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ABSTRACT

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The aim of this paper is to analyse the possible trade-off between employment and productivity using panel data on world economies, developed and developing. We begin with the importance of productivity growth for developing countries, followed by a brief discussion of the concept of productivity and how it is measured. We discuss the concept of "decent work" and provide an index to measure decent work, and study its changes over time. First we provide some simple descriptive statistics and then carry out an econometric investigation using alternative estimation techniques. Our broad results suggest that there is a trade-off between employment and productivity.

JEL Classification: O11, O47, O17

Keywords: employment, productivity, trade-off, economic development

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Is there a trade-off between employment and productivity?[1]

1. Introduction

After the onset of the recent global recession most countries have faced a serious problem of providing employment for the population of their countries. For the richer OECD countries, the post war period of high employment and low unemployment had come to an end with a sudden crash. However, for most of the less developed countries the problem of low employment, poor wages, and insecure employment was a continuing problem. The aim of this paper is to analyse the evidence for a trade-off between employment and productivity.

The OECD countries are now facing severe austerity programs that are leading to high unemployment, lower wages, and job insecurity. In some of the less developed countries (e.g. China and India) growth has slowed down and employment although still rising has also slowed down. An important question that has been discussed is whether the growth of employment in the less developed countries has been in vulnerable employment or informal labour markets, so-called "bad jobs".

In our study, we review some of the literature on growth and development. Most studies of economic development have found that, in general, economies begin as mainly agricultural economies and then become industrialised on the basis of manufacturing industries that are mainly low-tech, for example, textiles, clothing and footwear. In developed economies, the manufacturing sector first increased (as did the share of employment in that sector) and then decreased as these economies developed. However, in a globalised world many of the mega corporations from the US, Europe and Japan have been investing in developing countries to produce (for example) motor cars, TVs, sound systems etc. The technology is provided by the industrial giants and low labour costs and favourable taxation conditions in Less Developed Countries (LDCs) encourage such moves. Generally, these mega corporations repatriate their profits to their home country or to a tax haven, so that these profits do not get recycled in the developing country and hence expanding aggregate demand. Over the past few decades some of these corporations have been hopping from one LDC to another, "footloose capitalists" (e.g. from South Korea, to Vietnam, to China, etc.) as labour costs rise or because "tax

[1] I am grateful to C.Y. (Jenny) Wong for excellent research assistance for this project. Helpful comments from Dr Iyanatul Islam and Dr Kazu Chatani from the ILO, and Professor Geoff Harcourt and Assoc. Professor Peter Kriesler from UNSW, have improved the paper. However, I am responsible for any remaining errors.

holidays" come to an end. India has provided an unusual pattern of development where there has been a move from agricultural production to the service sector, especially in IT services (without an intervening period of moving to the industrial sector). There is evidence provided in the *OECD Employment Outlook 2007* that increased foreign competition has increased job instability, especially for workers with less tenure and low skills.

An important question from the perspective of "development" is whether these changes in the economic structures of these countries actually help the poor and low income groups. First, has there been an increase in overall employment as a result of this development? Has the increased growth in productivity led to an increase in overall employment or is there a trade-off? Secondly, is the growth of employment in these new activities in "good jobs"? That is, jobs that are using more skilled labour, provide security of full-time employment, work in a safe and healthy environment, etc. The International Labour Office (ILO) suggests that we should monitor four indicators: (i) labour productivity; (ii) the employment rate (employment to population ratio); (iii) working poverty; and (iv) "vulnerable" employment. These important questions are addressed in this research.

There has been much work done in recent years on studying the issue of a trade-off between employment and productivity, see for example, McMillan and Rodrik (Margaret S. McMillan and D. Rodrik, 2011). In a recent paper, Dew-Becker and Gordon (I. Dew-Becker and R.J. Gordon, 2012) find a "strong and robust negative correlation between the growth of labour productivity and employment per capita across the EU-15", (I. Dew-Becker and R.J. Gordon, 2012). This body of work is discussed in Section 2 below.

It is worth keeping in mind the caution from Stephen Durlauf, Paul Johnson and Jonathan Temple: *"More generally, nothing in the empirical growth literature suggests that issues of long-term economic development can be disassociated from the historical and cultural factors that fascinated commentators such as Max Weber."* (S. N. Durlauf et al., 2009). Some economists and geographers have argued that the long term productivity and development is determined by fundamental factors rooted in long term historical characteristics of populations that have been transmitted through generations. Some of these characteristics or traits may have been determined by the movement of peoples over different geographical, climatic areas which were affected by different biological conditions. Some of these issues are covered in an important paper, see (Enrico Spolaore and Romain Wacziarg, 2013).

Section 2 begins with a discussion of the definition of productivity, how it is measured, and some papers that attempt to decompose the growth of productivity into the component due to

productivity growth of individual sectors and the component due to the movement of factors of production from the slow productivity growth sectors to the faster productivity growth sectors.

Section 3 provides a discussion of what is meant by a "good job" and by "decent work". It argues that there are objective and subjective definitions. It also argues that a job may be a good job from an individual perspective but a bad job from a social perspective. It discusses the important concept of a "decent job" that was first proposed by the International Labour Organisation in 1999 and how this definition has been endorsed by the United Nations and other organisations. In this section, we provide statistical information on "vulnerable" employment, and then show how we create Decent Work Indexes". This is followed by estimates of Decent Work indexes for different regional groups. Section 4 of the paper then provides a brief review of the employment-productivity trade-off. Section 5 provides descriptive statistics on the changes in employment and productivity over the past few decades. Section 6 provides a detailed econometric analysis of the employment-productivity trade-off using Fixed Effects estimation, Instrumental Variables Fixed Effects estimation, and Generalised Method of Moments on Panel data. Section 7 provides a discussion of policies for the attainment of better conditions of employment and productivity growth. Section 8 concludes the paper. In general our results suggest that there is evidence for a trade-off between employment and productivity, that the investment and industrial production growth increase productivity growth, and the share of agriculture in GDP is negatively related to productivity growth.

2. What is productivity?

Productivity is a complex phenomenon. By productivity we mean the value of output produced by the factors of production (inputs). Often we look at labour productivity, that is, the value of output produced by the labour input. The labour input can be measured by the number of workers, or by the number of hours of work to produce that output. However, a better measure of productivity is called Total Factor Productivity (TFP). This measure tries to capture the value of all inputs (labour, capital, intermediate materials). Although a better measure, it is difficult to find data to enable us to produce meaningful estimates for most countries.

What determines the level and rate of change of productivity?[2] The level of productivity in a single firm or corporation depends on the capital employed, the labour employed, and the level of technology used in production. Capital is not a homogeneous commodity: capital goods embody the latest technology, so their "vintage" is important. Similarly, labour is heterogeneous: the level of education and skills (human capital) that the workforce has affects the productivity of the firm[3]. Further, if the workforce is healthy it would provide better labour services. Increasingly, we emphasise the importance of management skills in determining productivity. If workers are employed on a longer term contract (permanent rather than casual) they are likely to develop a relationship with the management and provide better and more efficient labour services. Although capital goods are important in determining productivity, often there are lags between the capital goods being installed and the improvements in productivity.

If we move from the level of the firm to the aggregate productivity of an entire economy, then the "whole is more than the sum of its parts". The productivity of one firm may depend on the productivity of other firms that are producing intermediate inputs for this firm. It may depend on the integration of the firm in the industry or the whole economy. There are benefits of agglomeration: if a set of firms are co-located they can benefit from the synergies of production. Similarly, the productivity of firms may depend on the efficiency (productivity) of the transport and communications system. A major problem in measuring aggregate productivity is that there is usually no independent method of measuring the productivity of the service sector. For example, the productivity of government services is simply measured by the labour input. Similarly, there has been a controversy about the measurement of the capital stock: is the aggregate measure of the capital stock independent of the distribution of income and wealth? Finally, aggregate productivity may depend on some "unobservables": trust in society, property rights, the legal and administrative structures, political conditions, and the economic framework.

Aggregate productivity depends on the productivity of the different sectors: agriculture, manufacturing, and the service sector. In general, agricultural productivity increases slowly, while manufacturing productivity tends to grow faster because of technological change, specialisation, learning-by-doing, economies of agglomeration, and static and dynamic

[2] See ILO (2004-2005) *World Employment Report*

[3] For a discussion about the problems of measurement of aggregate productivity, including the issue of the dispersion of firm level productivity, see **Syverson, Chad.** 2011. "What Determines Productivity?" *Journal of Economic Literature*, 49(2), 326-65. Also see **Banerjee, Abhijit and Esther Duflo.** 2005. "Growth Theory through the Lens of Development Economics," P. Aghion and S. N. Durlauf, *Handbook of Economic Growth.* Amsterdam: Elsevier Science, 473-552.

economies of scale. Hence, the larger share of the manufacturing sector the greater the likelihood of a faster growth in productivity as labour moves from a relatively low productivity sector (agriculture) to a higher productivity sector (manufacturing). For some countries, in recent years, the mining and resources sector has led to a dramatic increase in their growth, e.g. Kuwait, Brazil, Russian Federation, etc.

Aggregate productivity changes are driven by an increase in gross investment that embodies new technology, as well as general technological change that comes about with increased knowledge, innovation, and Research and Development. Aggregate productivity changes may be affected by the economic and social climate: is it conducive to innovations and investment, do entrepreneurs have confidence in the economy? This may depend on the political climate. Wars, floods, droughts, heat waves, famines may have long lasting effects on the level and rate of change of productivity.

Thus, in measuring and comparing aggregate productivity across different countries there are several issues: aggregation issues (aggregation over different industries and services, aggregation over different inputs); and changes in physical and human capital may lead to changes in productivity with some time lags.

