DOES ECONOMIC GLOBALIZATION CAUSE THE DECLINE OF THE LABOR SHARE : AN EMPIRICAL CROSS COUNTRY ANALYSIS OF MANUFACTURING INDUSTRY

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

I examine the empirical relationship between economic globalization (measured by outsourcing) and the labor share in a panel of up to 40 countries and 14 two-digit manufacturing industries covering a period from 1996 through 2012. Empirical studies investigate the role of economic globalization in explaining labor share, by grouping countries and industries into three groups: labor intensive vs capital intensive, skilled vs unskilled labor force and labor market institutions. This study provides additional empirical evidence to challenge the argument that economic globalization contributes to the decline of the labor share. In particular, the positive correlation between the labor share and economic globalization suggests that economic globalization might not be the contributor to the decline of the labor share.

Chapter 1

INTRODUCTION

The labor share (denotes *LBS* thereafter) is defined as the proportion of value added in production that is paid to labor input. The stability of the *LBS* has been considered as a fundamental feature of macroeconomic models, which affects the specification of production functions, income inequality and macroeconomic dynamics. However, recent studies observed that the aggregate *LBS* started to decline since the 1980s.

Numerous studies have tried to identify the key drivers of the decrease observed in the *LBS*. However, there is no consensus on the key determinants in driving movements of the *LBS*, and some studies have produced conflicting conclusions. One main branch of studies focuses on the trade-off between the labor and capital shares to explain the decrease in the *LBS* (Bentolila and Saint-Paul (2003); Karabarbounis and Neiman (2014); (Bassanini and Manfredi, 2012); Elsby et al. (2013)). These writers argue that capital and labor are substitutable more than complementary. Technological progress and economic globalization facilitate a process of capital deepening which then leads to the decrease observed in the *LBS*. However, the argument that attributes the decrease observed in labor's share to capital deepening is challenged by Barkai (2016) and Autor et al. (2013). Barkai (2016) demonstrated that the share of capital and labor are both declining and observed a large increase in firms' profits. Autor et al. (2013) attributed the decrease observed in labor's share to the increasing market power of firms. In addition, the argument of economic globalization facilitating capital deepening cannot explain the decrease of the *LBS* observed in non-trade sectors.

Identifying the drivers in the declining trend of the *LBS* is of great interest to policymakers. The *LBS* is considered as a measure of how the benefits of growth are shared between labor and capital in political debates. The decrease observed in the *LBS* has been used by trade unions to argue against policies of wage moderation. Conversely, governments have used it to justify the increased taxation of corporate profits.

More recently, some medias started to attribute the decrease observed in the *LBS* to the economic globalization which is believed to be a main cause of the deterioration of the labor force welfare. While trade policies and agreements certainly have to be revised to treat each participant country fairly, this does not mean that the development of globalization should be stopped. Global competition keeps inflation in check, and the free flow of capital keeps interest rates low. An open economy spurs innovation. Globalization allows for a more efficient allocation of resources worldwide, and thus benefits the labor force by increasing the total welfare. Therefore, it is important to identify the role of economic globalization in *LBS* movements, and especially whether economic globalization contributes to the fall of the *LBS*.

In line with a study by Young and Lawson (2014), my empirical study provides additional empirical evidence to show that economic globalization may not contribute to the decrease observed in the aggregate *LBS*, based on the data sample collected from the World Input–Output Database that covers 14 two-digit industries across 40 countries. Furthermore, economic globalization may have positive impacts on *LBS*. My study contributes to the studies of *LBS* in the following aspects.

First, the ratio of imported intermediate inputs to value added is used to measure the impact of economic globalization. This is deemed to be a better measurement of the impact of economic globalization than the measures used by previous studies (e.g., the ratio of trade to GDP). Recently, economic globalization has been characterized by production fragmentation. the production process is broke down the into various stages and allocated to the countries and regions where they have comparative advantages in specializing a certain production. The conventional variable, trade exposures, fails to capture the process of production fragmentation.

Second, I conduct a segmentation scheme to segment industry–country pairs into distinct groups in which the group characteristics such as the substitution between labor and capital and labor market institutions are relatively homogeneous. By controlling for these group characteristics, my empirical study is able to identify whether the correspondence of *LBS* to suspected key drivers such as capital deepening, technological progress, and economic globalization varies between segmentation groups. In particular, it is of interest to assess whether the effects of economic globalization vary across groups.

Third, my study focuses on manufacturing industries that are thought to be deeply involved with international trade and global chains of production, covering 40 countries. I demonstrate that the manufacturing industries can be deemed the largest contributor to the decrease observed in aggregated *LBS* (measured at the country level). Furthermore, the disaggregate data (industry level) across countries and industries avoid composition biases that come from aggregate level data. For example, in countries where the aggregate *LBS* only experienced decline to a small extent or not at all, the manufacturing industries experienced significant changes in *LBS* because of sectors shifting from manufacturing to services. Industry characteristics and comparative advantages of countries create variations in the suspected key drivers in explaining the *LBS* decline. For instance, the extent of involvement with economic globalization vary across manufacturing industries. Hence, this empirical study focuses more on disaggregate analysis, to avoid the composition biases that come from aggregate level data.

Finally, this study provides additional empirical evidence to challenge the argument that economic globalization contributes to *LBS* decline. Simple regressions based on a limited number of industries may not be sufficient to establish the causality between decrease observed in *LBS* and development of economic globalization. Due to salient industry and regional characteristics, the *LBS* and involvement in economic globalization vary across industries and countries. If the causality between economic globalization and *LBS* is valid, we should observe that an industry with larger imported intermediate inputs experiences decrease observed in *LBS* to a larger extent (negative correlation from the cross-country and -industry regression). My empirical study investigates the role of economic globalization in explaining labor's share, by segmenting countries and industries into three groups (labor intensive versus non-labor intensive, skilled versus unskilled labor force, and labor market institutions). In line with Young and Lawson's (2014) study, my study indicates that economic globalization effects the movements in *LBS* independently. Furthermore, the empirical evidence also indicates that the economic globalization may not be main cause of the decrease observed in the *LBS*.

The rest of my study is organized as follows. Chapter 2 provides a summary of recent studies that identified the movements of labor's share. Chapter 3 discusses the theoretical framework of labor's share. Chapter 4 discusses the movements observed in labor's share of income at aggregate level and rationale for why this study focuses on the manufacturing industries. Chapter 5 discusses the empirical specification and describes the data source and construction of the measure of offshoring. Chapter 6 reports the empirical results.

Chapter 2

LITERATURE REVIEWS

This chapter provides a summary of the studies that focus on identifying the potential drivers for the movement of the labor share.

2.1 Capital Deepening

The early literature approaches the determination of the *LBS* started by Bentolila and Saint-Paul (2003), who analyzed the movements of labor within a neoclassical production theory framework, in which the *LBS* can be expressed as a function of capital-output ratio. This one-for-one correlation is referred to as "share capital schedule". Within this framework, the *LBS* responds to potential drivers in three different ways: the labor's share follows the share capital schedule; capital-augmenting technological shifts the share capital schedule; and changes in labor adjustment cost either deviate from or move towards the share capital schedule. The substitution elasticity (denotes as *ES*) between capital and labor determines the *LBS*'s responses.

The theoretical prediction for the correlation between labor share and capital share was verified by empirical evidence that the *LBS* responds to the predictors with statistical significance, based on industry sector data covering 12 Organisation for Economic Co-operation and Development (OECD) countries from 1972 to 1993. Bentolila and Saint-Paul's empirical findings suggested that labor and capital are more substitutable than complementary, given the negative signs of capital share. In addition, total factor productivity negatively correlates with the *LBS*. Hence, the technical changes of capital deepening and capital augmenting are considered the main contributors to the decrease observed in labor's share. In adapting Bentolila and Saint-Paul's theoretical framework to my empirical study, we can identify the effect that economic globalization has on the *LBS* by utilizing a shifting share capital schedule. However, the findings of my empirical study conflict with Bentolila and Saint-Paul (2003) in terms of the *ES* between capital and labor. My study shows that labor and capital are more complementary than substitutable, given the positive correlation between labor and capital share. Different data samples may lead to a difference in empirical results. My empirical study is based on what can be classified as two-digit manufacturing industries, from 1996 to 2012, across 40 countries. Considering that the sample data applied in my empirical study has a greater number of countries and covers a relatively recent period, different results are expected.

More recently, Lawrence (2015) challenged Bentolila's conclusions. Lawrence (2015) argued that the *ES* is less than 1 and that technological change is deemed to be labor-augmenting. Therefore, the decrease observed in the aggregate *LBS* is attributed to the decline in effective labor-capital input ratio.

Lawrence (2015) estimated the magnitude of *ES* between capital and labor, based on the data from 18 U.S. manufacturing sectors from 1980 to 2010. Their empirical specifications, which are derived from the CES production function, calibrated the regression of labor-capital price ratio against capital-labor input ratios and the reversed regression (labor-capital input ratio against capital-labor price ratios). Compatible with numerous recent studies on the elasticity of substitution, Lawrence obtained strong evidence of an elasticity substitution of less than 1. Given the value of elasticity of substitution less than 1. Thus, Lawrence (2015) further concluded that the *LBS* should be positively correlated with the effective capital-labor ratio.

Lawrence's argument that the decrease observed in effective capital-labor ratio contributed to the decline of the *LBS* seems to be conflict with the development of automation in recent years, which intuitively seems to be capital augmenting. However, it is possible that technological progress leads to greater increase in the marginal product of labor greater than the marginal product of capital. As a result, the effective capital-labor ratio for a given amount of product will decrease, which then causes the *LBS* to decline.

My empirical study does not estimate the extent of the elasticity substitution between labor and capital; however, my empirical also indicates that labor and capital are more complementary than substitutable, which is consistent with Lawrence's empirical finding.

2.2 The Role of Technological Progress

The role of technological progress and how it affects the *LBS* have been the subject of much debate. On the one hand, some studies argue that capital augmenting technological progress contributes to the decline of *LBS*, as labor and capital are more substitutable than complementary. On the other hand, Elsby et al. (2013) provided evidence to challenge the assertion that the decline of *LBS* is attributed to the technology structure embodied in the neoclassical production theory.

First, Bentolila and Saint-Paul's empirical results indicated that technological progress is capital augmenting, given that Total Factor Productivity had a negative statistical significance. Additionally, Karabarbounis and Neiman (2014) argued that the computer information technology (IT) revolution results in decreases in the rental rate of capital, which contributes half of the decrease observed in the *LBS*. Karabarbounis and Neiman (2014) constructed a dynamic equilibrium model in which the *LBS* responds to shocks to the rental rate of capital. Such a shock during an otherwise steady-state period often causes producers to change their capital-labor ratio and the shares of each factor in production cost.

The key finding in Karabarbounis and Neiman (2014) is the estimation of *ES* between labor and capital, which determines the direction of *LBS* responding to the rental rate of capital. Karabarbounis and Neiman (2014) estimated the two production inputs (labor and capital) are more substitutable. Therefore, a decrease in the relative price level encourages employers to substitute labor input with capital input, which then causes the *LBS* to decrease.

However, there is no consensus on the elasticity of substitution between the two production inputs. The substitutability between the production inputs may be altered by the characteristics of countries and industries . For instance, the elasticity of substitution between labor and capital could vary across countries. For countries where the labor force is abundant, capital and labor can be more complementary than substitutable. For the capital- abundant countries with relatively higher labor prices, firms have incentives to replace labor with capital. At the disaggregate level, the elasticity can also vary across the educational levels of the labor force. Plenty of studies have argued that a lower-skilled labor force is easier to replace with automation than a highly skilled labor force is. So, we may ask whether labor and capital are more complementary in the industries with intensive highly skilled labor than those with intensive low-skilled labor. My empirical study divides the countries and industries into distinct groups according to country-level capital-labor ratios and the proportion of compensation paid to the highly skilled labor force. Country-level capital-labor ratio measures the factor endowment of countries, and the proportion of compensation paid to a highly skilled labor force measures the intensity of the highly skilled labor force for industries.

Bassanini and Manfredi (2012) also emphasized the role of capital-augmenting technological progress in explaining the decline of the *LBS*. Bassanini and Manfredi investigated the determinants of a downward turn in the *LBS* by using more dis-aggregate level data which covers 20 one and two-digit industries from 25 OECD countries from last 30 years. They argued that total productivity growth and capital deepening are the main causes of the decrease observed in the *LBS*. Based on the empirical results, total factor productivity growth and capital deepening jointly accounted for 80% of the within industry contraction of the *LBS*. In addition, Bassanini and Manfredi investigated the role of domestic and international competition, particularly the variable of international competition accounted for at least a 10% decrease in the *LBS*.

To analyze whether the technological progress is skill biased, Bassanini and Manfredi divided the sample into different groups according to education level. The empirical results indicated that employees with lower education level are more easily substituted by capital than employees with higher education levels. Specifically, the coefficient of the capital intensity of information and communications technology (ICT) is positive, with statistical significance in the regression based on the group with the high-skilled labor force. This coefficient sign has been flipped in the regression based on the group with the relatively low-skilled labor force. Bassanini and Manifredi therefore concluded that the technical changes embodied in ICT capital are only biased against the low-skilled labor given that the *LBS* of low-skilled workers is more negatively affected by ICT intensity.

Bassanini and Manfredi's results indicate that the elasticity of substitution between the two production inputs varies across industries. Low-skilled labor and capital are more substitutable than complementary; high-skilled labor is complementary with capital input. Inspired by Bassanini and Manfredi's (2012) empirical strategy, we segmented the manufacturing industries into two groups based on the proportion of compensation paid to the high-skilled labor force. Four industries in which more than 30% of total compensation is paid to high-skilled labor are deemed high-skilled labor-force intensive industries. These industries are as follows: chemical; electronics and optical equipment; pulp, paper, printing, and publishing; and transport equipment. All of these industries are characterized by relatively high compensation paid to a high-skilled labor force. The rest of the industries are grouped as low-skilled labor industries.

However, Elsby et al. (2013) provided evidence to challenge the explanation based on the neoclassical production theory that attributes the decease of *LBS* to technological progress. Elsby et al. (2013) investigated the impacts of the structure of technology according to the neoclassical theory of distribution. Assuming that *ES* is greater than 1, the decrease observed in the *LBS* can be traced to capital deepening which leads to an increase in efficient capital-labor ratio. As a result, the unit output level and real wages will increase simultaneously. This theoretical prediction, however, was not supported by the empirical evidence from the United States. Since the 2000s, both unit production and real wages experienced a downward trend. Furthermore, by examining the U.S. capital-labor ratio, which has also experienced a downward trend since 2000, the decrease observed in the *LBS* in the United States cannot be explained by neoclassical production theory.

In sum, the *ES* between labor and capital is the key factor when analyzing the role of technological progress in explaining the movements of *LBS*. The arguments of negative relationship between technological progress and *LBS* assume that capital and labor are substitutable to each other. My empirical study considered the possible variations in the *ES* between labor and capital by segmenting the countries and industries into distinct groups. In addition, my empirical study could provide a relatively more comprehensive empirical analysis by using data from 40 countries and 14 manufacturing industries, covering the last 15 years, which includes more data coverage than previous studies.

2.3 Effect of Economic Globalization

The question of whether economic globalization is the key driver in the declining the *LBS* trend is the subject of much debate and has been discussed in many studies. Plenty of literature supports the notion that the decrease observed in *LBS* can be attributed to economic globalization, such as Elsby et al. (2013) and Guscina (2006). In contrast, Young and Lawson (2014) provided evidence that *LBS* and the Economic Freedom of the World (EFW) index[1] are positively correlated.

The empirical work by Elsby et al. (2013) indicated that the recent decrease in the *LBS* can be attributed to economic globalization. Elsby et al.'s (2013) research is based on industry-level data and finds that production fragmentation was considered the impetus for production outsourcing, which negatively affects the *LBS* observed in U.S. manufacturing industries.

However, Elsby et al.'s conclusion is based on a simple regression that the difference of the *LBS* observed between 1993 and 2010 is regressed on the difference of

[1] EFW is measured with country's freedom to engage in international trade, the size of its government, and its regulation of credit, labor, and business.

import exposures observed over the same time period for US industries. This coincident between the decrease observed in the *LBS* and increase in import exposures that was observed in U.S. industries from 1993 to 2010, may not be sufficient to support the argument of economic globalization contributing to the decrease observed in the *LBS*. The argument of economic globalization contributing the decrease observed in the *LBS* needs empirical evidence based on data with broader coverage and different time period. My empirical study is based on 14 two-digit manufacturing industries across 40 countries. By controlling for the heterogeneity associated with country and industry characteristics, the negative correlation between the *LBS* and economic globalization was not observed with statistical significance.

Guscina (2006) discussed the role of technological progress and globalization in driving the decline observed in the *LBS* based on a panel of 18 industrial countries for the years 1960 to 2000. Guscina illustrates how technological progress and globalization impact labor-share developments. Specifically, information technology (IT) leads to a steep drop in the price of computer equipment. Given the lower cost of IT equipment, firms are encouraged to invest in newer equipment, which leads to an increase in both capital stock and the share of income paid to capital. Then they explained the role of economic globalization within the framework of the Heckscher Ohlin model, in which the development of economic globalization leads countries to specialize in the production of certain goods which have lower cost (comparative advantages), based on countries' endowments. Therefore, the *LBS* for capital abundant countries that tends to specialize in producing capital-intensive products would decrease, since the labor becomes less important with expanding globalization. Guscina's speculation that economic globalization contributes to the decrease observed in *LBS* is based on the subtitutable relationship between labor and capital, which was taken as an inherent assumption for Guscina's study.

