EMPIRICAL STUDIES IN TRADE, STRUCTURAL CHANGE AND GROWTH

ALLYSON JOHN (BSc., MSc.)

Thesis submitted to the University of Nottingham for the degree of Doctor of Philosophy

June 2016

Acknowledgments

The completion of my Doctorate at the School of Economics, University of Nottingham, was made possible via the contributions made by several individuals to whom I am forever indebted. Firstly, I must thank the Lord for providing me with the drive, patience and sustenance needed to complete this PhD journey. Secondly, I would like to pay special gratitude towards my supervisors Professor Chris Milner and Professor Richard Kneller for their guidance and encouragement in the writing of my thesis. I have benefitted from their critical appraisal of my research and their contributions of ideas and suggestions served towards its improvement.

I would like to express my sincerest thanks to my family for having great confidence in me and serving as a source of inspiration throughout this entire process. I must especially mention my husband Matt for his unwavering belief in my ability to do well. He was always at hand to provide that word of encouragement when needed the most. Additionally, thank you to my son Anthony. Although I submitted this thesis just before he was born, he gave me that extra push needed in the final stages of my research journey. The support of my parents has also been invaluable. They never doubted my ability to leave my home country to take on, and successfully complete this challenge. I would also like to say thank you to the rest of my immediate family, especially my aunts Hilary, Chris and Christine, whose constant support helped propel me onward towards achieving my goal.

Finally, I would like to say thank you to my Nottingham and non-Nottingham based friends. They have all been a great source of support, and helped provide me with that much needed balance that allowed me to maintain some level of normalcy throughout this process. Among these, special mention must be made to Karen, Donneil, Kian, Zo, Molicia, Jenille and Kenya.

Abstract

There is a general consensus regarding the positive relationship between trade and productivity growth. Openness to trade encourages an efficient allocation of the factors of production within that trade. This thesis encompasses three studies that analyse the relationships between trade policy and openness and economy-wide productivity growth and its components through different channels. In doing so, we attempt to add to the existing literature on international trade, while accounting for some observed shortcomings in the existing literature. Firstly, empirical studies examining relationships between trade, resource allocation and economy-wide productivity tend to focus only on developing economies and as such our studies comprise a mix of developed and developing nations. Furthermore, in the case of productivity growth, attention is usually biased in favour of looking at aggregate productivity, potentially missing important details at a disaggregated level. We account for this by conducting studies using disaggregated data so that we can identify any patterns or trends that may be masked by aggregate data. In addition to this, the trade-growth literature faces criticisms regarding its inability to identify an exogenous measure of trade and as such we employ the use of an exogenous instrument for trade to conduct a study on trade and productivity.

In our first study (Chapter 2), we examine the relationship between trade liberalisation events and structural adjustment in employment and output. To conduct this study, we employ the 3-digit level of the International Standard

Industrial Classification (ISIC), Revision 2 data for the manufacturing sector, covering the period 1976 to 2004 for a sample of 35 countries. We also investigate the conditioning effects of complementary policies, in particular institutional quality, on the trade-adjustment relationship. We use data on institutions from the Economic Freedom of the World Index. We find that the use of aggregate data indicates the absence of a systematic relationship between trade liberalisation and structural adjustment. However, through disaggregation, we find that the occurrence of a trade liberalisation event reduces adjustment in intermediate goods employment and output and increases adjustment in capital goods output.

In our second study (Chapter 3), we use a panel of 38 countries and employ the 10-sector productivity database derived from the Groningen Growth and Development Centre (GGDC) for the period 1990 to 2005, in order to explain labour productivity gaps across developing regions. Specifically, we analyse patterns of economy-wide productivity and its two components across countries within Latin America, Africa and High-Income regional groupings. The first component, structural change, captures changing sectoral shares of employment as labour reallocates across sectors. The second component, the within component, captures the reallocation of resources within sectors as well as technological improvements occurring within sectors. Our findings suggest that differences in economic performances across regions are accounted for by negative structural change occurring in individual countries within these regions. This means a reallocation of employment from high productivity activities in favour of lower productivity ones, thereby contributing negatively to overall productivity growth. Furthermore external shocks such as falling oil prices appear to drive this type of growth reducing structural change.

Finally in Chapter 4, we investigate the relationship between trade openness and economy-wide productivity and its structural change and within components as defined in Chapter 3. We use a panel of 38 countries, again employing the GGDC 10-sector productivity database for the period 1965 to 2006, along with the complete gravity dataset provided by Head, Mayer and Ries (2010). Our findings of this study support theories that suggest a positive relationship between trade and economy-wide productivity. Our results also indicate that it is the within component of economy-wide productivity that is driving this results.

Table of Contents

List of Tables

List of Figures

Chapter 1 : Introduction

1.1 Context and Motivation

There is a general consensus in the literature on international trade that international trade produces economic gains for countries across the world through the facilitation of an efficient allocation of the factors of production within countries. This agreement in favour of free trade is based on both theoretical and empirical reasoning (Rivera-Batiz and Romer, 1991; Dollar and Kray, 2004; Bernhofen and Brown 2005). Increased openness, however, means that countries are exposed to challenges and adjustment costs associated with changing patterns of trade.

Trade liberalisation and other economic reforms have contributed to significant changes in the structure of economies (Roy, 1997; Chang et al, 2005). It is therefore important that policy makers concern themselves with the effects of international trade on domestic sectors and industries. One of the most contentious issues in this arena is the potential loss of jobs in the import-competing industries following trade liberalisation (Kletzer, 2002). A vital first step to contributing to this debate requires an understanding of the effects of trade on employment adjustment. Given the potential for complementary policies to affect the outcome of trade policy, it is important that conditioning effects of such complementary policies are also investigated. The presence of complementary polices such as institutional and regulatory reforms that are effective, will allow economies to be flexible and aptly adapt to changing economic environments, such as that created by exposures to external shocks arising from increasingly liberalised trade. The presence of such policies can possibly reduce the length of time over which the process of adjustment occurs as well as associated costs of adjustment that accompany increased trade liberalisation. This is turn can ensure that the intended gains from trade are maximised. For example, if prices are inflexible prices, the transmission of vital signals to buyers and sellers will be restricted and this may inhibit resources from moving to areas in which they can be used more productively.

Much of the literature on labour adjustment usually places emphasis on individual countries or regions and focuses on transitional costs such as temporary unemployment induced by trade liberalisation. For example, Perry and Olarreaga (2005) investigate trade liberalisation, inequality and poverty reduction in Latin America and find that the impact of trade reform in imperfectly functioning labour markets, such as potential transitions in and out of unemployment, informality, as well as income volatility, are likely to affect and sometimes change the direction of the effect of trade reform on income inequality and poverty. Furthermore, most of the trade-adjustment studies limit their focus to analysing the effect on developing economies. One such study by Ravenga (1997) analyses the employment and wage effect of trade liberalisation and finds that trade liberalisation affected firm-level employment by shifting down industry product demand. Currie and Harrison (1997) investigate the impact of trade reform on capital and labour in Morocco and find that trade did not affect employment in the average private sector manufacturing firm, while exporting firms and firms most highly affected by the reforms, suffered significant employment losses. Furthermore the authors find that a significant fraction of manufacturing firms did not adjust employment. As such, we use this as an opportunity to conduct a study on a combination of developed and developing economies and attempt to empirically assess the effect of trade on adjustment in employment and output, as well as the extent to which institutional quality influences this relationship.

There is a general consensus regarding productivity gains from trade (Helpman and Krugman, 1985; Melitz 2003). However, the size of these gains and the mechanism through which these occur are central to policy debates on trade liberalisation. In particular, a comparison of productivity performance across countries and regions reveal dynamism in the economic records, or the existence of productivity gaps among these economies, raising broad questions regarding the relationship between trade, structural change and productivity growth. These questions go to the heart of thinking and theorising about growth and economic development and the relationship between changes in the sector composition of production inputs and outputs and aggregate economic performance. The extent of any productivity gaps existing among developing economies and between developed and developing economies requires a comprehensive understanding of the sources of aggregate growth. This is the first step towards drawing conclusions about the relationship between trade and aggregate productivity growth.

Aggregate productivity growth can arise from structural change as resources reallocate across sectors and industries to more productive use, thereby changing relative sectoral productivity. Alternatively overall productivity change can arise from within changes as resources reallocate within sectors and industries or as a result of firms becoming more technologically advanced and increasing their productivity performances. Observations of productivity gaps and diverse growth rates especially among developing nations highlights the need for a more profound understanding of the sources of aggregate growth, so that policy responses can be tailored to allow countries playing catch-up to do so in a quicker and more effective manner. Furthermore, the literature tends to place emphasis on economy-wide growth neglecting the relevance of the sources of growth, for not only growth theory but business cycle and labour market theory as well. We therefore use this to our advantage to contribute to the literature by investigating patterns of the within and structural change component over time; again for both developing and developed regions allowing us to explore heterogeneity in productivity growth across countries.

Naturally, the next step involves an investigation between the trade openness and the sources of growth. Proponents of increased openness have contributed both theory and empirical evidence in order to demonstrate the existence of a positive relationship between trade and improved economic performance. If the gains from trade are such that trade openness encourages increased national aggregate productivity, it could expand a country's production frontier. An open market implies that firms and workers will need to adjust as resources shift in favour of more efficient activities. In addition, with increased trade exposure, lower-productivity import-competing firms are forced to become more efficient or shut down while higher productivity firms expand, increasing overall productivity in the economy increasing firms' incentives to increase their employment levels. Melitz (2003) model of firm heterogeneity postulates that with greater trade exposure higher-productivity firms are induced to export with the low productivity firms exiting the industry. Taking all of the above into consideration, it is still unclear which source of growth, and to what extent, are the sources of growth responsible for this increased productivity induced by greater trade. It is therefore important to identify the source of this improvement in aggregate productivity; particularly, whether it stems from restructuring of resources or from technological improvements within sectors or from a restructuring of resources across sectors in response to trade reform.

The purpose of this thesis is to comprehensively illustrate or highlight any links between international trade, structural change and productivity. Trade liberalisation may trigger a process of domestic restructuring which could affect inputs and outputs of the production process. Through specialisation, resources can shift to their most productive use, increasing the value of aggregate production and incomes. Furthermore, with increased openness and foreign competition, producers are forced to search for more efficient methods of production, therefore increasing the aggregate productivity in the economy. This thesis is advantageous in that it captures all of the above, through different channels and leaves the reader with a more comprehensive understanding of the link among the different variables.

1.2 Organisation and Main Findings of Thesis

This thesis brings together three studies on the patterns of trade, structural change and productivity growth, as well as relationships among these variables in developing and developed countries. This introductory chapter is followed by the first study (Chapter 2), which investigates the conditioning impact of trade liberalisation on manufacturing employment and output. We also examine the effect of institutions on this relationship. By using a measure of structural adjustment that captures changes in manufacturing employment and output shares, a Sachs and Warner (1995) dummy to measure trade liberalisation events and a proxy measure for our unobservable institutional quality variable, we specify six econometric models and use fixed effect estimations in an effort to explain the behaviour of structural adjustment in manufacturing employment and output upon subjection to trade liberalisation policies and complementary institutional reforms.

To conduct this study we employ the United Nation's (UN) 3-digit level of the International Standard Industrial Classification (ISIC), Revision 2 data for the manufacturing sector, disaggregated into 28 manufacturing industries. Our data covers the period 1976 to 2004 for a sample of 35 Low-Income developing and High-Income Organisation for Economic Co-Operation and Development (OECD) countries. For our data on institutions we utilise the

Fraser Institute's Economic Freedom of the World Index, which measures the extent to which countries promote economic freedom through their policies and institutions.

The results of our first study suggest that there is no systematic relationship between inter- industry employment (and output) reallocation and trade liberalisation. This finding does not support a priori expectations of increased adjustment post-liberalisation. Our results also suggest that the presence of institutions does not affect this finding. However, disaggregation of the 28 manufacturing industries according to category of good, specifically, consumption, intermediate and capital goods indicate that the latter results of no systematic relationship between trade and structural adjustment hold for employment and output adjustment in the consumption goods category. However, we find reduced adjustment post liberalisation in manufacturing employment and output within the intermediate goods category. Furthermore, for industries within the capital goods grouping, there is an increase in output adjustment given the occurrence of a liberalisation event. Our findings suggest that different categories of goods appear to be facing different levels of liberalisation and as such are experiencing varying rates of adjustment. For example, our results suggest that industries within the intermediate and capital goods categories, often the non-competing imports in developing economies, are more liberalised than industries within the consumption goods category. Governments may encourage increased openness in some industries more than others to ensure the protection of infant industries from competing imports.

Our study extends on the work of Wacziarg and Wallack (2004) and supports their findings of the absence of a systematic relationship between trade and structural adjustment in employment when we employ aggregate data but as discussed above, such results do not hold when we disaggregate the data. Our results in Chapter 2 contribute to the trade literature in a number of ways. Firstly, we extend the geographical and period coverage on the adjustment literature by including both developing and developed countries in our sample along with an updated time coverage. Secondly, we do not limit our analysis to the use of the employment variable by also analysing the effect on output, another important variable directly affected by trade. Thirdly, we explore the importance of complementary reforms on the relationship between trade and employment adjustment by exploring the importance of institutions on this relationship. Finally, we not only explored heterogeneity across countries but also the heterogeneity across industries within the manufacturing sector. Our investigations of dynamism in trade liberalisation policies across industries provide evidence in support of arguments that there may not be as much liberalisation as suggested by lower average tariffs.

Our second study (Chapter 3) is an empirical essay, which we complete through the use of growth accounting analysis. This essay focuses on decomposing economy-wide labour productivity growth into its structural change and within components to examine the patterns of these components of economy-wide productivity growth over time for a sample of Asian, African, Latin American and High-Income countries. The structural change component measures the change in employment shares as resources reallocate across sectors. This component contributes positively to economy-wide productivity growth when the distribution of resources changes in favour of higher productivity activities. The within component captures the impact on overall productivity growth as employment reallocate within sectors. Within productivity growth also arises from technological improvements within sectors, thereby enabling an increase in efficiency within that particular sector.

In this study, we seek to investigate a puzzle proposed by McMillan and Rodrik (2011), in which the authors observe growth reducing structural change in Latin America and Africa, while Asia experienced growth enhancing structural change. To conduct this exercise, we use a panel of 38 countries, employing data on employment, value added and labour productivity. The dataset is the 10-sector productivity database derived from the Groningen Growth and Development Centre (GGDC). Our study covers the period 1990 to 2005.

The results of Chapter 3 suggest that the observations of McMillan and Rodrick (2011) hold true when employing aggregate regional data over long time periods. However, disaggregating the data on a country level indicates that these authors' results are driven by some specific countries within Latin America and Africa. In that regards, our results are a lot less pessimistic about productivity in developing countries as that study. Specifically, our results indicate that the growth reducing structural change observed is driven by Nigeria and Zambia (for Africa) and Venezuela (for Latin America). The analysis in this Chapter allows us to make important contributions to the growth literature as we are able to identify three new stylised facts existing in the data. The first fact relates to the first finding that patterns of structural change are country-specific. Not only is negative structural change occurring in Nigeria, Zambia and Venezuela, but this pattern is identified in a number of other countries within the different regions including Asia. However, in these cases the extent of negative structural change is small in comparison to the former three countries. Secondly, we not only identify heterogeneity across countries, but also observe the fact that the negative reallocation was more common post 1997 rather than being consistently present over the 15-year study period. Our third stylised fact highlights the importance of the within component in driving productivity growth. Developing countries studies place emphasis on the role of labour reallocation out of traditional into the modern sectors. Our study finds a more consistently positive relationship between the within sector and per capita GDP across all sample regions. This means that not only does the within component dominate in terms of its contributions to aggregate productivity, but for all regional groupings in this study, increasing within productivity is correlated with increasing GDP. McMillan and Rodrik (2011) did not highlight the relative importance of the within component and it is clear from our results that aggregate productivity growth will be limited if positive structural adjustment is not accompanied by within sector improvements.

Our paper allows us to address a more specific question about gaps in productivity across countries and more specifically, the heterogeneity in the components of economy-wide productivity across countries and identify possible drivers of such patterns. Our findings suggest that the economic and political instability of these countries and more importantly their dependence on natural resources, drive the observed labour reallocation in share terms from high to low productivity sectors or negative structural change. Additionally, the resultant unemployment arising due to such unstable economic environments may also mean that there is limited actual movement of resources into lower productivity sectors. The ability of the petroleum industry in particular to drive economic activity across the globe has made these countries highly susceptible to natural resource price shocks affecting both output demand and supply. Our results are advantageous, as it opens avenues for further research by identifying possible links between productivity changes and country- or region-specific shocks such as declining oil prices and economic crises.

Chapter 3 relates to Chapter 2 in that we use Chapter 2, to shed light on information regarding structural change, one component of economy-wide growth, and how it relates to policies on trade and institutional quality. Gains from trade arise arguably as resources reallocate in favour of more efficient, higher productivity activities. . It is therefore important to understand not only whether structural adjustment occurs after trade reform, but also the type of structural adjustment taking place across countries in general to determine whether the existence of heterogeneous resource reallocation at the country level plays a role in how employment and output adjust in response to trade policy. Chapter 3 affords us this opportunity along with the chance to not limit our study to one component of economy-wide growth but to also analyse patterns of within productivity growth. We also provide added information by conducting investigations across multiple sectors.

The first step to understanding the relationship between trade openness and productivity requires a more profound understanding of the sources of aggregate productivity. This is covered by our growth accounting analysis conducted in Chapter 3. The observed disparity in the contributions of the sources on aggregate productivity across countries in Chapter 3 opens up an avenue for us to investigate the productivity enhancing effects of trade and we cover this in our third and final study in Chapter 4. Specifically, we employ the decomposition obtained via the use of the shift-share analysis in Chapter 3 to move away from simply studying the behaviour of the components of economy-wide productivity to empirically assess the relationship between trade and economy-wide productivity and its components.

A conduct of this study requires the use of an appropriate measure of trade openness. There have been criticisms put forward by Rodriguez and Rodrik (2001) regarding the endogeneity of trade instruments used in the trade-growth literature. Feyrer (2009) constructs an exogenous geography-based instrument that corrects for these endogeneity issues to analyse the relationship between trade and income. For Chapter 4, we use this instrument constructed by estimating the gravity model to conduct an Instrumental Variable (IV) analysis on the relationship between trade and economy-wide productivity and its within and structural change components. Our investigations are done both in levels and in growth.

We employ a panel of 38 countries using the same dataset as that of Chapter 3. Specifically we utilise the GGDC 10-sector productivity database for the period 1965 to 2006 in order to derive our within and structural components of economy-wide productivity. For trade, we use the complete gravity dataset provided by Head, Mayer and Ries (2010), which provides data on bilateral trade flows, bilateral great circle distances and other gravity control variables such as common language and contiguity.

We firstly compare the effect of trade on aggregate productivity, both in levels and in growth and find a positive and significant relationship, an outcome that is in line with Feyrer's (2009) study on trade and income. Our study, however, extends on this literature in a number of ways. Feyrer conducted his estimations based on data at 5-year intervals. We conduct this exercise over alternative time intervals to observe differences in contemporaneous, medium term and longer term effects of trade on productivity over time. Our main contribution, however, comes from our examination of the relationship between trade and the components of economy-wide productivity. We find that it is the within productivity component that drives productivity growth in response to trade growth. For the structural change component, we observe some positive coefficients, however they were insignificant. Our findings are robust when we explore the heterogeneity in the data. Specifically, a separation of our dataset into a number of subsamples according to level of development and level of natural resource dependence, as well as an individual mining sector investigation, did not alter the results of a positive and significant relationship between trade and the within component of economy-wide productivity.

This thesis allows us to provide a link among the findings of our chapters, in particular, the findings of Chapters 2 and 4. In Chapter 2 we find no systematic relationship between trade liberalisation and structural adjustment. However, our results appear to indicate more liberalisation in the intermediate and capital goods categories relative to the consumption goods category, based on the observed post trade adjustment in employment and output for the former two categories. In Chapter 4, we observe a positive within sector effect of trade on productivity, especially in the case of developing economies. Firstly, trade reforms appear to be limited to, or focussed on opening up of intermediate and capital goods. This is especially so for developing economies. Intermediate and capital goods embody new technology and therefore induce within sector productivity growth. Countries that import this higher productivity intermediate and capital goods produced in the more technologically advanced economies derive benefits of knowledge spill overs. When developing countries import these products, they are able to learn and imitate the product or even engage in the innovation of competing products. Trade therefore plays an important role as a channel for the transmission of technology across countries (Coe et al., 1997). Through international trade, there is an opening up of communication channels which enable a cross border adoption of methods of production, design of products, organisation of methods and market conditions. This enables increased within-sector productivity growth which is a function of the increased efficiency arising from technologically improvements within sectors or industries. The greater the share of high productivity intermediate and capital goods in the import basket of developing economies, the higher the likelihood of learning and growth for these countries. These less developed economies therefore possess greater incentives to open up intermediate and capital goods industries to benefit from increased productivity growth.

In a similar light, trade policy practices such as tariff escalation allows for varying tariff structures among different category of goods. Furthermore, hidden barriers to trade such as that embodied in Non-Tariff Barriers restrict opening up of competing final goods. Such restrictive policies protect domestic industries, such as import-competing infant industries, and as a result, domestic production may remain unaffected as these industries are protected by the higher tariffs on imports of competing finished goods. The lack of change in domestic production means that any type of adjustment post trade liberalisation is therefore limited. This accounts for the lack of adjustment observed in consumption goods industries and the absence of post trade structural adjustment in both Chapters 2 and Chapter 4.

Following this study, we conclude the thesis in Chapter 5. In this chapter, we reflect on the main findings of our entire study, the implications for policy and the direction of future research.

Chapter 2 : Inter-Industry Adjustment: Analysing the Impact of Trade Liberalisation and Institutional Reform on Manufacturing Employment and Output

2.1 Introduction

2.1.1 Context and Background

A country's integration into the global economy affords opportunities for economic growth. It can give rise to aggregate efficiency gains as competition in the domestic market intensifies. This translates into observable gains for consumers, through lower prices and improved access to new products and technologies. Other benefits to countries come with the greater export potential to liberalized markets. The consequence of this is increased domestic production and growth in employment, but also changes in the structure of production associated with income growth and in changes in the pattern of specialisation.

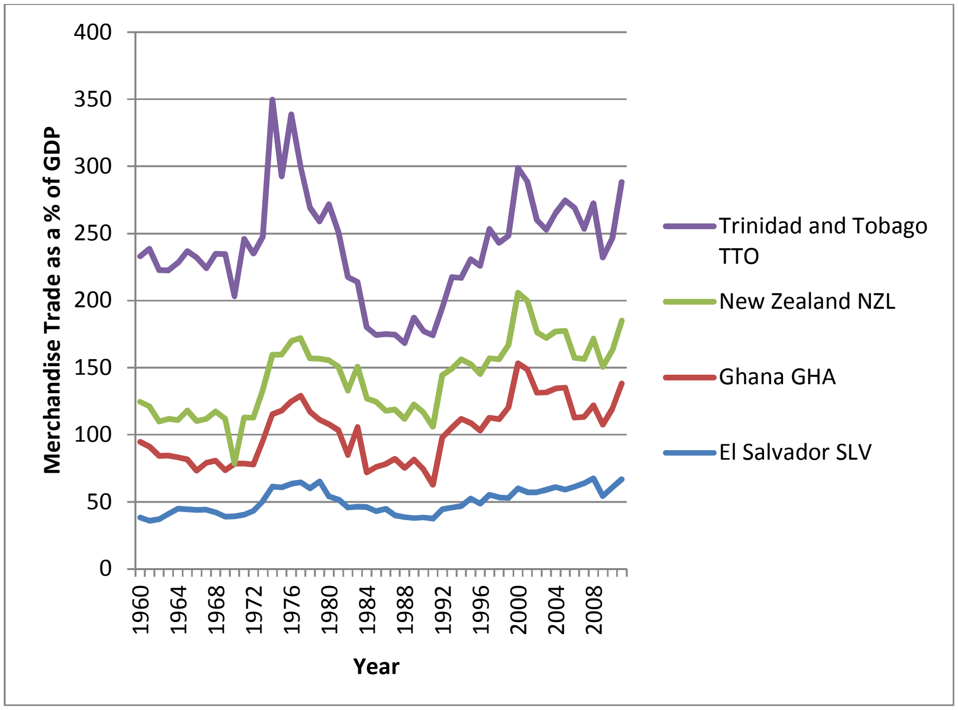
During the 1950s, 1960s and 1970s, a number of development economists embraced the protectionist view but by the late 1980s, protectionist proponents began to cave to the now popularly growing view that developing economies should move away from policies that promote protectionism and open their borders to foreign trade. The inward oriented policies and poor performance of countries such as those within Latin America in contrast to the aggressive outward oriented policies of rapidly growing Asia became a fundamental topic for debate. Debates on the importance of trade openness in developing countries now emphasise how important it is for poor countries to catch up to countries that lead economically in the competitive world.

International organizations such as the World Trade Organization (WTO) and the World Bank have included trade reform as a key component of the reform process in developing countries. Over the past twenty years an increasing number of countries have become integrated into the world economy with increasing trade to Gross Domestic Product (GDP) ratios. Dollar and Kraay (2004) identify a group of such developing countries and describe them as "globalisers". These countries doubled their trade from 16 percent of the Gross Domestic Product (GDP) to 33 percent in comparison to the 70 percent (29 percent to 50 percent) increase experienced by the rich countries. Conversely, non-globalisers had a decline in their trade to GDP ratios for the period under observation. Dollar and Kraay (2004) also report a convergence of per capita GDP between the rich countries and the globalisers.

We use Figure 2.1 to illustrate the increase in merchandise trade as a percentage of GDP for four selected sample countries. Merchandise trade as a share of GDP is the sum of merchandise exports and imports divided by the value of GDP, all in current U.S. dollars.[1] All countries exhibit an increase in openness and greater international integration.

[1] Data sourced from data.worldbank.org

Figure 2.1 Merchandise Trade (Imports and Exports) as a Percentage of GDP for Four Selected Sample Countries: 1960 – 2011



This increase in integration among countries is also characterised by reduction in average tariffs and Non-Tariff Barriers (NTBs). In Appendix 2.1 we present changes in average tariffs over time in one of the main export sectors of some selected sample countries. We observe a fall in average tariffs over time for all the selected countries in their main exporting sectors. This changing nature of tariffs is arguably accompanied by an adjustment of resources of national factor markets, such as labour markets. Specifically, global integration which encourages advances in technology and changing regulations is argued to have contributed to temporary and permanent shifts in international employment and production patterns.

In the labour market in particular, the relationship between workers' abilities to change jobs between or within sectors and industries, as well as the associated costs of this relocation in response to changes in the international economic environment, has attracted significant interest among politicians, academics and the general public. This is mainly due to the presence of adjustment costs incurred as resources reallocate as a result of increased competition arising for increased openness. Adjustment of resources can take place intra-industry or inter-industry and as such associated costs may differ. Adjustment costs can arise in perfectly competitive markets where prices a flexible. If factors are subjected to any degree of heterogeneity and product specificity, reallocation induced by trade can divert resources to make the transition possible, and production might occur inside the production possibility frontier for the period of adjustment, as resources are used to retrain and match labour as well as adapt the capital stock. Adjustment can also occur where there is market imperfection such as in the case of downwardly rigid wages. In this instance, trade costs could outweigh trade induced gains and trade liberalisation could be Pareto inferior (Brülhart et al., 2005).

Furthermore, the adjustment evidence, which usually involves individual or multi-developing country analysis suggests that structural change under a closed economy will be lower than the change occurring when the economy is opened to international trade. Openness implies heightened exposure to external risk, and consequently a greater demand for social insurance. Increased openness arguably leads to firm closure and job losses in some industries and sectors, while it may create opportunities in others affecting labour shares held. Post trade liberalisation, resources such as labour and land may become idle and obsolete, or may require retraining or realignment. It is a challenge for developing countries to reallocate resources to more productive uses in a manner that minimizes disruptions to these economies' operations. Ideally post-liberalisation structural change allows for the transfer of resources to more productive uses, thereby enabling sustained growth and improved living standards. However, structural adjustment policies such as trade liberalisation are often vehemently resisted, even in the light of the expectation of the associated benefits. It is the undesirable costs associated with structural adjustment policies, such as those resulting from the displacement of jobs that erode support for trade reform. It is thus necessary to understand whether trade liberalisation does indeed induce changes in the structure of the economy and we answer this question in this chapter. This vital first step is necessary to respond to the arguments that trade liberalisation results in unwanted structural adjustment costs.

For this study we therefore consider a key causal connection by linking two key concepts. The first being trade liberalisation and the second, structural adjustment, which captures changes in the structure of employment and production as patterns of specialisation change to reflect a more open economy. Conventional wisdom is that with trade reform, there are winners and losers as trade. These outcomes arise when reforms promote liberalisation and seek to exploit comparative advantages in order to foster increasingly productive economic environments. Trade policy reform changes a government's prevailing trading programme and effectively, it alters the production and employment structures of countries. This in turn results in economy-wide structural changes – changes in industrial and sectoral shares of employment, production and patterns of trade.

2.1.2 Motivation and Aims of Current Study

Analysing structural adjustment is important. It presents policy makers with an idea of the timing necessary to see the impact of reforms on economic development and the amplitude of short-term adjustment costs. Uncertainty exists regarding the resource reallocation and adjustment costs associated with increased trade openness. This may make countries reluctant to engage in new trading arrangements. If there is an expectation of large adjustments and accompanied costs associated with freer trade, ex-post inefficient industries will be less competitive and may lobby for protection.

Most studies on labour adjustment are usually focused on an individual country or a particular region with emphasis being placed on transitional costs and temporary unemployment associated with this type of trade-induced adjustment (Perry and Olarreaga, 2005). Additionally, others investigate the sectoral effects of employment of trade with developing countries and OECD countries, calculating jobs created and lost through exports and imports (Balassa, 1986). Furthermore, a large proportion of the work on developed countries focuses on the impact of exchange rate changes as against trade reform, with the former being a greater source of changes in the terms of trade (Berthou, 2008). Classical models, however, emphasise that more efficient factor reallocation is what allows countries to reap any associated gains from trade openness.

Wacziarg and Wallack (2004) empirically assess the effect of trade openness on structural adjustment on a sample of 25 developing countries, and the extent of this relationship, and find that the data indicate a zero or negative effect rather than a positive one. The authors' finding does not support theories based on comparative advantage, which suggest increased movement of resources post liberalisation. Proponents of increased openness put forward their arguments mainly on the basis of the expected long-run efficiency gains associated with trade liberalisation through structural adjustment. The findings by Wacziarg and Wallack's (2004) therefore motivate us to use this paper as a starting point to test the validity of such results given the contradictory nature of the results in relation to comparative advantage theories. Investigating, if and to what extent, does trade policy affects the reallocation of resources inspires more transparency regarding structural adjustment costs. This in turn can ensure that policy measures are designed to mitigate possible adverse effects and that programmes are targeted towards providing an immediate buffer so that countries, especially developing economies, can take advantage of export opportunities and welfare increases associated with increased openness.

We extend on the study by Wacziarg and Wallack (2004), by firstly employing an updated time period and a country sample that covers both High- and Low-

Income nations. Furthermore, a shortcoming of the existing literature is the lack of accountancy for policy complementarities that may themselves result in structural adjustment or affect the trade reform-adjustment relationship. Labour market, macroeconomic and business policies are a number of factors that may affect the ability of an economy to change its structure of production and employment, and the extent to which it changes post trade reform. We therefore further develop our analysis by attempting to assess the extent to which, if any, institutional quality influences the relationship between trade policy and intra-sectoral labour adjustment. Structural reforms can lead to a costly reallocation of resources and efficiency gains may take time to materialize. The presence of sound institutions will ease the strains associated with adjustments and improve the benefits from trade reform.

Another extension of the Wacziarg and Wallack (2004) study stems from the fact that structural adjustment usually makes reference to both employment and output, and as such, we also try to empirically assess the effect of trade liberalisation on output. Given possible measurement errors associated with any empirical analysis, we further extend this study by employing a different measure of structural adjustment as well as conducting regression analysis on reduced subsamples. Firstly, we exclude diversified economies from our sample. Secondly, we not only explore heterogeneity across countries but also the heterogeneity across industries within the manufacturing sector. Specifically, we disaggregate our dataset into subsamples of consumption, intermediate and capital goods and conducted fixed effect regressions of the effect of trade on adjustment within each category in an attempt to observe the extent and nature of adjustment occurring across different industries.

We concentrate our study on the manufacturing sector given the availability of data for this sector across our large sample of Low-Income economies. This is especially so for studies over longer time periods. For Low-Income countries, there is the presence of inadequate collection, and weaknesses in the measurement of data from other sectors, specifically the primary sector data. This inadequacy of economy-wide data resulting from poor data availability in certain sectors as previously mentioned inhibits our ability to efficiently estimate inter-sectoral labour reallocation over extended time periods. Our analysis therefore focuses on whether, and to what extent, inter-industry or manufacturing labour adjusts given trade liberalisation. Industries adjust their resource use with the objective of increased efficiency and profitability. Trade induced adjustment, centres on changes in trade costs, such as changes in the levels of barriers to international trade. Within the manufacturing sector, inter-industry adjustment is induced by trade if it is a result of a reduction of trade barriers, holding everything else constant, or similarly by relevant changes in the foreign market, holding trade costs constant (i.e. at zero).

Use of this sector does not limit the analysis, as for many countries, the manufacturing sector is one of the industry's most responsive to trade reforms. With more complex manufacturing value chains and fewer barriers to trade than other sectors such as the service sector, which is often impeded by trade and investment barriers and domestic regulations, policy makers and business leaders strive to realign jobs opportunities and respond to increasing competitiveness. Supply-chains have grown exponentially, now covering both finished and intermediate goods. In 2009, the world exports of intermediate goods exceeded combined values of final and capital goods.[2] The manufacturing sector is argued to possess the largest multiplier of all sectors in the economy and its productivity outpaces productivity growth in other sectors of the economy. Kaldor (1966) finds that manufacturing displays a positive correlation with GDP growth while other primary and tertiary sectors do not. The implication is that manufacturing is the core driver of GDP growth and employment and non-manufacturing output responds to growth in manufacturing. Understanding inter-industrial or manufacturing employment adjustment in a globalised world is critical in the development and implementation of policies that would effectively enable the enhancement of the benefits from trade, specifically mobilising higher growth and employment creations. Results from this study can also be useful in understanding the designing of policy measures that would allow for appropriate industrial development and skill upgrading relevant to changing reforms.

Our analysis therefore seeks to answer two questions. Firstly, if so, and to what extent does trade liberalisation affect inter-industrial or manufacturing labour adjustment? Secondly, if such a relationship exists, does institutional quality condition this relationship between trade policy and structural adjustment in labour?

[2] World Economic Forum Report (2013)

The rest of our study is organised as follows. In the next section, we give describe some of the literature relating to trade, structural adjustment and institutions. The sections that follow describe data employed as well as our measures of structural adjustment, trade liberalisation and institutional quality. Next we specify our model and describe our estimation methodology employed. This is followed by a presentation and analysis of our results. In our penultimate section we conduct checks for robustness of our results and then we provide our conclusions.

2.1.3 The Literature on Trade, Structural Adjustment and Institutions

The consequences of foreign trade on domestic markets have been long studied by economists and central to the welfare gains from trade is the possibility for an expansion of consumption as well as the reallocation of factors of production. Traditional trade theory identifies the benefits associated with international trade, with resources reallocating in favour of comparative advantage. Trade theories such as Melitz (2003) predicts that more efficient producers gain market shares as trade barriers fall, thereby suggesting that countries should experience some structural adjustment post-trade reform. This structural adjustment process encompasses resource reallocation that can be either within sectors, across sectors or both. We discuss both types of adjustment below. However, given that our study focuses on adjustment within the manufacturing sector, we skew our focus in favour of concentrating on within- manufacturing or inter-industry adjustment for the reasons discussed in Section 2.1.2.

Inter-industry adjustment requires workers to move from one industry to another but remain within the same sector. Trade models based on comparative advantage, emphasise international trade's influence for inter-industry resource allocation through trade-induced changes in relative industry prices. McCaig and Pavcnik (2013) postulates that in general equilibrium, trade policy effects on employment in smaller, less formal firms could differ as workers move into industries that experience increased access to foreign markets via large foreign tariff cuts and away from industries less affected by cuts in foreign tariffs. Furthermore, in expanding industries, where production is characterised by larger and more formal establishments, trade liberalisation could lead to an increase in employment in larger firms in the aggregate. If trade increases the relative demand for goods in the more formal (informal) industries, there would be an expansion of formal (informal) jobs in the economy. Trade's total effect on industries' employment shares is therefore arguably a function of the nature of the trade liberalisation concerned as well as the informalities of the industries subjected to the largest foreign tariff cuts.

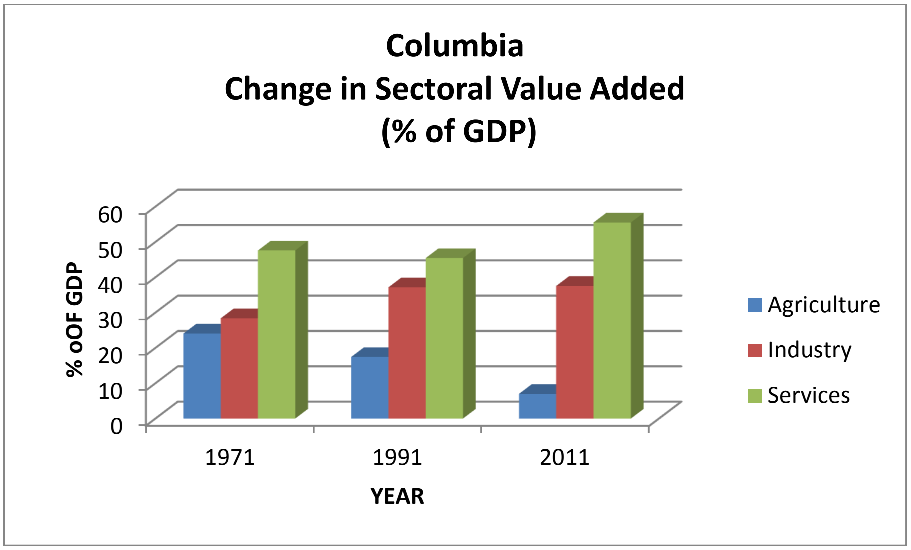
A number of developing country studies have analysed the effects of trade on inter-industrial adjustment in employment and output. One study by Shafaeddin (2005) analyses economic development in developing countries undertaking trade and structural reforms since the early 1980's with the objective of expanding exports and diversifying in favour of manufacturing. He finds that 40 percent of the sample experienced rapid expansion of manufacturing exports following the reforms. In addition the industrial sector was developed and reoriented according to static comparative advantage, the exception being industries near maturity. For example, Latin America's export expansion occurred in the resource based industries, the labour intensive stage and in some instances the automobile industry. An individual country study by Ravenga et al. (1994) evaluates the trade liberalisation program in Mexico that occurred between 1985 and 1988. She estimates that a 10 percentage point reduction in tariffs had a smaller effect on aggregate manufacturing employment (2 to 3 percent reduction). However, she finds marked changes in the composition of employment at the industry level. Similarly, Menezes-Filho and Muendler (2011) analyses changes in employment patterns after Brazil's trade liberalisation. The authors find that trade liberalisation triggered a displacement of workers, particular from the more protected industries. However, these workers were not immediately absorbed by the exporting or comparative advantage industries. An industry level study by Haltiwanger et al. (2004) shows that for six countries in Latin America, reduction in tariffs is associated with heightened within-sector churning.[3]

Another aspect of adjustment, in particular inter-sectoral adjustment, is a diversification away from the primary sectors in favour of manufacturing and then towards services as the economy becomes more developed. Studies such as those conducted by Kaldor (1963) and Kuznets (1971) established empirical regularities regarding structural adjustments occurring in advanced economies

[3] Churning is a mechanism by which labour markets reallocate workers towards more efficient ends (Definition obtained from a report "Go for the churn", The Economist, February, 2012)

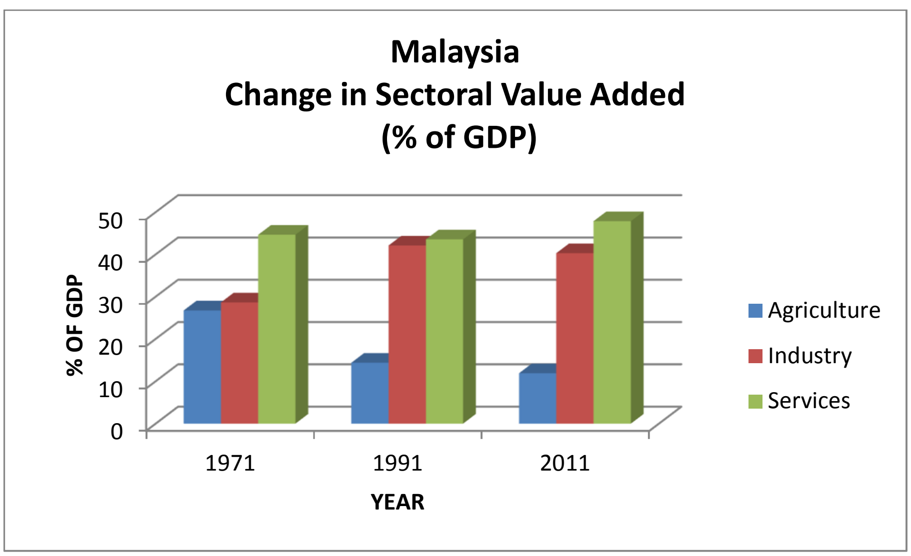
by describing a shift of employment and output away from agriculture towards manufacturing and from manufacturing to services. Similarly, Sachs and Warner (1995) show that economies that are more liberalized have the tendency to engage in adjustment more rapidly from primary-intensive to manufacturing-intensive exports. In order to demonstrate this process of inter-sectoral adjustment, we present Figures 2.2 and 2.3 to illustrate changing sectoral value-added across various years for selected countries for Columbia and Malaysia respectively. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. Both countries exhibit a movement away from agriculture towards industry and to services as the economy develops. Such structural changes play a crucial role in the development outcome of any economy and as such its understanding is vital to the formulation of policies that promotes economic growth and improvement in living standards.

Figure 2.2 Change in Sectoral Value Added for Columbia across Various Years



Author's Own Calculations
Data source: World Bank – World Databank

Figure 2.3 Change in Sectoral Value Added for Malaysia across Various Years



Author's Own Calculations
Data source: World Bank – World Databank

Structural adjustment that results in efficient resource allocation following trade reform is desirable. However, a major factor that could either drive or hinder this type of productivity-enhancing change is the presence or lack thereof of well-functioning institutions. Institutions as defined by North (1981) are "a set of rules, compliance procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals in the interests of maximizing the wealth or utility of principals". Glaeser et al. (2004) emphasizes that "the constraints need to be reasonably permanent or durable." There are different types of institutions. These include property rights institutions, regulatory institutions, institutions for macroeconomic stabilization, institutions for social insurance, and conflict management institutions. Institutional reforms are essential because they affect the ease and speed at which structural adjustment takes place. This makes it important to analyse the effect that such institutions may have on economic adjustments experienced across economies facing temporary shocks.

The size, speed and cost of adjustment depend on the flexibility and functioning of these institutions. An institutional approach has been used as one of the main explanations for differences in income levels and growth rates across countries (Gwartney, Holcombe and Lawson, 2004). Attention has been growing on the effects of labour markets institutions. In particular, emphasis has been on its contributions in determining the outcomes of trade reform on employment. Factors impeding labour mobility can affect the outcomes of macroeconomic policy shocks. Advocates of labour market reform argue that a flexible labour market – eliminating or restricting minimum wage laws and curtailing the role of trade unions among others – leads to successful trade liberalisation. Suppression of wages and labour inflexibility contributes to unemployment. Inadequate labour reform lengthens the adjustment process, increasing costs and furthermore contributes to the reluctance to implement structural adjustment policies.

Extending the work of Davidson et al. (1988), a number of theoretical papers have examined the implication of trade for labour market reallocation under institutional frictions. For example, in a model by Helpman et al. (2010), worker reallocation post trade liberalisation depends on a country's labour market institutions, such as the cost of firing as well as search frictions. Empirically, Edward (1989) was among the first to argue that labour market reform must precede trade reform in order that there can be an efficient allocation of resources across industries post-liberalisation. Borrmann et al. (2006) study the facets of institutional quality that mattered most in the provision of positive linkages between trade and growth. They find that a key factor in the reduction of trade-related adjustment costs is labour market regulations. Labour market policies aid in skill development of workers and enable labour mobility across occupations, firms, industries and regions. It also affords assistance to labour facing costs associated with structural change. Training of the workforce facilitates re-employment due to job losses arising from structural change; changing job-mix and production technology requires changing skills.

Other significant aspects of institutions that can affect the adjustment process include property rights and governance. Stefanadis (2010) reports that increased trade openness in countries with strong property rights institutions shifts domestic talents to more productive activities. Gains from trade rely on the presence of efficient property rights institutions. Property rights guarantee contract enforcement among economic agents and describe conflict resolution that could result from these contracts. The absence of property rights inhibits the adoption of new technology facilitated by trade reform. Borrmann et al. (2006) utilize the six indicators of good governance measures constructed by Kaufmann et al. (2005) to reflect institutional quality. They identified the rule of law and government effectiveness in playing a role in reducing trade related adjustment costs.

Most studies fail to analyse vital elements that influence the outcome of trade liberalisation on structural change. Increased international competition arguably drives structural change within and across firms, industries and regions. Successful structural adjustment requires that factors are employed more efficiently while adjustment costs for the macro and micro economy are minimised. The nature, speed and cost of the adjustment challenge differ for both developed and developing economies and these are in turn affected by the quality of institutions present. Institutions reduce uncertainties arising from the presence of incomplete information regarding the behaviour of other individuals in the process of interaction; it thereby reduces costs of adjustment. Its presence facilitates the channelling of information about market conditions, goods and participants, thereby providing co-operation among market actors.

Institutional quality affects industries differently and this in turn may result in heterogeneous effects of trade reform across industries. These inherent linkages motivate us to examine whether policy complementarities, in particular the presence of institutions, affect the trade liberalisation-structural adjustments relationship, and if so, to what extent.

2.2 Data

For this analysis, we concentrate our study on the manufacturing sector. Our study covers the period 1976 to 2004. The length of this time period allows both shorter and longer term effects to be captured. A panel of Trade, Production and Protection data was extracted from the World Bank's Research database on Trade and International Integration. This database has been disaggregated into 28 manufacturing industries, which follows the 3-digit level of the International Standard Industrial Classification (ISIC), Revision 2.[4] Table 2.1 reports this industry disaggregation.

[4] The ISIC is a United Nations classification of economic activities arranged so that entities can be classed based on the activity they carry out. It is used in classifying economic data in the fields of population, production, employment, GDP and other economy activities.

Table 2.1 Manufacturing Industries: 3-digit level of the International Standard Industrial Classification (ISIC), Revision 2[5]

ISIC 3-DIGIT REVISION 2	
CODE	**INDUSTRY**
300	Total manufacturing
311	Food products
313	Beverages
314	Tobacco
321	Textiles
322	Wearing apparel, except footwear
323	Leather products
324	Footwear, except rubber or plastic
331	Wood products, except furniture
332	Furniture, except metal
341	Paper and products
342	Printing and publishing
351	Industrial chemicals
352	Other chemicals
353	Petroleum refineries
354	Miscellaneous petroleum and coal products
355	Rubber products
356	Plastic products
361	Pottery, china, earthenware
362	Glass and products
369	Other non-metallic mineral products
371	Iron and steel
372	Non-ferrous metals
381	Fabricated metal products
382	Machinery, except electrical
383	Machinery, electric
384	Transport equipment
385	Professional and scientific equipment
390	Other manufactured products

This classification is compiled by the United Nations Statistics Division (UNSD), whereby economic activities are arranged according to the activity they carry out. The sample comprises of 35 economies. There are 29 Low-

[5] See unstats.un.org for a detailed breakdown of the structure together with explanatory notes for the various groupings.

Income developing economies, and 6 High- Income Organisation for Economic Cooperation and Development (OECD) economies. The combination of High- and Low-income countries suffers the disadvantage of assuming that the change in manufacturing labour adjustment to liberalisation and institutions are identical for all countries. As such, we also estimate our model, described later in the chapter, by splitting the sample according to their income status – High Income OECD or Low-Income developing countries – as classified by the World Bank. This classification is given below in Table 2.2.

Table 2.2 Sample Countries - Separation of Countries by Income Status (World Bank Classification)

LOW-INCOME COUNTRIES			
Argentina	ARG	Bangladesh	BGD
Bolivia	BOL	Bulgaria	BGR
Chile	CHL	Brazil	BRA
Costa Rica	CRI	Columbia	COL
Ecuador	ECU	Cyprus	CYP
Ghana	GHA	Guatemala	GTM
India	IND	Sri Lanka	LKA
Kenya	KEN	Morocco	MAR
Mexico	MEX	Malaysia	MYS
Mauritius	MUS	Nigeria	NGA
Pakistan	PAK	Panama	PAN
Philippines	PHL	Singapore	SGP
El Salvador	SLV	Trinidad and Tobago	TTO
Turkey	TUR	Tanzania	TZA
Uruguay	URY		
HIGH-INCOME COUNTRIES			
Australia	AUS	Spain	ESP
Hungary	HUN	Israel	ISR
New Zealand	NZL	Poland	POL

The production data is sourced from the United Nations Industrial Development Organization (UNIDO) statistics which comprise of annual data accumulated from its members. The production variables included are value added, industrial production index, number of establishments, number of employees, number of female employees, wages and salaries, output and gross fixed capital formation.

The UNSD's Commodity Trade (COMTRADE) is the source of the data relating to trade. The original data from the COMTRADE's original database follows the Standard International Trade Classification (SITC), Revision 2. Through the use of a concordance table, the data is then converted in order that it corresponds with the ISIC, Revision 2 classification. The trade data reports import and export information at the aggregate and bilateral levels. The availability of mirrored data helps to avoid a problem of missing observations. Mirrored data involves the use of the partner country's data as a reflection of the source country's data. This is especially the case for the developing countries. Import and export data are reported as both the value of the shipments as well as the corresponding physical quantities measured in thousands of US dollars and kilograms respectively. Unit values, measured in dollars per kilo are also given and are calculated as the ratio of the value of shipments and quantities. These statistics also match the 3-digit level ISIC, Revision 2 classification. Aggregate and bilateral information is provided.

Data on institutional quality is adapted from the Economic Freedom of the World database published by the Fraser Institute. This database has been previously used to obtain institutional proxies by Knack and Keefer (1995), Barro (1996), Gwartney, Lawson and Holcombe (1998). This report measures the extent to which countries promote economic freedom through their policies and institutions. This index's dataset covers the period 1970 to 2004. Data for 1970 to 2000 is available on a 5-year basis and annual thereafter. Countries are rated on a 0 to 10 scale with a higher rating indicating a greater degree of economic freedom.

Economic freedom encompasses personal choice, voluntary exchange, freedom to compete and security of privately owned property. The index measuring the degree of economic freedom was compiled using 42 variables and contains five broad categories. These are Size of Government, Legal System and Property Rights, Freedom to Trade Internationally and Regulation. Implicit in the cornerstones of economic freedom is the notion that individuals are free to transact voluntarily given that they do not harm the person or property of others. Individuals have a right to their time, talent and resources but not that of others. When a society is economically free, the primary role of the government is to ensure that individuals and their property are protected from aggression by others. The Economic Freedom of the World Index measures the extent to which a nation's policies and institutions are consistent with this protective function

2.3 Measurement Issues

2.3.1 Measuring Structural Adjustment

Structural adjustment, ADJ, measures absolute value changes in the share I_i^t of each industry i, in manufacturing employment for each country in a given year t: The rate of structural change in turn, is measured by the magnitude of changes in these industrial employment shares, in the pre- and post-trade liberalisation regimes. The difference in shares will be measured over 2-year and 5-year intervals, so that we can try to capture the rate of structural change over shorter and longer time periods.[6] Structural adjustment is therefore measured as follows:

$$ADJ_{st}\ (x) = \ |I_i^t - \ I_i^{t-x}| \qquad (2.1)$$

where $x = 2, 5$

This measure has two components. It captures the movement of labour across industries. In particular it captures the portion of jobs that move from industry to industry independent of overall employment gains or losses. Gains or losses in employment change the structure of employment across industries. This measure also captures industrially differentiated changes in aggregate employment (such changes potentially arising due to population growth or uneven entrance of workers into the labour force).

2.3.2 Measuring Trade Liberalisation

Trade liberalisation is the removal or reduction of market distortions such as tariffs and Non-Tariff Barriers on the exchange of goods and services between nations. Researchers are, however, faced with a major problem, namely, the absence of complete and comprehensive information on the overall restrictiveness of trade policy. An ideal measure will include all barriers that alter international trade inclusive of tariff rates and indicators of Non-Tariff

[6] We do not include annual changes due to the low frequency change in industrial employment share over 1-year intervals. The results, however, are consistent with our 2- and 5-year interval estimations.

Barriers. Many approaches have been developed to capture the multi-faceted nature of trade including the measures of Leamer (1988), Dollar (1992), and Sachs and Warner (1995). The most basic measure of trade openness is the trade intensity ratio: imports plus exports divided by GDP. This measure is usually employed because data on trade flows are readily available. It is however, argued that this it is a poor measure as it is endogenous and can be affected by demand and supply factors occurring within countries and independent of trade policy (Anderson and Neary 1994; Sachs and Warner 1995).

Sachs and Warner (1995) combine five different indicators in order to categorize countries as open or closed and to determine their liberalisation dates. A Sachs-Warner dummy classifies an economy as closed according to any one of the following five criteria: (i) its average tariff rate exceeded 40 percent, (ii) its Non-Tariff Barriers covered more than 40 percent of imports, (iii) it had a socialist economic system, (iv) it had a state monopoly of exports, or (v) its black-market premium exceeded 20 percent during either the decade of the 1970s or 1980s. Wacziarg and Wallack (2004) employ this methodology and chose liberalisation dates according to Sachs and Warner's criteria.[7] This paper extends on the work of Wacziarg and Wallack (2004) and in order that consistency is maintained, the method used by Wacziarg and Wallack (2004) will be employed to determine the dates of liberalisation.

[7] See Table A2.1 in Appendix 2.2 for Trade Liberalisation and Concurrent Events in a subsample of 5 countries.

To determine dating of liberalisation events, countries had to have experienced both a de jure liberalisation according to Sachs and Warner (1995) and a de facto liberalisation. The de facto liberalisation meant that countries had to have displayed year to year increases of 5 percent or more of their trade to GDP ratio in a year post de-jure liberalisation compared to pre-liberalisation levels. The first 5 percent increase in the ratio following the de jure date, determined the de facto date. To qualify as a de facto date, the increases in imports and exports to GDP had to be sustained over time. In instances where the liberalisation date was before the period of study captured by the data, the subsequent date meeting the criteria described above was chosen. Table 2.3 presents the countries that comprise our sample and their respective liberalisation years.

Table 2.3 Sample Countries and their Respective Years of Liberalisation based on the Sachs and Warner (1995) Criteria

Country Code	Country	Sachs and Warner – De jure year	De facto Year	Country Code	Country	Sachs and Warner – De jure year	De facto Year
ARG	Argentina	1976	1976	**AUS**	Australia	1976	1976
BGD	Bangladesh	1996	1996	**BGR**	Bulgaria	1991	1991
BOL	Bolivia	1985	1986	**BRA**	Brazil	1991	1991
CHL	Chile	1976	1976	**COL**	Columbia	1991	1991
CRI	Costa Rica	1986	1987	**CYP**	Cyprus	1976	1976
ECU	Ecuador	1991	1991	**ESP**	Spain	1979	1979
GHA	Ghana	1985	1985	**GTM**	Guatemala	1988	1989
HUN	Hungary	1990	1993	**IND**	India	1994	1994
ISR	Israel	1985	1987	**KEN**	Kenya	1993	1993
LKA	Sri Lanka	1991	1991	**MAR**	Morocco	1984	1987
MUS	Mauritius	1979	1979	**MEX**	Mexico	1986	1987
MYS	Malaysia	1987	1987	**NGA**	Nigeria	1994	1994
NZL	New Zealand	1986	1987	**PAK**	Pakistan	2001	2001
PAN	Panama	1996	1996	**PHL**	Philippines	1988	1988
POL	Poland	1990	1990	**SGP**	Singapore	1976	1976
SLV	El Salvador	1989	1990	**TTO**	Trinidad and Tobago	1994	1994
TUR	Turkey	1989	1990	**TZA**	Tanzania	1996	1996
URY	Uruguay	1990	1990				

For consistency, like Wacziarg and Wallack (2004), these de facto liberalisation dates were used to derive three liberalisation episodes to distinguish between pre- and post-liberalisation periods. The first (LIB), takes on a value of 1 for the year of liberalisation and all the following years. The second dummy (LIB2) takes on a value of 1 for the year of liberalisation and the subsequent 2 years, zero otherwise and the third (LIB5) takes on a value of 1 for the year of liberalisation and the following 5 years, zero otherwise.

Table 2.4 presents summary statistics for our measure of structural adjustment across our entire sample of countries for the period 1976 to 2004. In addition to sample means or the average absolute value change in employment shares across manufacturing industries, this Table 2.4, also presents these averages conditional on the presence or absence of liberalisation. Shares in employment adjustment are measured over 2- and 5-year intervals as indicated by equation (2.1). Specifically, column (2) in Table 2.4 presents average inter-industry labour adjustment for our sample period. Columns (4) to (9), present the average inter-industry adjustment in employment shares, conditional on whether or not there was a liberalisation in the past (LIB), in the past 2 years (LIB2), or in the past 5 years (LIB5). These values summarise the extent of typical changes expected in manufacturing industry employment shares conditioned on the presence or absence of a liberalisation episode.

The average absolute value change in employment shares in a typical 5-year period for a typical industry is 0.02 percentage points (see Row (B), Column (2)). In a 2-year period the average change is reduced. The conditional means show for example, that in a 5-year adjustment period, if a liberalisation episode occurred in the past 2 years a typical industry will experience a 0.06 percentage points absolute value change in its share of employment (see Row (B), Column (6)). If no liberalisation occurred in the past 2 years for that same adjustment period, that typical industry will experience a 0.02 percentage point change in its industrial employment shares (see Row (B), Column (7)). These estimated changes in industry share of employment are small compared to those obtained by Wacziarg and Wallack (2004).

These authors find that the average 5-year change in a sector's share of employment is 0.62 percentage points using the same data source. This captures both within manufacture shifts in employment as well as growth in manufacturing employment. The difference in means is explained by the fact that Wacziarg and Wallack (2004) use a sample of developing and transition economies. The nature of these economies is such that, higher levels of labour reallocation is expected to occur than that of a sample containing developed economies. This is because resources such as labour are still being efficiently reallocated in developing countries whereas less adjustment is expected in developed countries where resources are more efficiently allocation.

Table 2.4 Summary Statistics and Conditional Means for Sectoral Change in Employment for the entire sample: 1976 - 2004[8]

					Liberalisation in the past LIB		**Liberalisation in the past 2 years LIB2**		**Liberalisation in the past 5 years LIB5**	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Variable	No. of Obs.	Mean	Std. Dev.	Yes	No	Yes	No	Yes	No
Row A	2-Year Adjustment/ Change in Employment Shares (ADJ2)	18507	0.009	1.078	0.009	0.009	-0.004	0.010	-0.008	0.014
Row B	5-Year Adjustment/ Change in Employment Shares (ADJ 5)	15601	0.022	1.742	0.024	0.020	0.058	0.018	0.016	0.024

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred (or did not occur) in the past **(LIB)**, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

[8] See Table 2.2 for list of sample countries

Table 2.4 also shows that for a typical 2-year adjustment period, the average change in a manufacturing industry's employment shares appear to be lower with the occurrence of liberalisation than without. We observe that this is the case for all variants of our liberalisation measure. Specifically, in a 2-year adjustment period, if a liberalisation occurred in the past (LIB), in the past 2 years (LIB2), or in the past 5 years (LIB5) the absolute value change in a typical industry's share of employment is lower with a liberalisation event than without. For the 5-year adjustment period, if a liberalisation occurred in the past or in the past 2 years, there is a higher level of change in employment shares among the industries, with the occurrence of liberalisation than without.