Kaldor (Nicholas Kaldor, 1996, 1967) was a proponent of the importance of the manufacturing sector in promoting growth of aggregate productivity as it was a sector with technological change and increasing returns. The process of economic development consisted of the growth of the manufacturing sector with growing employment and a decline in employment in the lower productivity agricultural sector. Aggregate productivity growth is a combination of the productivity of different sectors, as well as the movement of labour from the low productivity agricultural sector to the other sectors (structural change).

These studies find that the major contributor to the growth of aggregate productivity, using a decomposition method, is the direct growth of productivity of the individual sectors, while the inter-sectoral reallocation (structural change) plays a relatively minor role (see below for a further discussion). It is worth noting that the mining sector may contribute significantly to the growth of productivity, but it makes only a marginal contribution to direct employment. Its contribution to overall employment is dependent on the inter-sectoral linkages and the impact of the increased incomes which lead to increased consumption and hence employment in other sectors. A sudden increase in the prices of mining products is likely to lead to an increase in the exchange rate (assuming that the country has a floating exchange rate) which leads to an increase in the real national income, which leads to increased aggregate demand. However, an increase in commodity prices that leads to an increase in the exchange rate is

likely to lead to a fall in exports of the manufacturing sector (Dutch Disease), which may counter balance the favourable effects mentioned above. For some LDCs, the mining sectors are owned by multinational corporations that tend to transfer large proportions of their profits to the "home" countries and as such have a smaller impact on employment. In addition, these mining corporations tend to import capital and intermediate goods from the developed countries so that the backward linkages are weak.

There have been many attempts to decompose the growth of productivity into the growth of productivity of each sector (weighted) and the inter-sectoral transfer of employment from one sector to another. One of the earliest such attempts was by Syrquin (Moshe Syrquin, 1986), followed by many others, (D. Kucera and L. Roncolato, 2012), (Margaret S. McMillan and D. Rodrik, 2011), (C. Pieper, 2000), (M. P. Timmer and G. J. de Vries, 2009). The method is based on simply using the definition of productivity growth and decomposing that into its components in an accounting sense.

Timmer and de Vries (M. P. Timmer and G. J. de Vries, 2009) find that the growth accelerations are largely explained by productivity increases within sectors, with market services and manufacturing being the major players. McMillan and Rodrik (Margaret S. McMillan and D. Rodrik, 2011) find that in Latin America and Sub-Saharan Africa as a result of globalisation, labour has moved from more productive activities to less productive activities. Pieper (C. Pieper, 2000) finds that if we look at the period between 1975 and 1984 ("pre-debt crisis period") and 1985 to 1993 ("post-crisis") and finds that the productivity growth of the industrial sector has the highest share of explaining the total variance of productivity growth. The paper finds that in Latin America and Sub-Saharan Africa there has been a process of productivity deindustrialisation. Kucera and Roncolato (D. Kucera and L. Roncolato, 2012) find that for Asia as a whole labour productivity growth is driven as much by services as by industry. The International Labour Organisation (International_Labour_Organisation, 2013) finds that productivity increases in industry have been particularly important in East Asia, whereas the service sector productivity increases have been more important for South Asia. Although structural change plays a less significant role compared to productivity increases in individual sectors, it has contributed significantly to economic growth in East Asia, South Asia, and South-East Asia and the Pacific and Sub-Saharan Africa. Not surprisingly, it finds that the global economic crisis has slowed down productivity growth in several regions.

3. Good Jobs and Decent Work

3.1 Some Definitions

A good job can be defined from the perspective of an individual or from the perspective of society[4]. From the perspective of an individual a good job is a well-paid secure job. From the perspective of societal welfare a job may have externalities: if it leads to jealousy or a feeling of unfairness for others then it may not be a good job. Again, a well-paid job (say) in a gambling house may benefit the employee, but if that work leads to increased gambling addiction, then society may not consider it a good job. The *World Development Report 2013* emphasises that if one person has a good job with perquisites (perks) but they may be less valuable to society if these perks were possible because of government transfers or restrictive regulations that undermine the earnings of other workers or job opportunities for others. From a societal point of view a good job is one that maximises societal welfare. This simply reinforces the argument that in most countries the wages paid do not reflect the marginal *social* benefits. If there were perfect competition in all markets (which requires some very stringent conditions to be met, including several buyers and sellers who are price takers, there is perfect information, there are no externalities, etc.) firms would pay the marginal product to workers.[5] Even ignoring social benefits, if there is discrimination against certain groups (e.g. women), wages paid are less than marginal products.

> "Good jobs for development are those that make the greatest contribution to society, taking into account the value they have to people who hold them but also their potential spillovers on others-positive or negative." (*World Development Report 2013*, p. 154.)

A good job can be defined both objectively and subjectively[6]. The former definition relies on the occupation of the person and whether s/he uses their prior skills/qualifications in their current job. An objective definition would include whether the wages are commensurate with the person's education, skills, experience, etc. A good job would also be one where the

[4] See **World_Bank.** 2013. "World Development Review 2013," Washington: World Bank, p.154.
[5] As discussed below under compensating differentials, wages do not necessarily reflect the marginal private benefits (marginal products) if we have non-competitive elements. Profit sharing by non-competing firms has been used to explain wage determination.
[6] See **Layard, Richard.** 2004. "Good Jobs and Bad Jobs." *Centre for Economic Performance, LSE*, 1-15.(2004), **Acemoglu, Daron.** 2001. "Good Jobs Versus Bad Jobs." *Journal of Labor Economics*, 19(1), 1-21, **Clark, A. E. .** 1998. "Measures of Job Satisfaction: What Makes a Good Job? Evidence from Oecd Countries," Paris: OECD Publishing,

employee's education and skills were being employed productively. Further, it would require conditions of work that are safe and healthy, prospects of promotion are based on objective criteria, where annual leave, and sick leave are generous. A good job would also be one where there are strict rules that govern the termination of the job, e.g. appropriate length of notice, redundancy pay, etc.

In the literature a good job is often defined in terms of whether it is a full-time or part-time job and whether there are other perquisites (perks) such as private health insurance, good superannuation, good leave facilities etc. A part time job is not necessarily a bad job: some people at a certain stage in their life-cycle may prefer a part time job. However, if a part time worker would prefer to work more hours but is unable to find such a job then that job is a bad job.

Objective definitions of a good job are based on characteristics which may be easily measured by aggregative data. However, determining whether a job is a good job from a societal perspective is more difficult. We need to know society's welfare function. The definition of a good job can be based on a job containing some specific characteristics[7]. The characteristics of a good job would usually include a wage commensurate with qualifications of the worker, security of employment, safe working conditions, decent working hours, flexibility regarding access to sick and carer's leave, etc.

European Commission's *Employment in Europe* 2008 argues that wages do not fully capture the job quality aspects: wage differentials do not fully compensate for the disutility of work and other negative aspects of the workplace. Compensating wage differentials require perfectly competitive markets with individuals maximising utility with perfect knowledge about the job characteristics, and with firms operating under competitive conditions. The characteristics of job quality that are contained in a good job include both objective and subjective indicators: wages, skills used in the job, intensity of work, worker autonomy, discretion in the tasks performed, etc. It finds that happiness and job satisfaction depend not only on the absolute level of wages, but also the wages relative to others in the organisation. This would require detailed data based on either individuals or based on the employer. There has been much research that suggests that wages may also involve rent sharing under non-competitive conditions. (Andrew K. G. Hildreth and Andrew J. Oswald).

[7]Some jobs are clearly bad jobs: these are the 3D jobs (dirty, dangerous, and degrading).

An important concept that has been introduced into the literature is the concept of "decent work". The ILO's former Director General Juan Somavia in a report to the International Labour Conference in 1999 described decent work as "opportunities for women and men to obtain decent and productive work in conditions of freedom, equity, security and human dignity". This is a fairly broad definition that includes, decent pay, working conditions that would include job security, access to training and career development, safe working conditions, etc.

Following the ILO, the UN Millenium Development Goals advocates the need for "full and productive employment and decent work for all, including young women and men". It suggests monitoring four indicators: (i) labour productivity, (ii) the employment-population ratio, (iii) working poverty, and (iv) employment status (vulnerable employment). This concept of full and productive employment is meant to capture both the qualitative and quantitative aspects of employment. Working poverty, vulnerable employment, and labour productivity are meant to capture the qualitative aspects of employment, while the employment-to-population is meant to capture the quantitative aspects ofemployment. These data are available on an aggregate basis for many countries.

In more recent literature, there is a discussion of "precarious" jobs or "vulnerable" jobs. The UN Definition of vulnerable jobs is:

> **Brief Definition:** Vulnerable is measured as the proportion of own-account workers and contributing family members in total employment.

These workers are defined as vulnerable because they are subject to economic risk because of weak institutional employment arrangements, including lack of tenure.

From a societal point of view, a good job is one that is highly productive taking account of any external benefits or costs. For a job to be highly productive it requires complementary factors that include modern technology (usually embodied in new capital goods), more capital, more human capital, and better management and industrial relations policies. *Obviously, if wages reflect productivity, which they do not necessarily, then from a worker's perspective a high productivity job is desirable.* Again, as previously noted, if this high productivity job is at the expense of making someone worse off, then it may not be socially desirable.

3.2 Monitoring Changes in the Quality of Employment

As discussed above, the ILO recommends (and as the UN Millenium Development Goals suggests) that we should monitor the quality of jobs by looking at changes in the following four indicators:

(i) labour productivity, (ii) the employment-population ratio, (iii) working poverty, and (iv) vulnerable employment.

