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**Is there a trade-off between
employment and productivity?**

Pramod Nagorao Junankar

Employment and
Labour Market
Policies Branch

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Preface

The primary goal of the ILO is to contribute, with member States, to achieve full and productive employment and decent work for all, including women and young people, a goal embedded in the ILO Declaration 2008 on Social Justice for a Fair Globalization,¹ and which has now been widely adopted by the international community.

The comprehensive and integrated perspective to achieve this goal are embedded in the Employment Policy Convention, 1964 (No. 122), in the Global Employment Agenda (2003) and, in response to the 2008 global economic crisis, in the Global Jobs Pact (2009) and in the Conclusions of the recurrent discussion on Employment (2010).

The Employment Policy Department (EMPLOYMENT) is fully engaged in global advocacy and in supporting countries placing more and better jobs at the centre of economic and social policies and of inclusive growth and development strategies.

Policy research, knowledge generation and dissemination is an essential component of the Employment Policy Department's action. The publications include books, monographs, working papers, country policy reviews and policy briefs.²

The *Employment Policy Working Papers* series is designed to disseminate the main findings of research initiatives on a broad range of topics undertaken by the various branches, units and teams in the Department. The working papers are intended to encourage exchange of ideas and to stimulate debate. The views expressed are the responsibility of the author(s) and do not necessarily represent those of the ILO.

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¹ See http://www.ilo.org/public/english/bureau/dgo/download/dg_announce_en.pdf

² See <http://www.ilo.org/employment>.

Foreword

Is there a trade-off between employment and productivity, that is, does employment growth typically occur at the expense of productivity growth? This question raises important policy conundrums. Thus, for example, policies that seek to promote labour-intensive industries in developing countries as a means of promoting rapid employment growth might paradoxically retard productivity growth and militate against the objective of attaining rapid and sustainable economic growth. The complications that emerge from a possible trade-off between employment and productivity were recognized by the ILO in its convention on employment policy (Convention No.122) leading the Organization to formulate the notion of ‘full and productive employment’ rather than ‘full employment’ per se. Similarly, the indicators pertaining to employment that form part of the global framework of the Millennium Development goals focus on both the quantity and quality of employment, with an indicator explicitly linked to labour productivity. The aspiration clearly is that employment growth should be accompanied by productivity growth in order for a country to make measurable progress towards ‘full and productive employment’.

Translating an aspiration into a policy-relevant target requires an appreciation of the pertinent evidence. Accordingly, this paper seeks to produce new cross-country evidence on the employment-productivity relationship. After a brief discussion of the concept of productivity, the problems in measuring it, and suggested methods of decomposing aggregate productivity growth, the paper discusses the concept of good jobs, with a particular focus on the notion of *Decent Work* as enunciated by the ILO. As noted, at the global level, this has entailed a focus on a set of indicators pertaining to labour productivity, the employment-population ratio, working poverty, and vulnerable employment.

The crux of the paper lies in an econometric investigation of the determinants of productivity growth that enables the author to provide formal tests of the proposition that there is a trade-off between employment and productivity after controlling for a range of other important factors that influence productivity growth. Despite the sensitivity of the results to variations in sample sizes and specification of cross-country regression equations, the paper finds significant evidence of the convergence of productivity growth across groups of countries. It also finds a negative and statistically significant correlation between productivity growth and the growth of employment. Thus, there appears to be evidence of a trade-off between productivity growth and employment growth – at least at the cross-country level. The paper suggests that aggregate demand is a significant determinant of productivity growth. The rate of investment as a share of GDP is, in general, a very significant explanatory variable.

The paper highlights some policy implications that follow from its empirical investigations. It suggests that 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, the paper emphasizes the importance of investment in social infrastructure, education, health, and improved conditions of work as part of redistributive strategies that can enable broad-based sharing of the gains accruing from productivity growth. This might be one way of attenuating the employment-productivity trade-off.

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1. Introduction

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

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 and then become industrialized on the basis of manufacturing industries that are mainly low-tech, e.g. 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. There is evidence provided in the *OECD Employment Outlook 2007* that increased foreign competition has increased job instability, especially for workers with less security of 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”, i.e. 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 the issue of a trade-off between employment and productivity (see for example Margaret S. McMillan and D. Rodrik, 2011). In a recent paper, Dew-Becker and Gordon 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).

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).

Section 2 begins with a discussion of the definition of productivity, its determinants, and how it is measured. It discusses the importance of structural change in explaining productivity growth: factors of production moving from slow to faster productivity growth sectors.

Section 3 discusses 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” first proposed by the International Labour Organization in 1999. It also includes statistical information on “vulnerable” employment. Section 4 goes on to provide a brief review of the employment-productivity trade-off. Section 5 gives a detailed econometric analysis of the employment-

productivity trade-off using fixed effects estimation, instrumental variables fixed effects estimation, and the generalized method of moments on panel data. Section 6 considers some implications for policies on development, while Section 7 summarizes the paper's findings. In general our results suggest that there is evidence of a trade-off between employment and productivity, that investment and industrial production growth increase productivity growth, and the share of agriculture in GDP is negatively correlated 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, i.e. the value of output produced by the labour input. 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 obtain data to enable us to produce meaningful estimates for most countries.

What determines the level and rate of change of productivity?³ 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 firm⁴.

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. Aggregate productivity depends on the productivity of the different sectors: agriculture, manufacturing, and the service sector. A major problem in measuring aggregate productivity is that there is usually no independent method of measuring the productivity of the service sector. Similarly, there has been 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 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. Wars, floods, droughts,

³ See ILO (2004-2005) *World Employment Report*.

⁴ For a discussion about the problems of measurement of aggregate productivity, including the issue of the dispersion of firm level productivity, see **Syverson, Chad**, *What Determines Productivity?* *Journal of Economic Literature*, 49(2), pp 326-65 (2011). 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*. Elsevier Science, Amsterdam, pp 473-552 (2005).

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 because 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).

3. Good Jobs and Decent Work

A good job can be defined from the perspective of an individual or from the perspective of society⁵. 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, for example, 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* emphasizes that if one person has a good job with perquisites (perks), that person 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 maximizes 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 would require some very stringent conditions to be met, including several buyers and sellers who are price takers, perfect information, absence of externalities, etc.) firms would pay the marginal product to workers.⁶ Even ignoring social benefits, if there is discrimination against certain groups (e.g. women), wages paid are less than the marginal product.

“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.)

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

⁵ See **World Bank**, *World Development Review 2013*, World Bank, Washington, D.C., p.154 (2013).

⁶ As discussed below under compensating differentials, wages do not necessarily reflect the marginal private benefits (marginal product) if we have non-competitive elements. Profit sharing by non-competing firms has been used to explain wage determination.

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”.