Regarding the empirical strategy, Guscina (2006) split the data sample at the mid-1980s period, which is generally considered to mark the beginning of economic globalization and ICT technological progress. From the 1960s to the mid-1980s, the positive, significant coefficient of the technology proxy indicates that technological progress was labor augmenting in the preglobalization and pre-IT era. During the postglobalization and post-IT era, a negative correlation between *LBS* and productivity was observed. Guscina (2006)'s argument that economic globalization contributes to decrease observed in the *LBS* is based on the result that statistical significance was only observed in the regression of post-globalization era.

Guscina's (2006) empirical results are estimated by OLS regressions on 18 industrial countries' aggregated-level data. The coincidence between the decrease observed in the *LBS*, the increase of international trade and the development of IT technology observed with aggregate level data is a weak evidence of causality. If economic globalization is the key contributor to the decrease observed in the *LBS*, industries with more exposure to economic globalization will tend to experience a greater decrease in the *LBS*. This negative correlation should be observed with data of covering different time periods and a broader range of countries. My empirical analysis based on a disaggregate level covering 40 countries may provide more insights on the role of economic globalization in explaining the decline of *LBS*.

In addition, Young and Lawson (2014) found evidence to challenge the argument that *LBS* is negatively correlated with the economic globalization. They examined the correlation between economic freedom and *LBS* with panel dataset of 93 countries covering the period 1970–2009. They also observed a positive correlation between the Fraser Institute's Economic Freedom of the World (EFW) score and *LBS* of national income. Specifically, they analyzed the mechanism of how economic freedom affects *LBS* based on the theoretical framework of neoclassical production, in which the *LBS* linearly related with the capital share given the *ES* between capital and labor. Specifically, within the framework of the "share-capital scheme," economic freedom may affect the *LBS* in three significant ways: (1) moving the effective capital labor ratio along the share capital scheme, (2) shifting the share capital scheme, and (3) driving the capital-labor ratio away from the share capital scheme, which is referred to in 3.6.

Young and Lawson (2014) proposed an empirical strategy to identify the role of economic freedom. If economic freedom affects labor by changing the capital share, economic freedom will not be statistically significant when the capital share is included in the regression. If economic freedom affects the *LBS* by altering technological progress or human capital that usually shift the share capital scheme, the economic freedom should lack statistical significance when considering technological progress or human capital in regressions. Similarly, by including the variables that move away or toward the share capital schedule (e.g., trade union power), Young and Lawson can determine whether economic freedom affects *LBS* by changing trade union power. In adapting of Young and Lawson (2014)'s strategy of identifying the role of economic freedom, this study also assumes that economic globalization may affect the *LBS* in three possible ways. In line with Young and Lawson's (2014) empirical findings, economic globalization may not contribute to the decrease observed in labor but may have a positive impact.

2.4 Summary

There is no consensus on the key determinants in driving movements of the *LBS*, and some studies have produced conflicting conclusions. The coincidence between the decrease observed in the *LBS* and increase of international trade and development of IT technology observed with aggregate level data is weak evidence of causality. My empirical study does not provide a direct answer to the question of what is the cause of the decrease observed in the *LBS*.

However, my dissertation provides evidence to reject the hypothesis that economic globalization contributed to the decrease observed in the *LBS* movements. As discussed above, the *ES* between capital and labor is a key determinant of the role of an explanatory variable. Assuming that the *ES* varies across industries and countries, this study conducted segmentation schemes to divide the countries and industries into distinct groups. As a result, within each group we may have new insights on the role of economic globalization in effecting the movements of labor's share.

Chapter 3

THEORETICAL BACKGROUND

This chapter introduces the theoretical background of the *LBS*. Specifically, I will explain how the *LBS* is correlated with other factors within the neoclassical production framework. Furthermore, I will illustrate the mechanism through which economic globalization affects the *LBS*.

3.1 Competitive Market

Under the assumption of neoclassical production theory, we can derive a relationship between the *LBS* and the efficient *K*-*L* ratio. Firms are indexed by i where each firm's production function is assumed to have constant returns to scale and technical progress can be either labor-augmenting or capital-augmenting : $Y_i = F(A_k K_i, A_l L_i)$ where Y_i is output, K_i and L_i are capital and labor input respectively, and A_k and A_l are defined as capital-augmenting and labor-augmenting technology respectively. If the technological progress is purely labor-augmenting or capital-augmenting, $A_k = 1$ or $A_l = 1$ respectively. If $A_k = A_l$, it indicates a "Hicks-neutral" technological progress. The production function is: $Y_i = A_l L_i f(k_i)$ where $k_i = \frac{A_k K_i}{A_l L_i}$. So the *LBS* can describe as:

$$S_{Li} = \frac{W_i L_i}{P_i Y_i} = \frac{w_i}{A_l f(k_i)} \tag{3.1}$$

where w_i denotes as the real wage rate. Firms maximize their profits by optimizing capital and labor input.

$$Max \quad \pi_i = P_i Y_i - W_i L_i - R_i K_i$$

$$s.t. \quad Y_i = A_l L_i f(k_i)$$

$f.o.c$,

$$\frac{\partial \pi_i}{\partial L_i} = P_i A_l(f(k_i) - f'(k_i)k_i) - W_i = 0 \tag{3.2}$$

$$\frac{\partial \pi_i}{\partial K_i} = P_i A_k f'(k_i) - R_i = 0. \tag{3.3}$$

rearrange the first order conditions, we can get the real wage and real interest rate equations:

$$w_i = A_l(f(k_i) - f'(k_i)k_i) \tag{3.4}$$

$$r_i = A_k f'(k_i) \tag{3.5}$$

substitute equation 3.2 and 3.5 into 3.1, equation 3.1 can described as,

$$S_{Li} = \frac{w_i}{A_l f(k_i)} = \frac{A_l(f(k_i) - f'(k_i)k_i)}{A_l f(k_i)} = 1 - \frac{f'(k_i)k_i}{A_l f(k_i)}. \tag{3.6}$$

Given equation 3.6, the LBS can be expressed as a function of the K-L ratio in efficiency units.[1]

This relationship is also referred as *share-capital* schedule by (Bentolila and Saint-Paul, 2003). Figure 3.1 provides three examples of the LBS's responses to potential drivers . First, the LBS follows the *share-capital* schedule corresponding to changes in efficient K-L ratio, k_i in 3.6. For example, point A moves to point B in figure 3.1. Second, the *share-capital* schedule can be shifted by the structure of production function embodied in $f(.)$. For example, changes in technological progress may cause to a shift of *share-capital* schedule. As shown in 3.1, point A moves to point A*. Third, labor adjustment cost or changes in bargaining power may drive the LBS away/toward *capital-share* schedule. For example, the movement between Point A and point A**.

[1] Note that k_i in 3.6 is obtained from the first order conditions of profit maximization subject to the production function. Therefore, k_i in 3.6 is the efficient unit of K-L ratio.

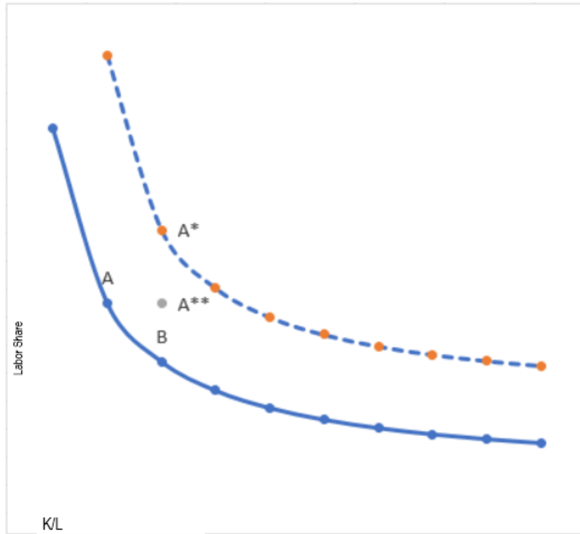

Figure 3.1: *LBS* Movements.

The *LBS*'s responses to the changes in the efficient *K*-*L* ratio is determined by the elasticity of substitution between capital and labor (see (Elsby, Hobijn, and Şahin, 2013)):

$$\sigma_i = \frac{d\frac{K_i}{L_i}}{d\frac{r_i}{w_i}} \frac{\frac{r_i}{w_i}}{\frac{K_i}{L_i}} \tag{3.7}$$

where $\frac{K_i}{L_i} = k_i$ is the efficient *K*-*L* input ratio and w_i and r_i are the real wage and interest rate respectively.

From 3.6, we get $k_i = (1 - S_{Li})\frac{f(k_i)}{f'(k_i)}$, take the derivative, $dk_i = ((1-S_{Li})\frac{f'(k_i)^2 - f''(k_i)f(k_i)}{f'(k_i^2)}) - dS_{Li}\frac{f(k_i)}{f'(k_i)}$.

Similarly, we can the take the derivative for $\frac{r_i}{w_i}$ and then substitute into 3.7, we can get:

$$\sigma_i = [1 + \frac{1}{1 - S_{Li}} \frac{dlnS_{Li}}{dln(k_i)}]^{-1} \tag{3.8}$$

Equation 3.8 can be transformed as:

$$dlnS_{Li} = (1 - S_{Li})\frac{1 - \sigma_i}{\sigma_i} dln(k_i) \tag{3.9}$$

where, S_{Li}, the LBS is theoretically assumed to be less than one[2]. If the production function is specified as Cobb-Douglas ($\sigma_i = 1$), LBS is constant regardless the value of capital-output ratio. If labor and capital are more complementary than Cobb-Douglas assumed, $\frac{1-\sigma_i}{\sigma_i} > 0$, LBS will move in the same direction as the efficient K-L. Conversely, if labor and capital are more substitutable, increases in the efficient K-L ratio will make the LBS decline.

So far, I have briefly introduced the movements of the LBS within the framework of neoclassical production theory. Next, I will respectively illustrate the sources that cause the LBS to shift and move away/toward the share-capital curve.

3.1.1 Capital-augmenting Technological Progress

Technological progress might be a source that causes a shift of the share-capital curve. Suppose we have a constant elasticity of substitution production function as:

$$Y_i = (\beta(A_k K_i)^\epsilon + (1-\beta)(A_l L_i)^\epsilon)^{1/\epsilon} \tag{3.10}$$

real wages are equal to the marginal product of labor (denotes MPL), we get

$$w_i = MPL = \partial Y_i / \partial L_i \tag{3.11}$$

so we can get the LBS as,

$$S_{Li} = W_i L_i / P_i Y_i = w_i L_i / Y_i = (1-\beta)\frac{(A_l L_i)^\epsilon}{Y_i^\epsilon} = \frac{(1-\beta)(A_l L_i)^\epsilon}{\beta(A_k K_i)^\epsilon + (1-\beta)(A_l L_i)^\epsilon} \tag{3.12}$$

Rearrange the above equation. Then we can get,

$$S_{Li} = \frac{1}{\frac{\beta}{1-\beta}(\frac{A_k K_i}{A_l L_i})^\epsilon + 1} \tag{3.13}$$

Equation 3.13 provides a more concrete illustration of how the LBS responds to efficient capital input and how capital-augmenting affects the LBS. Specifically, if technological

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[2] In our data sample, we have the ratios of labor compensation to value added greater than one, due to the imputation method for labor income

progress is capital-augmenting and follows an AR process, a positive shock to capital-augmenting technology will decrease the *LBS* given that labor and capital are more substitutable than in the Cobb-Douglas case. Conversely, if labor and capital are more complementary, the efficient *K*-*L* ratio or capital-augmenting technological progress will be positively correlated with the *LBS*.

Therefore, the direction of the *LBS* correspondence to technological progress and efficient *K*-*L* ratio is determined by the elasticity of substitution between the two production inputs. Specifically, for CES production function, if ϵ approaches 1, we have a linear or perfect substitutes function; if ϵ approaches zero, we have the Cobb-Douglas function; if ϵ approaches negative infinity, we have the Leontief or perfect complements production function.

In order to assess the role of technological progress in explaining *LBS* movement, the ratio of deflated value added to total hours worked by employees was used to represent the technological progress. Traditionally, Total Factor Productivity Factor is an measure for the technological progress, however, it is not available from the WIOD database. Hence, the labor productivity that is calculated as the ratio of the deflated value added to total hours worked by employees is used to measure the technological progress.

3.2 Imperfectly Competitive Market

A stable correlation between the *LBS* and efficient *K*-*L* ratio described equation (3.6) relies on the assumption that *MPL* is equal to the real wage. However, our real economic globalization is not perfectly competitive, the factors that causes the real wage equation (equation) no longer hold will cause the *LBS* to move away/towards share-capital schedule. (Bentolila and Saint-Paul, 2003) concluded that three factors, which are market power, bargaining and labor adjustment cost, may drive the economy off *share-capital* curve because the real wage equation is no longer hold.

3.2.1 Market Power

The real wage equation 3.2 will not be hold when monopolistic firms charge a markup, μ. Equation 3.2 will turn into

$$A_l(f(k_i) - f'(k_i)k_i) = \mu w. \tag{3.14}$$

The *LBS* will be expressed as:

$$S_{Li} = (1/\mu)(1 - \frac{f'(k_i)k_i}{f(k_i)}). \tag{3.15}$$

Holding item $1 - \frac{f'(k_i)k_i}{f(k_i)}$ constant, the *LBS* is negatively correlated with market power.

In this study, the role of market power is unable to be empirically identified due to data limitations. The measures of market power at the industry level for each of 40 countries are not available. Currently, available data for market power measurement is at the firm level because it is more appropriate to measure the market power at firm level, e.g., the market share is an appropriate measure of how much market power a firm has.

The main objective of my study is to investigate the role of the economic globalization on the decline of the *LBS*. Empirical conclusions on the role of economic globalization will still be valid. Even if the market power is assumed to be the key contributor to the decline of the *LBS*, omission of market power may not lead to biased estimates. Theoretically, omitted variables result in endogeneity in which the error item contains the information on omitted variable and hence other included explanatory variables may be correlated with error term. However, System GMM is designed to resolve the potential endogeneity of explanatory variables by using lagged variables as instruments.

3.2.2 Labor Market Institutions

The bargaining power between employers and employees may cause the real wage equation no longer hold. How the *LBS* is affected by changes in bargaining between workers and employers, depends on the bargaining model and the *ES* between labor and capital. Two models of wage negotiation : *Right-to-manage* (denotes R-M thereafter) and *Efficient bargaining* (denotes as E-B thereafter) can be used for illustrating the impact of bargaining power on labor share (refers to Bentolila and Saint-Paul (2003)).

Under the R-M model, unions will negotiate wages with the firms first, employers determine input of labor by taking wages as given. Thus, the correlation between the *LBS* and bargaining power relies on the *ES* between labor and capital, e.g. an increase in bargaining power in unions could push an increase in wages that in turn, encourages firms to substitute labor input with capital if capital and labor are substitutable. Therefore, an increase in labor bargaining power leads to an increase of *K*-*L* ratio which in turn causes a decrease in the *LBS* if capital and labor are substitutable. On the other hand, an decrease of labor bargaining power could lead to an increase in the *LBS* if labor and capital are complementary.

Under the E-B model, firms and workers negotiate over wage and employment simultaneously. So, wages and employment will be set efficiently that the *LBS* is equal to its real opportunity cost. Therefore, in the E-B model, the efficient *K*-*L* input ratio will be fixed in short term, as the *LBS* is fixed to the workers' real opportunity cost, not altered by the bargaining between employers and workers. Therefore, the *K*-*L* input ratio is pinned down, the changes in workers' bargaining power will move with the *LBS* in the same direction, regardless of substitution between labor and capital.

To capture the impacts of labor market institutions, my empirical model splits the advanced economies into three groups: Anglo, Continental Europe and Nordic countries. Anglo countries are considered to have competitive labor market which are characterized with low trade union density and wage bargaining coverage. Continental European countries are characterized by low density and high level of wage bargaining coverage. Trade unions in continental Europe are powerful but decentralized. We expect that bargaining mode for Continental European countries is R-M. For Nordic countries, the labor market institutions features high trade union density and wage bargaining coverage. The wage bargaining model is considered as E-B in Nordic countries.

If assuming economic globalization affects labor by changing the bargaining power of workers, we expect that the *LBS* corresponds to economic globalization in different ways between the three groups of countries.

3.3 Role of Economic Globalization

Based on the discussion above, the economic globalization may affect the *LBS* through three possible ways:

First, economic globalization may cause to a movement of the effective *K*-*L* ratio follows the share-capital schedule (equation 3.9). For example, economic globalization allow the capital free flow international that will facilitate the capital deepening. However, the direction of *LBS* response to economic globalization depends on the slope of capital-share schedule (equation 3.9), which is the elasticity of substitution between the two inputs for product. I explained this with CES production equation in section 2.3.1.

Second, economic globalization may lead to a shifting in the share-capital schedule. For example, economic globalization may lead to encourage the internal competition which may spurs the labor-augmenting technological progress. If assuming labor and capital are complementary, the labor-augmenting technological progress will shift up the share-capital schedule and a higher *LBS*.

Third, moving towards or away from the share-capital schedule, as explained in section 3.2 that explains how the *LBS* is driven by explanatory variables in an imperfectly market. For example, the bargaining between labor and a firm can be altered by economic globalization, in turn, the *LBS* will be affected.