Data on working poverty are not easy to obtain except for grouped data by region and for some countries for either one or two years only. We tabulated the data on the four indicators by region (using data from KILM)[8]. In Table 1 below, we list the changes that took place over the period 1991-2011. We used averaged data for the following periods: 1991-1995, 1996-2000, 2001-2007, and 2008-2011. Table 1 illustrates that for all regions productivity increased from period to period (except for a dip for Central & South-Eastern Europe (non-EU) & CIS between 1991-1995 and 1996-2000). Generally the share of vulnerable employment and working poverty decreased (except for the Middle East which had an increase between 1996-2000 and 2001-2007). Employment to population ratios went down slightly for the whole world, but for some groups (Developed Economies and the European Union, and for South Asia) they were increasing until the global crisis, after which they fell. The share of working poor at $2 a day in total employment generally came down over this period for most regions except for the Middle East, and North Africa.

[8] The data used in this report are described in Appendix 1: Data Appendix

Table 1: Decent Work Indicators

Region	Period	Output per worker (constant 2005 international $)	Employment-to-population ratio	Share of vulnerable employment in total employment (%)	Share of working poor at US$2 a day in total employment (%)
Central & South-Eastern Europe (non-EU) & CIS	1991-1995	17358	55.7	20.3	10.7
Central & South-Eastern Europe (non-EU) & CIS	1996-2000	15970	52.1	23.9	13.8
Central & South-Eastern Europe (non-EU) & CIS	2001-2007	20684	52.4	22.2	8.8
Central & South-Eastern Europe (non-EU) & CIS	2008-2011	24971	53.7	20.1	5.2
Developed Economies & European Union	1991-1995	56733	55.7	12.5	na
Developed Economies & European Union	1996-2000	62186	56.2	11.7	na
Developed Economies & European Union	2001-2007	68926	56.3	10.8	na
Developed Economies & European Union	2008-2011	71604	55.7	10.2	na
East Asia	1991-1995	4200	74.4	66.2	76.8
East Asia	1996-2000	5860	73.1	60.8	59.3
East Asia	2001-2007	8675	71.7	56.2	39.8
East Asia	2008-2011	13351	70.3	51.2	20.7
Latin America & the Caribbean	1991-1995	20108	57.9	36.6	15.9
Latin America & the Caribbean	1996-2000	20744	58.4	36.0	15.6
Latin America & the Caribbean	2001-2007	21039	59.6	34.8	13.2
Latin America & the Caribbean	2008-2011	22821	61.4	31.8	8.3
Middle East	1991-1995	36556	41.5	35.7	8.7
Middle East	1996-2000	37628	40.7	33.9	8.0
Middle East	2001-2007	37372	41.7	31.9	8.8
Middle East	2008-2011	39792	42.1	27.8	7.6
North Africa	1991-1995	14577	42.4	44.0	31.7
North Africa	1996-2000	14803	42.4	43.3	28.3
North Africa	2001-2007	16020	42.7	41.8	23.0
North Africa	2008-2011	17571	44.3	41.2	17.6
South Asia	1991-1995	3536	58.8	81.5	81.5
South Asia	1996-2000	4213	57.8	82.0	78.5
South Asia	2001-2007	5198	57.8	80.5	74.0
South Asia	2008-2011	7088	55.5	78.3	65.1

Region	Period	Output per worker (constant 2005 international $)	Employment-to-population ratio	Share of vulnerable employment in total employment (%)	Share of working poor at US$2 a day in total employment (%)
South-East Asia & the Pacific	1991-1995	6286	67.8	67.3	68.0
South-East Asia & the Pacific	1996-2000	7044	67.3	65.0	62.3
South-East Asia & the Pacific	2001-2007	8030	66.2	63.7	49.2
South-East Asia & the Pacific	2008-2011	9547	66.7	61.8	37.5
Sub-Saharan Africa	1991-1995	4435	63.9	83.0	76.0
Sub-Saharan Africa	1996-2000	4436	63.8	82.1	76.0
Sub-Saharan Africa	2001-2007	4731	64.4	80.2	72.5
Sub-Saharan Africa	2008-2011	5368	64.9	78.1	66.8
World	1991-1995	16253	62.1	55.1	52.7
World	1996-2000	17600	61.4	53.9	47.2
World	2001-2007	19671	61.1	52.3	39.4
World	2008-2011	21994	60.5	50.0	30.4

Source: KILM

The concept of Decent Work is based on four indicators:

(i) labour productivity, (ii) the employment-population ratio, (iii) working poverty, and (iv) vulnerable employment.

To provide a simple Index of Decent Work we have used a weighted index of these four indicators. However, the weighting is arbitrary. (In the indexed created below we have weighted each variable equally, although a case can be made to weight the productivity index less than the other variables.) In general, if Labour Productivity and Employment-Population ratios increase, Decent Work improves. If Working Poverty and Vulnerable Employment increase, Decent Work worsens. As such we created a new index that consists of:

(i) labour productivity, (ii) the employment-population ratio, (iii) 100-working poverty, and (iv) 100-vulnerable employment.

For this index any increase in these re-defined indicators leads to an improvement in the Decent Work Index. We have two possible such Decent Work indexes. The first one, we call the Main Decent Work Index which is an equally weighted index of these four variables. Given that labour productivity is being measured in constant US dollars in PPP terms, this variable will obviously dominate the value of the index. However, we can see if the ranking of groups of countries changes over time. This is presented in Table 2 below.

Table 2: Ranking of Country Groups for Decent Work (Main)

Decent Work Index, Main (Ranking)

	1991-1995	1996-2000	2001-2007	2008-2011
Developed Economies & European Union	1	1	1	1
Middle East	2	2	2	2
Latin America & the Caribbean	3	3	3	3
Central & South-Eastern Europe (non-EU) & CIS	4	4	4	4
North Africa	5	5	5	5
South-East Asia & the Pacific	6	6	7	7
Sub-Saharan Africa	7	8	9	9
East Asia	8	7	6	6
South Asia	9	9	8	8

Note: This index uses labour productivity measured in PPP. Since Labour Productivity is equally weighted with the other variables, it dominates this index.

Definition

Decent Work Index, Main=0.25*(Labour Productivity)+0.25*(Emp-Pop Ratio)+0.25*(Share of non-vulnerable Emp)+0.25*(Share of non-working poor at $2)

This Main Decent Work Index shows that Sub-Saharan Africa goes down in each period from 7 to 8 to 9 and then remains constant at 9. East Asia, in contrast moves up from 8 to 7 to 6, and then remains constant. South Asia, the bottom rank of 9, moves up slightly to rank 8 in 2001 and stays at that rank. The Global crisis seems to have stopped the relative improvement of these two regions, East Asia and South Asia.

Since this Decent Work Index is dominated by labour productivity, we have created another index that indexes labour productivity in the base period to equal 100.

Definition of Decent Work Index 2

=0.25*(Index of Labour Productivity)+0.25*(Emp-Pop Ratio)+0.25*(Share of non-vulnerable Emp)+0.25*(Share of non-working poor at $2)

Hence this index is useful to show changes over time in Decent Work. In Table 3 below we present these results. What is surprising is that for this index there is a continuous improvement in Decent Work for all regions (perhaps because of the equal weight given to productivity), even after the Global Recession. However, the data on Developed Economies and European Union are probably misleading as we did not have data on Working Poverty for this group and we have assumed (almost certainly an incorrect assumption) that there was no working poverty for any of these periods. There is certainly some evidence that working poverty would have increased in many of these countries after the Global Crisis.

Table 3: Decent Work Index 2

Region	Period	Decent Work Index 2
Central & South-Eastern Europe (non-EU) & CIS	1991-1995	81.2
Central & South-Eastern Europe (non-EU) & CIS	1996-2000	76.6
Central & South-Eastern Europe (non-EU) & CIS	2001-2007	85.1
Central & South-Eastern Europe (non-EU) & CIS	2008-2011	93.1
Developed Economies & European Union*	1991-1995	85.80
Developed Economies & European Union*	1996-2000	88.52
Developed Economies & European Union*	2001-2007	91.74
Developed Economies & European Union*	2008-2011	92.92
East Asia	1991-1995	57.84
East Asia	1996-2000	73.14
East Asia	2001-2007	95.55
East Asia	2008-2011	129.07
Latin America & the Caribbean	1991-1995	76.3
Latin America & the Caribbean	1996-2000	77.5
Latin America & the Caribbean	2001-2007	79.0
Latin America & the Caribbean	2008-2011	83.7
Middle East	1991-1995	74.3
Middle East	1996-2000	75.4
Middle East	2001-2007	75.8
Middle East	2008-2011	78.9
North Africa	1991-1995	66.7
North Africa	1996-2000	68.1
North Africa	2001-2007	72.0
North Africa	2008-2011	76.5
South Asia	1991-1995	48.9
South Asia	1996-2000	54.1
South Asia	2001-2007	62.6
South Asia	2008-2011	78.1

Notes: There were no data for Working Poverty for this group, so it was assumed that it was zero, which is obviously not true. The Index for Productivity was set equal to 100 for the first observation for each group. Hence, this provides information about the direction of change over time for each region, but comparisons across regions are not informative.

4. Is there a trade-off between employment and productivity?

There are four distinct issues (i) Do poor countries grow faster than rich countries? (ii) Do poor countries catch up with rich countries? How long will they take to catch up if current rates of growth continue for ever? (iii) Do countries with faster productivity growth have slower employment growth? and (iv) Do countries that have faster employment growth find that the quality of jobs is getting worse?

