance is mainly due to high agricultural employment, low level of education, financial depth, FDI and ICT investment as compared to Eastern and Southeast Asian economies.

Figure 2: Regional Comparison of Determinants of Labor Productivity level in 2005

Figure 2A: Determinants of Labor Productivity level 2005:Europe vs USA

Figure 2B: Determinants of Labor Productivity level 2005:Europe vs Eastern Europe

Figure 2C: Determinants of Labor Productivity level 2005:South Asia vs Southeast Asia

Figure 2D: Determinants of Labor Productivity level 2005:South America vs Africa

14
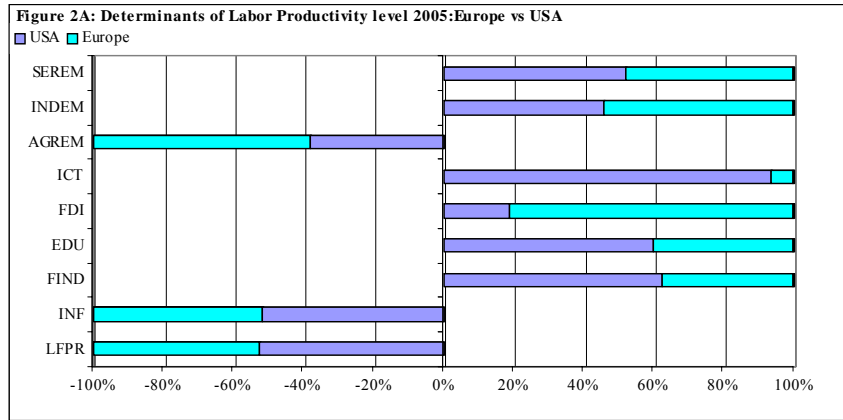
- Sub-Sharon African economies comparison with South American economies (Argentina, Brazil, Peru, Ecuador, Colombia and Chile) is presented in figure 2D. High level of inflation, labor participation and agricultural employment impact negatively labor productivity in African economies. The performance of South American economies in all indicators which affects the long term labor productivity is far better as compared to African economies.

The comparison among different regions of the world also highlights that ICT investment, employment distribution in different sectors, financial depth and education level explains the major differences in apparent labor productivity level in 2005.

VI: Conclusion:

We analyzed the determinants of labor productivity for the group of 40 countries, representing four different income groups in the world. This study confirms the diminishing return to labor force participation rate both in short run as well as in the long run. We find that negative impact of increased labor force participation is high in lower and lower middle income economies compared to high income and upper middle income economies. Similarly we find that process of urbanization impacts the labor productivity growth significantly and positively in lower and lower middle income group economies. The role of ICT is positive and significant for all income groups.

Long term analysis of labor productivity shows that disparity between labor productivity across different income groups and regions of the world are well explained by the diversity in the education level, employment distribution in different sectors, financial depth and ICT investment. The lower income economies are trapped in low labor productivity mainly because of high share of employment in agriculture sector, low financial sector development, poor level of education, high volatility in prices and meager level of ICT investment.

This analysis suggests that the difference in labor productivity between *European countries and the United States* is mainly because of high ICT investment, high financial depth and education level in the USA as compared to Europe. Similar analysis across different regions provides explanation for labor productivity differences around the world.

On the basis of above analysis, economic policy recommendations for different regions are as following.

To reduce the productivity gap between the USA and Europe, there is need to increase the skill level and average education attainment in working age population in European economies along with the increase in ICT related investment. These two potential measures are interdependent as ICT use requires high skilled labor as compared to use of other techniques in production.

Eastern European economies can reduce the labor productivity gap with the Western Europe by producing more employment in non farm activities, attracting foreign direct investment, controlling price level and emphasizing more on ICT diffusion in production process.

Africa and South Asian countries (except India) performance in labor productivity is not very encouraging. Labor productivity level in 2005 in sub Saharan African economies was the lowest among all regions. For South Asian and African Economies, there is need to pay more attention on average education attainment level, producing productive employment in non farm activities, to attract FDI, increase financial depth and ICT investment .But foremost priority should be the increase in education and training of working age population because without this all other measures will not be achievable.