3.3.1 Changes in *K*-*L* Ratio by Offshoring tasks

If the economic globalization impacts the *LBS* by changing the efficient *K*-*L* ratio which absorbs all the impacts from economic globalization, we expect to observe that the coefficient of economic globalization (measurement of outsourcing) has no statistical significance in an empirical specification which includes the capital-*LBS* because the K-L ratio contains all the impacts from economic globalization on the *LBS*.

On the other hand, if the coefficient of economic globalization (measurement of outsourcing) has statistical significance in a regression which includes capital-*LBS*, we may conclude that economic globalization plays an independent role in explaining the movement of the *LBS*.

3.3.2 Shifting the *Share-capital* Schedule

Under the assumption of a neoclassical economy in production, the correlation between the *LBS* and the capital share (3.6) can be derived from the first-order conditions of profit function maximization subject to the production function.

Therefore, the equation 3.6 can be expressed as:

$$S_{Li} = 1 - \frac{f'(k_i)k_i}{A_l f(k_i)} = A_l k_i g(A_l k_i) f'(g(A_l k_i)) \tag{3.16}$$

where A_l can be representative of human capital that can shift the *share-capital* schedule. Economic globalization can lead to an increase in human capital per worker, which will cause an increase in the *LBS* keeping other factors fixed.

If we assume economic globalization affects the labor force through the second channel (shifting the share-capital schedule as discussed in 2.3.2.), it is interesting to assess whether the economic globalization has opposite impacts on the high-skilled labor force vs the less skilled labor force. My empirical study splits industries into two groups: industries with intensive high-skilled labor force vs less skilled labor force.

3.3.3 Move Away or Towards the *Share-capital* Schedule

The third channel through which economic globalization affects *LBS* is to change the bargaining position between workers and firms. With development of economic globalization, capital becomes more mobile than the labor force is, as the cost of relocating labor force are typically much larger than that of relocating capital. Capital can move freely around the world to seek a larger return per unit of labor cost.

If economic globalization influence LBS by altering bargaining position between labor and capital, thee correspondence between LBS and economic globalization will vary by the labor market institution such as bargaining models.

For Anglo countries, firms maximize their profit by optimizing capital and labor inputs. As a result, changes in bargaining power will lead to changes in real wage, which in turn drive the efficient capital-output ratio follow the share-capital schedule. For European Continental countries, employers determine the labor input by taking wages as given. This also leads to the efficient capital-output ratio. Therefore, changes in bargaining should be reflected in the changes in efficient labor-capital ratio for both Anglo and European Continental countries.

In terms of empirical specification, if economic globalization affects LBS by changing the bargaining between firms and employees, we may observe insignificance of economic globalization when the capital-output ratio was included in the regression.

The direction of LBS responding to changes of bargaining power relies on the ES between labor and capital, e.g. an increase in bargaining power of employees could push an increase in wages that in turn, encourages firms to substitute labor input with capital if capital and labor are substitutable. Therefore, an increase in labor bargaining power leads to an increase of the K-L ratio which in turn causes a decrease in the LBS if capital and labor are substitutable. On the other hand, if labor and capital are more complementary, a decrease of labor bargaining power could lead to an increase in LBS.

For Nordic countries, a simple Nash bargaining model can be used to illustrate the impact of changes of bargaining power on LBS . As a results of the Nash equilibrium, the wage is the weighted average of averaged labor production and employee's real opportunity cost[3]. When real wage equation loaded into share-capital schedule(equation 3.6), the bargaining power will be the intersection item. Hence, changes in bargaining power will drive away from share-capital.

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[3] Under Nash equilibrium, equation 3.2 will be expressed as $w_i = \theta A_l f(k_i) - (1 - \theta) A_l f^{'}(k_i) ki$ where θ is the bargaining power.

In terms of empirical specification, if economic globalization affects the *LBS* by changing the bargaining between firms and employees for Nordic countries, we may observe statistical significance of economic globalization when the capital-output ratio was included in the regression.

3.4 Summary

This chapter explained how the *LBS* is correlated with other factors within the neoclassical assumption for production. As we discussed above, the direction of movement of *LBS* corresponding to the explanatory variables is determined by the elasticity of substitution between labor and capital. Hence, I split the estimation data sample into subgroups, to control for the potential heterogeneity of *ES* between countries and industries.

First, if *ES* between labor and capital varies across countries with different endowments of labor and capital, I will split countries into two groups: labor abundant vs capital abundant countries.

If economic globalization affects *LBS* by changing in effective capital-output ratio (first channel we discussed above), we will observe the coefficient sign for capital-output ratio is flipped between two groups and economic globalization measured by offshoring is insignificant when capital-output ratio is included in the regression. On the other hand, if economic globalization is statistically significant when including capital-output ratio in the regression, economic globalization affects *LBS* though shifting or driving away from the share-capital schedule.

Second, assuming the *ES* varies across workers' skill, the industries were split into two groups: industries with intensive the high-skilled labor force vs the less skilled labor force. It is interesting to assess whether the economic globalization has opposite impacts on high-skilled labor force vs less skilled labor force. If economic globalization only benefits the high-skilled labor force, we should observe the coefficient sign of economic globalization being flipped between the two groups. The coefficient of economic globalization will be significantly positive in the regression of the high-skilled labor force group, negative in the less skilled labor force.

Third, if *LBS* affects on *LBS* by changing the bargaining between employees and firms, we will observe that *LBS* correspondence to economic globalization varies across labor market institutions.

Chapter 4

MOVEMENTS IN THE LABOR SHARE

This chapter describes the data characteristics of the *LBS* across countries and industries. First, I demonstrated the variation of the aggregate *LBS* across countries and time trend of the aggregate *LBS* within the data sample covered by the time period. Then, I illustrated the critical role of manufacturing industries in explaining movements in the aggregated *LBS*. The empirical evidence shows that manufacturing industries make a significant contribution to the aggregated *LBS* movement. Considering that manufacturing industries are heavily involved with economic globalization and the magnitude of globalization involvement varies between the manufacturing industries, data of two-digit manufacturing industries across countries is an appropriate data sample to analyze the role of economic globalization in explaining the movements of the *LBS*.

4.1 Country Level Labor Share

The World Input-Output Database [1] provides an Input-Output table covering a total 35 industry sectors and 40 countries. The data was collected from the year 1995 and up to the year 2012. For each country, the aggregate *LBS* is defined as the ratio of compensations paid to employees to the sum of value added cross the total 35 industrial sectors.

As shown in 4.1, the variations of the aggregate *LBS* cross 40 countries may indicate that institutional factors may have impacts on the *LBS*. For instance, the majority of the relatively less developed countries/regions have a lower level of the *LBS*

[1] Detailed description of this database appears in section 5.2

compared to the relatively developed countries. Between developed countries, the *LBS* of the United States is of medium level compared to other developed countries. Specifically, Nordic Countries such as Sweden and Denmark have relatively high levels of the *LBS*. Mediterranean countries (Greece and Italy), Ireland and Asian countries/regions (Japan, Korea and Taiwan) have *LBS*s at relatively lower levels. Therefore, I will segment the countries by national characteristics (e.g., labor and capital endowment), to control for the national characteristics which may alter the correspondence between the *LBS* and explanatory variables.

Table 4.1: Statistical Summary of Country Level Aggregate LBSs, from 1995 to 2012. data source: World Input-out Table Database.

Country	Min.Value	Median	Mean	Max.value	Std.dev
Australia	52.32%	52.98%	53.23%	54.59%	0.0074
Austria	53.44%	56.01%	56.31%	59.59%	0.0185
Belgium	56.23%	57.22%	57.37%	58.91%	0.0081
Bulgaria	38.43%	40.01%	41.25%	45.16%	0.0235
Brazil	45.69%	47.26%	47.48%	50.57%	0.0132
Canada	54.39%	55.30%	55.27%	56.20%	0.0046
China	41.89%	48.66%	48.43%	54.65%	0.0475
Cyprus	45.99%	49.03%	48.56%	50.57%	0.0158
Czech Republic	36.45%	47.71%	47.06%	48.95%	0.0287
Germany	54.13%	58.13%	57.51%	59.69%	0.0168
Denmark	60.31%	63.16%	63.23%	68.81%	0.0200
Spain	50.42%	53.27%	53.35%	54.74%	0.0103
Estonia	49.59%	53.23%	53.65%	61.83%	0.0393
Finland	54.22%	56.13%	56.43%	60.85%	0.0189
France	57.36%	58.10%	58.11%	59.42%	0.0047
United Kingdom	57.32%	59.73%	59.67%	61.57%	0.0119
Greece	35.13%	38.94%	39.01%	43.23%	0.0254
Hungary	49.91%	52.25%	52.51%	54.51%	0.0150
Indonesia	29.36%	30.90%	30.69%	31.35%	0.0058
India	30.09%	32.30%	32.37%	35.35%	0.0158
Ireland	43.10%	46.71%	47.56%	52.89%	0.0316
Italy	43.93%	45.75%	45.56%	47.86%	0.0130
Japan	49.69%	50.70%	50.69%	52.40%	0.0067
Korea, Republic of	48.38%	50.98%	50.53%	52.99%	0.0139
Lithuania	41.64%	45.14%	45.69%	50.15%	0.0271
Luxembourg	47.73%	51.99%	52.27%	56.05%	0.0208
Latvia	42.62%	48.95%	48.59%	56.49%	0.0365
Mexico	28.60%	31.09%	31.20%	34.00%	0.0167
Malta	49.46%	52.75%	52.57%	55.90%	0.0171
Netherlands	55.22%	56.80%	56.77%	58.76%	0.0096
Poland	40.44%	43.26%	43.55%	47.25%	0.0267
Portugal	55.04%	57.31%	57.31%	58.85%	0.0105
Romania	34.89%	43.67%	43.05%	50.02%	0.0346
Russia	45.43%	47.19%	46.99%	49.39%	0.0106
Slovak Republic	31.51%	33.55%	33.56%	36.44%	0.0154
Slovenia	56.73%	59.15%	59.67%	65.19%	0.0215
Sweden	59.33%	61.60%	61.72%	64.44%	0.0139
Turkey	22.18%	26.24%	26.39%	30.68%	0.0199
Taiwan	47.03%	48.39%	49.32%	53.23%	0.0198
United States	54.90%	55.41%	55.61%	56.84%	0.0063

Next, we investigate the changes of LBS between 1995 and 2007 among 40 countries. In order to eliminate the impact of economic cycle, I calculated the changes in LBS between year 2007 and 1995 for each of countries ($\Delta LaborShare = LaborSahre_{2007} - LaborSahre_{1995}$). Figure 4.1 illustrates the changes in LBS between 1995 and 2007 at country level. The positive values indicate an increase in LBS; the negative values represent a decrease in LBS.The data applied in the regression covers a period up to 2012. To eliminate the impact of economic cycle (2008 financial crisis) on the LBS, this analysis just compares the data of 1995 against 2007.

As shown in figure 4.1, in the majority of countries occurred a decline in LBS between 1995 and 2007. The number of countries which experienced negative changes outpaces than the number of countries with positive changes of the LBS between 2007 and 1995. Further, it is observed that the magnitude of decline in the LBS is moderate, less than 10 percentage points. Given the relatively stable LBS measured at the country level, I will investigate whether the LBS is shifting between sectors and which sector is the largest contributor in the decline of the aggregate LBS.

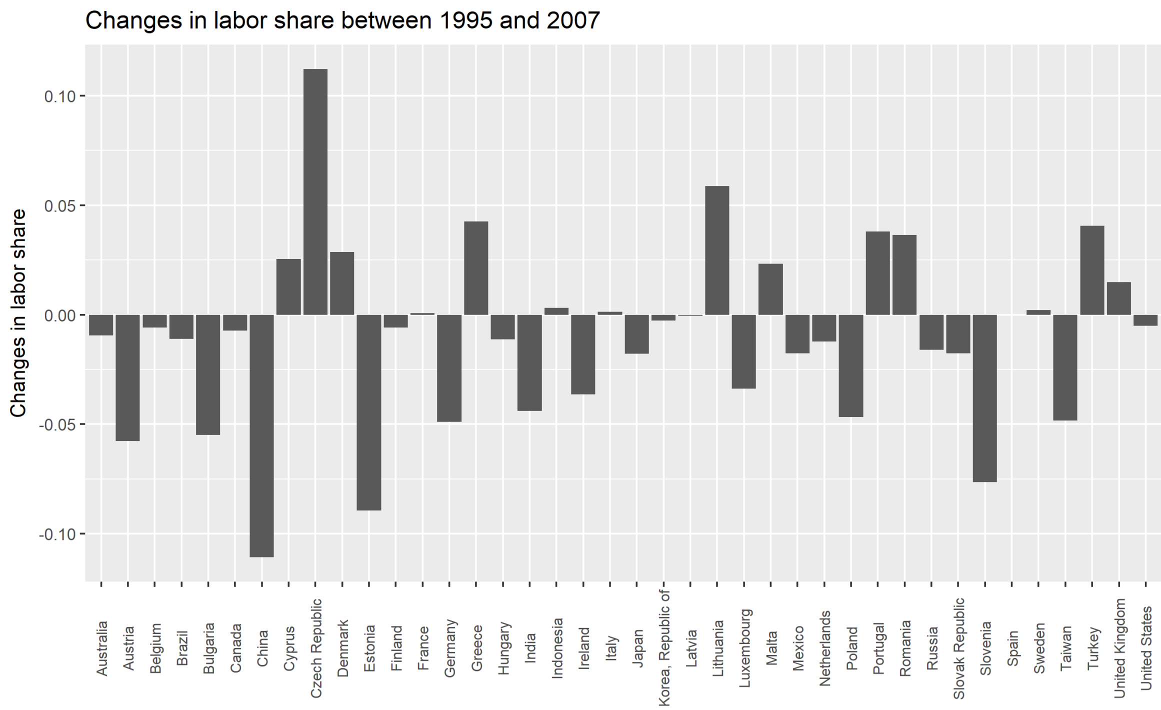

Figure 4.1: Changes of LBS between 1995 and 2007, Data source: World Input-Output Database.

4.2 The Origins of Movements in The Aggregate Labor Share.

Inspired by the decomposition analysis proposed by (Elsby, Hobijn, and Şahin, 2013), I break down the changes in aggregate LBS to investigate which sector is the largest contributor to the changes in aggregate LBS. The following formula can be used to break down the aggregate LBS:

$$\Delta Sl = \sum_i (\Delta SV_i Sl_i + SV_i \Delta Sl_i) \tag{4.1}$$

where ΔSl represents the difference of aggregate LBS between 1995 and 2007 ($\Delta Sl = Sl_{2007} - Sl_{1995}$).

SV_i denotes the value added share for industry i at year 2007. Value added share is the proportion of value added of an industry i in total value added for all industries. Sl_i denotes LBS in sector i at 2007.

ΔSV_i represents the changes of value added share between 1995 and 2007 for industry i.($\Delta SV_i = SV_{i,2007} - SV_{i,1995}$) and ΔSl_i represents changes of LBS between 1995 and 2007 in industry i. ($\Delta Sl_i = Sl_{i,2007} - Sl_{i,1995}$).

The first item of $\Delta SV_i Sl_i$ represents between sector shifts of LBS and the second item ($SV_i \Delta Sl_i$) represents the within sector changes of LBS.

By dividing the sum of within and between sector shift for industry i to total LBS changes, $(\Delta SV_i Sl_i + SV_i \Delta Sl_i)/\Delta Sl$, we can analyze how much the decline of LBS is attributed to a specific industry.

In order to control for the impact of economic cycles, this analysis was focuses on the changes of aggregate LBS between 1995 and 2007. As shown in table 4.2, while labor's share of value added for total industry only fell by 0.4% for the U.S. between 1995 and 2007, the changes of LBS for total manufacturing industries played a dominant role in the decline of aggregate LBS. In contrast, the sector of Financial Services made a positive contribution with a large magnitude.

Table 4.2: Decomposing Aggregate LBS of the United States. Source: World Input-Output Database.

Industry	Value Added		LBS					%impact
	1995	2007	1995	2007	$\Delta SV_i Sl_i$	$SV_i \Delta Sl_i$	$\Delta SV_i Sl_i + SV_i \Delta Sl_i$	$\frac{\Delta SV_i Sl_i + SV_i \Delta Sl_i}{\Delta Sl}$
Agriculture	0.012	0.009	0.274	0.326	-0.001	0.000	-0.001	14%
Mining	0.011	0.017	0.423	0.259	0.002	-0.003	-0.001	29%
Ultility	0.022	0.017	0.241	0.274	-0.001	0.001	-0.001	19%
Construction	0.042	0.051	0.658	0.657	0.006	0.000	0.006	-150%
Information	0.031	0.026	0.522	0.524	-0.003	0.000	-0.003	65%
Total Manufacturing	0.155	0.124	0.606	0.572	-0.017	-0.004	-0.022	542%
Sales and Trade	0.148	0.135	0.546	0.549	-0.007	0.000	-0.007	170%
Transportation Warehousing	0.058	0.059	0.686	0.644	0.001	-0.002	-0.002	44%
Financial Severice	0.288	0.334	0.362	0.398	0.018	0.012	0.030	-750%
Public and Other Service	0.232	0.228	0.766	0.763	-0.004	-0.001	-0.004	108%
Total Industry	1	1	0.554	0.559			-0.004	

Figure 4.2 shows the breakdown analysis results for all the 40 countries. We can observe that manufacturing industries are the largest contributor to the decline in

aggregate *LBS* for the majority of countries. For some countries, such as the United States, Latvia and Spain where the aggregate *LBS* declined to a small extent, total impacts from manufacturing (the sum of between and within shifts) are more than six times as large the changes in aggregate *LBS*. For some countries, we observed negative impacts (negative bars in figure 4.2). This observation is caused by the fact that for the countries where the aggregate *LBS* experienced a positive change, the *LBS* of manufacturing industries experienced a declining trend during the observed time period.