From a policy perspective, ideally we would like poor countries to get richer and hence decrease poverty (assuming that the gains are shared between different segments of society); we would like employment to increase and unemployment to decrease; and for the increased employment to be in "good jobs". Whether the poor countries ever catch up with rich countries is a completely different question which requires assumptions about the continuing higher growth rates of poor countries relative to the richer countries. We know from studies of income distribution within countries of the OECD, that although the average incomes have increased significantly and poverty rates are relatively low and come down, income distributions have not collapsed to a mass point (equalised incomes). In the past decade or so, poverty in the world has come down with a significant fall in poverty in (especially) China and India (although there is a debate about India). However, the per capita GDPs of China and India are far lower than those of the OECD countries. The Financial and Economic Crisis that hit the world economies in 2008 has clearly led to significant falls in employment (and concomitant increases in unemployment and long-term unemployment) in the OECD countries. The impact of this crisis had also led to a fall in employment and an increase in poverty rates in the economies of less developed countries (International_Labour_Organisation, 2012).

There is a large amount of research about whether there is "convergence" in the development of the world economies using cross-country regression analyses, see (W. J. Baumol, 1986), (S. Dowrick and D. T. Nguyen, 1989), Barro & Salai-i-Martin (1991), (S. N. Durlauf, 1996, 2009, S. N. Durlauf, P. A. Johnson and J. R. W. Temple, 2009, S. N. Durlauf et al., 2008). Whether or not there is convergence depends upon the transfer of technology and capital from the richer countries to the poorer countries. Convergence also depends on structural changes in the advanced economies that move production from manufacturing that has increasing returns to scale to the services sector that has either decreasing (or constant) returns to scale. Hence as structural change is taking place, productivity in the advanced countries would fall over time. In the globalised world, many of the larger corporations from the OECD countries have moved their production to less developed countries (bringing with them capital-intensive technology). This has led to segmented labour markets where wages in multinational corporations in the LDCs are high, compared to wages in domestic firms. In

addition, there is large informal labour market where incomes may be low, but more importantly, the conditions of work may be dangerous and unhealthy[9].

In several papers Danny Quah has argued that the simple regressions of growth on lagged levels of GDP suffer from Galton's fallacy of regression to the mean. He suggests that the analysis should look at the entire distribution. He finds that instead of convergence there is movement towards "twin peaks" of rich and poor (D. Quah, 1993a, 1994, 1993b, D. T. Quah, 1996a, b).

There are several issues in the models set up, the choice of data, the estimation techniques and the inferences drawn from the tests. There are issues of whether the researcher is estimating a model for economic growth, per capita economic growth, or productivity (total factor productivity, or labour productivity per employed person or per employed hour of work). The choice of the sample is important: are all countries included, were outliers excluded, what is the time frame, is it a balanced sample or unbalanced sample, were the data from the Penn World Tables (which version) or elsewhere[10]? Finally, the estimation method is critical: in general cross country regressions (panel data) have been estimated using fixed effects on averaged (five or ten years) data, but treating all the right hand side variables as if they are exogenous. In some cases, researchers have used instrumental variables estimation method using lagged values as instruments. An especially important criticism made of cross country regressions to test for the impact of policy variables on growth or productivity growth is made by Rodrik (D. Rodrik, 2012). He argues that policy variables are endogenous: *"In such a setting, treating policy as if it were exogenous or random is problematic not just from an econometric standpoint, but also conceptually."* ((D. Rodrik, 2012), p. 139)

The possibility of a trade-off between employment and productivity has a long history, see (W.E.G. Salter, 1960). Does technological change lead to labour being replaced by capital? Technological change would increase labour productivity (as well as total factor productivity) and may lead to a fall in employment. However, while technological change has been going on for centuries, it has not led to an aggregate fall in employment, although it has often led to a fall in employment in particular firms and industries.

[9] See for example **UNCTAD.** 2010. *Trade and Development Report 2010*. Geneva: United Nations.

[10] Some recent papers have shown that using different versions of the Penn World Tables can give completely different results, see and, **Johnson, Simon, William Larson, Chris Papageorgiou, and Arvind Subramanian.** 2013. "Is Newer Better? Penn World Table Revisions and Their Impact on Growth Estimates." *Journal of Monetary Economics*. Also see **Ponomareva, Natalia and Hajime Katayama.** 2010. "Does the Version of the Penn World Tables Matter? An Analysis of the Relationship between Growth and Volatility." *Canadian Journal of Economics-Revue Canadienne D Economique*, 43(1), 152-79.

In some sense, by definition productivity must be negatively related to employment since productivity is the ratio of total production (GDP) to employment: if employment increases, *ceteris paribus*, productivity must fall. If you take a given production function, an increase in employment means you move along the Production Possibility Frontier. Alternatively, with given capital and technology (the *ceteris paribus* assumption) the labour demand curve is downward sloping so an increase in employment entails a fall in the marginal product of labour as lower productivity workers are hired. Even if there is a fall in employment in a particular firm or industry as a result of technological change, the fall in costs of production lead to increased demand that expands output and hence aggregate employment. This increase in aggregate demand is likely to lead (in the longer run) to an increase investment and hence an increase in productivity.

An explanation for an inverse relationship between employment and productivity is based on sectoral differences in productivity: as developed economies (OECD) grew with an expansion of the high productivity manufacturing sector, it also led to an increased growth of the low productivity service sector. Employment in manufacturing went down (relatively, if not absolutely) while employment in the service sector expanded, see (Eileen and Ronald Schettkat Apellbaum, 1995). They argue that as the countries become richer their income elasticity for manufactured goods falls so that output and employment in that sector does not expand (or expands slowly).

It has been suggested by McMillan and Rodrik (Margaret S. McMillan and D. Rodrik, 2011) that in Latin America the rationalisation of some firms led to lower employment in the formal sector with the redundant workers moving to the lower productivity informal sector, hence average productivity fell. If the growth in employment is because of an increase in the utilisation of low productivity workers, then average productivity falls because of the low productivity of workers, hence the trade off, see Boulhol and Turner (H. Boulhol and L. Turner, 2009). With globalisation, many large corporations from OECD countries invest/outsource production in LDCs. They replace labour intensive production with capital-intensive production, which leads to a "rationalisation" of production, and workers moving out of the formal sector into the informal sector. Average productivity would fall, but formal employment may fall while informal employment increases.

5. Some Preliminary Results

5.1 Methodology

This paper begins with some simple descriptive statistics to see if there is any trade-off between employment and productivity. The data used are averaged over different periods. Firstly, we averaged the data over the periods 1950-1989 and 1990-2010. Unfortunately, more recent data are not available for most countries.

The next subsection provides summary statistics (again averaged over different periods). We also provide some information about the distribution of these average growth rates by looking at the Gini coefficient (a measure of inequality) and the ratio of the top decile to the bottom decile. The Gini provides some information about whether the growth rates of countries are all the same or very unequal. If we expect the average productivity levels of different countries to converge we would require the richer countries to grow at a lower rate than the poorer countries. Ideally, there should be a greater inequality with the spread being as mentioned above. However, the Gini does not capture this very well as it tends to put a heavier weight on the middle of the distribution. The ratio of the top decile of growth rates to the bottom decile (P90/P10 ratio) is a better measure as it captures the tails of the distribution. For convergence, we require the faster growing countries to be the poorer countries and the richer countries to be growing less slowly. When we study the average productivity levels and compare the Gini coefficients we see the level of inequality amongst countries and the P90/10 ratio shows how big the gap is between the richer and poorer countries. However, it is difficult to draw any inferences from this information. That has to rely on econometric analysis reported later in Section 6.

The Section 6 carries out an econometric analysis on panel data using fixed effects estimation, instrumental variables fixed effects estimation, and GMM estimation, with the growth rate of productivity as the dependent variable. We allow for a range of explanatory variables and test for their significance. This allows us to investigate if there is a trade-off between employment and productivity allowing for a range of other control variables.

5.3 Growth Rates of Productivity and Employment: Summary Statistics

We first break up the data from 1950 to 2010 into two periods (1950-1989 and 1990-2010), and look at all countries. For all countries (Table 4) it appears as if there was a slow-down in the *mean* growth rates of both productivity and employment. If we now look at the distribution of the growth rates of productivity and employment we find that the Gini coefficient (a measure of inequality) (Table 5) appears to increase for both productivity growth and employment growth for all countries. As has been argued by Kaldor (Nicholas Kaldor, 1967) and Verdoorn the manufacturing sector has increasing returns to scale while

the agricultural and service sectors have decreasing returns to scale. Hence the larger the manufacturing sector the greater the growth of productivity. As the manufacturing sector declines (as it has in the OECD countries) the growth of productivity has declined.

Table 4: Summary statistics for all countries, 1950-1989 & 1990-2010

Average growth of productivity					
Period	**mean**	**sd**	**min**	**max**	**med**
1950-1989	0.0181	0.0210	-0.0605	0.0825	0.0187
1990-2010	0.0138	0.0225	-0.0460	0.1401	0.0121
Employment growth					
1950-1989	0.0220	0.0118	-0.0081	0.0686	0.0234
1990-2010	0.0204	0.0143	-0.0195	0.0637	0.0225

Table 5: Gini coefficients & inequality measures for all countries

Average growth of productivity		
Periods	**p90/p10**	**Gini**
1950-89	-10.143	0.619
1990-2010	-3.584	0.853
Employment growth		
1950-89	5.383	0.288
1990-2010	32.802	0.392

If we now turn to the ***levels*** of productivity per person (GDP per worker) over the periods 1950-1989 and 1990-2010 (Table 10), we see that the Gini coefficient falls slightly for all countries and for the OECD over the two periods (Table 11), suggesting a regression to the mean. However, for all countries the ratio of P90/P10 rises, suggesting that the top percentile countries have improved their average productivity relative to the bottom percentile. It is interesting to note that both the minimum and maximum average productivities have fallen for all countries, although the mean and median have increased.