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Appendix:

Table A1: List of Countries in sample by income level and by level of Development

List of Countries in sample by income Groups				Development			
High Income Economies	**Upper Middle Income Economies**	**lower middle income economies**	**lower income Economies**	**Developed Economies**	**Developing Economies**		
Australia	Bulgaria	China	Bangladesh	Australia	Albania	China	Bangladesh
Belgium	Argentina	Colombia	India	Belgium	Argentina	Colombia	India
Canada	Brazil	Ecuador	Kenya	Canada	Brazil	Ecuador	Kenya
France	Chile	Egypt	Madagascar	France	Chile	Egypt	Madagascar
Italy	Malaysia	Indonesia	Nigeria	Hungary	Malaysia	Indonesia	Bulgaria
Hungary	Mexico	Morocco	Pakistan	Italy	Mexico	Morocco	Poland
Japan	S Africa	Peru	Tanzania	Japan	South Africa	Peru	Romania
Netherlands	Turkey	Philippines	Zambia	Netherlands	Turkey	Nigeria	
New Zealand	Poland	Sri Lanka	Zimbabwe	New Zealand	Philippines	Pakistan	
South Korea	Romania	Syria		South Korea	Sri Lanka	Tanzania	
Spain		Thailand		Spain	Syria	Zambia	
UK		Tunisia		UK	Thailand	Zimbabwe	
USA		Albania		USA	Tunisia		

Table A2 : Description of Data and its sources

Variable	Variable description	Source
LP	GDP per employed person	Groningen Growth and Development Centre
LFPR	Employed to total population ratio	Groningen Growth and Development Centre
Urb	Urban population (% of total)	World Development Indicators
FDI	Foreign direct investment, net inflows (% of GDP)	World Development Indicators
Serem	Employment in services (% of total employment)	World Development Indicators & Key Indicators of Labor Market 2005
Indem	Employment in industry (% of total employment)	World Development Indicators & Key Indicators of Labor Market 2005
Agrem	Employment in agriculture (% of total employment)	World Development Indicators & Key Indicators of Labor Market 2005
Financial depth	Domestic credit to private sector (% of GDP)	World Development Indicators
INF	inflation: consumer prices % annual	World Development Indicators
SWI	software investment quantity (discounted by quality-adjusted price index)	Jorgenson data
Edu	average years of schooling total population(15+)	Barro and Lee
Open	openness: imports of goods and services as % of GDP	World Development Indicators
ICT	Information and communication technology expenditure (% of GDP)	World Development Indicators

Figure A1: Growth in output per person employed in different regions 1980-2005 (selected Economies, Index 1990=100).

Growth in output per person employed in Africa (selected economies,index 1990=100)

Legend: Kenya, Madagascar, Nigeria, South Africa, Tanzania, Zambia, Zimbabwe

Growth in output per person employed in South Asia (selected economies,index 1990=100)

Legend: Bangladesh, India, Pakistan, Sri Lanka

Growth in output per person employed in Europe (selected economies,index 1990=100)

Legend: Belgium, France, Italy, Netherlands, Spain, United Kingdom

Growth in output per person employed in East and South East Asia (selected economies,index 1990=100)

Legend: China, Indonesia, Japan, Malaysia, Philippines, South Korea, Thailand

Growth in output per person employed in Middle East and North Africa (selected economies,index 1990=100)