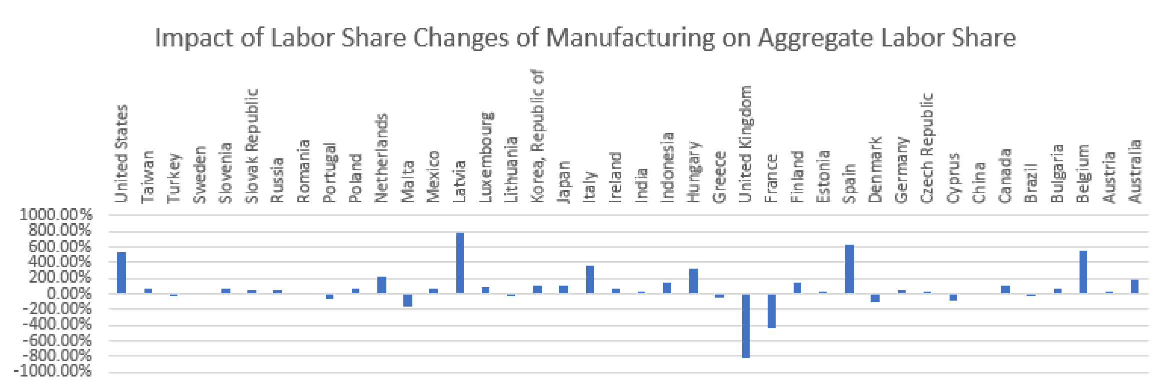

Figure 4.2: Impact of *LBS* Changes of Manufacturing on Aggregate *LBS*. Data Source: World Input-Output Database.1995-2007

In sum, manufacturing industries are the key contributors to the decline observed in the *LBS* and are heavily involved with technology revolution and economic globalization. Therefore, my empirical study of focusing on manufacturing industries should provide insights of what role economic globalization plays in the movements of the *LBS*.

Chapter 5

EMPIRICAL SPECIFICATION AND DATA COLLECTION

This Chapter specifies the empirical model and discusses the estimation strategy.

5.1 Empirical Specification

The *share-capital* schedule, equation (3.6), provides the foundation to specify an empirical model. As we discussed, capital deepening, economic globalization, capital-augmenting technological progress, decrease in relative price level of investment and the changes in bargaining between firms and employees are suspected to be the factors which drives the movements in *SL*. In the regression specification, capital-output ratio is used to represent the capital deepening. Two measures of outsourcing represent the development of economic globalization. The labor productivity is used as the proxy for technological progress. Segmentation by country's labor market institutions is to control for the wage bargaining between firms and employees.

The regression specification is illustrated at below,

$$\begin{aligned} \ln S^L_{ict} &= a_0 + a_1 \ln(k_{ict}) + a_2 \ln(\frac{P_{inv}}{P_v})_{ict} + a_3 \ln OFF_{ict} \\ &+ a_5 \ln Prod + \sum_{j=1}^{T-1} \tau_j T_j + \epsilon_{ict} \end{aligned} \tag{5.1}$$

where i and c index industries and countries respectively. S^L_{ict} refers to SL which is defined as labor compensation divided by value added for each country-industry pair. k_{ict} is the ratio of capital stock at 1995 price level to value added. OFF^B_{ict} and OFF^N_{ict} denote the two measures of outsourcing: broad and narrow measures of outsourcing respectively. These two measures of economic globalization will be included in the regression alternatively, to avoid collinearity. P_{inv}/P_v is the relative price level of investment to value added. $\ln Prod$ represents the productivity. τ_j is the coefficient on time dummy T_j which is equal to one at year j, zero elsewhere. Time dummy, T_j, captures the effects of one year on all units. ϵ_{ict} is the error term has two orthogonal components, capturing unobservable country-industry specific and period-specific individual effects. Specifically, the error term in equation (5.1) can be written as,

$$\epsilon_{ict} = \mu_{ic} + \upsilon_{ict} \tag{5.2}$$

where μ_{ic} refers to country-industry fixed effects which captures some salient industry characteristics, such as technology or organizational features, and markup in each country-industry pair. υ_{ict} refers to individual shocks incurred at a certain year, which capture the time dependent shocks.

5.2 Data Collection

The dataset is collected from the World Input-Output Database [1] constructed by Timmer et al. (2015). The WIOD database is constructed with national accounts data and the process of data transformation were applied in order to ensure international comparability of the basic data[2]. The dataset covers 40 regions, which in total accounts for around 85% of world's GDP in 2006. In addition, the WIOD database provides the data for fourteen two-digit manufacturing industries, covering the period from 1995 up to 2012. Thirteen[3] two-digit manufacturing industries included in the empirical study are: Foods (Industry Code: 15 and 16), Textiles (Industry Code: 17 and 18), Leather and Footwear (Industry Code: 19) Wood (Industry Code: 20), Paper (Printing and Publishing (Industry Code: 21 and 22), Chemicals (Industry Code: 24), Rubber

[1] The data is downloaded from the WIOD website: http://www.wiod.org. The version of the database as of December 2011 was used in this study.

[2] Details of data construction and harmonization procedures applied in WIOD databased appears in http://www.wiod.org/database/wiots13.

[3] the industry of Petroleum and Refining was exlcuded in the empirical spedification, as the outsourcing measure is more driven by the demands.

and Plastics (Industry Code: 25), Non-Metallic (Industry Code: 26), Basic Metals (Industry Code: 27 and 28), Machinery (Industry Code: 29), Electrical and Optical Equipment (Industry Code: 30 to 33), Transportation Equipment (Industry Code: 34 and 35), Manufacturing NEC Recycling (Industry Code: 36 and 37). Figure 5.1 provides the summary statistics for the variables applied in empirical study.

Variable	Obs	Mean	Std.Dev.	Min	Max
Labor Share	6,672	-0.617	0.331	-2.672	1.520
Capital Share	6,672	0.044	0.379	-2.017	2.936
Relative Price of Investment	6,672	-0.025	0.295	-2.455	1.232
Productivity	6,672	2.049	1.645	-5.028	5.551
Narrow Measurement of Outsourcing	6,672	-1.878	1.262	-8.640	1.819
Narrow Measurement of Outsourcing	6,672	-1.208	0.695	-3.591	0.872

Figure 5.1: Summary Statistics for Variables Applied in Regression.

5.2.1 Definition of Explanatory Variables

SL, S^L, is defined as the ratio of payroll compensation paid to employees to value added. WIOD provides the data for compensation paid to employees and value added that are both measured in millions of national currency and available in Socio Economic Accounts which is released in 2014.[4] Considering that measurement bias embodied in compensation share which include some payments such as stock options which have nothing to do with marginal labor cost, payroll share rather than total labor compensation (that includes benefits)share was used to measure the SL.

Capital share, k, is defined as the ratio of capital stock to value added. The capital stocks is measured in 1995 prices (national currency). WIOD provides the data for capital stocks measured in 1995 price. I transformed value added data by applying 1995 prices deflator that was sourced from WIOD. Specifically, I calculate the value added deflated by 1995 price level in national currency as $V_{ict}^{95} = V_{ict}/V_{ict}^{P}$, where V_{ict} value added for a country-industry pair measured by current price in national currency

[4] Please see http://www.wiod.org/database/seas13

and V^P_{ict} is price level of value added for each country-industry pair, year 1995 is indexed to 100.

The industry of Mining and Fuel Production was excluded from the empirical study, since fluctuations in value added mainly stem from the world demand for raw materials, changes of wages may not be the key contributor to changes of the SL.

Productivity. The productivity is measured by deflated value added (calculated as above) divided by total hours worked by persons (millions).

Measures of outsourcing. The intermediate input purchases are available in World Input-Output Table[5], so I follow Feenstra and Hanson (1999) who proposed two measures for outsourcing activity. The narrow measure of outsourcing is defined as the ratio of imported intermediate goods in a given industry from the same industry to the value added. OFF^N_{ict} is denoted as the narrow measure of outsourcing, which can be calculated as:

$$OFF^N_{ict} = \frac{\sum_F IM_{r=i}}{V_{ict}}$$

where $IM_{r=n}$ refers to imported intermediate goods purchases from industry $r = n$ and $\sum_F$ is sum of imported intermediate goods purchases from cross all countries. The broad measure is the ratio of the sum of imported intermediate goods from all industries to value added. OFF^B_{ict} is denoted as the broad measure of outsourcing, which we can calculate as:

$$OFF^B_{ict} = \frac{\sum_F \sum_{r=1}^{n} IM_{r\neq i}}{V_{ict}}.$$

Feenstra and Hanson (1999) prefer the narrow measures of outsourcing, as it is thought to be better to reflecting the changes in fragmentation which occurs in each industry. But the broad measure can be a good indication that to what extent a country-industry unit gets involved in economic globalization.

Relative price level of investment to value added. WIOD provides the price levels of gross value added and gross fixed capital formation (index, 1995=100).

[5] World IO tables are available at http://www.wiod.org/database/wiots13

The ratio of price levels of gross fixed capital formation to gross value added was defined as relative price level of investment to value added.

5.3 Estimation Method

5.3.1 Rationales of Chosen Estimation Method

There are several reasons that System GMM estimation fits this panel data structure:

Fixed effect. Recall that the error item is $\epsilon_{ict} = \mu_{ic} + \upsilon_{ict}$, μ_{ic} might be correlated with explanatory variables X_{ict} . For example, the comparative advantages of a country-industry pair (ic) could be correlated with the K-L ratio (k_{ict}). $E(\epsilon_{ict}|X_{ict}) \neq 0$. More specifically, labor intensive industries tend to locate in labor abundant countries. The Arellano-Bond system GMM estimator is designed to remediate fixed effects in the regression.

Classical OLS estimator suffers from "dynamic panel bias" which is defined by Nickell (1981), as $E(\mu_{ic}|X_{ict}) \neq 0$. An intuitive strategy to work on this endogeneity is to remove the fixed effects by transforming the data. First-difference transformation is a commonly used method to move out the fixed effects. Transform equation (5.1) by taking first order difference. We get

$$\Delta Y_{ict} = \beta \Delta X_{ict} + \Delta \upsilon_{ict} \tag{5.3}$$

where ΔX_{ict} represents all the explanatory variables.

However, the weakness of first-order-difference transform is that it enlarges the data loss in unbalanced panels. For example, if Y_{ict} is missing, then both ΔY_{ict} and ΔY_{ict+1} are missing in the transformed data.

To remediate the weakness of first-difference transform, Arellano and Bover (1995) proposed the forward orthogonal transformation technique which works better for unbalanced datasets.

Under forward orthogonal transformation, the transformed data is obtained by subtracting all future available observations of each variable. y^*_{it+1} is denoted as transformed by forward orthogonal deviation, then $y^*_{it+1} = \sqrt{T-t/_{T-t+1}}(y_{it} - \frac{1}{T-t}\sum_{s>t} y_{is})$. [6] Except for the last observation of each variable, all others are included in the transformed data. Another advantage of forward orthogonal deviation is that the orthogonality among errors remains valid after transformation.

The data collected from the WIOD database is unbalanced panel data. Therefore I applied forward orthogonal transformation in the empirical analysis.

Endogeneity. For the empirical specification, explanatory variables might be correlated with the error term, if the regression suffers from omitted variables or the common unobserved factors that exist in both independent and dependent variables. Theoretically, two potential issues lead to endogeneity of independent variables.

First, the disturbances may absorb omitted variables. Specifically, we cannot assume that the empirical specification covered all explanatory variables for SL. For example, direct measure of bargaining power for labor-union and market power are not included in the empirical specification because of data limitations. The residual term ϵ_{ict} will absorb these two unobserved variables. Intuitively, it is assumed that bargaining power may be correlated with firm's ability to offshore the production process. Therefore, the expectation of the error term conditional on regressors might not be equal to zero.

Second, the independent variables and dependent variables may share a common item–value added. Specifically, the effective K-L ratio (k_{ict}) and two measures of outsourcing (OFF^B_{ict} and OFF^N_{ict}) are treated as potentially endogenous. The dependent variable, ΔY_{ict} denotes the ratio of the compensation of employees to value added. The independent variables, $\ln(k_{ict})$ denotes the ratio of capital stock to value added;

[6] The * denotes the data transformed by forward orthogonal deviation. I follow Roodman (2009) to use $t+1$ instead of t as the standard software practice sorts the data transformed by forward orthogonal deviation one period late, in order to keep consistency with the first-difference transformation.

two measures of offshoring are defined by a ratio of imported intermediate goods to value added. Therefore, K-L ratio and two measures of offshoring are suspect to be endogenous in this regression equation.

The relative price level of investment $\ln \frac{P_{inv}}{P_v}$, productivity $\ln Prod$ and Labor adjustment cost $\Delta \ln L_{ict}$ are considered as predetermined, as they not simultaneously correlated with the error terms but could be affected by lagged error terms.

In section 5.3.2, I explain in details how the Arrelano-Bond GMM estimation strategy remedies the endogeneity by selecting instrumental variables and how to examine the validity of selected variables.

Serial correlation. Disturbances may have serial correlation, but have no correlations across individuals. The dependent variables may have autocorrelation, as the dataset of the regression is a panel dataset covering the period from 1996 up to 2012.

Data structure. GMM estimation requires the data structure is characterized with small T (relatively short time period) and large N (large numbers of individuals). The dataset applied in the regression is characterized by "small T and large N". Details on data construction are in 5.2.

Based on the data-generating process embodied in this regression, I employ system GMM estimation strategy which is originally proposed by Arellano and Bond (1991) and further developed by Blundell and Bond (1998).

The following sections will illustrate how the Arrelano-Bond GMM estimation strategy addresses the endogeneity by selecting instrumental variables and how to examine the validity of selected instrumental variables.

5.3.2 Selection of Instruments

External instruments are not always available for those regressors which are not strictly exogenous, Anderson and Hsiao (1982) are the first to propose selecting the instruments from within the dataset and incorporate them by Two-Stage Least Square.

For example, $\ln S_{it-2}^L$ is a valid instrument for $\Delta \ln S_{it-1}^L$ [7] , since $\ln S_{it-2}^L$ appears in $\Delta \ln S_{it-1}^L$ but is uncorrelated with ϵ_{it}^*[8]. However, if we would like to incorporate more lags in the instrument matrix, standard 2SLS suffers from sacrificing sample size in such a way that observations for which lagged observations are unavailable are dropped.

To avoid this loss of degrees of freedom, Holtz-Eakin et al. (1988) built a set ofinstruments from the second lag of $\ln S_{it}^L$, one instrument pertaining to each time period. With this solution to the trade-off between lag length and sample length, we can include all available lags of the untransformed variables as instruments. For endogenous variables, lag two and higher are valid instruments. For predetermined variables, lag one is also available. This method is entitled *Difference GMM*.

A potential weakness in the *Difference GMM* was revealed by Blundell and Bond (1998) who demonstrate that the lags may not be ideal instruments for the first order of differenced variables. For example, if a variable follows a random process, the prediction power of historical changes for current level can be better than that of historical level for current changes.

So, the *System GMM* (Blundell and Bond (1998)) approach was enhanced by choosing instruments levels with lagged differences. But the cost of this approach involves an additional assumption that the differenced instrumentals are orthogonal to the fixed effects. To be precise, if the condition $E(\Delta z_{ict}\mu_{ic}) = 0$ is satisfied for all ic and t, we can say $E(z_{ict}\mu_{ic})$ is time invariant. And then, we can show that Δz_{ict-1} is a valid instrument for the variables in levels,

$$E(\Delta z_{ict-1}\epsilon_{ict}) = E(\Delta z_{ict-1}\mu_{ic}) + E(z_{ict-1}\upsilon_{ict}) - E(z_{ict-2}\upsilon_{ict}) = 0 \tag{5.4}$$

Under *System GMM*, one lagged difference and higher are valid instrument for endogenous variables. For predetermined variables, the contemporaneous difference and higher are valid instruments.

[7] $\Delta \ln S_{it-1}^L = lnS_{it-1}^L - lnS_{it-2}^L$

[8] future individual period-specific shock will not affect lagged regressors.

Given of the advantages of the system GMM estimators over the difference GMM, the system GMM's strategy for selecting instrumental variables was applied to the empirical specification.

5.3.3 Diagnostic checks

Two possible specification problems are associated with *Difference GMM* and the *System GMM*. The estimation strategy we discussed above relies on the validity of instruments.

The Sargan/Hansen statistic is employed to check the endogeneity of instruments with a null hypothesis of joint validity of the overidentifying restrictions . Specifically, Z is denoted as the instrument matrix and E as the error term vector, under the null hypothesis, $({}^{1}/_{N})Z'E$ is randomly distributed around zero. Both Sargan and Hansen statistics are reported with the regression results to examine the validity of the additional instrumental variables, given exact identification.

The Sargan test is only appropriate after a difference-GMM estimator and under the assumption of homoskedasticity and no serial correlation (in levels) of the idiosyncratic error term.

Since my empirical specification was estimated by System GMM with additional instruments for the level equation besides the intercept and time dummies, the Hansen test results are relatively more reliable.