Table 10: Summary statistics for all countries, 1950-1989 & 1990 2010

Average productivity								
Countries	**Period**	**mean**	**sd**	**min**	**max**	**med**	**P90/P10**	**Gini**
All	1950-1989	17863.73	22821.09	738.04	185547.10	10267.11	25.62	0.56
	1990-2010	23398.14	24870.65	677.11	106715.50	14059.95	31.59	0.54

If we now turn to looking at the changes in Average productivity over five year periods for all countries (Table 12), we see that the mean increases consistently, the Gini changes very slightly, while the minima and maxima fall until 2004 and then increase after 2005. For all countries, the P90/P10 ratio rises and then falls in the Great Recession.

6 Regression Analyses: Panel Estimation

In some further work, we carried out regression analyses on a panel data set for all the countries for which we had data for the longest period available. These data are from 1950 to 2010. However, for many developing countries the data are sparse. Hence the inclusion of some variables leads to a significant decrease in the sample sizes.

We estimated models where the annual growth of labour productivity was determined by the growth of employment, the investment to GDP ratio, the openness of the economy, and the lagged level of labour productivity. The latter variable is included to capture any convergence over time of labour productivities. In addition, we introduced variables to capture the sectoral distribution of output as it has been argued that the more industrialised the economy the greater the access to economies of scale and hence higher productivity growth. To allow for the impact of expanded international trade on productivity growth, we added a variable called "Open" measured by the share of exports plus imports in GDP. We also tested to see if the Global Crisis had any impact on productivity growth. We estimated equations first for the full sample of countries, and then for sub-samples by Income (following the World Bank definitions) and by region. The sample sizes for these sub-sets are relatively small and may lead to problems of interpreting the results when we use more complex estimation techniques (see below when we use the Generalised Method of Moments estimation).

$$p = \alpha + \beta Productivity\ level\ (t-1) + \gamma empgrowth + \delta\left(\frac{I}{GDP}\right) + \theta Industry + \pi GFC$$

Where p denotes annual productivity growth, (I/GDP) is the share of investment in GDP, and Industry is a variable to capture the share of Industrial Production in the economy. We have tried measures like the share of Industrial Production in GDP[11], and the growth rate of industrial (manufacturing) production. The latter variable may also represent rapidly growing

[11] When we estimated our models including the share of industrial production in GDP, in almost all cases the variable was statistically insignificant. As such we are not reporting those results.

aggregate demand. In addition, we tried to control for the different policy/institutional conditions by using the share of Government Debt to GDP ratio. Other variables to measure the quality of business conditions were not available for many countries for many periods. All variables are measured in Purchasing Power Parity terms in constant US dollars. Data are derived from the Penn World Tables and the World Bank's World Development Indicators and the ILO's Key Indicators of the Labour Market, see Data Appendix. The data begin in 1950 and end in 2010 but for many countries the data begin at later dates and often there are missing values in the middle of the series. For some variables the data are very limited.

6.1 Fixed Effects Estimation

We first estimated Fixed Effects models[12]. Table 4 shows the estimates for the full sample and for the sub-sets by Income levels. Note that the standard errors are robust standard errors.

Table 4: Fixed Effects Estimation, All countries and Samples by Income Levels

Fixed Effects Estimates, by Income (Dependent Variable: Annual Growth of Productivity)

	All	Low Inc	Low Mid Inc	Upper Mid Inc	Mid Inc	High Inc
rgdpwok_lag	-0.0000014***	-0.0001409**	-0.0000047	-0.0000011	-0.000002	-0.0000017***
	(0.0000004)	(0.0000570)	(0.0000037)	(0.0000010)	(0.0000013)	(0.0000005)
gwok	-0.8705137***	-0.4352514	-0.9919124***	-0.8184919***	-0.8581290***	-0.9467309***
	(0.0579799)	(0.4393255)	(0.2287528)	(0.0752289)	(0.0744050)	(0.0942345)
indanngro	0.0033534***	0.0023079**	0.0024680***	0.0043102***	0.0032684***	0.0032297***
	(0.0003410)	(0.0008171)	(0.0007190)	(0.0008178)	(0.0005172)	(0.0005712)
ki	0.0010475***	0.0025079	0.0007453	0.0011216*	0.0011993**	0.0014919**
	(0.0003768)	(0.0031276)	(0.0005868)	(0.0006489)	(0.0005208)	(0.0005720)
openk	0.0002626**	-0.0023577**	0.0004079	-0.0000784	0.0001449	0.0004658***
	(0.0001271)	(0.0010690)	(0.0002870)	(0.0002196)	(0.0001776)	(0.0001407)
gdeb	-0.0004047***	-0.0002305	-0.0004033	-0.0004923***	-0.0004916***	-0.0002004
	(0.0001050)	(0.0002011)	(0.0003103)	(0.0001258)	(0.0001751)	(0.0001410)
gfc	-0.0111075***	0.0950463**	0.0035602	-0.0110606	-0.007267	-0.0129276**
	(0.0034140)	(0.0394629)	(0.0085375)	(0.0065525)	(0.0055696)	(0.0055859)
_cons	0.0412676***	0.3355206**	0.0399894	0.0383863	0.0322559	0.0451112**
	(0.0148297)	(0.1112207)	(0.0340432)	(0.0330873)	(0.0228788)	(0.0184565)
N	1032	71	241	235	476	386
R-sq	0.448	0.52	0.278	0.603	0.399	0.645

Source: Panel_Annual_FE4 (Model estimated using STATA 12, xtreg command)

First, if we look at the results for the **full sample** of countries for which we had data from the Penn World Tables, World Development Indicators, and KILM we find that there is clear

[12] We also estimated the models using random effects, but the fixed effects models were ranked superior using a Hausman test.

evidence of convergence. The variable, rgdpwok_lag is the lagged value of the level of productivity in the previous period. Although the parameter estimate is very small, it is statistically very significant. The second important result is that the growth of productivity is negatively and significantly related to the growth in employment (gwok) [13]. In other word the data suggest that there is a trade-off between the growth of productivity and employment growth. In earlier regressions, we had included the share of industrial production in GDP as an index of the sectoral composition of GDP and found that it was statistically insignificant from zero. Instead, we have used the growth rate of industrial production (indanngro), which is to reflect the fact that there are increasing returns to scale in this sector (compared to the agricultural sector). We find that for the full sample that the variable is positive and statistically significant. In other words, the faster the growth of industrial production, the faster the growth of aggregate productivity[14]. Another important finding is that the higher the share of investment in GDP (ki), the faster the growth of productivity. This variable also reflects the importance of aggregate demand: investment is high if aggregate demand is high and increasing. The results also suggest that the more open the economy (openk), the more rapid the productivity growth. For this sample we also find that the share of government debt to GDP is negatively related to productivity growth, and to the Global Crisis (GFC, acronym for Global Financial Crisis).

When we estimate the same model for samples broken down by income level the results clearly vary depending on the stage of development[15]. Note however, that since the data for government debt exists only for some countries and for some periods, the sample sizes may no longer reflect the real state of affairs for these groups of countries.

For Low Income countries, the results are broadly similar to the full sample but there are also significant differences. The employment-productivity trade-off no longer is significant, investment is no longer significant, nor is government debt. Curiously, the global crisis appears to have helped productivity growth (perhaps because of the fall in commodity prices). For Low Middle Income countries, there is a trade-off between productivity and employment, and the growth of industrial production helps productivity growth. Most other variables are not significant. For Upper Middle Income countries and Middle Income countries the results are similar to the Low Middle Income countries, except that government debt appears to be negative and significant, and investment is positive and significant. The High Income countries appear to have heavily influenced the full sample as these results are very similar to the full sample, with the exception that government debt is not significant.

As mentioned above the data for government debt are very sparse and as a result the sample sizes become much smaller. To see how the model performed without this variable (gdeb), we re-estimated the same model without this variable. These results are presented in Table 5. These results are broadly similar to those in Table 4 where Government Debt was included. However, the main differences are that the employment-productivity trade-off is significant for all groups, investment is significant for all groups, openness is not significant for any

[13] There is an issue of endogeneity of this variable which will be dealt with later.
[14] There is an issue of endogeneity of this variable which will be dealt with later.
[15] The full list of countries included in each income group are listed in the Appendix 1, D & E

group, and the global crisis is not significant for the full sample but negative and significant for the high income group. Curiously, the global crisis is positively and significantly related to the growth of productivity for the low income group.

Table 5: Fixed Effects Estimation, All countries and Samples by Income Levels

(Without Government Debt)

	All	Low Inc	Low Mid Inc	Upper Mid Inc	Mid Inc	High Inc
rgdpwok_lag	-0.0000007***	-0.0000262***	-0.0000049**	-0.0000008	-0.0000015***	-0.0000002
	(0.0000002)	(0.0000057)	(0.0000018)	(0.0000005)	(0.0000004)	(0.0000001)
gwok	-0.7965384***	-0.3827536***	-0.9569152***	-0.9126439***	-0.9313055***	-0.9162545***
	(0.0780884)	(0.1376704)	(0.1464624)	(0.1061337)	(0.0865002)	(0.0672117)
indanngro	0.0030553***	0.0022488***	0.0024202***	0.0036465***	0.0030853***	0.0049288***
	(0.0002914)	(0.0004826)	(0.0003306)	(0.0007195)	(0.0003931)	(0.0004273)
ki	0.0007512***	0.0010408*	0.0009487***	0.0007107*	0.0007793***	0.0005814
	(0.0001862)	(0.0005419)	(0.0002436)	(0.0003715)	(0.0002493)	(0.0003497)
openk	0.0000462	-0.0003183	0.0000239	0.0000228	0.0000599	0.000061
	(0.0000700)	(0.0002491)	(0.0001148)	(0.0001089)	(0.0000779)	(0.0000472)
gfc	-0.0027307	0.0179854**	0.0094906*	-0.0013999	0.0009953	-0.0102448**
	(0.0026827)	(0.0088209)	(0.0048225)	(0.0052614)	(0.0032455)	(0.0045413)
_cons	0.0127158**	0.0599589***	0.0381777**	0.0137768	0.0189979**	0.0079002
	(0.0050310)	(0.0199061)	(0.0156950)	(0.0096147)	(0.0075803)	(0.0097009)
N	5509	1055	1443	1608	3051	1148
R-sq	0.299	0.192	0.248	0.417	0.331	0.612

Source: Panel_Annual_FE1, (Model estimated using STATA 12, xtreg command)

If we now turn to estimating the same model for sub-sets of the full sample by regions, we find that the sample sizes when we have government debt as an explanatory variable are very small. These results are presented in Table 6 below.