Appendix 2.3 graphs the average 2- and 5-year changes in industrial shares of employment for the period 1976 to 2004 for selected countries.[9] The charts show that there is on average, more employment adjustment is taking place in some industries within each country than others. For all the selected countries, there was a greater volume of adjustment in food manufacturing, wearing apparel, textiles, electrical machinery and transportation equipment. Although the industries exhibiting more adjustment are similar among countries, we find that among this subsample, for a 2-year adjustment period, we observe a greater level of adjustment in Morocco than that of Bangladesh and Poland. Similarly, in a typical 5 year adjustment period, Sri Lanka shows more adjustment in manufacturing employment than Kenya and Turkey.

[9] Figures A2.4, A2.6, A2.8, A2.10, A2.12 and A2.14

2.3.3 Measuring Institutional Quality

Many aspects of institutional quality may be unobservable. It is, however, possible to measure the quality of institutions indirectly, through the use of some observable characteristics believed to be good proxies for the features that are difficult to measure. Papers on the effects of trade and institutions on economic growth have differed with respect to how trade and institutions are measured, the variables to control for and the choice of instruments used. Table 2.5 below presents a summary of instruments used to measure institutions in the existing literature.

Table 2.5 Summary of Estimates of Effects of Institutions on Trade and Growth

Paper	Institutions Variable	Trade Variable	Instruments	Included Exogenous Variables
Acemoglu, Johnson and Robinson (2001) Table 4	International Country Risk Guide	Trade/GDP at PPP	Settler mortality	None, but several other specifications include a number of other exogenous control variables
Dollar and Kraay (2002), Table 6	Rule of Law from Kaufmann, Kraay and Zoido-Lobaton (1999)	Trade/GDP at PPP	Trade predicted by gravity model, fraction of population speaking English, fraction of population speaking major European language	log (population)
Rodrik, Subramanian and Trebbi (2002), Table 2	Rule of Law from Kaufmann, Kraay and Zoido-Lobaton (2002)	Trade/GDP in current local currency units	Trade predicted by gravity model, Settler mortality	Distance from equator

Many indicators of institutional quality including those from the International Country Risk Guide (ICRG) or the Global Competitiveness Report measure institutional quality based on perceived levels of corruption versus actual data that measure cross-country differences of the relevant dimensions of institutional quality. This may result in biased conclusions. Kaufmann et al. (2005) produce six indicators of institutional quality by comparing good governance indicators across countries. They define governance as the set of traditions and institutions by which authority in a country is exercised. Namely, the six indicators are Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Control of Corruption and Rule of Law. These indicators address various elements of institutional quality. The data however, is only available for the period 1996 to 2013. The World Bank's Doing Business dataset objectively measures government regulations. This dataset is an indication of the regulatory cost of doing business but suffers from the same data limitation as Kaufmann et al (2005). This makes it difficult to address long-run and dynamic questions which link institutions to structural adjustment.

For this study, institutional quality will be measured via the use of a composite index. This will incorporate the aggregation of three subcomponents of the Economic Freedom of the World Index. These are Protection of Property Rights, Labour Market Regulations and Business Regulations. Protection of persons and their properties is one of the key responsibilities of the government. Restrictive regulations hamper the freedom of voluntary exchange. Restrictive labour market and business regulations may infringe on the rights of employees and employers and the activities of businesses respectively. Countries are rated on a 0 to 10 scale with a higher rating indicating greater protection of property rights and less restrictive labour market and business regulations. High scores for business activities mean that the market is allowed to determine prices, or regulations do not restrict entry or drive up production costs. A country that allows its market to determine wages and conditions for hiring and firing as well as avoidance of conscription will obtain a high rating. Securing property rights will reduce uncertainty and increase the interactions among the different economic agents.

Labour market and business regulations are expected to directly affect the speed and cost of any sectoral adjustments taking place in labour and output. These components are therefore relevant in capturing institutional factors occurring within any economy that are likely to affect the adjustment process. A key factor that the index offers is that it employs objective components and used external sources to construct the index. Internal sources are only utilized when external data are unavailable. Table 2.6 presents summary statistics for our measure of institutional quality for our entire sample over the sample period 1976 to 2004. For our sample, the average score for the protection of property rights is 4.9. The minimum score given for labour market regulations is 2.06 and the maximum score given for business regulations is 9.3. On average, the quality of business regulations in our sample is higher than that of both labour market regulations and the protection of property rights. On the other hand, institutional reform is weakest on average in the area of property rights protection.

Table 2.6 Summary Statistics for Separate and Constructed Index of Institutional Quality for the entire sample: 1976 - 2004[10]

Variable	No. of Observations	Mean	Std. Dev.	Min.	Max.
Protection of Property Rights	28415	4.87	1.705	1.17	8.50
Labour Market Regulations	28415	5.57	1.229	2.06	8.55
Business Regulations	28415	5.63	1.277	2.06	9.30
INSTITUTIONS	28415	5.36	1.129	2.48	8.27

Note: Mean presents the average score for each measure of institutional quality. Countries are rated on a 0 to 10 scale. Higher ratings indicate better institutional quality.
Min. presents the lowest score in the dataset for that relevant measure of institutional quality
Max. presents the highest score in the dataset for that relevant measure of institutional quality

2.4 Model Specification and Estimation

We wish to examine whether trade liberalisation impacts the movement of labour across industries. Secondly we wish to measure the impact of the presence of institutions on this relationship. Using our binary measure of liberalisation, we compare the means of our outcome measure across our sample by running fixed effects regressions of our outcome measure on our liberalisation indicators in order to observe the results for two groups over two time periods – the period with no liberalisation to the period when liberalisation occurred. The regression equations to be estimated are as follows:

[10] See Table 2.2 for list of sample countries

$$ADJ(x)_{cit} = \alpha_1 + \beta_1 Lib_{ct}(x') + \delta_{ci} + \varepsilon_{cit} \tag{2.2}$$

$$ADJ(x)_{cit} = \alpha_2 + \beta_2 Lib_{ct}(x') + \beta_3 Institutions_{ct} + \delta_{ci} + \varepsilon_{cit} \tag{2.3}$$

$$ADJ(x)_{cit} = \beta_4 Lib_{ct}(x') + \beta_5 Institutions_{ct} + \beta_6 Lib_{ct}(x') * Institutions_{ct} + \delta_{ci} + \varepsilon_{cit} \tag{2.4}$$

where ADJ measures inter-industry or manufacturing adjustment in labour described above in Section 2.3.1. $x = 2, 5,$ refers to the interval of time over which changes in manufacturing industry shares are computed. The *c, i* and *t* subscripts represent country, industry and time period respectively. *Lib* represents our measure of trade liberalisation described above in Section 2.3.2; x' indicates whether we are looking at a 2, 5, or all years of data following the year of liberalisation. δ_{ci} symbolises unobserved country by industry specific effects;[11] and ε denotes the regression residual. $Institutions$ measure institutional quality as described in Section 2.3.3.

The slope coefficient on the liberalisation dummy, measures on average, the difference in structural adjustment between an economy that is liberalised and an economy that has not been liberalised. We present robust standard errors clustered at the country x year level since trade liberalisation is common to all industries within a given country in a given year. We have one observation per country-industry-year for *ADJ*, so in any given country-year, every industry is

[11] For *ADJ* we have one observation per country-industry-year, and as such, we include country x industry effects.

associated with the same liberalisation status and clustering at the country x year level allows for correcting standard errors in a manner which acknowledges that observations may not be independent across industries within a country-year.

We also attempt to determine whether the post-liberalisation effect on structural change varies with institutional quality. As emphasised by the New Institutional Economics body of literature, the presence of institutions will influence the ease and cost of structural adjustment. We firstly include in equation (2.3), $Institutions$ so that we can first directly estimate the effect of institutional quality on inter-industry labour adjustment. Our second main research question, however, seeks to test the hypothesis that institutions impact the influence of trade liberalisation on the movement of resources across industries and to do this, we include a term that interacts trade liberalisation and institutional quality in equation (2.4). We employ these equations for estimation purposes. We expect that trade openness will increase the adjustment in labour and furthermore, we expect the presence of institutions to facilitate the ease of labour movement towards more efficient distributions.

With trade liberalisation resources are expected to reallocate in a more efficient manner due to increased competition from abroad and changes in domestic production, with some domestic production being replaced by imports. Net employment effects can be positive or negative depending on country specific factors such as the presence of institutions. Well-functioning institutions such as appropriate labour market regulations will facilitate the change in employment shares in response to trade policy as the presence of such institutions reduce barriers to labour movements, such as high costs of hiring and firing. We therefore expect increased labour adjustment and hence positive relationships between our outcome and predictor variables.

Country-level specialisation may see some industries attracting greater shares of labour than others thereby affecting employment patterns. This is because economists have argued that trade leads to a type of labour division that is advantageous to an economy. Reshuffling of labour according to principles of comparative advantage is expected so that labour can be more appropriately used in production, resulting in gains from trade. It is therefore necessary to account for any heterogeneity that may prevail among the industries to acknowledge that within a particular country in any given year observations may not be independent across industries. Tests for industry-specific effects failed to reject the null of no industry-specific effects. This indicates the existence of persistent differences among the industries. To account for the occurrence of these differences, we use standard errors clustered at the country-year level and robust to heteroskedasticity.

The presence of individual heterogeneity in panel data implies that pooled regression analysis may not be efficient.[12] Individual heterogeneity describes factors existing within each country and industry that can affect the trade-

[12] We still report Pooled Regression results at the beginning of the results section (2.5) for comparative purposes.

structural adjustment relationship. If such factors affecting both left- and right-hand side variables are omitted, our explanatory variable will be correlated with the error term and the regression coefficients will be biased measures of the structural effects. For this study, a fixed effects model is therefore used. The use of a fixed effects model controls for such factors that may bias the predictors or outcome variables. Unobservable factors are therefore treated as errors. Fixed effects estimation allows the individual heterogeneity term to be correlated with the regressors. These unobservable time-invariant characteristics are removed so that the predictor's net effect can be assessed. There are two methods to transform the data to eliminate the correlated effects. The first method is the within transformation. We can represent equations (2.5) to (2.7) as equation (2.8), where f_i represents the individual heterogeneity term.

$$y_{it} = \beta X_{it} + f_i + \varepsilon_{it}, i = 1, \dots, \mathrm{N};\ \mathrm{t} = 1, \dots . \mathrm{T} \qquad (2.5)$$

The first step involves taking the average of equation (2.5) for each sector over time as:

$$\overline{y_i} = \beta \overline{X_i} + f_i + \overline{\varepsilon_i} \qquad (2.6)$$

In step two we subtract (2.6) from (2.5) to eliminate f_i to obtain:

$$(y_{it} - \overline{y_i}) = \beta(X_{it} - \overline{X_i}) + (\varepsilon_{it} - \overline{\varepsilon_i}) \tag{2.7}$$

The resulting estimator of β is free of endogeneity bias and is called the within estimator.

The second method is the first difference transformation which involves taking that lag of equation (2.5) by one time period for each sector to obtain the first differenced model:

$$(y_{it} - y_{it-1}) = \beta(X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \tag{2.8}$$

As with (2.7) the resultant estimator of β is free of endogeneity bias.

2.5 Results

2.5.1 Pooled Sample Estimates

Initial estimations of a pooled model find that trade liberalisation has no contemporaneous or lagged effect on changes in employment shares or longer-term structural adjustment within the manufacturing sector. We present our pooled results in Table 2.7 below.

Table 2.7 Pooled Regressions: The effect of Trade Liberalisation on Sectoral Change in Employment (Full Sample: 1976 – 2004)[13]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB2	-0.001	-0.000	0.001	0.004	0.006	0.006
	(0.016)	(0.017)	(0.017)	(0.029)	(0.030)	(0.030)
INST		-0.001	-0.005		-0.003	-0.003
		(0.007)	(0.011)		(0.012)	(0.022)
INST*LIB			0.006			0.001
			(0.015)			(0.026)
Adj. R^2	0. 050	0. 111	0. 152	0. 062	0. 123	0. 194
LIB	-0.011	-0.011	0.011	0.039	0.039	0.038
	(0.025)	(0.025)	(0.025)	(0.045)	(0.045)	(0.045)
INST		-0.002	0.006		-0.002	0.002
		(0.007)	(0.015)		(0.012)	(0.013)
INST*LIB2			0.001			-0.031
			(0.020)			(-0.035)
Adj. R^2	0. 041	0. 102	0. 154	0. 060	0. 089	0. 099
LIB5	-0.022	-0.022	-0.022	-0.009	-0.009	-0.005
	(0.019)	(0.019)	(0.019)	(0.033)	(0.033)	(0.034)
INST		-0.001	-0.001		-0.002	0.005
		(0.007)	(0.008)		(0.012)	-0.014
INST*LIB5			-0.022			-0.026
			(0.019)			(0.027)
Adj. R^2	0. 020	0. 100	0.108	0.059	0. 121	0. 123
No. of Obs.	18507	18507	18507	15601	15601	15601

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years (LIB2) or in the past 5 years (LIB5).

ADJ2 and ADJ5 refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation (2.1).

Columns (1), (2) and (3) represent three different regressions corresponding to equations (2.2), (2.3) and (2.4) respectively. Similarly, columns (4), (5) and (6) correspond to equations (2.2), (2.3) and (2.4) respectively.

[13] See Table 2.2 for list of sample countries

We also split our sample according to income levels. Splitting our dataset according to income level is important because countries at different levels of development engage in varying levels of protection including infant industry-type protection and employment protection regulations. Such regulations may affect employment adjustment to different degrees. For example, some Lower-Income countries tend to engage in more restrictive labour market regulations and there may be a reduction in firms' incentives to partake in employment adjustment in the event of supply or demand shocks (Bertola, 1990), than Higher-Income countries with less restrictive labour markets. Table A2.2 and A3.3 in Appendix 2.4 present the pooled regression results for the High- and Low-income countries respectively. We find that we split the sample by income, the occurrence of trade reform did not affect employment share within the manufacturing sector for both the Low- and High-Income subsamples. We centred the institutions term so that we can meaningfully interpret the coefficients of all independent variables. Including the institutions term in the specification did not alter the overall result that trade liberalisation does not significantly affect inter-industry labour movement.[14]

2.5.2 Fixed Effect Regressions

We now employ a more robust fixed effect estimation which allows us to account for any industry heterogeneity that may exist within a particular country in any given year. If a pooled model is correctly specified and

[14] As seen in columns (2), (3), (5) and (6) in Tables A2.2 and A2.3 in Appendix 2.4

regressors are not correlated with the error term, this model can be consistently estimated using pooled OLS. However, due to the presence of unobserved heterogeneity, the error term is likely to be correlated over time for a given manufacturing industry, (for example the unobserved heterogeneity, of an industry in different years are correlated), or the error term of a given year may be correlated across industries, causing the usual standard errors to be greatly downward biased. Unobserved factors such as investment opportunities and management quality maybe be correlated with our liberalisation measure but is relegated to the error term. We need to control for such unobserved factors. For example, if industries with more investment opportunities are more likely to be liberalised, then failure to control for this correlation will yield an estimated trade liberalisation effect on manufacturing industry employment adjustment, that is biased downward.

Our results from this estimation method indicate that the occurrence of a liberalisation episode- in the past, or in the past 2 or 5 years - like our pooled results does not have any effects on structural adjustment in manufacturing employment. Our coefficient estimates are of mixed signs and statistically insignificant. As highlighted in Table 2.8, which gives the fixed effects regression results for the effect of trade liberalisation on the net inter-industry movement of labour, in a 2-year adjustment period, a liberalisation episode in the past 5 years reduces the change in manufacturing sector employment share by 0.02 percentage points less than in a non-liberalised system. This result, however, is insignificant and does not provide evidence of a causal relationship between our outcome and predictor variables.

Table 2.8 Fixed Effects Regressions: The Effect of Trade Liberalisation on Sectoral Change in Employment (Full Sample: 1976 – 2004)[15]

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	-0.015	-0.012	-0.011	-0.021	-0.010	-0.014
	(0.027)	(0.027)	(0.026)	(0.058)	(0.059)	(0.063)
INST		-0.005	-0.009		-0.023	-0.009
		(0.017)	(0.018)		(0.040)	(0.057)
INST*LIB			0.005			-0.021
			(0.017)			(0.054)
Adj. R^2	0. 027	0. 351	0. 415	0. 032	0.297	0.398
LIB2	-0.008	-0.009	-0.008	0.058	0.058	0.057
	(0.033)	(0.033)	(0.033)	(0.072)	(0.072)	(0.072)
INST		-0.008	-0.009		-0.025	-0.020
		(0.016)	(0.017)		(0.039)	(0.041)
INST*LIB2			0.006			-0.024
			(0.022)			(0.042)
Adj. R^2	0. 052	0. 400	0.421	0.079	0. 325	0.466
LIB5	-0.022	-0.021	-0.022	0.004	0.008	0.010
	(0.024)	(0.024)	(0.024)	(0.054)	(0.055)	(0.054)
INST		-0.007	-0.008		-0.025	-0.020
		(0.016)	(0.018)		(0.040)	(0.045)
INST*LIB5			0.006			-0.015
			(0.019)			(0.041)
Adj. R^2	0.039	0.475	0.485	0.068	0.503	0. 518
No. of Obs.	18507	18507	18507	15601	15601	15601

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.2).**

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[15] See Table 2.2 for list of sample countries

Our results do not change for our specifications identified in equations (2.3) and (2.4). Specifically, as shown in Table 2.8, we also find no statistically significant effects in our estimations when we include institutions and the interaction term in our full dataset in columns (2) and (3) for the 2-year adjustment interval and columns (5) and (6) for the 5-year adjustment period.

Like our pooled OLS regressions, we then split or sample subject to income level according to a World Bank classification into subsamples of High- and Low-Income countries. This fact that we find no significantly robust relationship between trade liberalisation and structural adjustment in employment holds for both subsamples. Regression results on our High-Income and Low-Income subsamples are presented in Tables A2.4 and A2.5 respectively in Appendix 2.5. Furthermore, we find that institutions do not have any effect on structural adjustment in manufacturing employment for the High- and Low-income countries. For this study we also seek to understand the importance of institutions in this trade liberalisation-inter-industry reallocation relationship as the existence of well-functioning institutions that may encourage or hinder adjustment varies across countries. To further test our hypothesis, we split or sample according to countries with institutional score of more than five and countries with institutional score of less than or equal to five and obtain no change in our core results of the absence of any significant relationship between our variables. Tables A2.6 and A2.7 in Appendix 2.5 contains results for the latter two subsamples.

The effect of trade liberalisation on employment reallocation is a topic subjected to extensive political discussion. An economy's human resource is one of its most important assets and it is important that we understand how it is affected by different policy decisions. Our results indicate that trade liberalisation does not have a systematic effect on adjustment of employment in the manufacturing sector, using a measure that captures both the movement of labour across industries and overall changes in the share of manufacturing labour. These results support the findings or Wacziarg and Wallack (2004), who also find that the data appears to indicate no relationship between trade liberalisation and manufacturing labour reallocation, rather than a positive one. Additionally, our disaggregation of the data by income and institutional level does not alter our core results. Given these findings, which contradict a priori expectations of positive labour allocation post liberalisation, we perform a number of robustness checks, presented in the following section, to determine whether these results hold subject to a changing variable of interest, a different measure of structural adjustment or to further altering the sample of countries used in the analysis.

2.6 Robustness Checks

The adjustment of any economy to reform such as trade liberalisation is a gradual process. Our study attempts to empirically quantify any inter-industrial labour reallocation following trade liberalisation episodes. We analyse this relationship to determine whether an improvement of the original model employed by Wacziarg and Wallack (2004), in terms of country coverage and updated time period results in a significant link between the occurrence of trade liberalisation and structural adjustment.

The fact that we continue to find no systematic effect of trade liberalisation on structural change is interesting. This contradicts predictions of conventional trade theories based on resource reallocation according to comparative advantages. As such it is vital that we investigate the robustness of our results. We do this in a number of ways. Firstly, we understand that it is important to study all dimensions of structural adjustment. In considering the process of structural adjustment, observers analyse sectoral changes not only in employment, but also in output. As such, we repeat our fixed effects analysis, this time, however, investigating structural adjustment in output instead of employment. Our second test of robustness involves the measurement of our dependent variable. We utilize an alternative measure of structural adjustment put forward by Hiscox and Rickard (2002) to determine whether our original findings hold. Additionally, there is a possibility that due to high levels of data aggregation, the significantly diversified economies within our sample may bias our results to finding little or no effect of trade liberalisation on structural adjustment. As such we exclude these diversified economies and re-estimate our regression equations. Finally, different categories of goods may face different levels of trade reform and this may affect adjustment levels. We therefore repeat our estimations on subsamples of consumption, intermediate and capital goods.

2.6.1 The Effect of Trade Liberalisation on Inter-Industrial Change in Manufacturing Output

Trade liberalisation is assumed to result in absolute value changes in structural adjustment and increasing productivity levels as resources such as labour and output are used and produced more efficiently. It is expected that trade liberalisation policies would encourage competition, through the flow of ideas and knowledge across national borders, resulting in faster import and export growth allowing a country to capture significant supply side benefits. It has also been argued that in addition to its effect on labour, trade liberalisation can impose heavy adjustment costs in the form of output contraction if less efficient firms are subject to increasing competition from lower cost foreign competition. Increased openness therefore affects not only the efficiency with which factors are employed by all firms, but also the distribution of output between the more and less efficient firms. Given the importance of output in assessing structural changes occurring in an economy, we incorporate the use of fixed effects regressions to investigate its relationship, if any, with international trade liberalisation.

We employ equations (2.9) to (2.11) used to estimate the effects of trade liberalisation on sectoral output allocation.

$$ADJ^{O}(x)_{cit} = \alpha_1 + \beta_1 Lib_{ct}(x') + \delta_{ci} + \varepsilon_{cit} \qquad (2.9)$$

$$ADJ^{O}(x)_{cit} = \alpha_2 + \beta_2 Lib_{ct}(x') + \beta_3 Institutions_{ci} + \delta_{ci} + \varepsilon_{cit} \tag{2.10}$$

$$ADJ^{O}(x)_{cit} = \beta_4 Lib_{ct}(x') + \beta_5 Institutions_{ct} + \beta_6 Lib_{ct}(x') * Institutions_{ct} + \delta_{ci} + \varepsilon_{cit} \tag{2.11}$$

where $x = 2, 5$. ADJ^{O} measures structural adjustment in output. The *c, i* and *t* subscripts represent country, industry and time period respectively. *Lib* represents our measure of trade liberalisation described above in Section 2.3.2; x' indicates whether we are looking at a 2, 5, or all years of data following the year of liberalisation. δ_{ci} symbolises unobserved country by industry specific effects; and ε denotes the regression residual. The slope coefficient on the liberalisation dummy, measures on average, the difference in structural adjustment between an economy that is liberalised and an economy that has not been liberalised. $Institutions$ measure institutional quality as described in Section 2.3.3.

Table 2.9 presents summary statistics and conditional means to give an indication of the magnitude of adjustment in output typically occurring across different liberalisation events for our entire sample of countries for the period 1976 to 2004. Sample means are presented in Column (2) for our two adjustment periods. Columns (4) to (9) also present the average absolute value change in sectoral output shares conditional on whether or not a liberalisation episode occurred in the past (or past 2 or 5 years). The average adjustment in sectoral output shares in a 5-year period for a typical sector is 0.08 percentage points in absolute value (see Row (B), Column 2). In a two year period the average adjustment is reduced to 0.03 percentage points. The conditional means indicate that if a liberalisation episode occurred in the past 5 years, the average 2-year adjustment the share of a typical industry's output is a 0.02 percentage points (see Row (A), Column 8). However, if no liberalisation occurred in the past 5 years for that same 2-year adjustment period, a that industry will experience a 0.03 percentage point adjustment in its output shares (see Row (A), Column 9). In comparison to adjustment employment presented in Table 2.4, typical output adjustment and output adjustment conditional on the occurrence of liberalisation episode are higher. Appendix 2.2 graphs the average 2- and 5-year changes in industrial shares of output for the period 1976 to 2004 for selected countries.[16] As with employment adjustment the charts indicate that on average, more output adjustment is taking place in some industries within each country than others. For all the selected countries, there was a greater volume of output adjustment in food manufacturing. Across countries, in a typical 2-year adjustment period, Bangladesh exhibited more output adjustment than Poland and Morocco. Likewise for a 5-year adjustment period we observe a greater level of output adjustment in Turkey in comparison to Sri Lanka and Kenya. We also observe that for some countries in the sample, the observed extent of output adjustment tend to be greater than that of employment adjustment.

[16] Figures A2.5, A2.7, A2.9, A2.11, A2.13 and A2.15

Table 2.9 Summary Statistics and Conditional Means for Sectoral Change in Output for the entire sample: 1976 - 2004[17]

					Liberalisation in the past LIB		Liberalisation in the past 2 years LIB2		Liberalisation in the past 5 years LIB5	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Variable	No. of Obs.	Mean	Std. Dev.	Yes	No	Yes	No	Yes	No
Row A	2-Year Adjustment/ Change in Output Shares (ADJ2)	17056	0.028	1.713	0.029	0.026	0.039	0.026	0.015	0.032
Row B	5-Year Adjustment/ Change in Output Shares (ADJ5)	14290	0.081	2.355	0.094	0.061	0.016	0.071	0.010	0.079

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred (or did not occur) in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

Our estimation of equation (2.9) shows that as with employment shares international trade does not have any effect on the changes in the share of manufacturing output in each industry when we employ our entire dataset. We present these results in Table 2.10 below.

Our second specification for output, equation (2.10) includes our institutions variable. Similar to our equation (2.3) results, trade liberalisation does not have any net effect on manufacturing output shares. We find however, that the presence of institutions reduces the adjustment in output across industries within the manufacturing sector. This however, occurs over the longer 5-year adjustment period. For example as seen in Column (5) in Table 2.10, our results indicate that in a 5-year period, the presence of institutions reduces the

[17] See Table 2.2 for list of sample countries

structural adjustment in output by 0.1 percentage points. In each case, specifically when we alternate the different variants of our liberalisation measure in the regression equation, the relationship is weakly significant at the 10 percent level. Institutional score ranges on a scale from 0 to 10 and it is interesting to determine whether this negative relationship is being driven by the presence of higher or lower quality institutions. This will be investigated later on in the chapter. Our third equation includes the interaction of our measures of trade liberalisation and institutional quality. Again we estimate our institutions variable at its mean and continue to find no relationship between trade reform and inter-industrial output adjustment.

Table 2.10 Fixed Effects Regressions: The Effect of Trade Liberalisation on Sectoral Change in Output

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	-0.033	-0.014	-0.014	-0.022	0.028	0.024
	(0.038)	(0.042)	(0.040)	(0.078)	(0.082)	(0.083)
INSTI		-0.034	-0.036		-0.098*	-0.067
		(0.028)	(0.028)		(0.058)	(0.079)
INST*LIB			0.003			-0.047
			(0.046)			(0.089)
Adj R^2	0. 153	0. 219	0.531	0. 519	0. 601	0. 702
LIB2	0.008	0.008	0.009	0.122	0.127	0.123
	(0.069)	(0.069)	(0.069)	(0.103)	(0.104)	(0.105)
INSTI		-0.037	-0.054**		-0.094*	-0.108**
		(0.025)	(0.023)		(0.055)	(0.054)
INST*LIB2			0.109			0.077
			(0.091)			(0.106)
Adj R^2	0.261	0.329	0.258	0. 242	0. 101	0.109
LIB5	-0.028	-0.022	-0.018	0.037	0.057	0.050
	(0.040)	(0.041)	(0.047)	(0.083)	(0.088	(0.090)
INSTI		-0.035	-0.029		-0.097*	-0.113*
		(0.026)	(0.023)		(0.058)	(0.061)
INST*LIB5			-0.021			0.044
			(0.048)			(0.082)
Adj R^2	0. 182	0.357	0.210	0.293	0.379	0.380
No. of Obs.	17056	17056	17056	14290	14290	14290

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10)** and **(2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10)** and **(2.11)** respectively.

For consistency, similar to our employment adjustment analysis, we create subsamples according to income and institutional ranking. In particular, our countries were placed in subsamples of either High- or Low-Income and secondly sub-categories of countries with institutional scores of either more than or less than and equal to 5. Aggregate data assumes that causal relationships are the same across countries. It is therefore essential to conduct disaggregation that allows countries that are similar economically to be grouped together to test the robustness obtained from our aggregated results. For example, trade liberalisation in Lower-Income may facilitate export diversification by allowing them to access new markets and new materials, which can open up new production possibilities, thereby affecting the distribution of resources. A priori expectation therefore points to an increase in output adjustment as industries as sectors alter their products and expand and/or contract their production levels in response to changing domestic and foreign demand. Furthermore, it is argued that the presence of higher quality institutions can aid the intended gains of economic policies such as trade liberalisation. For some countries this means increased adjustment as resources are allowed to freely reallocate more efficiently. However, for highly restrictive countries, such as those with poor labour market institutions and high transaction costs, industries may not be able to free adjust output in response to trade liberalisation policies.

We report these Fixed Effects Regression Results on High- and Low-income Countries respectively in Tables A2.8 and A2.9 in Appendix 2.6. As with the employment adjustment results, neither trade reform nor institutional quality affect the adjustment of manufacturing output across industries for the Low-Income countries. Estimated coefficients relating to equations (2.9) to (2.11) have mixed signs and are statistically insignificant. For the High-Income countries, however, trade liberalisation generally increases the net inter-industry adjustment of output for our different specifications. Additionally, most adjustment takes place over the longer time period. The effect of institutions appears to alter this relationship depending on specification.

Finally our fixed effect regressions are performed on the countries separated into subsamples according to institutional quality. Our results are consistent with our previous findings that trade liberalisation has no systematic effect on the adjustment of industrial output shares for both the low and high institutional quality grouping (see Tables A2.10 and A2.11 respectively in Appendix 2.6). However, for countries with higher institutional quality, that is more than 5, like our core output estimations in Table 2.10, institutions reduce the adjustment of output across industries by between 0.1 and 0.2 percentage point. For all estimated equations, this relationship is significant at the 5 percent level and the longer the adjustment period, the greater the relationship. For countries with average institutional quality of less than or equal to 5, we find that, given a longer adjustment period, institutions increase output adjustment by approximately 0.5 percentage points, significant at the 1 percent level for all relevant specifications.

Given the robustness checks carried out on our new variable of interest, output, our core results match our labour results in that trade liberalisation does not significantly alter of output adjustment and institutions does not condition the relationship between these two variables when we use our entire sample. However, further investigations reveal differences in our labour and output results. Firstly, estimated coefficients using adjustment in output as the dependent variable are higher, suggesting a greater relationship between trade liberalisation and output adjustment than that of labour. Additionally, we find that the absence of a relationship between trade liberalisation and output adjustment is being driven by the Low-income countries in our subsample given that our results discussed above identify a positive relationship between our variables for our subsample of High-Income countries. Furthermore, unlike labour the level of institutional quality affects output adjustment; specifically, higher or lower quality institutions reduce or increase inter-sectoral output adjustment respectively. [18]

2.6.2 Excluding Diversified Economies

[18] Inter-industry structural adjustment as measured by Wacziarg and Wallack (2004) is used as the dependent variable to measure the effect of trade reform on intra-sectoral labour shifts. An alternative measure of structural adjustment has been proposed by Hiscox and Ricard (2002) to measure the movement of labour across industries. Hiscox and Rickard (2002) modified the measure employed by Wacziarg and Wallack (2004), to derive a structural adjustment (ADJ) measure. This alternative measure is given in the equation below:

$$ADJ_{t-z}\,(x) = 0.5 \sum_{i=1}^{N} |S_i^t - S_i^{t-z}|$$

where S_i is the share of total employment by the ith industry in time t and t-z years (and summation is over all N=28 manufacturing industries). The index is bounded at one end by zero (representing no change in the sectoral structure) and at the other end by one (a complete shift of all employees from one subset of industries into another subset of industries). Higher values of the index indicate more rapid change in the employment distribution in the specified period. For comparative purposes, we repeated the analysis using this new measure for both employment and output. Our results based on the use of this modified measure of structural adjustment do not change our results. That is, we find no systematic effect of trade liberalisation on structural change in both output and employment..

We continue our robustness checks by removing the diversified economies from our sample.[19] Within our sample we define these economies as the countries where a wide range of profitable industries exist, such that, the economy does not rely on any one industry for growth. Economic diversification is important so that countries, especially resource rich countries, do not rely heavily on a single industry as its main revenue source. Specifically, these diversified economies have a number of different revenue streams that provide the nations with the ability for growth that is sustainable due to their lack of reliance on a single revenue source.

With respect to the data, there may be a high level of aggregation and these diversified economies will need to have their industries further disaggregated so that results are not biased towards little or no change in industries' shares of employment or output. This is because more diversified economies are less volatile to some shocks, for example in terms of output adjustment. This higher level of disaggregation is not available from our dataset. To account for this, we create a subsample that excludes these diversified economies. We continue to find that trade liberalisation has no systematic effect on structural change – neither in employment nor output adjustment. We present these results for Employment and Output in Tables A2.12 and A2.13 respectively in Appendix 2.8.

2.6.3 Heterogeneity across Industries

[19] Diversified Economies excluded are Brazil, Mexico, India and Turkey.

Our study thus far investigates heterogeneity across countries and we continue to find no systematic relationship between trade liberalisation and manufacturing output and employment adjustment. For our final robustness check, we are therefore motivated to explore the relationship between these two variables via a different channel. We examine this relationship further; however in this instance, we investigate the relationship according to category of good. Specifically, within the 3-digit industrial classification of the manufacturing sector employed in this study, there are 28 industries. Each of these 28 industries can be classified as consumption, intermediate or capital goods. For this final test of robustness, we separate the manufacturing industries into these three categories and repeat our regression analysis.

We engage in this robustness check based on the assumption that the absence of a systematic relationship between trade liberalisation and structural adjustment could be because of the nature of trade reform. Specifically, liberalisation may be taking place at different levels across consumption, intermediate and capital goods. For example, more liberalisation might be occurring in intermediate and capital goods, which are often non–competing imports in developing economies. Das (2012) finds that in developing economies such as China, India and Latin America, a higher percentage of trade can be credited to production-sharing in high-technology products, services and capital goods. Furthermore, Goldberg et al. (2010) in estimates that input tariffs declined on average by 24 percentage points over the period 1989 to 1997. This hypothesis therefore now opens up an important research agenda, which involves an examination of the implication of liberalisation on resource reallocation across different categories of goods within the manufacturing sector.

When we separate our manufacturing industries into the three sub-categories, namely consumption goods, intermediate goods and capital goods for both employment and output, we obtain some interesting results. We present these results from Tables 2.11 to Tables 2.14.[20] Firstly, we find that for adjustment in the consumption good category within the manufacturing sector, our core results do not change. Specifically, we find that for this category and for both employment and output, there is no systematic relationship between trade liberalisation and adjustment. For intermediate goods, however, we observe a reduction in adjustment in both employment and output. Furthermore this is the case for our longer adjustment period of 5 years. Specifically as illustrated in Table 2.11 we find that in a 5-year adjustment period, if a liberalisation episode occurred in the past 2 years, employment adjustment among intermediate goods industries reduces by approximately 0.11 percentage points less than a non-liberalised system. In addition, the presence of institutions reduces the level of employment adjustment in a 5-year adjustment period. As highlighted in Table 2.12 for the same intermediate good category, in a 5-year adjustment period, a liberalisation episode in the past reduces the change in manufacturing sector output share by 0.3 percentage points less than in a non-liberalised system. Like employment, institutions appear to reduce output adjustment.

[20] We exclude Tables for consumption goods give the absence of any significant relationships.

Table 2.11 Fixed Effects Regressions: The Effect of Trade Liberalisation on Sectoral Change in Employment: Intermediate Goods

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	-0.031	-0.022	-0.021	-0.048	-0.029	-0.026
	(0.019)	(0.020)	(0.019)	(0.040)	(0.040)	(0.040)
INST		-0.017	-0.021		-0.042*	-0.053
		(0.013)	(0.016)		(0.023)	(0.035)
INST*LIB			0.006			0.017
			(0.017)			(0.034)
Adj. R^2	0.195	0.207	0.219	0.239	0.358	0.386
LIB2	-0.026	-0.027	-0.027	-0.109**	-0.109*	-0.108**
	(0.025)	(0.025)	(0.024)	(0.043)	(0.043)	(0.043)
INST		-0.022	-0.022*		-0.047**	-0.050**
		(0.013)	(0.013)		(0.023)	(0.025)
INST*LIB2			-0.001			0.014
			(0.024)			(0.038)
Adj. R^2	0.203	0.235	0.247	0.315	0.422	0.483
LIB5	-0.002	0.001	0.001	-0.030	-0.022	-0.022
	(0.018)	(0.018)	(0.018)	(0.038)	(0.037)	(0.038)
INST		-0.022	-0.023*		-0.046*	-0.047*
		(0.013)	(0.014)		(0.023)	(0.028)
INST*LIB5			0.004			0.003
			(0.017)			(0.031)
Adj. R^2	0.200	0.265	0.282	0.253	0.295	0.350
No. of Obs.	6751	6751	6751	5652	5652	5652

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1).**

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

Table 2.12 Fixed Effects Regressions: The Effect of Trade Liberalisation on Sectoral Change in Output: Intermediate Goods

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.034	0.023	0.019	-0.348***	-0.254**	-0.256**
	(0.053)	(0.065)	(0.061)	(0.110)	(0.123)	(0.122)
INST		-0.107*	-0.084*		-0.195*	-0.176
		(0.059)	(0.046)		(0.117)	(0.121)
INST*LIB			-0.041			-0.030
			(0.093)			(0.165)
Adj. R^2	0.212	0.258	0.296	0.498	0.572	0.593
LIB2	0.068	0.072	0.071	-0.149	-0.131	-0.135
	(0.125)	(0.126)	(0.124)	(0.153)	(0.158)	(0.164)
INST		-0.103*	-0.092**		-0.241**	-0.259***
		(0.053)	(0.036)		(0.110)	(0.091)
INST*LIB2			-0.076			0.091
			(0.190)			(0.199)
Adj. R^2	0.224	0.241	0.271	0.241	0.445	0.493
LIB5	0.020	0.044	0.059	-0.154	-0.092	-0.089
	(0.070)	(0.077)	(0.091)	(0.141)	(0.160)	(0.180)
INST		-0.106*	-0.083**		-0.233*	-0.227**
		(0.056)	(0.038)		(0.119)	(0.098)
INST*LIB5			-0.076			-0.016
			(0.102)			(0.148)
Adj. R^2	0.222	0.274	0.300	0.224	0.513	0.564
No. of Obs.	6131	6131	6131	5087	5087	5087

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10)** and **(2.11) respectively**. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10)** and **(2.11) respectively**.

A repeat of the exercise, however in this instance, including capital goods industries only, suggests that for employment the result is less systematic. Specifically, the change in employment shares is highly dependent on the specified equation as seen in Table 2.13. Institutions on the other hand increase employment adjustment. However for output, we find increasing adjustment post trade liberalisation among the capital goods industries. We present our fixed effect regressions for the effect of trade liberalisation on output adjustment within capital goods in Table 2.14. Like the intermediate goods category, this adjustment occurs over the longer 5-year period. Table 2.14 indicates that output adjustment among capital goods post trade liberalisation is approximately 0.3 percentage points more than a non-liberalised system. This result is consistent across all variants of our liberalisation dummy. For example, a liberalisation in the past 5 years increases output adjustment among capital goods by between 0.2 and 0.3 percentage points.

Table 2.13 Fixed Effects Regressions: The Effect of Trade Liberalisation on Sectoral Change in Employment: Capital Goods

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.073	-0.124**	-0.101*	-0.125	-0.200*	-0.149
	(0.054)	(0.058)	(0.054)	(0.118)	(0.119)	(0.116)
INST		0.088***	0.023		0.150**	-0.014
		(0.030)	(0.029)		(0.067)	(0.077)
INST*LIB			0.105***			0.249***
			(0.031)			(0.068)
Adj. R^2	0.231	0.378	0.459	0.243	0.428	0.479
LIB2	-0.089	-0.086	-0.082	0.060	0.063	0.059
	(0.057)	(0.057)	(0.056)	(0.105)	(0.105)	(0.104)
INST		0.061**	0.054**		0.114*	0.123*
		(0.027)	(0.027)		(0.065)	(0.068)
INST*LIB2			0.048			-0.050
			(0.040)			(0.070)
Adj. R^2	0.228	0.314	0.320	0.241	0.363	0.372
LIB5	-0.049	-0.057	-0.066	-0.035	-0.052	-0.059
	(0.058)	(0.058)	(0.057)	(0.103)	(0.104)	(0.103)
INST		0.069**	0.032		0.117*	0.080
		(0.027)	(0.026)		(0.067)	(0.069)
INST*LIB5			0.105**			0.106
			(0.052)			(0.073)
Adj. R^2	0.235	0.352	0.471	0.290	0.335	0.367
No. of Obs.	4090	4090	4090	3457	3457	3457

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

Table 2.14 Fixed Effects Regressions: The Effect of Trade Liberalisation on Sectoral Change in Output: Capital Goods

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	0.034	-0.004	-0.001	0.276**	0.241**	0.207
	(0.068)	(0.069)	(0.068)	(0.138)	(0.131)	(0.130)
INST		0.066*	0.048		0.135	0.119
		(0.039)	(0.044)		(0.095)	(0.113)
INST*LIB			0.031			0.025
			(0.053)			(0.131)
Adj. R^2	0. 284	0.365	0.392	0.381	0.427	0.501
LIB2	-0.006	-0.004	0.002	0.311**	0.310**	0.310**
	(0.082)	(0.081)	(0.078)	(0.152)	(0.153)	(0.154)
INST		0.065*	0.034		0.174*	0.177*
		(0.038)	(0.039)		(0.097)	(0.099)
INST*LIB2			0.199**			-0.017
			(0.085)			(0.095)
Adj. R^2	0.311	0.424	0.497	0.562	0.612	0.687
LIB5	0.055	0.045	0.042	0.269**	0.241**	0.227*
	(0.072)	(0.072)	(0.075)	(0.118)	(0.121)	(0.123)
INST		0.062	0.056		0.158	0.125
		(0.038)	(0.040)		(0.099)	(0.101)
INST*LIB5			0.020			0.094
			(0.069)			(0.092)
Adj. R^2	0.297	0.299	0.376	0.441	0.541	0.599
No. of Obs.	3804	3804	3804	3203	3203	3203

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10)** and **(2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10)** and **(2.11)** respectively.

Our findings support the presence of variations in the nature of liberalisation occurring among different categories of industries. Liberalisation policies generally shift resources away from non-traded areas in favour of traded ones. If these policies are being formulated such that the liberalisation is in the area of non-competing imports, then we can expect less adjustment post-liberalisation. If an economy is restricted, it can only profitably produce a narrow range of specialised intermediate or capital goods and as a result, the full range of technological possibilities, which relies on a potentially broader range of inputs, cannot be exploited effectively. Greater access to a variety of inputs can do more for production in comparison to a narrow range and as such these foreign intermediate and capital goods are accessed at lower costs through increased liberalisation in these areas, shifting the production function of the economy outwards. Our results indicate that there is a greater presence of liberalisation among capital and intermediate goods categories. The outcome of this is reduced adjustment in intermediate employment and output and increased adjustment in capital output.

2.7 Conclusions

Economic development plans usually result in some kind of structural adjustment within economies. In theory, as development occurs, countries should increase their efficiency and productivity levels. Included in the collection of reforms accompanying development occurring is trade reform, as more and more countries become integrated into the world economy. Traditional trade theory postulates that as openness occurs, countries specialise according to principles of comparative advantage and as such one would expect a redistribution of resources across different economic sectors and industries as this process takes place. The theories therefore suggest that this type of structural adjustment is not independent of trade policy. This inherent linkage motivates us to examine whether, and to what extent, a relationship exists between these two variables occur. This is important as it helps policy makers to understand the impact of trade policy on labour and output, thereby reducing any uncertainties associated with the implementation of reforms of that nature.

The impact of trade on employment is key to determining overall economic welfare, especially for developing economies where there is a greater likelihood of poor social protection. Specifically, trade liberalisation may affect the level and structure of employment, and to a larger extent, exude some influence on poverty, wage and income distribution and employment quality. These factors make the issue of the impact of trade reform on employment reallocation a central point of contention in political debates. It is therefore also essential to understand the effect of complementary policies on this relationship. Given such, we enhance our investigation by attempting to measure the effect of institutional quality on this relationship. The presence of sound institutions affects the speed and cost with which any type of economic adjustments take place and as such, its effect should be investigated.

Using the study of Wacziarg and Wallack (2004) as a starting point, our core results support their findings that the presumption in favour of labour reallocation as a result of trade liberalisation is an empirically unproven hypothesis; however these results do not hold for one of our robustness checks. Specifically, when we disaggregate the data into sub-categories of consumption, intermediate and capital goods, we find some adjustment post liberalisation in the intermediate and capital goods category.

We extend on the study of Wacziarg and Wallack (2004), firstly by using updated country and time coverage.[21] We start by using employment adjustment as our dependent variable and we run regressions of structural adjustment in labour on our measure of trade liberalisation. We measure employment adjustment at 2- and 5-year intervals and our liberalisation measure analyses the effect on structural adjustment if a liberalisation occurred in the past, in the past 2 years or the past 5 years. To further extend on this analysis, while simultaneously testing the robustness of our findings of the absence of a systematic relationship when we employ the full dataset, we also estimate adjustment in output to allow for the comparison between employment adjustment and another variable that is significantly correlated with productivity and growth performance in an economy. We also create subsamples by income and institutional quality for further robustness checks

[21] Wacziarg and Wallcak (2004) most recent time period is 1997 in comparison to our latest year, which is 2004. They also focus on developing and transition economies, whereas our sample includes both Low- and High-Income countries.

and estimate the equations for both output and employment. We use a modified measure of adjustment as well as create additional subsamples by excluding diversified countries from our sample and finally by disaggregating the data according to goods produced at different levels of the production process.

Our findings of no systematic relationship between trade liberalisation and structural adjustment in labour and output when we employ the full dataset appear to suggest that there are no obvious patterns or evidence of within-manufacturing employment adjustment occurring following a liberalisation episode. However, we find that disaggregating our data according to goods category alters this result of no systematic relationship between our variables of interest. Specifically, if we examine consumption, intermediate and capital goods separately, we find that trade liberalisation reduces adjustment in intermediate goods employment and output and increases adjustment in capital goods output.

Our investigations also reveal that manufacturing industries' output shares appear to be more susceptible to trade policy and the presence of institutions with larger estimated coefficients and some significant results. These results, however, depend heavily on the specification used, in particular, the length of the adjustment period and the variant of the liberalisation measure employed. Most of our statistically significant results arise when we split our sample into subsamples by income and institutional quality. For example, we find that for our original measure of adjustment, although we find no relationship between output adjustment and trade reform for our entire dataset, we observe that for our High-Income subsample, trade liberalisation increases output adjustment, even when we use a modified measure of structural adjustment. We also find that in countries with higher (lower) institutional quality, institutions reduce (increase) output adjustment (using our original measure of adjustment). Similarly, we obtain the greatest level of adjustment in output in the capital good category. It is important to note that these observed relationships between our variables tend to be stronger over the longer 5-year adjustment period.

In summary, unless we disaggregate our dataset, our results do not support inter-industry employment adjustment following trade liberalisation. We find, however, some evidence of trade liberalisation having an effect on output adjustment within the manufacturing sector. However, this finding is highly sensitive to the sample selected. The debate on the impact of trade reforms and a greater degree of openness generally centres on the allocation of employment across sectors as well as the returns to different types of labour (factors). Given our discoveries, it is important that trade economists understand the source of our results to determine the factors that are indeed affected by trade liberalisation events. Adjustment in an industry takes place as a result of drivers of such change such as increased openness. The extent that trade reform is translated into structural adjustment pressures is dependent upon the responsiveness of demand and supply to trade reform which in turn is dependent on the level and nature of liberalisation.

Our finding of the absence of a systematic relationship between trade liberalisation and structural adjustment using the full dataset may be capturing Balassa's (1966) Smooth Adjustment Hypothesis (SAH). Our measure of structural adjustment accounts for inter-industry changes in employment and output shares and ignores intra-industry adjustment. Balassa's (1966) claims that intra-industry trade expansion entails lower adjustment cost than trade expansion of inter-industry type (SAH), and as such, one would expect a greater shift in resources intra-industry as employment changes within industry are greater for lower adjustment costs. The rationale is such that, according to the Hecksher-Ohlin model of international trade, in response to the new good's relative price, free trade induces countries to specialise in industries in which they possess a comparative advantage (inter-industry specialisation). If, however, a country's relative factor endowments are similar and industries consist of differentiated varieties with economies of scale in its production, consumers' tastes will create an exchange of different varieties of the same product (intra-industry trade). The need to adapt to this new situation of intra-industry specialisation requires adjustment in production factors. Given that the skill of workers and managers are more similar within than they are between industries, this adjustment of factors will be easier (or smoother), if it occurs within as opposed to between industries. Research on interfirm reallocation of labour within-industry has shown that structural adjustment is a result of intra-industry job growth and decline rather than by inter-industry turnover. Therefore to get a complete picture of the effect of trade on employment shares within any sector, it is important to consider job reallocation within industries, job reallocation between industries (structural change) and labour turnover not related to these factors. Therefore we can be argue that analysing inter-industry changes might be masking any adjustment that is taking place within each of the 28 manufacturing industries used in this analysis therefore resulting in small and insignificant coefficients for the effect of trade liberalisation episode on structural adjustment and as such our data may require greater disaggregation. .

Based on our argument that the aggregated dataset masks the heterogeneity in the extent of liberalisation across the different manufacturing industries, one channel of increased data disaggregation arises from the fact that we can separate the 28 manufacturing industries according to goods found at different stages of the production process as trade liberalisation could affect industries differently if trading agreements are dissimilar across industries, in terms of the levels of protection. Trade liberalisation, together with increased openness is usually accompanied by reduced protection for domestic producers. There is therefore an expectation that production will shift towards more export oriented and unprotected markets. Given this we would also expect a parallel shift in employment, especially in the labour-intensive exportables. In our final robustness test, we investigated the extent to which protectionist measures have truly declined by exploring the heterogeneity across industries which allows us to take the nature of liberalisation into account. Specifically, we are able to account for different levels of protection by separating our dataset according to consumption, intermediate and capital goods. In disaggregating our data, we find reduced adjustment in intermediate goods employment and output and increased adjustment in capital goods output post liberalisation relative to pre-liberalisation. One possibility accounting for this is evidence that suggests that some trade liberalisation do not lead to a "real opening" of the world economy or specifically, that national borders may now face less protection, with the expectation of increased trade flows. However, this increased liberalisation may not be accompanied by adjustments in production because of the presence of "hidden" barriers such as Non-Tariff Barriers (NTBs) that protect the import-competing or infant industries. Most studies look at average tariffs when measuring the impact of trade reform, but the use of average tariffs masks actual tariff peaks as well as the protective nature of tariffs. Import tariffs especially in developed economies are reducing; however tariffs for some producers that governments wish to protect remain high thereby affecting the production and exports of developing economies (Milner, 2013).

The second possible explanation has to do with the nature of trade openness. Trade policy practices such as tariff escalation allows for varying tariff structures for raw materials, semi-processed and finished goods and its presence enables the protection of domestic processing or manufacturing industries. This means that domestic production may remain unaffected as industries such as intermediate good industry, face low import tariffs for their imported materials in comparison to the higher tariffs on the competing finished goods. This type of tariff escalation is present in both developed and developing economies. Encouraging trade rules that are fairer and public can help promote predictability and stability that will allow economies to respond to trade policies by allowing resources to adjust towards more efficient distributions and acquire the intended gains from trade while limiting adjustment costs for individuals, communities and societies as a whole. Our findings suggest the presence of different structures of protection among consumption, intermediate and capital goods.

To avoid these types of practices that inhibit resource reallocation, Dornbusch (1992) proposed a path to trade liberalisation to encourage resources to shift naturally so that economies can access the intended gains from trade. The author suggests that liberalisation should occur in two steps. In round one, the country should move from quotas and licences and other NTBs to a more uniformed high tariff (for example, 50 percent). Later on as the economy grows, the external balance can support liberalisation without risks such as foreign exchange crisis, and tariffs can be reduced (for example to 10 percent). This type of moderate policy serves the purpose of opening up the economy. This is because high tariff rates allow competition at the margin, while quotas and licenses prevent this. At the same time risks such as exchange rate crises are prevented.

To summarize, claims that trade liberalisation is followed by structural adjustment is not consistently supported by the data. This type of study is a major step in understanding how economic variables respond to trade reform, a topic which continues to encourage considerable debate around the globe. Further research should seek to uncover the nature and extent of liberalisation occurring among these industries. Countries differ in their economic performances for various reasons. Between- and within-sector adjustment in the presence or absence of reform is believed to be one of the major factors driving such differences. It is therefore important to understand not only whether structural adjustment occurs after trade reform, but also the type of structural adjustment taking place across countries in general and whether any observed patterns are such that, they contribute to different levels of efficiency and productivity, with the result that some countries outperform others economically. We conduct this analysis in Chapter 3.

Appendices to Chapter 2

Appendix 2.1

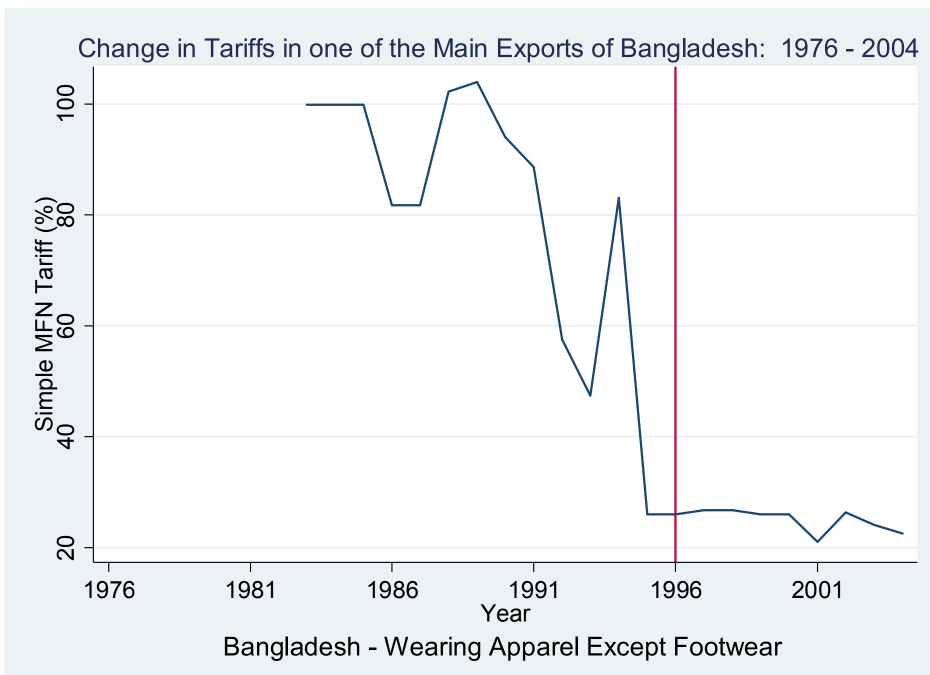
Appendix 2.1 presents the change in tariffs over time occurring in one of the main export sectors of selected countries. The Simple Most Favoured Nation (MFN) tariff is the simple average tariff rate that must be paid for the item at the border of the importing country. The **vertical** line indicates the year of **liberalisation.**[22]

[22] See Table 2.3 for Liberalisation Dates

Bangladesh

One of Bangladesh's main exports is garments inclusive of male and female suits, t-shits, singlets and jerseys.[23] Bangladesh's major trading partners for agricultural products are India, the European Union and the United States. The European Union, the United States and Turkey are the country's main trading partner for non-agricultural products.[24] Figure A2.1 shows change in tariffs for one of Bangladesh's major export industries, garments.

Figure A2.1 Change in Tariffs in the Main Export Sector of Selected Countries - Bangladesh

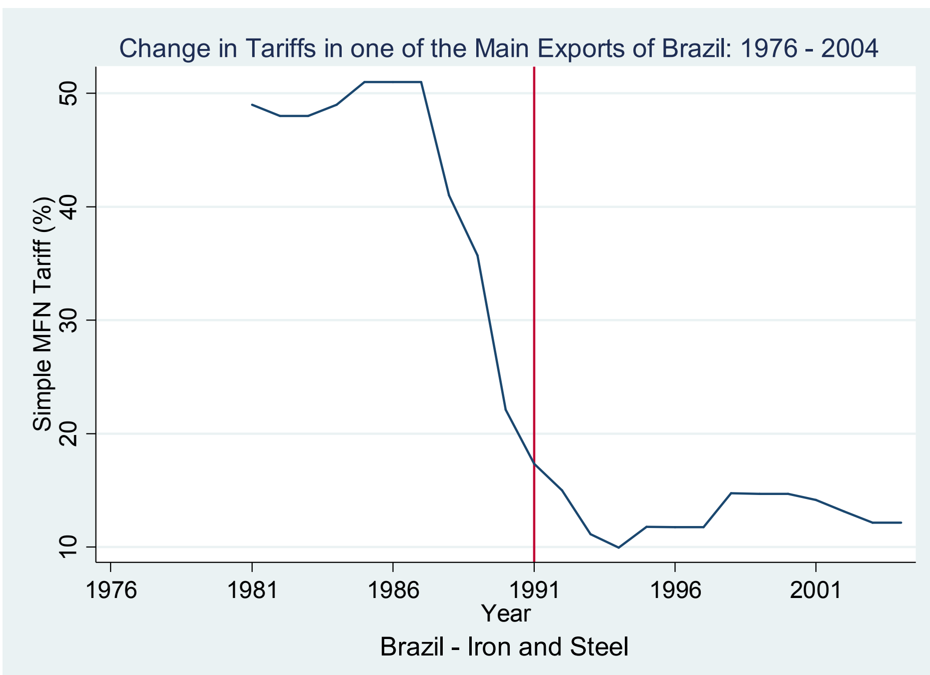


[23] See data.un.org for full country profile
[24] World Tariff Profiles 2012

Brazil

Some of Brazil's main exports are iron ores and concentrates, petroleum oils and soya bean.[25] Brazil's major trading partners for agricultural products are the European Union, China and the Russian Federation. China, the European Union and the United States are the country's main trading partner for non-agricultural products.[26] Figure A2.2 shows change in tariffs for one of Brazil's major export industries, iron and steel.

Figure A2.2 Change in Tariffs in the Main Export Sector of Selected Countries - Brazil

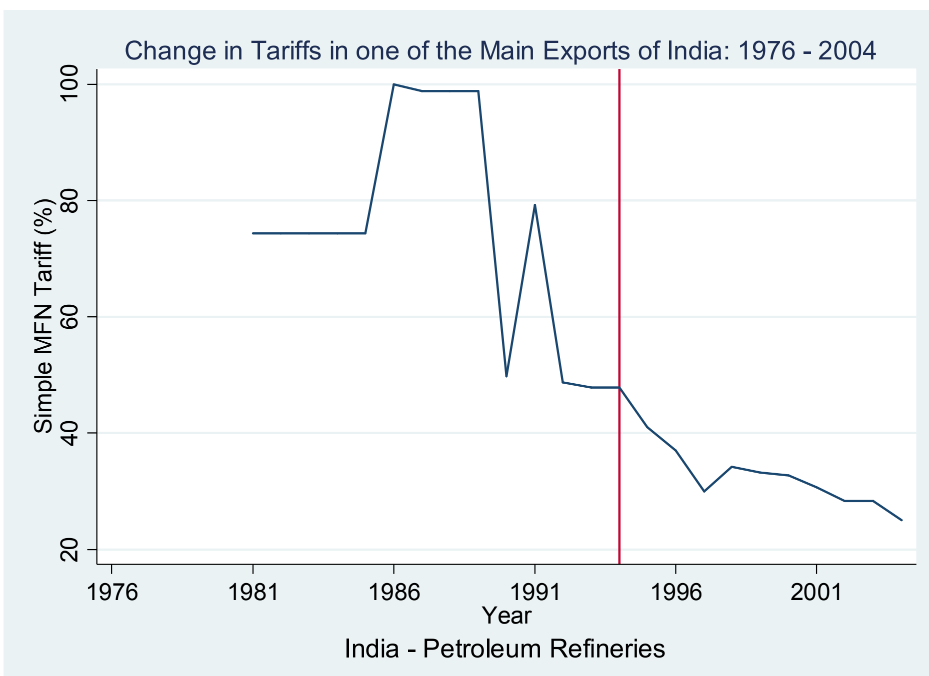


[25] See data.un.org for full country profile
[26] World Tariff Profiles 2012

India

Some of India's main exports are petroleum oils other than crude oil, diamonds (whether worked or not, but not mounted or set) and articles of jewellery.[27] India's major trading partners for agricultural products are the European Union, China and the United States. The European Union, the United States and China are the country's main trading partner for non-agricultural products.[28] Figure A2.3 shows change in tariffs for one of India's major export industries, petroleum refineries.