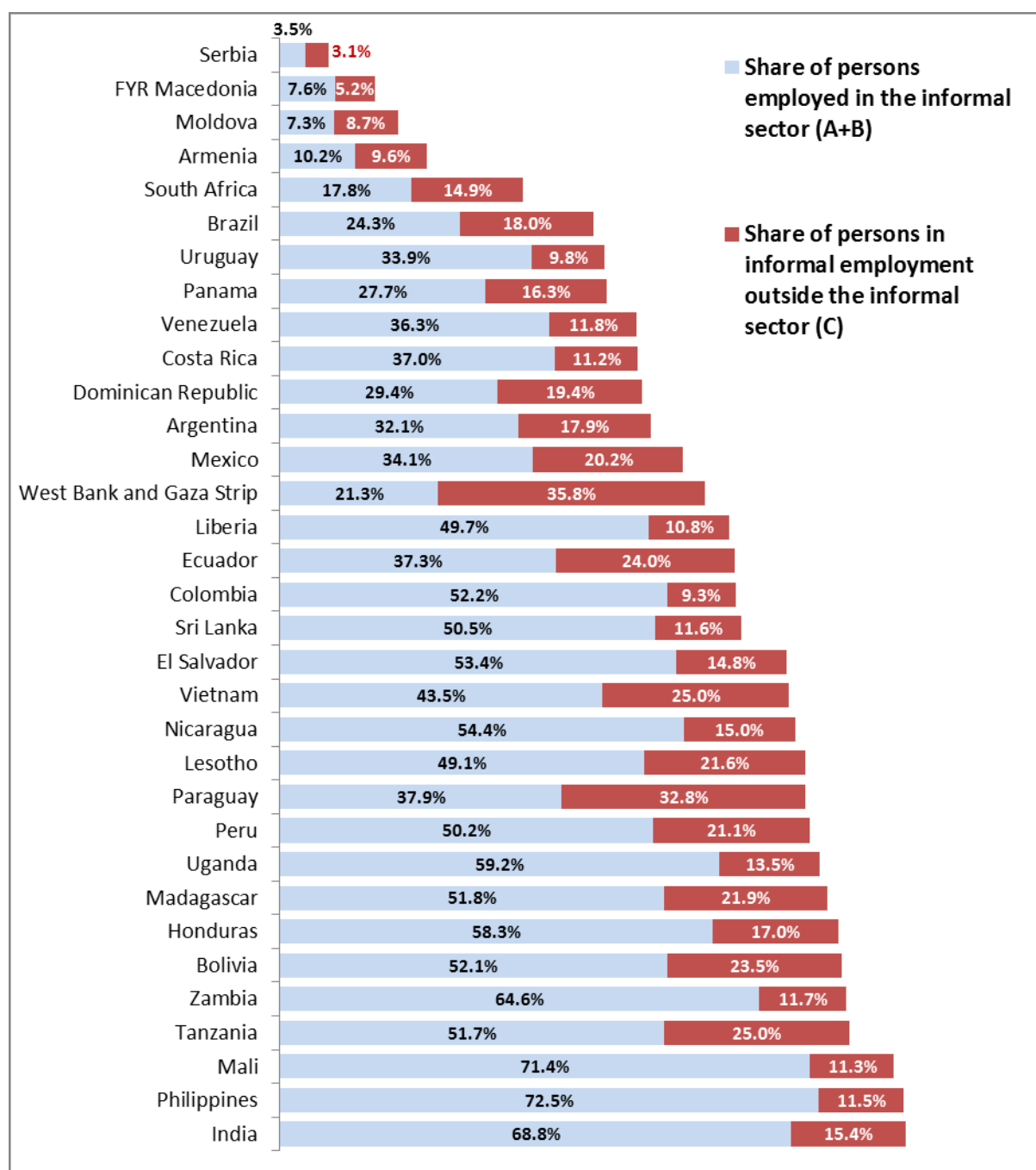
Following the ILO, the UN Millennium Development Goals advocate the need for “full and productive employment and decent work for all, including women and young people”. It suggests monitoring four indicators: (i) labour productivity, (ii) the employment-population ratio, (iii) working poverty, and (iv) 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 ratio is meant to capture the quantitative aspects of employment. 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 brief definition of vulnerable jobs states that “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 as a consequence of weak institutional employment arrangements, including lack of tenure.

The share of employment in the informal sector (non-agricultural employment) in developing countries is very large, see Figure 1 below.

Figure 1: Share of Employment in the Informal Sector



Source: ILO (2012)

Notes: Data are for different years for different countries, usually between 2004 and 2010. Data are for non-agricultural employment.

In general, there is a negative correlation between informal jobs and the level of development in an economy (as measured by GDP per capita).

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

There are four distinct questions⁷:

- (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?

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 can 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.

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 countries become richer their income elasticity for manufactured goods falls, with the result that output and employment in that sector does not expand (or expands slowly).

5. Regression analyses: Panel estimation

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 industrialized 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 so-called “open” variable measured by the share of

⁷ These four issues are important although some of them are beyond the terms of reference of this project. However, they provide an important backdrop for the understanding of the issues of a trade-off between and employment.

exports plus imports in GDP. We also tested to see if the global financial 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 subsets 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 generalized method of moments estimation).

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

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 also tried measures such as the share of industrial production in GDP⁸, and the growth rate of industrial (manufacturing) production. The latter variable may also represent rapidly growing 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, the World Bank's World Development Indicators and the ILO's Key Indicators of the Labour Market, (see Data Appendix). The data cover the period from 1950 to 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.

5.1. Fixed Effects Estimation

We first estimated fixed effects models⁹. Table 1 shows the estimates for the full sample and for the sub-sets by income levels. Note that the standard errors are robust standard errors.

First, if we look at the results for the full sample of countries and for samples broken down by income level, for which we had data from the Penn World Tables, World Development Indicators and Key Indicators of the Labour Market (KILM), we find that there is clear evidence of convergence. The variable, "Prod 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 for all groups except for the high-income countries. The second important result is that the growth of productivity is negatively and significantly correlated to the growth in employment¹⁰. In other words, the data suggest

⁸ When we estimated our models including the share of industrial production in GDP, in almost all cases the variable was statistically insignificant. Consequently, we are not reporting those results.

⁹ We also estimated the models using random effects, but the fixed effects models were ranked superior using a Hausman test.

¹⁰ There is an issue of endogeneity of this variable which will be dealt with later.

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, which is to reflect the fact that there are increasing returns to scale in this sector (compared to the agricultural sector). We find for all these samples that the variable is positive and statistically significant. In other words, the faster the growth of industrial production, the faster the growth of aggregate productivity¹¹. Another important finding is that the higher the share of investment in GDP, the faster the growth of productivity (except for the high income countries). This variable also reflects the importance of aggregate demand: investment is high if aggregate demand is high and increasing. The results also suggest that openness of the economy is not significant.

Curiously, the global financial crisis is positively and significantly correlated to the growth of productivity for the low-income and low middle-income groups, but negative and significant for the high-income group¹².

Table 1: Fixed effects estimation: All countries and samples by income level

Dependent variable: Annual growth of productivity (without government debt)

	All	Low Inc	Low Mid Inc	Upper Mid Inc	Mid Inc	High Inc
Prod Lag	- 0.0000007*** (0.0000002)	- 0.0000262*** (0.0000057)	-0.0000049** (0.0000018)	-0.0000008 (0.0000005)	- 0.0000015*** (0.0000004)	-0.0000002 (0.0000001)
Emp Growth	- 0.7965384*** (0.0780884)	- 0.3827536*** (0.1376704)	- 0.9569152*** (0.1464624)	- 0.9126439*** (0.1061337)	- 0.9313055*** (0.0865002)	- 0.9162545*** (0.0672117)
Inds Growth	0.0030553*** (0.0002914)	0.0022488*** (0.0004826)	0.0024202*** (0.0003306)	0.0036465*** (0.0007195)	0.0030853*** (0.0003931)	0.0049288*** (0.0004273)
Investment	0.0007512*** (0.0001862)	0.0010408* (0.0005419)	0.0009487*** (0.0002436)	0.0007107* (0.0003715)	0.0007793*** (0.0002493)	0.0005814 (0.0003497)
Openness	0.0000462 (0.0000700)	-0.0003183 (0.0002491)	0.0000239 (0.0001148)	0.0000228 (0.0001089)	0.0000599 (0.0000779)	0.000061 (0.0000472)
GFC	-0.0027307 (0.0026827)	0.0179854** (0.0088209)	0.0094906* (0.0048225)	-0.0013999 (0.0052614)	0.0009953 (0.0032455)	-0.0102448** (0.0045413)
_cons	0.0127158** (0.0050310)	0.0599589*** (0.0199061)	0.0381777** (0.0156950)	0.0137768 (0.0096147)	0.0189979** (0.0075803)	0.0079002 (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)

¹¹ There is an issue of endogeneity of this variable which will be dealt with later.

¹² When we estimated this model using government debt as a proportion of GDP, the sample sizes dropped significantly, and consequently we are not reporting these results here.

When we estimated the model for samples broken down by regions (Table 2), the results are similar to the results for groups broken down by income level. Although the coefficient on the lagged productivity level (as an indicator of convergence) is negative in all cases, it is significant only for the full sample, for East Asia and the Pacific, and sub-Saharan Africa. The employment-productivity trade-off is significant for all regions. The growth of industrial production is positive and significant for all regions. Investment is significant for the full sample, and for the OECD, EU 15, and for Sub-Saharan Africa. Openness is not significant for any group. The global financial crisis only affects the OECD and EU15 negatively.

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 1, the variable was usually not significant except in the case of the European Union 15 when it was positive and significant.