Another important diagnostic check is the autocorrelation (AR) test. Due to the data transformation, the residuals of first order of difference equations ($AR(1)$) are serially correlated. Therefore, as long as the original error terms are independently distributed, the transformed residuals (second order of difference) should not be correlated at $AR(2)$. I also report AR(1) and AR(2) test results in the regression result tables and will discuss the results in Chapter 6.

Chapter 6

EMPIRICAL RESULTS

As discussed in the chapter on the theoretical framework, the elasticity of substitution between capital and labor is a key to determine the relationship of the *LBS* to the explanatory variables. Hence, I split the estimation data sample into subgroups, to control for the potential heterogeneity of *ES* in capital and labor across countries and industries

First, since the substitution elasticity between capital and labor may vary across countries with different endowment in labor and capital, countries are split into two groups: labor abundant vs capital abundant countries.

If the substitution elasticity between capital and labor varies across countries with different endowments of labor and capital, we will observe that the sign of the capital output ratio will be flipped between two groups.

If economic globalization affect *LBS* by changing the effective capital-output ratio (first channel we discussed above), we will observe that economic globalization measured by offshoring is insignificant when the capital-output ratio is included in the regression. Conversely, if economic globalization is statistically significant when including the capital-output ratio in regression, economic globalization affects *LBS* though the second and third channel.

Second, since the *ES* may vary across workers' skill levels, the industries were split into two groups: industries with intensive high-skilled labor force vs less skilled labor force. It is interesting to assess whether the economic globalization has opposite impacts on the high-skilled labor force vs the less skilled labor force. If economic globalization only benefits the high-skilled labor force, we should observe the coefficient sign of economic globalization being flipped between the two groups.

Third, if *LBS* affects *LBS* by changing the bargaining power between employees and firms, we will observe that *LBS* correspondence to economic globalization varies across labor market institutions.

6.1 A Comparison Study Between Labor Abundant and Capital Abundant Countries

Data was sourced from Penn World Tables. Average capital-labor ratio for each country are provided at the country level from 1995 to 2011 in table 6.1. The capital labor ratio is defined as the capital stock at current PPPs (in millions 2011 US dollars) divided by the number of persons engaged. Table 6.1 sorted countries' capital-labor ratios from small to large. Countries were split into two groups based on the median of this indicator: labor abundant and capital abundant. The labor abundant countries includes: Brazil Mexico, Russian Federation, Poland, Romania, Turkey, Lithuania, Estonia, Slovakia, Hungary, Malta, Latvia, Republic of Korea and Taiwan. The capital abundant countries includes: Slovenia, Japan, Canada, United Kingdom, Czech Republic, Portugal, Netherlands, Germany, Denmark, Sweden, Australia, Spain, France, Austria, United States, Ireland, Finland, Cyprus, Greece, Belgium, Italy.

6.1.1 Results

Tables 6.2 and 6.3 show empirical results for labor abundant and capital abundant countries respectively. Several highlights on observations are summarized at below.

First, the capital share is positively correlated with *LBS* across labor abundant countries. This observation indicates that labor and capital are complementary more than substitutable, which is in line with Lawrence (2015)'s empirical findings, but in conflict with the empirical findings of Bentolila and Saint-Paul (2003) and Karabarbounis and Neiman (2014) who concluded that labor and capital are substitutable.

For the capital abundant countries, the coefficient is flipped between regressions with different control variables. In addition, the coefficient value is lower than the coefficient observed in the regression results from the labor abundant group. This finding may be caused by the fact that the correlation between *LBS* and capital in capital abundant countries seems not homogeneous as that in labor abundant counties. Thus, I will further segment the capital abundant counties by labor market characteristics, to control for the potential heterogeneity within the capital abundant countries.

Second, the positive correlation between *LBS* and outsourcing (*BroadOFF* and *NarrowOFF*) is observed in both groups. Further, we observed that the coefficients of the two measures of outsourcing are statistically significant. This observation indicates that economic globalization plays an independent role in driving the movements in *LBS*. More importantly, economic globalization may not be the contributor of the decline of *LBS*.

Third, the coefficient sign of the relative price of capital to output (*KPrice*) is expected to be negative. Given of the positive sign of the capital share, the labor and capital are deemed to be more complementary than substitutable. Hence, a lower price of investment that facilitates the process of capital deepening, may lead to an increase of *LBS*, and vice versa.

Forth, technological progress (productivity) seems to have opposite impacts on the *LBS*. The technological progress benefits the *LBS* in labor abundant countries. For capital abundant countries, the technological progress seems to be negatively correlated with *LBS*. This finding align with some studies that argue that the development of information technology is the key contributor.

As we discussed in Chapter 3, if the economic globalization effects the *LBS* by changing the capital-output ratio, the coefficients of economic globalization may not have statistical significance when including the capital-output ratios. Given that the coefficients are statistically significant, we can conclude that economic globalization plays an independent role in affecting the *LBS*. The broad measurement of outsourcing represents the degree of institutions of economic freedom. Openness of the economic globalization benefits the LBS in both capital-abundant and labor-abundant countries.

Table 6.1: Capital-Labor Ratio at Country level

Country	**Capital-Labor Ratio**
India	21212.95
China	36082.52
Bulgaria	43064.95
Indonesia	47570.18
Brazil	76214.26
Mexico	88640.18
Russian Federation	90131.54
Poland	93587.37
Romania	97532.7
Turkey	104730.1
Lithuania	123480.3
Estonia	132784
Slovakia	146125.5
Hungary	155565
Malta	163029.5
Latvia	181130.7
Republic of Korea	198032.9
Taiwan	202024
Slovenia	224063.1
Japan	228871.3
Canada	254169.2
United Kingdom	254534.4
Czech Republic	259254.6
Portugal	259361.7
Netherlands	266162.7
Germany	267356.2
Denmark	268597.6
Sweden	276557.5
Australia	288302.7
Spain	288918.9
France	289754.1
Austria	300348.4
United States	302733.6
Ireland	306419.1
Finland	307115.6
Cyprus	311391.2
Greece	316505.8
Belgium	325121.9
Luxembourg	338192.5
Italy	370510.5

Table 6.2: System GMM: Labor Abundant Countries

	(1) ln(paysh)	(2) ln(paysh)	(3) ln(paysh)	(4) ln(paysh)	(5) ln(paysh)	(6) ln(paysh)	(7) ln(paysh)
CapitalShare	0.171*	0.159*	0.0857	0.120+	0.130*	0.112*	0.0987
	(2.82)	(3.12)	(1.61)	(1.71)	(2.40)	(2.26)	(1.60)
NarrowOFF		0.0428				0.147*	
		(0.84)				(2.75)	
BroadOFF			0.232*				0.274*
			(3.30)				(4.39)
Kprice				−0.0927		−0.198*	−0.130*
				(−1.39)		(−3.37)	(−1.99)
ln(prod)					0.0656*	0.0162	0.0157
					(3.16)	(0.87)	(0.89)
Constant	−0.795*	−0.704*	−0.477*	−0.769*	−0.878*	−0.483*	−0.436*
	(−30.22)	(−6.94)	(−5.01)	(−25.22)	(−25.21)	(−4.29)	(−5.05)
Observations	3190	3190	3190	3190	3190	3190	3190
AR(1)	0.148	0.168	0.061	0.143	0.155	0.378	0.108
AR(2)	0.228	0.189	0.074	0.308	0.186	0.122	0.042
Sargan	0.088	0.277	0.005	0.002	0.000	0.000	0.000
Hansen	0.039	0.150	0.128	0.025	0.000	0.034	0.065

t statistics in parentheses

$^{+}$ $p < 0.1$, * $p < 0.05$

Table 6.3: System GMM: Capital Abundant Countries

	(1) ln(paysh)	(2) ln(paysh)	(3) ln(paysh)	(4) ln(paysh)	(5) ln(paysh)	(6) ln(paysh)	(7) ln(paysh)
ln(ksh)	0.0700*	0.0709*	0.0912*	0.0690*	−0.101*	−0.0699+	−0.0607
	(2.47)	(2.73)	(3.26)	(2.35)	(−2.05)	(−1.65)	(−1.32)
NarrowOFF		0.0180				0.0639*	
		(1.08)				(3.12)	
BroadOFF			0.124*				0.216*
			(3.23)				(4.11)
Kprice				−0.0111			
				(−0.34)			
ln(prod)					−0.269*	−0.227*	−0.231*
					(−3.52)	(−3.59)	(−3.61)
Constant	−0.515*	−0.484*	−0.385*	−0.511*	0.435	0.397+	0.533*
	(−38.73)	(−16.53)	(−8.63)	(−37.17)	(1.64)	(1.74)	(2.21)
Observations	3482	3482	3482	3482	3482	3482	3482
AR(1)	0.049	0.042	0.157	0.052	0.057	0.058	0.191
AR(2)	0.112	0.175	0.336	0.116	0.150	0.144	0.427
Sargan	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen	0.058	0.001	0.001	0.113	0.000	0.000	0.000

6.1.2 Diagnostic Tests

As instrumental variables were applied in the Arrelano-Bond System GMM estimation, two types of diagnostic tests are carried out to examine the validity of the instrumental variables. First, autocorrelation tests in the idiosyncratic disturbance term with one and two lags are reported. The large p-value of AR(2) indicates that endogenous variables with at least three lags can be valid instruments. Specifically, if the residual errors are serially correlated with lag of order one, endogenous variables with 3 or more lags can be used as valid instruments.[1] Second, Sargan-Hansen tests were used for assessing the validity of the overidentifying restrictions . The null hypothesis is that additional instrumental variables are exogenous to the residuals, given exact identification.

As shown in the regression results for labor abundant countries regressions, the test results are mixed. We have regressions (4), (5), (6) and (7) that do not pass the joint validity test. However, difference-in-Hansen test results indicate the overidentifying restrictions are valid. (refer to appendix B.1 to B.7.)

Similarly to the regressions for labor abundant countries, the regressions failed the overidentifying restrictions validity test for capital abundant countries, but difference-in-Hansen tests results support the validity of the overidentifying restrictions for models with levels of the variables.

While reliability of some regressions is not fully supported by Sargan/Hansen tests, this empirical analysis can provide new evidence for the role that economic globalization plays in affecting the *LBS*. First, the impact of outsourcing on the *LBS* is positive for both groups. This is new evidence that supports the viewpoint that the labor force benefits from an open economy. Second, the *LBS* corresponds to drivers in a slightly different way in countries with different factor endowments. The coefficient of capital share in capital abundant countries is consistently smaller than that in labor abundant countries. In addition, the coefficients' sign of capital output ratio was not

[1] $E(X_{t-3}|\Delta\epsilon_t) = 0$

consistent within the capital abundant group. The correlation between *LBS* and capital share in capital abundant countries seems not homogeneous as that in labor abundant counties. countries seems not homogeneous as is the case that in labor abundant counties. Thus, I will further segment the capital abundant counties by labor market characteristics, to control for the potential heterogeneity within the capital abundant countries.

Complete regression diagnostic results are reported in appendix B.1 to B.7 and from B.8 to B.14.

Roodman (2009) stated that instrument validity tests are hard to satisfy when more moments are needed. In another words, it is difficult to obtain satisfactory validity test results when too many endogenous variables are included in the regression. Therefore, the following empirical analysis will only focus on the effects of capital share and economic globalization.

6.2 Effect of Outsourcing on the labor share: Skilled vs Unskilled Labor Force

In order to assess whether the relationship between *LBS* and outsourcing is affected by labor force skill type, industries are segmented into two groups: high-skilled labor force intensive industries vs high-skilled labor force less intensive industries.

The industries were segmented by the proportion of high-skilled labor force compensation in total labor compensation.[2] As shown in table 6.4, four industries in which the proportion of *LBS* contributed by high skilled labor force is greater than 30% are categorized as high-skilled labor force intensive industries: Chemicals, Electronical and optical equipment, Pulp, Paper, Paper , Printing and Publishing and Transport Equipment. All these industries are characterized by relatively high compensation

[2] WIOD Socio-Economic Accounts (SEA) provides High-skilled labor compensation (share in total labor compensation) and Low-skilled labor compensation (share in total labor compensation).

shares paid to high-skilled labor force. The rest of the industries are grouped as unskilled labor intensive.

Table 6.4: *LBS* contributed by high skilled labor force for U.S. manufacturing industries, 1995-2012. Data source: WIOD database

Description	Median	Mean	Min.Value	Max.value	Std.dev
Metals, Code: 27 and 28	0.216	0.215	0.186	0.249	0.017543687
Chemicals, Code: 24	0.577	0.563	0.514	0.61	0.034810644
Electrical and Optical, Code: 30-33	0.49	0.528	0.409	0.625	0.076824165
Food, Code: 15 and 6	0.29	0.293	0.266	0.322	0.021245055
Leather and footwear, Code: 19	0.261	0.264	0.225	0.304	0.029428363
MACHINERY, Code: 29	0.298	0.309	0.228	0.386	0.04930778
MANUFACTURING, Code: 36-37	0.283	0.284	0.236	0.347	0.038146085
NON-METALLIC MINERAL, Code: 26	0.233	0.233	0.192	0.277	0.025396288
PAPER, PRINTING AND PUBLISHING, Code:21-22	0.441	0.428	0.38	0.472	0.033365651
Rubber and plastics, Code:25	0.257	0.2584	0.229	0.288	0.021626043
Textiles and textile, Code:17-18	0.261	0.264	0.225	0.304	0.029428363
TRANSPORT EQUIPMENT, Code:34-35	0.339	0.362	0.292	0.473	0.052584173
WOOD, Code: 20	0.166	0.173	0.123	0.227	0.034896718

The empirical results as shown in the table 6.5 indicate that outsourcing is not the contributor to the decline of *LBS*. The broad measure of outsourcing is positively correlated with *LBS* with statistical significance in the group of unskilled labor. The statistical significance for capital share and outsourcing is only observed in the group of unskilled labor. This may be due to the small size of data sample, given that only four industries are included for the group of skilled labor force.

Based on this empirical finding, economic globalization seems not the key driver in the decline of *LBS*. Additionally, the positive sign of outsourcing indicates that economic globalization benefits the *LBS* to some extent.

6.2.1 Diagnostic Tests

As shown in table 6.5, we can observe that the Hansen testing results support the validity of the overidentifying restrictions when only the capital share and measures of

Table 6.5: System GMM: Effect of Outsourcing in Capital Abundant: Skilled VS Unskilled

	Unskilled (1) ln(paysh)	Unskilled (2) ln(paysh)	Skilled (3) ln(paysh)	Skilled (4) ln(paysh)
ln(ksh)	0.101***	0.0829***	0.0338	0.0228
	(4.14)	(3.62)	(0.81)	(0.51)
BroadOFF	0.187***			0.0279
	(5.58)			(0.51)
NarrowOFF		0.00723	0.0212	
		(0.69)	(0.56)	
Constant	−0.316***	−0.430***	−0.534***	−0.533***
	(−8.15)	(−15.28)	(−11.64)	(−8.13)
Observations	2410	2410	1072	1072
AR(1)	0.168	0.049	0.553	0.605
AR(2)	0.694	0.343	0.066	0.060
Sargan	0.000	0.000	0.007	0.018
Hansen	0.368	0.013	0.137	0.196

* First two columns report results for Unskilled group; last two columns report Skilled group.

economic globalization are included, except for regression (2). The p values for AR(2) indicate the error terms are not serially correlated.

6.3 Empirical results: Labor Market Institutions

To examine whether the economic globalization affects the *LBS* by altering the bargaining power between employees and firms, I assess the relationship of the *LBS* to economic globalization across different labor market institutions. Therefore, I split the countries into three groups by their labor market characteristics.

Based on the coverage and intensity of trade unions, I split the advanced economies into three groups: Anglo, Continental Europe and Nordic countries. As we can see in table 6.6, the group of Anglo countries is considered to have competitive labor markets which are characterized by low trade union density and wage bargaining coverage. Continental European countries are characterized by low density and high level of wage bargaining coverage. Trade unions in continental Europe are powerful but decentralized. We expect that bargaining mode for Continental European countries is *R-M*.For Nordic countries, the labor market institutions feature high trade union density and wage bargaining coverage. So, we expect that Nordic countries are characterized by the *E-B* model where employees and employers negotiate the wage rate and employment simultaneously.

For Anglo countries, firms maximize their profit by optimizing capital and labor inputs. As a result, changes in bargaining power will lead to changes in real wages, which in turn drive the efficient capital-output ratio following the share-capital schedule. For European Continental countries, employers determine the labor input by taking wages as given. This also leads to the efficient capital-output ratio. Therefore, changes in bargaining power will be only reflected in the changes in capital-labor ratio both Anglo and European Continental countries.

In terms of empirical specification, if economic globalization affects the *LBS* by changing the bargaining power between firms and employees, we may observe insignificance of economic globalization when capital-output ratio was included in regression.

The direction of the *LBS* responding to changes of bargaining power relies on the *ES* between capital and labor, e.g. an increase in bargaining power of employees could push an increase in wages that in turn, encourages firms to substitute labor input with capital if capital and labor are substitutable. Therefore, an increase in labor bargaining power leads to an increase of the capital-labor ratio, which further causes *LBS* to decrease if capital and labor are substitutable. On the other hand, if labor and capital are more complementary, a decrease in labor bargaining power could lead to an increase in the *LBS*.