Figure A2.3 Change in Tariffs in the Main Export Sector of Selected Countries - India



[27] See data.un.org for full country profile
[28] World Tariff Profiles 2012

Appendix 2.2

Table A2.1 Trade Liberalisation and Concurrent Events in a Sample of Five Countries

Country	of Liberalisation	Policy Changes and Political Events
Mexico	1986	The 1940s-1960s was characterised by high economic growth along with political and social instability. Expansionary fiscal and monetary policy in the 1970s increased debts, prices and overvalued the exchange rate. By 1976, inflation was increasing and private investment decreasing forcing the government to devalue the peso and reduce its expenditure. The 1977 oil discovery revived the economy and accounted for ¾ of Mexico's export by 1981. Government spending increased again through international borrowing overvaluing the peso. Oil prices fell mid-1981 and by 1982 Mexico was unable to service its debt. The peso was devalued and the government implemented a two-tiered foreign exchange system in 1982. Mexico experienced a severe recession between 1982 and 1983 (Gonzalez, 1994). To attract FDI the country pursued privatization and liberalisation policies in 1984 and implemented a stabilization and structural adjustment program which included trade liberalisation in 1985 (Henry, 1999). Import restrictions and tariffs were significantly reduced when Mexico joined the General Agreement on Tariffs and Trade (GATT) in 1986. A debt rescheduling agreement was signed in August 1985 and further trade reform measures implemented in 1987 (Henry, 1999). 1994-1995 met with an economic crisis and political unrest. In 1995 the country received a bailout which improved the economy for 1995-1998. The peso was devalued and a floating exchange rate regime implemented. Persistent macroeconomic instability inhibits the country's ability to maximise its gains from trade through the prevention of efficient resource reallocation. The country continued to promote trade liberalisation signing several Free Trade Agreements (FTAs) with Latin America and European countries among others

		becoming one of the most open economies to trade. Total exports and imports almost quadrupled between 1991 and 2003.
Philippines	1988	During the 1960s, the Marcos regime increased trade barriers that remained in effect until the 1980s. There was a severe recession in 1984-1985 and the economy shrank by 10%, the inflation rate increased significantly, the currency was devalued by 50% in 1984, and expansionary monetary policy limited capital inflow and economic growth. The Philippines secured debt rescheduling agreements between 1985 and 1988 and the International Monetary Fund (IMF) approved a stabilization plan in 1989. In 1986 (the end of the Marcos era), under the Ramos regime, the country introduced a broad range of economic reforms to spur business growth and foreign investment. Trade reform included lifting import restrictions. The initiatives saw some growth but the Asian financial crises in 1997 slowed economic development again. Despite further trade liberalisation measures, the Philippines has not witnessed the increased economic growth experienced in other countries following liberalisation. Fiscal problems remain one of the economy's weakest points and biggest vulnerability.
Colombia	1991	In December 1990, Colombia was unable to repay its debt principal payments and was unable to refinance its debt until April 1991. Various liberalised economic policies were initiated by the government. This led to rapid industrialisation and increasing per capita incomes. There was further reform in the 1990's, including trading agreements with Latin American countries. Growth was set back by a recession in 1999. The early part of the 21st Century saw the country on its way to economic recovery.
Ghana	1985	Upon gaining independence in 1957, Ghana pursued a strategy of import substitution and implemented a series of restrictive trade. Cocoa prices were falling and foreign exchange reserves disappeared by mid-1960s. Foreign donors provided import loans to enable to government to import essential commodities. The Acheampong government undertook austerity programs which failed due to post-1973 rising oil prices and a drought in 1975-1977. Continued mismanagement

		saw record inflation, an overvalued currency and increasing corruption. The country under an agreement with the IMF in 1979 agreed to undertake economic reforms but became inoperative following a military coup. Another economic crisis in 1982 led to a 4-year recovery program the following year that included restructuring of physical and economic institutions, and decreasing inflation to fiscal, monetary and trade policies. In the 1985 trade reform program, multiple exchange rates were initially implemented to promote exports. Ghana continued to implement trade and capital market reforms through the late 1980s and 1990s. By the early 1990s, government efforts had resulted in the restoration of many of Ghana's historical trade relationships. Exports were again dominated by cocoa. In the 21st century, Ghana qualified for substantial debt relief measures, including relief from the World Bank and International Monetary Fund's Heavily Indebted Poor Country program in 2002 and the total debt forgiveness plan agreed upon by the Group of Eight country leaders in 2005.

Appendix 2.3

Structural Adjustment and Trade Liberalisation in Employment and Output

The figures in this section graph the average 2-year or 5-year changes inter-industry manufacturing employment and output shares (1976-2004).[29] The vertical line is the year of liberalisation. For all chosen countries the charts indicated that industries such as food manufacturing, textiles, wearing apparel and machinery were the more volatile industries.

[29] See Table 2.1 for the Decomposition of the Manufacturing Sector

Bangladesh: Liberalisation Year 1996

Figure A2.4 Average 2-year Changes in Industrial Shares of Employment Bangladesh: 1976 - 2004

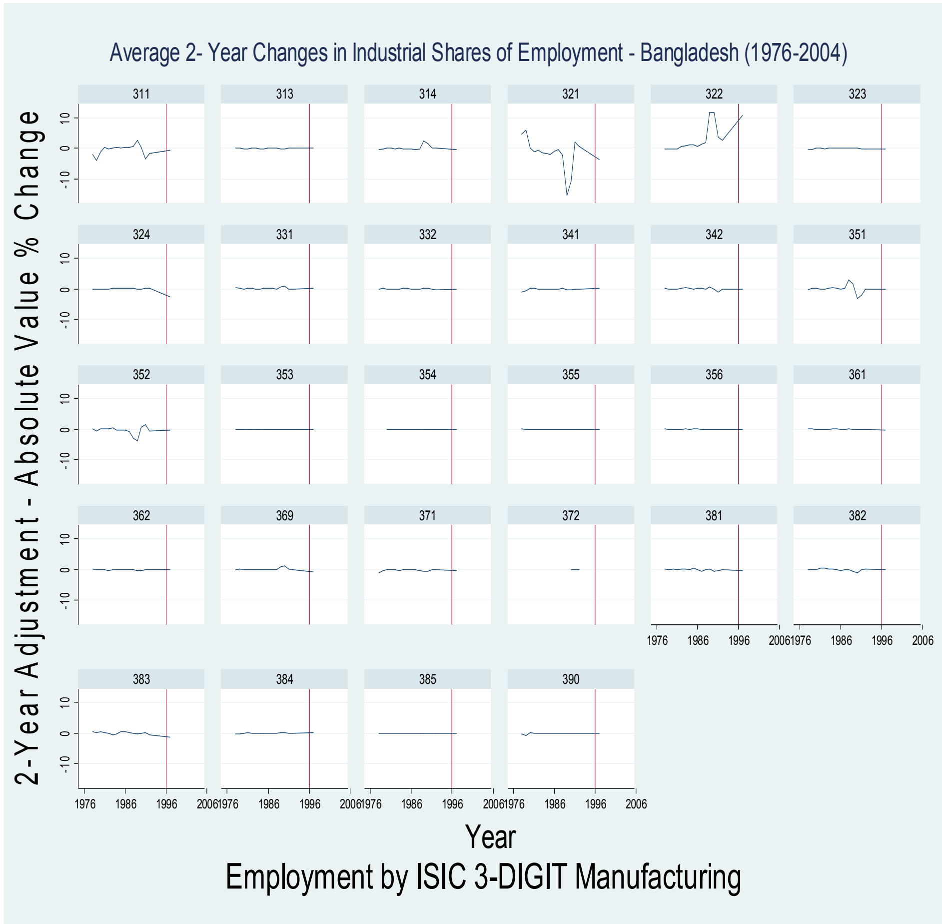
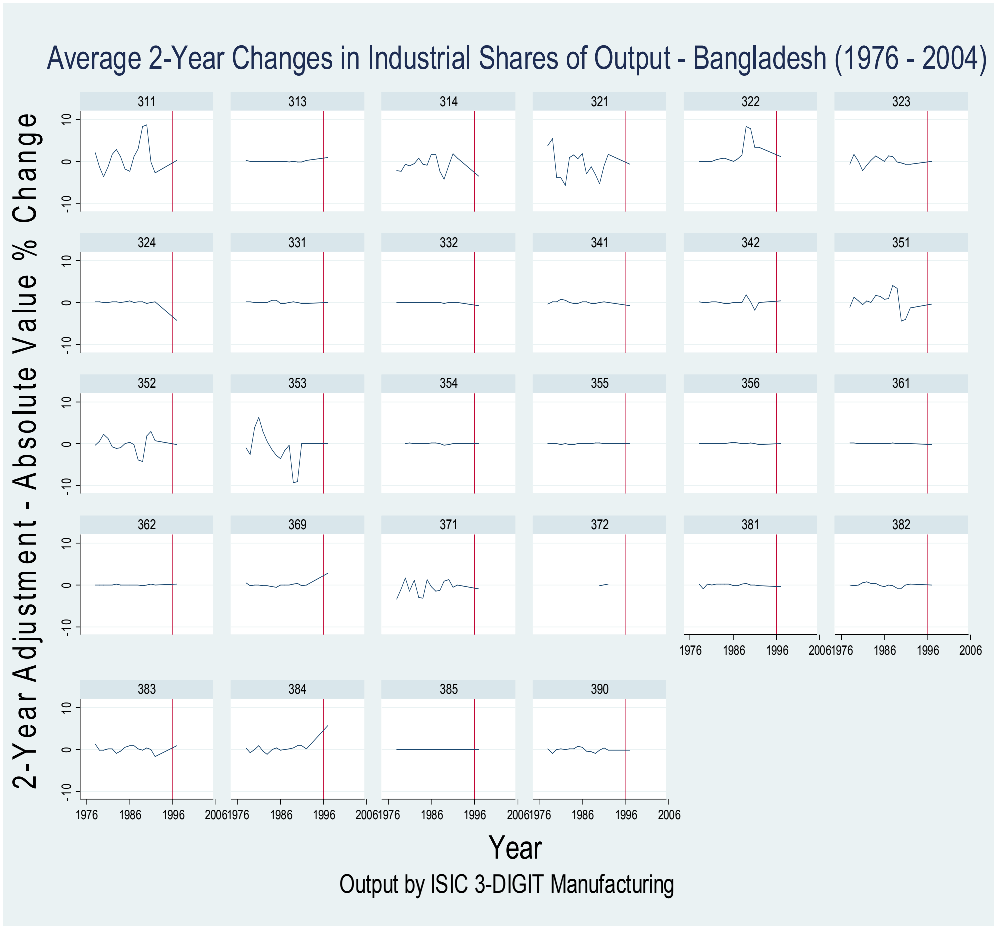


Figure A2.5 Average 2- year Changes in Industrial Shares of Output Bangladesh: 1976 – 2004



Poland: Liberalisation Year 1990

Figure A2.6 Average 2- year Changes in Industrial Shares of Employment Poland: 1976 - 2004

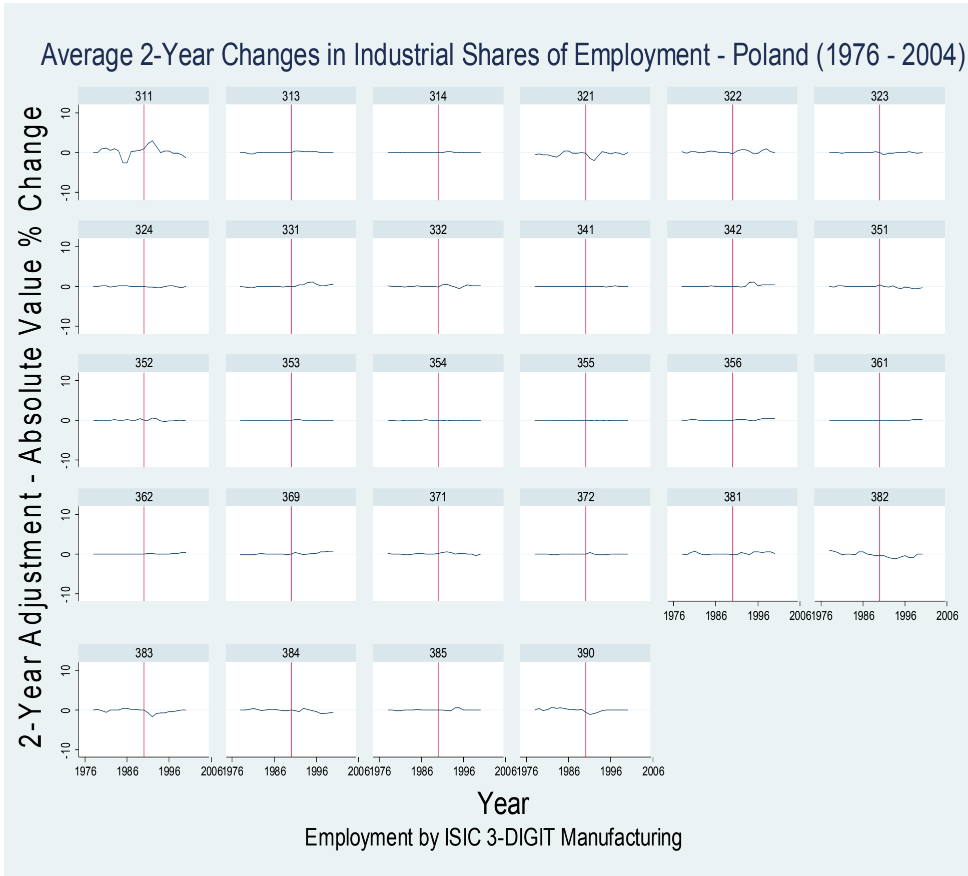
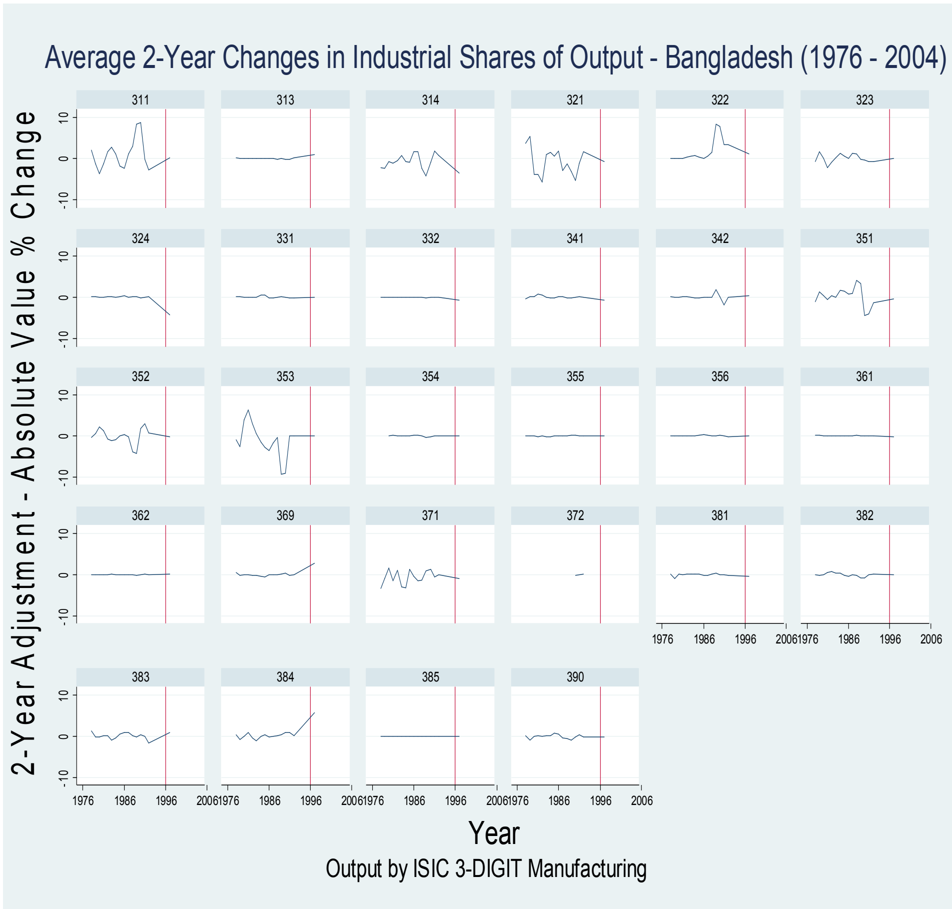


Figure A2.7 Average 2- year Changes in Industrial Shares of Output Poland: 1976 - 2004



Morocco: Liberalisation Year 1984

Figure A2.8 Average 2- year Changes in Industrial Shares of Employment Morocco: 1976 - 2004

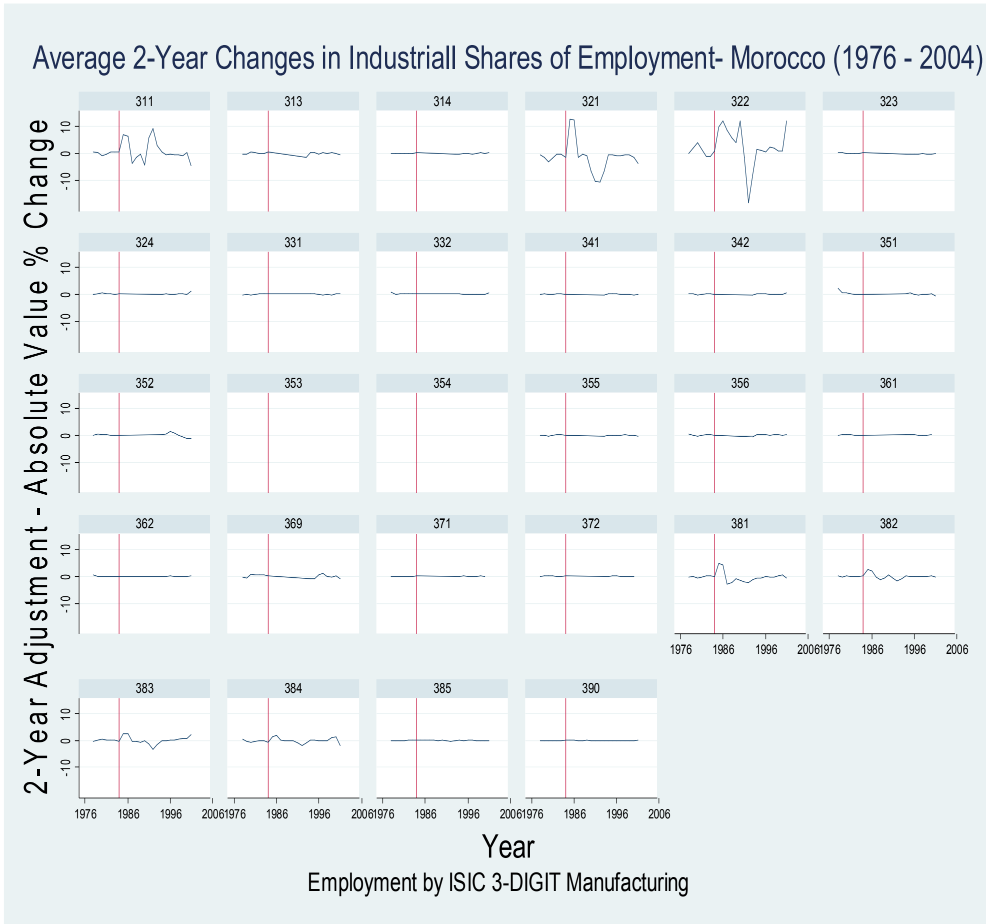
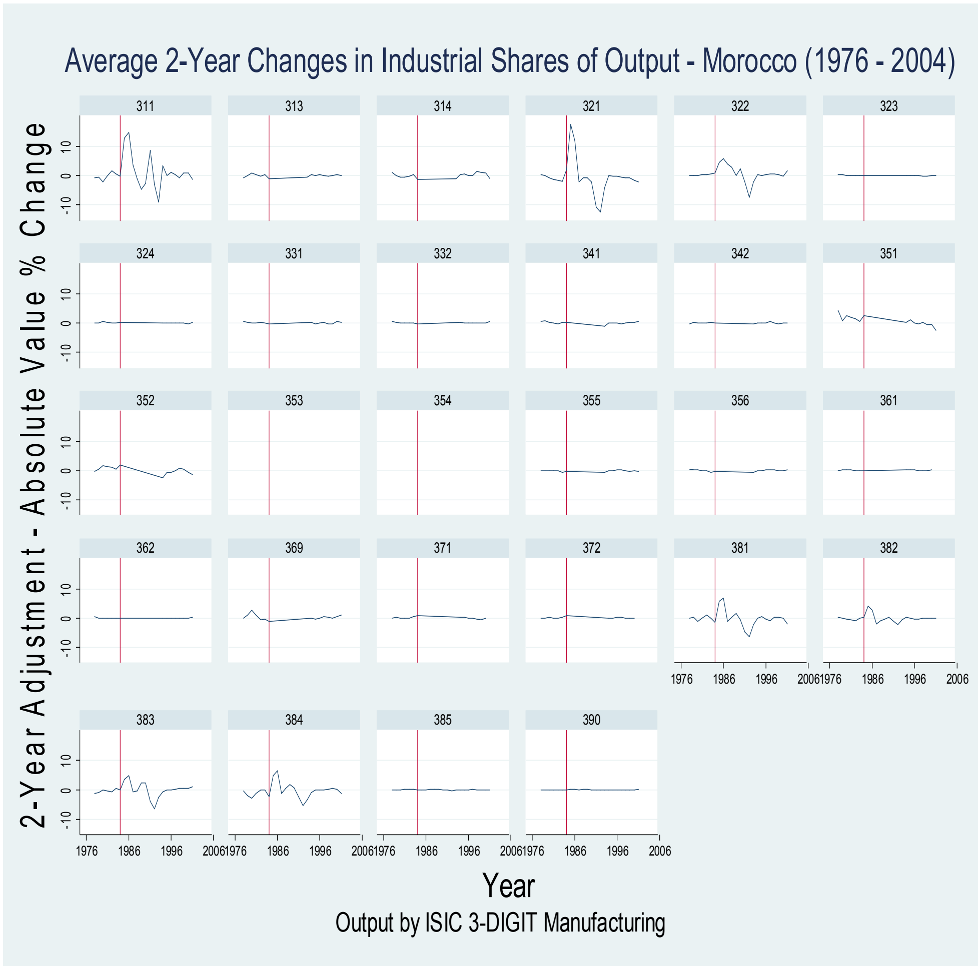


Figure A2.9 Average 2- year Changes in Industrial Shares of Output Morocco: 1976 - 2004



Sri Lanka: Liberalisation Year 1991

Figure A2.10 Average 5- year Changes in Industrial Shares of Employment
Sri Lanka: 1976 - 2004

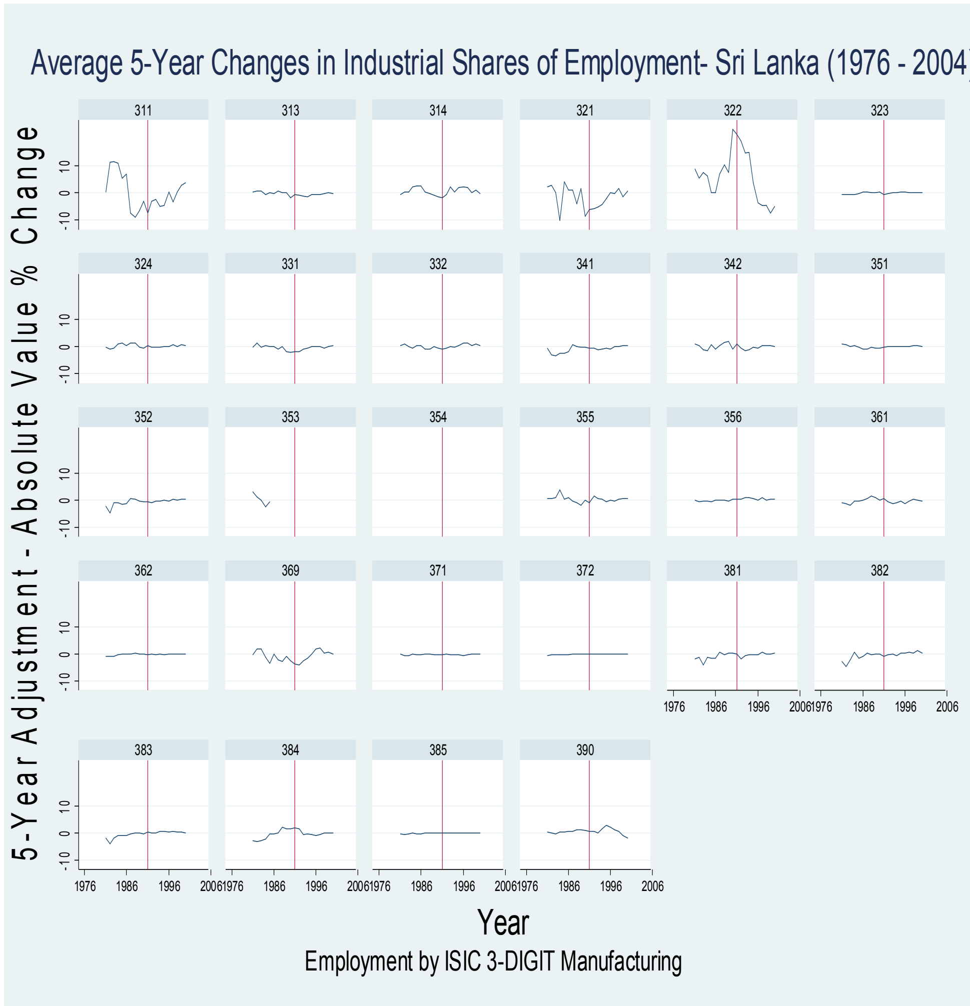
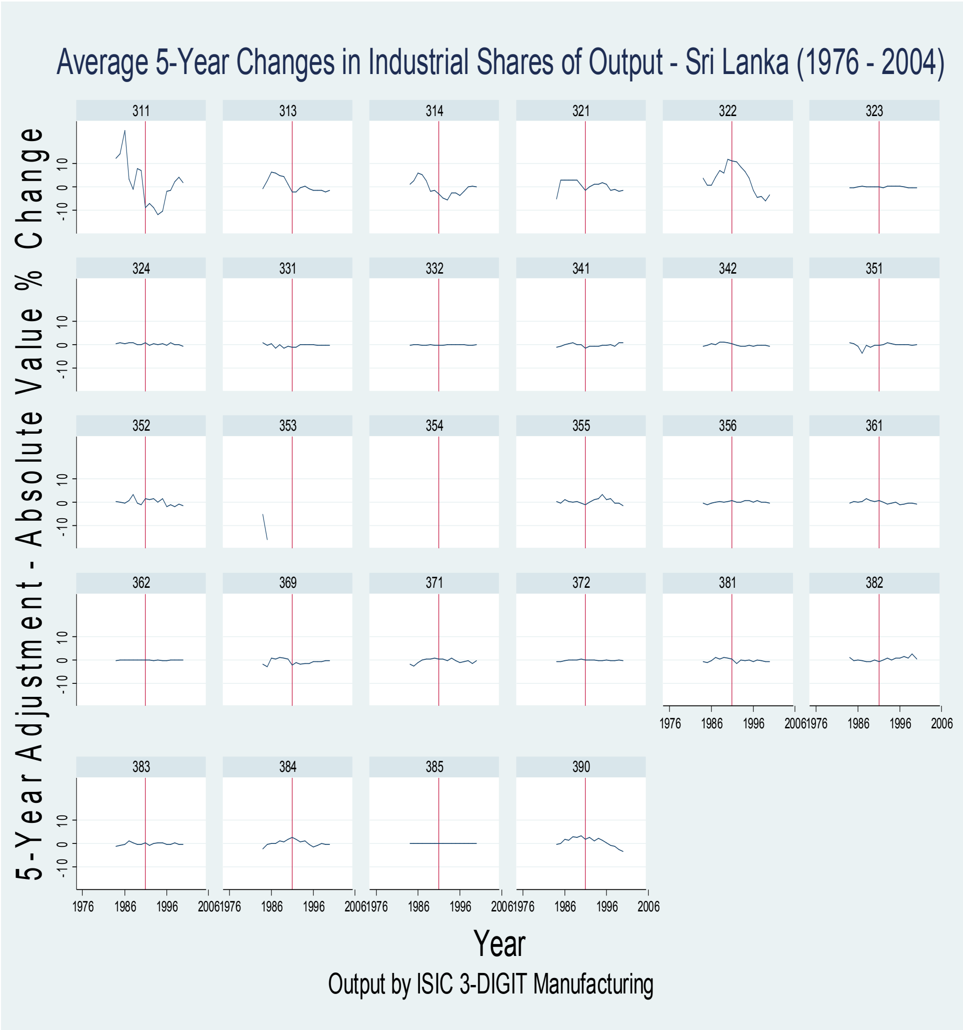


Figure A2.11 Average 5- year Changes in Industrial Shares of Output
Sri Lanka: 1976 - 2004



Kenya: Liberalisation Year 1993

Figure A2.12 Average 5- year Changes in Industrial Shares of Employment
Kenya: 1976 - 2004

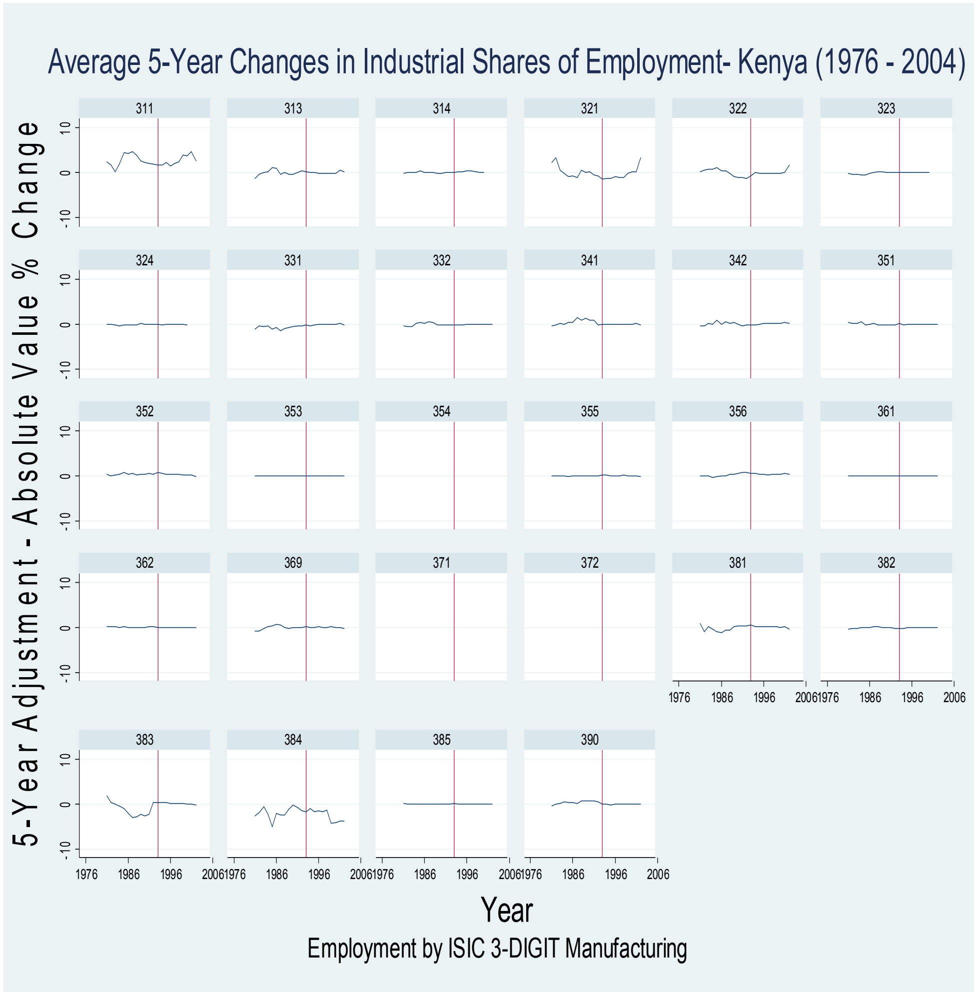
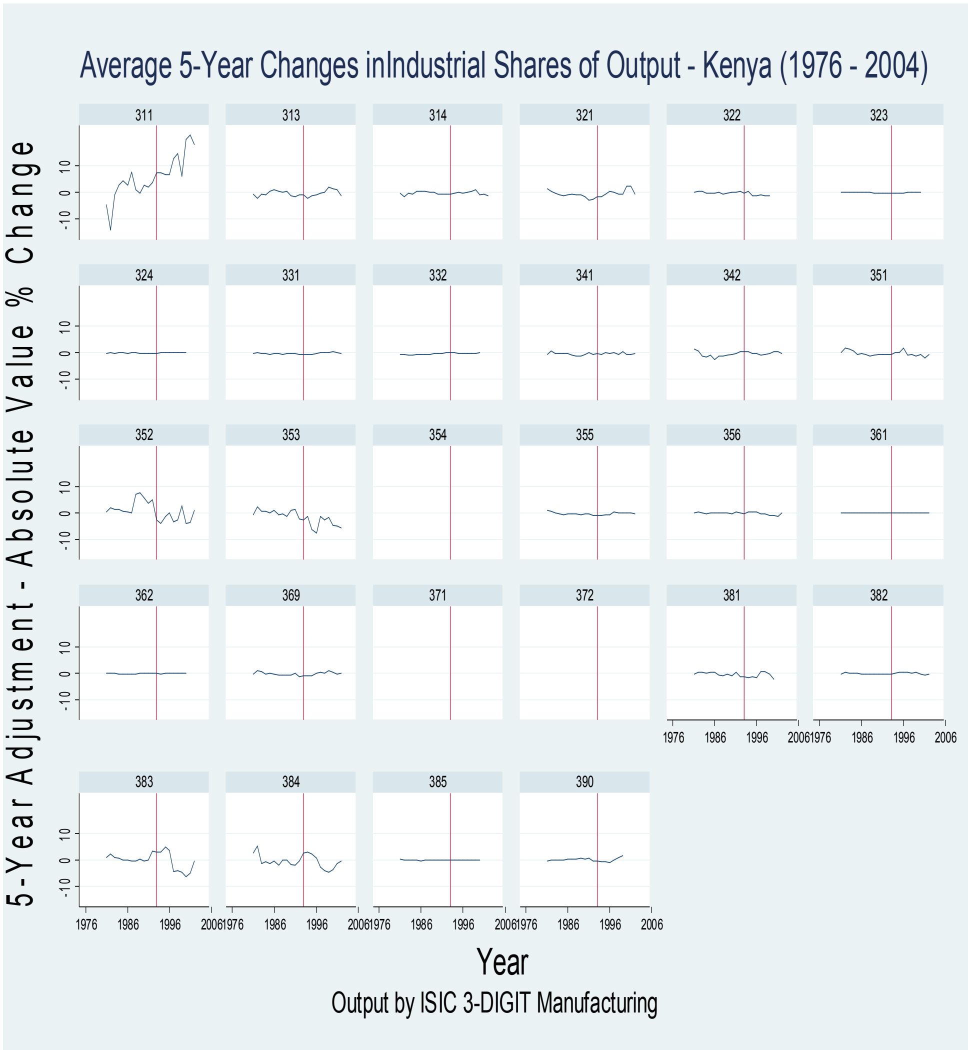


Figure A2.13 Average 5- year changes in Industrial Shares of Output: Kenya (1976 - 2004)



Turkey: Liberalisation Year 1989

Figure A2.14 Average 5- year changes in Industrial Shares of Employment
Turkey: 1976 - 2004

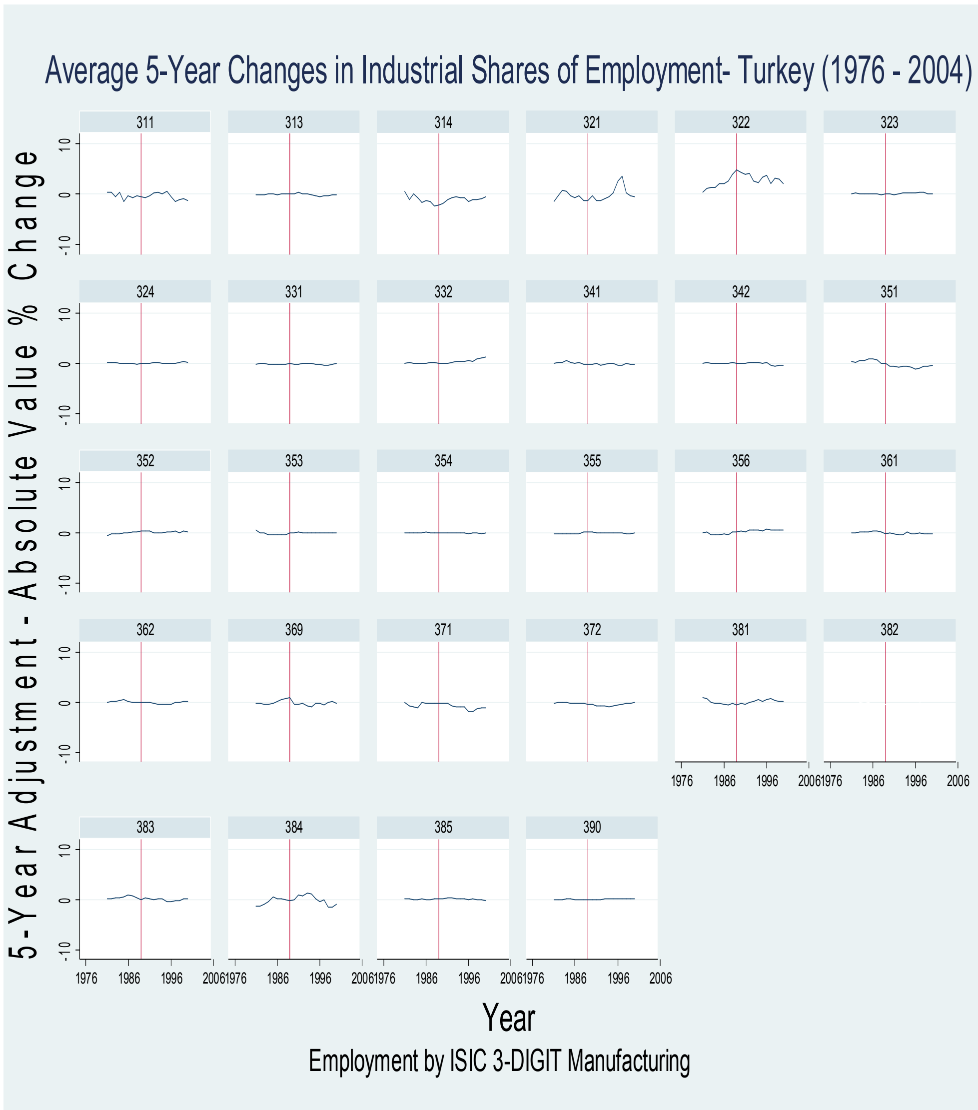
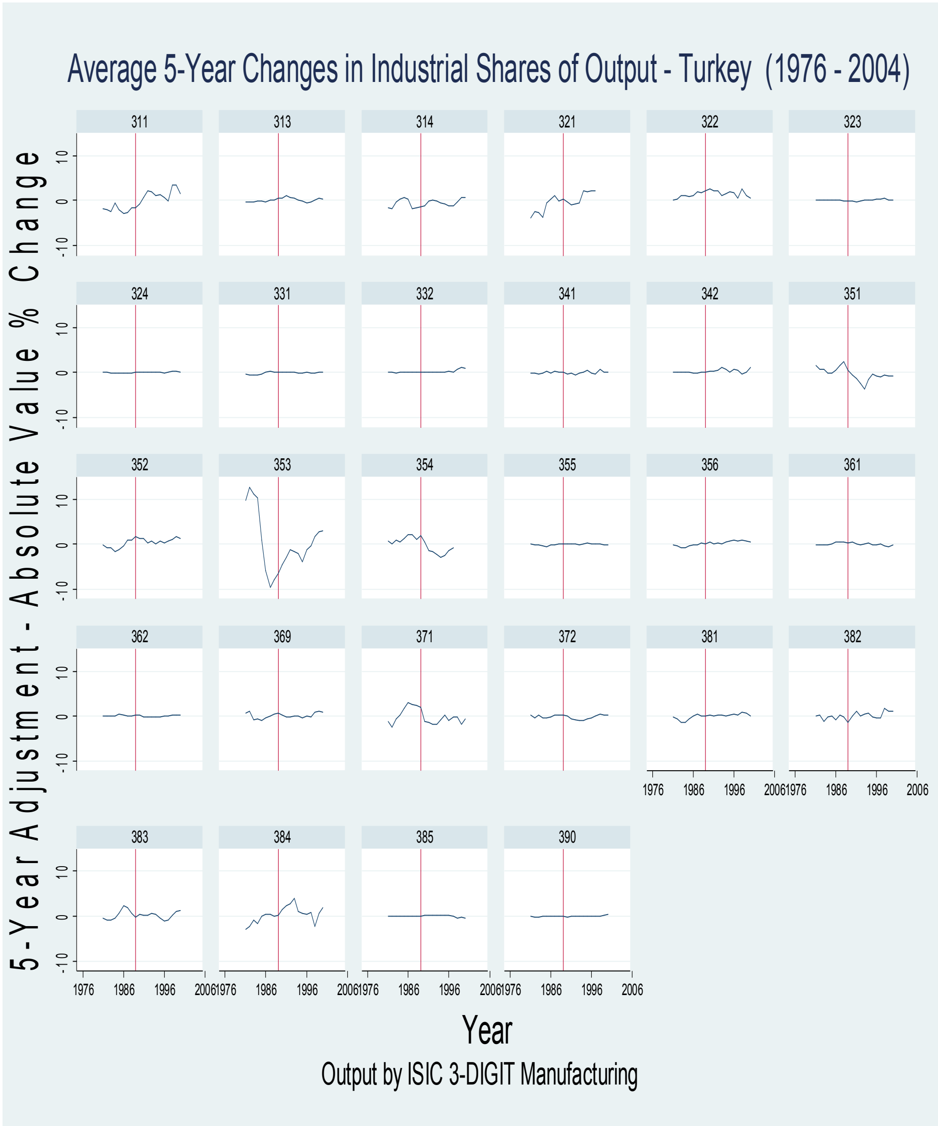


Figure A2.15 Average 5- year changes in Industrial Shares of Output Turkey: 1976 - 2004



Appendix 2.4 – Pooled Regressions for Employment

High-Income Countries – Pooled Regressions for Employment

Table A2.2 The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for High-Income Countries: 1976 - 2004[30]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	0.038	0.036	0.037	0.102	0.085	0.096
	(0.0284)	(0.030)	(0.030)	(0.065)	(0.066)	(0.066)
INST		0.002	0.000		0.018	0.000
		(0.009)	(0.009)		(0.022)	(0.020)
INST*LIB			0.004			0.029
			(0.015)			(0.033)
Adj. R^2	0. 064	0. 140	0.116	0. 029	0.127	0.129
LIB2	-0.028	-0.026	-0.029	-0.086	-0.070	-0.087
	(0.045)	(0.044)	(0.041)	(0.089)	(0.085)	(0.091)
INST		0.005	0.006		0.023	0.026
		(0.008)	(0.008)		(0.021)	(0.021)
INST*LIB2			-0.006			-0.027
			(0.027)			(0.039)
Adj. R^2	0.047	0.113	0.139	0.010	0. 134	0. 117
LIB5	-0.020	-0.019	-0.022	-0.082	-0.070	-0.083
	(0.031)	(0.030)	(0.028)	(0.080)	(0.076)	(0.079)
INST		0.006	0.009		0.022	0.032
		(0.008)	(0.009)		(0.020)	(0.021)
INST*LIB5			-0.014			-0.040
			(0.018)			(0.040)
Adj. R^2	0. 069	0.114	0.121	0.001	0. 175	0. 207
No. of Obs.	3730	3730	3730	3228	3228	3228

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[30] See Table 2.2 for list of sample countries

<u>Low-Income Countries</u> – Pooled Regressions for Employment

Table A2. 3 The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for Low-Income Countries: 1976 - 2004[31]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.012	-0.010	-0.011	-0.024	-0.016	-0.017
	(0.026)	(0.028)	(0.028)	(0.064)	(0.071)	(0.072)
INST		-0.003	-0.001		-0.012	-0.009
		(0.013)	(0.020)		(0.032)	(0.061)
INST*LIB			0.011			-0.005
			(0.024)			(0.071)
Adj. R^2	0.042	0. 109	0. 155	0. 047	0.183	0. 164
LIB2	-0.006	-0.006	-0.007	0.073	0.072	0.076
	(0.043)	(0.042)	(0.043)	(0.086)	(0.086)	(0.086)
INST		-0.004	-0.005		-0.014	-0.008
		(0.012)	(0.012)		(0.030)	(0.030)
INST*LIB2			0.004			-0.042
			(0.029)			(0.062)
Adj. R^2	0. 069	0. 121	0. 183	0.061	0.145	0.127
LIB5	-0.024	-0.023	-0.025	0.010	0.013	0.019
	(0.030)	(0.031)	(0.032)	(0.066)	(0.067)	(0.066)
INST		-0.003	-0.006		-0.014	-0.009
		(0.012)	(0.014)		(0.029)	(0.033)
INST*LIB5			0.008			-0.022
			(0.026)			(0.056)
Adj. R^2	0.011	0.157	0. 118	0. 083	0.194	0. 143
No. of Obs.	14777	14777	14777	12373	12373	12373

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[31] See Table 2.2 for list of sample countries

Appendix 2.5 – Fixed Effects Regressions for Employment

High-Income Countries - Fixed Effects Regressions for Employment

Table A2.4 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for High-Income Countries: 1976-2004[32]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	0.009	0.042	0.035	0.032	0.064	0.053
	(0.119)	(0.038)	(0.036)	(0.079)	(0.075)	(0.069)
INST		-0.042	-0.034		-0.055	-0.042
		(0.034)	(0.032)		(0.081)	(0.076)
INST*LIB			-0.013			-0.020
			(0.018)			(0.034)
Adj. R^2	0. 041	0. 304	0.496	0.010	0.377	0.469
LIB2	-0.066	-0.025	-0.028	-0.036	-0.050	-0.049
	(0.092)	(0.044)	(0.040)	(0.085)	(0.079)	(0.082)
INST		-0.032	-0.032		-0.043	-0.043
		(0.032)	(0.032)		(0.079)	(0.079)
INST*LIB2			-0.004			0.001
			(0.027)			(0.035)
Adj. R^2	0. 032	0.156	0.130	0.017	0.335	0.441
LIB5	-0.058	-0.018	-0.022	-0.032	-0.041	-0.045
	(0.109)	(0.030)	(0.028)	(0.077)	(0.074)	(0.072)
INST		-0.031	-0.030		-0.043	-0.041
		(0.032)	(0.032)		(0.078)	(0.078)
INST*LIB5			-0.012			-0.011
			(0.018)			(0.036)
Adj. R^2	0. 100	0.354	0.444	0.107	0.343	0.418
No. of Obs.	2392	2392	2392	3228	3228	3228

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[32] See Table 2.2 for list of sample countries

<u>Low-Income Countries</u> - Fixed Effects Regressions for Employment

Table A2.5 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for Low-Income Countries: 1976-2004[33]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.023	-0.023	-0.021	-0.034	-0.027	-0.028
	(0.032)	(0.032)	(0.031)	(0.071)	(0.072)	(0.074)
INST		0.001	-0.013		-0.018	-0.007
		(0.018)	(0.023)		(0.045)	(0.081)
INST*LIB			0.022			-0.016
			(0.027)			(0.091)
Adj. R^2	0.019	0.207	0.217	0.102	0.243	0.210
LIB2	-0.006	-0.006	-0.006	0.085	0.087	0.092
	(0.040)	(0.040)	(0.041)	(0.089)	(0.089)	(0.091)
INST		-0.004	-0.004		-0.024	-0.012
		(0.018)	(0.019)		(0.045)	(0.047)
INST*LIB2			0.00			-0.054
			(0.029)			(0.063)
Adj. R^2	0.062	0.213	0.219	0.016	0.218	0.223
LIB5	-0.025	-0.025	-0.027	0.015	0.022	0.028
	(0.030)	(0.030)	(0.031)	(0.067)	(0.068)	(0.068)
INST		-0.002	-0.006		-0.024	-0.014
		(0.019)	(0.022)		(0.046)	(0.056)
INST*LIB5			0.013			-0.027
			(0.027)			(0.061)
Adj. R^2	0.025	0.271	0.192	0. 073	0.256	0.287
No. of Obs.	14777	14777	14777	12373	12373	12373

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**

ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.

Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[33] See Table 2.2 for list of sample countries

Countries Institutional Score of > 5 - Fixed Effects Regressions for Employment

Table A2.6 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for Countries with Institutional Score of more than 5: 1976-2004[34]

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	0.010	0.013	0.023	-0.012	-0.003	0.008
	(0.024)	(0.026)	(0.035)	(0.082)	(0.087)	(0.076)
INST		-0.014	-0.002		-0.040	-0.025
		(0.031)	(0.039)		(0.091)	(0.143)
INST*LIB			-0.016			-0.018
			(0.036)			(0.126)
Adj. R^2	0.071	0.211	0.217	0.090	0.216	0.314
LIB2	-0.002	-0.001	0.001	-0.010	-0.001	-0.005
	(0.029)	(0.029)	(0.033)	(0.072)	(0.070)	(0.088)
INST		-0.012	-0.012		-0.040	-0.041
		(0.030)	(0.030		(0.087)	(0.087)
INST*LIB2			-0.002			0.005
			(0.041)			(0.097)
Adj. R^2	0. 081	0.213	0.322	0.095	0.216	0.315
LIB5	-0.020	-0.018	-0.032	-0.021	-0.012	-0.012
	(0.025)	(0.026)	(0.034)	(0.066)	(0.070)	(0.072)
INST		-0.010	-0.015		-0.038	(0.095)
		(0.031)	(0.032)		(0.091)	-0.038
INST*LIB5			0.018			-0.001
			(0.034)			(0.075)
Adj. R^2	0. 019	0.270	0.312	0. 062	0.268	0.314
No. of Obs.	12076	12076	12076	10607	10607	10607

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[34] See Table 2.2 for list of sample countries

Countries Institutional Score of ≤ 5 - Fixed Effects Regressions for Employment

Table A2.7 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for Countries with Institutional Score of more than 5: 1976-2004[35]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.012	-0.014	-0.050	0.095	0.090	0.073
	(0.045)	(0.047)	(0.098)	(0.079)	(0.077)	(0.144)
INST		0.018	0.029		0.082	0.088
		(0.039)	(0.046)		(0.103	(0.010)
INST*LIB			-0.027			-0.011
			(0.055)			(0.087)
Adj. R^2	0.014	0.224	0.234	0.087	0.233	0.314
LIB2	-0.031	-0.029	-0.069	0.117	0.132	0.237
	(0.057)	(0.055)	(0.116)	(0.107)	(0.108)	(0.187)
INST		0.014	0.019		0.102	0.085
		(0.035)	(0.038)		(0.106)	(0.010)
INST*LIB2			-0.028			0.073
			(0.061)			(0.078)
Adj. R^2	0.079	0.219	0.230	0.082	0.277	0.382
LIB5	-0.017	-0.015	-0.051	0.098	0.110	0.151
	(0.050)	(0.0489)	(0.103)	(0.098)	(0.010)	(0.169)
INST		0.016	0.023		0.101	0.089
		(0.036)	(0.043)		(0.106)	(0.110)
INST*LIB5			-0.026			0.029
			(0.055)			(0.084)
Adj. R^2	0. 128	0.124	0.234	0.080	0.218	0.253
No. of Obs.	6431	6431	6431	4994	4994	4994

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[35] See Table 2.2 for list of sample countries

Appendix 2.6 – Fixed Effects Regressions for Output

High-Income Countries - Fixed Effects Regressions for Output

Table A2.8 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Output for High-Income Countries: 1976-2004[36]

		ADJ2			ADJ5	
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	0.187**	0.268***	0.229**	0.700***	0.885***	1.050**
	(0.089)	(0.089)	(0.102)	(0.264)	(0.317)	(0.440)
INST		-0.154*	-0.112		-0.348	-0.562
		(0.080)	(0.089)		(0.225)	(0.384)
INST*LIB			-0.058			0.300
			(0.046)			(0.305)
Adj. R^2	0.177	0. 446	0. 437	0. 147	0.522	0.652
LIB2	0.197	0.180	0.641*	0.333	0.317	0.989
	(0.215)	(0.210)	(0.387)	(0.376)	(0.362)	(0.703)
INST		-0.082	-0.087		-0.146	-0.151
		(0.072)	(0.073)		(0.186)	(0.185)
INST*LIB2			0.770**			1.535*
			(0.352)			(0.920)
Adj. R^2	0. 162	0.423	0.593	0. 189	0.431	0.432
LIB5	0.174**	0.162**	0.117*	0.418*	0.406*	0.523*
	(0.068)	(0.068)	(0.062)	(0.249)	(0.240)	(0.308)
INST		-0.079	-0.053		-0.135	-0.206
		(0.079)	(0.079)		(0.188)	(0.215)
INST*LIB5			-0.163***			0.423
			(0.038)			(0.324)
Adj. R^2	0.130	0.480	0. 515	0.105	0.486	0.551
No. of Obs.	2984	2984	2984	2485	2485	2485

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.
Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10) and (2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10) and (2.11)** respectively.

[36] See Table 2.2 for list of sample countries

<u>Low-Income Countries</u> - Fixed Effects Regressions for Output

Table A2.9 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Output for Low-Income Countries: 1976-2004[37]

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	-0.065	-0.055	-0.054	-0.122	-0.088	-0.089
	(0.041)	(0.046)	(0.045)	(0.081)	(0.083)	(0.082)
INST		-0.018	-0.041		-0.067	-0.036
		(0.029)	(0.031)		(0.058)	(0.074)
INST*LIB			0.042			-0.050
			(0.058)			(0.096)
Adj. R^2	0.118	0.216	0.219	0.147	0.378	0.378
LIB2	-0.035	-0.034	-0.036	0.088	0.094	0.097
	(0.069)	(0.070)	(0.079)	(0.103)	(0.104)	(0.112)
INST		-0.029	-0.032		-0.086	-0.081
		(0.027)	(0.022)		(0.057)	(0.052)
INST*LIB			0.018			-0.020
			(0.105)			(0.102)
Adj. R^2	0.133	0.246	0.227	0.184	0.271	0.364
LIB5	-0.074	-0.068	-0.077	-0.039	-0.017	-0.018
	(0.046)	(0.049)	(0.060)	(0.086)	(0.092)	(0.105)
INST		-0.023	-0.033		-0.082	-0.084
		(0.028)	(0.024)		(0.060)	(0.057)
INSTI*LIB			0.032			0.006
			(0.062)			(0.088)
Adj. R^2	0.124	0.225	0. 254	0.136	0.253	0.345
No. of Obs.	14072	14072	14072	11805	11805	11805

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10) and (2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10) and (2.11)** respectively.

[37] See Table 2.2 for list of sample countries

Countries Institutional Score of > 5 - Fixed Effects Regressions for Output

Table A2.10 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Output for Countries with Institutional Score of more than 5: 1976-2004[38]

	ADJ2			ADJ5		
	(1)	(2)	(3)	(4)	(5)	(6)
LIB	-0.022	0.002	-0.063	-0.071	-0.027	-0.249*
	(0.047)	(0.048)	(0.068)	(0.110)	(0.115)	(0.128)
INST		-0.0973**	-0.189**		-0.206**	-0.559**
		(0.047)	(0.084)		(0.103)	(0.240)
INST*LIB			0.117			0.418**
			(0.080)			(0.212)
Adj. R^2	0.161	0.251	0.319	0.152	0.315	0. 325
LIB2	0.070	0.083	-0.016	0.070	0.128	-0.094
	(0.077)	(0.079)	(0.062)	(0.110)	(0.117)	(0.109)
INST		-0.102**	-0.114**		-0.227**	-0.249**
		(0.047)	(0.051)		(0.103)	(0.109)
INST*LIB2			0.135			0.282
			(0.117)			(0.184)
Adj. R^2	0.208	0.274	0.311	0.250	0.382	0.326
LIB5	-0.055	-0.040	-0.081	0.002	0.063	-0.096
	(0.039)	(0.039)	(0.056)	(0.090)	(0.098)	(0.084)
INST		-0.0911**	-0.108**		-0.226**	-0.292**
		(0.046)	(0.047)		(0.106)	(0.126
INST*LIB5			0.054			0.217*
			(0.052)			(0.114)
Adj. R^2	0.211	0.264	0.263	0.210	0.315	0. 323
No. of Obs.	11421	11421	11421	10089	10089	10089

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10) and (2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10) and (2.11)** respectively.

[38] See Table 2.2 for list of sample countries

Countries Institutional Score of ≤ 5 - Fixed Effects Regressions for Output

Table A2.11 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Output for Countries with Institutional Score of more than 5: 1976-2004[39]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.016	-0.021	-0.096	0.285**	0.279*	-0.047
	(0.094)	(0.096)	(0.192)	(0.144)	(0.143)	(0.330)
INST		0.104	0.129		0.445***	0.605***
		(0.074)	(0.082)		(0.157)	(0.231)
INST*LIB			-0.063			-0.267
			(0.183)			(0.321)
Adj. R^2	0.117	0.116	0.128	0.386	0.467	0.478
LIB2	-0.141	-0.130	0.001	0.104	0.142	0.174
	(0.146)	(0.143)	(0.297)	(0.167)	(0.168)	(0.328)
INST		0.093	0.074		0.461***	0.454***
		(0.067)	(0.077)		(0.160)	(0.164)
INST*LIB2			0.102			0.026
			(0.296)			(0.292)
Adj. R^2	0.148	0.170	0.171	0.312	0.421	0.482
LIB5	0.033	0.041	-0.120	0.100	0.142	-0.277
	(0.116)	(0.113)	(0.204)	(0.180)	(0.179)	(0.362)
INST		0.106	0.148*		0.466***	0.642***
		(0.068)	(0.086)		(0.158)	(0.236)
INST*LIB5			-0.130			-0.341
			(0.192)			(0.342)
Adj. R^2	0.113	0.121	0.239	0.251	0.408	0.493
No. of Obs.	5635	5635	5635	4201	4201	4201

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**.
Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10) and (2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10) and (2.11)** respectively.

[39] See Table 2.2 for list of sample countries

Appendix 2.7 – Dataset Excluding Diversified Economies

Dataset Excluding Diversified Economies: - Fixed Effects Regressions for Employment

Table A2.12 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Employment for Dataset excluding Diversified Economies: 1976-2004[40]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.023	-0.021	-0.020	-0.021	-0.003	-0.007
	(0.031)	(0.032)	(0.031)	(0.057)	(0.056)	(0.056)
INST		-0.004	-0.008		-0.030	-0.019
		(0.017)	(0.019)		(0.040)	(0.050)
INST*LIB			0.005			-0.017
			(0.017)			(0.040)
Adj. R^2	0.023	0.214	0.210	0.045	0.281	0.293
LIB2	-0.014	-0.014	-0.014	0.081	0.083	0.081
	(0.040)	(0.040)	(0.040)	(0.086)	(0.086)	(0.085)
INST		-0.008	-0.009		-0.032	-0.026
		(0.017)	(0.017)		(0.039)	(0.040)
INST*LIB2			0.006			-0.029
			(0.023)			(0.043)
Adj. R^2	0.059	0.208	0.210	0.021	0.238	0.237
LIB5	-0.031	-0.030	-0.030	0.014	0.021	0.022
	(0.028)	(0.028)	(0.028)	(0.059)	(0.059)	(0.060)
INST		-0.007	-0.009		-0.032	-0.027
		(0.017)	(0.018)		(0.039)	(0.043)
INST*LIB5			0.006			-0.015
			(0.019)			(0.036)
Adj. R^2	0.094	0.241	0.213	0.068	0.211	0.262
No. of Obs.	15451	15451	15451	13000	13000	13000

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of employment if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry employment shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.2), (2.3)** and **(2.4)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.2), (2.3)** and **(2.4)** respectively.