Table 2: Fixed effects estimation: All countries and samples by region

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
Prod Lag	-0.0000007***	-0.0000052***	-0.000001	-0.0000004	-0.0000014	-0.0000016	-0.000004***	0	-0.0000001
	(0.0000002)	(0.0000017)	(0.0000011)	(0.0000004)	(0.0000019)	(0.0000022)	(0.0000012)	(0.0000002)	(0.0000001)
Emp Growth	-0.7965384***	-0.7449737**	-0.872359***	-0.8575518***	-0.8303199**	-0.783507***	-0.603132***	-0.965995***	-0.933204***
	(0.0780884)	(0.3195571)	(0.1843575)	(0.1064991)	(0.3105706)	(0.1462267)	(0.1789179)	(0.0755206)	(0.0695747)
Inds Growth	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)
Investment	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)
Openness	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	-0.010821***	-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)

5.2. The Atlantic Divide

As there has been some discussion about the Atlantic Divide, we have estimated fixed effects models for the European Union 15 (EU15) and the North Atlantic (US and Canada)¹³. In Table 3 several differences appear between the two groups. Although there seems to be convergence for the US and Canada, it is not significant for the EU15. There appears to be an employment-productivity trade-off for both the EU15 and the US and Canada. The growth of industrial production and openness are positively correlated to productivity growth for both groups. Investment is positively correlated to productivity growth, but only significant for the EU15. The global financial crisis (GFC) hurt the growth of productivity for both the EU15 and the US and Canada. Openness is positive and significant for US and Canada, but not for the EU15.

Table 3: Fixed effects estimates

European Union 15 and North Atlantic (US and Canada)

	EU15	US & Canada
Prod Lag	-0.0000001	-0.0000006**
	(0.0000001)	(0.0000000)
Emp Growth	-0.9332041***	-0.6905507***
	(0.0695747)	(0.0102009)
Inds Growth	0.0054408***	0.0044469**
	(0.0003012)	(0.0002049)
Investment	0.0017053***	0.0017382
	(0.0003170)	(0.0005315)
Openness	-0.0000077	0.0002337**
	(0.0000386)	(0.0000058)
GFC	-0.0072756**	-0.0055573*
	(0.0027050)	(0.0008115)
_cons	-0.0205632**	0.0064217
	(0.0086871)	(0.0080560)
N	538	80
R-sq	0.795	0.853

Source: Panel_Annual_FE_Atlantic3

¹³ Note: Our results are not comparable to some other studies where the dependent variable is labour productivity *per hour* worked.

There are some limitations to 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 result of some long-run changes.

5.3. 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 employment growth, investment as a share of GDP and the growth of industrial production as endogenous variables and instrument them by lagged values of these variables, we get consistent estimates.

In Table 4 we list these results (broken down by income level). When we include the share of industrial production with 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 the middle-income level.

Table 4: 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
Emp Growth	- 1.0666** *	-1.9081***	-0.8867**	-0.8558**	-0.8777***	-0.304
	(0.1782)	(0.4729)	(0.3866)	(0.3874)	(0.2827)	(0.3497)
Investment	0.0002	0.0008	0.0008**	-0.0001	0.0002	-0.0003
	(0.0002)	(0.0006)	(0.0003)	(0.0003)	(0.0002)	(0.0004)
Inds Growth	0.0070** *	0.0091***	0.0053** *	0.0080** *	0.0068***	0.0103** *
	(0.0005)	(0.0028)	(0.0011)	(0.0006)	(0.0006)	(0.0016)
Prod Lag	0	-0.0000***	- 0.0000** *	0	0	0
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Openness	- 0.0002** *	-0.0006***	-0.0001	- 0.0003** *	-0.0001	-0.0003**
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Inds Share	-0.0004**	-0.0058***	- 0.0009** *	0.0002	-0.0002	0.0002
	(0.0002)	(0.0019)	(0.0004)	(0.0003)	(0.0002)	(0.0004)
Agri Share	- 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: Emp Growth, Investment, Inds Growth

Instruments: Prod Lag, Openness, Inds Share, Agri Share, GFC, Emp Growth Lag, Investment Lag, Inds Growth Lag, Inds Growth Lag

5.4. 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). There is also a very useful discussion in Roodman (David Roodman, 2006 and 2009,). Note that this method is efficient for samples with a large number of countries but a small number of time periods. As a consequence we have only estimated this model for all countries for the period 2000-2010.

Table 5 presents these results, using STATA command `xtdpdsys`, employs the generalized method of moments for estimating the model. As suggested by Roodman (David Roodman, 2009) we estimated the model with time dummies for each year (less one) but these are not reported in the table (as a result we could not test for the impact of the global financial crisis). We treat the following variables as being endogenous in this estimation: the growth rate of employment, the ratio of investment to GDP, and the rate of growth of industrial production. Using this method of estimation, there is clearly an employment-productivity trade-off, even after we have treated this variable as endogenous and instrumented in the estimation. Investment share in GDP is not significant in explaining the growth of productivity. The growth of industrial production is statistically very significant, even when we allow for its endogeneity. The variable to pick up the idea of convergence (productivity level lagged) is negative and significant but only at the ten per cent level. Curiously, openness of the economy is no longer significant in explaining labour productivity growth.

The diagnostics show that there is no serial correlation using the Arellano-Bond test for AR (2), and that the Sargan instrument validity test shows that the instruments are valid.

Table 5: SGMM estimates (Dependent variable: Average productivity growth)

Productivity Growth Lagged	-0.0156403
	(0.0658931)
Employment Growth	-1.9432057***
	(0.4029306)
Investment share of GDP	0.0009144
	(0.0008814)
Industry Growth	0.0041254***
	(0.0009641)
Productivity Level Lagged	-0.0000006*
	(0.0000003)
Openness	-0.0001519
	(0.0002382)
Industry Share of GDP	-0.0005851
	(0.0006420)
constant	1.0814335
	(1.4826323)
N	1487
Instruments	85
Arellano-Bond test for AR (2) in differences (p-value)	0.3189
Sargan test of joint validity of instruments (p-value)	0.0769

Note: Model estimated with time dummies, but not reported above.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: GMM2_Annual_12-12-2013

Note: Estimated using STATA 12, command `xtdpdsys`

Note: Investment, employment growth, & industry growth are treated as endogenous variables

5.5. 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.

Firstly, there is evidence of 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 correlation between the growth of industrial production and overall productivity growth, which is true even when we allow for endogeneity in the SGMM estimation. This suggests that the Kaldorian argument that industrial production has increasing returns to scale, as well as externalities that help economic development, seems to be substantiated.

The global financial crisis usually has a negative impact on productivity growth, especially for the OECD and the EU15. The evidence of the impact of the composition of GDP (share of industrial production in GDP) is very mixed. 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 industrialized the economy, the greater the amount of “outsourcing” 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 correlated 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 financial 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 level, 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.

6. Policies for development

There is no single set of policies that is appropriate for all countries. Policies for each country have to suit the particular historical, social, cultural and economic situation in that particular country. The Asian Crisis of 1997 and the recent events that led to the global financial crisis have shown that policies of deregulation and the Washington consensus (“stabilize, privatize, and liberalize”) are not the panacea that the World Bank and the International Monetary Fund were proposing (Dani Rodrik, 2006).

A major finding of this report was the trade-off between employment and growth. This result was fairly robust when we estimated the models by fixed effects, instrumental variables fixed effects, and by the generalized method of moments. For the full sample of countries and for all sub-samples by income level, there was a negative correlation between employment growth and productivity growth. Hence, it appears that the development that has taken place since the 1950s has been beneficial for productivity growth but not for

employment. We need to qualify the above results because growth in informal employment, if any, would not have been picked up in official employment estimates. Another important finding was the importance of investment in stimulating productivity growth through increased capacity and the introduction of technological change as overall investment embodies the newest techniques. Similarly, the growth of industrial production was a significant factor in explaining productivity growth. A rapidly growing industrial sector adds to aggregate demand and stimulates investment and technological change. This suggests that stimulating the industrial sector is important because of its economies of scale and its role in technological change. Another finding, perhaps surprising, was that openness generally decreases aggregate productivity growth. In a globalized world, it appears unusual that the more open an economy the slower is the growth of productivity. An interesting result was that the higher the share of agriculture in GDP the lower the productivity growth. Since investment is an important determinant of productivity growth, for developing countries investment in social infrastructure, public health, and education would be important policies.