In general these results are similar to the results for groups broken down by Income levels. Although the coefficient on the lagged productivity level (as an indicator of convergence) is negative in all cases it is significant only for Sub-Saharan Africa, the OECD (the original members), and for the European Union 15 (EU 15). The employment-productivity trade-off is significant for all regions. The growth of industrial production is positive and significant for all regions. Investment and Openness are significant only for the OECD and the EU15. Government Debt is only significant for Latin America and the Caribbean, and for Sub-Saharan Africa. The global crisis only affects the OECD and EU15 negatively.

Table 7 provides similar result when we exclude Government Debt. However, convergence is now significant only for the East Asia Pacific region and for Sub-Saharan Africa, but not for the OECD or EU15. The employment-productivity trade-off is significant for all regions, industrial growth is significant for all regions, and investment is significant for most regions (except East Asia Pacific, Europe and Central Asia, and South Asia). Openness seems to help only the East Asia and Pacific. The global crisis hurt only the OECD and EU15.

When we estimated these fixed effects models by Income level with the share of agricultural production in GDP added to the above results in Table 6, the variable was usually not significant except in the case of the European Union 15 when it was positive and significant.

Table 6: Fixed Effects Estimation, All countries and Samples by Regions

Fixed Effects Estimates by Region (Dependent Variable: Growth of Productivity)									
	All Countries	East Asia Pacific	Europe & Cent Asia	Latin America & Caribbean	Middle East & North Africa	South Asia	Sub-Saharan Africa	OECD OLD	EU 15
rgdpwok_lag	-0.0000014***	-0.0000004	-0.0000012	-0.0000029	-0.0000054	-0.0000003	-0.0000799**	-0.0000013***	-0.0000017***
	(0.0000004)	(0.0000031)	(0.0000021)	(0.0000032)	(0.0000027)	(0.0000062)	(0.0000307)	(0.0000003)	(0.0000003)
gwok	-0.8705137***	-1.5095457***	-0.8678287***	-0.7878014***	-0.7252888***	-0.7166536**	-0.7922185**	-0.8106690***	-0.6373485***
	(0.0579799)	(0.3503158)	(0.1987033)	(0.1178000)	(0.0460871)	(0.2714079)	(0.3750316)	(0.0937587)	(0.0879055)
indanngro	0.0033534***	0.0045354***	0.0039534***	0.0031312*	0.0040979**	0.0022913**	0.0019048**	0.0041372***	0.0041786***
	(0.0003410)	(0.0004669)	(0.0011954)	(0.0015096)	(0.0007732)	(0.0005898)	(0.0007831)	(0.0002656)	(0.0003308)
ki	0.0010475***	0.0010099	0.0019324	0.0032148	0.001434	-0.0000009	0.0037623	0.0024202***	0.0030873***
	(0.0003768)	(0.0011804)	(0.0016263)	(0.0018976)	(0.0007860)	(0.0005193)	(0.0025291)	(0.0005241)	(0.0007729)
openk	0.0002626**	-0.0001216	-0.0002662	-0.0000796	-0.0001683	0.0001857	-0.0006706	0.0004116***	0.0004326***
	(0.0001271)	(0.0002981)	(0.0003460)	(0.0006459)	(0.0003586)	(0.0003290)	(0.0009545)	(0.0001130)	(0.0000865)
gdeb	-0.0004047***	0.000282	-0.0007888	-0.0004283***	-0.0002694	-0.0007982	-0.0003498**	-0.0000425	-0.0000182
	(0.0001050)	(0.0007106)	(0.0005523)	(0.0001126)	(0.0002796)	(0.0006386)	(0.0001229)	(0.0001520)	(0.0001451)
gfc	-0.0111075***	0.0053089	-0.0116422	-0.0047225	0.0066828	-0.0092583	0.0342015	-0.0111376***	-0.0078000**
	(0.0034140)	(0.0157304)	(0.0118554)	(0.0121015)	(0.0088554)	(0.0233051)	(0.0214165)	(0.0024269)	(0.0028043)
_cons	0.0412676***	0.0052213	0.0620111**	0.0207093	0.0805655	0.066857	0.3135444**	0.0115459	0.0106954
	(0.0148297)	(0.0872977)	(0.0238093)	(0.0362595)	(0.0711061)	(0.0534446)	(0.1217708)	(0.0324386)	(0.0204012)
N	1032	104	111	108	49	88	105	272	211
R-sq	0.448	0.589	0.526	0.614	0.627	0.208	0.297	0.826	0.849

Source: Panel_Annual_FE4, (Model estimated using STATA 12, xtreg command)

Table 7: Fixed Effects Estimation, All countries and Samples by Regions

(Excluding Government Debt)

Fixed Effects Estimates by Region (Dependent Variable: Growth of Productivity)									
	All Countries	East Asia Pacific	Europe & Cent Asia	Latin America & Caribbean	Middle East & North Africa	South Asia	Sub-Saharan Africa	OECD OLD	EU 15
rgdpwok_lag	-0.0000007***	-0.0000052***	-0.000001	-0.0000004	-0.0000014	-0.0000016	-0.0000035***	0	-0.0000001
	(0.0000002)	(0.0000017)	(0.0000011)	(0.0000004)	(0.0000019)	(0.0000022)	(0.0000012)	(0.0000002)	(0.0000001)
gwok	-0.7965384***	-0.7449737**	-0.8723591***	-0.8575518***	-0.8303199**	-0.7835073***	-0.6031321***	-0.9659947***	-0.9332041***
	(0.0780884)	(0.3195571)	(0.1843575)	(0.1064991)	(0.3105706)	(0.1462267)	(0.1789179)	(0.0755206)	(0.0695747)
indanngro	0.0030553***	0.0025908***	0.0042144***	0.0043168***	0.0034005***	0.0012164***	0.0019870***	0.0051532***	0.0054408***
	(0.0002914)	(0.0007750)	(0.0006128)	(0.0005084)	(0.0007223)	(0.0002951)	(0.0005021)	(0.0002314)	(0.0003012)
ki	0.0007512***	0.0002522	0.0000577	0.0006200*	0.0013307*	0.0012416	0.0011584***	0.0012764***	0.0017053***
	(0.0001862)	(0.0005270)	(0.0006023)	(0.0003466)	(0.0006258)	(0.0007967)	(0.0003126)	(0.0002269)	(0.0003170)
openk	0.0000462	0.0003475**	0.0003093	0.000036	-0.0005674*	-0.000018	-0.0001596	-0.0000363	-0.0000077
	(0.0000700)	(0.0001279)	(0.0003364)	(0.0000742)	(0.0002931)	(0.0001112)	(0.0002110)	(0.0000647)	(0.0000386)
gfc	-0.0027307	0.0092033	-0.0007957	-0.0021132	0.0131745	-0.0018222	0.0069697	-0.0108208***	-0.0072756**
	(0.0026827)	(0.0064860)	(0.0078706)	(0.0041898)	(0.0095131)	(0.0115173)	(0.0066438)	(0.0028241)	(0.0027050)
_cons	0.0127158**	0.0305142	0.0042633	0.0051501	0.044113	0.0141329	0.0197683	-0.0126830*	-0.0205632**
	(0.0050310)	(0.0181931)	(0.0218706)	(0.0107539)	(0.0319134)	(0.0223389)	(0.0127055)	(0.0072839)	(0.0086871)
N	5509	507	420	1088	295	299	1522	726	538
R-sq	0.299	0.28	0.506	0.491	0.386	0.134	0.163	0.716	0.795

Source: Panel_Annual_FE1, (Model estimated using STATA 12, xtreg command)

As mentioned earlier, when we had included the share of industrial production in GDP that variable was not significant in most cases. When we added both the shares of industrial and agricultural production in GDP the results were interesting. When we estimated the model over sub-samples by Income levels the share of industrial production was not significant except for the high income levels countries. However, agricultural share in GDP was not significant. When we estimated the same equation by Regional levels the industrial share variable was significant and positive for Latin America and the OECD. What is interesting is that the share of agriculture is now *positive* and significant for Latin America and the Caribbean, and for the OECD and EU15. This is a curious result that the advanced economies of the OECD and EU15 have the growth of productivity overall is increasing in the share of agriculture. Europe and Central Asia have a significant and negative relation between the agricultural share and productivity growth. These results are presented in Table 8.