[40] See Table 2.2 for list of sample countries

<u>Dataset Excluding Diversified Economies:</u> - Fixed Effects Regressions for Output

Table A2.13 Fixed Effects Regressions: The Effect of Trade Liberalisation on Manufacturing Industry Change in Output for Dataset excluding Diversified Economies: 1976-2004[41]

	ADJ2			ADJ5		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LIB	-0.043	-0.024	-0.023	-0.015	0.049	0.045
	(0.044)	(0.050)	(0.048)	(0.091)	(0.099)	(0.100)
INST		-0.030	-0.031		-0.100	-0.077
		(0.030)	(0.028)		(0.062)	(0.081)
INST*LIB			0.002			-0.036
			(0.048)			(0.092)
Adj. R^2	0.052	0.213	0.282	0. 081	0.285	0.306
LIB2	0.006	0.008	0.011	0.138	0.149	0.146
	(0.084)	(0.085)	(0.084)	(0.125)	(0.127)	(0.128)
INST		-0.035	-0.053**		-0.094	-0.103
		(0.027)	(0.025)		(0.058)	(0.057)
INST*LIB2			0.113			0.051
			(0.098)			(0.114)
Adj. R^2	0.071	0.210	0.226	0.033	0.226	0.272
LIB5	-0.036	-0.028	-0.022	0.057	0.087	0.080
	(0.047)	(0.049)	(0.055)	(0.100)	(0.109)	(0.111)
INST		-0.033	-0.025		-0.099	-0.114
		(0.028)	(0.024)		(0.062)	(0.065)
INST*LIB5			-0.026			0.043
			(0.050)			(0.087)
Adj. R^2	0.019	0.215	0.226	0.047	0.205	0.234
No. of Obs.	14374	14374	14374	11945	11945	11945

*p<0.1 **p<0.5 ***p<0.01

Standard errors in parenthesis clustered at the country-sector level and robust to heteroskedasticity

LIB – Average Absolute Value Change in industry *i*'s share of output if Liberalisation occurred in the past, in the past 2 years **(LIB2)** or in the past 5 years **(LIB5).**
ADJ2 and **ADJ5** refer to the interval of time over which changes in manufacturing industry output shares or structural adjustment are computed and corresponded to the measure defined in equation **(2.1)**. Columns **(1), (2)** and **(3)** represent three different regressions corresponding to equations **(2.9), (2.10) and (2.11)** respectively. Similarly, columns **(4), (5)** and **(6)** correspond to equations **(2.9), (2.10) and (2.11)** respectively.

[41] See Table 2.2 for list of sample countries

Chapter 3 : Understanding the Structural Change Component of Economy-Wide Productivity - A Critical Review

3.1 Introduction

3.1.1 Economic Growth and Productivity

Comparing productivity performance at the regional and country levels is central towards answering ongoing questions about differences in long-run economic growth. Growth economics is rooted in the production frontier type of analysis, which involves the decomposition of productivity growth into its technical efficiency change sources or growth-accounting type applications. Growth accounting allows economic growth to be decomposed into each sector's contribution, as well as changes in sectoral composition of resources, that is, structural change.

Growth accounting allows economy-wide growth or aggregate productivity growth to be decomposed into two components. Specifically, within any one economy, aggregate labour productivity can change either through the improvement of sectors' productivity performances as they progress technologically or as resources reallocate across firms within sectors. This is commonly termed the "within effect". Economy-wide labour productivity may also change when sectoral shares of labour change. In the case of latter, or "structural change" component, if there is a change in sectoral shares of labour away from lower productivity towards higher productivity sectors, then aggregate productivity will rise. Both effects serve to enhance the growth performance of sectors independently or in cooperation with the other.

A comprehensive understanding of the sources of growth has strong bearings on policy-making and results in the implementation of different policy measures across countries. A priori belief is that the structural change dimension through employment reallocation is the more relevant paradigm for growth of developing and emerging economies, with higher shares of their labour force in lower productivity, primary sectors and less so industrial ones. Structural reallocation, in which labour moves from traditional low-productivity sectors to more dynamic and higher productivity economic activities, should be a significant source of improved living standards, poverty reduction and the provision of better jobs that accompany economic development. In advanced economies, however, growth is believed to be a result of the adoption of higher productivity technologies which occurs through the process of creative destruction within existing industries. These industries possess novel and more efficient technologies and firms that are less productive are forced to exit the market. (Aghion and Howitt, 1992).

The literature suggests that productivity enhancing labour reallocation within and across sectors plays a vital role in the growth rate of economies. There is also a general consensus regarding the existence of productivity gaps among countries and across regions, resulting in differential growth rates. McMillan and Rodrik (2011) document these productivity gaps and observe a growth-reducing type, sectoral labour reallocation occurring in Africa and Latin America.[42] For Asia, however, there was an increase of high-productivity employment prospects and growth enhancing structural change. Given such findings, it is worthwhile that we raise questions about the productivity enhancing effects of trade liberalisation. In particular, the theory is that increased competition following reduced trade barriers induces increased efficiency and forces inefficient firms out of the market, thereby increasing economy-wide productivity. Studies by Esclava et al. (2009) and Fernandez et al. (2007) report increased efficiency due to more competition, with excess labour being shed after firm adjustments and the exit of the least productive firms from the industry. This highlights the type of within sector labour reallocations that increases aggregate productivity.

The first step to understanding the relationship between trade and productivity, however, requires a more profound understanding of the sources of aggregate productivity, specifically, the contributions of structural and within productivity to economy-wide productivity levels. The data on economic growth focuses mainly on aggregate growth and does not adequately scrutinise the importance of labour reallocation or the contribution of the structural and within components towards overall productivity growth. McMillan and Rodrik (2011) investigate this by observing the pace and nature of structural change in developing economies over the period 1990 to 2005, citing this period as the

[42] Sectors are defined according to the ISIC Revision 3.1 description presented in Table A3.2 in Appendix 3.1

most recent period and one where globalisation exerted a significant impact on developing countries. This period also has a large sample of developing countries that does not suffer from the problem of missing observations, usually found in datasets on developing countries. The authors aim to demonstrate that there are large differences in patterns of structural change or labour reallocation across regions. Furthermore, they argue that these differential patterns account for the bulk of differential growth rates among regions.

To obtain these results, specifically, that Asia outperforms Africa and Latin America because the latter two countries experience growth reducing structural change, McMillan and Rodrik (2011) conduct a broad economy-wide study. To complete this study, the authors employ simple averages to calculate the change in economy-wide productivity for the 1990 – 2005 period, for a group of countries within five regions: Latin America, Sub-Saharan Africa, Asia, High-Income and the Middle East. They find that structural change played very little role in the High-Income region. This supports the theory that more developed economies exhibit smaller inter-sectoral productivity gaps, with inter-sectoral labour relocation having little consequences on aggregate productivity. They show that in both Latin America and Africa, however, growth reducing structural change accounts for most of the productivity differences between these two regions and Asia.

Historically, Asia, Latin America and Africa have displayed similar growth performances with an expectation that such trends would continue. However, the Asian countries have outshone Africa and Latin America in recent decades. Additionally, with Africa's relatively poor economic performance, the a priori expectation is that labour will have a strong incentive to move out of the traditional into more modern sectors. Since the 1980's Latin American and African countries have undergone significant reforms to improve their institutional environment. The findings of McMillan and Rodrik (2011) therefore present a puzzle which we seek to investigate further and form the basis of this study.

It is important that we scrutinise the contribution of inter-sectoral labour reallocation to aggregate productivity performance in these regions, given a priori belief of this component's relative importance in its contributions in developing economies as opposed to developed ones. If we find that labour is moving into, rather than out of the traditional sectors, the consequence is that this structural change component may be contributing little or even slowing down overall productivity growth. Furthermore, it is vital that we understand the role of within sector labour reallocation as much emphasis is usually placed on the inter-sectoral movement of labour. The within sector component is fundamental to economic development. It allows for the rise of new productive activities and technologies within sectors that allow resources to be used more efficiently, as well as a reallocation of labour from lower to higher productivity activities across firms, thereby raising overall productivity. Both components work in tandem with each other as structural changes are required for the diffusion of productivity gains to the rest of the economy and within changes help to propel the economy forward.

If our investigations support that of McMillan and Rodrik (2011) and we observe that structural change contributes negatively to overall productivity, or furthermore does not play a prominent role as initially expected, this may suggest that within sector productivity changes are just as important for developing regions. For policy, the implication is that countries will need to develop capabilities for more innovative activities to assist in this type of productivity change.

Empirically investigating the sources of aggregate productivity changes is data intensive requiring large numbers of observations across time and space. This is because reallocation is a slow moving variable and is therefore difficult to detect. Much of the literature on the components of economy-wide productivity focus on data rich countries such as members of the Organisation for Economic Cooperation for Development (OECD). We are therefore adding to the literature by covering both developed and developing regions. As we shall see, we differentiate our study from McMillan and Rodrik (2011) by disaggregating our data by time and country so that we could have a better appreciation of what is driving the results. Specifically, we decompose our data into 2-year sub-periods instead of taking 15-year averages to scrutinise the changing patterns of the structural and within components over narrower windows with the aim of identifying the possible factors influencing such patterns. We also analyse our data on a country and not only the regional level as reported by McMillan and Rodrik (2011). Regional aggregation assumes countries within each regional grouping experience identical productivity changes. Our country-level examination allows us to eliminate this assumption. Aggregated analyses may also hide crucial information about individual countries and dynamics occurring in the components of economy-wide productivity. From our investigations, we are able to identify a number of stylised facts existing in the data and adequately relate these observations to internal and external factors that may be driving such patterns.

The remainder of our study is organised as follows. In the following section we review the existing literature. In particular, we discuss the theoretical and empirical growth literature and the literature on the components of economy-wide productivity and growth. The section that follows describes the data utilised in this study. The subsequent section provides a thorough description of how we measure our variables. We then present some general trends in labour productivity and employment for our sample regions or country groupings.[43] This is followed by our results, where we identify some new stylised facts obtained via a thorough empirical review of the data. Finally, we conclude with a summary of our findings.

[43] We use region and country or regional grouping interchangeably thereafter.

3.2 Literature Review

3.2.1 Theoretical and Empirical Growth Literature

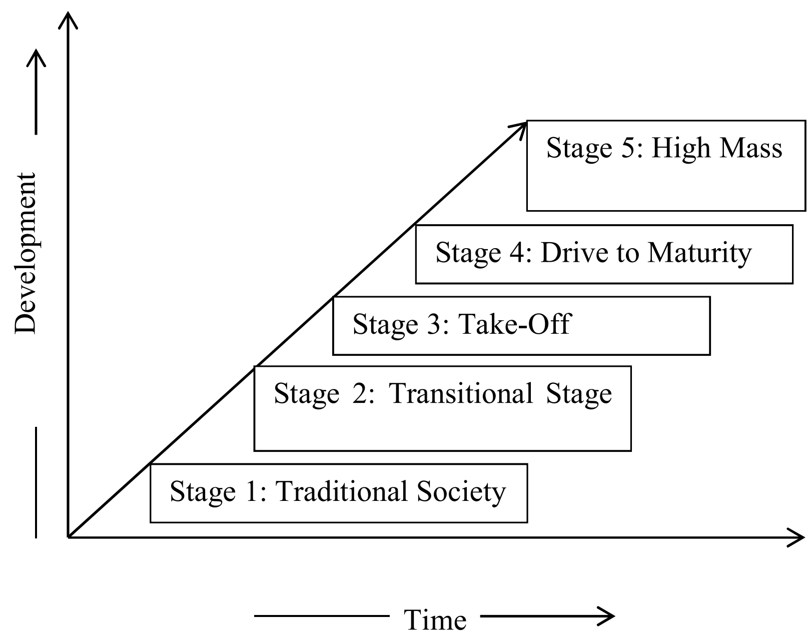
Development entails structural change. It involves economic, social and political adjustments. Countries that manage to move out of poverty through the development process are those that diversify from agriculture and other traditional products into more modern economic activities. The transfer of labour from low-productivity subsistence activities rife with informal employment to higher productivity-type activities possessing stronger linkages and greater knowledge spill overs is central to the development process.

For developing nations a movement towards a more diversified and complex production structure, which involves more technology and knowledge, allows these countries to realise a convergence of per capita income with developed ones. With this, productivity rises, incomes expand and structural heterogeneities are reduced. Structural heterogeneities occur when regions differ in terms of per capita incomes and there are sharp inequalities in income distribution both across regions and within countries. Structural transformation does not merely involve the closing of productivity and income gaps between developed and developing regions. Important to this process is the narrowing of the internal gaps within economies - especially where extreme disparities exist. Differences in the speed of this process differentiate the nations that thrive from the ones that lag behind economically.

A number of studies in the growth literature highlight how important it is for economies to make the transition across different stages of development in order to achieve rising Gross Domestic Products (GDP). A poor country is believed to ascend to wealth by engaging in a number of structural changes and by moving up from one stage of development to the next. Some models that highlight this process of development include Arthur Lewis' (1954), Rostow (1959) and Chenery (1979). Arthur Lewis' (1954) dual economy model emphasised productivity differentials between broad sectors of the economy (traditional and modern). This model sought to explain how developing economies move from a traditional agricultural base to a modern manufacturing-led economy. Surplus unproductive labour is attracted to the growing manufacturing sector which offers higher wages. Entrepreneurs earn profit by charging a price above the fixed wage. This profit is assumed to be reinvested in more capital and more workers are hired. The process continues until all surplus workers from the agricultural sector are employed and the economy becomes industrialised.

Similar to Lewis (1954), Rostow's (1959) also suggested that to achieve developed country status, a country must pass through different stages of development. Rostow's (1959) model on the stages of growth postulates that economic growth occurs in five basic stages of varying length. These five stages are the traditional society, the preconditions for take-off, the take-off, the drive to maturity and the age of high mass consumption. The stages progress from the traditional society, where a country is yet to begin developing to the stage of high mass consumption. In the latter, the economy's production shifts from heavy industry to the production of more consumer goods. We present an illustration of Rostow's Model of Development in Figure 3.1 below.

Figure 3.1 Rostow's Model of Development



Another study that describes the importance of changing the structure of economy to promote growth is that of Chenery (1979), who presents the structural change and pattern of development model, where in addition to the accumulation of capital, both physical and human, a set of interrelated changes in the economic structure of the country are required for the transition from a traditional economic system to a modern one. These structural changes involve all economic functions, including the transformation of production and changes in the composition of consumer demand, international trade and resource use, as well as changes in socioeconomic factors such as urbanization and the growth and distribution of a country's population. The above models describe the different stages of development a country will encounter and the structural changes within each of these stages that occur, in order to promote productivity improvements and a movement out of one developmental stage to the next. They also focus on aggregate growth occurring across the different stages.

More recently, empirical studies have attempted to quantify the factors contributing to aggregate productivity growth, to learn about the sources of productivity change. There have been contrasting views on what explains growth acceleration and deceleration within each of these stages discussed above. Jones and Olken (2008) investigate growth experiences within countries, together with the changes associated with growth transitions. They report that employment reallocation to more productive sectors lie behind accelerations and decelerations of growth in developing countries. Timmer and De Vries' (2009) apply a novel shift share method to measure sectors' contributions to productivity accelerations in Asia and Latin America. They find that accelerations are explained by productivity increases within sector, not by employment reallocation to more productive sectors.

With sustained economic growth being the pillar on which societies' welfare is built, it is only to be expected, that productivity growth takes the centrepiece of attention for policy makers. However, it is important that focus is not only limited to aggregate growth and how to increase such growth, but research must also understand where such growth has its roots. Growth-accounting types of applications, employed by us in this study, allow economy-wide productivity growth to be decomposed into its components – structural productivity growth and within productivity growth. We briefly describe the how the components promote economic growth in the following two sections.

3.2.2 Economic Growth and Structural Productivity Changes

Growth enhancing labour reallocation across sectors may arise as a result of labour pull factors such as individuals transferring their labour to more productive sectors with the aim of obtaining higher remuneration. It, however, may come about in the face of paradigm shifts in demand for output produced in different sectors. The labour pull approach to structural change describes how rising productivity of other sectors such as manufacturing attracts underemployed agricultural labour into the industrial sector (Lewis, 1954; Harris and Todaro, 1970). A worker that becomes unemployed, and replaces his old job with another that exists in a higher productivity sector, contributes positively towards the rate of economic growth in that economy. If, however, this worker moves towards a less productive sector, this type of labour reallocation contributes negatively to overall productivity and does not promote economic growth. Structural change towards higher productivity sectors implies that resources allocation was not always productivity enhancing or being employed inefficiently. This could be a result of factors such as institutional barriers to entry into the modern sectors, such as state ownership of plants.

Progression towards higher value-added activities has positive consequences on the level of development and quality of living. Maddison's Millenial Perspective of the World Economy (2001), suggests that the absence of such reallocation effects, affects growth in the long term. Europe, for centuries prior to the industrial revolution, suffered from the "Malthusian trap" Specifically, for that period, the region failed to realize increasing per capita GDP, as the majority of the working age population remained employed in the agricultural sector. Growth in population headcount almost immediately matched growth in output due to technological changes. Some countries get stuck at key stages of development. Some stop at low levels of development, some stop at higher levels and other continue to achieve economic growth. There is evidently a central role for growth enhancing structural change in achieving a faster progression through the stages of development. It is also important in our understanding of the factors that affect the way in which economies evolve and grow over time.

3.2.3 Economic Growth and Within Productivity Changes

Aggregate productivity depends not only on the efficiency with which firms allocate resources in the production process across sectors, but also how these factors are allocated within sectors. Baily et. al (1992) find that in the United

States, 50 percent of growth in the manufacturing sector can be attributed to not only entry and exit, but also the reallocation of factors across plants. Similarly, Barnet et. al (2014) find that the labour reallocation across firms explained 48 percent of the growth in labour productivity in the United Kingdom in the five years preceding 2007. The within effect also reflects the ability of firms within sectors to translate their innovative activities into productivity growth. A well-developed innovation system, human capital base and resources for research and development, are necessary foundations for this translation to occur smoothly.

Economic theory suggests that more productive firms should inherently be able to attract higher levels of labour and capital, in comparison to the more inefficient ones. With any movement of factors within sectors, resource misallocation may occur. Factors impeding efficient allocation of resources include, but are not limited to, labour and product market rigidities, market structure and financial rigidities. These give rise to variances in the rate of returns across sectors, deflating aggregate productivity growth. A study by Hopenhayn and Rogerson (1993) suggests that labour market rigidities such as firing taxes distort labour reallocation across organizations. Their attempt to quantify possible losses to aggregate labour productivity, suggest that such a tax could generate losses in Total Factor Productivity (TFP) of about 5 percent.

A reduction in resource misallocation within a sector increases efficiency and stimulates economic growth. Industry and firm-level data suggest that substantial input misallocation results in cross-country variations in the firm level productivity, and highlights the potential role that such effects might play in the generation of losses to aggregate productivity (Retuccia and Rogerson, 2013).

3.3 Data

Our analysis employs a panel of 38 countries utilizing data on employment, value added and labour productivity. Value added and productivity levels are both presented in 2000 PPP U.S million dollars. The data is disaggregated into 9 sectors.[44] The period covered by this study is 1990 to 2005.

The main dataset is derived from the Groningen Growth and Development Centre (GGDC). The Centre was founded in 1992 by a group of researchers working on comparative analysis of economic performance and difference in growth rates. The dataset employed is the 10-Sector Productivity Database by Marcel P. Timmer and Gaaitzen J. de Vries (2014). It provides a long-run internationally comparable dataset on sectoral productivity performance. It covers countries in the Asian, European and Latin American regions and the United States (US).

[44] See Table A3.2 in Appendix 3.1 for List of Sectors

The variables included in the dataset are reported annually. The variables are value added, output deflators and persons employed, reported in millions, for 10 sectors. The dataset consists of a series for 10 countries in Asia, and 9 countries in Latin America and Europe each, and the United States. Asian and Latin American data is based on Timmer and de Vries (2007) cross-country database on productivity and sectoral employment.[45] The data for US and Europe is based on an update of Bart van Ark (1996). The dataset provides data from 1950. However, the annual series of some countries start at a later date.

The GGDC dataset does not provide data for China and the 9 African countries included in this analysis. Given this, McMillan and Rodrik (2011) supplemented the 10-Sector Database with data for these countries. To compile this extended dataset, the authors closely followed Timmer and de Vries (2009) to ensure the provision of comparable value-added, employment and labour productivity data.

McMillan and Rodrik (2011) employ national accounts data from numerous national and international sources. Data from population censuses and labour and household surveys are used to derive estimates of sectoral employment. Sectoral employment as defined by Timmer and de Vries (2009) is maintained to be all persons employed in a particular sector, regardless of their formality status or whether they were self-employed or family-employed workers.

[45] See Table A3.1 in Appendix 3.1 for Sample Countries by Regional or Country Grouping

Specifically for China, several Chinese Statistical Yearbooks, published by the National Bureau of Statistics (NBS) were utilized. Data for Africa was obtained from labour force and household surveys. For this grouping, the sample includes Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa and Zambia which accounts for 47 percent of the Sub-Saharan population and close to two-thirds of the total Sub-Saharan GDP.

To account for employment in the informal sector, the authors used data (where available) from surveys of the informal sector. This involved the use of national accounts from different sources supplemented by the use of United Nations (UN) national accounts where national sources were inadequate. In the Asian regional classification, China is included in place of Japan. Instead McMillan and Rodrik (2011) include Japan as part of the High-Income country grouping in place of Germany. McMillan and Rodrik (2011) aggregate the 10 sectors into 9 main sectors according to the second revision of the International Standard Industrial Classification (ISIC, Rev 2). We employ the extended dataset compiled by McMillan and Rodrik (2011).

3.4 Variables Measurement

3.4.1 Measuring Labour Productivity

The Organisation of Economic Co-operation (OECD, 2001) defines productivity as the ratio of a volume measure of output (such as gross value-added or gross domestic product) to a measure of input used (such as total employment or the total number of hours worked). That is:

$$\text{Labour Productivity} = \text{Volume measure of output/measure of input use} \qquad (3.1)$$

Labour productivity measures the effectiveness with which an economy utilizes its inputs in the production of goods and services. Measures of productivity are important in assessing efficiency, competitiveness and potential economic growth rates. Among other measures of productivity, for example, capital or multifactor productivity, of particular importance is labour productivity, both for the statistical and economic analysis of any country. Labour productivity in particular is a "revealing indicator" of a number of economic indicators. It provides a dynamic measure not only of economic growth, but also of the level of competitiveness and standards of living within an economy. It is the measure of labour productivity that assists in the provision of an explanation of the primary economic building blocks for economic growth and social development.

3.4.1.1 Volume Measure of Output

The goods and services produced by the workforce are given by the volume measure of output. It is either measured by the gross domestic product or the gross value added.[46] Both measures can be utilized but there tends to be a strong correlation between the two and value added is usually preferred because of the exclusion of taxes. In our calculation of labour productivity in this chapter, we utilize value added as our volume measure of output.

3.4.1.2 Measure of Input

This input measure embodies the time and skill, as well as the effect of the scale of the labour force. As the denominator of the labour productivity ratio, this is an important element, as it influences the measure of labour productivity. Total amount of hours worked by all employed individuals or the total employment can be used to measure labour input.

The different input measures each have their advantages and disadvantages. Total number of workers is generally accepted as an imperfect but acceptable measure. The imperfection arises due to the fact that obtaining a simple headcount of persons employed can mask any changes in average hours worked as a result of differences in employment structure such as full or part-time work, overtime, and shift working regimes. Conversely, the quality of estimates of hours worked is not always transparent. Specifically, statistical agencies and surveys such as household surveys vary in the quality of their estimates and international comparability of hours worked making the measure

[46] Conceptually, they are the same although GDP is usually measured by the expenditure method. (GDP at market prices = Gross value added at market prices plus taxes less subsidies on products).

challenging to use in the calculation of labour productivity. Additionally, labour quality is an important and heterogeneous input in the production process. Failure to account for diversity within the labour force can result in an overestimation of productivity. For the purpose of this chapter, we employ the measure utilized by Mc Millan and Rodrik (2011), specifically total number of persons employed, to ensure comparability of our results.

3.4.2 Measuring Economy-Wide Labour Productivity

Shift-share analysis is usually used to describe differences in employment growth across sectors and in the analysis of nationwide trends. We use this analysis to examine changes in labour productivity levels across different regions.

Productivity growth measures constitute core indicators in the analysis of economic growth. Economy-wide productivity can be decomposed into the following components:

$$\Delta Y_t = \sum_{i=n} \theta_{i,t-k}\, \Delta y_{i,t} + \sum_{i=n} y_{i,t}\, \Delta\theta_{i,t} \qquad (3.2)$$

Where Y_t and $y_{i,t}$ refer to economy-wide and sectoral labour productivity levels respectively, and $\theta_{i,t}$ is the share of employment in sector i. The Δ

denotes the change in productivity or employment shares between time t-k and t.

The first term in equation (3.2) is the weighted sum of productivity growth within individual sectors, where the weights are the employment share of each sector at the beginning of the time period. It is called the "within" component of productivity growth. The second term is the inner product of productivity levels (at the end of the time period) with the change in employment shares across sectors. This is called the "structural change" term. When changes in employment shares are positively correlated with productivity levels, this term will be positive and structural change will increase economy-wide productivity.

The decomposition highlights the importance of analysing how labour productivities differ across countries. If an industry's productivity grows, but its share of employment shrinks rather than expands, it can have ambiguous effects on overall growth. It is important to consider what happens to displaced workers. This is especially important in developing economies, where the possibility that such workers end up in lower productivity activities exists. Studies engaging in partial analysis of industry or plant productivity mask the possibility that negative productivity growth may be occurring when there are large differences in labour productivities across economic activities. Important to note is that unemployment, the least productive status is not included in the calculation. If included, any productivity reducing structural change would be magnified.

3.5 Descriptive Statistics

3.5.1 General Trends in Employment and Labour Productivity

To understand the nature of employment and economy-wide labour productivity, we analyse changes in their levels across different regions over the period 1990 to 2005. We begin by considering average annual employment and labour productivity levels across our sample countries in Table 3.1 below across our 1990 to 2005 sample period. Our statistics indicate the region with the highest average annual employment level for the study period is Asia (1.3 billion). This is specifically owing to an average annual employment level of 715 million in China. For the same period, 1990 to 2005, labour productivity levels are highest in the High- Income region. The largest contributor to labour productivity levels in this region is the United States (US$60bn). Although Mauritius in Africa has the lowest average annual employment level across all sample countries (0.5 million), the country with the lowest average annual productivity over 1990 to 2005, is Malawi (US$1.4bn).

Table 3.1 Average Annual Employment and Labour Productivity Levels by Country: 1990-2005

Country	Abbr.	Employment Level (millions)	Labour Prod. Level (US$m)	Country	Abbr.	Employment Level (millions)	Labour Prod. Level (US$m)
	AFRICA				**ASIA**		
Ethiopia	ETH	27	1,858	China	CHN	715	5,583
Ghana	GHA	7	2,890	Hong Kong	HKG	3	51,950
Kenya	KEN	12	3,860	Indonesia	IDN	82	9,457
Mauritius	MUS	0.5	28,384	India	IND	362	5,308
Malawi	MWI	4	1,410	South Korea	KOR	20	25,803
Nigeria	NGA	40	3,680	Malaysia	MYS	8	25,492
Senegal	SEN	3	4,215	Philippines	PHL	28	8,936
South Africa	ZAF	9	32,553	Singapore	SGP	2	51,721
Zambia	ZMB	3	2,484	Thailand	THA	31	11,867
				Taiwan	TWN	9	36,284
	Total	106	81,335			1,261	232,401
Country	**Abbr.**	**Employment Level (millions)**	**Labour Prod. Level (US$m)**	**Country**	**Abbr.**	**Employment Level (millions)**	**Labour Prod. Level (US$m)**
	HIGH INCOME				**LATIN AMERICA**		
Denmark	DNK	3	41,018	Argentina	ARG	13	28,100
Spain	ESP	15	46,236	Bolivia	BOL	3	6,679
France	FRA	24	51,979	Brazil	BRA	63	12,305
Italy	ITA	23	50,373	Chile	CHL	5	25,474
Japan	JPN	66	43,097	Columbia	COL	14	14,256
Netherlands	NLD	8	47,210	Costa Rica	CRI	1	18,939
Sweden	SWE	4	41,593	Mexico	MEX	35	20,937
United Kingdom	UKM	27	41,979	Peru	PER	8	11,115
United States	USA	140	60,524	Venezuela	VEN	8	20,739
	Total	310	424,008			150	158,542
Country	**Abbr.**	**Employment Level (millions)**	**Labour Prod. Level (US$m)**				
	MIDDLE EAST						
Turkey	TUR	20	18,730				
	Total	20	18,730				

Note: Abbr. = Abbreviation

In Tables 3.2 and 3.3, we present average growth rates for both sectoral employment and labour productivity respectively by region or country grouping for 1990 to 2005. We observe significant variations in the growth rates of these two variables on a regional group level, suggestive of the fact that the country groupings are responding differently to diverse internal and external factors. Tables A3.3 and A3.4 in the Appendix 3.1, report on growth in employment and labour productivity respectively at the country level.

Table 3.2 reports growth in sectoral employment by country grouping. We obtain this by taking the employment growth across the five country groupings in our sample from 1990 to 2005. Table 3.2 indicates that the African grouping has the largest growth (44 percent) in its labour force over the period 1990 to 2005. This means that for this period, economy-wide employment growth is greater than the other regions. While the other country groupings experience declining growth in their agricultural sectors, for Africa, agricultural employment grew by 26 percent between 1990 and 2005. The High-Income grouping's lowest percentage growth in employment levels is in mining. For this same grouping, there are declines in employment growth rates of all primary sectors.

Table 3.2 Percentage Change in Sectoral Employment by Country Grouping: 1990 - 2005

REGION/ COUNTRY GROUPING	SECTOR*									
	AGR	MIN	MAN	PU	CON	WRT	TSC	FIRE	CSPSGS	ECON.-WIDE**
	%									
LAC	-1.8	8.0	15.9	110.0	41.7	101.2	71.8	142.6	31.9	35.5
HI	-28.8	-33.2	-17.7	-15.1	13.8%	16.0	12.9	45.8	23.7	11.6
ASIA	-17.1	-11.5	22.1	23.6	67.3	64.3	64.6	148.2	58.6	30.3
AFRICA	26.1	61.3	107.7	34.3	313.1	112.8	60.9	136.9	58.3	43.9
MIDDLE EAST	-40.7	-43.3	52.2	184.6	24.0	101.3	31.6	108.9	22.9	8.2

Econ.-Wide = Economy-Wide
LAC = Latin America HI = High-Income
Source: Author's own calculations
*See Table A3.2 in Appendix 3.1 for Sector Abbreviation Meaning
** Total Sectoral Productivity = Sum Each Sector's Value Added/ Sum Each Sector's Employment

Table 3.3 presents regional growth in labour productivity from 1990 to 2005. We find that Asia has the highest average growth rate in labour productivity. Although the rate of increase of its labour force was 6 percent less than that of Latin America as demonstrated in Table 3.2, its labour productivity grew by more than three times that of the Latin American region. Similarly, Asian employment grew by 14 percent less than that of Africa over the same period. The labour productivity of the Asian grouping, however, increases by more than 5 times that of the African region.

Table 3.3 Percentage Change in Sectoral Labour Productivity by Country Grouping: 1990–2005

REGION/ COUNTRY GROUPING	AGR	MIN	MAN	PU	CON	WRT	TSC	FIRE	CSPSGS	ECON.- WIDE**
	SECTOR*									
	%									
LAC	64.3	125.4	49.4	59.1	122.0	-7.0	37.9	-10.0	15.1	24.2
HI	63.5	61.2	64.0	64.7	-1.8	30.9	57.5	7.3	3.0	24.7
ASIA	47.1	174.3	128.7	193.1	8.0	52.4	95.5	17.6	56.8	83.7
AFRICA	35.3	241.1	-9.4	651.5	71.4	21.8	127.8	35.1	7.9	16.0
MIDDLE EAST	110.3	89.5	25.1	-18.0	25.6	-11.3	91.0	-22.2	15.0	59.4

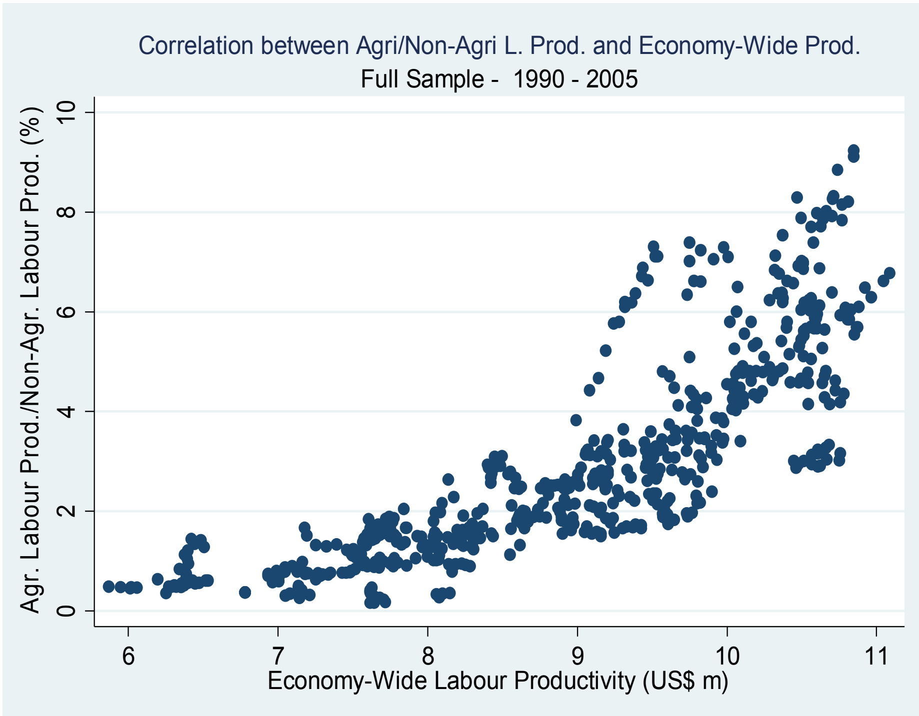
Econ.-Wide = Economy-Wide
LAC = Latin America
HI = High-Income
Source: Author's own calculations
*See Table A3.2 in Appendix3.1 for Sector Abbreviation Meaning
** Total Sectoral Productivity = Sum Each Sector's Value Added/ Sum Each Sector's Employment

Our analysis of Table A3.3 in Appendix 3.1, which presents growth in sectoral employment at the country level for 1990 to 2005, reveals that every country with the exception of Sweden has an increase in its labour force over the 15 year period. Costa Rica has the highest growth rate in aggregate or economy-wide employment (72 percent). Table A3.4 in Appendix 3.1 shows that China has the largest average growth in economy-wide productivity over 1990 – 2005.

Traditional dual economy models highlight the presence of labour productivity gaps between the traditional and modern sectors of an economy. As these gaps are reduced, overall economy-wide productivity and growth increases. Productivity in agriculture is generally the lowest in Low-Income countries. This sector has high employment levels in these countries, but in most cases, contributes the least towards economic development through overall productivity growth. Figure 3.2 plots the relative productivity (agriculture to non-agriculture productivity) against economy–wide labour productivity for the entire dataset for the period 1990-2005.

In Figure 3.2, the observations for the less developed countries are clustered in the lower left corner of diagram. In this section of the diagram, productivity is generally low, that is, at both the sectoral and the economy-wide level. Here agriculture still plays a major role in the economy and the non-agricultural activities relative to agricultural activities are low. With reference to growth theories, this exemplifies the beginning of the development process. The Higher-Income countries in the sample, specifically the more industrialised economies, lie to the right of the chart, as they engage in less agricultural production and possess higher productivity levels in non-agricultural activities. Together, these two factors result in higher levels of economy-wide productivity than that of developing nations.

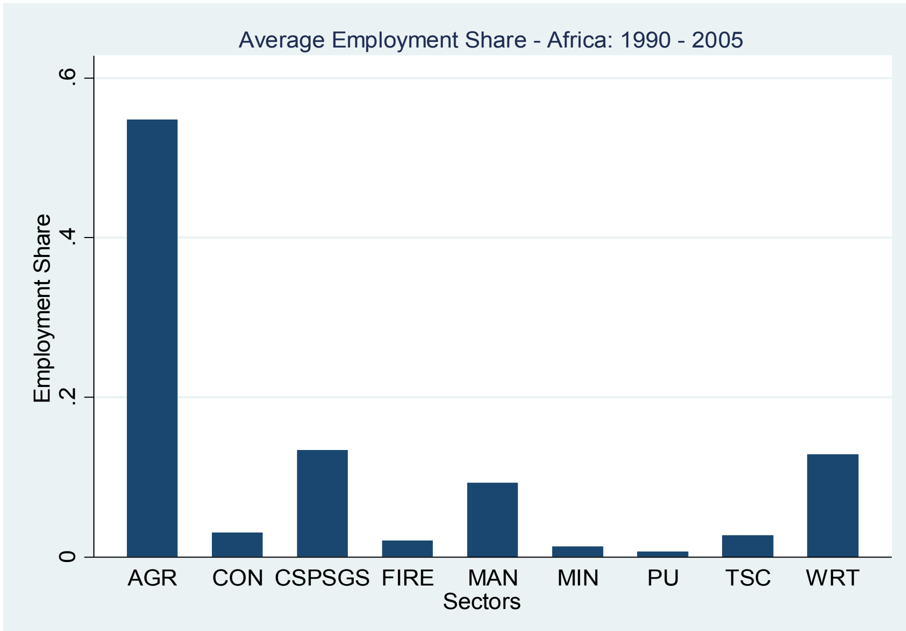
Figure 3.2 Correlation between Agricultural/Non-Agricultural Labour Productivity and Economy-Wide Productivity for the entire sample: 1990 - 2005



Figures 3.3 and 3.4 both provide graphical representations of the data and aids in identifying the presence of gaps in productivity among sectors within an economy. We utilise the African region to highlight trends in sectoral employment share and labour productivity respectively over the 1990 to 2005 period of study. The African region or country grouping is of particular interest to us because as previously highlighted by Tables 3.2 and 3.3, although this region has the largest growth in economy-wide employment, it has the smallest growth in economy-wide productivity levels. These diagrams illustrate the occurring mismatch between productivity and employment shares among sectors exposed to the same economic conditions.

Specifically, Figures 3.3 and 3.4 together demonstrate that for Africa, a Low-Income region possessing a large agricultural sector, substantial disparities exist among each sector's contributions towards total productivity and the share of employment each sector accounts for. Sectors such as agriculture and wholesale, retail and trade possess on average, a large proportion of the economy's labour force (Figure 3.3), but their levels of labour productivity are lower than sectors such as finance, insurance and real estate, mining and public utilities (Figure 3.4), which account for relatively small shares of employment. For sectors to contribute to economy-wide productivity growth, rising sectoral employment shares must be accompanied by equal or larger increases in their relevant shares of labour productivities. Studies such as those focusing on Dutch Disease theories suggest that this mismatch occurs because the higher-productivity sectors possess limited capacity in terms of their ability to absorb labour. As such, a very small proportion of the working population is employed by these high productivity sectors. There may also be a mismatch of skills, especially if a large percentage of the labour force does not possess the required skills to perform the work of the higher-productivity sectors. These lower skilled workers then become employed in the lower productivity sectors and as such, do not aid in increasing economy-wide productivity.

Figure 3.3 Average Employment Share for Africa: 1990-2005



See Table A3.2 in Appendix3.1 for Sector Abbreviation Meaning

Figure 3.4 Average Labour Productivity for Africa: 1990 - 2005

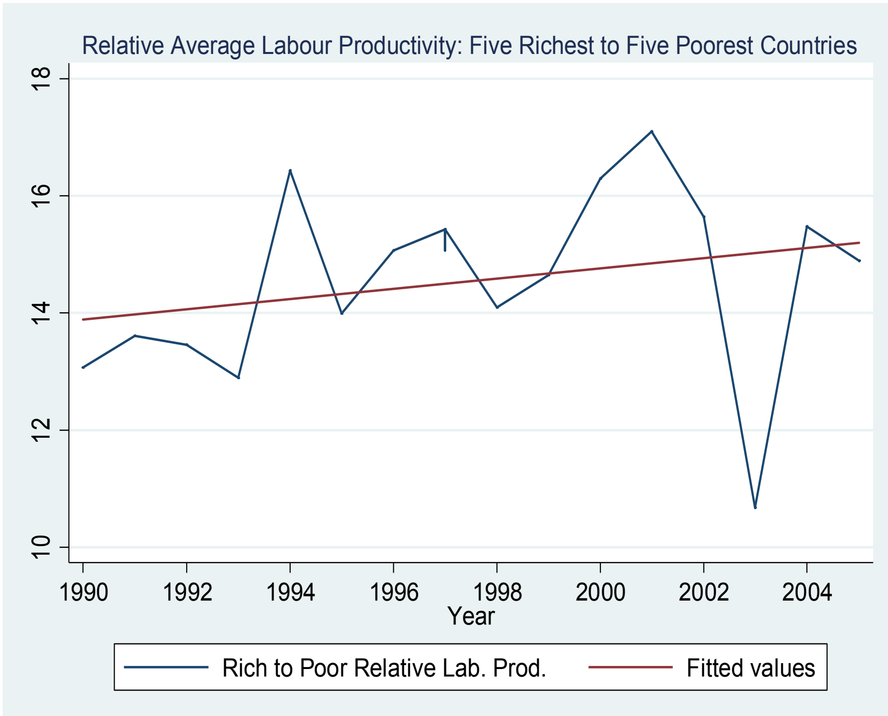
See Table A3.2 in Appendix3.1 for Sector Abbreviation Meaning

3.5.2 Disparity in Productivity

Differences in productivity levels and growth across countries provide some indication of the differences occurring among countries' in terms of their production capacities and technological capabilities. Development studies have suggested large disparities in productivity across countries. A movement from traditional to modern sectors can occur rapidly for some while others lag behind because local and global of factors. We therefore attempt to identify this disparity by observing labour productivity levels across countries and regions. As previously described in sub-section 3.4 on variable measurement, we calculate labour productivity using value-added per worker. In Figure 3.5 we focus on the five richest and five poorest countries in our sample for our period of study 1990 – 2005. This classification was based on per capita GDP for 2005.[47] To produce Figure 3.5, we compute the relative average labour productivity between these two subsamples over the study period. At its peak, specifically 2001, labour productivity in the richest five countries was on average 17 times that of the poorest five countries in the sample and at its minimum, these rich countries are 10 times more productive than our sample's poorest countries. Additionally, not only are the productivity differences between these two subgroups substantial, but the upward trend line indicates that the disparity in productivity increases over the sample period.

[47] See Table A3.5 in Appendix 3.1 for a list of the five richest and five poorest countries in our sample.

Figure 3.5 Relative Average Labour Productivity of Five Richest to Five Poorest Countries*



*

Note: See Table A3.5 in Appendix 3.1 for a list of the five richest and five poorest countries in our sample.

The gap in productivity fluctuates over time and declines significantly in 2003. Productivity tends to increase over time as new technology and better skills allow nations to become more efficient. Productivity gaps are therefore expected to become narrower over time as less developed economies play catch up to the industrialised one. The upward trend observed in Figure 3.5 suggests a smaller reduction or even growth in productivity gaps between these two extreme groups of countries over time. The poorer countries continue appear to lag behind via an apparent sluggish rate of progression of their productivity levels.

In Table 3.4 below, we report labour productivity statistics relative to the United States. Given that the United States is a rich, stable and diverse country, it serves as a benchmark and reference country for comparative purposes. Measuring these statistics relative to the US provides an indication of the gap that must be reduced to bring any region closer to the US in the terms of labour productivity.

For the purpose of comparison, we focus on the entire distribution of labour productivity across all countries in the sample. Table 3.4 reports the average relative value added per worker or labour productivity of countries at each quartile of the distribution of per capita GDP. This is done for selected years. The first quartile, Q1, includes the 25 percent of countries at the bottom of the distribution of per capita GDP. Similarly, Q4 includes the 25 percent of countries at the top of the distribution of GDP per head. The last two rows report the ratio of the Q4 to Q1 and the ratio of Q3 to Q2 respectively.

Table 3.4 Relative Labour Productivity by Quartile: Various Years**

	Relative Labour Productivity*			
	1990	**1995**	**2000**	**2005**
Quartile**	**Percent (%)**			
Q1	15.22	14.20	15.15	15.34
Q2	17.53	19.45	18.00	17.83
Q3	42.92	47.52	46.48	45.47
Q4	71.21	76.75	75.92	72.94
Q4/Q1	4.68	5.41	5.01	4.75
Q3/Q2	2.45	2.44	2.58	2.55

* Labour productivity of each quartile calculated relative to the United States
** Each quartile contains 25% of total observations. Observations are ordered ranging from countries with lowest to highest per capita GDP values, with Q1 containing the lowest values and Q4 containing the highest values.
Source: Author's own calculations

In 1990, the poorest 25 percent of countries had an average labour productivity of around 15 percent of that of the United States, while the richest 25 percent had an average productivity of approximately 71 percent of that of the United States. This yields a ratio of 5 (Q4/Q1) between the richest 25 percent to the poorest 25 percent of countries. This means that in 1990, the 25 percent of our sample countries possessing the highest GDP per capita, is approximately 5 times more productive than the poorest 25 percent of our sample countries. For the same year, the ratio of productivity for countries in Q3 to those in Q2 is approximately 2.5. This means that these two latter quartiles possess a smaller gap in productivity than that existing between Q1 and Q4. Over time, the relative productivities of the second richest quartile, specifically those in Q3, realised the most improvement in labour productivity relative to the US. Our data suggest that by 2005, for the countries in our first, second and fourth quartiles, there is little change in their labour productivities relative to the US. These patterns tell us that the rate of change in productivity levels vary across countries at different levels of the development process.

We expect to find the more industrialised economies in Q4. Given that these economies are at the final stages of the development process, we do not expect significant productivity growth relative to the US as demonstrated by the minimal change between 1990 and 2005. Other economies such as the emerging regions are experiencing significant economic growth evidenced by narrowing productivity gaps with industrialised nations. We expect to find such countries in Q3. The issue, however, is with the poorest countries in Q1 and Q2. These countries not only possess the lowest per capita GDP in the sample but they also show little improvement in their productivity growth relative to the US. This indicates little reduction or even a potential widening of the gap in productivity between these poor countries and developed nations like the United States. The calculated ratio for Q4/Q1 is always larger than the ratio estimated for Q3/Q4. This simply tells us that productivity gaps are larger among countries with greater variations in their per capita GDP.

It is worth noting that over time, some of the countries changed quartiles in both directions, changing the country-composition of the respective quartile. This means that some countries moved into a lower quartile because of a fall in their per capita GDP and others moved into higher quartiles because of a rise in per capita GDP. This is especially the case for countries that started in quartiles Q2 and Q3 in 1990. These two groups of countries were more likely to move between quartiles than countries in Q1 and Q4. In particular, countries in Q2 tend to move into Q3 and vice versa. This also highlights the smaller gap in productivity existing between Q2 and Q3 as mentioned above. Furthermore, the countries that started in Q4 in 1990 did not move quartiles and a small percentage of countries from Q1 moved into Q2. This is also an indication of the larger productivity gap that exists between these country groups.

We further analyse the behaviour of labour productivity on a regional basis. By taking the average labour productivity for each country grouping relative to the US, we identify the existence of variances in productivity levels across regions. We report our findings in Table 3.5 below. As expected, the relative labour productivities of the High-Income region to the United States ranges from approximately 63 percent to 67 percent for the reported years. In 1990, the average labour productivity for Asia is 32 percent of that in the United States. For Latin America and Africa, this percentage is 28 and 15 percent respectively for 1990. By 2005, Asia position relative to the US improved more than any other country grouping. With the exception of Asia, by 2005 productivity gaps between all country groupings relative to the United States have decreased over time.

Table 3.5 Relative Labour Productivity by Country Grouping: Various Years

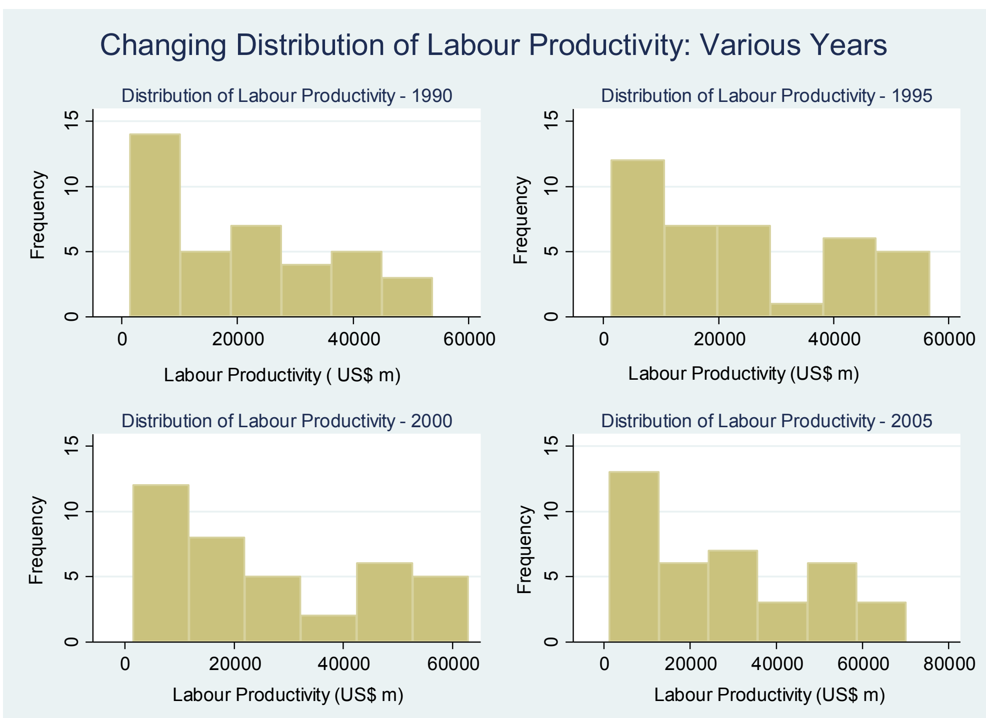
	Relative Labour Productivity*			
	1990	**1995**	**2000**	**2005**
Country Grouping	**Percent (%)**			
High Income**	67.10	69.6	66.94	63.04
Asia	31.93	38.93	40.18	41.83
Latin America	27.65	28.52	23.44	25.25
Africa	15.44	14.19	15.17	14.83

* Labour productivity calculated relative to the United States
**United States excluded from High Income group for these calculations
Source: Author's own calculations

The Latin American Economic Outlook (2014) reported some empirical evidence on the disparity in productivities across regions relative to the US which supports the results presented above. Specifically, a comparison of the productivity dynamics of Asian countries with those of Latin America and the Caribbean showed divergent progress in the two latter regions for the period 1980 to 2011. Generally for Asia, the gap narrowed.

Changes in the dispersion of relative labour productivities over time suggest movement of individual countries in the distribution of productivity across countries over time. We illustrate those changes through the use of histograms, which demonstrate the distribution of labour productivities across our entire sample at different points in time in Figure 3.6. In Figure 3.6, the most noticeable change in the shape of the distribution from 1990 to 2005 is the movement of the mass from the centre of the distribution to the left and right. This is reflective of what is known as "twin peaks" in the literature on per worker productivity (Beaudry et. al, 2002). Specifically, the distribution polarizes into twin peaks of rich and poor and thereby demonstrates the increasing dispersion of relative productivities across countries and time. It is important that we understand the factors contributing to this phenomenon. Our results presented in the following section aims to provide an explanation for these observed gaps in productivity.

Figure 3.6 Changing Distribution of Labour Productivity for the entire sample: Various Years



The array of statistics described above reveal the presence of productivity gaps across regions and countries alike. The presence of this variance in productivity is observed to be increasing over time. These observations inherently imply differences in policy and institutional factors occurring at the country and regional levels. They also highlight the need to understand why such differences occur so that appropriate policy measures can be designed and implemented.

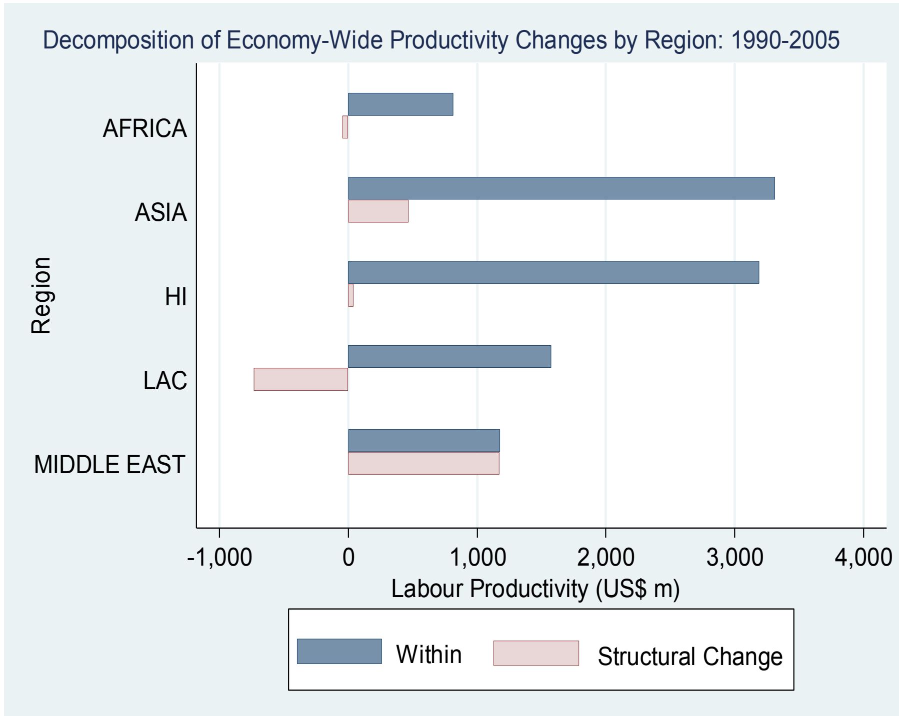
3.6 Results

3.6.1 Decomposing Productivity Change

Empirical evidence indicates that there exists a disparity in growth among developing regions. In particular, the Asian region is realising productivity growth and structural change that follows theories of development, that is, a movement from agriculture to manufacturing to services, and is playing catch-up with industrialised economies. However, this is not the case for other developing regions such as Africa and Latin America, creating an interesting puzzle. McMillan and Rodrik (2011) investigate this puzzle by exploring the components of economy-wide wide productivity across regions over the period 1990 to 2005. They find that on average, Africa and Latin America are experiencing lower economic growth rates because employment is moving back into traditional sectors, thereby contradicting development theories. We start our analysis by subjecting this finding to further scrutiny. Specifically, we explore whether the change in the within and structural components over time are such that, they contribute positively or negatively to economy-wide productivity growth. We illustrate our results for this first step in Figure 3.7.

We find that for our study period, the structural change components for both the African region and Latin American region or country groupings, make negative contributions to overall growth; albeit a very small effect in the case of Africa. That is, on average, this component does not contribute to increases in economy-wide labour productivity. Specifically, the sectoral labour reallocation taking place within these two regions occurs in the "wrong" direction, or labour reallocates from high, in favour of low productivity sectors. Negative structural change implies that the changes in employment shares are negatively correlated with productivity levels. The within component, however, contributes positively on average to overall productivity growth for the countries in our African and Latin American groupings. The other regions in our sample, specifically the Asian and High-Income groupings, experience average overall positive changes in economy-wide productivity resulting from both within sector improvements and positive labour reallocation or structural change.

Figure 3.7 Decomposition of Economy-Wide Productivity Changes by Country Grouping* : 1990 - 2005



*HI – High-Income LAC - Latin America

These results suggest that McMillan and Rodrik's (2011) findings hold. More recent data on our sample regions indicate that in 2012, average per capita GDP ranged from US$2,670 to US$43,970. Table 3.6 presents per capita GDP by country grouping for the year 2012. We observe from this table that Asia is placed second to our High-Income grouping, with average per capita GDP of just over US$13,000. The unanticipated scale of negative labour reallocation displayed, especially by Latin America is surprising when compared to Africa, given that by 2012, Latin America's GDP per capita was almost four times that of the African region. These figures support our findings on Asia's superior performance presented in Figure 3.7. Asia post 2005 continues to outperform

Africa and Latin America, although all three regions are comprised of developing economies.

Table 3.6 Per Capita GDP by Region

Region	Average Per Capita GDP US$ (2012)*
High Income	43,970
Asia	13,275
Middle East	10,653
Latin America	9,713
Africa	2,670

* Average of sample countries used in this study
Source: United Nations Statistics

It is also important to highlight the observed dominant nature of the within component of economy-wide labour productivity growth. Figure 3.7 indicates that this component contributes positively to economy-wide productivity growth across all our country groupings. In addition, the within effect comprises the majority contributor to economy-wide labour productivity, significantly outweighing the structural change component in terms of its average contributions across the 1990-2005 period.

Our findings indicate gaps in productivity among regions, reflected in their respective levels of productivity growth. The observed varying patterns of labour reallocation impact economy-wide labour productivity differently resulting in very diverse growth patterns among countries. Reallocation of resources from high to low productivity sectors may hinder the economic progress of countries, causing them to lag behind those that engage in productivity enhancing reallocation.

The confirmation of the findings of Rodrik and McMillan (2011) is based on the use of highly aggregated data and on examining average changes over a long time period. We explore next the robustness of these base results through the analysis of more disaggregated data. To conduct this exercise, we investigate the behaviour of the components over shorter time periods. We also engage in some country-level analyses.

For our first robustness check, we decompose our data into sub-periods instead of simply taking simple averages across a 15-year time span. Our base results, as presented in the same way by McMillan and Rodrik (2011), imply that the outcomes in economy-wide productivity are similar across time and country within each region. This motivates us to disaggregate the data in order to more convincingly provide an explanation for the differing patterns as observed in Figure 3.7. We commence by taking averages over 2- and 5-year sub-periods. A comparison of the 2- and 5-year sub-periods produces similar results. Given this, we focus on the more disaggregated 2-year decomposition. A biennial analysis enables us to scrutinize the change in the components of economy-wide productivity over shorter time frames, allowing us to easily identify any outlier influences that may exist. Our method enables us to determine whether the patterns identified by the original authors are robust to monitoring average changes over shorter time periods. Our second test for robustness involves the use of country level studies. These checks help us to determine whether the results obtained employing the methodology of McMillan and Rodrik (2011) are consistent across countries within each region or country grouping and across time.

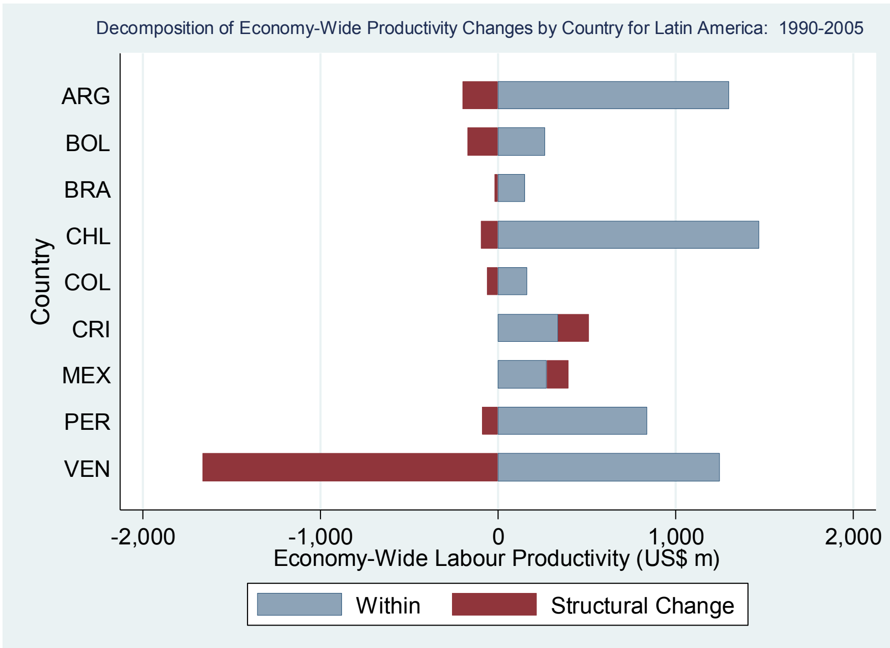
Conducting analyses on our newly decomposed data reveal some interesting findings which we present below in a number of stylised facts. We find that simply taking long averages obscures what is occurring at the micro level, specifically within the individual regions. The estimated 15-year changes in the components of economy-wide productivity across regions as conducted by McMillan and Rodrik (2011) results in conclusions which mask the heterogeneity in productivity changes that exists across and time and across region. Our analysis specifically reveals that the results the patterns of structural change observed across the different regions are country and time specific. Our robustness checks allows us to obtain a number of stylised facts which we present in the following sections.