Legend: Egypt, Morocco, Syria, Tunisia

Growth in output per person employed in South America (selected economies,index 1990=100)
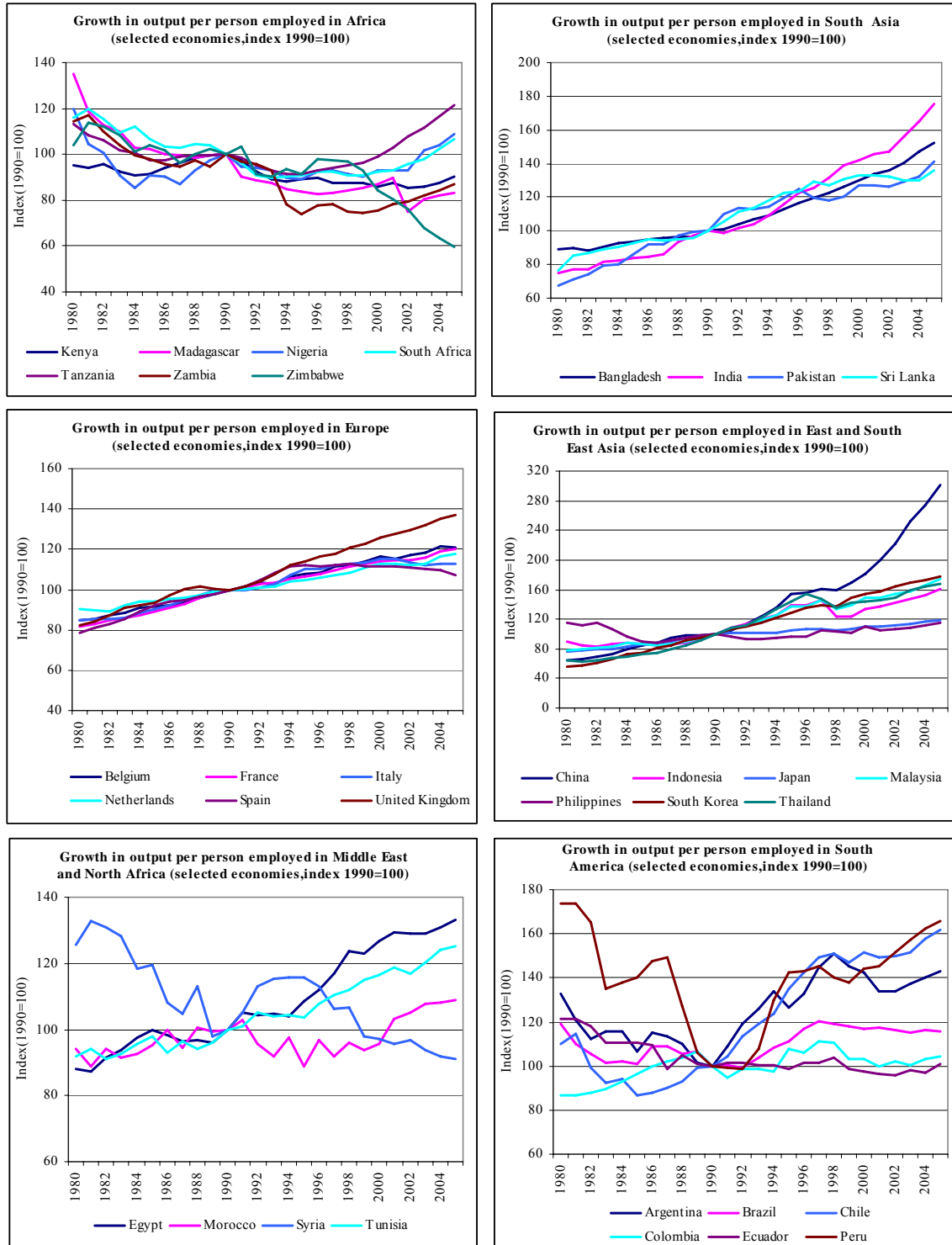
Legend: Argentina, Brazil, Chile, Colombia, Ecuador, Peru