Table 8: Fixed Effects Estimation, All countries and Samples by Regions (With Agricultural Share added)

	All Countries	East Asia Pacific	Europe & Cent Asia	Latin America & Caribbean	Middle East & North	South Asia	Sub-Saharan Africa	OECD OLD	EU 15	US & Canada
rgdpwok_lag	-0.0000008**	-0.0000053***	-0.0000058***	-0.0000020***	-0.0000058*	-0.0000019	-0.0000048***	-0.0000003	-0.0000004	-0.0000037
	(0.0000003)	(0.0000014)	(0.0000018)	(0.0000006)	(0.0000027)	(0.0000058)	(0.0000012)	(0.0000003)	(0.0000004)	(0.0000023)
gwok	-0.6032415***	-0.7053355	-0.7214063**	-0.8944761***	-0.9696182***	-0.5983521**	-0.4923242**	-0.9180658***	-0.8856563***	0.1050737
	(0.1102639)	(0.4452390)	(0.2961018)	(0.1102674)	(0.1636837)	(0.2230372)	(0.1945261)	(0.0849292)	(0.0898338)	(0.2533560)
indgdppct	0.0002665	0.0001307	-0.000719	0.0012238**	0.0003973	-0.000511	0.0001979	0.0012338***	0.0010205*	-0.0054196
	(0.0003174)	(0.0005125)	(0.0012723)	(0.0005857)	(0.0008755)	(0.0011370)	(0.0004835)	(0.0003787)	(0.0004781)	(0.0042893)
agr	0.0000835	-0.0004595	-0.0032518***	0.0009516**	-0.0006578	-0.0005298	-0.0001191	0.0013904***	0.0013626***	0.0020342
	(0.0002794)	(0.0006689)	(0.0010685)	(0.0004100)	(0.0020354)	(0.0004399)	(0.0004064)	(0.0002485)	(0.0004167)	(0.0025391)
ki	0.0011859***	0.0007296	0.0008578	0.0013232**	0.0015493*	0.0008593	0.0015595***	0.0029392***	0.0031350***	0.0070766
	(0.0002315)	(0.0005764)	(0.0011199)	(0.0006149)	(0.0007718)	(0.0010740)	(0.0002806)	(0.0005163)	(0.0005401)	(0.0045328)
openk	0.0001023	0.0002093	0.0002357	0.0001561	-0.0003671	-0.0000387	-0.0002519	0.0004420***	0.0004475**	0.0008944***
	(0.0000986)	(0.0001749)	(0.0005346)	(0.0001775)	(0.0002728)	(0.0001537)	(0.0002228)	(0.0001530)	(0.0002012)	(0.0000058)
gfc	-0.0104121***	0.0031095	-0.0061714	-0.0034889	0.0115055	-0.0137315	0.002985	-0.0359307***	-0.0393920***	-0.0041522
	(0.0035501)	(0.0070884)	(0.0143128)	(0.0051696)	(0.0136203)	(0.0160664)	(0.0063921)	(0.0049849)	(0.0054563)	(0.0250730)
_cons	0.0023001	0.0539613	0.1558974**	-0.0253112	0.1035779	0.0612709	0.0292686	-0.0945618***	-0.0964276***	0.2109838
	(0.0176052)	(0.0388564)	(0.0667511)	(0.0237045)	(0.0708876)	(0.0397385)	(0.0238463)	(0.0181513)	(0.0278615)	(0.1750186)
N	5798	544	434	932	311	284	1731	784	585	85
R-sq	0.064	0.053	0.1	0.161	0.17	0.04	0.067	0.333	0.331	0.308

Source: Panel_annual_FE2a

There are some limitations of the above analysis based on estimating the model with fixed effects as we had treated all the explanatory variables as if they were exogenous. In fact, as discussed earlier we would expect that the growth of employment and the ratio of investment to GDP would be endogenous variables. Similarly, we would expect that the growth of industrial production would also be endogenous. Further, the above estimation assumes that the impacts of the explanatory variables are limited to the same period, when in fact we would expect productivity growth to be a resultant of some long run changes.

6.2 Instrumental Variables Estimation

To allow for the endogeneity of some of the explanatory variables we estimated the same models using Instrumental Variables Fixed Effects estimation. If we now treat the growth of employment (gwok), investment as a share of GDP (ki), and the growth of industrial production (indanngro) as endogenous variables and instrument them by lagged values of these variables, we get consistent estimates.

In Table 9 we list these results (broken down by Income levels) when we include the share of industrial production and the share of agricultural production in GDP, and the growth of industrial production, we find that there is a significant employment-productivity trade-off for all income levels. Further, the share of agriculture in GDP is consistently negative, while the share of industrial production in GDP is negative and significant for the full sample, for the Low Income, and for Low Middle Income levels. For higher income levels it is positive but not significant. Growth of industrial production is positive and significant for all levels of income. Curiously, openness is now negative and significant for all levels except for the Low Middle Income level and for the Middle Income level.

Table 9: Instrumental Variables, Fixed Effects Estimation

IV, Fixed Effects Estimates, by Income (Dependent Variable: Growth of Productivity)

	All	Low Inc	Low Mid Inc	Upper Mid Inc	Mid Inc	High Inc
gwok	-1.0666***	-1.9081***	-0.8867**	-0.8558**	-0.8777***	-0.304
	(0.1782)	(0.4729)	(0.3866)	(0.3874)	(0.2827)	(0.3497)
ki	0.0002	0.0008	0.0008**	-0.0001	0.0002	-0.0003
	(0.0002)	(0.0006)	(0.0003)	(0.0003)	(0.0002)	(0.0004)
indanngro	0.0070***	0.0091***	0.0053***	0.0080***	0.0068***	0.0103***
	(0.0005)	(0.0028)	(0.0011)	(0.0006)	(0.0006)	(0.0016)
rgdpwok_lag	0	-0.0000***	-0.0000***	0	0	0
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
openk	-0.0002***	-0.0006***	-0.0001	-0.0003***	-0.0001	-0.0003**
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
indgdppct	-0.0004**	-0.0058***	-0.0009***	0.0002	-0.0002	0.0002
	(0.0002)	(0.0019)	(0.0004)	(0.0003)	(0.0002)	(0.0004)
agr	-0.0005***	-0.0025***	-0.0008**	-0.0011**	-0.0006**	-0.0017**
	(0.0002)	(0.0007)	(0.0004)	(0.0004)	(0.0003)	(0.0007)
gfc	0.0049	0.0277*	0.007	0.0093	0.0055	0.0129*
	(0.0035)	(0.0146)	(0.0068)	(0.0061)	(0.0046)	(0.0077)
_cons	0.0376***	0.3096***	0.0731***	0.0196	0.0252**	-0.0034
	(0.0097)	(0.0639)	(0.0230)	(0.0152)	(0.0124)	(0.0206)
N	5027	977	1291	1441	2732	1072

Source: Panel_Annual_FE1b_IV3b

Instrumented: gwokkiindanngro

Instruments: rgdpwok_lagopenkindgdppctagrgfcL.gwok L.ki L.indanngro

6.3 System Dynamic Panel Estimation

We then set up a system dynamic panel-data estimation model that allows for the productivity growth in one period to depend on the previous period's productivity growth as well as allowing for the endogeneity of some of the explanatory variables. In this estimation, we test for the validity of the instruments used, and for autocorrelation in the residuals. This method is based on work by Arellano, Bond, Blundell and Bover, (M Arellano and O. Bover, 1995), (R Blundell and S Bond, 1998, S. Bond, 2002).

Table 10 presents these results using STATA command xtdpdsys uses the Generalised Method of Moments for estimating the model. We treat the following variables as being endogenous in this estimation: the growth rate of employment (gwok), the ratio of investment to GDP (ki), and the rate of growth of industrial production (indanngro). In general the lagged dependent term is significant for the full sample. For the full sample, there is clearly an employment-productivity trade-off, even after we have treated this variable as endogenous

and is being instrumented in the estimation. Investment is significant in explaining the growth of productivity, as is the growth of industrial production. The variable to pick up the idea of convergence (rgdpwok_lag) is negative and significant. Curiously, the more open the economy the slower the growth of productivity. Similarly, the share of industrial production in GDP is negative and significant, which is curious. The variable representing the global crisis (GFC) is also not significant.

When we look at the results for countries at different income levels, we see that the lagged dependent variable is not significant, and except for the Low Income countries there is an employment-productivity trade-off. Investment is only significant for the Middle Income countries. Growth of Industrial production is always significant (even though we have now treated it as an endogenous variable). The variable to pick up the convergence idea is significant only for the Low Income and Middle Income countries. The global crisis is negative and significant only for the High Income countries. The share of industry in GDP is not significant for any of the sub-samples although it was significant (and negative) for the full sample.

When we look at the results of using this GMM estimation method for the sub-samples by regions we find that the lagged dependent variable is not significant, employment growth is positive and significant for Sub-Saharan Africa (but positive, hence no trade-off) and negative and significant for the OECD (not for the EU15). The growth of industrial production is usually positive and significant. However, there are some problems with these results. In many cases the variance matrix is nearly singular, there are problems of autocorrelation, and at times the test for instrument validity is rejected.

Note: When we estimated these models including government debt, the variable was never significant and the other results were similar.