3.6.2 Stylized Fact 1: Patterns of Structural Changes are Country-Specific and Not a Regional Phenomenon

McMillan and Rodrik (2011) find that the Latin American and African regions or groupings suffered from growth reducing structural change, whereas the Asian and High-Income groupings experienced growth enhancing structural change. Although this does occur on average, we find that applying the productivity decomposition to less aggregate data, shows that there is important heterogeneity across individual countries within regions. Our country level results indicate that the patterns of negative structural change identified for the Latin American and African groupings are in fact driven by a few countries within these regions or groupings. Specifically, Venezuela for Latin America and Nigeria and Zambia for Africa, drive the observed negative structural changes in these regions. Figures 3.8 and 3.9 decompose economy-wide productivity into its components for our Latin America and Africa groupings respectively.

In Figure 3.8, the level of negative structural change occurring in Venezuela far outweighs the structural change of all the other countries in the region, both individually and in total. In Africa, although we also observe labour reallocation that contributes negatively to economy-wide labour productivity Senegal and South Africa, the presence of such growth reducing structural change for these two nations is small relative to the contributions of Nigeria and Zambia (see Figure 3.9 for the African region or grouping). These illustrations serve to pinpoint an important source of productivity gaps across countries. They bring support to the fact that even within regions, where countries tend to be economically similar and subjected to the same type of policies, variance in productivity exists.

Figure 3.8 Decomposition of Economy-Wide Productivity Changes by Country for Latin America: 1990 – 2005



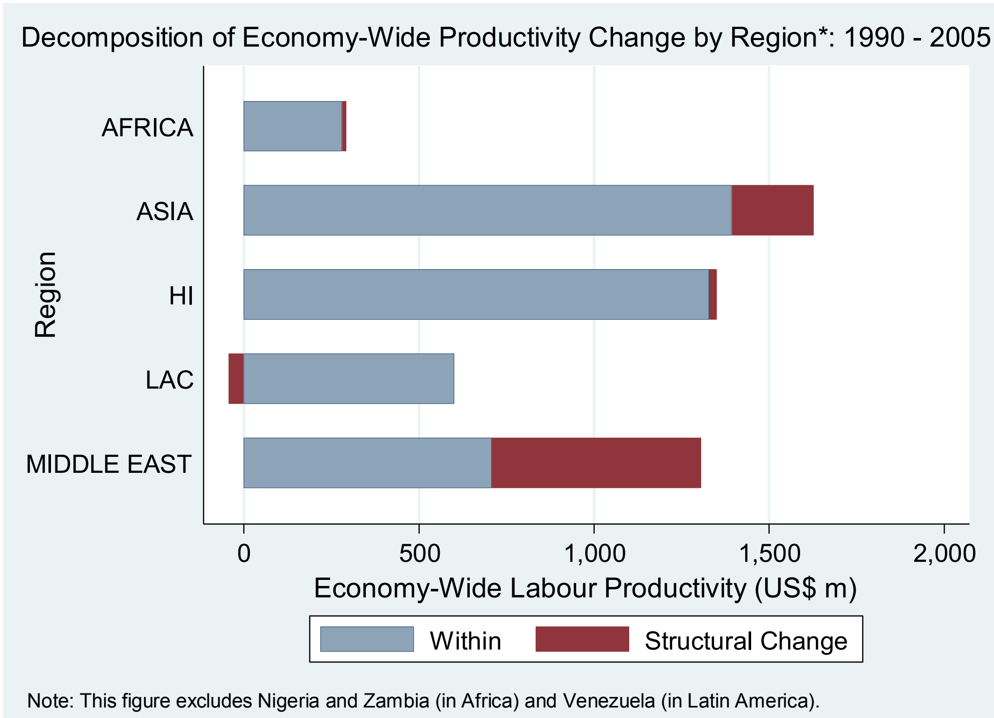
See Table A3.1 in Appendix 3.1 for the Meaning of Country Abbreviations

Figure 3.9 Decomposition of Economy-Wide Productivity Changes by Country for Africa: 1990 – 2005

See Table A3.1 in Appendix 3.1 for the Meaning of Country Abbreviations

Figure 3.10 below presents economy-wide productivity growth across regions. However, we now exclude the countries identified above as the drivers of the negative structural change in Africa and Latin America (Nigeria, Zambia and Venezuela). For Latin American, the negative structural change component was reduced significantly with the removal of Venezuela, but it does not completely disappear. Removing other contributors of growth reducing structural change within this region, results in a complete reversal of the structural change component from negative to positive contributions towards economy-wide labour productivity. The combined negative contributions of these three countries, however, are significantly less than that of Venezuela. A comparison of Figures 3.7 and 3.10 shows that removal of specific countries experiencing growth reducing structuring change, results in sectoral labour reallocation that increases average productivity in all regions.

Figure 3.10 Decomposition of Economy-Wide Productivity Changes by Region* excluding Nigeria and Zambia (in Africa) and Venezuela (in Latin America): 1990 – 2005



*HI = High Income LAC = Latin America

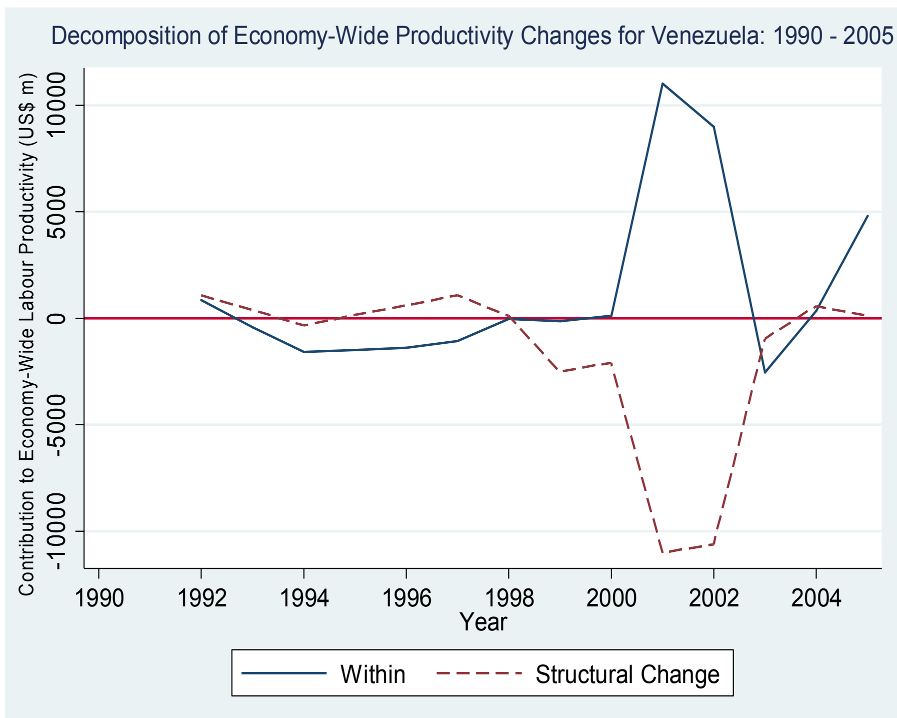
3.6.2.1 Individual Country Analyses

3.6.2.1.1 Latin America- Venezuela

For the 1990 to 2005 period on average, within Latin America, all the countries with the exception of Costa Rica and Mexico had growth reducing structural change (see Figure 3.8). The performance of Venezuela, however, indicates that this country is the main driver of the results for this region. For 1990 to 2005 Venezuela had an average overall negative structural change component. The size of this component was also more than five times that of

Argentina, the nation with the second highest level of negative structural change (see Figure 3.8). The illustration Figure 3.11, presents the decomposition of Venezuela's economy-wide productivity growth. A closer examination of the data reveals that for the period up till 1998, with the exception of 1994, Venezuela's structural change component was positive.

Figure 3.11 Decomposition of Economy-Wide Productivity Changes for Venezuela: 1990 - 2005



By 1999, however, this pattern changes considerably with the country experiencing an adjustment in its flow of labour in favour of lower productivity sectors. Venezuela recovered in 2004 when inter-sectoral labour reallocation reverted to contributing positively to economy-wide productivity.

Between 2000 and 2003, productivity changes in the Latin American countries were relatively constant with the exception of Venezuela, whose structural change component was large and negative. In Figures 3.12 and 3.13 we decompose Latin America's productivity growth into its components with and without Venezuela respectively, in order to illustrate the magnitude of the structural change component before and after we exclude Venezuela from the sample.

Figure 3.12 Decomposition of Economy-Wide Productivity Changes for Latin America With Venezuela: 1990-2005

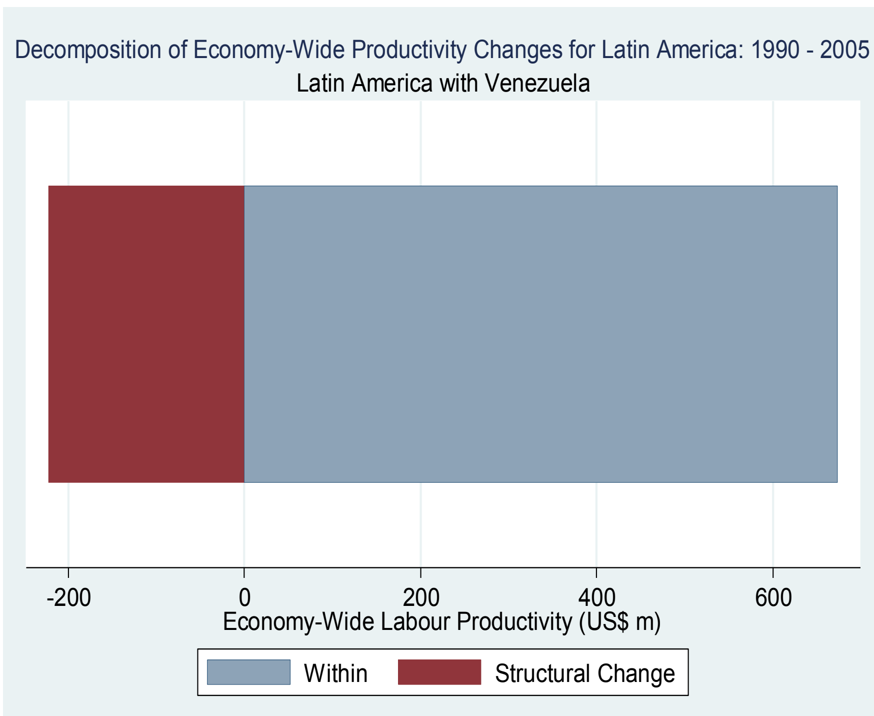
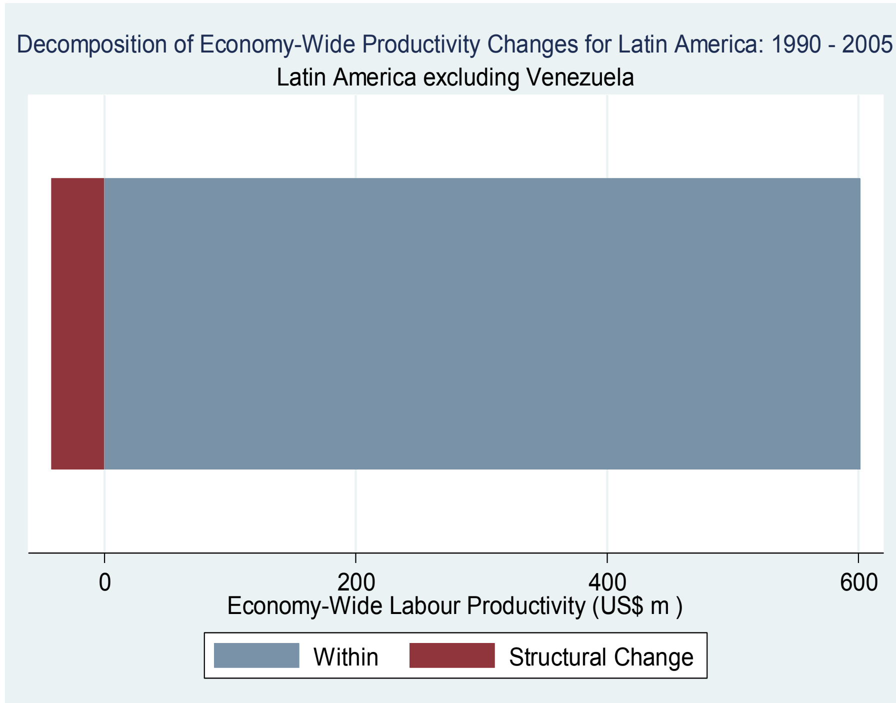


Figure 3.13 Decomposition of Economy-Wide Productivity Changes for Latin America Without Venezuela: 1990-2005



As discussed above, the residual negative structural change component observed in Figure 3.13 is the combination of the smaller cases of growth reducing structural change occurring over the 15-year period in some other Latin American countries. Our analysis suggests that labour is indeed reallocating from high- to low-productivity sectors. However, it is specific countries driving such results.

3.6.2.1.2 Venezuela – Changes in Sectoral Employment: Where Did the Labour Go?

Further analysis on changes in the sectoral share of employment, revealed that between 1999 and 2003 manufacturing, mining and construction suffered the greatest losses in terms of employment share. This employment reallocates towards the lower productivity and non-tradable sectors such as wholesale retail and trade and transport storage and communication. Between 1999 and 2003, these latter two sectors had employment share growth rates of 853 and 43 percent respectively. Prior to 1999, Venezuela experienced a 50 percent rate of growth in the share of mining employment between 1990 and 1998. In Figure 3.11, this period corresponds to a period of growth enhancing structural change. However, post 1998 to 2003, this sector realised a fall in its growth rate of 29 percent. The data thereby implies that this changing share of mining employment is one of the main contributors towards the pattern of growth reducing structural change occurring in Venezuela.

Changes in employment share must be positively correlated with productivity levels for the structural change term to be positive, and for economy-wide productivity as defined to increase. For Venezuela, although some sectors experience increasing shares of employment, this increase is not accompanied by rising labour productivities, and are by definition, growth reducing. With the exception of finance, insurance and real estate which displays a positive but weak correlation between labour productivity levels and change in employment shares, every other sector have negative relationships. This was especially the case for mining whose correlation coefficient between employment share and labour productivity is -0.81.

Much of our findings are supported by the economic and political history of the Venezuelan economy. To illustrate this, it is necessary to commence by describing the nature of the Venezuelan economy prior to 1999 or the period leading up to that of growth reducing structural change. Prior to 1999, the Venezuelan economy experienced significant political and social instability which led then President Carlos Andrés Pérez (1989 to 1993) to implement an International Monetary Fund (IMF) neo-liberal structural adjustment package.[48] His domestic economic programs in the early 1990s led to growing GDP contributions from oil and non-oil industries, as well as falling unemployment levels. A proportion of this growth, however, was attributable to a rise in world oil prices.

A 1999 rise to Presidency by Hugo led to new attempts at economic stimulation through the implementation of a civilian-military project "Plan Bolivar 2000", which included road building and housing construction as well as efforts to increase oil prices and revenues by reducing local extraction as well as lobbying other Organisation for Petroleum Exporting Countries (OPEC) countries to reduce production rates. Conflict continued resulting in a December 2002 strike by the national oil company Petróleos de Venezuela S.A. (PDVSA)[49], stopping oil production, worsening the level of oil revenues. The strike withered in February 2003 but had dislocated the Venezuelan economy. First trimester of 2003 realised a 25 percent decline in GDP with

[48] This package required privatisation, deregulation and the dismantling of social welfare programs and subsidies.
[49] In English Petróleos de Venezuela S.A. (PDVSA) translates to Petroleum of Venezuela, South America.

unemployment falling to 20.3 percent in March 2003 from 15 percent before the strike. Crude oil production was 5 percent less in 2003 than 2002 and the volume of refined oil products was 17 percent lower (Lopez, 2005). When the strike ended oil production increased to pre-strike levels by April 2003 and the regime fired 18,000 PDVSA employees, a figure comprising 40 percent of the company's workforce. By 2004 Chavez's mission for economic and social transformation together with sharp increases in global oil prices increased Venezuela's foreign exchange reserves with economic growth reaching double digits in 2004 and 9.3 percent for 2005.

The facts suggest that it was falling oil prices and production, together with rising unemployment and informal employment that account for our observations of negative structural change for the period 1999 to 2003.[50] In particular, as previously discussed we observe decline in the shares of mining and manufacturing employment in the data that coincides with this same period. For our dataset, the extraction of crude petroleum is included in the mining sector and the refining of crude petroleum in the manufacturing sector. Additionally, for the same 1999 to 2003 period we observe positive within sector productivity changes. Chavez led reform of the country's constitution help improved the economy standings and performance of some of its sectors allowing the economy to access larger reserves of foreign exchange.

[50] We investigated the rate of population growth taking place during 1999 to 2003 to determine whether increasing population could account for this increase in the share of unemployment in lower productivity sectors. However, Venezuela's population growth declined by 0.13 percent from 1.92 percent to 1.79 percent (1999 – 2003) (World Development Indicators, WDI, 2015).

3.6.2.1.3 Africa - Nigeria and Zambia

The exclusion of Nigeria and Zambia from the subsample of African countries results in positive contributions from both our components of economy-wide labour productivity. Figures 3.14 and 3.15 illustrate the shift in the structural change contribution to economy-wide labour productivity from negative to positive when we exclude both Nigeria and Zambia from the sample of African countries. Again our results highlight the fact that the conclusions presented by McMillan and Rodrik (2011), which suggest that all African nations suffer equally from growth reducing structural change is misleading, due to the fact that conclusions are based on average regional effects.

Figure 3.14 Decomposition of Economy-Wide Productivity Changes for Africa With Nigeria and Zambia: 1990-2005

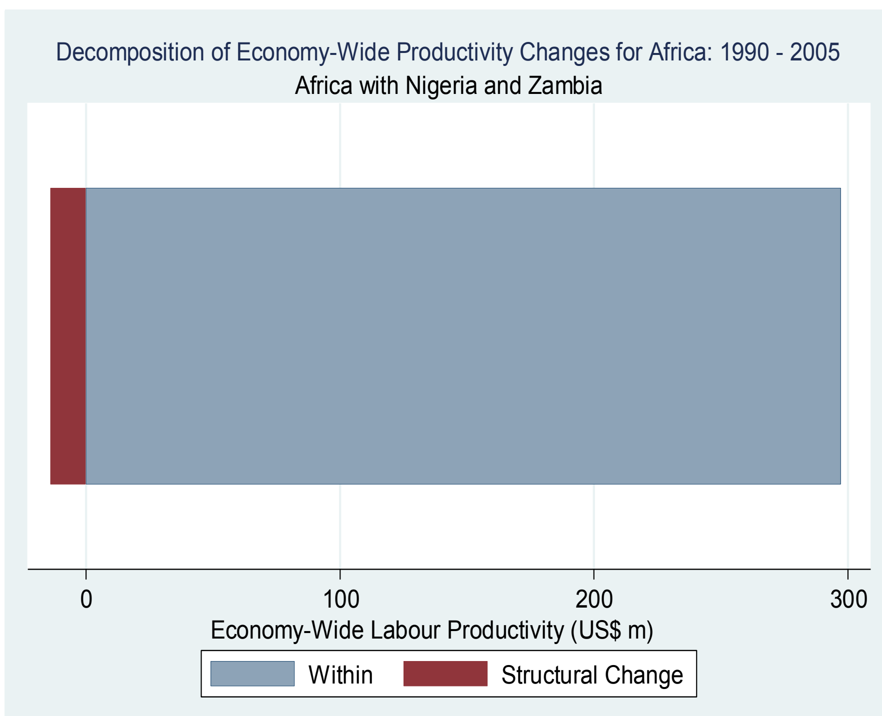
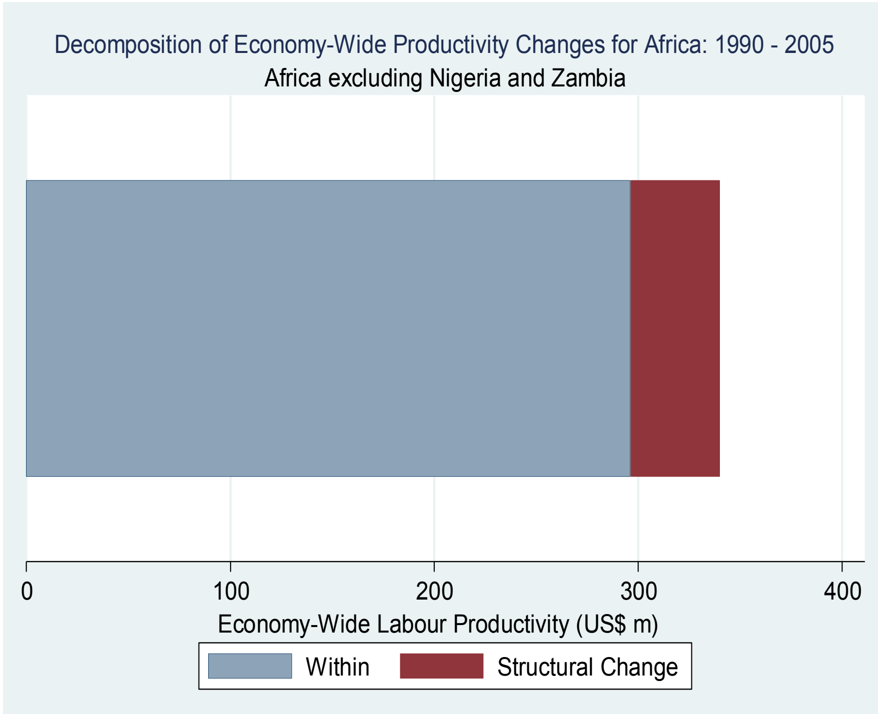


Figure 3.15 Decomposition of Economy-Wide Productivity Changes for Africa Without Nigeria and Zambia: 1990-2005



3.6.2.1.4 Nigeria – Changes in Sectoral Employment: Where Did the Labour Go?

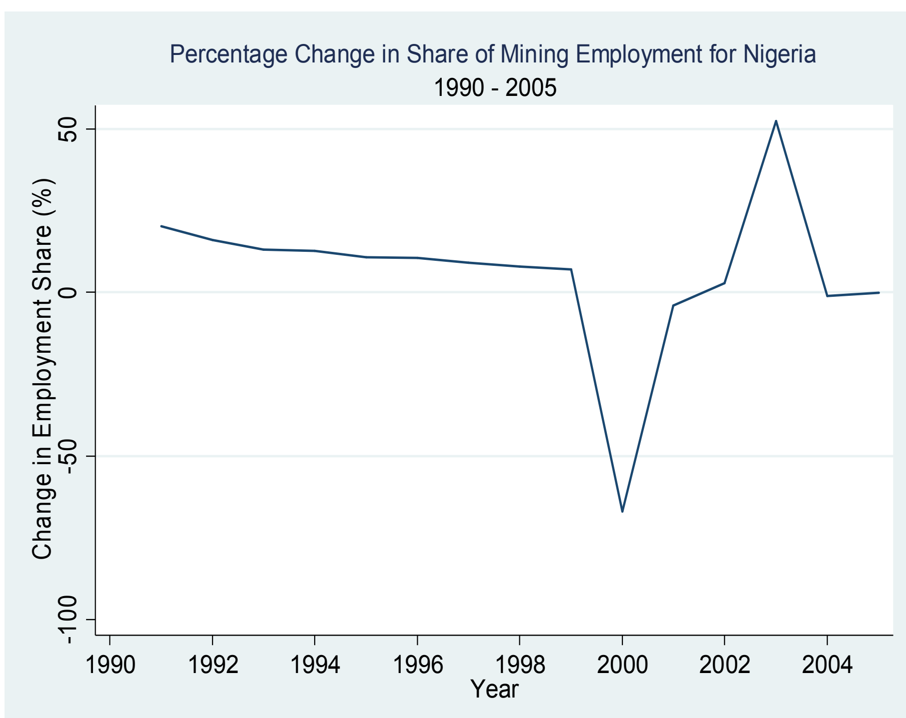
Nigeria's structural change component was negative for the period 1998 to 2001. A closer look at this time period reveals that the share of labour from mining, manufacturing, public utilities and wholesale, retail and trade declined while employment shares in the remaining five industries increased.[51] Like Venezuela, mining suffered the greatest loss in its share of employment during this period. Figure 3.16, which presents the change in employment share in mining for Nigeria, illustrates the sharp decline in the share of mining

[51] See Table A3.2 in Appendix 3.1 for sector breakdown

employment from 1998 followed by a steep rise in the rate over the 2001 to 2002 period.

This huge fall in mining employment share occurred specifically between 1999 and 2000 with a corresponding 66 percent fall in the rate of productivity growth. There was a 34 percent increase in the share of employment in the construction sector from 1998 to 2001. This sector gained the greatest from the labour reallocation when Nigeria experienced its bout of growth reducing structural change. This gain in employment share, however, was growth reducing as there was a corresponding 17 percent decline in labour productivity.

Figure 3.16 Percentage Change in Share of Mining Employment for Nigeria - Mining: 1990-2005



The Nigerian economy, by 1988, relied on petroleum for 87 percent of its export receipts and 77 percent of Federal government revenue. We find that a fluctuation in oil prices and falling demand in 1998 and 2001 account for the negative structural change observed, specifically, via its spill-off effect on other sectors, causing labour to move into agriculture and construction. As Figure 3.17 illustrates below, in 1998 world oil prices were declining. This continued until December 1998, when there was a sharp increase in the price of oil. This decline in oil prices started in 1998 when OPEC increased its quota by 10 percent and when the Asian Financial crisis caused Asian economies' rapid growth to halt and Asian Pacific oil consumption to decline. Prices spiralled downwards until OPEC cut its quota in April, with prices recovering early 1999. Another OPEC quota increase saw oil prices declining from November 2000. High productivity sectors such as the petroleum sector cannot absorb a large portion of the population, and the falling oil prices and falling demand for Nigerian oil in 1998 triggered the movement of employment into construction and agriculture. Furthermore, the subsequent rise in oil prices in 1999 led to rising costs and decreasing productivity in agriculture and construction.

Figure 3.17 Monthly Trends in World Oil Prices: January 1990 to December 2005

Source: Interactive chart of historical monthly West Texas Intermediate (WTI) (NYMEX)[52]
Figure presents monthly oil prices adjusted for inflation using headline CPI and is shown by default on a logarithmic scale.

For Nigerian construction, variable cost is not simply explained by price indices of common goods and services, but rather the booms and bursts triggered by oil prices. Batini (2004) finds that for Nigeria, oil prices are found to influence the rate of inflation and the lending rate, while Olatunji (2010) discovered a positive correlation between the price of petroleum

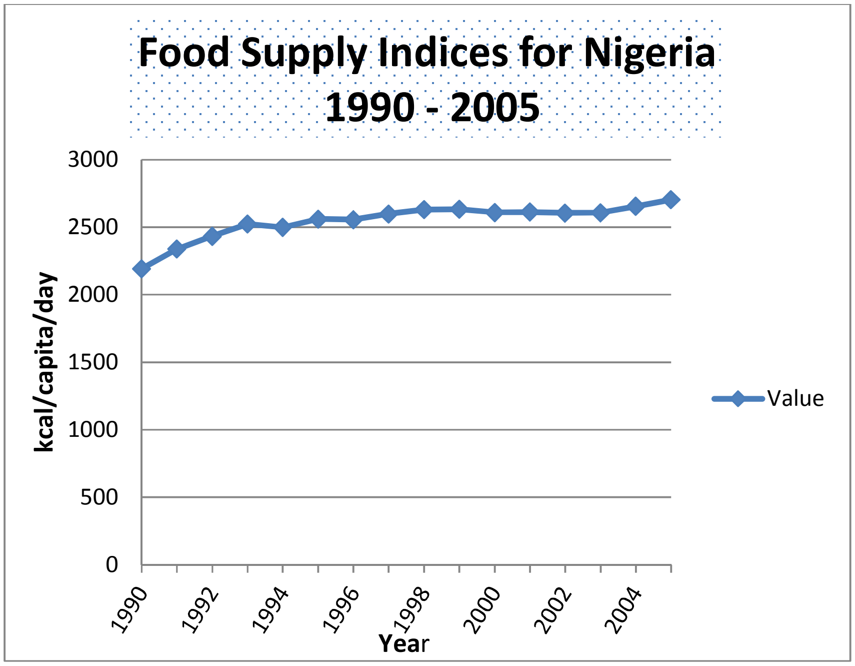
[52] West Texas Intermediate (WTI) is light sweet crude oil commonly referred to as oil in the Western world. WTI is the underlying commodity of the New York Mercantile Exchange's (NYMEX) oil futures contract. Sweet crude oil is a type of oil that meets certain content requirements including low levels of hydrogen sulphide and carbon dioxide. Sweet crude gets its name if it contains less than 0.5 percent sulphur. Sweet crude oil is preferred by refiners because of the low sulphur content and relatively elevated yields of high-value products, including gasoline, diesel fuel, heating oil and jet fuel.

products and the cost of construction. Furthermore, research has shown that that although Nigeria's construction industry is an important grower of GDP, it is a low and slow earner (Omole, 2000). For the construction industry, this presents a challenge to the contractors in the form of high interest loans and cost overruns and delays (Aibinu and Jagboro, 2002). Increasing construction employment was therefore accompanied by high costs and falling productivity, contributing negatively to overall economy-wide productivity.

A detailed look at the behaviour of the agricultural sector show that falling food output and rising agricultural production costs and prices again triggered by rising oil prices occurred during the growth reducing period in Nigeria. In Figure 3.18 below, the evolution of food supply in Nigeria, specifically total kilocalories available per capita per day, from 1990 to 2005 show an overall increase in the country's food supply.[53] However, we observe in Figure 3.19, that within that same period, a sharp decline in food supply coincided with the period of growth reducing structural change (1998 – 2001). This was the only period of decline in food supply during our sample period.

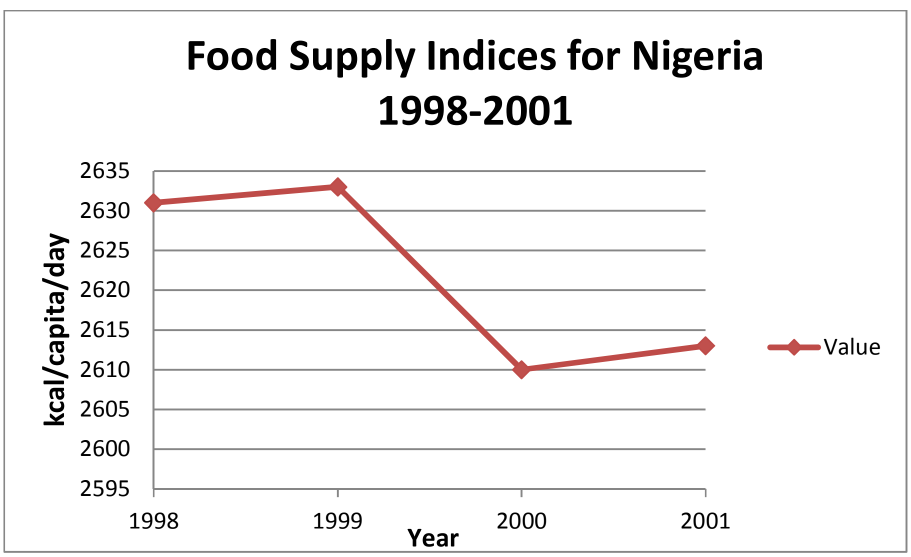
[53] Food is constructed by the Food and Agriculture Organisation (FAO) to represent the total amount of food available for consumption in Nigeria. It roughly equates to production plus imports minus exports, with modification for use as seed in agricultural production. Food supply is measured in kilocalories per capita per day. Its calculation allows it to be a more accurate measure of food availability than production numbers.

Figure 3.18 Food Supply Indices for Nigeria: 1990 - 2005



Source: FAOSTAT database.
Food supply represents total amount of food available for consumption in Nigeria. It roughly equates to production plus imports minus exports, with modification for use as seed in agricultural production. Food supply is measured in kilocalories per capita per day (kcal/capita/day).

Figure 3.19 Food Supply Indices for Nigeria: 1998 - 2001



Source: FAOSTAT database.
Food supply represents total amount of food available for consumption in Nigeria. It roughly equates to production plus imports minus exports, with modification for use as seed in agricultural production. Food supply is measured in kilocalories per capita per day.

Additionally, the data show distinct inflation between 1998 and 2001, with a 51 percent increase in the food price index for that same period, when the food price index between 1990 and 1997, increased by only 15 percent.[54] Although this trend of rising food prices follows the general trend of prices across the country over the 1990 to 2005 period, statistics show, however, that the rise in food price was steeper than general prices with general prices rising by 36 percent between 1998 and 2001. Inflation brought about by rising oil prices led to increase production costs through high fertiliser and transportation costs and like construction, the increase in agricultural employment was accompanied by falling productivity.

3.6.2.1.5 Zambia – Changes in Sectoral Employment: Where Did the Labour go?

Zambia exhibits persistent structural change in a direction that suggests limited economic progress. The reason for this is that the share of agriculture is increasing with the share of employment in other sectors falling. The process of economic development requires a movement of labour out of low productivity agriculture towards more productive industry and then to services. By 2001, there was a 38 percent increase in the growth rate of agriculture's share of employment from 1990 and by 2005, this rate increased to 39 percent. From 1990 to 2005 (excluding 2002 to 2004), all other sectors, with the

---

[54] Author's own calculations from FAOSTAT

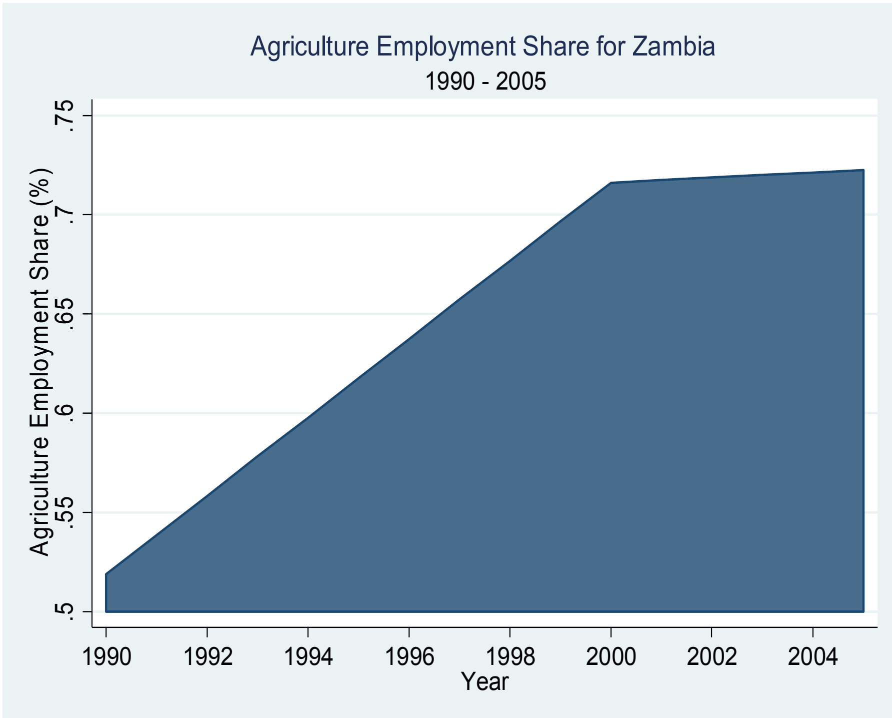
exception of wholesale, retail and trade, suffered declines in their employment shares.[55]

Unlike the variation in labour reallocation taking place in Venezuela and Nigeria, the case of Zambia is simple. The movement of labour is unidirectional. There is a constant reallocation of employment in share terms towards the agricultural sector, Zambia's least productive sector. Average productivity from 1990 to 2005 in agriculture grew by approximately 2 times less than average economy-wide productivity. Figure 3.20 reveals that Zambia's share of agricultural employment increased steadily from 1990 until 2000 when there was a reduction in the rate of employment reallocation into this sector. This reduction in the rate of growth was attributed to the movement of labour into the wholesale, retail and trade sector.[56] The wholesale retail and trade sector realised a 175 percent growth in its share of employment between 2000 and 2005, coinciding with the period in which the rate of growth of the share of agricultural employment slowed. In the previous years (1990 to 1999), wholesale, retail and trade's share of employment grew by only 28 percent. This sector is Zambia's third least productive growth sector after agriculture and manufacturing for our sample period.

[55] Author's own calculations

[56] This sector was had the second highest employment share after agriculture (Zambia Labour Force Survey Report 2008)

Figure 3.20 Agricultural Employment Share for Zambia: 1990 - 2005



The case of Zambia emphasises the fact that structural change is not a homogenous process and broadly represents the challenge of social transformation facing much of Africa. Like Nigeria, the negative structural change observed in Zambia during our study period arises as a result of the country's high dependence on natural resources, whose performance largely affects national economic development, while employing a small percentage of the population. Zambia was a prosperous middle-income nation some decades ago, with per capita income of US$175 (1965).[57] Its economic fallout came as a result of the decline in the purchasing power of copper, its primary export commodity, when international copper prices declined in the 1970s alongside

[57] Government of the Republic of Zambia, United Nations Development Programme (UNDP, 2010)

the oil crises in 1974 and 1979. This offset a decline in all development indicators since the 1990s.

The mining sector suffered from little investment in exploration and drilling, increasing production costs, falling production, and low job creation, contributing to falling employment shares and reallocation towards the agricultural and informal sectors.[58] Although over 60 percent of the labour force is employed in the agricultural sector, government spending is only 1 percent of the GDP. The lack of investment results in poor infrastructure, livestock diseases and a sector that operates at 40 percent of its potential capacity.[59] The majority of farmers in Zambia do not possess the capacity, resources and finance to adapt to worsening climatic conditions affecting the efficiency and sustainability of the sector.

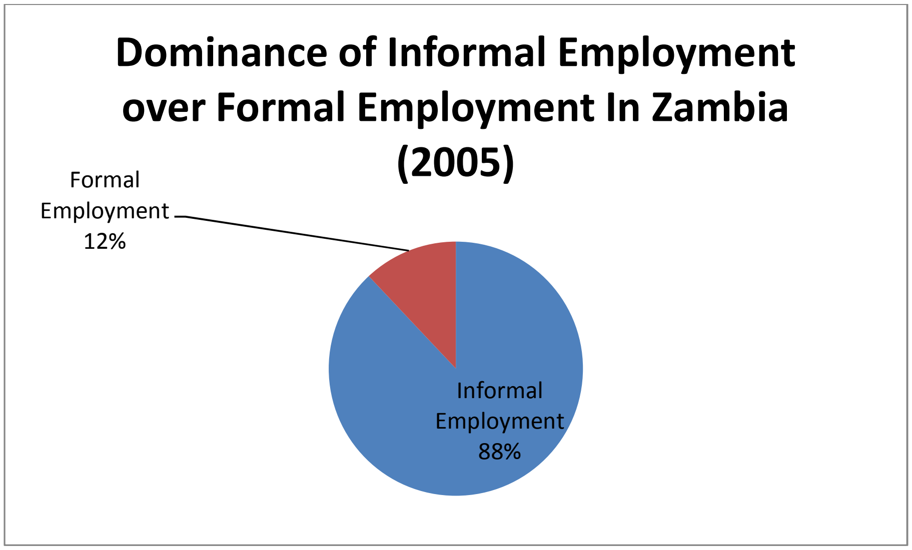
As demonstrated in Figure 3.22, informal employment dominated total number of persons employed with only 12 percent of the population occupying formal employment in 2005. Of total person employed in the informal sector, 96 and 71 percent of persons comprised informal employment in the rural and urban areas respectively.

---

[58] Informal employment was defined as employment in an establishment where workers were not entitled to paid leave, their employer did not cover them under any form of social security and they worked in an establishment employing less than 5 persons. Any one the three conditions had to be fulfilled in order to classify a person as working in the informal employment.

[59] Ministry of Finance and National Planning (2006). Fifth National Development Plan, 2006 - 2010

Figure 3.21 Informal Employment versus Formal Employment in Zambia: 2005



Source: Zambia Central Statistical Office. Labour Force Survey (2008)

Zambia requires a complete reversal of its structural transformation patterns. With such a large increasing share of the labour force, agriculture is a potential driving force for economic growth required for poverty reduction. Increasing productivity in this sector will then allow labour to move into other sectors, thereby driving the much needed transition that promotes economic development.

3.6.2.1.6 South Africa and Senegal – Changes in Sectoral Employment: Where Did the Labour go?

It is important that we highlight the performance of South Africa and Senegal. South Africa and Senegal exhibit some labour reallocation in favour of lower productivity sectors. This contribution of growth reducing structural change is, however, small relative to that of Nigeria and Zambia. South Africa had an overall 55 percent fall in the share of agricultural employment between 1990 and 2005. The difference in the size of the structural component between South Africa and that of Nigeria and Zambia can be attributed to the fact that between the 1998 to 2001 and 2004 to 2005 period when South Africa's structural change component was negative, sectors such as manufacturing and finance insurance and real estate had increasing employment shares and increasing productivities.

Specifically, the increase in employment in the manufacturing sector was accompanied by increasing manufacturing labour productivity. Public utilities, South Africa's second most productive sector after finance, insurance and real estate, experienced a fall in its employment share between 1998 and 2001 by 48 percent corresponding to the period of negative structural change. Although some of this employment reallocated to sectors less productive than public utilities, such as wholesale, retail and trade and community, social, personal and government services, a proportion of this labour went into finance, insurance and real estate and manufacturing, the country's first and third most productive sectors. This movement was large enough to offset some of the adverse effects to economy-wide productivity from the loss of employment in public utilities.

This period of growth reducing structural change beginning 1998 can be explained by the depreciation of the Rand in 1998 and worsened by the intervention policy by the South African Reserve Bank (SARB), through official reserves and short-term interest rates resulting in falling investment and losses equating to 8 percent of the GDP (Bhundia and Ricci, 2006).[60] A weakening of global demand for commodities in 1998, arising on the back of the Asian financial crisis in 1997, resulted in a downward pressure on the market prices of some of South Africa's commodity exports. Studies have found that a 1 percent fall in the real price of exported commodities in South Africa is associated in the long run with a 0.5 percent depreciation of the real exchange rate Ricci (2005).

The vulnerability of the Rand to changes in market sentiments presented economic and social challenges for policy makers resulting in employment reallocation to lower productivity sectors identified above and an accompanying slowdown of economic growth. In 2001, the authorities avoided the implementation of the 1998 policies to deal with the depreciating Rand and were successful in limiting macroeconomic repercussion, strengthening the Rand and thus reversing any growth reducing employment reallocation.

For Senegal, finance, insurance and real estate and mining hold the top two places in terms of productivity levels for the period. From 1994 to 1995, labour share from the two highest productivity sectors fell as employment reallocated to other sectors of the economy creating growth reducing structural change. This instance of negative structural change lasted for a short 1-year

[60] The currency unit of South Africa

period such that the economy was back on a path of labour reallocation that contributed towards increased economic growth. The 1994 to 1995 period of negative reallocation can be aligned to the devaluation of the CFA Franc in 1994.[61] Such macroeconomic changes resulted in a reduction of the public wage bill and as such the country would have experienced a reallocation of labour due to increased job opportunities in other sectors of the economy. However, there was an increase in private investment, thereby curtailing further growth reducing structural change via increased opportunities in other industries such as transportation and telecommunications Azam et al. (2007).

3.6.2.1.7 Asia - South Korea

McMillan and Rodrik (2011) argued that the performance of Asia was more favourable and growth-enhancing in comparison to that of Africa and Latin America in terms of changes in economy-wide productivity – particularly with reference to the structural change component which results from the reallocation of labour across sectors. Although on average, the entire Asian region in our sample did not demonstrate negative structural adjustment, we find that the performance of South Korea is worth highlighting because over the 1990 – 2005 period, we observe consistent labour reallocation from high-productivity to low-productivity sectors. This problem peaked between 1998 and 1999.

[61] The Communauté Financière Africaine (African Financial Community) (CFA) France is the currency unit of Senegal.

The peak in growth reducing structural change appears to have some correlation with the Asian Financial Crisis which gripped much of East Asia around July 1997. There was a fall in demand and confidence throughout the region. The effect of this is evident in the data as during this period we find the largest quantity of growth reducing labour reallocation occurring across the Asian grouping. South Korea and Indonesia were two of the crisis' most affected nations. Figure 3.22 illustrates the decomposition of economy-wide productivity for our Asian sample of countries immediately following the crisis. We observe large negative structural change components for South Korea, Indonesia and Singapore.

Figure 3.22 Decomposition of Economy-Wide Productivity for Asia: 1998 - 1999

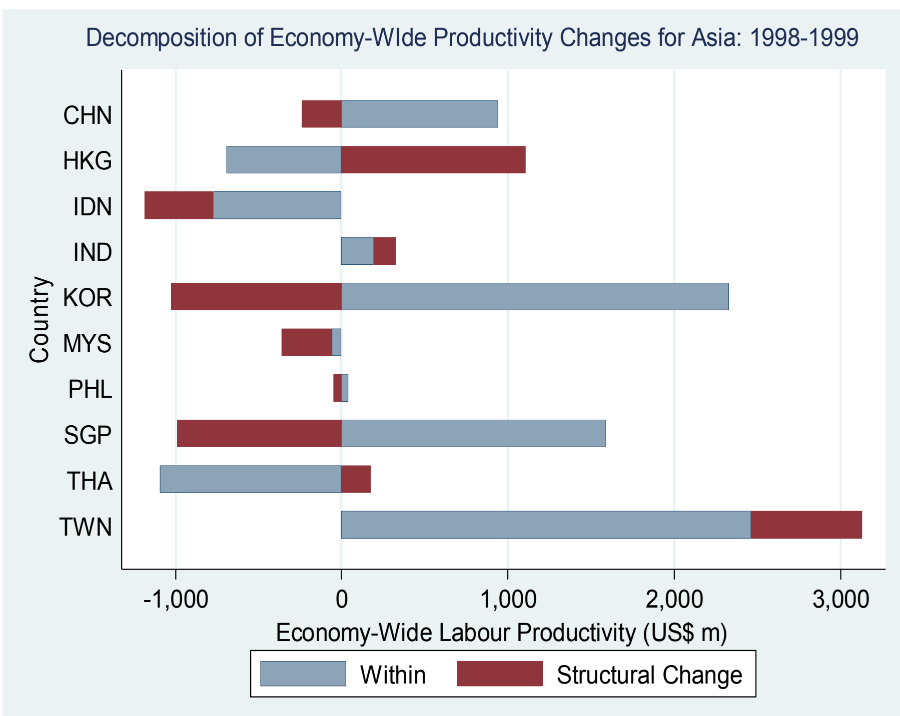
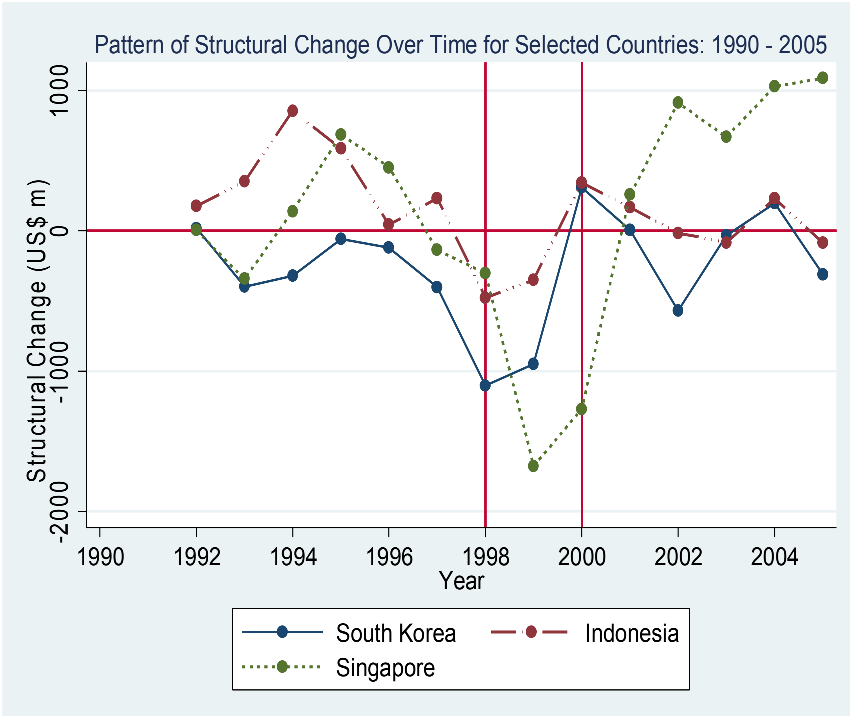


Figure 3.23 follows the paths of the structural change components for South Korea, Indonesia and Singapore over time. The impact of the financial crisis led to a reduction of capital inflows into emerging Asia resulting in a slowdown of the economic performance of the region. In figure 3.24 we observe a reallocation of employment towards less productive sectors during this period. The region began as a whole recovering in 1999. A comparison of our data from 1999 to the end our sample period 2005, reveals that by 2000, the negative structural change component significantly reduced or disappeared for most countries, and this pattern was maintained through to 2005.

South Korea appears to have experienced growth reducing structural change before the crisis as this component appears below the horizontal reference line at zero on the y-axis for much of the period in Figure 3.24. This worsened between 1997 and 1998. The country's agricultural sector which was on the decline from the beginning of the sample period realised a 10 percent increase in its share of agricultural employment between 1997 and 1998.

Figure 3.23 Pattern of Structural Change over Time for Selected Countries: 1990 - 2005

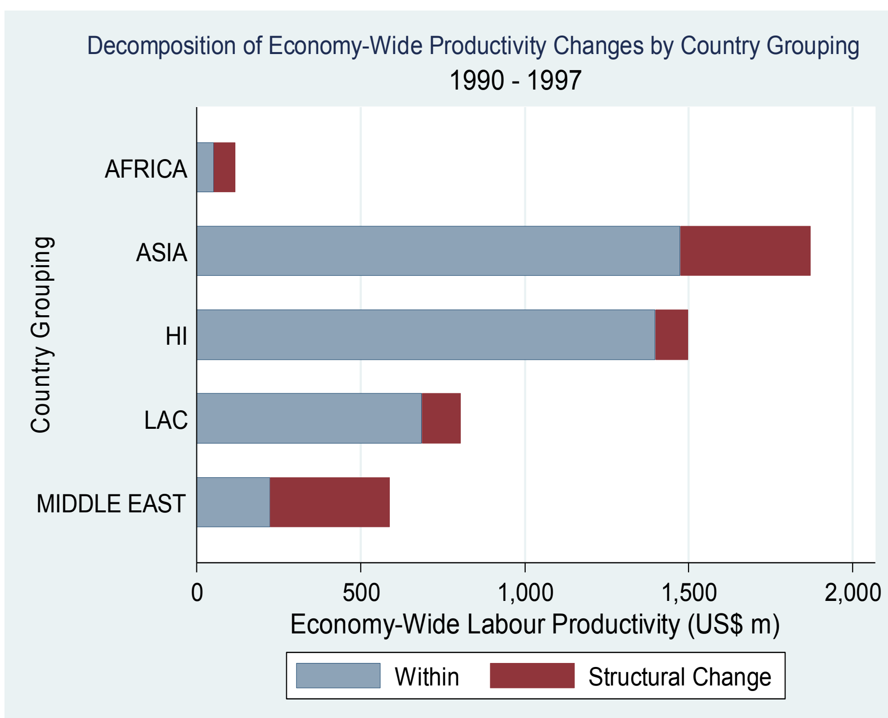


3.6.3 Stylised Fact 2: Trend in Negative Labour Reallocation is More Common Post 1997 across All regions

Our first set of discussions is centred on our observation that our findings are driven by specific countries within each region. Our second stylised fact emanating from our more disaggregated analysis concerns heterogeneity across time. The conclusions presented by McMillan and Rodrik (2011) indicate that across the 15-year period, structural adjustments in Asia and the High-Income regional groupings were positive, whereas the Africa and Latin America grouping realized growth reducing structural adjustment and the pattern implies that this trend was consistent for the entire period under study.

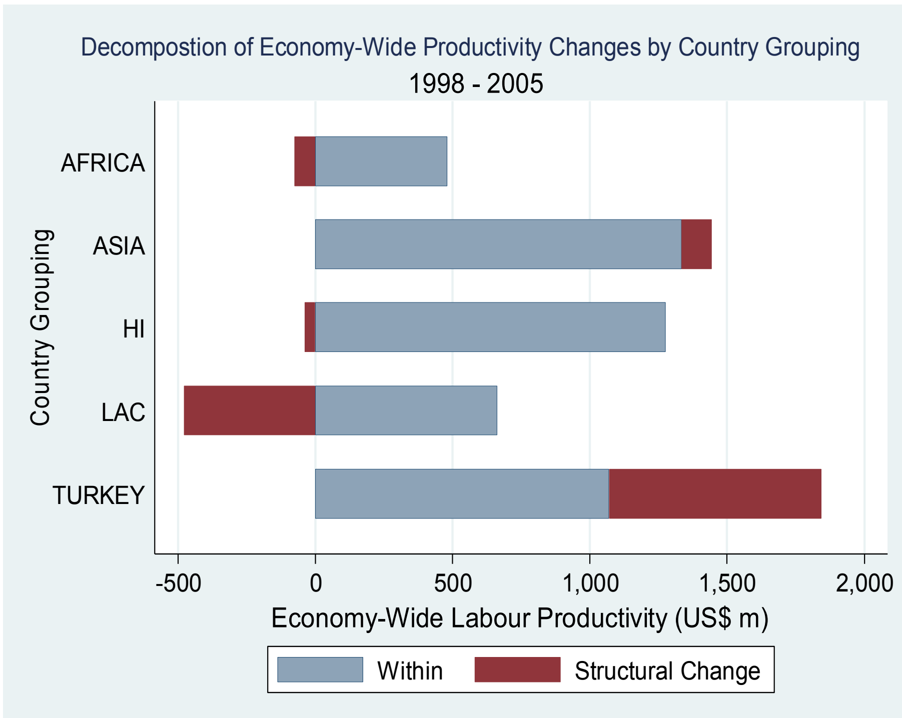
Our findings, however, reveal that the period 1998 to 2005 experienced higher incidences of negative structural change relative to the period 1990 to 1997. Interestingly, this pattern was common across all countries and in aggregate regions. The following two figures (3.24 and 3.25) present the change in economy-wide labour productivity for two periods, 1990 to 1997 and 1998 to 2005 respectively. Figure 3.24 suggests that the structural change component was positive for all regions in our sample between 1990 and 1997. The regions experienced changes in this pattern post 1997 as demonstrated in Figure 3.25, where Latin America, Africa and even the High-Income region realise an average negative structural change component.

Figure 3.24 Decomposition of Economy-Wide Productivity Changes by Country Grouping: 1990 - 1997



*HI = High Income LAC = Latin America

Figure 3.25 Decomposition of Economy-Wide Productivity Changes by Country Grouping: 1998 - 2005



*HI = High Income LAC = Latin America

Inter-sectoral labour reallocation pre-1998 contributed positively to economy-wide productivity. Figures A3.1 (i to vi) in the Appendix 3.2 present the breakdown by country for the emerging regions. This decomposition mirrors the regional results presented above. That is, that it was the post-1997 period that experienced a greater quantity of labour reallocation that adversely affected economy-wide productivity.

Earlier discussions on growth reducing structural change occurring within countries highlights an apparent relationship between the observed change in labour shares from high productivity to lower productivity sectors and the Asian financial crisis and declining oil prices. Our data shows that much of the decline in productivity from the reallocation of labour across sectors occurred post 1997 following the crisis. Following the crisis, investors were reluctant to support developing economies worldwide. There was also a spill over effect on the price of oil. At the end of 1998, the price of oil reached a low price (US$11 per barrel) affecting revenues of oil exporters. This crisis affected some countries in the High-Income sample, such as the United States through trade. Additionally, it sent other developing nations like Argentina into crisis and also resulted in a by-product, the 1998 Russian Financial crisis.

The Asian financial crisis, immediately impacted financial markets, but also impacted levels of real output and employment due to a number of factors such as unstable exchange rates, capital outflows and sagging or declining productivity. Such an outcome resulted in the closure of production units amid lack of funds and eroding profits as well as the displacement of large numbers of employees. A 2009 International Labour Office (ILO) study on the experience of the financial crisis on Asian countries reported that the effect of the crisis left unemployment rates in 2000 higher than pre-crisis levels in some countries such as Indonesia. Some countries' growth in employment post-crisis was unable to keep up with the pace of the growing labour force. There was also a spill-off emanating from the emergence of high levels of unemployment, which in turn resulted from retrenchment and loss of job opportunities, leading to increased poverty. Rising poverty levels were exacerbated by recourse to lower paid self-employment and real wage and income cuts occurring in countries identified as being affected by the crisis. There was a general decline in wages across sectors including the informal sector where the impact on workers were more severe as workers were less organised and possess lower access to social protection. Across Asia in particular, sectors such as non-oil manufacturing, construction, government and financial and tourism services suffered significant job losses. The sectoral reallocation of labour was not homogenous in nature across countries. The gender impact also varied as women were more subjected to layoffs and were more likely to shift towards self or informal employment. Furthermore in many sectors regular workers were replaced by temporary workers (Krishnamurty, 2009).

Oil exporting African countries faced sharp decline in export revenues, and fiscal receipts were exacerbated by the impact on commodity prices and for some, a contraction in demand for other major exports. For example, difficulties among Asian textile producers in securing credit resulted in delays in the completion of export contracts with Sub-Saharan cotton producers. The weakening of world diamond demand, of which Asia then accounted for one third, resulted in self-imposed quotas on African production in 1998 (Harris, 1999). With the countries of East and South-East Asia accounting for 31 percent of the increase in world imports between 1990 and 1995, and 28 percent of the increase in exports, this crisis also affected demand for Latin American exports (Stallings, 1998). Lower Asian demand affected not only the volume of trade but also product prices, for example copper and oil, thereby affecting government revenues highly dependent on sales of these products and employment shares in these markets. The Asian financial crises and the falling oil prices that followed clearly rendered some countries unable to cope with demands generated by loss of jobs and employment opportunities thus contributing to growth reducing labour reallocation within nations in our country groupings.

3.6.4 Stylised Fact 3: Within-Sector Productivity Improvement is at Least as Important as Productivity-Enhancing Structural Change in Driving Productivity Growth across Regions at Different Levels of Development

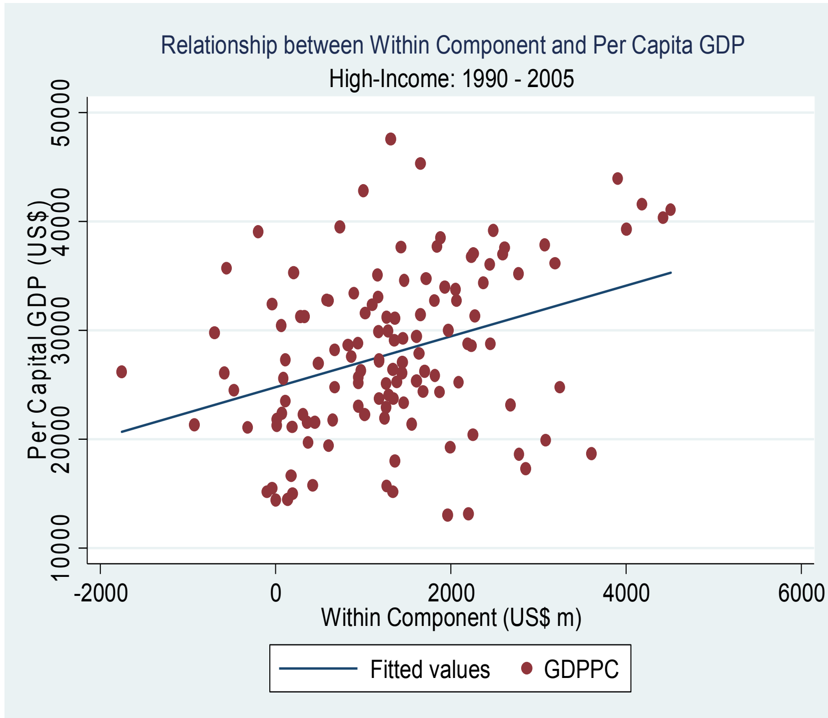
Most studies on productivity observe developing countries and place emphasis on the fact that high-growth countries are those that typically experience growth-enhancing structural change. Former illustrations, however, suggest that it is vital to monitor the performance of both components as they are both significant to the growth process. The relative importance of the within-sector improvements was not emphasised by McMillan and Rodrik (2011). Improvements in economy-wide productivity are limited if structural adjustment in employment is not accompanied by within sector improvements.