For Nordic countries, Bentolila and Saint-Paul (2003) employed a simple Nash bargaining model to determine the impact of changes of bargaining power on *LBS*. As a results of Nash equilibrium, the wage is the weighted average of average labor productivity and employee's real opportunity cost[3]. When the real wage equation loaded into share-capital schedule(equation 3.6), the bargaining power will be the intersection item. Hence, changes in bargaining power will drive away from share-capital.

In terms of empirical specification, if economic globalization affects the LBS by changing the bargaining power between firms and employees for Nordic countries, we may observe statistical significance of economic globalization when capital-output ratio was included in the regression.

[3] Under Nash equilibrium, equation **??** will be expressed as $w_i = \theta A_l f(k_i) - (1 - \theta) A_l f^{'}(k_i) ki$ where θ is the bargaining power.

Table 6.6: Density and Coverage of Labor Relationships

Country		**Density**		**Coverage**
	1995-1999	**1995-1999**	**1995-1999**	
Anglo				
Canada	32.8	30.8	30.5	30.9
Ireland	42.8	35.3	31.9	42.1
Japan	23	20.3	18.4	19.2
Korea	11.8	11	10.6	12.8
United Kingdom	28.2 *	29.1	27.2	28.2
United States	13.7	12.6	11.7	12.3
Taiwan**				
Continental Europe				
Australia	29.4	25.7	24.5	57.5
Austria	39.2	36.6	35.9	98
France	8.3	8	7.9	96.4
Germany	27	23.4	20	68.4
Greece	29.3	24.4	23.9	82.7
Italy	36.5	34.1	34.1	80
Netherlands	24.4	21.7	19.8	81.8
Portugal	24.4	21.5	20.7	78.9
Spain	17	16.1	15.9	83.1
Nordic				
Belgium	53	55.2	54.5	96
Denmark	75.3	72.6	68.2	84
Finland	78.9	73.5	70.1	87.2
Sweden	83.5	78.1	71.9	93.5

* Data of labor union density for United Kingdom is not available during 1995-1999. I take the average value of labor union density from 2000-2009.

** Data for Taiwan is not available. I classify it into ANGLO group with respect to geographic consideration.

Data Source: Data Base on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960-2011 (ICTWSS).

6.3.1 Anglo Countries

The countries are grouped into Anglo Countries are: Australia, Canada, Ireland, Japan, Korea, Taiwan and United States and UK. Table 6.7 provides the estimation results. The share capital scheme was not observed in Anglo countries, except when controlling for the broad measure of outsourcing. While the correlation between the *LBS* and capital share is significantly positive, the magnitude is small given the small coefficient value. Both measures of outsourcing are negatively correlated with the *LBS*, but lack of statistical significance.

Table 6.7: Anglo Countries

	(1) ln(paysh)	(2) ln(paysh)	(3) ln(paysh)
ln(ksh)	0.0246	0.0345	0.0716*
	(0.80)	(1.36)	(2.67)
NarrowOFF		−0.0466	
		(−1.30)	
BroadOFF			−0.0334
			(−0.72)
Constant	−0.526*	−0.611*	−0.563*
	(−20.93)	(−7.82)	(−8.64)
Observations	1404	1404	1404
AR(1)	0.618	0.227	0.538
AR(2)	0.324	0.957	0.303
Sargan	0.000	0.000	0.000
Hansen	0.094	0.103	0.016

6.3.2 Continental Europe Countries

Table 6.8: Continental Europe Countries

	(1)	(2)	(3)
	ln(paysh)	ln(paysh)	ln(paysh)
ln(ksh)	0.0158	0.0450	0.0842^{+}
	(0.34)	(1.00)	(1.76)
NarrowOFF		0.0480^{+}	
		(1.79)	
BroadOFF			0.213^{*}
			(6.33)
Constant	-0.494^{*}	-0.457^{*}	-0.319^{*}
	(-33.40)	(-10.19)	(-8.88)
Observations	1441	1441	1441
AR(1)	0.050	0.046	0.177
AR(2)	0.872	0.751	0.561
Sargan	0.000	0.003	0.040
Hansen	0.458	0.231	0.212

Under the *R-M* model, unions will negotiate wages with the firms first, employers determine the labor input taking wages as given. In this case, the correlation between the *LBS* and bargaining power relies on the *ES* between capital and labor, e.g. an increase in bargaining power of unions could push an increase in wages. Given the increased labor cost, firms tend to substitute labor input with capital if capital and labor are substitutable. Therefore, a decrease in labor bargaining power will cause the labor's share of income to increase if capital and labor are substitutable. On the other hand, if labor and capital are complementary, an decrease in bargaining power of employees could lead to a decrease in the *LBS* .

As shown in table 6.8, the positive sign of the coefficient of capital share indicates that labor and capital are is complementary. If economic globalization affects labor by eroding the bargaining power of employees and there is a complementary relationship between labor and capital, we should observe a negative correlation between outsourcing measures and the *LBS*. However, both the broad and narrow measures of outsourcing are positively correlated with the *LBS*. Therefore, this is additional empirical evidence to challenge the hypothesis that economic globalization contributes to the decline of the *LBS*.

6.3.3 Nordic Countries

The group of Nordic countries are: Denmark, Finland, Netherlands and Sweden.

Table 6.9: Nordic Countries

	(1)	(2)	(3)
	ln(paysh)	ln(paysh)	ln(paysh)
ln(ksh)	0.220*	0.202*	0.190*
	(8.53)	(5.11)	(3.55)
NarrowOFF		0.0712	
		(0.74)	
BroadOFF			0.206*
			(2.28)
Constant	−0.441*	−0.333*	−0.288*
	(−21.39)	(−2.32)	(−4.09)
Observations	650	650	650
AR(1)	0.209	0.302	0.150
AR(2)	0.077	0.194	0.064
Sargan	0.014	0.000	0.007
Hansen	0.802	0.158	0.504

Similarly to the European Continental countries, the broad measure of outsourcing is positively correlated with labor in Nordic countries. This is strong evidence to reject the hypothesis that economic globalization causes the decline of the *LBS*. As we discussed in section 3, under the *E-B* model, the efficient capital-labor input ratio is not affected by bargaining power. If economic globalization eroded bargaining power of workers, we will observe a decline of the *LBS*. However, the empirical results do not support this hypothesis. As shown in table 6.9, the economic globalization is positively correlated with *LBS*.

6.4 Summary

As discussed in Section 3, if we assume that employees' bargaining power is reduced due to economic globalization, the relationship between the *LBS* and outsourcing can be vary across labor market institutions. However, results in tables 6.7 to 6.9 indicates that the role of outsourcing in affecting *LBS* does not vary cross labor market institutions. Therefore, the channel in which economic globalization effects on *LBS* is not through changes in bargaining between firms and employees.

Furthermore, the assumption of economic globalization eroding employees' bargaining power is not supported by empirical evidence. In the Anglo group, outsourcing is negatively correlated with the *LBS*, but without statistical significance. The broad measure of outsourcing is positively correlated with the *LBS* for both Continental European and Nordic countries. Therefore, this study's empirical work provides additional evidence to challenge the assertion that the *LBS* declined is attributed to economic globalization.

The empirical results from the comparison between labor markets clearly reject the hypothesis that economic globalization may impact the *LBS* by eroding the bargaining power of workers. Further, economic globalization is positively correlated with the *LBS*.

Chapter 7

CONCLUSION

This study provided additional empirical evidence to answer the question of whether or not the economic globalization contributes to the *LBS* decline.

First, I introduced the theoretical background for analyzing the determinants of *LBS* movements. Based on the theoretical framework of neoclassical production, there exists a one-to-one relationship between *LBS* and capital share, which is denoted as "share-capital schedule" by Bentolila and Saint-Paul (2003). This "share capital schedule" will be altered by the elasticity of substitution between capital and labor. Further, I discussed the potential role of economic globalization in explaining the movement of *LBS*.

Next, I demonstrated the data characteristics of the *LBS* across countries and industries. Specifically, I illustrated the critical role of manufacturing industries in explaining movements in the aggregate *LBS*. Empirical evidence shows that manufacturing industries make a significant contribution to the aggregate *LBS* movement.

Last, in the empirical study, the sample was segmented by country and industry characteristics, to assess whether the *LBS*'s responses to the efficient capital-labor ratio depends on the substitution between the two production inputs capital and labor; whether economic globalization tends to benefit high-skilled labor force and whether the correlation between the labor's and capital's share varies by labor market.

This study provided empirical evidence to challenge the argument that economic globalization contributes to the *LBS* decline. Specifically, economic globalization measures are positively correlated with the *LBS* across three comparison studies (labor intensive vs capital intensive, skilled vs unskilled labor force and labor market institutions). This study indicates that economic globalization plays an independent role in explaining the movement of the *LBS*. Furthermore, the positive correlation between the *LBS* and economic globalization suggests that economic globalization might not be the key contributor to the decline of the *LBS*.

In terms of policy implication, an increase in tariffs may not be an effective policy to benefit the labor force and reverse the declining trend observed in the *LBS*. While the key contributors to the decline of the labor's share of income remains an open question for future research, I partially agree with Autor et al. (2017) and Barkai (2016)'s findings which indicate that the decline of aggregate *LBS* could be attributed to the increasing market power (or less competition) of firms in recent decades.

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Appendix A

STATISTIC SUMMARY OF MOVEMENTS IN LABOR SHARE

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.52	0.56	0.55	0.58	0.02
Austria	0.51	0.56	0.56	0.63	0.04
Belgium	0.56	0.58	0.58	0.60	0.01
Bulgaria	0.39	0.46	0.47	0.55	0.04
Brazil	0.42	0.46	0.49	0.62	0.07
Canada	0.45	0.46	0.46	0.49	0.01
China	0.27	0.28	0.28	0.30	0.01
Cyprus	0.45	0.47	0.48	0.53	0.03
Czech Republic	0.38	0.42	0.42	0.50	0.03
Germany	0.62	0.63	0.63	0.65	0.01
Denmark	0.65	0.69	0.69	0.71	0.02
Spain	0.58	0.59	0.60	0.61	0.01
Estonia	0.54	0.59	0.59	0.67	0.03
Finland	0.57	0.61	0.61	0.70	0.03
France	0.54	0.55	0.56	0.60	0.02
United Kingdom	0.58	0.62	0.62	0.67	0.03
Greece	0.34	0.46	0.45	0.52	0.05
Hungary	0.54	0.62	0.62	0.69	0.04
Indonesia	0.25	0.25	0.26	0.27	0.01
India	0.23	0.27	0.28	0.33	0.03
Ireland	0.30	0.34	0.35	0.41	0.04
Italy	0.42	0.46	0.46	0.50	0.02
Japan	0.37	0.42	0.42	0.46	0.03
Korea, Republic of	0.39	0.45	0.45	0.54	0.04
Lithuania	0.41	0.49	0.50	0.63	0.06
Latvia	0.48	0.60	0.60	0.67	0.06
Mexico	0.20	0.24	0.23	0.25	0.02
Malta	0.43	0.50	0.51	0.62	0.06
Netherlands	0.44	0.49	0.49	0.52	0.02
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.47	0.50	0.51	0.60	0.04
Romania	0.19	0.29	0.28	0.36	0.05
Russia	0.38	0.43	0.42	0.46	0.02
Slovak Republic	0.26	0.36	0.35	0.42	0.05
Slovenia	0.57	0.60	0.62	0.68	0.04
Sweden	0.57	0.60	0.60	0.62	0.02
Turkey	0.17	0.28	0.27	0.31	0.04
Taiwan	0.39	0.43	0.43	0.54	0.04
United States	0.46	0.50	0.50	0.53	0.02

Figure A.1: Food, Industry Code: 15 and 16

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.63	0.69	0.69	0.74	0.03
Austria	0.62	0.66	0.66	0.71	0.03
Belgium	0.66	0.69	0.70	0.80	0.04
Bulgaria	0.54	0.60	0.62	0.80	0.07
Brazil	0.29	0.43	0.41	0.52	0.07
Canada	0.60	0.68	0.71	0.88	0.09
China	0.42	0.46	0.45	0.48	0.02
Cyprus	0.45	0.47	0.48	0.52	0.03
Czech Republic	0.59	0.64	0.65	0.72	0.04
Germany	0.65	0.74	0.73	0.80	0.04
Denmark	0.67	0.71	0.71	0.82	0.04
Spain	0.65	0.70	0.69	0.75	0.03
Estonia	0.66	0.73	0.73	0.82	0.05
Finland	0.63	0.68	0.68	0.73	0.03
France	0.66	0.69	0.70	0.77	0.03
United Kingdom	0.69	0.79	0.79	0.87	0.06
Greece	0.45	0.54	0.54	0.62	0.04
Hungary	0.74	0.79	0.79	0.90	0.05
Indonesia	0.28	0.31	0.30	0.34	0.02
India	0.24	0.31	0.32	0.40	0.05
Ireland	0.54	0.68	0.68	0.81	0.08
Italy	0.54	0.56	0.57	0.61	0.03
Japan	0.69	0.87	0.86	0.97	0.10
Korea, Republic of	0.53	0.62	0.61	0.68	0.05
Lithuania	0.53	0.60	0.61	0.70	0.06
Latvia	0.56	0.78	0.78	0.92	0.10
Mexico	0.32	0.44	0.42	0.47	0.05
Malta	0.46	0.57	0.58	0.77	0.10
Netherlands	0.59	0.63	0.63	0.67	0.02
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.68	0.71	0.71	0.74	0.02
Romania	0.53	0.82	0.81	0.98	0.13
Russia	0.57	0.65	0.65	0.74	0.06
Slovak Republic	0.44	0.54	0.53	0.59	0.04
Slovenia	0.77	0.82	0.83	0.90	0.03
Sweden	0.65	0.69	0.71	0.80	0.05
Turkey	0.30	0.35	0.36	0.43	0.03
Taiwan	0.59	0.64	0.68	0.81	0.08
United States	0.65	0.73	0.72	0.80	0.04

Figure A.2: Textiles, Industry Code: 17 and 18

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.48	0.55	0.62	0.91	0.14
Austria	0.53	0.66	0.65	0.79	0.06
Belgium	0.61	0.70	0.70	0.78	0.04
Bulgaria	0.40	0.75	0.69	0.87	0.16
Brazil	0.63	0.78	0.78	0.89	0.08
Canada	0.60	0.68	0.71	0.88	0.09
China	0.42	0.46	0.47	0.54	0.04
Cyprus	0.45	0.47	0.48	0.52	0.03
Czech Republic	0.71	0.85	0.84	0.98	0.08
Germany	0.62	0.70	0.71	0.81	0.08
Denmark	0.43	0.70	0.65	0.81	0.13
Spain	0.66	0.70	0.70	0.76	0.03
Estonia	0.70	0.79	0.81	1.00	0.10
Finland	0.63	0.70	0.70	0.75	0.03
France	0.65	0.71	0.71	0.78	0.04
United Kingdom	0.59	0.64	0.64	0.69	0.03
Greece	0.45	0.58	0.59	0.83	0.11
Hungary	0.65	0.83	0.83	0.93	0.08
Indonesia	0.43	0.46	0.46	0.48	0.02
India	0.30	0.34	0.34	0.37	0.02
Ireland	0.18	0.41	0.38	0.58	0.13
Italy	0.47	0.51	0.53	0.58	0.04
Japan	0.53	0.59	0.60	0.66	0.04
Korea, Republic of	0.65	0.79	0.76	0.82	0.06
Lithuania	0.38	0.62	0.62	0.93	0.17
Latvia	0.71	1.09	1.06	1.27	0.16
Mexico	0.34	0.41	0.40	0.47	0.04
Malta	0.72	0.83	1.02	1.63	0.33
Netherlands	0.45	0.60	0.58	0.64	0.06
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.66	0.68	0.68	0.71	0.02
Romania	0.71	0.91	0.88	0.99	0.08
Russia	0.57	0.65	0.65	0.74	0.06
Slovak Republic	0.39	0.55	0.62	1.06	0.19
Slovenia	0.81	0.91	0.91	1.09	0.08
Sweden	0.59	0.66	0.67	0.82	0.06
Turkey	0.25	0.32	0.32	0.39	0.03
Taiwan	0.52	0.72	0.70	0.80	0.08
United States	0.73	0.80	0.82	0.99	0.07

Figure A.3: Leather and footwear, Industry Code: 19

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.63	0.69	0.69	0.74	0.03
Austria	0.62	0.66	0.66	0.71	0.03
Belgium	0.66	0.69	0.70	0.80	0.04
Bulgaria	0.54	0.60	0.62	0.80	0.07
Brazil	0.29	0.43	0.41	0.52	0.07
Canada	0.60	0.68	0.71	0.88	0.09
China	0.42	0.46	0.45	0.48	0.02
Cyprus	0.45	0.47	0.48	0.52	0.03
Czech Republic	0.59	0.64	0.65	0.72	0.04
Germany	0.65	0.74	0.73	0.80	0.04
Denmark	0.67	0.71	0.71	0.82	0.04
Spain	0.65	0.70	0.69	0.75	0.03
Estonia	0.66	0.73	0.73	0.82	0.05
Finland	0.63	0.68	0.68	0.73	0.03
France	0.66	0.69	0.70	0.77	0.03
United Kingdom	0.69	0.79	0.79	0.87	0.06
Greece	0.45	0.54	0.54	0.62	0.04
Hungary	0.74	0.79	0.79	0.90	0.05
Indonesia	0.28	0.31	0.30	0.34	0.02
India	0.24	0.31	0.32	0.40	0.05
Ireland	0.54	0.68	0.68	0.81	0.08
Italy	0.54	0.56	0.57	0.61	0.03
Japan	0.69	0.87	0.86	0.97	0.10
Korea, Republic of	0.53	0.62	0.61	0.68	0.05
Lithuania	0.53	0.60	0.61	0.70	0.06
Latvia	0.56	0.78	0.78	0.92	0.10
Mexico	0.32	0.44	0.42	0.47	0.05
Malta	0.46	0.57	0.58	0.77	0.10
Netherlands	0.59	0.63	0.63	0.67	0.02
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.68	0.71	0.71	0.74	0.02
Romania	0.53	0.82	0.81	0.98	0.13
Russia	0.57	0.65	0.65	0.74	0.06
Slovak Republic	0.44	0.54	0.53	0.59	0.04
Slovenia	0.77	0.82	0.83	0.90	0.03
Sweden	0.65	0.69	0.71	0.80	0.05
Turkey	0.30	0.35	0.36	0.43	0.03
Taiwan	0.59	0.64	0.68	0.81	0.08
United States	0.65	0.73	0.72	0.80	0.04