Table 10: GMM Estimates, by Income (Dependent Variable: Average Growth of Productivity)

	All	Low Inc *	Low Mid Inc	Upper Mid Inc	Mid Inc	High Inc
L.grgdpwk	-0.0325999*	-0.2209923	-0.0795291	0.0023842	-0.0340924	-0.0170964
	(0.0193074)	(0.1891054)	(0.0635989)	(0.0445348)	(0.0277852)	(0.0790707)
gwok	-1.6271584***	-0.1105292	-2.0098305***	-1.2094942**	-1.8517147***	-1.0816204***
	(0.1917154)	(0.8245044)	(0.6641983)	(0.5813302)	(0.3065641)	(0.3039002)
ki	0.0009670**	0.0060858	0.0003543	0.0012455	0.0011938**	0.0025116
	(0.0003969)	(0.0062269)	(0.0011496)	(0.0030352)	(0.0004895)	(0.0021756)
indanngro	0.0043030***	0.0009532	0.0030651***	0.0044817***	0.0039556***	0.0050410***
	(0.0003953)	(0.0020242)	(0.0006638)	(0.0007740)	(0.0003803)	(0.0008206)
rgdpwok_lag	-0.0000007***	-0.0001040*	-0.0000018	-0.0000013	-0.0000016**	-0.0000009
	(0.0000002)	(0.0000559)	(0.0000050)	(0.0000022)	(0.0000006)	(0.0000006)
openk	-0.0003382**	-0.0004878	-0.0002001	-0.0000624	-0.0002186	0.0001278
	(0.0001411)	(0.0005814)	(0.0002759)	(0.0002115)	(0.0001345)	(0.0002089)
gfc	-0.0022607	-0.0150011	-0.0030292	0.0004663	-0.0032975	-0.0096136**
	(0.0036204)	(0.0265547)	(0.0076613)	(0.0058331)	(0.0030346)	(0.0045048)
indgdppct	-0.0006928**	0.0016744	-0.0016326	-0.0000609	-0.0000924	-0.0008247
	(0.0003523)	(0.0020888)	(0.0015870)	(0.0011192)	(0.0004327)	(0.0008441)
_cons	0.0681585***	0.1418448	0.1156923***	0.0237309	0.0509527***	0.1101749*
	(0.0105916)	(0.1791418)	(0.0432642)	(0.0530044)	(0.0187055)	(0.0635195)
N	5147	1002	1319	1471	2790	1103

Source: Panel_Annual_GMM2

Notes: Estimated using STATA 12, command xtdpdsys

Notes: ki, gwok, &indanngro are treated as endogenous variables

Table 11: GMM Estimates, by Region (Dependent Variable: Average Growth of Productivity)

	All Countries	East Asia Pacific*	Europe & Cent Asia	Latin America & Caribbean	Middle East & North Africa*	South Asia*	Sub-Saharan Africa	OECD OLD	EU 15 *
L.grgdpwk	-0.0325999*	-0.0524559	0.05592	-0.0177791	-0.3447667	-0.2573729	-0.0918298	-0.0126258	-0.2103688
	(0.0193074)	(0.0000000)	(0.1747188)	(0.0558310)	(1.0475499)	(1.3911017)	(0.0609049)	(0.0842560)	(0.0000000)
gwok	-1.6271584***	0.6776063	-1.0321216	-1.3650054	0.8269383	-9.0777119	1.4478524***	-1.0470104***	-0.5932267
	(0.1917154)	.	(0.8161590)	(0.8386061)	(4.5270621)	(19.6174548)	0.3589035	0.3240033	(0.0000000)
ki	0.0009670**	0.0002256	0.0005766	-0.000655	0.0061812	0.0275263	0.0011679	0.0022456	-0.0007715
	(0.0003969)	.	(0.0036439)	(0.0014394)	(0.0046404)	(0.0268822)	(0.0013999)	(0.0019078)	(0.0000000)
indanngro	0.0043030***	-0.0034873	0.0045410***	0.0054785***	0.0005863	-0.0145206	0.0026805***	0.0051048***	0.0054065
	(0.0003953)	(0.0000000)	(0.0013899)	(0.0011418)	(0.0035314)	(0.0303505)	(0.0004599)	(0.0005523)	.
rgdpwok_lag	-0.0000007***	-0.000035	-0.0000016	0.0000027	-0.0000788*	-0.0000424	0.0000105**	-0.0000004	0.0000018
	(0.0000002)	(0.0000000)	(0.0000058)	(0.0000029)	(0.0000471)	(0.0011781)	(0.0000049)	(0.0000009)	.
openk	-0.0003382**	0.0005984	0.0002567	0.0001347	-0.0046496***	-0.001317	-0.0002593	-0.000121	-0.0003345
	(0.0001411)	.	(0.0012496)	(0.0002361)	(0.0009290)	(0.0056807)	(0.0006227)	(0.0004550)	(0.0000000)
gfc	-0.0022607	0.0223053	-0.0129331	-0.0072727	3.5612948	-1.8959936	0.0031116	0.0006359	-0.0589132
	(0.0036204)	.	(0.0298140)	(0.0116761)	(4.8406021)	(4.4966030)	(0.0074877)	(0.1121646)	(0.0000000)
indgdppct	-0.0006928**	0.0248182	-0.0027722*	-0.0000885	0.0332359*	-0.0113946	0.0000202	0.0016606	0.0078929
	(0.0003523)	.	(0.0016292)	(0.0009211)	(0.0192229)	(0.2424065)	(0.0005615)	(0.0031216)	.
_cons	0.0681585***	-1.942239	0.175361	0.0265758	0	0	0.0780801	-0.0539997	0
	(0.0105916)	(0.0000000)	(0.1558842)	(0.1179705)	(0.0000000)	(0.0000000)	(0.0747039)	(0.0779350)	(0.0000000)
N	5147	500	399	901	277	270	1469	723	537

Source: New GMM2_Annual_130815

Notes: * The variance matrix is nearly singular.

6.4 Discussion

The econometric evidence presented above is fairly mixed depending upon the sample selected, the variables included, and the method of estimation. However, there are some common features in all these estimates provided.

Firstly, there is some evidence for convergence when we use the full sample of countries. Secondly, in almost all cases we find that there is a trade-off between employment growth and productivity growth. Thirdly, in almost all cases the share of investment in GDP had a positive and significant impact on productivity growth. Fourthly, there is generally a positive and significant relationship between the growth of industrial production and overall productivity growth, which holds even when we allow for endogeneity in the GMM estimation. This suggests that the Kaldorian argument that industrial production has increasing returns to scale as well as externalities that helps economic development seems to be substantiated.

The Global Crisis usually has a negative impact on productivity growth, especially for the OECD and the EU15. The evidence for the impact of the composition of GDP (share of industrial production in GDP) is very mixed: using GMM techniques we find that there is a *negative* relationship between the proportion of industrial production in GDP (for the full sample). This negative sign may be due to the fact that the richer and more developed countries had reached "maturity" and were going through a period of "senescence". Another possibility is that the more industrialised the economy, the greater the amount of "out-sourcing" to smaller informal sector lower productivity firms, see (Margaret S. McMillan and D. Rodrik, 2011). This negative relationship was not true for most sub-samples, and in some cases this variable was not even statistically significant. The growth of productivity is negatively related to Government debt for the full sample when we estimate it by Fixed Effects but not when we estimate it by GMM techniques. Other variables to pick up institutional or policy variables were such that the samples were reduced considerably. The global crisis had mixed impacts on productivity growth.

A word of caution: we found that the results were very sensitive to the variables used in the estimation as they affected the sample sizes. Similarly, when we estimated the models for sub-samples by region or income levels we found that the results varied enormously. Whether this was because the sample sizes were too small or because there were significant differences between different regions and countries at different levels of development was not always clear. A lot more work needs to be done to get more concrete results.

Definitions

grgdpwk:	Growth of productivity per worker
rgdpwok_lag:	Real GDP per worker, lagged by 1 period
gwok:	Annual growth rate of employment
ki:	Investment Share of PPP Converted GDP per capita at 2005 constant prices
openk:	Openness at 2005 constant prices (%) (Openness is defined as [(Exports+Imports)/GDP]
indgdppct:	Industry, value added (% of GDP)
indanngro:	Growth rate of industrial production
gdeb:	Government Debt as a share of GDP
gfc	Global Financial Crisis Dummy, 1 for 2008-2010, 0 otherwise

8. Conclusions

This research has investigated the proposition that there is a trade-off between employment and productivity. We discussed the concept of good jobs. In particular we discussed the ILO concept of "Decent Work" that entailed labour productivity, the employment-population ratio, working poverty, and vulnerable employment. We suggested a new Decent Work Index which combined these four elements and then provided data on this Index for different regions of the world over different periods.

Next we provided a brief review of the literature on employment and productivity. Subsequently, we provided a description of employment and productivity growth to see if there was a trade-off.

We carried out an econometric investigation of the determinants of productivity growth and provided formal tests of the proposition that there is a trade-off between employment and productivity when we control for a range of other important factors that influence productivity growth.

We found significant evidence for the convergence of productivity growth across groups of countries; however, this was not supported when we used GMM estimation. We found that there was a negative and statistically significant relation between productivity growth and the growth of employment. Thus, there appears to be evidence for a trade-off between productivity growth and employment. We found that the aggregate demand (as proxied by the growth of industrial production) was a significant determinant of productivity growth. The rate of investment as a share of GDP was a very significant explanatory variable. The impact of the global crisis was significant for some groups of countries.

As we stated earlier, it is not possible to provide a "one-size-fits-all" set of policies as different countries face different social, cultural, institutional, and historical conditions. However, our general proposals were to emphasise the importance of investment in social infrastructure, education, health, and improved conditions of work. If productivity growth is not being accompanied by employment growth we need to place greater weight on

employment in economic policies. Policies need to address the quality of employment in addition to simply increasing employment.

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Appendix

Data Appendix

A. Data sources

(1) The Penn World Tables 7.1: PWT 7.1, Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.1, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, Nov 2012.

(2) World Bank Indicators: World Development Indicators, World Bank, 2012.

(3) International Labour Office, Key Indicators of the Labour Market, KILM,

http://kilm.ilo.org/manuscript/default.asp

B. Variable definitions

gwok: Growth in employment. Calculated by
$gwok = \ln(worker)_t - \ln(worker)_{t-1}$, where
worker = (rgdpl/rgdpwok)*pop
rgdpl=PPP Converted GDP Per Capita (Laspeyres), derived from growth rates of c, g, i, at 2005 constant prices
rgdpwok=PPP Converted GDP Chain per worker at 2005 constant prices
pop: Population in thousand people

grgdpwk: Growth in labour productivity. Calculated by
$grgdpwk = \ln(rgdpwok)_t - \ln(rgdpwok)_{t-1}$, where
rgdpwok: PPP Converted GDP Chain per worker at 2005 constant prices

rgdpwok_lag: Real GDP per worker, lagged by 1 period

ki: Investment Share of PPP Converted GDP Per Capita at 2005 constant prices over the period

openk: Openness at 2005 constant prices (%) over the period

indgdppct: Industry, value added (% of GDP)