Development requires not only the growth of per capita GDP, but also the growth of employment in decent work. An increase in productivity growth offers the possibility of making everyone better off if the gains are spread out evenly over the population. Thus, an increase in productivity growth does not necessarily lead to a better outcome unless the gains are shared between rich and poor. If this growth of productivity is distributed towards wages (for example by instituting minimum wages), it would help to increase aggregate demand which would then stimulate further growth.

As discussed earlier, productivity growth is not an end in itself. It is a means for a better life for people. As the ILO has emphasized, productivity growth should be accompanied by an increase in employment-population ratios, a decrease in vulnerable employment, and a fall in poverty. Hence, policies for development should not rely on “trickle down” effects.

Productivity growth, in the final analysis, is driven by producers responding to aggregate demand and introducing technological change. Policy makers can attempt to help this process by providing the conditions to stimulate aggregate demand and the introduction and transfer of technological change. This requires a better educated population, expenditure on research and development, providing conditions for producers to increase investment (which usually embodies new technology), and favourable conditions for introducing change in the workplace. However, in a market-oriented economy, these changes are often at the expense of the workers, since it involves keeping wages low and increasing the employers’ freedom to hire and fire workers. From an individual firm’s point of view, it may be profitable to keep wages low, but from the point of view of the whole economy, it keeps aggregate demand low and is therefore not conducive to increasing aggregate productivity.

Average productivity can increase either by an increase in the productivity of each firm, an increase in the sector, or by a shift of factors of production from the lower productivity sectors to the higher productivity sectors.

Let us first look at the productivity of individual firms. If the firms with lower productivity move towards the efficient frontier then it would increase productivity. Similarly, if the less efficient firms went bankrupt, average efficiency would rise. But this may be at the expense of falling employment. If the more efficient firms take over the less efficient firms it would increase productivity. However, that is likely to increase the degree of monopolization in the economy which is not beneficial. How can policies encourage an increase in efficiency of individual firms? Often it is argued that this requires less government regulation and a

more “flexible” labour market (in other words, a limit on unionization, freedom to hire and fire, etc.). There has been some literature in recent years that has demonstrated that a so-called flexible labour market with limited regulation does not increase productivity.¹⁴ (UNCTAD, 2010) (OECD, 2004) (Peter Kriesler and John Nevile, 2011). Eventually, increased productivity requires the employers to cooperate with the workers to increase productivity. Governments can provide services to encourage workers to move from low-productivity firms to higher productivity firms, this could be in the form of re-settlement allowances. Governments can also help in terms of increasing research and development by government grants and tax benefits to firms which invest in R & D. In many developing countries, governments may encourage foreign direct investment which brings in new methods of production. However, this is often at the expense of providing tax holidays to multinational firms.

The manufacturing and industrial sectors usually have faster rates of productivity growth as a result of increasing returns to scale, externalities in production, and increased investment in new technologies. If aggregate demand is increasing rapidly then firms are encouraged to invest and expand. This requires wages to be growing, as workers spend a higher proportion of their incomes than capitalists.

The final method of increasing aggregate productivity in developing countries is to move factors of production from agriculture to the industrial sector. Agricultural or rural workers who migrate to the urban sector usually end up working in the informal sector, at least for a fairly long period of time, (P. N. (Raja) Junankar and Abu Shonchoy, 2013 (forthcoming)). To help a country to develop, it is necessary for it to have a strong and dynamic agricultural sector that produces a surplus to sustain the population that is producing in the industrial/urban sector. Hence, investment in agriculture is important. However, the econometric results suggest that agriculture does not help productivity growth. But from a wider perspective, agricultural production is important, (UNCTAD, 2010).

Our econometric results show that there are significant differences between different regions and between countries at different income levels. Hence, the policies recommended have to be tailored differently for each country depending on its history, its social and cultural settings, and its institutions. The econometric results in this research only give some broad indications about which directions policies should follow.

7. Conclusions

This research has investigated the proposition that there is a trade-off between employment and productivity. After a brief discussion of the concept of productivity, the problems in measuring it, and suggested methods of decomposing aggregate productivity growth into two components: a component that was due to increased productivity of individual sectors and a component due to inter-sectoral reallocation (structural change). 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. Next we provided a brief review of the literature on employment and productivity.

¹⁴ In 2004, the OECD *Employment Outlook* stated that: “The impact of EPL on overall employment and unemployment rates is ambiguous... Overall, theoretical analysis does not provide clear-cut answers as to the effect of employment protection on overall unemployment and employment. ... no clear association can be detected between EPL and unemployment rates. [OECD 2004, 80.]

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 of the convergence of productivity growth across groups of countries. We found that there was a negative and statistically significant correlation 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, in general, a very significant explanatory variable. The impact of the global financial 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 I: Country Studies

8.1. Bangladesh (low-income economy)

Bangladesh emerged as an independent nation after the war of independence from Pakistan in 1971. Its early years were traumatic and affected by the oil price shocks of the early seventies, as well as political turmoil. It set out on the path to democracy after the elections in 1991. These factors have played an important role in its subsequent economic development.

It is a densely populated country heavily dependent on agriculture and very much reliant for foreign exchange on remittances from overseas migrants. In recent years it has become one of the largest exporters of garments in an industry which employs a large number of (mainly) women. There has been a significant decline in the fertility rate and an increase in female labour force participation. It is a low-lying country subject to flooding and natural disasters. It is the birthplace of microfinance with Nobel Laureate Mohammad Yunus's Grameen Bank.

After an erratic beginning, real GDP grew at 3.5 per cent from 1990 to 1999 and 5.6 per cent from 2000 to 2010; labour productivity grew at the rate of 1.6 per cent in the 1990s, rising to 3.0 per cent in the 2000s; meanwhile employment grew at 1.9 per cent in the 1990s and rose to 2.5 per cent in the 2000s. From 2005 to 2010, labour productivity grew faster than employment. The employment-population ratio fell from 72.7 per cent in 1991 to 67.6 per cent in 2011, while vulnerable employment increased from 69.4 per cent in 1996 to 85.0 per cent in 2000, the last year for which we have data on this variable. The poverty head count at \$2.00 per day went down from 90.46 per cent to 76.54 per cent in 2010. Thus, overall we see an improvement, with productivity growing and decreasing poverty, albeit with a decline in the employment-population ratio and an increase in vulnerable employment.

Since about 2007, productivity has been growing faster than employment so there appears to be a short-term trade-off.

The recent global financial crisis has led to a slowing down of the Bangladesh economy.