As previously discussed, we find that the countries in the Asian and High-Income regional groupings outperformed those in Latin America and Africa, both in terms of positive structural change, and in improvements within sectors (see Figure 3.7). The within sector contributions for the Asian and High-Income regions on average, accounted for 77 and 88 percent respectively, of overall productivity changes between 1990 and 2005.

Gaps in productivity levels in developing countries are greater than that of High-Income economies. Movement of labour across sectors will therefore have a smaller impact on overall changes in productivity levels for High-Income countries for the period 1990 to 2005. In such economies, it is within sector improvements that promote economic growth and separates the economic performances from one sector to another. In addition to within sector reallocation, such improvements could result from technological improvements through research and development or through increased workforce training or management efficiency.

Figure 3.26 plots the linear relationship between within productivity changes and per capita GDP for High-Income nations. The positive relationship is an indication of the importance of the within sector improvements towards improving living standards. As the literature suggests, the within component makes a greater contribution to economy-wide productivity, the more developed the country.

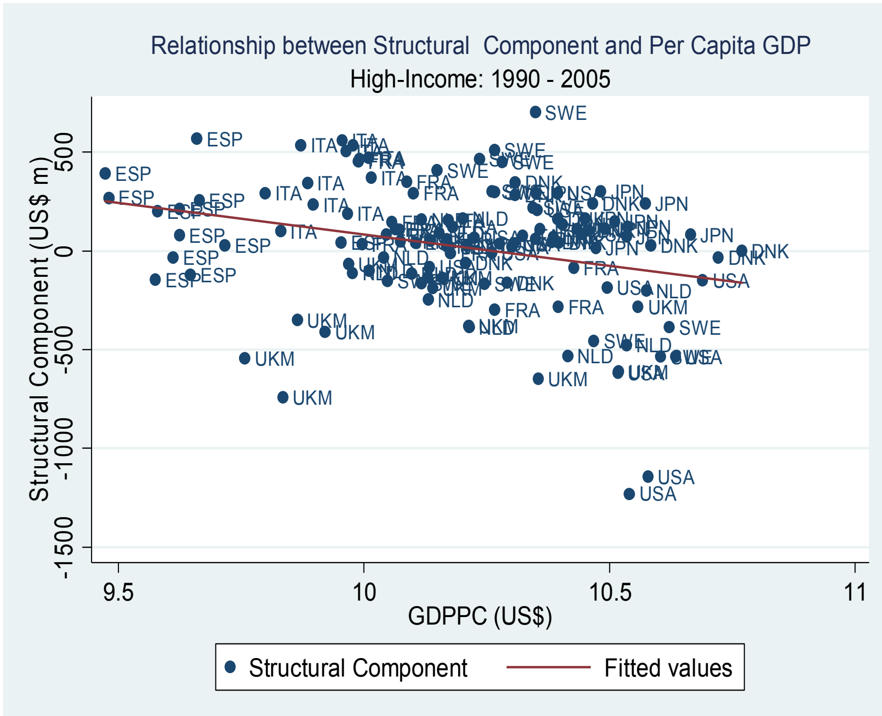
Figure 3.26 Relationship Between Within Component and Per Capita GDP for the High-Income Grouping: 1990 – 2005*



* Each observation represents the relationship between GDP per capita (US$) and the within component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

We repeat this exercise using the structural change component and observe in Figure 3.27 below, a negative relationship between the structural change component and per capita GDP. This subsample comprises industrialised countries with highly productive operations and efficiently distributed resources. As such, inter-sectoral reallocation of resources may lead to undesirable effects on the economic health of these nations possible resulting in the type of negative relationship we observe occurring in Figure 3.27.

Figure 3.27 Relationship Between Structural Component and Per Capita GDP for the High-Income Grouping: 1990 – 2005*



* Each observation represents the relationship between GDP per capita (US$) and the structural change component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

We compare these results to that of the other three regions. Figures A3.2, A3.4 and A3.6 in the Appendix 3.3 continue to highlight the importance of within-productivity improvements. Similar to that of the High-Income regional grouping in Figure 3.27, a positive relationship between within-sector productivity improvement and GDPPC exists for the remaining three regions. This relationship is stronger for Asia than Africa and Latin America.

Furthermore in Figures A3.3, A3.5 and A3.7 also in Appendix 3.3, we plot the relationship between structural change and per capita GDP, and find that for

Asia, a positive relationship exits. However, there is little or no relationship between these two variables for Africa and Latin America. Comparing these findings to our previous results, where we identify growth reducing structural change in Latin America and Africa, our data suggests that the within component of economy-wide labour productivity dominates in terms of the contributions of the components of economy-wide productivity growth. Our findings, however, also indicate that negative or growth reducing structural change may be exaggerated by commodity price and political and financial crises effects, thereby driving the overall results in some regional groupings.

3.7 Conclusions

In this study we conduct a growth accounting exercise, whereby we decompose aggregate productivity into its structural change and within components. The structural change component measures the change in employment shares across sectors and must be positively correlated with productivity levels in order to increase economy-wide productivity. This component contributes to overall productivity increases if resources reallocate from low- to high-productivity sectors, thus enriching the distribution in favour of higher productivity activities. The within component captures the impact of overall productivity growth as employment reallocate within individual sectors. Gains to overall productivity via within productivity can also accrue when individual sectors become more technologically progressive and when resources are allocated more efficiently, even within narrowly defined industries. Attempts to increase productivity growth are not only based on our understanding of the determinants of productivity change. A vital component of this understanding is our ability to identify where such growth has its roots.

Rodrik and McMillan (2011) observe some interesting trends among a group of developing regions. Specifically they find that the Asian region realised better economic success than that of other developing regions, Latin America and Africa. The latter two regions were experiencing negative structural change. That is, there was a change in sectoral employment shares from high productivity sectors in favour of low productivity sectors. Growth literature emphasises the importance of productivity enhancing labour reallocation on the economic development of nations. Additionally, the development literature suggests that the process of development follows a path whereby resources move out of traditional low productivity sectors into more modern, higher productivity activities. Given that the opposite of this appeared to occur in Latin America and Africa we were motivated to investigate such findings, especially given a priori belief that for developing economies the structural change component is expected to be an important source of growth.

We utilise McMillan and Rodrik's (2011) finding as the starting point in our analysis to conduct a more disaggregated study on the components of economy-wide productivity across regions. We do this firstly by observing the changes in the components over shorter 2-year averages instead of taking the simple average over 15 years as done by the previous authors. Secondly we investigate the changes in the components on a country level to scrutinise labour's reallocation and the effect on productivity within each country. Finally, we split our dataset into different time periods in an attempt to more efficiently observe the exact timings of such growth reducing structural change. From this extension of the analysis we are able to identify three new stylised facts existing in the data.

Our first stylised observation is that the patterns of negative structural change identified are country and not region specific. Specifically, the patterns of negative structural change identified as a problem of the entire Latin American and African regions are in fact driven by Venezuela for Latin American and Nigeria and Zambia for Africa.

Venezuela's growth reducing structural change can be accounted for by the country's history of political and economic instability and the effect of fluctuations in the price of oil on this oil-dependent nation. Massive unemployment in the petroleum sector along with labour strikes and rising informal employment, coupled with falling levels of production and oil prices contribute to this growth reducing structural change observed in Venezuela. Our findings cement the importance of the petroleum sector on the Venezuelan economy and raises questions relating to the Dutch Disease and the importance of diversification of natural resource rich economies.

The story of Nigeria is similar to that of Venezuela. The high dependence on the volatile petroleum sector triggered instabilities in other macroeconomic variables. Fluctuating oil prices and falling output demand between 1998 and 2001 caused labour to reallocate towards lower productivity agriculture and construction. The ripple effect of increased inflation also increased costs in those sectors and this was accompanied by falling output levels.

For Zambia, the story is less complex. Labour consistently moved out of most sectors into low productivity agriculture. Zambia's negative structural change is as a result of the country's high dependence on natural resources, whose performance largely affects national economic development. The decline in the price of its primary export copper sent the economy into an economic crisis and coupled with a lack of mining investment, rising production costs and low job creation, labour is forced to reallocation in favour of less productive agriculture and informal sectors.

We also identify negative structural change in the performance South Africa, Senegal and South Korea. Like the case of Venezuela and Nigeria, changes in the economic climate such currency depreciation (in South Africa and Senegal) and the Asian financial crisis (South Korea) corresponds with negative structural change observed in these countries. The growth reducing structural change in these countries was, however, less significant than that of the negative structural change observed during specific periods in Venezuela, Nigeria and Zambia.

Our second stylised fact is that the observed negative reallocation was more common across countries post 1997 rather than occurring consistently over the 15-year study period. We observe that 1998 to 2005 experienced higher incidents of negative structural change across all countries within our sample regions. We also identify a possible correlation between this corresponding decline in productivity and the Asian financial crisis. Our data indicate that much of the productivity decline from labour reallocation occurred following the 1997 crisis, which was followed by falling oil prices at the end of 1998. The resultant effect was on employment through capital outflows and declining productivity, not only in the financial and oil sector, but other sectors such as construction and non-oil manufacturing faced job losses due to falling world demand.

Finally, our third and final stylised fact is that within productivity improvement is at least as important as the structural change component in driving productivity growth across developed, emerging and even more importantly developing regions. Studies on developing regions tend to place emphasis on the role of labour reallocation out of the traditional into the modern sectors. Our findings show a positive relationship between per capita GDP and within productivity changes for all regions emphasising its importance in not only the advanced countries, but the developing ones as well.

The point of this paper is not to rehash familiar territory. Instead we address a more specific question about what is driving the changes in aggregate productivity within those regions and identified three new stylised facts existing in the data. Our findings suggest the need for stability in the economic and political climate within countries and across regions and the need to promote oil prices stability. Extreme prices - either too high or too low - are not in the interest of consumers or producers. The petroleum industry has become one of the main indicators of economic activity worldwide. It importantly supplies the world's energy demand, is the backbone of the transport industry and is used to produce a vast array of products. As such, it impacts real economic activity through both demand and supply channels.

Our research draws attention to the need for further research. Aggregate data does not bring light to possible correlation with specific events such as the effects of economic shocks to individual countries. Our results are advantageous as our choice to disaggregate does not only allow us to identify patterns of labour movement and its effect on overall labour productivity, but we are also able to suggest possible links between productivity changes and country or region specific shocks – a vital step necessary in effective policy design and implementation. Our first stylised fact highlights the need to investigate the relationship between the effect of natural resources dependence on structural change and sectoral employment. Furthermore, an investigation between macroeconomic policies such as exchange rate fluctuations and structural change could provide insight into patterns of employment reallocation. Of equal significance is investigating the difference in the timings of these relationships. Specifically, we observe that countries that are dependent on natural resource revenue appear to have negative structural change that is greater in terms of levels, as well as the length of time, in comparison to the negative structural change occurring as a result of changes in macroeconomic policies. Furthermore, based on stylised fact number two, further research should seek to investigate the effect of economic crises on global employment patterns.

The economic development literature has long argued the movement of production from agriculture to manufacturing and then on to the services sector. Labour reallocation towards lower productivity sectors by the Latin American and African regions served as a source of considerable consternation and mystery and motivated us to understand the behaviour of the components of economic growth across regions. By analysing the sources of growth, we are able to aid in the understanding of what affects aggregate productivity, by identifying specific national and international factors influencing each economy. The next step in such an analysis, naturally, is to utilise our results and attempt to formally verify the observed relationships presented in our findings.

Appendices to Chapter 3

Appendix 3.1

Table A3.1 Sample Countries

High-Income (HI)			
Denmark	DNK	Spain	ESP
France	FRA	Sweden	SWE
Italy	ITA	United Kingdom	UKM
Japan	JPN	United States	USA
Netherlands	NLD		
Asia			
China	CHN	Philippines	PHL
Hong Kong	HKG	Singapore	SGP
India	IND	South Korea	KOR
Indonesia	IDN	Taiwan	TWN
Malaysia	MYS	Thailand	THA
Latin America (LAC)			
Argentina	ARG	Costa Rica	CRI
Bolivia	BOL	Mexico	MEX
Brazil	BRA	Peru	PER
Chile	CHL	Venezuela	VEN
Columbia	COL		
Africa			
Ethiopia	ETH	Nigeria	NGA
Ghana	GHA	Senegal	SEN
Kenya	KEN	South Africa	ZAF
Malawi	MWI	Zambia	ZMB
Mauritius	MUS		
Middle East			
Turkey	TUR		

Table A3.2 Sector Coverage

Sectors Covered from GGDC 10-Sector Database[62]	**Abbreviations**
Agriculture, Hunting, Forestry and Fishing	AGR
Mining and Quarrying	MIN
Manufacturing	MAN
Public Utilities (Electricity, Gas and Water Supply)	PU
Construction	CON
Wholesale and Retail trade; repair of motor vehicles, motorcycles and personal and household goods, Hotels and Restaurants	WRT
Transport, Storage and Communications	TSC
Finance, Insurance, Real Estate and Business Services (Financial Intermediation, Renting and Business Activities (excluding owner occupied rents)	FIRE
Community, Social, Personal and Government Services (Public Administration and Defence, Education, Health and Social work, Other Community, Social and Personal service activities, Activities of Private Households)	CSPSGS
Total Economy (Economy-Wide or Sum of Sectors)	TOTAL ECONOMY

[62] See data description in Section 3.3

Table A3.3 Growth in Sectoral Employment by Country: 1990 - 2005

CTY**	REG.	AGR	MIN	MAN	PU	CON	WRT	TSC	FIRE	CSPSGS	ECO-WIDE***
		SECTOR*									
		%									
ETH	AFRICA	9	447	226	50	472	121	1	370	96	22
GHA		37	103	90	183	107	48	109	217	44	48
MWI		46	-76	137	154	202	-23	83	200	130	54
NGA		79	103	-23	112	-22	-52	-54	107	101	50
ZAF		-41	-57	43	9	123	105	47	17	16	32
SEN		20	125	288	-93	1763	128	107	50	-13	49
ZMB		113	-61	-14	-76	-48	175	-33	-64	-25	53
MUS		-28	-70	-8	-25	15	140	48	142	40	25
KEN		-0.1	38	23	-6	207	373	239	31	136	63
HKG	ASIA	-59	-33	-70	-17	20	58	35	143	73	25
IDN		-1	53	52	39	115	71	140	118	17	30
IND		18	53	40	57	110	44	39	460	4	25
KOR		-44	-79	-14	1	35	48	54	190	85	25
MYS		-22	17	70	73	103	51	75	117	65	46
PHL		22	-9	39	31	66	78	123	98	44	46
SGP		-10	-32	10	8	50	41	72	104	67	48
THA		-20	7	79	14	72	107	46	72	81	23
TWN		-44	-65	3	-5	18	45	9	120	53	20.
CHN		-11	-26	12	36	87	100	52	61	100	17
DNK	HIGH INCOME	-39	-26	-23	-21	1	12	2	40	11	5
ESP		-31	-34	14	24	79	52	51	95	46	39
FRA		-32	-56	-21	-2	-6	13	14	38	25	10
JPN		-32	-38	-27	2	-3	3	13.	-5	38	1
ITA		-41	-28	-11	-31	23	7	3	67	17	8
NLD		-7	-17	-16	-28	14	31	20	63	26	23
SWE		-41	-24.1	-23.1	-8.2	-16.6	-3.6	-9.0	38.5	-3.7	-6
UKM		-27	-62	-34	-47	-8	12	10	40	25	8
USA		-8	-14	-19	-26	30	18	14	35	28	18
ARG	LATIN AMERICA	-22	-23	-25	-5	15	21	71	76	30	15
BOL		-14	-70	120	170	222	274	37	119	-3	39
BRA		-8	-4	5	-19	4	60	45	30	51	25
CHL		-16	-37	-7	53	68	82	5	255	49	42.
COL		17	33	22	-37	66	85	101	97	46	48
CRI		0.3	164	38	134	45	201	225	403	49	72
MEX		-12	-35	13	-0.4	61	76	52	231	24	30
PER		21	0	-13	-7	-16	9	6	32.5	11	10
VEN		19	43	-11	702	-88	103	57	38	31	37
TUR	M-EAST	-40.7	-43	52	185	24	101	31	109	23	8

Source: Author's own calculations Reg. = Region
* See Table A3.2 in Appendix 3.1 for Sector Abbreviation Meaning
CTY** (Country): See Table A3.1 in Appendix 3.1 for Country and Regional Abbreviation Meaning
ECO-WIDE*** (Economy-Wide): Total Sectoral Productivity = Sum Each Sector's Value Added/ Sum Each Sector's Employment

Table A3.4 Growth in Sectoral Labour Productivity by Country: 1990 – 2005

CTY**	REG.	AGR	MIN	MAN	PU	CON	WRT	TSC	FIRE	CSPSGS	ECO-WIDE***
		SECTOR*									
		%									
ETH	AFRICA	50	-71	-47	16	-50	-10	137	-44	-64	32
GHA		15	318	0	50	201	-33	-12	-70	22	17
MWI		27	1608	-68	-37	1	23	4	-5	-38	-7
NGA		54	33	88	705	153	354	763	7	15	40
ZAF		94	140	-8	35	-40	-24	50	-33	9	10
SEN		7	-31	-59	2940	-83	-34	4	27	51	7
ZMB		-7	48	-10	1713	458	-0.4	114	443	61	-5
MUS		44	92	83	298	72	-11	110	35	56	66
KEN		33	97	-65	-144	-69	69	20	30	-40	-17
HKG	ASIA	-44	3	143	228	-25	42	68	-0.7	23	62
IDN		48	-8	63	164	-4	17	11	22	34	51
IND		21	26	76	53	19	101	153	-36	160	87
KOR		128	290	236	245	16	32	145	-54	-11	77
MYS		60	51	86	122	-6	82	86	110	49	82
PHL		17	99	14	54	-26	7	14	11	11	15
SGP		5	-70	129	111	29	115	60	18	46	73
THA		80	162	48	142	-51	-31	80	-36	10	57
TWN		58	68	94	120	4	79	159	4	49	80
CHN		98	1121	398	691	127	82	179	138	198	254
DNK	HIGH INCOME	135	277	36	57	-2	37	64	-1	10	26
ESP		60	17	13	47	-4	5	25	-13	4	10
FRA		62	-4	64	63	5	10	66	0.2	-0.1	20
JPN		2	-1.4	74	35	-27	18	21	45	3	23
ITA		108	49	15	63	-10	13	66	-24	1	12
NLD		37	27	58	60	-10	23	70	3	-3	17
SWE		61	28	165	17	17	76	52	1	9	51
UKM		42	150	57	167	25	37	92	33	7	34
USA		66	8	95	74	-10	61	61	21	-3	30
ARG	LATIN AMERICA	95	133	101	145	95	28	37	-3	9	42
BOL		76	374	-31	-27	-57	-61	35	26	52	14
BRA		80	85	29	109	10	-13	0	-26	3	7
CHL		154	280	98	77	20	39	110	+18	10	54
COL		5	25	16	124	-10	-21	-13	-5	19	3
CRI		62	-45	62	-8	22	-38	14	-48	2	21
MEX		42	110	36	67	-11	-12	49	49	1	17
PER		57	169	104	124	164	58	81	46	35	65
VEN		6	-3	30	-79	866	-44	27	-14	5	-5
TUR	M-EAST	110	90	25	-18	26	-11	91	-22	15	59

Source: Author's own calculations Reg. = Region
* See Table A3.2 in Appendix 3.1 for Sector Abbreviation Meaning
CTY** (Country): See Table A3.1 in Appendix 3.1 for Country and Regional Abbreviation Meaning
ECO-WIDE*** (Economy-Wide): Total Sectoral Productivity = Sum Each Sector's Value Added/ Sum Each Sector's Employment

Table A3.5 Per Capita GDP for Five Richest and Five Poorest Countries in Sample: 2005

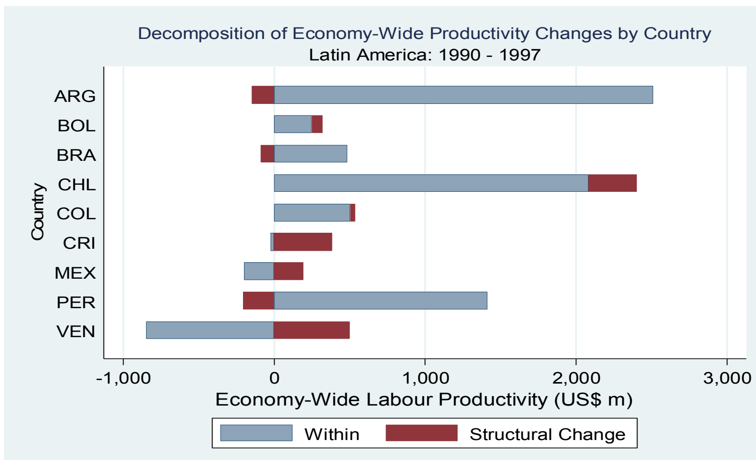
FIVE RICHEST COUNTRIES	2005 GDPPC US$	FIVE POOREST	2005 GDPPC US$
United Kingdom	38,502	Ethiopia	160
Netherlands	39,165	Malawi	264
Sweden	41,038	South Korea	524
United States	43,920	Kenya	548
Denmark	47,562	South Africa	626

Appendix 3.2

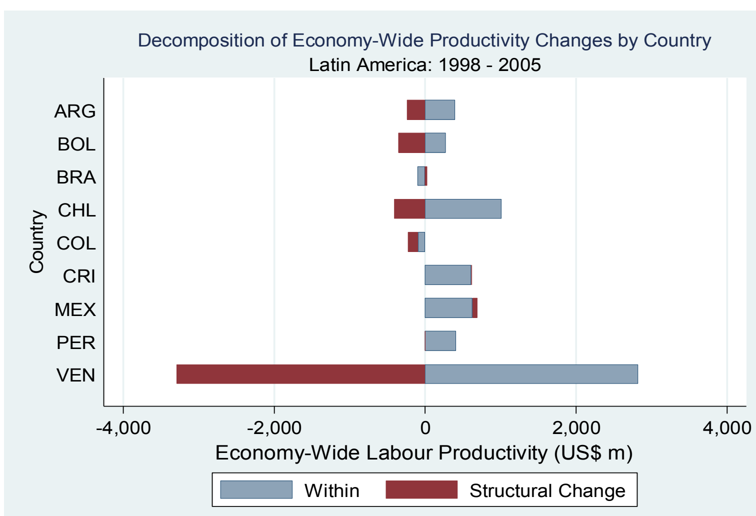
Figure A3.1 Decomposition of Economy-Wide Productivity Changes by Country for Each Region for 1990-1997 and 1998-2005[63]

LATIN AMERICA

(i) 1990 - 1997 Period



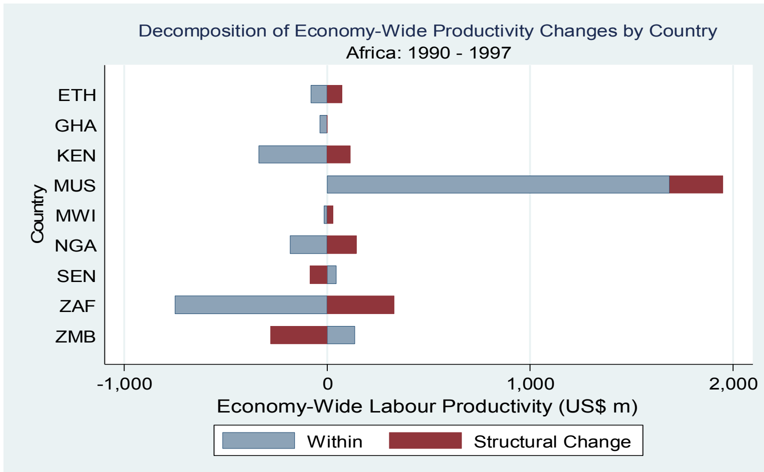
(ii) 1998 – 2005 Period



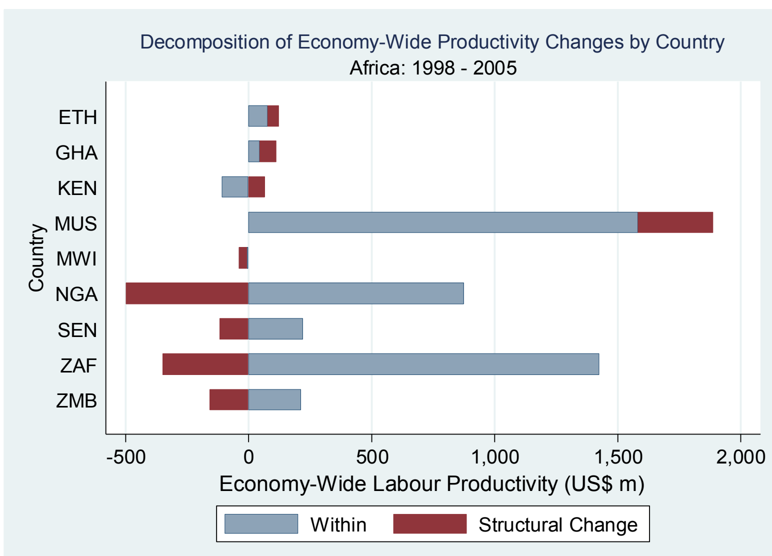
[63] See Table A3.1 in Appendix 3.1 for Country Abbreviation Meaning

AFRICA

(iii) 1990 - 1997 Period

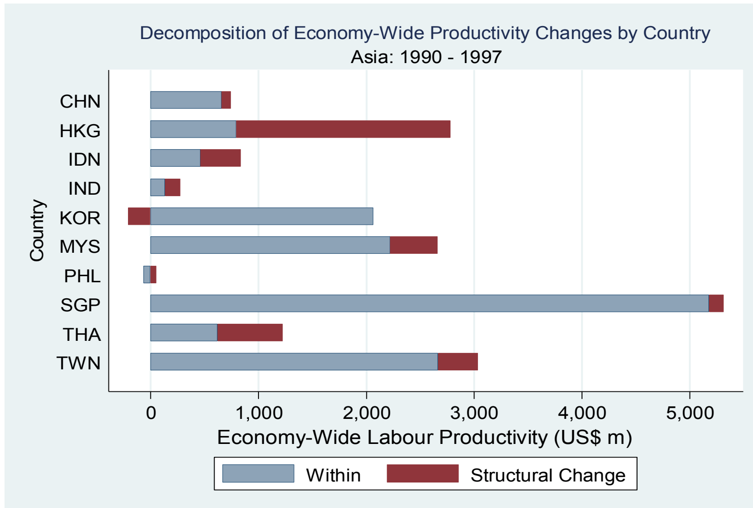


(iv) 1998 – 2005 Period

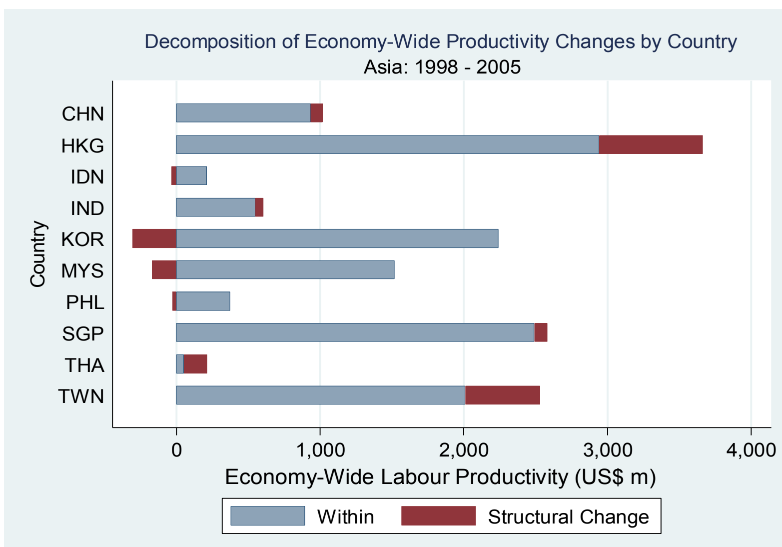


ASIA

(v) 1990 - 1997 Period

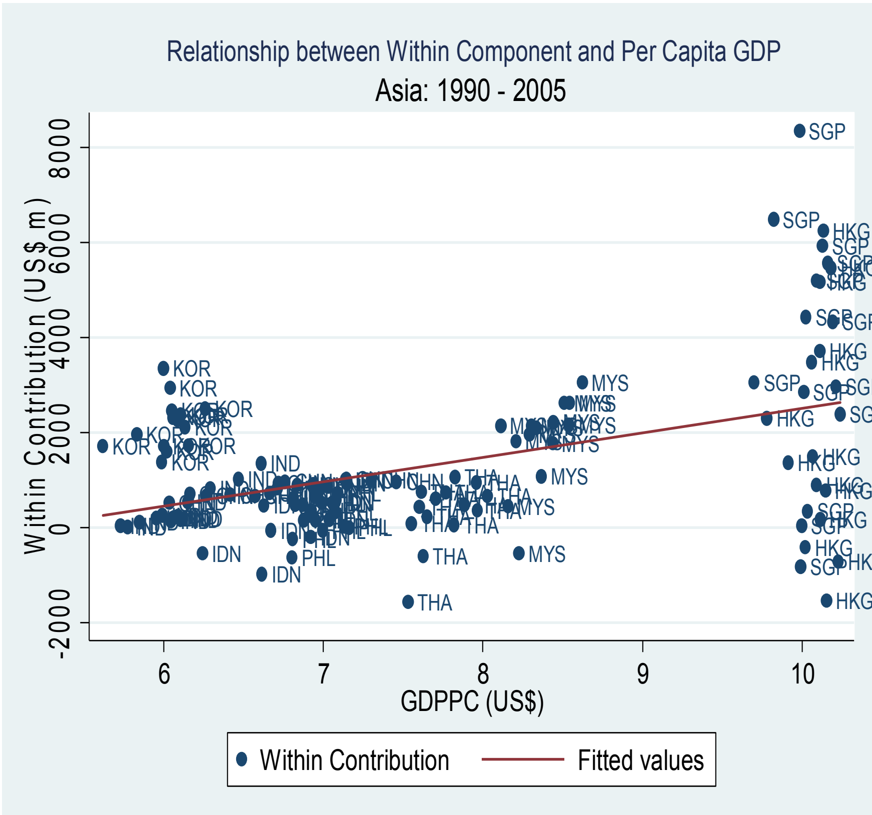


(vi) 1998 – 2005 Period



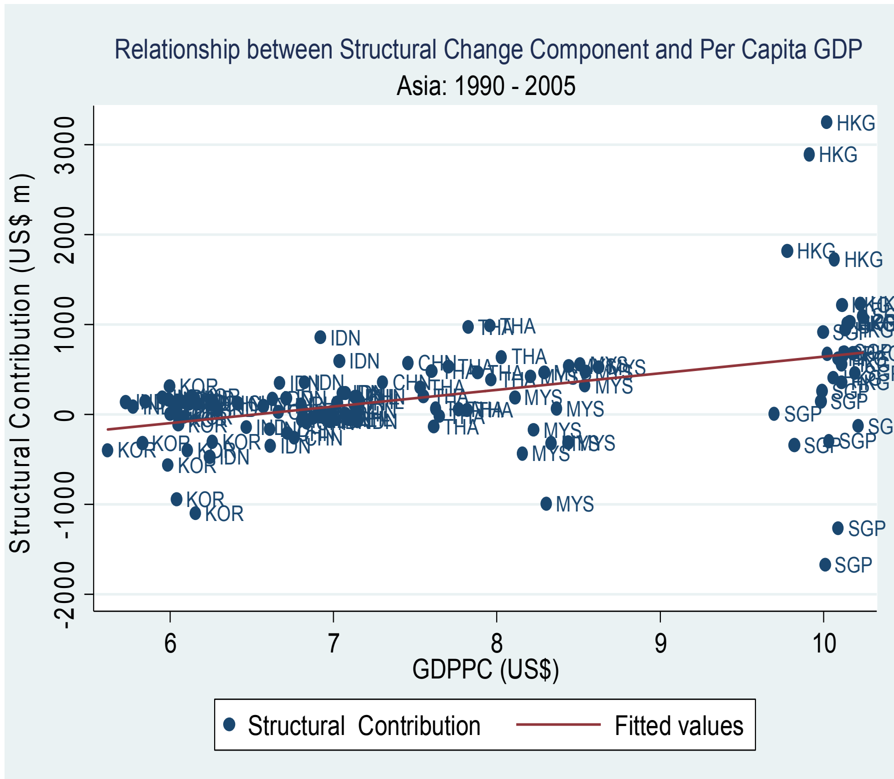
Appendix 3.3

Figure A3.2 Relationship Between Within Component and Per Capita GDP – Asia: 1990 - 2005



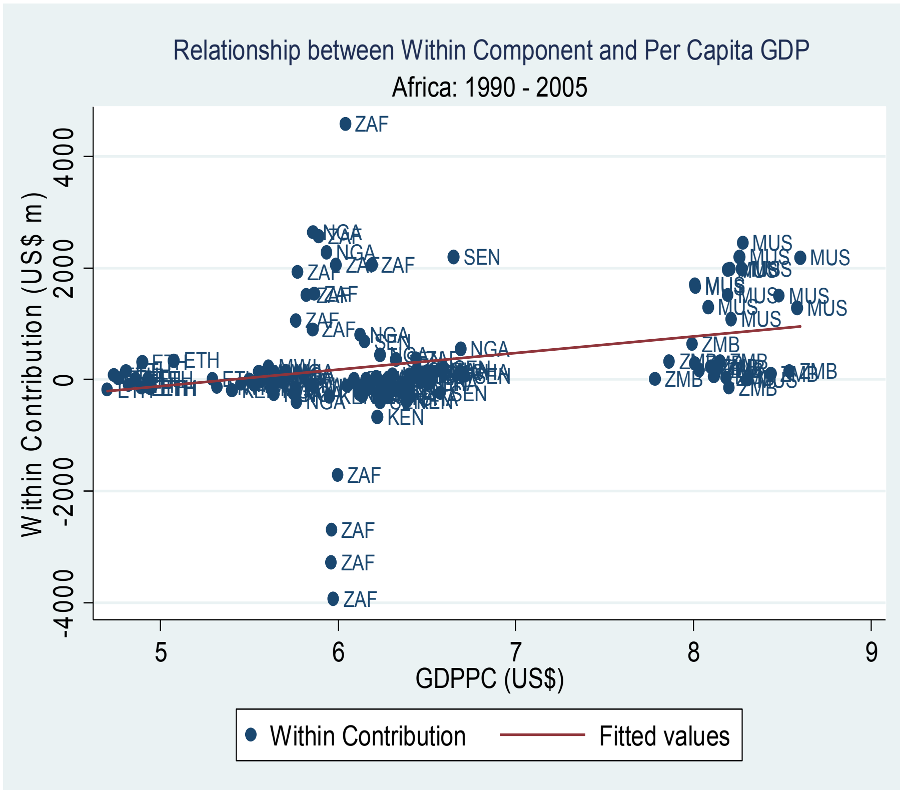
* Each observation represents the relationship between GDP per capita (US$) and the within component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

Figure A3.3 Relationship Between Structural Component and Per Capita GDP – Asia: 1990 – 2005



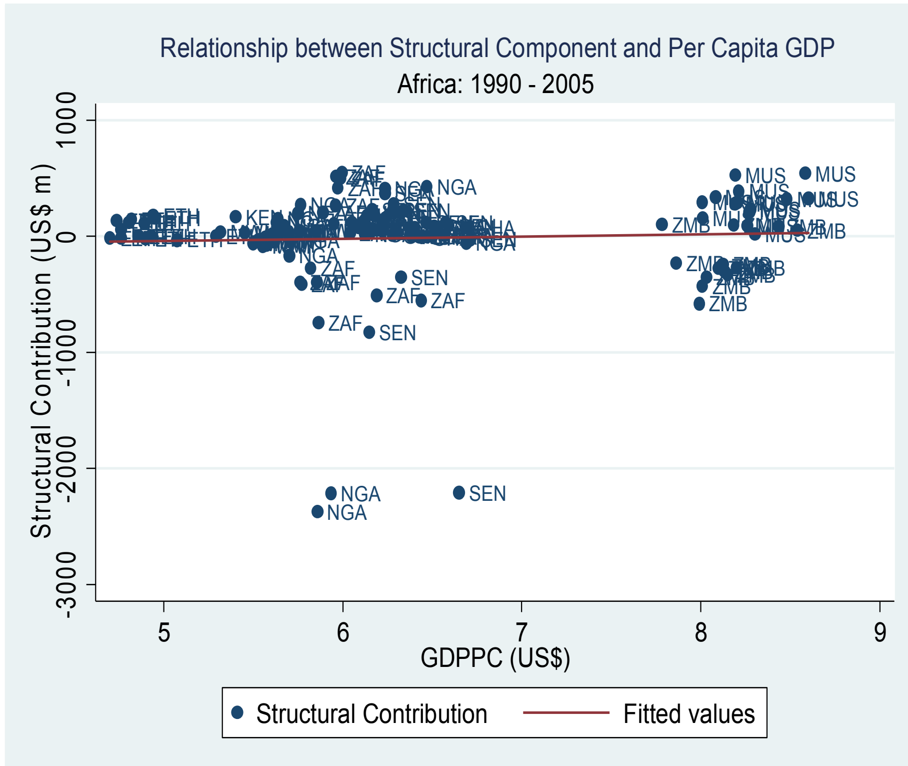
* Each observation represents the relationship between GDP per capita (US$) and the structural change component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

Figure A3.4 Relationship Between Within Component and Per Capita GDP – Africa: 1990 - 2005



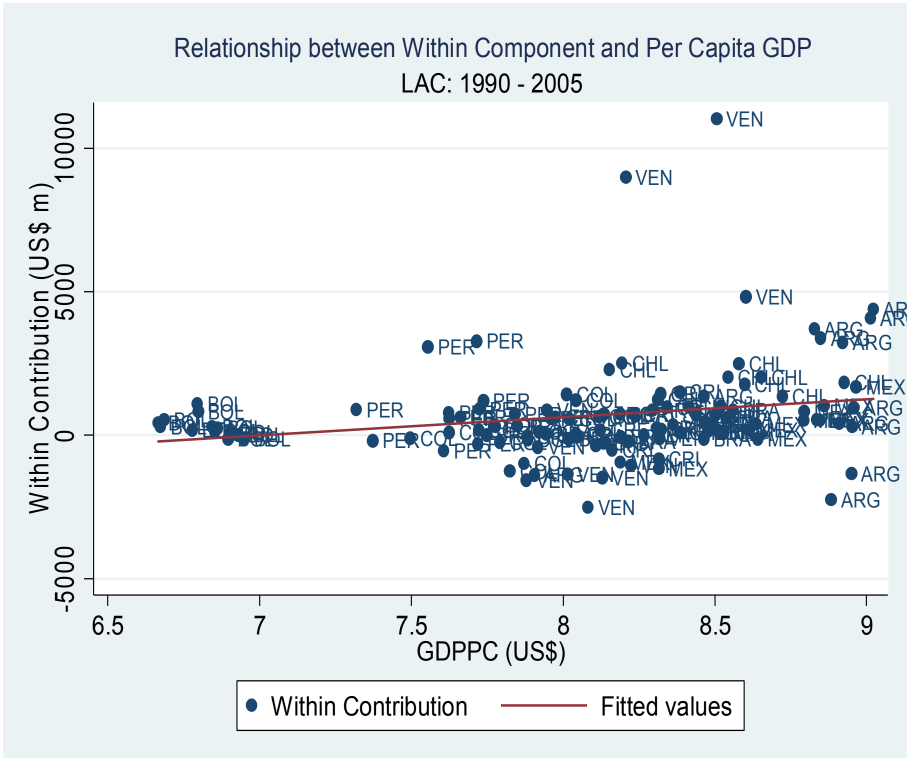
* Each observation represents the relationship between GDP per capita (US$) and the within component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

Figure A3.5 Relationship Between Structural Component and Per Capita GDP – Africa: 1990 - 2005



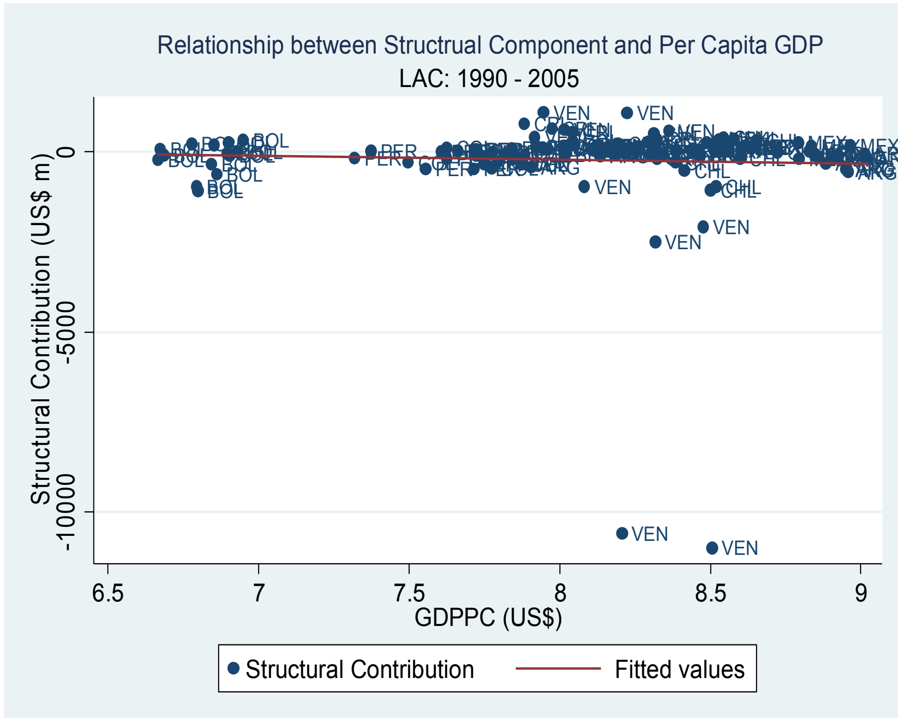
* Each observation represents the relationship between GDP per capita (US$) and the structural change component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

Figure A3.6 Relationship Between Within Component and Per Capita GDP - Latin America: 1990 - 2005



* Each observation represents the relationship between GDP per capita (US$) and the within component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

Figure A3.7 Relationship Between Structural Component and Per Capita GDP - Latin America: 1990 - 2005



* Each observation represents the relationship between GDP per capita (US$) and the structural change component of economy-wide labour productivity (US$) per sample country for each sample year (1990 to 2005).

Chapter 4 : The Relationship between Trade and the Components of Economy-Wide Productivity

4.1 Introduction

In the previous chapter, we decomposed economy-wide labour productivity into two components; namely the structural change and the within-sector components in an attempt to analyse the relationship between structural change and economy-wide productivity among different regions. To do this, we utilized shift-share analysis, usually employed to highlight differences in labour productivity across regions. We found that for some specific countries and time periods, structural change, one of the components of economy-wide productivity moved in the "wrong or unexpected direction" – that is, in a manner that adversely affected productivity growth. This type of structural change occurs when changes in employment shares are negatively correlated with productivity levels. As a consequence for these economies, per capita Gross Domestic Product (GDP) and hence economic growth was slower than that of the economies experiencing reallocations of employment towards higher productivity sectors. In this chapter, we investigate one possible avenue for such varied outcomes; specifically the differential effects of international trade on productivity growth and its components.

Given the findings of Chapter 3, in particular, the disparity in the contributions of the sources of aggregate productivity, we recognise the need to understand the productivity enhancing effects of trade. Trade theory suggests that increased international competition increases aggregate efficiency, as inefficient firms are forced to improve their productivity or face exclusion from the market. The first step to understanding the relationship between trade and productivity growth requires an understanding of the components of aggregate productivity. This was covered in our study in Chapter 3. Subject to our a priori beliefs on the effect of international trade on productivity growth, we now shift our focus away from simply analysing the behaviour of the components of economy-wide productivity across regions, towards considering one of the most contentious issues in the Economics discipline; that is, the relationship between trade and economic growth. An investigation involving sources or components of aggregate growth is not only interesting, but also more informative as policies can be better designed and implemented, thereby producing more favourable results. Since most of the existing literature focuses on aggregate growth, this represents the primary contribution of this Chapter to the literature.

Productivity enters the trade-growth nexus as differences in productivity growth are believed to contribute to varying economic performance across countries. In the past few decades, the world economy has experienced a phenomenon, whereby some countries have realised rising per capita GDP, while others lag behind, failing to achieve any significant developments in their economic standings (Krueger, 2004). These observations have resulted in a plethora of questions being raised about the different factors driving economic growth, including productivity.

Advocates for more trade openness, have contributed both theoretical and empirical evidence to demonstrate that the implementation of policies that promote trade growth improves economic performance in the long-run. Increased openness fosters a transfer of technology from industrial countries to developing ones. As a consequence, growth in the productivity levels of developing economies relies on the rate of technology acquisition. International trade is believed to be the tool that fosters that transfer, and as such, more liberal trade policies should enable higher levels of productivity growth in developing regions.

The role that trade plays in the transmission of technology is generally accepted and the effects of increased trade also extend to its effect on intermediate inputs. A reduction in tariffs on intermediate inputs increases productivity via lower product prices and improved learning, variety or quality effects. Such productivity can increase due to the foreign technology embodied in those inputs (Amiti and Konings, 2007). Increased trade is believed to reduce X-inefficiency and market shares are reallocated to more efficient producers and as such, domestic producers in import-competing sectors must become more competitive (Sekkat, 2010).

Reservations, however, remain about trade's role in enhancing productivity. One such relevant reservation is that developing countries possess comparative advantages that lie in traditional sectors with low skill, technology and growth potential. Free trade could therefore encourage specialisation in these sectors and limited productivity growth. This would only serve to widen the gap between rich and poor countries (Choudhri and Hakura, 2000).

There exist micro-level studies such as Tybout (2000) and Topalova (2011) that investigate the trade-productivity relationship and argue that efficiency increases across firms with the removal of trade barriers. Another such study is that of Melitz and Ottaviano (2008), who use a monopolistically competitive model of trade with heterogeneous firms and endogenous mark-ups to show that market size induces changes in industry performance measures. Larger competition due to trade liberalisation results in lower average mark-ups and higher aggregate productivity.

On a more macro level, there is a lack of empirical evidence relating international trade to the components of economy-wide productivity growth. Rather than attempting to find causal relationships papers such as that produced by the Organisation for Economic Co-operation and Development (OECD, 2005) conduct studies on trade and structural adjustment with the aim of identifying the requirements for successful adjustment in developed and developing economies. Other studies engage in individual country analysis in an attempt to identify patterns of structural change across different developing countries and its role in economic development (McCaig and Pavcnik, 2003; Osei and Jedwab, 2013). Even fewer studies make the within component of economy-wide productivity one of their central point of investigation (van de Klundert, 2013; Dabla-Norris et. al 2013). Studies investigating trade-growth relationships tend to analyse the relationship between trade and overall income growth, usually measured by GDP or GDP per capita (Frankel and Romer, 1999; Brunner, 2003; Furusawa et. al, 2014). Decades later in the research arena, following the rapid growth in the world economy after the Second World War, the openness-growth linkage therefore, still attracts attention; however, this usually relates to trade's relationship with aggregate growth. In addition, it comes with a reversal of sentiment on the apparent relationship between the two variables. Opinions of economists are now far from unanimous regarding the relationship trade openness and economic growth.

In their criticisms of the "foundation" trade-growth literature, Rodriguez and Rodrik (2001) and Easterly (2005) point out that techniques used in the debate thus far, are inadequate in many ways.[64] The data is scant spatially and temporally, and cross sectional studies are plagued by endogeneity problems. Our study serves to fill this gap in the literature by capitalising on a new geography-based instrument developed by Feyrer (2009) to investigate the relationship between trade growth and growth in aggregate productivity and its components.

Our paper is organised as follows. We start by highlighting the main criticisms of the Rodriguez and Rodrik (2001) paper. The following section thoroughly describes the methodology employed to conduct this study and our model is specified. Next, we provide a description of the data, followed our gravity

[64] Some of the papers critiqued by Rodriguez and Rodrik (2001) include Sachs and Warner (1995), Frankel and Romer (1999), and Dollar (1992).

estimations and relevant summary statistics. In the sections that follow, our estimated results on the effects of trade and productivity growth and its components are presented and analysed, followed by further robustness checks. We then finally conclude.

4.1.1 Describing the Shortcomings of the "Foundation" Trade Growth Literature

In a frequently cited paper, by Rodriguez and Rodrik (2001), it was argued that earlier literature analysing the openness-growth relationship employed simple measures of trade barriers that do not enter significantly in well-specified growth regressions. Specifically, the argument is that these measures of trade barriers are highly correlated with other sources of poor economic performance. Furthermore, the empirical methods employed to provide the trade policy and growth link, contain shortcomings which, if removed, results in significantly weaker findings. The popularity of this paper led to growing concerns, such that the recent trade literature relies on more creative approaches such as constructing alternative indicators to openness and testing robustness through the use of a wide range of empirical approaches.

Edwards (1993) analyses the openness-growth literature of the 1980s. His evaluation was highly negative, highlighting the fact that much of the cross-country regression-based studies have been plagued by empirical and conceptual shortcomings, which weaken the policy impact of the cross-national econometric research. The cross-national econometric studies of that time focus on the relationship between trade volumes such as exports and growth rather than trade policy. Rodriguez and Rodrik (2001) picks up where Edward's (1993) survey leaves off and examines four of the best known papers in this field in an attempt to analyse their findings based on the following question:

"Do countries with lower policy-induced barriers to international trade grow faster, once other relevant country characteristics are controlled for?"

Arguing that the nature of the relationship between trade policy and economic growth is still an open question, Rodriguez and Rodrik (2001) use an endogenous-growth model, often thought of as having provided the link between trade openness and long run growth, to highlight why they believe that such models provide an ambiguous answer. They argue that the answer about whether trade promotes innovation in a small open economy depends on whether the resources of that economy are pushed towards, or diverted away, from activities generating long run growth by the forces of comparative advantage.

Rodriguez and Rodrik (2001) use a simple model of a small open economy with learning-by-doing, analysing the implications of changing the import tariff on growth.[65] In this model a two sector economy agriculture (a) and manufacturing (m) is assumed, with manufacturing being subjected to learning

[65] A simplified version of Matsuyama (1992) who, however, simply compared free trade with autarky. Rodriguez and Rodrik (2001) analyse the growth implications of varying the import tariff.

by doing that is external to individual firms within the sector, but internal to manufacturing as a whole.[66] Labour is the only mobile factor and the economy's labour endowment is normalized to one. Each sector's production function is given as follows:

$$X_t^m = M_t n_t^\alpha \tag{4.1}$$

$$X_t^a = A\,(1-n)^\alpha \tag{4.2}$$

Where X represents output, n is the manufacturing labour force, α each sector's share of labour in value-added assumed identical and t represents time. A, agricultural productivity, may reflect the level of technology, land endowment and climate change, is constant over time and treated as an exogenous parameter. M_t, the productivity coefficient in manufacturing is a state variable and evolves according to:[67]

$$\dot{M}_t = \delta X_t^m \qquad \delta > 0 \tag{4.3}$$

where an overdot represents a time derivative. δ captures the strength of the learning effect which is purely external to individual firms that generate them. Rodriguez and Rodrik (2001) assume that the economy possesses an initial

[66] Description of model presented below taken from Rodriguez and Rodrik (2001)

[67] For simplicity, it is assumed that M_t never depreciates. Introducing depreciation generates possibility of a growth trap in the model.

comparative disadvantage in manufacturing, and the price of manufactures is normalized to one. Given an ad valorem tariff on importable manufactures, τ, the domestic relative price of manufactured goods is $1+\tau$. Equality of the value marginal products of labour in both industries is required for instantaneous equilibrium:

$$A(1-n_t)^{\alpha-1} = (1+\tau)M_t n_t^{\alpha-1}. \tag{4.4}$$

An increase in the import tariff has the effect of increasing the allocation of the economy's labour to the manufacturing sector, that is:

$$\frac{dn_t}{d_\tau} > 0 \tag{4.5}$$

For a constant level of τ, n_t evolves according to:

$$\hat{n}_t = \frac{\delta}{1-\alpha}(1-n_t)n_t^{\alpha} \tag{4.6}$$

where $\widehat{\ }$ represents proportional changes. Let Y_t denote the economy's output value evaluated at world prices:

$$Y_t = M_t n_t^{\alpha} + A(1 - n_t)^{\alpha} \tag{4.7}$$

As such, the instantaneous growth rate of output at world prices can be expressed as follows:

$$\hat{Y}_t = \delta\,(\lambda_t + \frac{\alpha}{1-\alpha}(\lambda_t - n_t))n_t^{\alpha} \tag{4.8}$$

where λ_t is manufacturing's share of output in total output when both are expressed at world prices, that is, $\lambda_t = X_y^m / Y_t$.

If $\tau = 0$, the instantaneous growth rate simplifies to $\hat{Y}_t = \delta \lambda_t n_t^{\alpha}$, which is strictly positive when $n_t > 0$. Growth is a result of the dynamic effects of learning. A larger manufacturing base *n*, results in faster growth. Small tariffs would positively affect growth via this channel as it increases the manufacturing base, i.e. increases n_t.

When $\tau > 0$, manufacturing output share at world prices is less than labour share in manufacturing and $\lambda_t < n_t$. As such, the second term expression in the expression for $\hat{Y}_t$ is negative. The intuition is such that, a production-side distortion in the allocation of the economy's resources is imposed as a result of the tariff. For any gap between λ_t and n_t, the productive efficiency cost of this distortion rises as manufacturing output gets larger. The tariff therefore has two contradicting effects on growth.

The model above presented by Rodriguez and Rodrik (2001) sought to clarify a range of issues. The authors show how to write a simple model that generates conclusions supported by opponents of trade openness, such as the argument that free trade hampers some countries' economic opportunities, especially so for countries that lag in terms of technological development. Additionally, they illustrate the absence of a determinate theoretical link between trade protection and growth if real-world occurrences such as learning and technological change (all captured by the learning-by-doing externality) are accounted for. They highlighted the exact sense through which trade restrictions distort market outcomes. In particular, trade barriers alter the domestic price ratio by increasing the domestic price of import-competing activities relative to the domestic price of exportables, thereby having reallocation effects.

One of the studies analysed by Rodriguez and Rodrik (2001) was that of Dollar (1992). Dollar (1992) creates two indices, whose variations captured the cross-national differences in the restrictiveness of trade policy. Rodriguez and Rodrik (2001) find that the first measure, an index of real exchange rate distortion implemented using comparative price levels, has serious conceptual flaws as a measure of trade restrictions and is not a robust correlate of growth. They argue that a comparison of price indices for tradables is informative about levels of protection only under very restrictive conditions that are unlikely to hold in practice. In summary, this index appropriately measures trade restrictions if three conditions hold:

(1) there are not export taxes or subsidies in use
(2) the Law of One Price holds continuously
(3) there are no systematic differences in national price levels due to transport costs and other geographic factors.

The second measure, an index of real exchange rate variability, calculated as the coefficient of variation of the annual observations of first measure, is argued by Rodriguez and Rodrik (2001) to be robust to alterations in specifications unlike the first index.

Another paper critiqued by Rodriguez and Rodrik (2001) is the highly cited Sachs and Warner's (1995) paper, where the authors construct an openness index that combines information about several aspects of trade policy in order to solve the measurement error problem. The Sachs and Warner (1995) openness indicator is a zero-one dummy that takes the value of zero if the economy is closed based on any one of the following criteria:

(1) it had average tariff rates higher than 40 percent
(2) its Non-Tariff Barriers covered on average more than 40 percent of imports

(3) it had a socialist economic system
(4) it had a state monopoly of major exports
(5) its black market premium exceeded 20 percent during either the decade of the 1970s or the decade of the 1980s.

Sachs and Warner (1995) view these criteria as representative of the various ways in which policy makers close their economies. The critique of the Sachs and Warner (1995) paper was that the statistical power is driven not by direct indicators of trade policy but rather by components (4) and (5). The significance of these indicators is linked to growth via factors such as macroeconomic problems (no. 5) and location (no. 4) and as a consequence, the Sachs and Warner (1995) index is more of a proxy for a number of policy and institutional differences and it yields an upward-biased estimate of the effects of trade restrictions.

The general notion is that barriers should be dismantled by governments and it is therefore imperative that there is the question as to how well the evidence supports the presumption that this will increase growth rates. Rodriguez and Rodrik (2001) argue that the literature is largely uninformative regarding the question posed and that there are flaws based on the measurement of trade policy. Furthermore, and of equal importance, is the conflict regarding the direction of causality between trade and growth resulting in some endogeneity issues.

The implication of the study conducted by Rodriguez and Rodrik (2001) is such that, increased incidence of trade openness, suggests that the level of trade occurring among these countries reflect other factors such as growth patterns, changing geography, economic size and transport costs. Additionally, the problem of reverse causality between trade and economic growth implies that caution is required when interpreting empirical findings. Feyrer (2009), to compensate for these limitations highlighted by Rodriguez and Rodrik (2001), introduces a time-varying instrument based on geographic fundamentals that allow him to conduct investigations in a panel regression of per capita GDP on trade. Feyrer (2009) finds that trade has a significant effect on income with an elasticity of roughly one half.

In this chapter, we strive to deal with the endogeneity problem discussed above by employing this novel instrument for trade. We have identified an avenue for further research absent in the trade and growth literature that allows us to differentiate our paper from the existing literature. This regards investigations surrounding the behaviour of the components of economy-wide labour productivity growth in response to trade growth. Most of the literature focuses on aggregate growth as measured by GDP or per capita income. It is important that we decompose aggregate productivity growth into its components, namely the structural and within components given that, as discussed in Chapter 3, the two components are of differential relative importance in their contributions to aggregate productivity for developing and developed countries. Both components work in tandem with each other allowing resources to be distributed and used more efficiently.

We use this appropriate exogenous instrument for trade, generated by Feyrer (2009), through the employment of an improved benchmark gravity model, to examine the relationship between trade growth and the growth in economy-wide productivity and its components. By engaging in this study, we are able to analyse the effects of trade on the productivity growth and its components, and to do so free from the criticisms met by Frankel and Romer (1999).

4.2 Methodology and Model Specification

4.2.1 Solving the Problem of Omitted Variable Bias in the Trade-Growth Literature

Feyrer's (2009) points out that many economists over time, have agreed that there is a positive relationship between trade and income. However, a common conflict arises regarding the direction of causality. Frankel and Romer (1999) produce one of the most influential papers by using a geographic instrument to tackle this issue. To predict trade between bilateral pairs, they use the distance between countries and from this, construct an exogenous instrument for aggregate trade in each country pairs. The justification is that geography is a powerful determinant of a country's bilateral and overall trade. Furthermore a country's geographical characteristics have important effects on trade that are plausibly uncorrelated with other determinants of income. Frankel and Romer (1999) instrument trade share by estimating the gravity equation, regressing bilateral flows on a number of geographic characteristics.[68] Fitted trade values are then aggregated across partners to create an instrument for actual trade share.

The concern regarding Frankel and Romer's (1999) paper is that the instruments may not be valid because they may be correlated with geographic differences in outcomes that are not generated through trade. For example, countries may have low income due to unproductive colonial institutions influenced by geography. Geography may also affect the quantity and quality of natural endowments. This instrument may therefore cause the Instrumental Variation (IV) estimates to be biased upwards unless these additional channels are explicitly controlled for. Rodriguez and Rodrik (2001) by entering these additional variables into the equation, show that their results obtained using Frankel and Romer's (1999) instrument are not robust to controlling for omitted variable bias.[69] Specifically Rodriguez and Rodrik (2001) find that IV coefficient estimates become statistically insignificant and point estimates on trade are reduced below their OLS counterparts.