Figure A.4: Wood, Industry Code: 20

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.53	0.62	0.61	0.65	0.04
Austria	0.49	0.55	0.56	0.69	0.06
Belgium	0.60	0.62	0.62	0.66	0.02
Bulgaria	0.42	0.55	0.56	0.73	0.09
Brazil	0.39	0.46	0.50	0.70	0.10
Canada	0.52	0.62	0.61	0.69	0.05
China	0.34	0.39	0.42	0.53	0.07
Cyprus	0.45	0.47	0.48	0.54	0.03
Czech Republic	0.41	0.47	0.49	0.57	0.04
Germany	0.52	0.57	0.60	0.70	0.06
Denmark	0.72	0.75	0.76	0.84	0.03
Spain	0.57	0.58	0.59	0.62	0.02
Estonia	0.60	0.64	0.65	0.73	0.04
Finland	0.40	0.51	0.48	0.54	0.05
France	0.68	0.71	0.72	0.77	0.03
United Kingdom	0.60	0.66	0.67	0.73	0.05
Greece	0.53	0.60	0.60	0.69	0.05
Hungary	0.57	0.65	0.64	0.70	0.05
Indonesia	0.27	0.29	0.29	0.29	0.01
India	0.24	0.26	0.27	0.31	0.02
Ireland	0.19	0.24	0.25	0.38	0.04
Italy	0.50	0.54	0.54	0.57	0.02
Japan	0.50	0.56	0.57	0.61	0.03
Korea, Republic of	0.52	0.66	0.67	0.80	0.09
Lithuania	0.43	0.51	0.51	0.58	0.05
Latvia	0.50	0.66	0.65	0.76	0.08
Mexico	0.26	0.28	0.29	0.32	0.02
Malta	0.57	0.60	0.61	0.66	0.03
Netherlands	0.58	0.61	0.61	0.62	0.01
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.46	0.53	0.52	0.56	0.03
Romania	0.30	0.38	0.38	0.44	0.04
Russia	0.41	0.49	0.49	0.57	0.04
Slovak Republic	0.28	0.32	0.33	0.39	0.04
Slovenia	0.59	0.66	0.66	0.72	0.03
Sweden	0.51	0.60	0.58	0.63	0.05
Turkey	0.19	0.33	0.31	0.35	0.06
Taiwan	0.49	0.64	0.63	0.72	0.07
United States	0.53	0.58	0.57	0.62	0.02

Figure A.5: Paper, Printing and Publishing, Industry Code: 21 and 22

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.47	0.54	0.53	0.58	0.03
Austria	0.36	0.51	0.51	0.65	0.09
Belgium	0.54	0.57	0.57	0.63	0.03
Bulgaria	0.39	0.44	0.55	0.95	0.21
Brazil	0.35	0.44	0.44	0.55	0.05
Canada	0.37	0.42	0.45	0.56	0.06
China	0.29	0.33	0.33	0.36	0.03
Cyprus	0.45	0.47	0.49	0.55	0.03
Czech Republic	0.28	0.38	0.37	0.43	0.05
Germany	0.55	0.65	0.63	0.69	0.05
Denmark	0.44	0.52	0.52	0.64	0.05
Spain	0.52	0.53	0.54	0.58	0.02
Estonia	0.32	0.40	0.44	0.61	0.09
Finland	0.41	0.45	0.46	0.52	0.03
France	0.52	0.54	0.55	0.58	0.02
United Kingdom	0.52	0.62	0.60	0.63	0.04
Greece	0.48	0.56	0.60	0.75	0.10
Hungary	0.37	0.41	0.43	0.54	0.05
Indonesia	0.35	0.36	0.36	0.39	0.02
India	0.16	0.20	0.20	0.25	0.03
Ireland	0.07	0.11	0.11	0.15	0.03
Italy	0.51	0.53	0.55	0.61	0.04
Japan	0.34	0.37	0.37	0.42	0.03
Korea, Republic of	0.33	0.39	0.40	0.46	0.03
Lithuania	0.22	0.37	0.35	0.45	0.07
Latvia	0.49	0.65	0.67	0.86	0.11
Mexico	0.29	0.34	0.34	0.39	0.04
Malta	0.19	0.45	0.47	0.80	0.23
Netherlands	0.37	0.41	0.40	0.42	0.02
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.43	0.53	0.52	0.55	0.03
Romania	0.51	0.67	0.65	0.79	0.08
Russia	0.28	0.40	0.38	0.43	0.05
Slovak Republic	0.22	0.27	0.28	0.46	0.06
Slovenia	0.44	0.51	0.51	0.62	0.05
Sweden	0.33	0.36	0.36	0.39	0.02
Turkey	0.23	0.42	0.40	0.45	0.06
Taiwan	0.29	0.40	0.40	0.49	0.06
United States	0.38	0.44	0.44	0.49	0.03

Figure A.6: Chemicals, Industry Code: 24

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.58	0.66	0.66	0.73	0.05
Austria	0.59	0.63	0.63	0.70	0.03
Belgium	0.62	0.65	0.66	0.71	0.03
Bulgaria	0.38	0.48	0.57	0.94	0.21
Brazil	0.56	0.63	0.64	0.81	0.07
Canada	0.57	0.61	0.62	0.68	0.03
China	0.33	0.38	0.38	0.42	0.03
Cyprus	0.45	0.47	0.48	0.52	0.02
Czech Republic	0.48	0.49	0.52	0.61	0.04
Germany	0.63	0.69	0.68	0.74	0.03
Denmark	0.64	0.67	0.68	0.72	0.02
Spain	0.63	0.66	0.66	0.70	0.02
Estonia	0.52	0.61	0.65	1.04	0.13
Finland	0.58	0.60	0.60	0.63	0.02
France	0.66	0.70	0.70	0.79	0.04
United Kingdom	0.57	0.74	0.71	0.76	0.07
Greece	0.40	0.48	0.48	0.59	0.06
Hungary	0.58	0.61	0.62	0.67	0.03
Indonesia	0.38	0.40	0.40	0.43	0.01
India	0.19	0.28	0.28	0.36	0.05
Ireland	0.55	0.61	0.61	0.68	0.05
Italy	0.53	0.58	0.58	0.63	0.04
Japan	0.63	0.69	0.70	0.78	0.05
Korea, Republic of	0.46	0.51	0.51	0.61	0.04
Lithuania	0.26	0.36	0.42	0.97	0.19
Mexico	0.37	0.40	0.41	0.48	0.04
Netherlands	0.61	0.70	0.68	0.73	0.05
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.51	0.58	0.58	0.65	0.05
Romania	0.26	0.38	0.41	0.65	0.12
Russia	0.48	0.49	0.51	0.61	0.04
Slovak Republic	0.31	0.39	0.39	0.47	0.04
Slovenia	0.52	0.58	0.58	0.63	0.03
Sweden	0.63	0.66	0.67	0.72	0.02
Turkey	0.24	0.34	0.34	0.42	0.04
Taiwan	0.59	0.63	0.66	0.74	0.06
United States	0.60	0.63	0.63	0.69	0.03

Figure A.7: Rubber and Plastics, Industry Code: 25

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.49	0.54	0.53	0.57	0.02
Austria	0.56	0.61	0.60	0.65	0.03
Belgium	0.61	0.64	0.64	0.69	0.02
Bulgaria	0.28	0.50	0.63	1.38	0.40
Brazil	0.45	0.52	0.51	0.58	0.04
Canada	0.52	0.54	0.55	0.59	0.02
China	0.35	0.48	0.45	0.52	0.06
Cyprus	0.45	0.47	0.48	0.53	0.03
Czech Republic	0.43	0.46	0.46	0.52	0.02
Germany	0.59	0.66	0.67	0.71	0.03
Denmark	0.63	0.66	0.67	0.75	0.03
Spain	0.55	0.56	0.57	0.60	0.02
Estonia	0.41	0.48	0.48	0.65	0.07
Finland	0.55	0.58	0.58	0.65	0.02
France	0.61	0.64	0.64	0.71	0.03
United Kingdom	0.62	0.68	0.67	0.70	0.03
Greece	0.40	0.50	0.50	0.64	0.07
Hungary	0.43	0.51	0.52	0.60	0.05
Indonesia	0.31	0.32	0.32	0.33	0.00
India	0.17	0.22	0.21	0.25	0.03
Ireland	0.39	0.42	0.43	0.46	0.02
Italy	0.48	0.54	0.54	0.57	0.03
Japan	0.50	0.56	0.55	0.59	0.03
Korea, Republic of	0.45	0.51	0.52	0.60	0.06
Lithuania	0.47	0.55	0.57	0.70	0.07
Latvia	0.34	0.51	0.53	0.77	0.11
Mexico	0.24	0.27	0.26	0.29	0.02
Malta	0.46	0.56	0.55	0.62	0.05
Netherlands	0.54	0.59	0.60	0.64	0.03
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.47	0.53	0.53	0.60	0.05
Romania	0.51	0.59	0.60	0.69	0.06
Russia	0.41	0.45	0.45	0.52	0.03
Slovak Republic	0.32	0.35	0.36	0.42	0.04
Slovenia	0.56	0.61	0.61	0.73	0.05
Sweden	0.63	0.69	0.70	0.78	0.04
Turkey	0.24	0.33	0.31	0.34	0.03
Taiwan	0.52	0.57	0.57	0.63	0.04
United States	0.47	0.51	0.52	0.58	0.03

Figure A.8: Non-Metallic, Industry Code: 26

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.46	0.53	0.52	0.57	0.04
Austria	0.53	0.61	0.60	0.65	0.04
Belgium	0.63	0.73	0.73	0.83	0.05
Bulgaria	0.32	0.56	0.58	1.01	0.23
Brazil	0.31	0.43	0.43	0.52	0.06
Canada	0.55	0.60	0.60	0.66	0.03
China	0.28	0.43	0.40	0.49	0.08
Cyprus	0.45	0.47	0.49	0.62	0.05
Czech Republic	0.48	0.53	0.54	0.58	0.04
Germany	0.60	0.73	0.72	0.81	0.06
Denmark	0.72	0.74	0.74	0.79	0.02
Spain	0.56	0.59	0.59	0.61	0.02
Estonia	0.61	0.65	0.67	0.76	0.05
Finland	0.50	0.61	0.60	0.65	0.05
France	0.67	0.72	0.72	0.79	0.03
United Kingdom	0.69	0.81	0.79	0.83	0.05
Greece	0.37	0.57	0.55	0.66	0.08
Hungary	0.59	0.65	0.65	0.71	0.04
Indonesia	0.25	0.31	0.30	0.31	0.02
India	0.14	0.23	0.22	0.29	0.06
Ireland	0.48	0.53	0.53	0.56	0.03
Italy	0.52	0.55	0.55	0.58	0.02
Japan	0.47	0.53	0.53	0.58	0.03
Korea, Republic of	0.37	0.42	0.43	0.50	0.03
Lithuania	0.56	0.67	0.66	0.82	0.06
Latvia	0.41	0.54	0.53	0.64	0.06
Mexico	0.18	0.24	0.26	0.35	0.06
Malta	0.49	0.60	0.60	0.68	0.05
Netherlands	0.60	0.66	0.67	0.75	0.05
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.63	0.65	0.65	0.68	0.01
Romania	0.56	0.68	0.67	0.77	0.07
Russia	0.46	0.52	0.52	0.58	0.05
Slovak Republic	0.28	0.36	0.35	0.42	0.05
Slovenia	0.60	0.62	0.64	0.76	0.05
Sweden	0.54	0.61	0.61	0.66	0.03
Turkey	0.24	0.34	0.34	0.41	0.04
Taiwan	0.52	0.58	0.57	0.61	0.03
United States	0.63	0.67	0.67	0.73	0.03

Figure A.9: Basic Metals, Industry Code: 27 and 28

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.75	0.82	0.81	0.85	0.03
Austria	0.58	0.66	0.67	0.74	0.05
Belgium	0.62	0.69	0.69	0.73	0.04
Bulgaria	0.63	0.71	0.79	1.18	0.19
Brazil	0.57	0.66	0.66	0.77	0.06
Canada	0.59	0.64	0.64	0.67	0.03
China	0.37	0.44	0.43	0.48	0.04
Cyprus	0.45	0.47	0.49	0.59	0.04
Czech Republic	0.61	0.67	0.67	0.74	0.03
Germany	0.67	0.78	0.76	0.81	0.04
Denmark	0.72	0.77	0.77	0.80	0.03
Spain	0.64	0.66	0.66	0.68	0.01
Estonia	0.63	0.73	0.75	0.99	0.09
Finland	0.63	0.70	0.70	0.74	0.03
France	0.72	0.75	0.76	0.83	0.03
United Kingdom	0.63	0.74	0.71	0.75	0.05
Greece	0.49	0.67	0.65	0.77	0.09
Hungary	0.60	0.69	0.68	0.78	0.05
Indonesia	0.41	0.42	0.42	0.44	0.01
India	0.26	0.44	0.40	0.50	0.10
Ireland	0.50	0.55	0.56	0.61	0.03
Italy	0.59	0.63	0.63	0.66	0.02
Japan	0.56	0.64	0.64	0.74	0.06
Korea, Republic of	0.54	0.63	0.63	0.66	0.03
Lithuania	0.53	0.68	0.72	0.94	0.12
Latvia	0.46	0.63	0.63	0.78	0.10
Mexico	0.44	0.68	0.63	0.77	0.13
Malta	0.47	0.52	0.57	0.74	0.10
Netherlands	0.60	0.72	0.71	0.79	0.06
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.67	0.69	0.71	0.78	0.04
Romania	0.69	0.80	0.80	0.91	0.06
Russia	0.61	0.66	0.66	0.74	0.03
Slovak Republic	0.46	0.54	0.56	0.73	0.08
Slovenia	0.65	0.68	0.69	0.80	0.04
Sweden	0.64	0.68	0.68	0.75	0.03
Turkey	0.18	0.36	0.34	0.38	0.05
Taiwan	0.51	0.67	0.65	0.73	0.06
United States	0.44	0.66	0.64	0.68	0.07

Figure A.10: Machinery, Industry Code: 29

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.62	0.68	0.67	0.71	0.02
Austria	0.62	0.65	0.65	0.71	0.03
Belgium	0.70	0.74	0.75	0.84	0.04
Bulgaria	0.40	0.48	0.62	1.14	0.27
Brazil	0.54	0.56	0.56	0.61	0.02
Canada	0.51	0.77	0.72	0.83	0.12
China	0.33	0.37	0.37	0.42	0.03
Cyprus	0.45	0.47	0.48	0.52	0.03
Czech Republic	0.48	0.57	0.57	0.67	0.06
Germany	0.67	0.79	0.78	0.85	0.05
Denmark	0.62	0.68	0.67	0.76	0.04
Spain	0.61	0.67	0.66	0.69	0.02
Estonia	0.61	0.69	0.70	0.82	0.06
Finland	0.34	0.40	0.40	0.54	0.05
France	0.67	0.75	0.74	0.78	0.04
United Kingdom	0.59	0.73	0.71	0.82	0.08
Greece	0.43	0.53	0.53	0.65	0.07
Hungary	0.41	0.50	0.51	0.64	0.08
Indonesia	0.25	0.25	0.26	0.27	0.01
India	0.22	0.36	0.32	0.40	0.08
Ireland	0.29	0.35	0.35	0.45	0.05
Italy	0.56	0.59	0.59	0.61	0.02
Japan	0.54	0.58	0.60	0.70	0.05
Korea, Republic of	0.39	0.45	0.46	0.57	0.05
Lithuania	0.50	0.57	0.57	0.67	0.04
Latvia	0.38	0.51	0.49	0.60	0.06
Mexico	0.34	0.43	0.42	0.49	0.05
Malta	0.29	0.45	0.45	0.58	0.07
Netherlands	0.68	0.93	0.93	1.09	0.13
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.52	0.71	0.68	0.79	0.08
Romania	0.38	0.50	0.50	0.62	0.07
Russia	0.48	0.57	0.57	0.67	0.05
Slovak Republic	0.30	0.43	0.43	0.55	0.06
Slovenia	0.66	0.68	0.69	0.77	0.03
Sweden	0.56	0.64	0.76	1.42	0.26
Turkey	0.21	0.38	0.37	0.43	0.06
Taiwan	0.36	0.40	0.42	0.55	0.06
United States	0.61	0.73	0.71	0.79	0.06