Figure 1: Bangladesh – labour productivity and employment

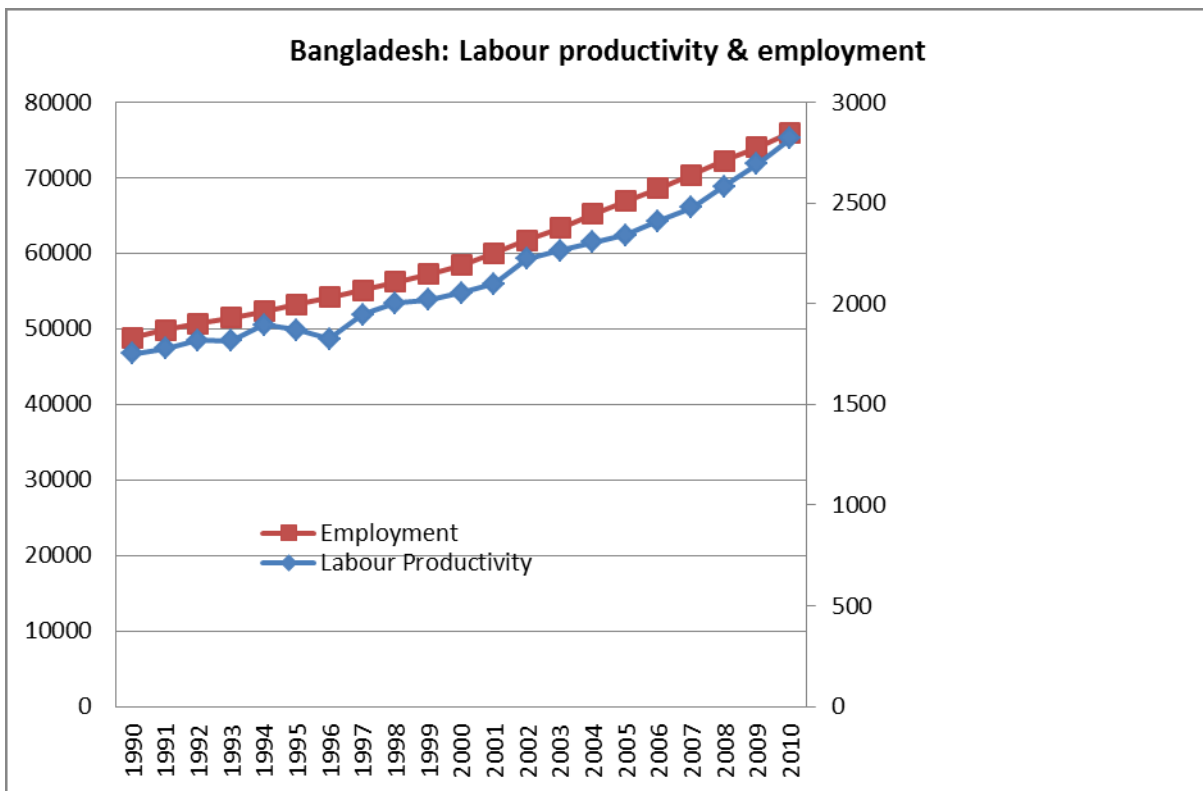


Figure 2: Bangladesh, growth of labour productivity

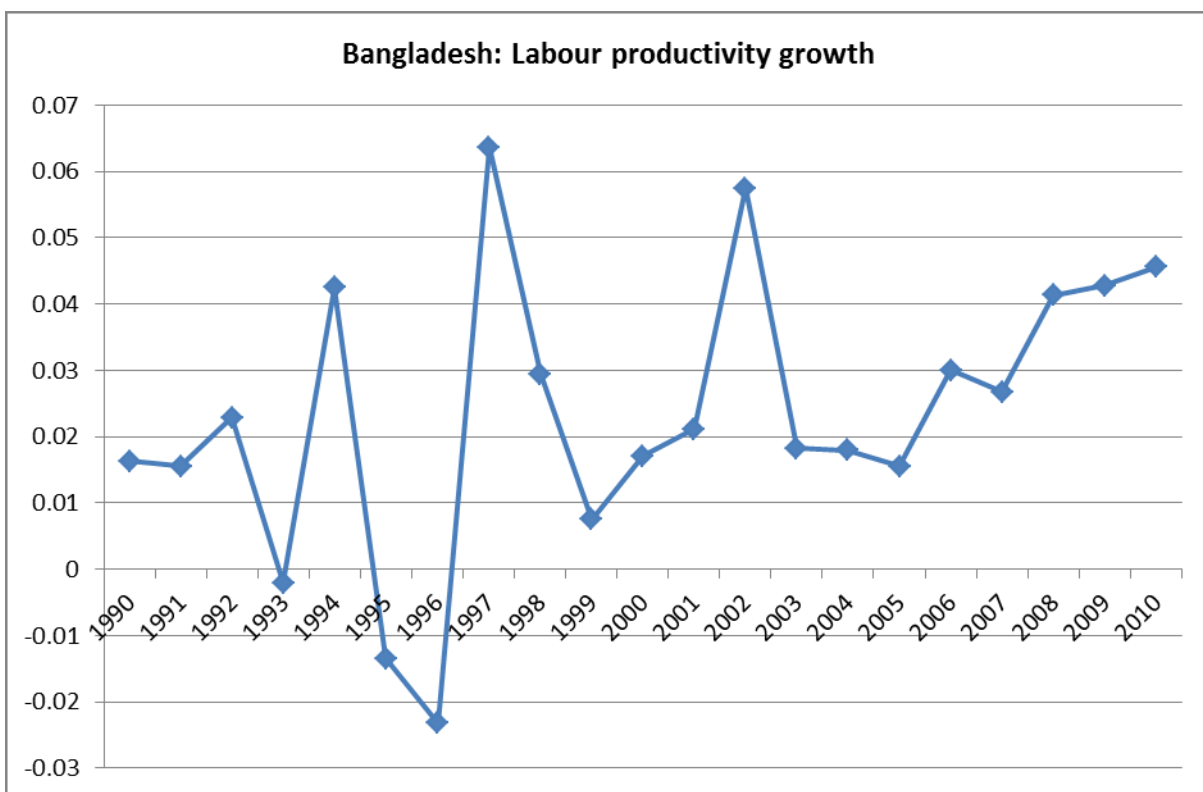


Figure 3: Bangladesh – Employment growth



8.2. Indonesia (lower middle-income economy)

After becoming independent from the Netherlands in 1945, Indonesia was led by President Sukarno. He was removed in a coup by President Suharto in 1967. The end of the Suharto regime was followed by a democratic transition in 1998, just after the Asian Crisis of 1997-98. Indonesia is a densely populated country with a population of approximately 240 million.

Indonesia survived the global financial crisis with comparative ease, partly because it had already made various policy reforms (including reform of the financial sector) after the Asian Crisis of 1997-98. The growth rate of real GDP fell from 7 per cent for the pre-crisis period of 1990-1997 to 5 per cent in the post- crisis period 2000-2010.

Labour productivity fell after the 1997 Asian Crisis and did not recover to the pre-crisis level until 2008. In the pre-crisis period (1990-1997) average labour productivity growth was 4.6 per cent p.a. falling to 3.15 per cent in the post-crisis period (2000-2010); employment growth fell from 2.6 per cent to 1.8 per cent over the same period. The employment-population ratio fell from 70.0 per cent in 1997 to 67.2 per cent in 2010, and vulnerable employment decreased slightly from 62.8 per cent in 1997 to 61.6 per cent in 2010. Head count poverty at \$2 per day fell from 77.0 per cent in 1996 to 46.1 per cent in 2010.

In interesting papers, Tadjoeiddin (2013a, b) shows that since 2004 real earnings have been declining although labour productivity has been increasing (using data from the Indonesian labour force survey - Sakernas). The paper also shows that wages as a proportion of labour productivity have been declining in most industries, especially in agriculture which is a major sector of informal employment. (Unfortunately, these data are neither available in the World Bank data set nor in the Penn World Tables.)

This suggests that the Indonesian economy has improved in some ways (although with a slower growth rate) with increasing productivity but slowing employment and a fall in the employment-population ratio. A major achievement is that Indonesia did not suffer from the global financial crisis.

In 2011, World Bank raised Indonesia’s status to “middle-income country”.

Figure 4: Indonesia – Labour productivity and employment

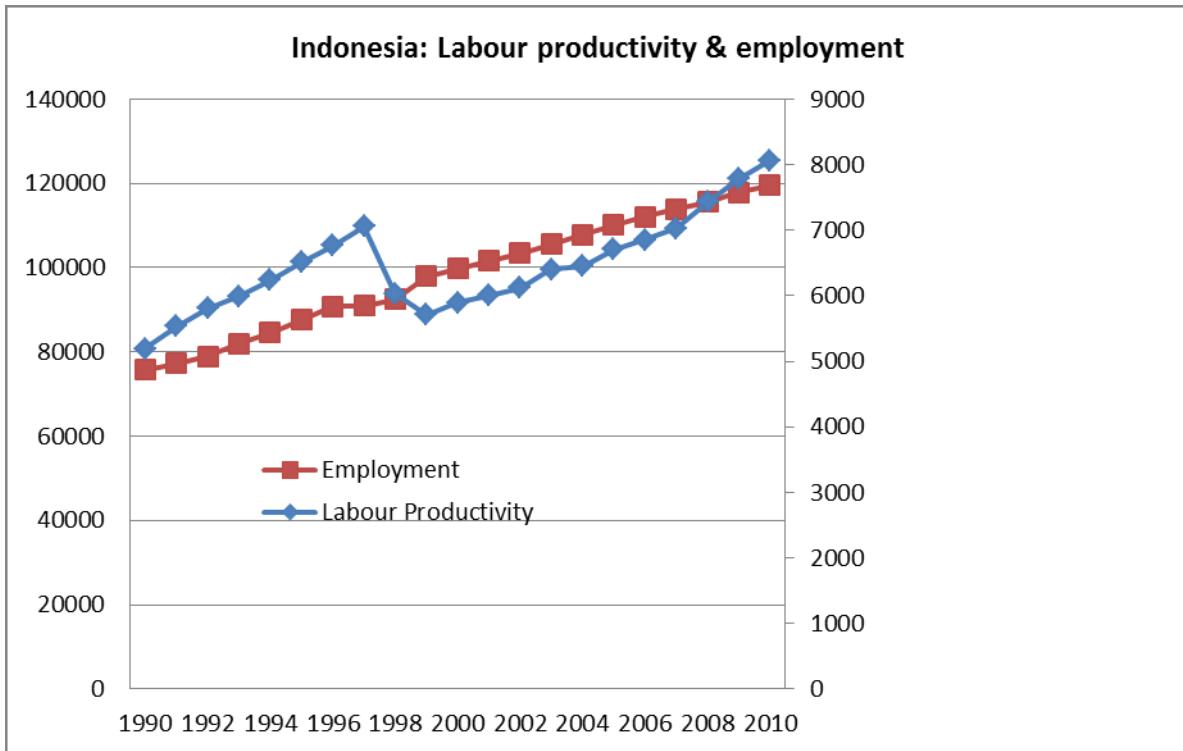


Figure 5: Indonesia, Labour Productivity Growth



Figure 6: Indonesia – Employment growth



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8.3. Egypt (lower middle-income country)

Egypt has recently been through some difficult times and the social and political events have led to a slowing of economic growth and increasing unemployment. Economic reforms have now been watered down or delayed. Future developments in the Egyptian economy are very uncertain.