The above criticism, specifically, that Frankel and Romer's (1999) instrument might be correlated with other time invariant country characteristics that affect growth, implies the exclusion restriction is therefore violated and the IV are unreliable. Feyrer (2009), to correct for this problem of omitted variable bias, generates a time varying geographic instrument based on geographic

[68] Geographic characteristics used were: country size, their distance from one another, whether they share a border and whether they are landlocked.
[69] The variables used were distance from the equator, the percentage of a country's land area that is in the tropics and a set of regional dummies.

fundamentals, which allows the examination of trade and income to be done in a panel. This instrument allows for the inclusion of country fixed effects, which controls for all time invariant variables that are correlated with income.

Central to Feyrer's (2009) analysis is the idea that distance is not a static concept. Interacting *physical geography and transportation* determines *effective distances* around the world. Therefore technological change "alters the shape of the globe". He exploits the case of air transportation as it has significantly altered the effective distances between countries in comparison to the era where only ships were used. Air freight prices have been falling and values of air trade have been rising. The cost of air freight fell by a factor of ten by 2004 from 49 years prior with less rapid falls in ocean freight prices leading to shifts towards air transportation (Hummels, 2007). Regressions of bilateral trade over time show that the relative importance of distance of air over sea has been increasing. Changes in transportation technologies shared by all countries will allow the time series changes in *effective geography* to be exogenous with respect to any particular country. These changes are the result of the interaction of transportation technology and geography and from this an exogenous instrument for bilateral trade can be created. The time variant component comes from the changes in technology, which are shared equally across all countries but result in diverse consequences across country pairs based on geographic differences. Feyrer (2009) uses this to create a panel version of Frankel and Romer (1999) and employs this to identify the effect of trade on income.

4.2.2 Creating an Exogenous Geography-Based Instrument for Trade using the Gravity Model

The starting point of creating this instrument is the use of the gravity model. There has been a resurgence of research activity seeking to relate bilateral trade flows to trade costs. Gravity models have been benchmarked and have been used in both the theoretical and empirical literature to analyse the effects of different economic disturbances on trading volumes. More recently, they have been used as a measure of trade policy and its effects on economic outcomes. The basic idea is that the distance between two countries has a strong influence on the volume of bilateral trade.

In its most basic form, the gravity model posits that bilateral trade between any country pair, i and j, can be explained by the product of the economic sizes of the two countries, divided by the distance between the major economic centres of both countries. This can be expressed as follows:

$$X_{ij} = \beta_0 (Y_i)^{\beta_1} (Y_j)^{\beta_2} (\tau_{ij})^{\beta_3} \varepsilon_{ij} \tag{4.9}$$

where X_{ijt} is the value of bilateral trade between country *i* and country *j*, and Y_i and Y_j are the incomes of country *i* and country *j*. τ_{ij} is the bilateral physical distance between the economic centers of i and *j*. It is a bilateral resistance term representing trade costs existing between i and *j*. ε_{ij} is a random disturbance term, assumed to be normally distributed.

This intuitive gravity model takes the log-linearized form:

$$\ln X_{ij} = \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(\tau_{ij}) + \varepsilon_{ij} \qquad (4.10)$$

$$\begin{aligned}\ln(\tau_{ij}) = \; & b_1 \log(distance_{ij}) + b_2(contig_{ij}) \\ & + b_3(comlang_{ij}) + b_3(colcur_{ij}) \\ & + b_4(colhist_{ij})\end{aligned} \qquad (4.11)$$

X_{ij} and τ_{ij} are as previously defined. Equation 4.11 includes dummies which equal to one if countries share a common border ($contig_{ij}$), a common language ($comlang_{ij}$), are in a colonial relationship ($colcur_{ij}$) or ever were in a colonial relationship ($colhist_{ij}$). The intuition is that in equation (4.10) $\beta_1 > 0$, $\beta_2 > 0$ and $\beta_3 < 0$. Empirical estimation of this basic model highlights two facts that have been accepted in the International Economics literature. That is, that trade flows are increasing in market size and decreasing in distance.

The basic gravity model, however, is not without its limitations. Specifically, it considers trade costs between countries *i* and *j*. It however, does not consider the effects of changes in trade costs between *i* and *k*. By construction, it suffers from omitted variable bias. Anderson and van Wincoop (2003) added some fundamental dimensions to the basic gravity model to deal with the above issue that it posed. Their main contribution is the inclusion of importer and exporter multilateral resistance terms that serve to account for the presence of unobserved trade barriers. The model assumes that countries are representative agents and that import and export goods are differentiated by place of origin.[70] Each country specialises in producing one good. The model also assumes preferences that are identical, homothetic and approximated by a Constant Elasticity of Substitution (CES) function.

The gravity relationship estimated by Anderson and van Wincoop (2003) is:

$$X_{ij} = \frac{Y_i Y_j}{Y_w} \left(\frac{\tau_{ij}}{P_i P_j}\right)^{1-\sigma} \tag{4.12}$$

where X_{ij} Y_i, Y_j and τ_{ij} are as previously defined. Y_w is world income. P_i and P_j are country-specific multilateral resistance terms capturing the fact that exports and imports depend on trade costs across all possible export markets and suppliers respectively. P_i and P_j are not observed and must be estimated. They do not correspond to any price indices collected by national statistical agencies. Log linearized the model is:

$$\begin{aligned} \ln X_{ij} = \ln(Y_i) + \ln(Y_j) - \ln(Y_w) \\ + (1-\sigma)\left(\ln(\tau_{ij}) + \ln(P_i) + ln(P_j)\right) \end{aligned} \tag{4.13}$$

where all variables in equation 4.13 are as previously defined above.

[70] Representative agents in a model act in such a manner that their cumulative actions might as well be the actions of one agent maximising its expected utility function. Representative agents are usually constructed by Economists to deal with the complicated issue of aggregation.

4.2.3 Our Model Specification

Using the baseline gravity model (equation 4.13) to provide an exogenous instrument for trade policy, Feyrer (2009) posits that the bilateral resistance term, τ_{ij}, is a function of air distance with the exact relationship changing over time. A key assumption is that all country pairs share the same bilateral resistance function or are subject to the same bilateral trade cost and trade-resistant variables such as common language for each time period,

$$\ln(\tau_{ij}) = f_t(airdist_{ij}) = \beta_{air} \ln(airdistance_{ij}) + \beta Q_{ij} \qquad (4.14)$$

Changing transportation technology, which is common to all countries, drives changes in the function over time. As with the classic gravity literature, the bilateral resistance term is assumed to be log linear. Feyrer (2009) alters the model by using air distances and by allowing the coefficient to be time varying to capture the changing technology.[71] Q_{ij} is a set of control variables representing time invariant characteristics. Evidence in the literature suggests that these observables impact the flow of trade.

Following the literature, the P and Y terms can be controlled for in many different ways. Historically, the proxy for the multilateral resistance term was

[71] Feyrer (2009) also included sea distance in equation (4.14) to emphasise the increasing importance of air distance over time. We did not include this variable as Feyrer (2009) provided great detail on sea distance used together with air distance and on its own. The use of this exogenous instrument is secondary to our main contribution of investigating the components of economy-wide productivity and due to data limitations we only included air distance in the creation of our instrument.

a remoteness variable, which progressively appeared inadequate once the theoretical modelling of gravity became clearer (Head and Mayer, 2014). Modern practice has been moving towards the use of fixed effects to account for the specific country multilateral resistance terms. The coefficient of the dummies for the importer and exporter should be reflective of the multilateral resistance for each country.[72] Its consistency with theory and easy implementation led to rapid adoption in empirical trade research. Using importer and exporter fixed effects does not require strong structural assumptions on the underlying model but still complies with general gravity. Using fixed effects will lead to consistent estimates of the components of Q_{ij}, as long as the precise modelling structure yields an equation in its multiplicative form such as equation (4.12). They correct for biases that arise for a panel rather than a cross-section (Baldwin and Taglioni, 2006).

We control for the P and Y terms using country dummies implicitly assuming that they are time invariant. Common growth rates of all sample countries are controlled for using time effects with idiosyncratic growth rate differences going into the error term. The second stage regressor is the idiosyncratic growth differences and accounting for them econometrically in trade regressions will contaminate predictions in the second stage.

The equation to be estimated is therefore:

[72] See Table A4.1 in Appendix 4.1 for different proxies for multilateral resistance terms

$$\ln X_{ijt} = \beta_0 + \beta_{1t} ln(airdist_{ij}) + \beta_2 contig_{ij} + \beta_3 comlang_{ij} + \beta_4 colcur_{ij} + \beta_5 colhist_{ij} + \gamma_i + \gamma_j + \gamma_t + \varepsilon \quad (4.15)$$

The dependent variable, X_{ijt}, is the logarithm of the exports from exporting country i to importing country j in time t reported in current US dollars. $airdist_{ij}$ represents bilateral great circle distances (the measure of air distance) between countries i and j and it improves on previous literature by allowing the coefficients to be time varying.[73] We include a dummy $contig_{ij}$ equal to one for countries sharing a common border. We include other dummy variables equal to one if the country pairs share a common language ($comlang_{ij}$), if they are in a colonial relationship ($colcur_{ij}$) and if they were ever in a colonial relationship ($colhist_{ij}$). Compound hypothesis tests show that these variables do indeed matter for bilateral trade. Equation (4.15) includes country (γ_i, γ_j) and time (γ_t) fixed effects.

It is important to notes that equation (4.15) does not seek to find causal estimates of the effect of distance on trade, but to describe the correlation between these two variables and then use that variation to generate an exogenous instrument for trade.

[73] See Footnote 71

4.2.4 Our Exogenous Instrument for Trade

The instrument is constructed by estimating equations (4.16) and generating fitted values for the log of bilateral trade for each pair of countries in each year. Predicted trade volumes are aggregated to arrive at a prediction for aggregate trade in each year. This instrument provides a full panel of trade predictions used to estimate the impact of trade on the components of growth.

Following Frankel and Romer (1999), we sum unlogged versions of these bilateral relations to derive a prediction for total trade for each country. Actual trade values are similarly summed to arrive at a value for total trade.

$$\begin{aligned} \hat{X}_{it} &= \sum_{i \neq j} e^{\hat{\gamma}_t + \hat{\gamma}_i + \hat{\gamma}_j + \hat{\beta}_{3t} * \ln(airdist_{ij})} \\ &= e^{\hat{\gamma}_t} e^{\hat{\gamma}_i} \sum_{i \neq j} e^{\hat{\gamma}_j} \, e^{\hat{\beta}_{3t} * \ln(airdist_{ij})} \end{aligned} \tag{4.16}$$

Equation (4.16) presents predictions when individual country dummies are used. Time and own country effects can be taken outside the summation. Time and country effects are included in the second stage and will therefore be removed in the country level productivity regressions. Weighted average air distance with weights derived from the value of the dummy for the other country in the pair remains inside the summation. Idiosyncratic time variation is provided by the changing $\hat{\beta}'s$ common to all countries and which represent technological shocks to all countries. By the interaction of physical geography with changing technology, we generate variation for a variable that would otherwise be dropped because it is constant.

The problem of reverse causality does not exist within these predictions. Second-stage time and country dummies controls for the terms outside the summation. The bilateral distance measures are time invariant and exogenous within the summation. Dummy values for each of the other sample countries and $\beta's$ are shared by all sample countries.

The time variation is exogenous for the purpose of estimating the effect of trade of the components of growth. Air travel has risen in importance reflecting technological change independent of any particular country. It, however, affects countries differently based on their exogenous geographic characteristics. Countries physically located close to the rest of the world benefit more from the technological change.

4.3 Data

4.3.1 Groningen Data on Labour Productivity

The analysis employs a panel of 32 countries utilizing data on employment, value added and labour productivity. Value added and productivity are both presented in year 2000 PPP US dollars. The period covered by this study is 1965 to 2006.

The main dataset is derived from the Groningen Growth and Development Centre (GGDC).[74] The dataset employed is the 10-Sector Productivity Database by Marcel P. Timmer and Gaaitzen J. de Vries (2009).[75] It provides a long-run internationally comparable dataset on sectoral productivity performance across 10 sectors. It covers countries in the Asian, European and Latin American regions and the United States (US).

The variables included in the dataset are reported annually. The variables are value added, output deflators and persons employed for ten sectors. The dataset consists of a series for 10 countries in Asia, and 9 each in Latin America and Europe, and the United States. Asian and Latin American data are based on the Timmer and de Vries (2007) cross-country database on productivity and sectoral employment in Asia and Latin America. The data for

[74] Feyrer (2009) used the data provided by Glick and Taylor (2008) who employed the gravity model to study the contemporaneous and lagged effects of war on bilateral trade.
[75] See Table A4.4 in Appendix 4.2 for a list of the GGDC's sector coverage.

US and Europe is based on an update of Bart van Ark (1996). The dataset provides data from 1950; however, the annual series of some countries start at a later date.

The GGDC dataset does not provide data for China and the 9 African countries included in this analysis. We supplement the 10-Sector Database with data for these countries compiled by McMillan and Rodrik (2011). To complete this extended dataset, the authors closely followed Timmer and de Vries (2009) to ensure the provision of comparable value-added, employment and labour productivity data.[76]

4.3.2 Gravity Data

To further supplement the Groningen data with, we utilise the complete gravity dataset for all world country pairs 1948 to 2006 provided by Head, Mayer and Ries (2010). The bilateral trade data used is the International Monetary Fund's (IMF) Direction of Trade Statistics (DOTS). In the DOTS database, two values for the same trade flow from country A to B are often reported. This results when two countries report the same trade flow value. For example, country A reports its imports from B while B also reports its exports to A. Some researchers take simple averages of the two values (Glick and Taylor, 2010). Head et al. (2010), however, use the more reliable source and drop the

[76] See Appendix 4.2 for Additional Data Description. Table A4.2 in Appendix 4.2 presents a list of our sample countries. We used a reduced list of countries based on data availability.

information from the other. In the presence of zeros, the larger value reported is considered more reliable.

Exporter reported trade is adjusted as it is reported Free on Board (FOB) with imports being reported as Cost Insurance and Freight (CIF), with a 10 percent difference in value, which is the actual mean margin shown by countries reporting both values.[77] The IMF records trade in millions of US dollars with accuracy at one to two decimal places conditional on the reporting country, which with two decimal places will make the smallest value $10,000. As such the data is rounded to the nearest $10,000 with values below $5,000 becoming zero.

We restrict our analysis to the period 1965 to 2006. This time period allows us to test our hypothesis over a long time period (42 years) for 32 sampled countries. Data before 1965 possess many missing data observations, which would result in many observations being dropped. This limitation is especially present for developing countries. Using this period also allows us to correspond with the structural change data calculated from the Groningen Growth Development Centre's 10-sector database. We provide a more thorough description of the data sources employed by Head et al. (2010) below.

[77] With CIF agreements, insurance and other costs are assumed by the seller, with liability and costs associated with successful transmission paid by the seller up until goods are received by the buyer. FOB contracts relieve sellers of responsibility once goods are shipped.

4.3.3 Gravity Control Variables

GDP and population data originates from the World Bank's World Development Indicators (WDI). GDP, like trade flows, are not deflated. To compensate for missing data or problems arising from changing definitions or in countries' existence, the WDI data was supplemented by Angus Madison (2006) and Katherine Barbieri's et al. (2012) Correlates of War data.

Bilateral great circle distances (the measure of air distance) are available from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).[78] The CEPII provides several different variations for measuring the great circle distance between countries. Head et al. (2010) use the population-weighted distance, which incorporates information about the internal distribution of the population within countries.[79] CEPII also provides a set of bilateral dummies which we also employ to estimate our gravity equations. This binary variables take on value of one when two countries are contiguous, share a common language, have had a common colonizer after 1945, have ever had a colonial link, have had a colonial relationship after 1945, are currently in a colonial relationship, or share a common language.

[78] In English Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), translates to Centre for Prospective Studies and International Information

[79] Feyrer (2009) also employed the use of populated weighted distance as the measure of great circle distance.

This data comes directly from CepII's ***GeoDist*** database, which provides data on geographic elements and variables. The first dataset, ***geo_cepii***, incorporates country-specific variables for 225 countries in the world.[80] The second dataset, ***dist_cepii***, is dyadic, in the sense that it includes variables valid for pairs of countries.[81] Distance is the most common example of such a variable, and the file includes different measures of bilateral distances (in kilometres) available for most countries across the world.[82] There are two kinds of distance measures: simple distances, for which only one city is necessary to calculate international distances; and weighted distances, for which we need data on principal cities in each country. The simple distances are calculated following the great circle formula, which uses latitudes and longitudes of a country's most important city (in terms of population) or of its official capital.

4.4 Gravity Estimations

We seek to investigate the effect of trade on productivity growth (aggregate and the components) while dealing with the problem of endogeneity associated with trade-growth modelling. In his work Feyrer (2009) employs a time varying instrumental approach by generating an exogenous geography based instrument for trade, and uses it to analyse the effect of trade on income. Our first step in generating this instrument requires estimation of a gravity equation. Our equation is estimated using data at 5-year intervals. We present

[80] See Table A4.5 in Appendix 4.2 for the geo_cepii dataset
[81] See Table A4.6 in Appendix 4.2 for the dist_cepii dataset
[82] See Table A4.7 in Appendix 4.2 for simple distance measures

our estimated results below in Table 4.1. Column (1) gives the coefficients for our distance variable.[83] These point estimates represent the elasticity of trade with respect to effective air distance over time, and corresponds to equation (4.15). We observe from our β's in column (1) that the effect becomes more negative over time. The increase in the absolute value of the β's in column (1) is an indication of the increasing significance of air distance on trade, that is, over time it has an increasingly negative effect on bilateral trade flows. Our findings tell a story similar to that of Feyrer (2009), in his gravity estimations. He also observed that elasticity of trade with regards air distance becomes more negative over him sample period, 1950 to 1997.

[83] Columns (2) to (5) in Table 4.2 present the coefficients on our bilateral controls. We observe expected positive and highly significant relationships between our bilateral controls and trade.

Table 4.1 Gravity Model Estimation for the Period 1965 to 2006

	Log (distance) **(1)**	**Com Off. Lang.** (2)	**Contiguous** (3)	**Col. History** (4)	**Cur. Colonial** (5)	**No. of Obs.** (6)	**Adj. R^2** (7)
(1965≤year<1970)	**-0.936*** **	0.356***	0.496***	1.368***	0.709***	12408	0.734
	(0.021)	(0.043)	(0.075)	(0.068)	(0.144)		
(1970≤year<1975)	**-1.118*** **	0.523***	0.903***	1.188***	1.121***	15833	0.730
	(0.022)	(0.045)	(0.085)	(0.078)	(0.177)		
(1975≤year<1980)	**-1.216*** **	0.546***	0.654***	1.174***	1.225***	16946	0.735
	(0.022)	(0.045)	(0.085)	(0.078)	(0.188)		
(1980≤year<1985)	**-1.205*** **	0.537***	0.713***	1.131***	1.659***	17338	0.748
	(0.022)	(0.045)	(0.084)	(0.077)	(0.214)		
(1985≤year<1990)	**-1.226*** **	0.542***	0.948***	1.012***	2.004***	18433	0.759
	(0.022)	(0.044)	(0.084)	(0.076)	(0.240)		
(1990≤year<1995)	**-1.275*** **	0.412***	1.104***	0.950***	2.141***	21399	0.782
	(0.020)	(0.041)	(0.079)	(0.073)	(0.230)		
(1995≤year<2000)	**-1.330*** **	0.621***	1.130***	0.758***	2.155***	24057	0.806
	(0.018)	(0.038)	(0.075)	(0.069)	(0.249)		
(2000≤year<2005)	**-1.458*** **	0.698***	0.967***	0.619***	2.461***	24991	0.808
	(0.018)	(0.038)	(0.076)	(0.070)	(0.291)		
(2005≤year<2007)	**-1.524*** **	0.729***	1.011***	0.580***	2.606***	9971	0.808
	(0.029)	(0.061)	(0.122)	(0.113)	(0.465)		

Robust Standard Errors in Parentheses *p<0.05, **p<0.01, ***p<0.001
All regressions include: A full set of time dummies
A full set of country dummies
Bilateral Controls

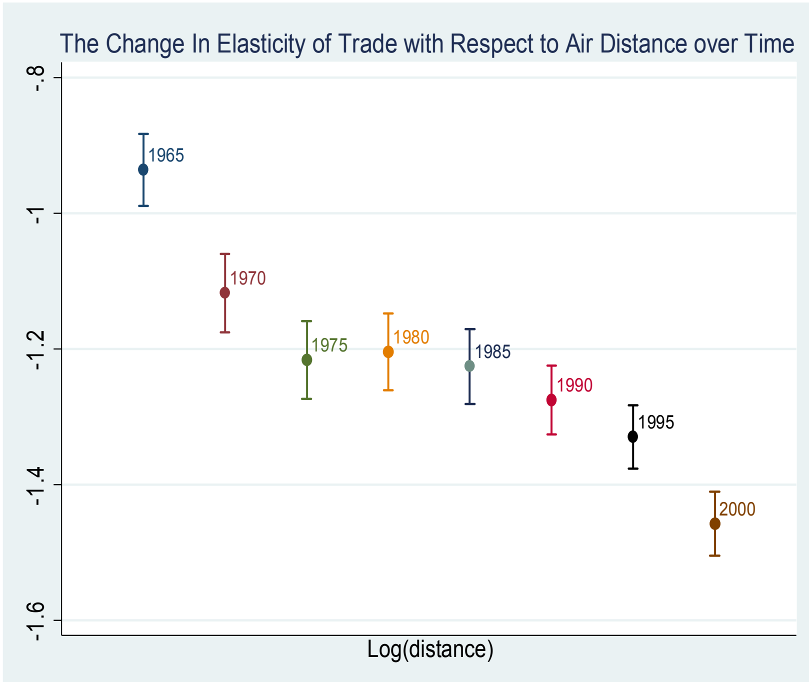
Between 1965 and 1969, the elasticity of trade with respect to air distance is estimated to be approximately -0.9. If we increase air distance between two countries by 10 percent, this is associated with a fall in trade of 9.4 percent. By the 2000 to 2004 interval, the effect increases in absolute value from the 1965 to 1969 value. This means that trade between two countries decreased by a larger amount with time when the effective distance increased between these two countries. Between 2000 and 2004, a 10 percent increase in air distance between two countries results in a fall in trade flows between these countries of 14 percent, an almost 5 percentage point percent increase in the effect of distance from our initial 1965 to 1969 period. These relationships are all highly significant at the 0.001 level of significance. Our findings support the theory that these changes over time are reflective of improvements in technology in air freight which have yielded cheaper, faster and better transportation services (Garrison, 2000; Hummels, 2007). In this context, the increase in distance of trade, or the increase in the distance over which a country's trade flows are transported to another country over time, means that its trade is becoming less intense with countries that are further away relative to nearer countries. Specifically, the reduction in air transportation costs has increased overall trade volumes. However, the argument is that air freight costs are such that they favour short over long distance trade causing the distance variable to become more negative, suggestive of less trade between countries with increasing distance. Technological advancement in air transportation has been about creating aircrafts that can fly further distances over less time and for lower cost and as such, one would expect a decrease in the significance of distance on trade. However, the technological improvements have favoured country pairs with shorter trade routes. The improvement in air technology allowed trade to increase differentially between country pairs especially those relatively remote by sea. If the rise in air transport allows a voyage between country pair "A" to be relatively shorter by air than an air voyage between country pair "B", then this improvement in air technology should lead to a relative rise in trade between country pair "A".

In Figure 4.1 below, we plot our distance coefficients corresponding to Table 4.1 to provide a clearer illustration of the change in the effect of distance on trade over time. Each point represents the coefficient on air distance over a 5-

year interval. Each bar corresponds to the 99 percent confidence interval for each coefficient. This observed increase in the absolute value of our air distance coefficients in Figure 4.1 is also reported by Disdier and Head (2008), who examine 1467 distance effects in 103 papers to test hypotheses on the causes of the variations in the estimates. In our diagram we observe a slowdown in the change in the elasticity of trade with respect to air distance after the 1970s. Studies on air transport show that from 1957 to 1972 the widespread use of the faster, more fuel efficient and lower maintenance jet engine coincided with falling quality adjusted real prices of between 12.8 and 16.6 percent dependent on the calculation method. Additionally, the newly built Boeing 747 was used for air freight for the first time in the early 1970s.[84] There, however, was a slowdown in quality change after 1972, when quality-adjusted prices still fell, but by between 2.2 and 3.8 percent until 1983. This period corresponds and therefore accounts for the flattening out of our estimates between 1975 and 1989. Additionally, air transport prices increased from 1973 to 1980 due to rising oil prices. After 1980 prices declined by approximately 2.52 percent per annum (Hummels, 2007).

[84] http://www.boeing-747.com/

Figure 4.1 The Change in Elasticity of Trade With Respect to Air Distance Over Time for the Period 1965 to 2006

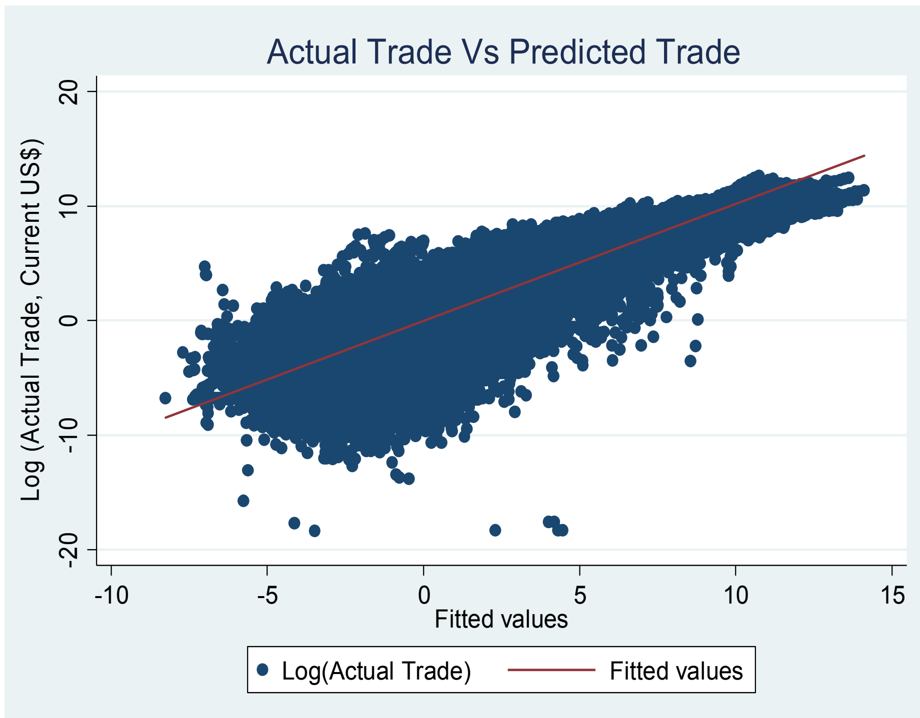


Source: Coefficients from Table 4.2, Column (1)
Estimates obtained from gravity model with country fixed effects

The improvement is air transportation technology is shared by all countries and acts as an exogenous shock having heterogeneous effects across country pairs. The next step in our analysis involves our exploitation of this change in technology to generate a time series in effective bilateral distances between countries.

Our instrument is constructed by estimating equation (4.15) and generating fitted values for the log of bilateral trade for each pair of countries in each year. By taking the aggregate of predicted trade, we then obtain a prediction for aggregate trade in each country for each year. Figure 4.2 illustrates the strong positive relationship between actual and predicted trade flows reflected in the steep upward sloping regression line.

Figure 4.2 Scatter Plot: Actual and Predicted Trade for the Period 1965 to 2006

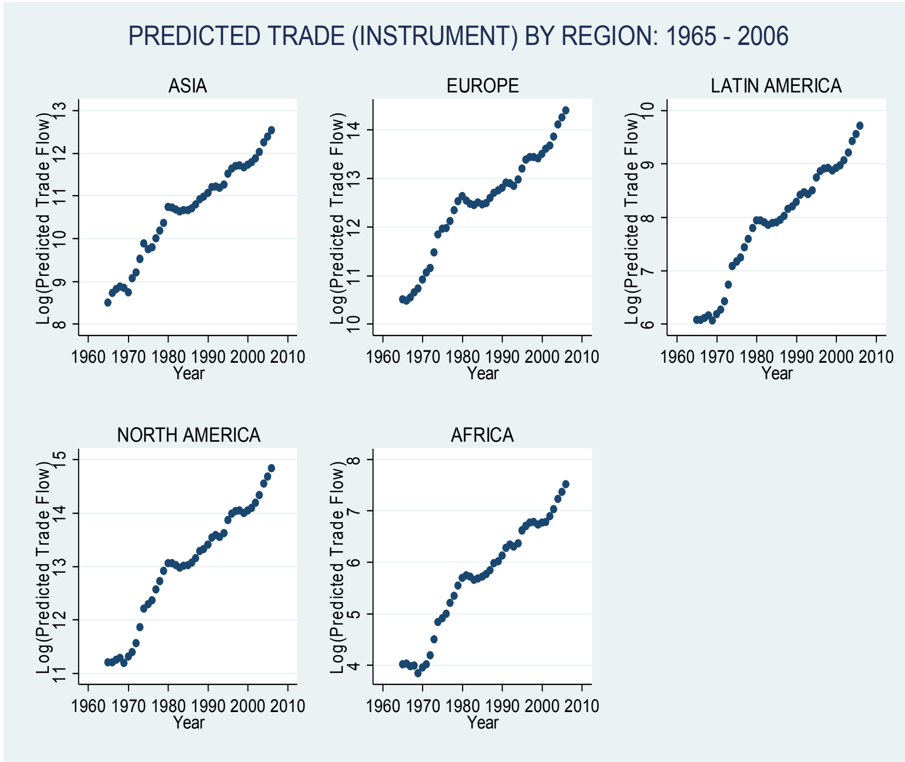


Like Frankel and Romer (1999), we sum unlogged versions of these bilateral relations to derive a prediction for total trade for each country.[85] Actual trade values are similarly summed to arrive at a value for total trade. This instrument provides a full panel of trade predictions used to estimate the impact of trade on the economy-wide labour productivity and its components of growth.

[85] See equation (4.16)

In today's interconnected economy, there has been an expansion of world trade over the last three decades facilitated by the reduction of trade barriers in many countries, together with declining transportation costs and information and communication technology improvements. According to the World Trade Report (2013), the value of world merchandise trade rose from US$2.03 trillion in 1980 to US$18.26 trillion in 2011, the equivalent of a 7.3 percent growth over the same period. In terms of trading volumes, world merchandise trade recorded a more than four-fold increase between 1980 and 2011. We create an Instrumental Variable that must be highly correlated with actual trade flows. Similarly, our instrument must also reflect this expansion of world trade over time. To illustrate this, we plot the movement of our instrument across time by taking the average regional predicted flow of trade over our 1965 to 2006 sample period in Figure 4.3. Like the increase in actual trade over the past decades, our predicted trade flow instrumental variable increases over time. This pattern of increase is also consistent across all regions in our dataset.

Figure 4.3 Scatter Plot: Predicted Trade (Instrument) by Region over Time: 1965 – 2005



* We plot the average regional predicted trade flow across. See Table A4.2 in Appendix 4.2 for list of regions and relevant countries.

We present our results from our estimated equations in the following sections.

4.5 Results

4.5.1 The Effect of Trade on Economy-Wide Labour Productivity

Our aim is to consider the effects of trade growth on the components of economy-wide productivity growth. However, we start by looking at aggregate productivity to ensure that our results are in line with those of Feyrer (2009).

In our analysis we utilize labour productivity instead of GDP per capita as employed by Feyrer (2009). There is a high positive correlation between the two variables, which allows for comparison of results.

To analyse the effect of trade on growth, we use the coefficients estimated in our gravity equation (4.15) to first obtain trade predictions for each country in each year. We generate an exogenous, time-varying geographic instrument based on the heterogeneity in technological improvements across countries. The use of this instrument developed by Feyrer (2009) enables us to control for fixed effects, thus removing the problem of bias stemming from time invariant variables such as distance from the equator.

This newly generated instrument is an improvement on the work of Frankel and Romer (1999) who also investigated the effect of trade on income using a geography-based instrument. One possible problem of the identification used by Frankel and Romer (1999) is the possibility that geography may be correlated with other country characteristics beyond trade. Rodriguez and Rodrik (2000) argue that this instrument may result in biased coefficients as it might be incorrectly appropriating the direct influences of geography on income and may be picking up other slow moving factors such as harmful effects of poor health conditions and tropical diseases or the presence of institutions. Employing a panel of predicted values allows us to include individual country effects in the second stage of our regressions, thereby removing any deep determinants contributing to differences in productivity.

Another criticism faced by Frankel and Romer (1999) surrounds the idea that bilateral factors other than trade may be fashioned by distance. Their identification may potentially suffer from the same shortcoming discussed above, since bilateral trade can be used as a proxy for factors such as foreign direct investment and technology transfers, which may be correlated with distance and other explanatory variables. Feyrer (2009) notes that non-trade channels for the instrument to act on income are limited to time-varying relationships, limiting the scope for omitted variable bias especially in comparison to previous trade-income studies.

Feyrer (2009) uses reduced form regressions as a means of describing the general effects of globalization. Predicted changes in trade should be exogenous with respect to our dependent variable, labour productivity and reflect real causal effects of changes in geography on labour productivity.

4.5.2 Fixed Effect Regressions of the Effect of Trade on Economy-Wide Labour Productivity

We start our analysis by estimating the effect of trade growth on economy-wide productivity growth for the period 1965 to 2006. This is in the line with the existing literature that focuses mainly on aggregate economy growth. We also estimate the effect of the level of trade flows on the level of economy-wide productivity for the same period before conducting our growth regressions in order to compare our work to that of Feyrer (2009). We complete this by employing fixed effect regressions,[86] utilising predicted trade volumes as an instrument for actual trade flows in these regressions. Including country fixed effects allows us to control for time invariant characteristics like distance to the equator as well as any other factors that may correlated with geography other than through trade, thereby controlling for omitted variable bias as discussed above. We include time effects to take into account macroeconomic shocks and cyclical effects affecting our dependent variable.

The equation to be estimated for the country level regression is as follows:

$$\ln(Y_{it}) = \gamma_i + \gamma_t + \beta \ln(Trade_{it}) + \varepsilon_{it} \qquad (4.17)$$

where Y_{it} is economy-wide labour productivity. γ_i and γ_t represent country and time fixed effects with ε_{it} as the error term. Endogeneity issues are dealt with by instrumentation of $\ln(Trade_{it})$ with predicted trade as earlier discussed.

It is useful to compare our results to the original work of Feyrer (2009). Feyrer (2009) made trade predictions at 5-year intervals from 1950 to 1995 to investigate the effect of trade on real per capita GDP. We present the author's results in Table A4.8 in the Appendix 4.3. His Ordinary Least Square (OLS) investigation reveals a positive relationship between trade and income that is

[86] Fixed effects models allow for correlation between individual heterogeneity and the regressors. If there is no correlation, random effects is the appropriate model. We conducted the Hausman test and rejected that null that there existed no correlation between the regressors and the effects from individual heterogeneity. The fixed effect model is therefore the most appropriate model for the analysis.

very strong, but with indeterminate causality. He then conducts a more sophisticated Instrumental Variable (IV) analysis and in doing so employs a number of different specifications to correspond with the specifications utilised in the construction of his instrument. His results are robust to all specifications. As such, for our study we focus on his specification which included a balanced panel, bilateral controls in the first stage regressions, and time and country dummies corresponding to column (4) of Table 5 of Feyrer (2009).[87] We match this particular specification in the construction of our instrument.

Feyrer's (2009) results suggest the instrument has a strong relationship with trade, with an F-statistic of 24. Weak instruments can produce biased IV estimators. Additionally, the sampling distribution for IV statistics is nonnormal and standard inference is not reliable. Staiger and Stock (1997) formalise the definition of weak instruments, and the general consensus is that the threshold for first stage F-statistics is 10. The estimated coefficient for this stage of the regression analysis is 2.033 and statistically significant at the 1 percent level. When actual trade is instrumented with predicted trade, the estimated elasticity of income with respect to trade is approximately 0.5, also significant at the 1 percent level. That is, an increase in trade volumes of 10 percent, increases income per capita by 5 percent. Feyrer (2009) therefore concludes that regardless of sample, instrument set, or estimation method, trade is positively associated with per capita income.

[87] See Table A4.9 in the Appendix 4.3 which presents Feyrer's (2009) panel estimates of trade on per capita GDP

We utilize equation (4.17) to investigate the effect of trade on labour productivity levels rather than GDP per capita as used by Feyrer (2009). Feyrer (2009) estimates all his regressions on data at 5-year intervals from 1950 to 1995. For our analysis, we conduct estimations over multiple time periods. This allows us to observe differences in contemporaneous, medium-term and longer-term effects of trade on productivity over time. We estimate the effect of trade on economy-wide labour productivity levels over 1-year, 5-year, 10-year, 15-year, 20-year and 35-year intervals. We stop at a 35 year interval analysis as this corresponds with Feyrer (2009) 1960 to 1995 analysis period when he used his reduced sample with no missing observations.[88] Furthermore we extend on the analysis by employing a longer time period, specifically 1965 to 2006 for our annual changes. To ensure that the 5-year intervals are even our end dates vary as seen in the estimated time period row in Table 4.2.[89] Our OLS and IV estimates are presented in Tables 4.2 and 4.3 below respectively.

[88] Our instrument is created based on 5-year intervals. Our analysis is based on estimations over multiple time periods. To ensure that our instrument can be used across various intervals instead of 5-year interval regressions only, we construct the instrument on data at 1-year intervals. It must be noted that our estimated coefficients were marginally different from those estimated on our 5-year interval instrument. We therefore use our instrument created on 5-year intervals so that our study can be compared directly with that of Feyrer (2009).

[89] Due to a number of years not divisible by 5, we alter the end dates in columns (1) to (6) in Table 4.3 and other relevant Tables to ensure that all our intervals contain exactly 5 years and multiples of 5 up to 35 years.

Table 4.2 OLS Estimates of the Effect of Trade Flows on Economy-Wide Labour Productivity 1965-2006

	(1)	(2)	(3)	(4)	(5)	(6)
Intervals*	1 year	5 year	10 year	15 year	20 year	35 year
	LN(ECONOMY-WIDE LABOUR PRODUCTIVITY)					
Ln (Trade Flows)	0.207***	0.198***	0.199***	0.175***	0.207***	0.104
	(0.025)	(0.024)	(0.025)	(0.025)	(0.030)	(0.225)
Observations	1320	255	128	64	64	32
Number of Countries	32	32	32	32	32	32
R^2	0.018	0.016	0.015	0.008	0.013	0.006
Estimated Time Period	1965-2006	1965-2004	1965-2004	1965-1994	1965-2004	1965-2000

Robust Standard Errors In Parentheses

All regressions include a full set of time and country dummies

$^+$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

* We estimate the effect of trade on economy-wide labour productivity levels on data at 1-year, 5-year, 10-year, 15-year, 20-year and 35-year intervals.

Our OLS estimations suggest a highly significant relationship between trade and economy wide productivity. For regressions on data at 5-year intervals, we find that a 10 percent increase in trade increases economy-wide labour productivity levels by 2 percent. Our estimated coefficients are consistent across our varying time intervals. Our findings therefore suggest that Feyrer's (2009) findings hold. Differences in the size of the coefficient between our findings and that of Feyrer (2009) can be attributed to our different dependent variables. Interestingly, however, this effect, although positive becomes insignificant when we estimate the effect of trade on labour productivity levels over a 35-year interval. One explanation for this finding is a trade-off that occurs when engaging with longer time periods in terms of the loss of precision of the estimate suggested by the larger standard error, because of the reduced number of observations.

We repeat these regressions using an Instrumental Variable approach (Table 4.3). IV analysis allows us to measure the effect of trade without omitted variable bias, by using an instrument; that is, a variable related to trade but unrelated to economy-wide labour productivity except through its relationship to trade. With IV, two regression models are "fitted together". The first model examines the relationship between endogenous trade as the dependent variable and predicted trade as the independent variable. The second model uses economy-wide labour productivity levels as the outcome or dependent variable and predicted (instrument) trade as the dependent variable. From the procedure, we obtain asymptomatically unbiased estimates of the effect of trade on labour productivity subject to the fact that the following three predictions hold true. Specifically, for our regression model:

$$\ln(Y_{it}) = \beta_0 + \beta \ln(Trade_{it}) + \varepsilon_{it} \tag{4.18}$$

where actual trade (x_i) is endogenous: $E(x_i\varepsilon_i \neq 0)$

There exists at least one variable, predicted trade (z_i) with the following properties:

1. Predicted trade is not correlated with the error term, i.e. $E(x_i\varepsilon_i = 0)$. That is, unlike actual trade which is endogenous, predicted trade is exogenous.
2. Predicted trade is strongly correlated with actual trade, i.e. $Cov(x_i z_i)$ is highly and significantly different from zero.
3. Predicted trade does not have a direct effect on economy-wide labour productivity (Y_{it}), but only affects Y_{it} through its effect on actual trade.

Our instrument satisfies the conditions described above. Our model is exactly identified so we cannot test for over-identifying restrictions and therefore we make the assumption that it satisfies criteria (1). Earlier in Figure 4.2, we plotted actual and predicted trade to illustrate the strong positive relationship between the two variables thereby satisfying criteria (2). Additionally as previously described, our instrument interacts physical geography with changing transportation technology via the use of the empirically-established gravity model which indicates that distance has a strong influence on the volume of bilateral trade. These technological changes are shared by all countries, but have differential effects across countries based on their exogenous geographical characteristics. The time series variation in the instrument allows for country specific effects to be included in the second stage, eliminating the effects of time invariant country specific factors. We can therefore conclude that the instrument has no direct effect on productivity, except through actual trade.

Estimating equation (4.17), we obtain our IV results. We also report first stage regression coefficients and F-statistics. Our IV estimates obtained in the second stage of our two-staged least square estimations with robust standard errors are presented in Table 4.3.

Table 4.3 IV Estimates of the Effect of Trade Flows on Economy-Wide Labour Productivity for the Period 1965 to 2006

	(1)	(2)	(3)	(4)	(5)	(6)
Intervals*	1 year	5 year	10 year	15 year	20 year	35 year
	LN(ECONOMY-WIDE LABOUR PRODUCTIVITY)					
Ln (Trade Flows)	0.193***	0.170***	0.170***	0.139***	0.174***	0.087
	(0.008)	(0.012)	(0.017)	(0.031)	(0.032)	(0.248)
	FIRST STAGE					
	Ln (Trade Flows)					
Predicted Trade Flows	1.095***	1.112***	1.100***	1.133***	1.094***	0.624***
	(0.016)	(0.036)	(0.050)	(0.089)	(0.089)	(0.039)
F-Stat	4985	972	475	160	149	259
Observations	1320	255	128	64	64	32
Number of Countries	32	32	32	32	32	32
R^2	0.832	0.844	0.854	0.843	0.867	0.909
Estimated Time Period	1965-2006	1965-2004	1965-2004	1965-1994	1965-2004	1965-2000

Robust Standard Errors In Parentheses

All regressions include a full set of time and country dummies

$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

* We estimate the effect of trade on economy-wide labour productivity levels on data at 1-year, 5-year, 10-year, 15-year, 20-year and 35-year intervals.

The first stage relationship between actual trade and predicted trade is very strong. The first stages F-statistics surpass the threshold of 10 as suggested by Staiger and Stock (1997) for strong instruments. We observe coefficients in the first stage of our regressions across the different intervals ranging from 0.624 to 1.133. These coefficients are highly significant satisfying the condition of strong positive correlation between actual trade and predicted trade. Across our different intervals, explanatory variables account for more than 83 percent of the variation in economy-wide labour productivity.

Like Feyrer (2009), our instrumenting of actual trade with predicted trade yields similar results to that of our OLS estimates. We find strong positive effects of trade on economy-wide labour productivity. For our 5-year interval regression in column (2), a 10 percent increase in trade, increases economy-wide labour productivity levels by 2 percent. This result is highly significant at the 0.001 percent level. Mirroring our OLS results, this relationship disappears when regressions of the effect of trade on economy-wide labour productivity is estimated are on data at of a 35 year interval (1965-2000, column 6, Table 4.3). OLS and IV estimations are consistent with the findings of Feyrer's (2009. That is, trade positively affects labour productivity.

4.5.3 Growth Estimations of the Effect of Trade on Economy-Wide Labour Productivity

The previous section analyses the relationship between trade and economy-wide labour productivity in levels. In order to provide a closer comparison with our decompositions of productivity growth into the within and between sector components later in the chapter, we now repeat the analysis for growth rates. Investigating this relationship is important as a popular view is that international trade presents an important avenue for technology transfer, and increased trade openness may assist developing economies achieve faster rates of economic growth. Coe et al. (1997) reported that via Research and Development (R&D) spill overs, productivity growth of developing economies increased as a result of increased trade relations with industrial countries. A large body of the literature also observes a positive relationship between trade and economic growth. Most of these studies, however, fall within Rodriguez and Rodrik's (2001) criticism, that these studies may be capturing a connection between trade policy and growth as well as picking up other factors that affect the growth rate of income.

Feyrer (2009) examines the change in GDP per capita from 1960 to 1995 against changes in actual and predicted trade. Instead of employing trade shares as done by Frankel and Romer (1999), Feyrer (2009) uses the change in trade on the right hand side. The argument for this is to ensure that GDP per capita does not appear on both sides of the equation, as trade share is a function of trade, GDP per capita and population.

In these regressions taking differences allows us to control for individual country effects with the overall time trend being absorbed in the constant. Equation (4.19) is the equation that is estimated.

$$\Delta \ln(Y_i) = \beta_0 + \beta \Delta ln(Trade_i) + \varepsilon \qquad (4.19)$$

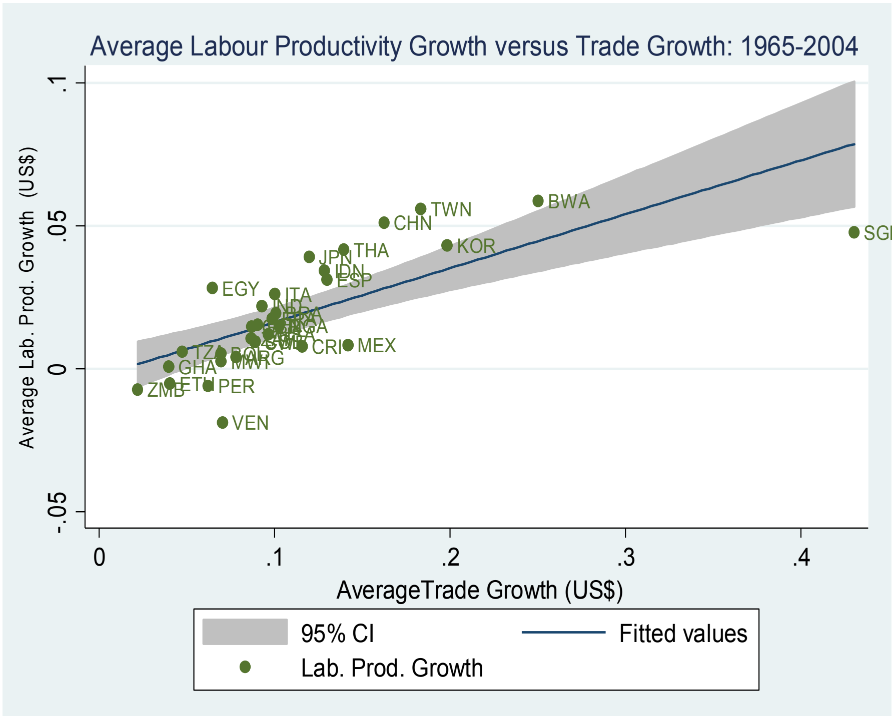
where Δ represents change and Y_i economy-wide productivity growth (rather than income per capita as in the case of Feyrer (2009)). OLS, reduced form and IV estimates (utilizing the geography-based instrument) of a change in the log of per capita GDP on a change in the log of trade are applied. Feyrer (2009) finds a strong positive relationship between trade growth and growth in per capita GDP over the 1960 to 1995 period. (We present Feyrer's (2009) results in Table A4.10 in the Appendix 4.3 for the purpose of comparison with the current results.)

We conduct our own investigations of the effect of trade growth on the growth in productivity corresponding to equation (4.19). Like our estimation in levels, we also investigate the dynamic time effects by performing regression analysis over alternative time intervals (1-year, 5-year, 10-year, 15-year and 35-year). This will allow us to investigate whether short-, medium- and long-term contemporaneous effects of trade growth on labour productivity growth differ.

Before we present our result, we present a visual representation of the relationship between labour productivity growth and trade growth in Figure 4.4 below. As expected we observe a strong positive relationship on average between our two variables for the period 1965-2004.[90] This relationship is strongest for most of the Asian countries in our sample.

[90] This 35-year period is utilized to make our work comparable to Feyrer's 35-year period (1960-1995).

Figure 4.4 The Relationship between Average Labour Productivity Growth and Trade Growth: 1965-2004*



Note: See Table A4.2 in Appendix 4.2 for Country Abbreviation Meanings

The regression results for our estimations of the effect of trade growth on labour productivity growth for our 1-year and 5-year intervals are presented in Tables 4.4 and 4.5 respectively. Column (1) shows the statistical relationship between trade growth and labour productivity growth corresponding with Figure 4.4 above. Column (2) presents reduced form regressions on the instrument which can be seen as describing the general effects of globalization. The problems associated with using OLS regressions to understand the trade growth relationship still exist and therefore we employ more formal IV estimations using our instrument in column (3).[91]

[91] Actual trade is instrumented with predicted trade growth.

For both our 1-year and 5-year interval OLS regressions, we find a positive relationship between trade growth and labour productivity growth. However, this relationship is only weakly significant for our 5-year interval analysis. Our reduced form and IV analyses, however, for both these intervals, suggest strong positive significant relationships. We obtain similar results for these two intervals. In each case, the first stage is strong with F-statistics of 50. Furthermore, for regressions on data at both the 1-year and 5-year intervals, we find that a 10 percent increase in trade growth increases economy-wide labour productivity growth by 1.2 percent. The IV results are significant at the 0.01 percent level and the 0.001 percent level of for the 1- and 5-year interval respectively.

Table 4.4 The Effect of Trade Growth on Economy-Wide Labour Productivity Growth 1965-2006 : One Year Intervals

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH 1965-2006		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.046		0.129**
	(0.032)		(0.042)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.065**	0.502***
		(0.025)	(0.071)
F-Stat			50
Observations	1281	1281	1281
R^2	0.004	0.002	0.057

Robust Standard Errors In Parentheses

$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Fall in Number of Observations due to Missing Data

Table 4.5 The Effect of Trade Growth on Economy-Wide Labour Productivity Growth 1965-2004: Five-Year Intervals

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH 1965-2004		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.054^{+}		0.122***
	(0.030)		(0.035)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.097**	0.780***
		(0.034)	(0.113)
F-Stat			50
Observations	255	255	255
R^2	0.058	0.027	0.093

Robust Standard Errors In Parentheses

$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Fall in Number of Observations due to Missing Data

The investigation for longer time intervals, however, suggests a positive relationship between trade growth and productivity growth. We report these results in Tables A4.11 to A4.14 in Appendix 4.3. These Tables show that for our OLS regressions, we identify a positive and significant relationship, but we cannot assume causality due to endogeneity issues. Additionally, we find that increasing our interval period results in a weakening of our instrument with the observed F-statistics of below the required 10. As such we cannot argue for a causal relationship between our outcome and explanatory variables using a 10-year, 20-year and 35-year intervals. The exception is regression on data at 15-year intervals where we find strong positive relationships between trade growth and economy-wide labour productivity growth. The F-statistics for this interval period is ten. Moreover like our 1-year and 5-year intervals, a year we find that increasing trade growth by 10 percent increases our growth in labour productivity by 1.3 percent, the estimated coefficient is significant at the 1 percent level.

Given our results, we can conclude that the effect of trade growth on productivity growth is quantitatively similar to the effect of trade levels on productivity levels. We find that an increase in trade increases labour productivity, both in growth and in levels by approximately 0.1 and 0.2 units respectively. This means that a 10 percent increase in trade growth (levels) increases labour productivity growth (levels) by 1 (2) percent. These positive relationships between trade and productivity, both in levels and growth, suggests that Feyrer's (2009) results hold, subject to the use of different measure of economic progress, namely productivity instead of per capita income. Furthermore, the effect of trade on economy-wide productivity is smaller than the effect on per capita income. Feyrer (2009) concludes that the elasticity of trade with respect to income is between 0.5 and 0.75. Finally, although our growth results support Feyrer (2009) for shorter- term effects, this effect of trade growth on productivity growth is indeterminate when we conduct longer term investigations due to a weakening of the instrument as a result of a transformation of the data. The instrument's quality is much higher for shorter term intervals than for longer intervals (i.e. more than 5 years). This may be due to the smaller country coverage for which we have available data. The IV estimates therefore, cannot eliminate the strong bias of the parameter estimates.

4.5.4 The Effect of Trade Growth on Growth of the Components of Economy-Wide Labour Productivity

In the previous section on the relationship between trade growth and growth in economy-wide labour productivity, we find that there is a significant and positive relationship between trade and economy-wide productivity in the short- to medium-term. Given these results, our next step is to decompose productivity growth into its within and between components, and estimate the effects of trade on these two components. McMillan and Rodrik (2011) in a study on structural change and productivity growth decomposed economic growth into these two components.[92] The structural change component measures the changes in total productivity, as there is the reallocation of labour across sectors. The within-sector component measures productivity changes occurring within sectors. This decomposition was used to investigate the behaviour of the structural change component across regions and across time.

McMillan and Rodrik's (2011) empirical investigation suggest that regions facing rapid economic growth realised a labour movement pattern from the less (agriculture) to the more (industrial) productivity sectors. Positive "structural change" such as the one described above promotes economic development prompting policies that encourage such labour rearrangements. These policies

[92] Refer to Chapter 3 as we studied the decomposition of economy-wide productivity in this Chapter. In particular, we investigated changes in the structural and within change components of aggregate productivity across countries and regional groupings. We still, however, include a description of the components and a summary of the findings of Chapter 3 in this section for ease of referral.

could produce spill-over effects, affecting important economic variables such as consumption, savings, investment and expenditure.

In their study, McMillan and Rodrik (2011) show that over a 15-year period (1990 to 2005), the developing Asian region experienced productivity-enhancing structural change similar to that of a sample of High-Income countries. Conversely for developing Africa and Latin American, the reallocation of labour across sectors appear to be growth reducing, that is a reallocation in favour of lower productivity sectors. Empirical data suggest that a number of negative internal and external political and economic factors contribute to such reallocations in specific countries within these regions. An important observation is that, in a number of cases, these negative factors reduce trading volumes across countries thereby affecting employment, and further adding to the problem of growth reducing structural change. It is therefore worthwhile to raise questions on the productivity enhancing effects of trade. With economies becoming more open and as ascension of countries into the World Trade Organisation (WTO) increases, it is vital that we understand the effects of trade on the components of economic growth.

The arguments still exist about whether increased openness hinders developing economies by making them more specialised in their trade and production. This would be the case for countries of the African region, for example, where most of their labour is employed in the agricultural sector. The effect on aggregate productivity then depends on the productivity levels of the agricultural sector and its productivity growth. The intuition is such that, these developing economies having not yet undergone the necessary structural change, specifically a movement of labour out of the agriculture sector, is introduced to increased external competition, inhibiting them from proceeding along the traditional path of development. Ultimately, the intended advantages afforded by increased openness, as suggested by the trade growth literature, are cancelled out, or these developing economies may realise reduced productivity growth.

Our findings suggest that it is the within component driving much of the growth in economy-wide productivity in response to trade growth. This to a large extent supports the trade and productivity literature, when attention is given to the within effect. Popular contributions in the literature on trade and productivity come from the work of Eaton and Kortom (2002) and Melitz (2003). On a more micro level, their models suggest that trade impacts vary across producers and their arguments are based around the increase in import competition arising from increased openness. Specifically, productivity gains arise from new technology embodied in intermediate capital inputs. Additionally gains are argued to come from improved selection and the heightened competition that trade brings as individual producers become more efficient as a result of increased competition. Industries or plants facing less competition have less incentive to become more efficient and adopt new technology. This is because higher per-unit profits resulting from the reduced competition, increases the opportunity cost of changing production practices. With increased import competition from trade, industries and firms may alter their existing structures and invest more in the necessary technology. This is to ensure that they increase their rate of productivity growth so as to remain competitive.

Most of the trade growth literature draws attention to aggregate growth. Research that disaggregates growth into its components is limited. We are therefore motivated to fill this gap by employing the decomposition[93] as utilized by McMillan and Rodrik (2011) to conduct our own investigations on the effects of trade growth on the components of economy-wide productivity growth. We repeat the exercise of the previous section by instrumenting actual trade with geography-based predicted trade. The equations to be estimated are as follows:

$$\Delta \ln S_i = \beta_0 + \beta \Delta ln(Trade_i) + \varepsilon \qquad (4.20)$$

$$\Delta \ln Z_i = \beta_0 + \beta \Delta ln(Trade_i) + \varepsilon \qquad (4.21)$$

where S_i and Z_i are the structural change and the within components of economy-wide productivity growth respectively. Similar to our earlier estimations of the effect of trade growth on aggregate growth, taking differences allows us to control for individual country effects with the overall time trend being absorbed in the constant.

[93] See equation (3.2) in Chapter 3.

To ensure consistency, we estimate our equations for the same time interval used in the previous sections. We estimate equations (4.20) and (4.21) on data at 5-, 10-, 15-, 20- and 35-year intervals. We present the data our results for the 1-year interval regressions in Tables 4.6 and 4.7. Tables 4.7 and 4.8 present results for our 5-year interval regressions.

We find that when we disaggregate growth according to its within and structural change components, the positive effect of trade on aggregate trade that we observe in our previous section is being driven only by the within component of economy-wide labour productivity. Trade growth does not significantly affect the structural source of productivity growth. For our 1-year interval regressions in Table 4.6, we observe in column (3) that although our instrument is strong, with an F-statistic well over the required 10, we obtain a negative and insignificant coefficient on our structural change component.

Table 4.6 The Effect of Trade Growth on Structural Labour Productivity Growth 1965 2006: One-Year Intervals

	(1)	(2)	(3)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH 1965-2006		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.208		-0.497
	(0.285)		(0.955)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		-0.233	0.470***
		(0.445)	0.066
F-Stat			51
Observations	1281	1281	1281
R^2	0.000	0.000	0.049

Robust Standard Errors In Parentheses

$^+$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Fall in Number of Observations due to Missing Data

However, when we regress trade growth on the within component of productivity growth, we find a positive relationship between our two variables. Controlling for endogeneity by the instrumentation of actual trade growth with geography-based predicted trade growth, results give a significantly positive coefficient on our independent variable. The first stage regression shown in Column (3) in Table 4.7 indicates a strong positive relationship between trade growth and predicted trade growth with F-stats of 51. Specifically, we find that an increase in trade growth by 10 percent, increases productivity growth within sectors by approximately 1.5 percent, statistically significant at the 1 percent level.

Table 4.7 The Effect of Trade Growth on Within Labour Productivity Growth 1965-2006: One-Year Intervals

	(1)	(2)	(3)
	WITHIN LABOUR PRODUCTIVITY GROWTH 1965-2006		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.032		0.147**
	(0.024)		(0.050)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.069*	0.470***
		(0.027)	0.066
F-Stat			51
Observations	1281	1281	1281
R^2	0.002	0.002	0.049

Robust Standard Errors In Parentheses
$^+$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001
Fall in Number of Observations due to Missing Data

Our 5-year interval regressions of the effect of trade growth on the within and structural components of economy-wide productivity growth, are similar to our 1-year interval regressions. As seen in Table 4.8, we find no significant relationship between trade growth and our structural change component, with aggregate productivity growth being driven by the within productivity growth component. First stage regressions on both components indicate an F-stat of 7, which is on the boundary of the acceptable threshold of 10. Our IV estimates on our structural change component, however, is now positive unlike the negative coefficient obtained in the 1-year interval regression. This appears to indicate that the structural change effect may take time to materialise. Of further interest is the magnitude of the coefficient which stands at 11.6 in comparison to corresponding coefficient of 0.124 on the within component.