Table A3: Descriptive Statistics by Income Groups

Table A3: Descriptive Statistics by Income Groups

High Income Economies					
Variable	Obs	Mean	Std. Dev.	Min	Max
Labor Productivity Growth	338	1.74	1.93	-6.00	10.53
Initial level of labor Productivity	338	36.95	10.31	11.46	61.92
Participation rate growth	338	0.35	1.75	-9.25	5.08
Inflation	338	5.17	5.22	-0.90	34.23
Information and Communication Technology Expenditure	78	6.67	1.67	3.70	11.24
Gross Capital Formation	333	22.92	4.58	15.64	39.73
Openness	333	30.97	17.44	6.94	84.80
Foreign Direct Investment	333	2.65	6.47	-4.70	92.67
Urbanization	338	76.97	9.84	56.70	97.20
Upper Middle Income Economies					
Labor Productivity Growth	260	1.41	4.74	-13.49	21.90
Initial level of labor Productivity	260	15.03	5.48	4.82	29.93
Participation rate growth	260	0.13	2.58	-13.68	8.82
Inflation	242	114.27	383.22	-1.17	3079.81
Information and Communication Technology Expenditure	60	5.75	1.99	2.82	9.86
Gross Capital Formation	247	22.62	6.02	8.12	43.64
Openness	240	30.26	21.64	4.63	104.46
Foreign Direct Investment	235	2.29	2.35	-0.67	12.00
Urbanization	260	66.55	12.93	42.00	90.10
Lower Middle Income Economies					
Labor Productivity Growth	364	1.86	5.22	-27.87	20.43
Initial level of labor Productivity	364	9.67	4.61	2.12	25.62
Participation rate growth	364	0.64	2.37	-13.90	12.29
Inflation	338	49.97	447.65	-3.85	7481.66
Information and Communication Technology Expenditure	72	4.73	1.89	1.03	8.92
Gross Capital Formation	364	25.01	6.56	5.20	44.48
Openness	364	29.77	12.91	7.13	88.51
Foreign Direct Investment	352	1.56	1.53	-2.76	8.48
Urbanization	364	44.34	16.07	15.10	72.70
Lower Income Economies					
Labor Productivity Growth	208	0.08	4.24	-16.32	9.61
Initial level of labor Productivity	208	2.70	1.56	0.99	7.83
Participation rate growth	208	0.21	0.96	-6.11	3.62
Inflation	192	21.28	25.83	-1.22	183.31
Information and Communication Technology Expenditure	29	6.88	12.27	2.02	69.28
Gross Capital Formation	198	17.84	4.34	8.03	27.23
Openness	198	27.63	9.31	10.13	52.94
Foreign Direct Investment	196	1.32	1.83	-1.15	9.60
Urbanization	208	27.26	8.10	14.60	48.20

Table A4: Correlation Matrix for Explanatory Variables.

Table A4: Correlation Matrix for Explanatory Variables (N=1076)

	LP	Part	Inf	GCF	Open	FDI	Urb
labor Productivity (LP)	1.00						
Participation (Part)	-0.36	1.00					
Inflation (Inf)	-0.16	-0.03	1.00				
Gross Capital Formation (GCF)	0.32	0.10	-0.07	1.00			
Openness (Open)	0.09	0.03	-0.12	0.17	1.00		
Foreign Direct Investment (FDI)	0.06	0.04	-0.04	0.04	0.35	1.00	
Urbanization (Urb)	-0.02	0.02	0.07	-0.05	0.02	0.22	1.00

Correlation Matrix for Explanatory Variables including ICT (N=230)

Variables	LP	Part	Inf	ICT	GCF	Open	FDI	Urb
labor Productivity (LP)	1.00							
Participation (Part)	-0.41	1.00						
Inflation (Inf)	-0.18	-0.07	1.00					
ICT expenditure (ICT)	-0.07	0.01	-0.03	1.00				
Gross Capital Formation (GCF)	0.46	0.12	-0.26	-0.17	1.00			
Openness (Open)	0.13	0.06	-0.10	-0.05	0.16	1.00		
Foreign Direct Investment (FDI)	-0.02	0.10	-0.06	0.05	0.01	0.34	1.00	
Urbanization (Urb)	-0.18	0.05	-0.17	0.49	-0.16	0.07	0.29	1.00