Egypt’s real GDP was growing at a fairly rapid rate of 5.4 per cent in the 1990s, but that declined to 5.0 per cent in the 2000s. Labour productivity growth slowed from 3.8 per cent in the 1990s to 1.8 per cent in the 2000s, while employment growth rose from 1.7 per cent to 3.2 per cent. The employment-population ratio over these two periods remained almost constant at 42 per cent. Vulnerable employment decreased from 28.3 per cent in 1993 to 20.6 per cent in 2001, but the trend reversed over the next few years, rising to 27.3 per cent in 2007, the last year for which we have data. The poverty head count ratio at \$2 per day fell from 27.84 per cent in 1991 to 15.43 per cent in 2008.

These movements suggest some improvement in decent work, with increases in productivity, increases in employment and a fall in the poverty ratio. However, the recent increase in vulnerable employment is a matter of concern, especially with the recent crisis, when it is likely that most of the variables affecting decent work are likely to have become much worse.

Figure 7: Egypt – Labour productivity and employment

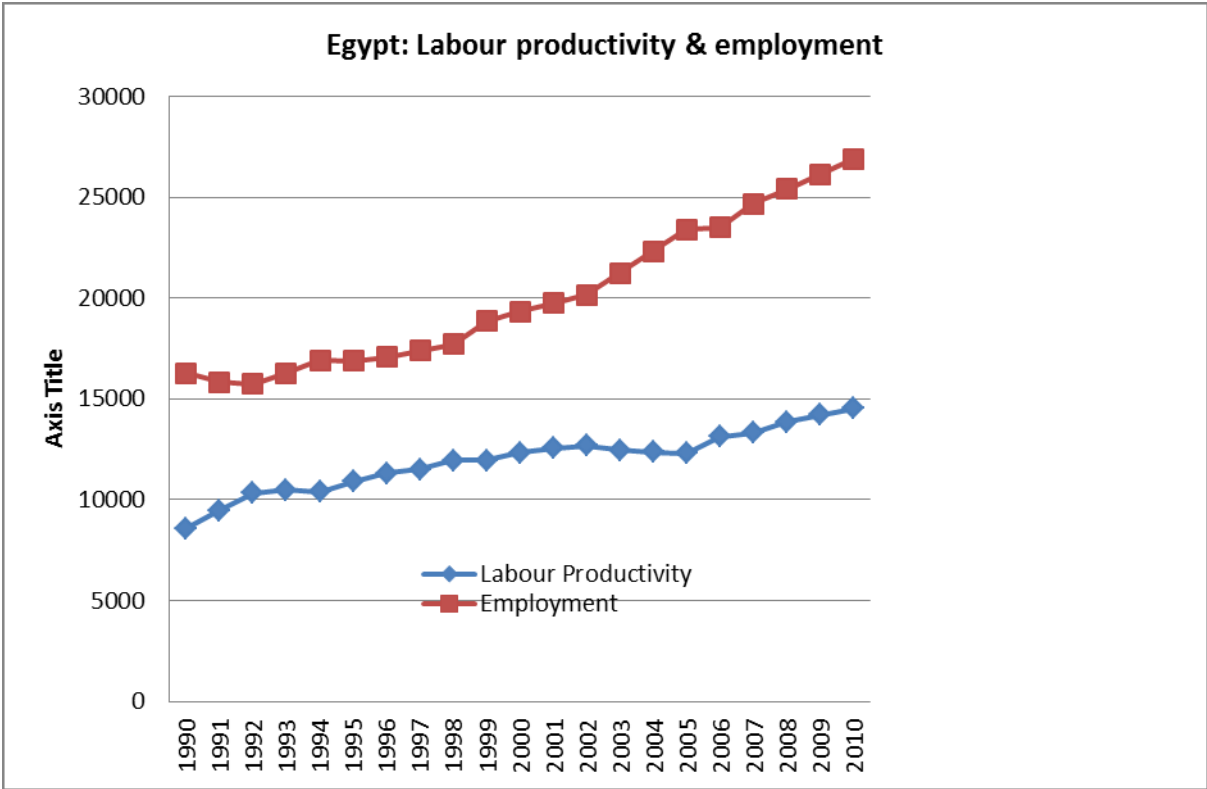


Figure 8: Egypt - Labour productivity growth

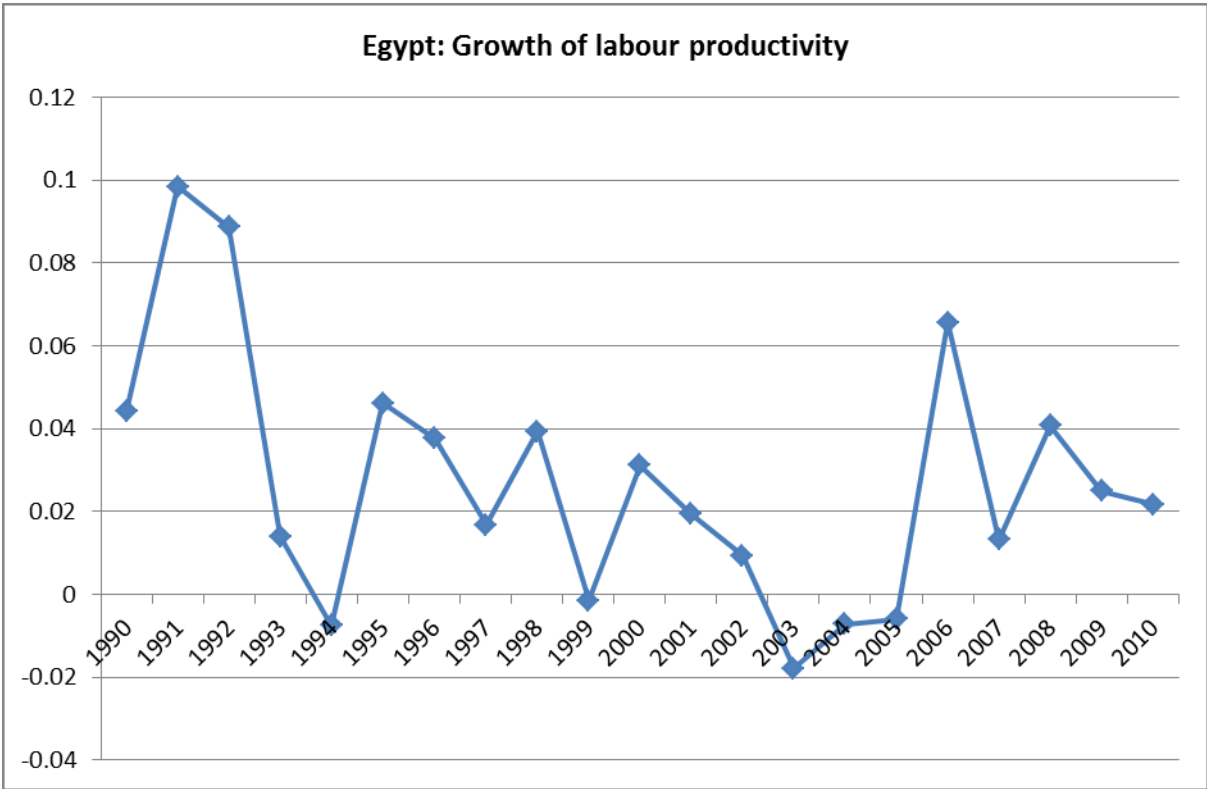


Figure 9: Egypt - Employment growth



8.4. Argentina (upper middle-income country)

Argentina is one of the largest economies in South America. Real GDP growth has averaged about 3.9 per cent per annum since the 1990s although during the crisis from 1999 to 2002 it suffered negative growth. The average growth rate of GDP in the 1990s was 4.0 per cent but fell to 3.8 per cent in the 2000s. Labour productivity growth fell from 2.5 per cent to 2.0 per cent, while employment growth increased from 1.5 per cent to 1.8 per cent over the same period. The graph below shows that labour productivity began to increase rapidly after the crisis, but employment growth slowed.