Table 4.8 The Effect of Trade Growth on Structural Labour Productivity Growth 1965-2004: Five-Year Intervals

	(1)	(2)	(3)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH 1965-2006		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.528		11.578
	(0.716)		(7.838)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		6.805*	0.588**
		(3.015)	(0.222)
F-Stat			7
Observations	255	255	255
R^2	0.002	0.039	0.051

Robust Standard Errors In Parentheses

$^+$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Fall in Number of Observations due to Missing Data

Both our OLS and IV estimations for our 5-year interval regressions on the within component give positive and significant coefficients. Endogeneity issues in our OLS regressions suggest that we cannot make causality statements based on our findings. For our IV estimates, however, we find that a 10 percent increase in trade growth, increases labour productivity growth within sectors by 1.2 percent. This is significant at the 1 percent level. An F-statistic of 7, however, indicates a weakening of the instrument, possibly due to a transformation of the data. Similar to our earlier estimates of the effect of trade growth on economy-wide productivity growth the instrument's quality appear much higher for shorter-term intervals and again IV estimates many not efficiently eliminate the strong bias of the parameter estimates.

Table 4.9 The Effect of Trade Growth on Within Labour Productivity Growth 1965-2004: Five-Year Intervals

	(1)	(2)	(3)
	WITHIN LABOUR PRODUCTIVITY GROWTH 1965-2006		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.039*		0.124**
	(0.019)		(0.046)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.073*	0.588**
		(0.033)	(0.222)
F-Stat			7
Observations	255	255	255
R^2	0.026	0.013	0.047

Robust Standard Errors In Parentheses
$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001
Fall in Number of Observations due to Missing Data

Some comments on the magnitude of our coefficients are merited. When we estimate the effect of trade growth on the components of economy-wide productivity over the 1965 to 2006 period, it appears that the within component is driving much of the observed significantly positive effect between trade growth on aggregate productivity growth. We observe that the magnitude of the coefficients on the within component, is similar to our estimate of trade growth on economy-wide productivity growth, estimated at approximately 0.1 for both 1- and 5-year intervals. Likewise, our coefficient estimate of trade growth on within labour productivity growth is approximately 0.1 for the same intervals. Additionally, it should be noted that, although it appears to be within productivity growth influencing the changes in aggregate productivity, the coefficients on the structural change component, are generally larger. These results suggest that there is an economically important relationship between structural change and trade, although one that is poorly identified. The effect of trade is large enough to be considered important enough for decision makers to deem it important. An area of further research would be to repeat our study for individual countries to determine whether the results would hold for different levels of geographic aggregation.

For our study, we also conduct estimations for longer time periods.[94] We report these results in Tables A4.15 to A4.22 in Appendix 4.3. These results are similar to that of our 1- and 5-year intervals in that in response to trade growth, the within components appears to be the main driver of economy-wide productivity growth. We find that for our 10- and 15-year intervals trade growth positively and significantly affects within productivity growth. For our 10-year interval estimations reported in Table A4.16, however, our first stage regression indicates a weakening of our instrument with an F-stat to below 10. Our IV estimates for our 15-year interval regressions, as presented in Table A4.18, suggest that if trade growth increases by 10 percent, within productivity growth increases by 1.1 percent, significant at the 5 percent level. For our 20-

[94] 10-year, 15-year, 20-year and 35-year intervals

and 35-year interval estimates, however, although we find a positive relationship between trade growth and within productivity changes, our IV coefficients are no longer significant.

The effect of trade growth on the structural component of economy wide productivity for all intervals exceeding our 5-year interval suggest a positive relationship for OLS and IV estimations with the exception of the 35-year interval where we observe a negative coefficient on our IV estimates. Like previous findings, our estimated coefficients on our structural change productivity are all insignificant. Moreover, we notice that estimates on these components, though insignificant, tend to be larger than the estimates on our within component of economy-wide labour productivity.

In this section, we attempt to fill a gap in the literature, by shifting away from analysing the effects of trade on aggregate growth as is focused on in most of the literature. Instead, we disaggregate economy-wide productivity growth into its components. We therefore investigate the effect of trade growth on the structural and the within components of economy-wide labour productivity growth. Our results show that much of the significantly positive effect of trade on aggregate productivity appears to be due to within productivity growth. We find that a 1 percent increase in trade growth increases within productivity growth by approximately 0.1 percent, a similar effect for aggregate productivity growth, which is also estimated at approximately 0.1. For structural productivity change, associated with employment reallocation across sectors, we find that although most of the coefficients on this variable are positive and larger than the coefficients on the within component, the effect of trade on this source or productivity growth is insignificant.

Our findings on the importance of within labour productivity further support other empirical studies investigating productivity and trade within individual countries. Pavcnik (2002) in her investigations on the productivity of Chilean manufacturing firms demonstrates that sectors facing new import competition realised faster productivity growth over a 1979 to 1986 sample period. Bloom, Mirko Draca and Van Reenen (2011) investigate how import competition from China affected the productivity of twelve European firms between 1996 and 2007, and find that Research and Development (R&D), Information Technology (IT) adoption and Total Factor Productivity (TFP) increased concurrently. Synonymous with labour productivity, there is an incentive for labour to improve in terms of the quality of its human capital or face being replaced by more efficient labour. Increased trade openness seemingly acts as a catalyst towards increased productivity within industries.

This section's findings suggest the positive effect of trade on aggregate productivity is being driven by growth in the within productivity component. We, however, observe large and positive, although insignificant coefficients on our structural change component and consider its relationship with trade to be of economic importance to policy makers. Our observations motivate us to further explore the heterogeneity of the data by disaggregating our dataset in a number of ways to identify the source of our results. Aggregate analyses may sometimes mask patterns in the data and our next step attempts to uncover any unobserved factors that might be driving our results. To do this, we disaggregate the data according to stage of development, level of resource dependence and finally we look at the mining sector on its own.

4.5.5 Further Robustness Checks

For tests of robustness, we repeat the exercise of the previous section where we estimate the effect of trade on the components of economy-wide productivity growth. These estimations, however, are performed on different subsamples to determine the strength of our results. We explore whether our findings are not sensitive to the subsample used and that our core results hold. We estimate our equations on subsamples of developed and developing economies, resource dependent and resource rich economies and finally the effect on the mining sector for the entire sample set is estimated.

It may be important to separate our countries by level of development because theory suggests that the relative importance of the components differ across developed and developing countries. Within sector productivity might be more dominant in advanced economies. These industrialised countries have reduced resource misallocation and improved efficiency within narrowly-defined industries through their abilities to engage in faster technological adoption and their larger pool of educated workers employed in human-capital intensive industries. Alternatively, the structural change component is believe to be relatively more important for developing economies, as within these economies a large proportion of the labour is employed in the agricultural sector and is still reallocating towards more productive sectors. The level of economic development may therefore play a role in how trade affects the components of economy-wide labour productivity. For this study, we follow the United Nations (UN) country classification (2014) to classify sample countries as developed and developing.[95]

Our next two subsamples features resource rich and resource dependent economies. The difference between these two samples being the percentage contribution of natural resources to an economy's GDP. Resource rich as defined by the International Monetary Fund (IMF) is a country where oil, gas and/or minerals dominate, making up at least 25 percent of GDP, exports or government revenues. For the resource dependent countries, less than 25 percent of contributions come from natural resources. The resource dependent and resource rich countries in our sample are identified in Table A4.3 in the Appendix 4.2. Some resource rich and resource dependant countries heavy reliance on these resources can result in them being disadvantaged due to the "Dutch disease" effect. This theory is such that within these economies, non-natural resource industries tend to become less productive. As a result, this

[95] See Table A4.2 in Appendix 4.2 for countries classified as developed and developing in sample. We obtained this classification via the use of the statistical annex of the World Economic Situation and Prospects (WESP, 2014) prepared by the Development Policy and Analysis Division (DPAD) of the Department of Economic and Social Affairs of the United Nations Secretariat (UN/DESA).

may affect the rate at which both structural change and within productivity growth contribute to aggregate growth in response to trade.

Finally, we look at the effect of trade growth on structural and within productivity growth in the mining sector. We draw attention to this sector because we find that in our previous Chapter 3, a movement out of the mining sector appears to occur in tandem with negative structural productivity growth in countries such as Nigeria and Venezuela. This suggests results may be biased towards a greater effect on the structural change component when we include this sector. We present results for the effect of trade on the structural and within components respectively in Tables 4.10 and 4.11 below for the 1- and 5-year intervals for the subsamples. Also note that we only present IV results, as we have shown above that it is the more efficient method of estimation given the endogeneity issues present in the trade growth literature.

Our results suggest that the use of different subsamples do not appear to matter. Specifically, this means that our core results hold and the effect of trade appears to be on the within component of economy-wide productivity. Table 4.10 shows that the effect of trade on structural change continues to be insignificant. Additionally, the sign on the coefficient is sensitive to the subsample and time interval used. The exception is the developed countries subsample for our 1-year interval where we find a positive effect of trade on the structural component. In particular, a 1 percent increase in trade increases structural productivity growth by approximately 1 percent. This is, however, is weakly significant at the 10 percent level of significance. We make mention to the fact the F-statistic on the 5-year intervals across the different subsamples fall below the required threshold of 10 with the exception of the developed countries subsample.

Our results of the effect of trade on the within component support our core results across multiple subsamples as seen in Table 4.11. We obtain positive coefficients for our different subsamples for both the 1- and 5-year interval regressions. Additionally, first stage results indicate that for our 1-year interval F-statistics are well above 10 across all subsamples. It is only for this time interval, however, that we obtain significant causal relationships for our developing, resource dependent and resource rich groups. In particular, we find that a 10 percent increase in trade, increases within sector productivity in developing, resource rich and resource dependent countries by approximately 2, 3 and 2 percent respectively. Quantitatively, these results are in line with our core results. The IV estimates may therefore be considered unreliable outside of this group.

Of interest is the fact that our 1-year interval results are significant for our subsamples in columns 2, 3 and 4. It appears to be supporting the arguments on the effect of import competition in developing economies, where increases in the number of competitors force domestic firms to become more efficient or face exit, thereby increasing within sector productivity. Additionally, resource rich and resource dependent economies may realise different levels of the

Dutch disease effect dependent upon how important the natural resource is to their economy's survival. With increased trade these economies may be forced to divert attention towards "neglected" less productive import-competing sectors. This in turn increases productivity within multiple sectors in these economies. We also find that although our five-year interval regressions result in positive coefficients on trade growth, the F-statistic is below 10 for all subsamples with the exception of our developed group of countries and our instrument is therefore considered weak.[96]

[96] In our previous Chapter3, we observe a number of stylised facts existing in the data. Specifically, we find that negative structural change occurred in specific countries, namely Nigeria, Zambia and Venezuela. We also observe that most of the negative structural change occurring across countries takes place between 1998 and 2005. As such, in addition to the robustness checks performed above, we eliminate the three countries identified above. We also separate our sample into two sub-periods, specifically 1990 to2007 and 1998 to 2005. We estimated the effect of trade growth on three subsamples for both our components and find that it does not alter our core results.

Table 4.10 The Effect of Trade Growth on Structural Labour Productivity Growth 1965-2006: One-and Five-Year Intervals

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH									
	IV ESTIMATIONS									
	ONE YEAR: 1965-2006					FIVE YEAR: 1965-2004				
Trade Growth	**Dev'd**	**Dev'ping**	**Res. Dependent**	**Res. Rich**	**Mining**	**Dev'd**	**Dev'ping**	**Res. Dependent**	**Res. Rich**	**Mining**
	0.960⁺	-0.802	-0.122	1.612	0.276	-5.500	15.227	34.025	107.802	2.527
	(0.505)	(1.116)	-1.918	(2.753)	(0.450)	(5.797)	(10.728)	(41.173)	(324.044)	(1.666)
	FIRST STAGE					**FIRST STAGE**				
	Ln (Trade Growth)					**Ln (Trade Growth)**				
Predicted Trade Growth	0.667***	0.448***	0.703***	0.698***	0.470***	0.650***	0.578*	0.388	0.207	0.588**
	(0.046)	(0.069)	(0.111)	(0.182)	(0.066)	(0.102)	(0.267)	(0.401)	(0.618)	(0.222)
F-Stat	209	42	40	15	51	41	5	1	0	7
Observations	228	1016	729	408	1281	48	199	143	80	255
R^2	0.470	0.041	0.121	0.085	0.050	0.470	0.041	0.049	0.011	0.051

Robust Standard Errors In Parentheses

⁺ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Fall in Number of Observations due to Missing Data

Note: Dev'd = Developed Dev'ping = Developing Res. Dependent = Resource Dependent Res. Rich = Resource Rich

Table 4.11 The Effect of Trade Growth on Within Labour Productivity Growth 1965-2006: One-and Five-Year Intervals

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	WITHIN LABOUR PRODUCTIVITY GROWTH									
	IV ESTIMATIONS									
	ONE YEAR: 1965-2006					**FIVE YEAR: 1965-2004**				
Trade Growth	**Dev'd**	**Dev'ping**	**Res. Dependent**	**Res. Rich**	**Mining**	**Dev'd**	**Dev'ping**	**Res. Dependent**	**Res. Rich**	**Mining**
	0.225	0.136**	0.272*	0.156⁺	0.058	0.257	0.086⁺	0.154	0.156	-0.003
	(0.218)	(0.048)	(0.106)	(0.083)	(0.038)	(0.141)	(0.048)	(0.120)	(0.245)	(0.002)
	FIRST STAGE					**FIRST STAGE**				
	Ln (Trade Growth)					**Ln (Trade Growth)**				
Predicted Trade Growth	0.667***	0.448***	0.703***	0.698***	0.470***	0.650***	0.578*	0.388	0.207	0.588**
	(0.046)	(0.069)	(0.111)	(0.182)	(0.066)	(0.102)	(0.267)	(0.401)	(0.618)	(0.222)
F-Stat	209	42	40	15	51	41	5	1	0	7
Observations	228	1016	729	408	1281	48	199	143	80	255
R^2	0.470	0.041	0.121	0.085	0.050	0.470	0.041	0.049	0.011	0.051

Robust Standard Errors In Parentheses

⁺ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Fall in Number of Observations due to Missing Data

Note: Dev'd = Developed Dev'ping = Developing Res. Dependent = Resource Dependent Res. Rich = Resource Rich

4.6 Conclusions

In this Chapter, we use the Instrumental Variable approach first adapted by Feyrer (2009) to investigate the effect of trade on the components on productivity growth, namely the within and the structural change components. Within productivity describes improvements in productivity within sectors. The structural change component on the other hand, describes productivity changes resulting from labour reallocation across sectors. Investigating the components of economy-wide productivity provides a deeper understanding of productivity growth across countries. We employ this alternative and more direct measure of economic growth in our study, specifically productivity, as much of the literature provides evidence on the relationship between trade and GDP or per capita GDP as its measure of economy performance. We contribute to the literature by conducting a thorough study on the effect of trade on the components of economy-wide labour productivity as much of the trade growth literature focuses on aggregate income or productivity. We conduct this analysis using a sample of countries inclusive of countries at different stages of the development process.

To deal with the criticisms of Rodriguez and Rodrik (2001) met by Frankel and Romer (1999) our analysis uses an exogenous geography-based instrument developed by Feyrer (2009). Specifically, this instrument allows for the control for the omitted variable bias that exists in the trade growth literature.

By generating this time-varying geographic instrument, Feyrer (2009) allows us to include country fixed effects in panel regressions to control for time-invariant variables that correlate with our dependent variable, productivity.

Our study starts by comparing our results on the effect of trade on aggregate productivity using fixed effects regressions, against the positive and significant results (coefficient estimates of between 0.5 and 0.75) obtained by Feyrer (2009) on the relationship between trade and income for the period 1960 and 1995 using this geography-based instrument. We analysed the effect for both levels and growth and our results are consistent with those obtained by Feyrer (2009).

More precisely, although Feyrer's (2009) estimations were based on data at 5-year intervals, we conducted this exercise over alternative time intervals. In particular we do so across 1-, 5-, 10-, 15-, 20- and 35-year intervals over the period 1965 to 2006. We find that the effect of trade growth on productivity growth is quantitatively similar to the effect of trade levels on productivity levels. Results indicate that a 1 percent increase in trade increases labour productivity, both in growth and in levels by approximately 0.1 and 0.2 percent respectively. Countries open to trade are able to import a variety of foreign products, that are not invented locally and this produces a level effect as productivity in sectors like manufacturing increases permanently, however, the innovation rate of new products does not change. There may also be a positive and permanent growth effect of access to intermediate inputs from abroad if product varieties are used as input to research. Increases in varieties raise productivity in research, which in turn increases the rate of innovation to possibly ensure a permanent increase in the growth rate.

However, although our growth results are in line with Feyrer (2009) for shorter- and medium-term effects (1- and 5-year intervals), the effect of trade growth on productivity growth is indeterminate when we conduct longer-term investigations due to a weakening of the instrument (F-statistic less than 10 and insignificant coefficients). The instrument's quality is much higher for shorter-term intervals than for longer intervals (i.e. more than 5 years). The IV estimates therefore, cannot eliminate the strong bias of the parameter estimates for longer time intervals.

We then focus on our main contribution, where we investigate the effect of trade growth on growth of the components of economy-wide productivity. This allows us to pinpoint the source of the growth in productivity in response to trade growth. Our findings suggest that the within sector productivity component drives the growth in productivity in response to trade growth. Specifically, we find that a 1 percent increase in trade growth increases within sector productivity growth by approximately 0.1 percent.

For the employment reallocation or structural change component, we mostly obtain positive coefficients; however, the effect of trade on this component is insignificant. The coefficients on this source of productivity growth tend to be larger than the within component and as such we conclude that its relationship with trade is still economically significant to decision makers. This means that although we may not be able to indicate causal relationships between trade and structural change, structural change is still a vital component of economy-wide labour productivity and changes in its patterns can influence the overall welfare of an economy. It is therefore necessary for policy measures other than trade reform to be created and implemented in ways that encourage structural adjustment that is growth enhancing.

The importance of the within component of productivity growth is supported by trade growth studies that stress the importance of increasing sectoral productivity for firms facing increased competition due to increased openness. This increasing within productivity is essentially a value-added process that raises living standards. Increased within sector productivity, lowers the required level of inputs required for production, which can in turn reduce prices in import-competing sectors and minimise working hours, while retaining high levels of consumption. Studies by Pavcnik (2002) and Bloom et al. (2011) support our findings by reporting increasing productivity and faster productivity growth within sectors in response to growing import competition.

Our findings highlight the need for the promotion of innovation through trade and foreign investment. Creating channels for increased trade and foreign investment, improves productivity directly though the provision of new investment capital, technologies, expertise and export markets and indirectly by accelerating the reallocation process. Sectors could realise stronger performances through higher export discoveries and export sophistication via the use of improved capital intensive methodologies.

We then conducted a series of robustness checks, in particular, a further exploration of the heterogeneity of the data by disaggregating our dataset into a number of subsamples and then repeating the growth estimations described above. Aggregate analyses may sometimes mask patterns in the data and this step attempts to uncover any unobserved factors that might be driving our results. We disaggregate the data according to stage of development, level of resource dependence and finally we investigate the mining sector.

Specifically we estimate the effect of trade growth on growth of the components for groups of developed and developing countries, resource rich and resource dependent economies and the mining sector and obtain some results that support our main finding of the effect of trade on the components of growth on the entire sample. We find that it is the within component driving the growth in aggregate labour productivity. Specifically a 1 percent increase in trade growth increases within productivity growth by between 0.1 and 0.2

percent. This finding is significant for our developing, resource rich and resource dependent subsamples. We did not find any relationship between trade growth and the structural change component. There appears, however, for the developed country subsample to be a weakly positive relationship between trade growth and structural productivity growth. The effect of trade growth therefore suggests that such findings are sensitive to countries included in the subsamples and serves as a point of further research, such as individual country analysis.

We find that our positive and significant relationship between trade and labour productivity occurs when we use 1- and 5-year intervals. Although data transformation weakened the instrument in the longer term, the literature agues the existence of a time-varying relationship between openness and growth and this may account for the difference in the findings across the different intervals. Countries may gain in the short- to medium-term following increased trade; however, these same countries may not grow faster or may experience growth reversals in the longer-term due to a number of absent factors such as the quality of domestic institutions and the size of FDI inflows.

It is also important to understand how well countries are able to achieve and sustain productivity growth through trade. One could argue that a focus on static trade openness versus continuous trade growth that encourages sustained significant additions to per capita GDP contributes to the fact that this positive relationship between trade and productivity are realised in the short- or medium-term and not in the longer term as observed. Ongoing openness to trade is a significant source of growth as researchers believe that countries like those in East Asia experienced fast economic development in the past 50 years due to their participation in the global economy (Birdsall et al., 1993). Findings such as Broda et. al (2006) suggest that although some countries may boost growth through international trade, the lack of complementary inputs, including institutions and capital, mean they do not benefit from trade due to complementary inputs. Simply increasing world trade will not automatically lead to a higher productivity and growth in the long run. Education, property rights, the business environment and other institutions are necessary to ensure that this positive relationship between trade and labour productivity are extended beyond the short-term and medium-term, as these are found to be important driving forces of growth in the medium- to the longer-term. An opportunity for further research will seek to answer questions not simply about whether countries benefit from trade openness in the long-run, but also the timing and circumstances under which they benefit.

We explore the impact of trade growth on the aggregate productivity and its components using a growth accounting framework and panel data analysis and we effectively accounted from dynamics and endogeneity issues in the trade growth literature. Given our thorough investigations and accounting for the endogeneity issues present in the trade growth literature, we can conclude that trade increases aggregate productivity growth and this is being driven by the positive effect of the within component. However, this is not the case for all countries as indicated by our robustness checks and as such individual country studies is the next step to understanding the differential effects of trade on the components of aggregate productivity. Our study sheds light on the importance of trade in influencing not just economic growth, but its sources. Economic growth is a dynamic phenomenon and it comprises the ultimate goal of governments worldwide. Openness is a vital ingredient for growth and policy measures should encourage the removal of barriers that inhibit trade in order to enhance within productivity growth as it is this component of economy-wide productivity is increases as trade growth increases.

Appendices to Chapter 4

Appendix 4.1

Table A4. 1 Articles using fixed effects, random effects or both fixed effects in the estimation of the gravity equation

Article	Effects Included	Data	Dependent Variable
Rose and van Wincoop (2001)	-Importer, Exporter and Time effects	200 countries; data at 5-year intervals between 1970 and 1995	Bilateral Trade
Glick and Rose (2002)	-Country-Pair Effects -Symmetric country-pair effects	217 countries, 1948 - 1997	Real bilateral trade
Baltagi et al. (2003)	-Importer, Exporter and Time effects -Country-pair fixed effects -Importer Time effects	EU15, USA and Japan with their 57 most important trading partners; 1986-1997	Real bilateral exports
Ruiz and Vilarrubia (2007)	- Importer, Exporter and Time effects -Exporter period and importer period dummies (annual, triennial and quinquennial)	205 countries; 1948 - 2005	Bilateral trade
Henderson and Millimet (2008)	- Importer, Exporter and Time effects -Country pair fixed effects	US Data, 25 2-digit industries; 1993 and 1997	Nominal value of exports

Appendix 4.2

Table A4. 2 Sample Countries (Period of Study 1960– 2006)

ASIA	**ABBREVIATION**	**SUB-SAHARAN AFRICA**	**ABBREVIATION**
China	CHN	Botswana	BWA
Indonesia	IDN	Ethiopia	ETH
India	IND	Ghana	GHA
Japan*	JPN	Malawi	MWI
Korea	KOR	Nigeria	NGA
Singapore	SGP	Tanzania	TZA
Thailand	THA	South Africa	ZAF
Taiwan	TWN	Zambia	ZMB
LATIN AMERICA	**ABBREVIATION**	**EUROPE**	**ABBREVIATION**
Argentina	ARG	France*	FRA
Bolivia	BOL	Great Britain*	GBR
Brazil	BRA	Italy*	ITA
Chile	CHL	Spain*	ITA
Columbia	COL	Sweden*	ESP
Costa Rica	CRI		
Mexico	MEX		
Peru	PER		
Venezuela	VEN		
NORTH AMERICA	**ABBREVIATION**	**MIDDLE EAST AND AFRICA**	**ABBREVIATION**
United States of America*	**USA**	**Egypt**	**EGY**

Note: An "*" indicates list of countries classified as developed as part of the robustness checks of this study (Section 2.7.5 in this Chapter). All other countries are classed as developing. Countries are classified according to the United Nation's *World Economic Situation Prospects (WESP)* country classification.

Table A4.3 List of Resource Rich and Resource Dependent Countries in Sample

Country	Resource measured
Bolivia*	Hydrocarbons
Botswana*	Minerals
Brazil	Hydrocarbons
Chile*	Minerals
China	Hydrocarbons
Colombia	Hydrocarbons
Egypt	Hydrocarbons
Ghana	Minerals
India	Hydrocarbons
Indonesia*	Hydrocarbons
Mexico*	Hydrocarbons
Nigeria*	Hydrocarbons
Peru*	Minerals
South Africa	Minerals
Tanzania*	Minerals
United Kingdom	Hydrocarbons
United States (Gulf of Mexico)	Hydrocarbons
Venezuela*	Hydrocarbons
Zambia*	Minerals

Note: Table A4.3 presents the list of resource rich and resource dependent countries as defined by the International Monetary Fund. Note: "*" identifies Resource Rich Countries as defined by the IMF. To be classed as "resource rich", oil, gas and minerals must make up at least 25 percent of GDP, exports or government revenue. For "resource dependent", less than 25 percent contributions must come from natural resources. This classification is used to identify our resource rich and resource dependent countries as part of our robustness analysis in Section 4.5.5 in this Chapter.

Table A4.4 Sector Coverage – Groningen 10-Sector Database

Sectors	Abbreviations
Agriculture, Hunting, Forestry and Fishing	AGR
Mining and Quarrying	MIN
Manufacturing	MAN
Public Utilities (Electricity, Gas and Water)	PU
Construction	CON
Wholesale and Retail Trade, Hotels and Restaurants	WRT
Transport, Storage and Communications	TSC
Finance, Insurance, Real Estate and Business Services	FIRE
Community, Social, and Personal Services	CSPS
Government Services	GS

Cepii Data on Distances Measures

The ***GeoDist*** database provides data on geographic elements and variables. See Data description in Section 4.3 in this Chapter.

Table A4.5 Country-level Variables (geo_cepii)

iso2, iso3, cnum	ISO codes in two and three characters, and in three numbers respectively.
country, pays	Name of country in English and French respectively.
area	Country's area in km2
dis_int	Internal distance of country i, dii = .67 √area/π (an often used measure of average distance between producers and consumers in a country
landlocked	Dummy variable set equal to 1 for landlocked countries.
continent	Continent to which the country is belonging
langoff_i	Official or national languages and languages spoken by at least 20% of the population of the country (and spoken in another country of the world) following the same logic than the "open-circuit languages" in Mélitz (2002)
lang20_i	Languages (mother tongue, lingua francas or second languages) spoken by at least 20% of the population of the country
lang9_i	Languages (mother tongue, lingua francas or second languages) spoken by between 9% and 20% of the population of the country
colonizeric	Colonizers of the country for a relatively long period of time and with a substantial participation in the governance of the colonized country
short_colonizeri	Colonisers of the country for a relatively short period of time or with only low involvement in the governance of the colonised country

Table A4.6 The Bilateral Files: dist_cepii

Variables	**Description**
contig	whether the two countries are contiguous
comcol	share a common language, have had a common coloniser after 1945
colony	have ever had a colonial link
col45	have had a colonial relationship after 1945
curcol	are currently in a colonial relationship
smctry	or were/are the same country

Table A4.7 Simple distances: dist and distcap

Geodesic distances are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations (in terms of population) for the *dist* variable and the geographic coordinates of the capital cities for the *distcap* variable.
Weighted distances: *distw* and *distwces*   The general formula developed by Head and Mayer (2002) and used for calculating distances between country i and j is: $$d_{ij} = (\sum_{k\in i}(\frac{pop_k}{pop_i}) (\sum_{l\in j}(\frac{pop_l}{pop_j})d_{kl}^{\theta} \quad (A4.1)$$ where popk designates the population of agglomeration k belonging to country i. The parameter θ measures the sensitivity of trade flows to bilateral distance dk. For the ***distw*** calculation, θ is set equal to 1. The ***distwces*** calculation sets θ equal to -1, which corresponds to the usual coefficient estimated from gravity models of bilateral trade flows.

Appendix 4.3

Table A4.8 Feyrer (2009): OLS Estimates of Trade on per Capita GDP

	ln (Real GDP per Capita)	
	(1)	(2)
ln(Trade)	0.446	0.398
	(0.041)**	(0.038)**
Observations	774	560
Countries+	101	62
Years	10	10
R-Squared	0.965	0.978
All Regressions are on Data at 5-year Intervals from 1950-1995		
All Regressions Include a Full Set of Time and Country Dummies		
Standard Errors are Clustered by Country		
** Significant at 1% level		

+Column (1) is based on a full sample and column (2) is a reduced sample because data was limited to a set of bilateral country pairs that had continuous trade from 1950-1997

Table A4.9 Feyrer (2009): Panel Estimates of Trade on per Capita GDP

	ln (Real GDP per Capita)
ln(Trade)	0.429
	(0.075)**
	First Stage
	ln (Trade)
ln(Predicted Trade)	2.033
	(0.410)**
R-Squared	24.6
F-Stat on Instrument	0.223
Observations	774
Countries	101
Years	10
Characteristics of Trade Regressions	
Bilateral Controls	yes
Balanced Panel	yes
Country Dummies	yes
All Regressions are on Data at 5-year Intervals from 1950-1995	
All Regressions Include a Full Set of Time and Country Dummies	
IV Standard Errors corrected for constructed instruments	
Standard Errors are Clustered by Country	
** Significant at 1% level	

Table A4.10 Feyrer (2009): The Effect of Trade Growth on per Capita GDP growth 1960-1995

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.558		0.688
	(0.070)**		(0.111)**
Predicted Trade Growth		0.877	
		(0.189)**	
First Stage F-Stat			29.4
First Stage R-Squared			0.242
Observations	32	32	76
R^2	0.525	0.129	0.439

In column (3) trade growth instrumented with predicted trade growth

* Significant at 5% ** Significant at 1% level

Table A4.11 The Effect of Trade Growth on Economy-Wide Labour Productivity Growth 1965-2004: Ten-Year Intervals

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.103*		0.104*
	(0.047)		(0.052)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.155^{+}	1.492^{+}
		(0.091)	(0.782)
F-Stat			3
Observations	128	128	128
R^2	0.166	0.021	0.127

Robust Standard Errors In Parentheses

$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.12 The Effect of Trade Growth on Economy-Wide Labour Productivity Growth 1965-1994: Fifteen-Year Intervals

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.118*		0.125**
	(0.048)		(0.046)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.181**	1.450**
		(0.065)	(0.460)
F-Stat			10
Observations	64	64	64
R^2	0.359	0.089	0.220

Robust Standard Errors In Parentheses
$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4. 13 The Effect of Trade Growth on Economy-Wide Labour Productivity Growth 1965-2004: Twenty Year Intervals

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.127*		0.064
	(0.050)		(0.091)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.151	2.350^{+}
		(0.241)	(1.261)
F-Stat			3
Observations	64	64	64
R^2	0.231	0.009	0.158

Robust Standard Errors In Parentheses
$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.14 The Effect of Trade Growth on Economy-Wide Labour Productivity Growth 1965-2000: Thirty-Five-Year Interval

	(1)	(2)	(3)
	ECONOMY-WIDE LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.189**		0.354*
	(0.062)		(0.175)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.739	2.087
		-0.442	(1.824)
F-Stat			1
Observations	32	32	32
R^2	0.525	0.129	0.070

Robust Standard Errors In Parentheses

$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.15 The Effect of Trade Growth on Structural Labour Productivity Growth 1965-2004: Ten-Year Intervals

	(1)	(2)	(3)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.335		4.946
	(0.628)		(4.094)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		7.380	1.492^{+}
		(4.522)	(0.782)
F-Stat			4
Observations	128	128	128
R^2	0.001	0.022	0.127

Robust Standard Errors In Parentheses

$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.16 The Effect of Trade Growth on Within Labour Productivity Growth 1965-2004: Ten-Year Intervals

	(1)	(2)	(3)
	WITHIN LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.070**		0.141*
	(0.026)		(0.061)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.210**	1.492⁺
		(0.070)	(0.782)
F-Stat			4
Observations	128	128	128
R^2	0.069	0.036	0.127

Robust Standard Errors In Parentheses

⁺ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.17 The Effect of Trade Growth on Structural Labour Productivity Growth 1965-1994: Fifteen-Year Intervals

	(1)	(2)	(3)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.799		2.536
	(0.811)		(2.513)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		3.677	1.450**
		(3.504)	(0.460)
F-Stat			10
Observations	64	64	64
R^2	0.006	0.013	0.220

Robust Standard Errors In Parentheses

⁺ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.18 The Effect of Trade Growth on Within Labour Productivity Growth 1965-1994: Fifteen-Year Intervals

	(1)	(2)	(3)
	WITHIN LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.086**		0.105*
	(0.027)		(0.042)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.152*	1.450**
		(0.060)	(0.460)
F-Stat			10
Observations	64	64	64
R^2	0.266	0.087	0.220

Robust Standard Errors In Parentheses
$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.19 The Effect of Trade Growth on Structural Labour Productivity Growth 1965-2004: Twenty-Year Intervals

	(1)	(2)	(3)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.772		0.848
	(1.236)		(2.414)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		1.992	2.350^{+}
		(5.629)	(1.261)
F-Stat			3
Observations	64	64	64
R^2	0.004	0.001	0.158

Robust Standard Errors In Parentheses
$^{+}$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.20 The Effect of Trade Growth on Within Labour Productivity Growth 1965-2004: Twenty-Year Intervals

	(1)	(2)	(3)
	WITHIN LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.080**		0.100
	(0.024)		(0.086)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.236	2.350⁺
		(0.182)	(1.261)
F-Stat			3
Observations	64	64	64
R^2	0.092	0.023	0.158

Robust Standard Errors In Parentheses

⁺ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.21 The Effect of Trade Growth on Structural Labour Productivity Growth 1965-2000: Thirty-Five-Year Interval

	(1)	(2)	(3)
	STRUCTURAL LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.677		-2.470
	(1.956)		(3.590)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		-5.153	2.087
		(6.331)	(1.824)
F-Stat			1
Observations	32	32	32
R^2	0.005	0.004	0.070

Robust Standard Errors In Parentheses

⁺ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Table A4.22 The Effect of Trade Growth on Within Labour Productivity Growth 1965-2000: Thirty-Five-Year Interval

	(1)	(2)	(3)
	WITHIN LABOUR PRODUCTIVITY GROWTH		
	OLS	**Reduced Form**	**IV**
Trade Growth	0.152***		0.466
	(0.040)		(0.280)
			FIRST STAGE
			Ln (Trade Growth)
Predicted Trade Growth		0.972**	2.087
		(0.275)	(1.824)
F-Stat			1
Observations	32	32	32
R^2	0.461	0.001	0.070

Robust Standard Errors In Parentheses

$^+$ P<0.1, * p<0.05, ** p<0.01, *** p<0.001

Chapter 5 : Conclusions

The effects of international trade on different economic variables and the intended gains from trade continue to be a contentious topic among trade economists and policy makers alike, especially with regards to trade's contribution to economic growth and overall improvement in welfare. We also recognise that structural change is a vital component of economic development. The sectoral composition of employment and output is important in understanding the dynamics of growth and development. Notwithstanding the significant growth in econometric research looking at these issues in the context of developing and Low-Income economies, there exists a dearth of literature that examines these issues in the context of both developed and developing economies, while simultaneously accounting for heterogeneities that exist in the data. In this regard, we are motivated to conduct a comprehensive study examining the relationship between trade, structural change and productivity, via alternative mechanisms through which allow us to investigate these issues.

It is important that we understand the relationships among these subjects, as they are important in the formulation of trade policy and the promotion of increased openness in both developed and developing economies, especially given the continue and unprecedented movement towards openness among the world's economies. Our use of trade, productivity and gravity data at different levels of aggregation, and across different levels of space and time allow us to unearth several key findings.

Firstly, the results of our first study show that the use of aggregate manufacturing data suggests that there is no systematic relationship between trade liberalisations and economy-wide employment and output reallocation or structural change. However, this result does not hold when we separate our dataset into consumption, intermediate and capital goods in an attempt to explore liberalisation heterogeneities across industries. Although this core result of no systematic relationship holds for consumption goods, we find reduced output and employment adjustment in the intermediate goods category post liberalisation. Furthermore, output adjustment in capital goods post liberalisation is greater than output adjustment pre-liberalisation.

The structural change process is not only characterised by broad shifts from primary production to industry but also by shifts within manufacturing. Furthermore, as most of manufacturing is tradeable and it is expected to be highly susceptible to trade policies leading to shifts in the industrial and sectoral composition of output and employment. Our finding supports arguments that the level and nature of liberalisation occurring across different industries matter for structural adjustment. Specifically, hidden measures of protection such as NTBs mask the real level of protection, which might actually be higher than what is actually observed by simply looking at average tariffs. In this chapter, we employ the Sachs and Warner (1995) measure of liberalisation to categorise a country as open or closed. The authors' measure of liberalisation captures both tariffs and NTBs as two of its five criteria used to declare countries as open or closed and therefore accounts for the possibility of hidden trade barriers or higher levels of protection as discussed above.

The variation in the level of adjustment across the consumption, intermediate and capital goods can be accounted for by different tariff structures especially in the case of developing economies. For example, across different types of goods, there may be greater liberalisation in non-competing imports such as capital and intermediate goods, to facilitate the protection of certain domestic industries, thereby inhibiting the resource adjustment in favour of more productive activities. The absence of a relationship between trade liberalisation in the consumption goods group posits some implications for policy formulation. Import-competing final goods industries tend to be subjected to higher levels of protection, especially in developing economies. Domestic production in these industries is hence unaffected as foreign competition is limited. By opening up these industries to foreign competition, policy makers could encourage domestic producers to become more efficient, as they are now forced to become more competitive in order to survive in the industry. This type of increase in efficiency would then improve the efficiency of the industry or sector and could contribute positively to economy-wide productivity. Our findings open up channels for future research. In particular, an investigation of the level of effective protection or the true nature of protection across countries is important to determine whether domestic policies encouraging infant protection and tariff escalation reduce the intended gains from trade by restricting the redistribution of the factors of production in favour of higher productivity activities.

Our second study extends our focus away from simply looking at whether structural adjustment occurs after trade reform, and towards investigating the nature of both components of economy-wide productivity growth, in particular, growth due to structural change and within sector efficiency changes across countries. In this chapter we attempt to account for observed differences in growth rates and the presence of productivity gaps observed among developing regions. Our study which encompasses a growth accounting exercise reveals some interesting findings. We find that within different regions, there are individual countries such as Nigeria, Zambia and Venezuela that are experiencing an adjustment of employment across sectors in a manner that is productivity growth reducing. More specifically, lower productivity sectors are experiencing increasing shares of employment, thereby contributing negatively to overall productivity. Not only is this result specific to individual countries, but it also appears to be time-specific, for example, following periods of falling oil prices and economic crises. Specifically, observations of negative reallocation were more common post 1997 rather than being consistently present over the 1990 to 2005 study period.

These findings highlight a possible correlation between our observations of negative structural change and global economic shocks, especially for natural resource dependent economies. Policy needs to promote stability in the economic and political climate, as failure to do so encourage resource distribution that opposes development theories that promote a movement out of low productivity in favour of high productivity sectors. Furthermore, unemployment arising due to such unstable economic environments may also mean that there is limited actual movement of resources into lower productivity sectors as workers exit the labour market. There is also a need for economic diversification across natural resource dependent countries, as the ability countries to obtain their revenue from multiple sources reduces their susceptibility to adverse economic shocks.

From Chapter 3, we also observe in the data that not only did the within component dominate in terms of its contribution to aggregate productivity growth but it has a consistently positive relationship with per capita GDP across all sample regions. This highlights the importance of within productivity growth in the promotion of economic growth. Without adequate within productivity growth, such as technological improvements to induce increased efficiency, aggregate productivity growth will be limited.

Further research highlights the need to investigate the relationship between natural resource dependence and structural change. Empirical investigations on the relationship between structural change and other macroeconomic policies such as exchange rate fluctuations are also important in understanding the impact of different global crises on the pattern of employment or resource reallocation.

In the final Chapter 4, we use an exogenous gravity-based instrument to investigate the relationship between trade openness and economy-wide productivity and its structural and within change components. We find that there is a positive relationship between trade openness and economy-wide productivity. This result is consistent when we measure our variables in both levels and in growth. A key finding in this chapter is that effect of trade on productivity growth appears to be via the within component of economy-wide productivity, given the finding of a positive and significant relationship between the two variables. As with Chapter 1, one would expect an increase in the reallocation of resources across sectors or structural change, with increased trade openness; however, we obtain positive but insignificant results between these two variables. Policy makers need to be cognisant of the need for activities that continue to increase within sector reallocation as well as those that encourage technological improvements. For example, innovation through trade and foreign investment improves productivity within sector by the providing new technologies and expertise that could aid industries in realising stronger performances. Our finding does not necessarily lessen the importance of the structural change component. It emphasises the need for policy measures other than trade reform to encourage structural change that is conducive to productivity growth.

Across all three chapters, we analysed the behaviour of structural adjustment and included the within component in the final two studies. These two components are fundamental variables in discussions involving both trade and productivity growth. Shifts within and across industries and sectors, occur in response to changes in the availability of the inputs into the production process. Comparative advantage driving trade is a function of the relative abundance of these factor inputs. Changing shares of factors change sectoral and industrial composition as well as the composition of trade. The ideas posed for future research will extend the trade growth literature, for both academics and policy makers, by increasing our understanding of the sources of growth. Development requires a reallocation of resources and a transfer of knowledge. It is therefore important that we understand all the contributing factors, to ensure that relevant and adequate policies are formulated and intended welfare gains obtained.

References

Acemoglu, D., S. Johnson, et al. (2001). "The Colonial Origins of Comparative Development: An Empirical Investigation." The American Economic Review 91(5): 1369-1401.

Aghion, P. and P. Howitt (1992). "A Model of Growth through Creative Destruction." Econometrica 60(2): 323-351.

Aibinu, A. A. and G. O. Jagboro (2002). "The effects of construction delays on project delivery in Nigerian construction industry." International Journal of Project Management 20: 593-599.

Amiti, M. and J. Konings (2007). "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia." The American Economic Review 97(5): 1611-1638.

Anderson, J. E. and J. P. Neary (1994). "Measuring the Restrictiveness of Trade Policy." The World Bank Economic Review 8(2): 151-169.

Anderson, J. E. and E. van Wincoop (2003). "Gravity with Gravitas: A Solution to the Border Puzzle." American Economic Review 93(1): 170-192.

Azam, J.-P., M. Dia, et al. (2007). "Has Growth in Senegal After the 1994 Devaluation Been Pro-Poor?" World Bank Working Paper 79: 45-67.

Baily, M. N., C. Hulten, et al. (1992). "Productivity Dynamics in Manufacturing Plants." Brookings Papers: Microeconomics 4(1): 187-267.

Balassa, B. (1966). "Tariff Reductions and Trade in Manufacturers among the Industrial Countries." The American Economic Review 56(3): 466-473.

Balassa, B. (1986). "The employment effects of trade in manufactured products between developed and developing countries." Journal of Policy Modeling 8(3): 371-390.

Baldwin, R. and D. Taglioni (2006). "Gravity for Dummies and Dummies for Gravity Equations." National Bureau of Economic Research Working Paper Series 12516.

Baltagi, B. H., G. Bresson, et al. (2003). "Fixed effects, random effects or Hausman-Taylor?: A pretest estimator." Economics Letters 79(3): 361-369.

Barbieri, K. and O. Keshk (2012). "Correlates of War Project Trade Data Set Codebook Version 3.0." http://correlatesofwar.org.

Barnett, A., A. Chiu, et al. (2014). "The productivity puzzle: a firm-level investigation into employment behaviour and resource allocation over the crisis." Bank of England Working Paper 495: 114-128.

Barro, R. J. (1996). "Democracy and Growth." Journal of Economic Growth 1(1): 1-27.

Batini, N. (2004). "Achieving and Maintaining Price Stability in Nigeria " International Monetary Fund Working Paper WP/04/97

Beaudry, P., F. Collard, et al. (2002). "Decomposing the Twin-peaks in the World Distribution of Output-per-worker." National Bureau of Economic Research Working Paper Series 9240.

Bernhofen, D. M. and J. C. Brown (2005). "An Empirical Assessment of the Comparative Advantage Gains from Trade: Evidence from Japan." The American Economic Review 95(1): 208-225.

Berthou, A. (2008). "An Investigation on the effect of Real Exchange Rate Movements on OECD Bilateral Exports." European Central Bank Working Paper Series(920).

Bertola, G. (1990). "Job security, employment and wages." European Economic Review 34(4): 851-879.

Bhundia, A. J. and L. A. Ricci (2006). "The Rand Crises of 1998 and 2001: What Have We Learned?" Chapter in Post-Apartheid South Africa: the First Ten Years, IMF.

Birdsall, N. M., J. E. L. Campos, et al. (1993). "The East Asian miracle : economic growth and public policy: Main report." A World Bank Policy Research Report, New York: Oxford University Press.

Bloom, N., M. Draca, et al. (2011). "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity." National Bureau of Economic Research Working Paper Series 16717.

Borrmann, A., M. Busse, et al. (2006). "Institutional Quality and the Gains from Trade." Kyklos 59(3): 345-368.

Broda, C. and D. E. Weinstein (2006). "Globalization and the Gains From Variety." The Quarterly Journal of Economics 121(2): 541-585.

Brülhart, M., R. Elliot, et al. (2005). "Intra-industry trade and labour market adjustment: A reassessment using data on individual workers." Sheffield Economic Research Paper Series 2005005.

Brunner, A. D. (2003). "The Long-Run Effects of Tradeon Income and Income Growth." International Monetary Fund Working Papers WP/03/37.

Chang, R., L. Kaltani, et al. (2005). "Openness Can be Good for Growth: The Role of Policy Complementarities." National Bureau of Economic Research Working Paper Series 11787.

Chenery, H. (1979). "Structural change and development policy." A World Bank research publication 1.

Choudhri, E. and D. S. Hakura (2000). "International Trade and Productivity Growth: Exploring the Sectoral Effects for Developing Countries." International Monetary Fund Staff Papers 47(1).

Coe, D. T., E. Helpman, et al. (1997). "North-South R & D Spillovers." The Economic Journal 107(440): 134-149.

Currie, J. and A. E. Harrison (1997). "Sharing the Costs: The Impact of Trade Reform on Capital and Labor in Morocco " Journal of Labor Economics 15(3): S44-71.

Dabla-Norris, E., A. Thomas, et al. (2013). "Benchmarking Structural Transformation Across the World " International Monetary Fund Working Paper WP/13/176.

Das, G. G. (2012). "Fragmentation in Production, Vertical Integration and Wage Inequality: A Theoretical Note." Modern Economy 3: 958-964.

Davidson, C., L. Martin, et al. (1988). "The Structure of Simple General Equilibrium Models with Frictional Unemployment." Journal of Political Economy 96(6): 1267-1293.

Disdier, A.-C. and K. Head (2008). "The Puzzling Persistence of the Distance Effect on Bilateral Trade." The Review of Economics and Statistics 90(1): 37-48.

Dollar, D. (1992). "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985." Economic Development and Cultural Change 40(3): 523-544.

Dollar, D. and A. Kraay (2002). "Growth Is Good for the Poor." Journal of Economic Growth 7(3): 195-225.

Dollar, D. and A. Kraay (2004). "Trade, Growth, and Poverty." Economic Journal 114(493): F22-F49.

Dornbusch, R. (1992). "The Case for Trade Liberalization in Developing Countries." The Journal of Economic Perspectives 6(1): 69-85.

Easterly, W. (2005). "National Policies and Economic Growth: A Reappraisal." Handbook of Economic Growth 1: 1015-1059.

Eaton, J. and S. Kortum (2002). "Technology, Geography, and Trade." Econometrica 70(5): 1741-1779.

Edwards, S. (1989). "On the Sequencing of Structural Reforms." National Bureau of Economic Research Working Paper Series 3138.

Edwards, S. (1993). "Openness, Trade Liberalization, and Growth in Developing Countries." Journal of Economic Literature 31(3): 1358-1393.

Eslava, M., J. C. Haltiwanger, et al. (2009). "Trade Reforms and Market Selection: Evidence from Manufacturing Plants in Colombia." National Bureau of Economic Research Working Paper Series 14935.

Fernandes, A. M. (2007). "Trade policy, trade volumes and plant-level productivity in Colombian manufacturing industries." Journal of International Economics 71(1): 52-71.

Feyrer, J. (2009). "Trade and Income -- Exploiting Time Series in Geography." National Bureau of Economic Research Working Paper Series 14910.

Frankel, J. A. and D. H. Romer (1999). "Does Trade Cause Growth?" American Economic Review 89(3): 379-399.

Furusawa, T. and H. Konishi (2013). "International Trade and Income Inequality." Boston College Working Papers in Economics 849.

Garrison, W. L. (2000). "Technological Changes and Transportation Development." The University of California Transportation Center No. 495.

Glaeser, E. L., R. La Porta, et al. (2004). "Do Institutions Cause Growth?" National Bureau of Economic Research Working Paper Series 10568.

Glick, R. and A. K. Rose (2002). "Does a Currency Union Affect Trade? The Time Series Evidence." European Economic Review 46(6): 1125-1151.

Glick, R. and A. M. Taylor (2010). "Collateral Damage: Trade Disruption and the Economic Impact of War." Review of Economics and Statistics 92(1): 102-127.

Goldberg, P. K., A. K. Khandelwal, et al. (2010). "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India." The Quarterly Journal of Economics 125(4): 1727-1767.

González, D. A. (1994). "Changes in the Distribution of Income in México and Trade Liberalization." El Colegio de la Frontera Norte.

Gwartney, J. D., R. Holcombe, et al. (2004). "Economic Freedom, Institutional Quality,and Cross-Country Differences in Income and Growth." Cato Journal 24(3): 205-233.

Gwartney, J. G., R. A. Lawson, et al. (1998). "The Size and Functions of Government and Economic Growth." Report to the Joint Economic Committee of the U.S. Congress, Washington, D.C.

Haltiwanger, J., A. Kugler, et al. (2004). "Effects of Tariffs and Real Exchange Rates on Job Reallocation: Evidence from Latin America." Journal of Policy Reform 7(4): 191-208.

Harris, E. (1999). "Impact of the Asian Crisis on Sub-Saharan Africa." Finance and Development, A Quarterly Magazine of the IMF 36(1).

Harris, J. R. and M. P. Todaro (1970). "Migration, Unemployment & Development: A Two-Sector Analysis." American Economic Review 60(1): 126-142.

Head, K. and T. Mayer (2014). "Gravity Equations: Workhorse,Toolkit, and Cookbook." Handbook of International Economics 4(131-195).

Head, K., T. Mayer, et al. (2010). "The erosion of colonial trade linkages after independence." Journal of International Economics 81(1): 1-14.

Helpman, E., O. Itskhoki, et al. (2010). "Inequality and Unemployment in a Global Economy." Econometrica 78(4): 1239-1283.

Helpman, E. and P. Krugman (1985). "Market structure and foreign trade: Increasing returns, imperfect competition and the international economy." Journal of International Economics 21(1-2): 183-187.

Henderson, D. J. and D. L. Millimet (2008). "Is gravity linear?" Journal of Applied Econometrics 23(2): 137-172.

Henry, P. B. (1999). "Appendix of Major Policy Changes in Selected Developing Countries." Mimeo, Stanford University Graduate School of Business.

Hiscox, M. J. and S. Rickard (2002). "Birds of a Different Feather? Varieties of Capitalism, Factor Specificity, and Interindustry Labor Movement."

Hopenhayn, H. and R. Rogerson (1993). "Job Turnover and Policy Evaluation: A General Equilibrium Analysis." Journal of Political Economy 101(5): 915-938.

Hummels, D. (2007). "Transportation Costs and International Trade in the Second Era of Globalization." Journal of Economic Perspectives 21(3): 131-154.

Jones, B. F. and B. A. Olken (2008). "The Anatomy of Start-Stop Growth." The Review of Economics and Statistics 90(3): 582-587.

Kaldor, N. (1963). "Taxation for Economic Development." The Journal of Modern African Studies 1(1): 7-23.

Kaldor, N. (1966). "Marginal Productivity and the Macro-Economic Theories of Distribution: Comment on Samuelson and Modigliani." The Review of Economic Studies 33(4): 309-319.

Kaufmann, D., A. Kraay, et al. (2005). "Governance Matters IV : Governance Indicators for 1996-2004." World Bank Policy Research Working Paper Series(3630).

Kaufmann, D., A. Kraay, et al. (1999). "Governance Matters." World Bank Policy Research Working Paper(2196).

Kaufmann, D., A. Kraay, et al. (2002). "Governance Matters II - Updated Indicators for 2000/1." World Bank Policy Research Working Paper(2772).

Kletzer, L. G. (2002). "Imports, exports, and jobs : what does trade mean for employment and job loss?" Upjohn Institute for Employment Research.

Knack, S. and P. Keefer (1995). "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." Economics & Politics 7(3): 207-227.

Krishnamurty, J. "Learning from the 1997-1998 Asian Financial Crises: The ILO Experience in Thailand and Indonesia." International Labour Organisation International Programme on Crisis Response and Reconstruction, Employment Report No. 3.

Krueger, A. (2004). "Expanding Trade and Unleashing Growth: The Prospects for Lasting Poverty Reduction." International Monetary Fund Seminar on Trade and Regional Integration.

Kuznets, S. (1971). "Modern Economic Growth: Findings and Reflections." Nobel Prize in Economics documents(1971-2).

Leamer, E. E. (1988). "Measures of Openness." National Bureau of Economic Research Chapter 145 - 204.

Lewis, W. A. (1954). "Economic Development with Unlimited Supplies of Labour." The Manchester School 22(2): 139-191.

López Maya, M. (2005). "Venezuela 2002–2003: Polarization, Confrontation, and Violence," in Olivia Burlingame Goumbri, The Venezuela Reader." Washington.

Maddison, A. (2001). The World Economy: A Millenial Perspective, OECD Publishing.

Maddison, A. (2006). "Historical Statistics for the World Economy: 1-2003 AD." http://www.ggdc.net/maddison/Historical_Statistics/horizontal-file_10-2006.xls.

Mayer, T. and K. Head (2002). "Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade." CEPII Research Centre Working Paper No. 2002-01.

McCaig, B. and N. Pavcnik (2013). "Moving out of Agriculture: Structural Change in Vietnam." National Bureau of Economic Research Working Paper Series 19616.

McMillan, M. S. and D. Rodrik (2011). "Globalization, Structural Change and Productivity Growth." National Bureau of Economic Research Working Paper Series 17143.

Melitz, J. (2002). "Language and Foreign Trade." Centre for Economic Policy Research Discussion Papers 3590.

Melitz, M. J. (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." Econometrica 71(6): 1695-1725.

Melitz, M. J. and G. I. P. Ottaviano (2008). "Market Size, Trade, and Productivity." The Review of Economic Studies 75(1): 295-316.

Menezes-Filho, N. A. and M.-A. Muendler (2011). "Labor Reallocation in Response to Trade Reform." National Bureau of Economic Research Working Paper Series 17372.

Milner, C. (2013). "Declining Protection in Developing Countries: Fact or Fiction?" The World Economy 36(6): 689-700.

North, D. C. (1981). Structure and Change in Economic History, Norton.

Olatunji, O. A. (2010). "The impact of oil price regimes on construction cost in Nigeria." Construction Management and Economics 28(7): 747-759.

Omole, A. O. (2000). "Surveying input into engineering projects: need for professionalism." The Quantity Surveyor 30(1): 10-18.

Organisation for Economic Co-Operation and Development (2005). "Trade and Structural Adjustment."

Osei, R. D. and R. Jedwab (2013). "Is Structural Change in Sub-Saharan Africa Different? New Historical Evidence from Ghana." World Bank's Country Case Studies Workshop on “Structural Change in Developing Countries.

Pavcnik, N. (2002). "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants." The Review of Economic Studies 69(1): 245-276.

Perry, G. and M. Olarreaga (2006). "Trade Liberalization, Inequality and Poverty Reduction in Latin America." World Bank's Annual Bank Conference on Development Economics, Saint Pertersburg, Russia.

Restuccia, D. and R. Rogerson (2013). "Misallocation and productivity." Review of Economic Dynamics 16(1): 1-10.

Revenga, A. (1997). "Employment and Wage Effects of Trade Liberalization: The Case of Mexican Manufacturing." Journal of Labor Economics 15(3): S20-43.

Revenga, A., M. Riboud, et al. (1994). "The impact of Mexico's retraining program on employment and wages " The World Bank Economic Review 8(2): 247-277.

Ricci, L. A. (2005). "South Africa's Real Exchange Rate Performance." Chapter 9 in Post-Apartheid South Africa: The First Ten Years, edited by Micheal Nowak and Luca Antonio Ricci, International Monetary Fund.

Rivera-Batiz, L. A. and P. M. Romer (1991). "International Trade with Endogenous Technological Change." National Bureau of Economic Research Working Paper Series 3594.

Rodriguez, F. and D. Rodrik (2001). "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence." National Bureau of Economic Research Chapters: 261-338.

Rodrik, D., A. Subramanian, et al. (2002). "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development." National Bureau of Economic Research Working Paper Series 9305.

Rose, A. and E. van Wincoop (2001). "National Money as a Barrier to International Trade: The Real Case for Currency Union." American Economic Review 91(2): 386-390.

Rostow, W. W. (1959). "THE STAGES OF ECONOMIC GROWTH." The Economic History Review 12(1): 1-16.

Roy, S. (1997). "Globalisation, Structural Change and Poverty: Some Conceptual and Policy Issues." Economic and Political Weekly 32(33/34): 2117-2135.

Ruiz, J. M. and J. M. Vilarrubia (2007). "The Wise Use of Dummies in Gravity Models: Export Potentials in the Euromed Region." Bank of Spain Research Paper 0720.

Sachs, J. D. and A. Warner (1995). "Economic Reform and the Process of Global Integration." Brookings Papers on Economic Activity 26(1): 1-118.

Sekkat, K. (2010). "Market Dynamics and Productivity in Developing Countries: Economic Reforms in the Middle East and North Africa." Springer, New York(1).

Shafaeddin, M. (2005). "Trade Liberalization and Economic Reform in Developing Countries: Structural Change or De-Industrialization?" United Nations Conference on Trade and Development Discussion Papers(179).

Staiger, D. and J. H. Stock (1997). "Instrumental Variables Regression with Weak Instruments." Econometrica 65(3): 557-586.

Stallings, B. (1998). "Impact of the Asian Crisis on Latin America." United Nations Economic Commission for Latin America and the Caribbean (ECLAC).

Stefanadis, C. (2010). "Appropriation, Property Rights Institutions, and International Trade." American Economic Journal: Economic Policy 2(4): 148-172
.

Timmer, M. P. and G. J. De Vries (2007). "A cross-country database for sectoral employment and productivity in Asia and Latin America, 1950–2005." GGDC Research Memorandum 98.

Timmer, M. P., G. J. de Vries, et al. (2014). "Patterns of Structural Change in Developing Countries." Groningen Growth and Development Centre Research Memorandum(149).

Timmer, M. P. and d. V. G. J (2009). "Structural Change and Growth Accelerations in Asia and Latin America: A New Sectoral Data Set." Cliometrica 3(2): 165-190.

Topalova, P. and A. Khandelwal (2010). "Trade Liberalization and Firm Productivity: The Case of India." Review of Economics and Statistics 93(3): 995-1009.

Tybout, J. R. (2000). "Manufacturing Firms in Developing Countries: How Well Do They Do, and Why?" Journal of Economic Literature 38(1): 11-44.

United Nations Policy and Analysis Division (2014). "Country Classification." World Economic Situation and Prospects

van Ark, B. (1996). "Sectoral Growth Accounting and Structural Change in Post-War Europe." in B. van Ark and N.F.R. Crafts, eds., Quantitative Aspects of Post-War European Economic Growth, CEPR/Cambridge University Press: 84-164.

van de Klundert, T. (2013). "Capitalism and Democracy A Fragile Alliance." Tillburg University, The Netherlands.

Wacziarg, R. and J. S. Wallack (2004). "Trade liberalization and intersectoral labor movements." Journal of International Economics 64: 411-439.

World Economic Forum (2013). "Manufacturing for Growth Strategies for Driving Growth and Employment." A World Economic Forum Report in collaboration with Deloitte Touche Tohmatsu Limited.

World Trade Organisation (2013). "World Trade Report - Factors Shaping the future of the World."