Over the same period, the employment-population ratio rose from 50.7 per cent to 53.1 per cent; vulnerable employment fell from 24.2 per cent to 21.2 per cent; but the poverty head count ratio increased from 6 per cent to 10 per cent. This conceals the fact that the poverty head count ratio was rising slowly from 2.51 per cent in 1991, followed by a sudden increase during the crisis of 2001-2002 to 23.05 per cent, after which it fell steadily to 1.87 per cent in 2010. Since the crisis there have been significant efforts to increase expenditure on health and education. The global financial crisis of 2008-2009 again led to a worsening of the economic situation in Argentina.

Figure 10: Argentina – Labour productivity and employment

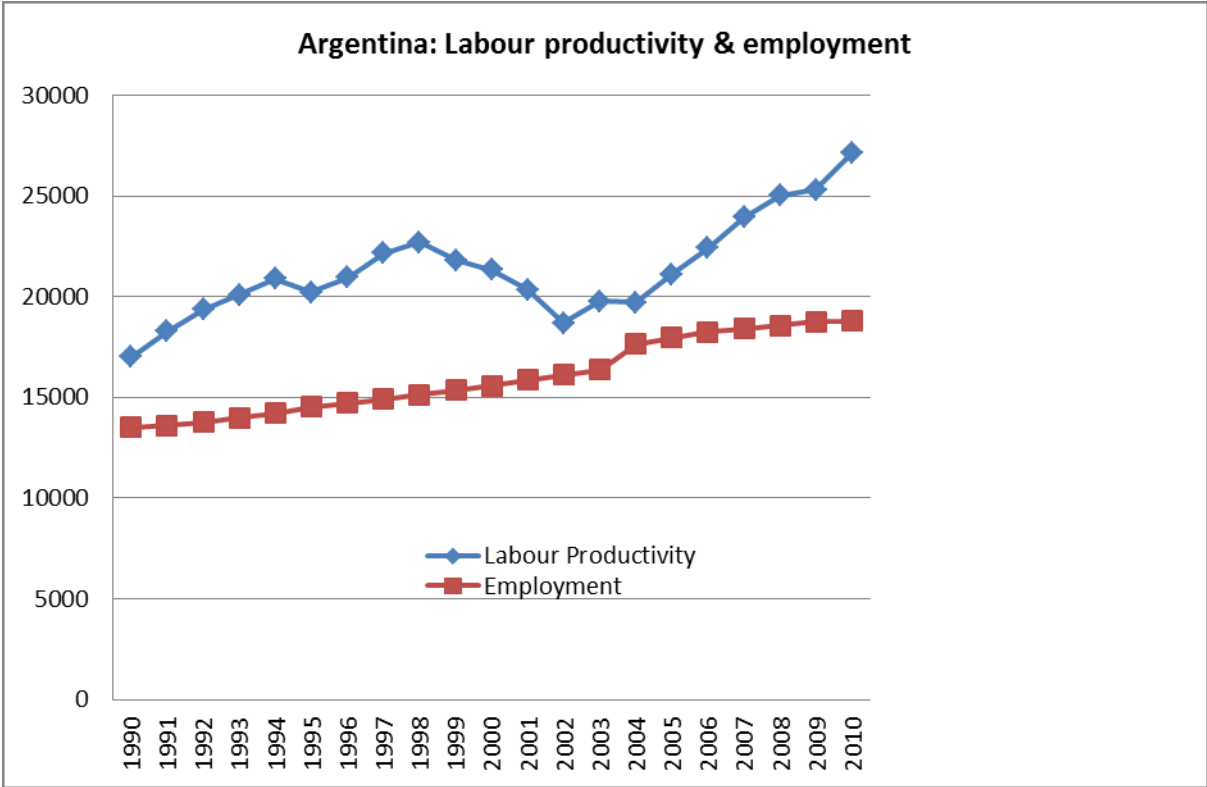


Figure 11: Argentina – Labour productivity growth

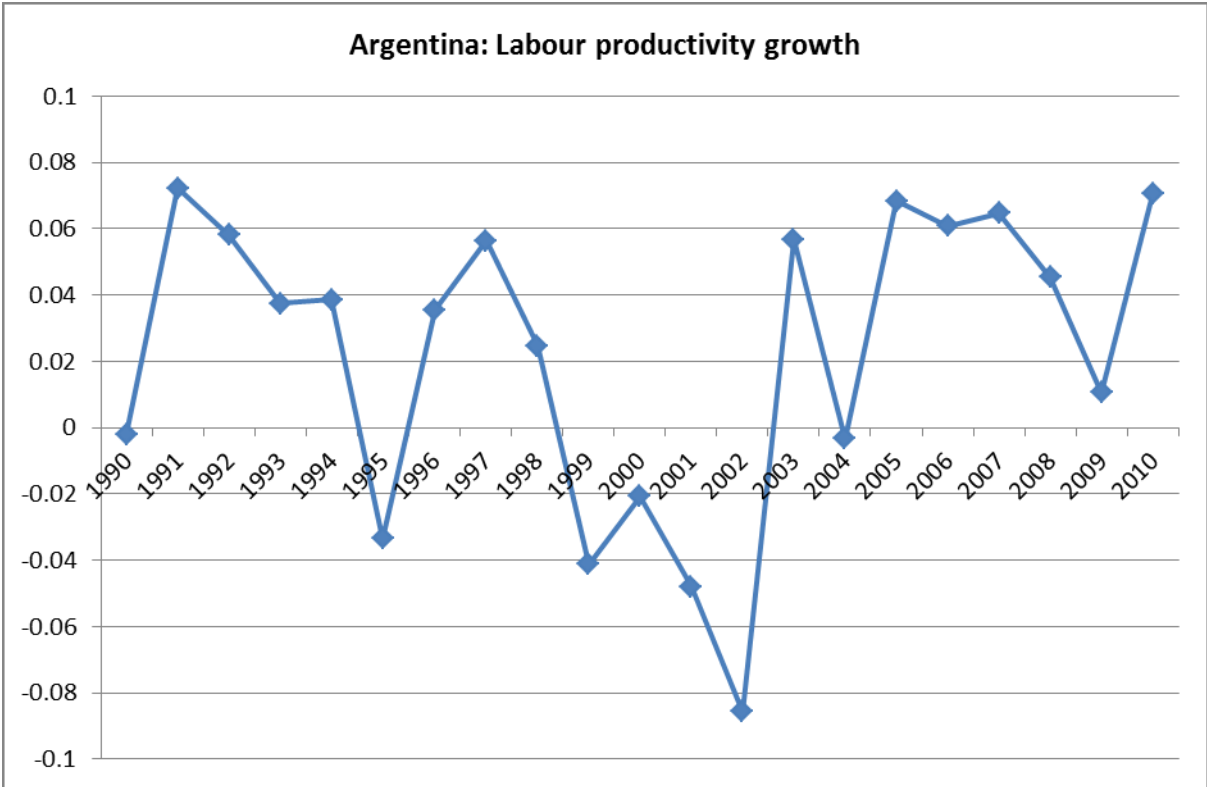


Figure 12: Argentina - Employment growth



8.5. Australia (high-income country)

Australia is one of the OECD high-income countries. It has had a well-developed social security system for many years. It was one of the few OECD countries that did not go through a recession during the global financial crisis, although unemployment increased and employment growth slowed.

As a developed economy, it has had a relatively slow growth rate of GDP, which averaged 3.6 per cent during the 1990s and fell to 3.0 per cent in the 2000s. It had gone through a major recession in the early 1990s when unemployment rose to 11.0 per cent in 1993, after which unemployment slowly came down.

Labour productivity growth fell from 2.1 per cent in the 1990s to 1.1 per cent in the 2000s. Employment growth went up from 1.3 per cent in the 1990s to 1.7 per cent in the 2000s. The employment-population ratio went up from 57.4 per cent to 60.9 per cent and vulnerable employment decreased from 11.1 per cent to 9.9 per cent over the same period. The slowdown in productivity growth is causing serious concern to policy makers as this makes Australia less competitive internationally.

Figure 13: Australia– Labour productivity and employment

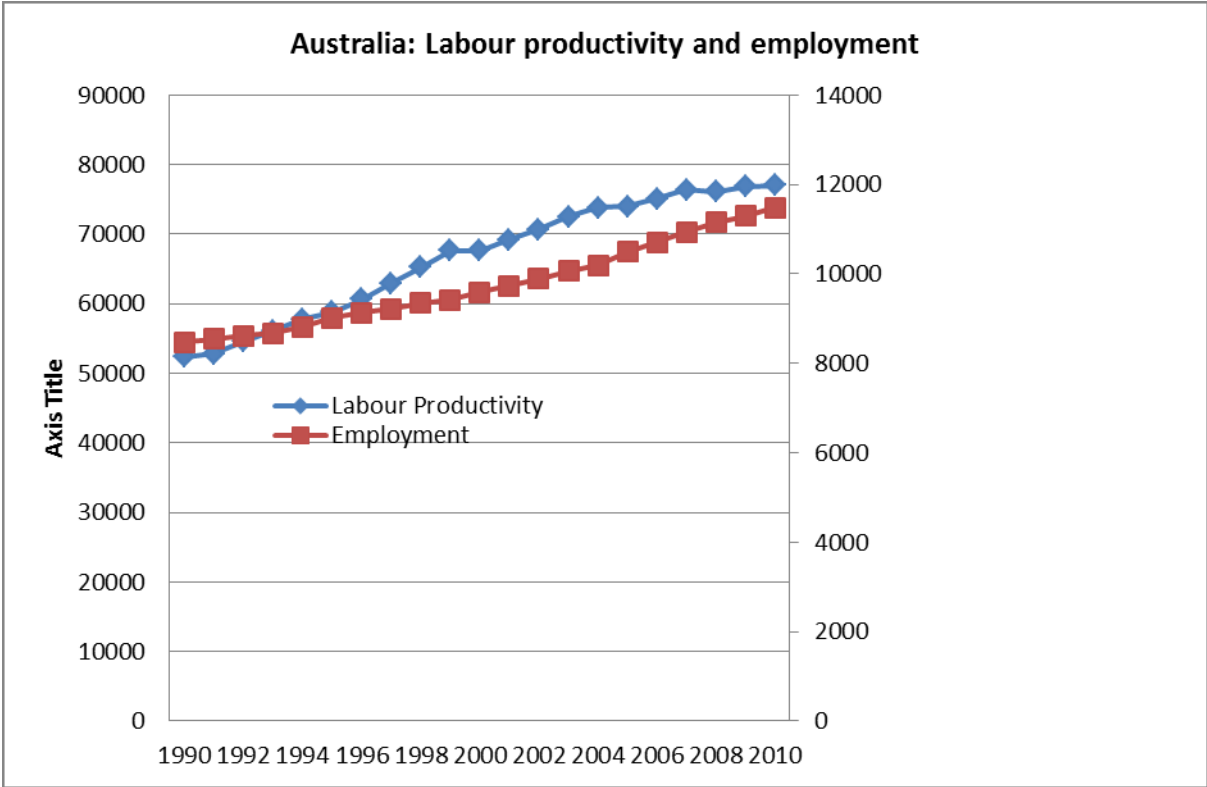


Figure 14: Australia – Labour productivity growth

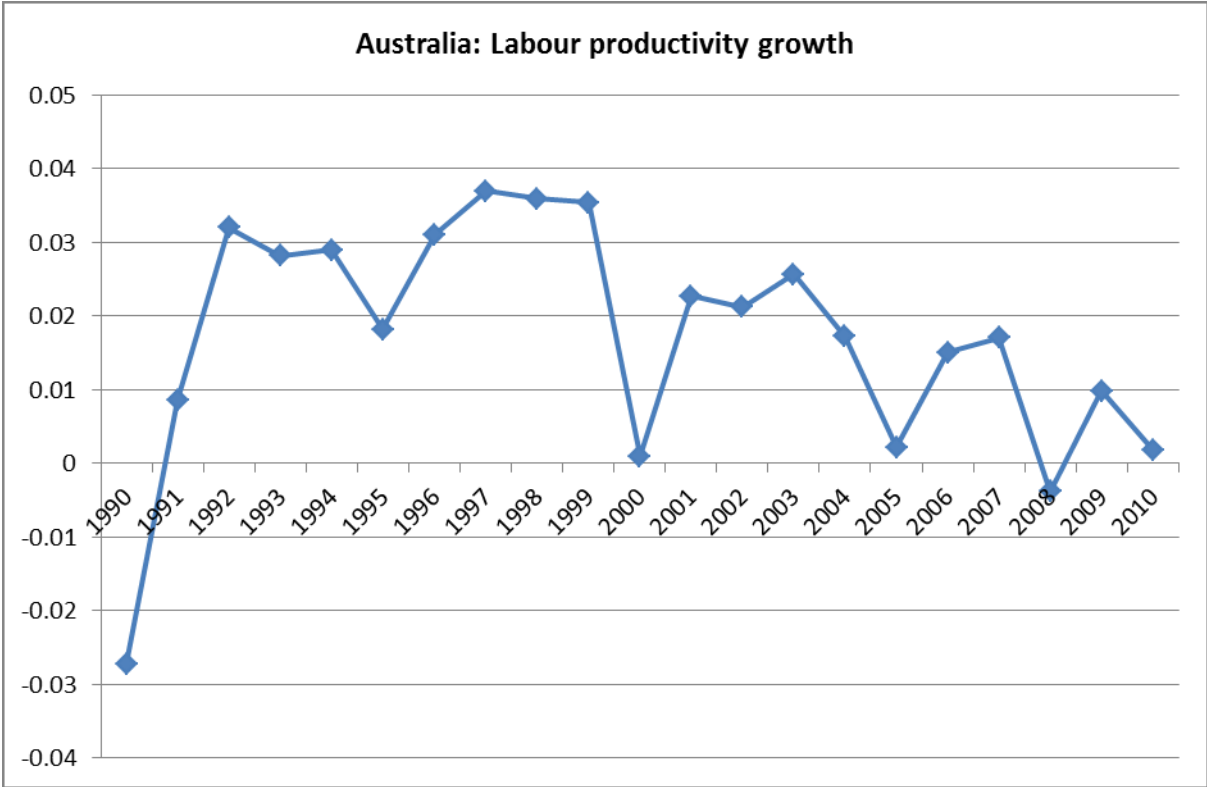


Figure 15: Australia – Employment Growth



8.6. Conclusions

These country studies show that the behaviour of these economies is very diverse. It is difficult to draw any firm conclusions about a trade-off between employment and productivity. As discussed in the main report, we need to control for several factors in an econometric model to be able to draw any conclusions. However, these country studies exemplify that the low-income countries are growing relatively rapidly in terms of labour productivity but are not keeping up in terms of employment. Although poverty rates are coming down in most countries, they are still very high. Policies to help development need not only to target economic growth and productivity, but also need to focus on the growth of employment, a lowering of vulnerable employment and poverty.

Appendix II: 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
$$gwok = \ln(\text{worker})_t - \ln(\text{worker})_{t-1}$$
, where
$$\text{worker} = (\text{rgdpl}/\text{rgdpwok}) * \text{pop}$$

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
$$\text{grgdpwk} = \ln(\text{rgdpwok})_t - \ln(\text{rgdpwok})_{t-1}$$
, 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 (per cent) over the period
- indgdpct: Industry, value added (per cent of GDP)

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- . 2001. *Reducing the decent work deficit: A global challenge*, Report of the Director General, International Labour Conference, 89th Session, Geneva, 2001 (Geneva). Also available at: <http://www.ilo.org/public/english/standards/reim/ilc/ilc89/rep-i-a.htm> [24 April 2008].
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