Figure A.11: Electrical and Optical Equipment, Industry Code: 30 to 33

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.58	0.65	0.65	0.70	0.04
Austria	0.56	0.58	0.59	0.62	0.02
Belgium	0.72	0.78	0.81	1.00	0.07
Bulgaria	0.55	0.67	0.68	0.87	0.10
Brazil	0.74	0.78	0.78	0.85	0.04
Canada	0.44	0.58	0.59	0.75	0.11
China	0.39	0.40	0.40	0.41	0.01
Cyprus	0.45	0.47	0.50	0.77	0.08
Czech Republic	0.41	0.49	0.48	0.58	0.05
Germany	0.71	0.79	0.80	0.92	0.05
Denmark	0.78	0.88	0.88	0.96	0.05
Spain	0.63	0.65	0.65	0.68	0.02
Estonia	0.49	0.56	0.58	0.72	0.08
Finland	0.71	0.79	0.78	0.90	0.06
France	0.58	0.61	0.63	0.73	0.06
United Kingdom	0.72	0.77	0.79	0.88	0.06
Greece	0.76	0.81	0.82	0.95	0.06
Hungary	0.29	0.38	0.37	0.45	0.05
Indonesia	0.32	0.33	0.32	0.33	0.00
India	0.14	0.21	0.20	0.27	0.05
Ireland	0.64	0.70	0.73	0.85	0.07
Italy	0.69	0.74	0.75	0.84	0.04
Japan	0.47	0.55	0.54	0.62	0.04
Korea, Republic of	0.56	0.62	0.62	0.67	0.04
Lithuania	0.50	0.65	0.64	0.88	0.12
Latvia	0.64	0.85	0.84	0.97	0.10
Mexico	0.26	0.31	0.32	0.37	0.03
Malta	1.26	1.64	2.23	4.57	1.18
Netherlands	0.57	0.63	0.64	0.78	0.06
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.58	0.65	0.65	0.72	0.04
Romania	0.33	0.58	0.58	0.80	0.18
Russia	0.41	0.47	0.48	0.58	0.05
Slovak Republic	0.21	0.30	0.33	0.46	0.07
Slovenia	0.56	0.65	0.67	0.85	0.09
Sweden	0.56	0.66	0.65	0.69	0.04
Turkey	0.24	0.48	0.44	0.50	0.09
Taiwan	0.42	0.48	0.50	0.62	0.06
United States	0.56	0.68	0.68	0.75	0.04

Figure A.12: Transportation Equipment, Industry Code: 34 and 35

country	Min.Value	Medium	Mean	Max.value	Std.dev
Australia	0.62	0.68	0.68	0.72	0.03
Austria	0.55	0.60	0.61	0.66	0.04
Belgium	0.58	0.63	0.65	0.73	0.05
Bulgaria	0.40	0.46	0.76	1.93	0.59
Brazil	0.35	0.39	0.39	0.44	0.02
Canada	0.60	0.63	0.63	0.66	0.01
China	0.22	0.31	0.29	0.34	0.05
Cyprus	0.45	0.47	0.48	0.53	0.03
Czech Republic	0.50	0.57	0.57	0.66	0.05
Germany	0.64	0.75	0.75	0.85	0.06
Denmark	0.68	0.70	0.70	0.73	0.01
Spain	0.66	0.69	0.69	0.72	0.02
Estonia	0.62	0.67	0.67	0.74	0.05
Finland	0.65	0.67	0.68	0.74	0.03
France	0.61	0.63	0.64	0.69	0.02
United Kingdom	0.62	0.64	0.65	0.68	0.02
Greece	0.42	0.52	0.55	0.83	0.11
Hungary	0.64	0.68	0.68	0.72	0.03
Indonesia	0.29	0.32	0.31	0.32	0.01
India	0.23	0.30	0.30	0.35	0.04
Ireland	0.61	0.69	0.69	0.80	0.06
Italy	0.48	0.50	0.51	0.53	0.02
Japan	0.54	0.58	0.59	0.70	0.05
Korea, Republic of	0.57	0.65	0.65	0.74	0.06
Lithuania	0.47	0.57	0.55	0.66	0.06
Latvia	0.49	0.59	0.60	0.73	0.07
Mexico	0.36	0.43	0.43	0.49	0.03
Malta	0.46	0.49	0.50	0.54	0.02
Netherlands	0.77	0.82	0.82	0.86	0.03
Poland	0.47	0.59	0.56	0.64	0.07
Portugal	0.69	0.71	0.72	0.75	0.02
Romania	0.41	0.58	0.58	0.77	0.09
Russia	0.50	0.55	0.56	0.66	0.05
Slovak Republic	0.36	0.44	0.45	0.55	0.06
Slovenia	0.62	0.66	0.66	0.74	0.03
Sweden	0.99	1.10	1.10	1.23	0.08
Turkey	0.12	0.31	0.27	0.33	0.07
Taiwan	0.60	0.67	0.67	0.73	0.04
United States	0.48	0.58	0.60	0.74	0.09

Figure A.13: Manufacturing NEC Recycling, Industry Code: 36 and 37

A.1 Effects of manufacturing on aggregate labor share

Countries	Within effect	Between effects	total	Changes in Aggregate Labor Share (1995-2006)	Effects of Manufacturing
USA	-0.017485	-0.0042	-0.02169	-0.004	542.22%
TWN	-0.013174	-0.02183	-0.03501	-0.048	72.93%
TUR	-0.033633	0.031045	-0.00259	0.015	-17.26%
SWE	-0.015331	-0.00187	-0.0172	0	tot labor share is zero
SVN	-0.012484	-0.03958	-0.05207	-0.072	72.31%
SVK	-0.009158	-0.00121	-0.01037	-0.024	43.20%
RUS	0.0022455	-0.01144	-0.00919	-0.021	43.77%
ROU	-0.00867	-0.01406	-0.02273	0	tot labor share is zero
PRT	-0.021181	0.000233	-0.02095	0.034	-61.61%
POL	-0.010931	-0.01686	-0.02779	-0.043	64.62%
NLD	-0.019976	-0.00543	-0.0254	-0.011	230.95%
MLT	-0.034556	0.002289	-0.03227	0.019	-169.82%
MEX	-0.004007	-0.00753	-0.01154	-0.019	60.73%
LVA	-0.054251	0.006785	-0.04747	-0.006	791.09%
LUX	-0.036737	0.002501	-0.03424	-0.039	87.78%
LTU	0.0047084	-0.0063	-0.00159	0.052	-3.05%
KOR	0.0012729	-0.01014	-0.00887	-0.008	110.88%
JPN	-0.0106	-0.00794	-0.01854	-0.017	109.04%
ITA	-0.020675	0.005913	-0.01476	-0.004	369.07%
IRL	-0.024753	-0.01637	-0.04113	-0.054	76.16%
IND	-0.00409	-0.01409	-0.01818	-0.045	40.41%
IDN	-0.010355	-0.00055	-0.01091	-0.007	155.81%
HUN	0.0070483	-0.03353	-0.02648	-0.008	330.97%
GRC	-0.012073	-0.00208	-0.01415	0.032	-44.23%
GBR	-0.062824	0.013728	-0.0491	0.006	-818.26%
FRA	-0.010998	-0.00186	-0.01286	0.003	-428.75%
FIN	-0.006882	-0.0055	-0.01239	-0.008	154.82%
EST	-0.02407	-0.00379	-0.02786	-0.083	33.57%
ESP	-0.021947	-0.00326	-0.02521	-0.004	630.24%
DNK	-0.020466	-0.00076	-0.02122	0.021	-101.07%
DEU	0.0045886	-0.02497	-0.02038	-0.048	42.45%
CZE	0.0104614	0.024909	0.035371	0.111	31.87%
CYP	-0.019398	-0.00205	-0.02144	0.026	-82.48%
CHN	-0.000982	-0.02538	-0.02636	-0.121	21.79%
CAN	-0.02523	0.006033	-0.0192	-0.017	112.92%
BRA	-0.006271	0.007114	0.000843	-0.029	-2.91%
BGR	-0.016237	-0.04446	-0.0607	-0.093	65.27%
BEL	-0.022764	-0.00487	-0.02763	-0.005	552.63%
AUT	0.0017153	-0.02363	-0.02191	-0.058	37.78%
AUS	-0.021323	-0.00234	-0.02366	-0.013	181.99%

Figure A.14: Effect of Manufacturing on aggregate labor share

A.2 Statistics Summary for two-digit Manufacturing industries

Industry	Medium	Mean	Min.Value	Max.value	Std.dev
FOOD , BEVERAGES AND TOBACCO	0.500643	0.495601	0.455554	0.528042	0.023475
Textiles and textile	0.725526	0.718222	0.65253	0.802924	0.040181
Leather, leather and footwear	0.800834	0.815759	0.730429	0.987238	0.069419
WOOD AND OF WOOD AND CORK	0.778526	0.777533	0.714741	0.860314	0.049445
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	0.576054	0.572211	0.532645	0.617964	0.021236
Chemicals and chemical	0.436685	0.436779	0.384324	0.486417	0.030283
Rubber and plastics	0.6275	0.627603	0.59538	0.694655	0.025748
OTHER NON-METALLIC MINERAL	0.507031	0.515629	0.470017	0.579031	0.031937
BASIC METALS AND FABRICATED METAL	0.666764	0.672565	0.633979	0.730845	0.032647
MACHINERY, NEC	0.657646	0.635194	0.436828	0.678788	0.066563
ELECTRICAL AND OPTICAL EQUIPMENT	0.729278	0.712931	0.611435	0.787624	0.060522
TRANSPORT EQUIPMENT	0.679778	0.678108	0.558428	0.748747	0.044324
MANUFACTURING NEC; RECYCLING	0.578407	0.59885	0.482814	0.741571	0.088925

Figure A.15: Labor share of two-digit manufacturing industries, USA.

Industry	Medium	Mean	Min.Value	Max.value	Std.dev
FOOD , BEVERAGES AND TOBACCO	0.630232	0.631259	0.618076	0.649658	0.010085
Textiles and textile	0.736127	0.727042	0.647682	0.799784	0.044517
Leather, leather and footwear	0.704893	0.710598	0.621359	0.810811	0.076326
WOOD AND OF WOOD AND CORK	0.656211	0.644677	0.563342	0.733249	0.048054
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	0.574757	0.595807	0.524209	0.699806	0.063186
Chemicals and chemical	0.651815	0.631884	0.546386	0.685965	0.053309
Rubber and plastics	0.688392	0.68341	0.628284	0.742477	0.031612
OTHER NON-METALLIC MINERAL	0.66279	0.669824	0.593308	0.712509	0.034513
BASIC METALS AND FABRICATED METAL	0.732783	0.715203	0.6	0.806352	0.063251
MACHINERY, NEC	0.784116	0.763873	0.669049	0.810454	0.044283
ELECTRICAL AND OPTICAL EQUIPMENT	0.787126	0.776247	0.668935	0.848429	0.053498
TRANSPORT EQUIPMENT	0.794902	0.802784	0.714141	0.921236	0.050428
MANUFACTURING NEC; RECYCLING	0.752437	0.747194	0.639717	0.848199	0.061118

Figure A.16: Labor share of two-digit manufacturing industries, Germany.

Industry	Medium	Mean	Min.Value	Max.value	Std.dev
FOOD , BEVERAGES AND TOBACCO	0.417612	0.415496	0.374383	0.464601	0.031824
Textiles and textile	0.866191	0.857519	0.688449	0.96663	0.101095
Leather, leather and footwear	0.585659	0.595844	0.532722	0.663244	0.03917
WOOD AND OF WOOD AND CORK	0.622838	0.642606	0.594161	0.742489	0.049565
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	0.563717	0.567025	0.496789	0.609441	0.028685
Chemicals and chemical	0.366489	0.372803	0.335408	0.420234	0.030345
Rubber and plastics	0.688253	0.698376	0.629355	0.777109	0.045145
OTHER NON-METALLIC MINERAL	0.557966	0.549219	0.499632	0.594753	0.032721
BASIC METALS AND FABRICATED METAL	0.527968	0.52984	0.473422	0.584974	0.034149
MACHINERY, NEC	0.638579	0.639986	0.562574	0.741908	0.055902
ELECTRICAL AND OPTICAL EQUIPMENT	0.581772	0.598747	0.540124	0.698505	0.04929
TRANSPORT EQUIPMENT	0.546929	0.542379	0.471216	0.615952	0.038789
MANUFACTURING NEC; RECYCLING	0.577464	0.593338	0.538665	0.701377	0.050038

Figure A.17: Labor share of two-digit manufacturing industries, Japan.

Industry	Medium	Mean	Min.Value	Max.value	Std.dev
FOOD , BEVERAGES AND TOBACCO	0.277197	0.283277	0.267762	0.303656	0.013376
Textiles and textile	0.458868	0.451357	0.417192	0.479514	0.022494
Leather, leather and footwear	0.464452	0.473069	0.423344	0.540287	0.043664
WOOD AND OF WOOD AND CORK	0.413542	0.409048	0.361378	0.455773	0.036029
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	0.392831	0.415852	0.337827	0.534519	0.073644
Chemicals and chemical	0.330929	0.326052	0.288717	0.360764	0.027709
Rubber and plastics	0.38107	0.37685	0.334927	0.41757	0.031582
OTHER NON-METALLIC MINERAL	0.476146	0.446079	0.350474	0.517631	0.062749
BASIC METALS AND FABRICATED METAL	0.42532	0.396888	0.279944	0.487338	0.082503
MACHINERY, NEC	0.44276	0.430518	0.368376	0.482865	0.040984
ELECTRICAL AND OPTICAL EQUIPMENT	0.367624	0.37077	0.329851	0.420605	0.033966
TRANSPORT EQUIPMENT	0.398534	0.40096	0.393679	0.412421	0.00703
MANUFACTURING NEC; RECYCLING	0.308111	0.288816	0.218286	0.340385	0.049169

Figure A.18: Labor share of two-digit manufacturing industries, China.

Appendix B

FULL REPORTS OF DIAGNOSTIC CHECKING

B.1 Diagnostic Check-Labor Abundant

Figure B.1: Labor Abundant Countries Regression (1)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.45  Pr > z =  0.148
Arellano-Bond test for AR(2) in first differences: z =   1.21  Pr > z =  0.228
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  11.00  Prob > chi2 =  0.088
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =  13.25  Prob > chi2 =  0.039
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(5)    =  13.25  Prob > chi2 =  0.021
    Difference (null H = exogenous): chi2(1)    =   0.00  Prob > chi2 =  0.954
```

Figure B.2: Labor Abundant Countries Regression (2)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.38  Pr > z =  0.168
Arellano-Bond test for AR(2) in first differences: z =   1.31  Pr > z =  0.189
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)   =  14.38  Prob > chi2 =  0.277
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)   =  17.00  Prob > chi2 =  0.150
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(10)   =  15.62  Prob > chi2 =  0.111
    Difference (null H = exogenous): chi2(2)    =   1.37  Prob > chi2 =  0.503
```

Figure B.3: Labor Abundant Countries Regression (3)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.87  Pr > z =  0.061
Arellano-Bond test for AR(2) in first differences: z =   1.79  Pr > z =  0.074
Arellano-Bond test for AR(3) in first differences: z =  -0.91  Pr > z =  0.364
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  18.77  Prob > chi2 =  0.005
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   9.92  Prob > chi2 =  0.128
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =   6.84  Prob > chi2 =  0.145
    Difference (null H = exogenous): chi2(2)    =   3.08  Prob > chi2 =  0.214
```

Figure B.4: Labor Abundant Countries Regression (4)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.46  Pr > z =  0.143
Arellano-Bond test for AR(2) in first differences: z =   1.02  Pr > z =  0.308
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  21.03  Prob > chi2 =  0.002
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =  14.41  Prob > chi2 =  0.025
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =  10.94  Prob > chi2 =  0.027
    Difference (null H = exogenous): chi2(2)    =   3.47  Prob > chi2 =  0.177
  gmm(Kshare, collapse lag(3 5))
    Hansen test excluding group:     chi2(2)    =   9.13  Prob > chi2 =  0.010
    Difference (null H = exogenous): chi2(4)    =   5.27  Prob > chi2 =  0.260
  gmm(PriceKG, collapse lag(2 4))
    Hansen test excluding group:     chi2(2)    =   7.60  Prob > chi2 =  0.022
    Difference (null H = exogenous): chi2(4)    =   6.81  Prob > chi2 =  0.146
```

Figure B.5: Labor Abundant Countries Regression (5))

```
Arellano-Bond test for AR(1) in first differences: z =  -1.42  Pr > z =  0.155
Arellano-Bond test for AR(2) in first differences: z =   1.32  Pr > z =  0.186
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    = 104.02  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =  27.43  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =  27.35  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(2)    =   0.08  Prob > chi2 =  0.961
  gmm(Kshare, collapse lag(3 5))
    Hansen test excluding group:     chi2(2)    =  17.21  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(4)    =  10.22  Prob > chi2 =  0.037
  gmm(lnProd, collapse lag(2 4))
    Hansen test excluding group:     chi2(2)    =   6.22  Prob > chi2 =  0.045
    Difference (null H = exogenous): chi2(4)    =  21.21  Prob > chi2 =  0.000
```

Figure B.6: Labor Abundant Countries Regression (6)

```
Arellano-Bond test for AR(1) in first differences: z =  -2.88  Pr > z =  0.004
Arellano-Bond test for AR(2) in first differences: z =   0.74  Pr > z =  0.461
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  77.35  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =  10.09  Prob > chi2 =  0.121
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =   7.20  Prob > chi2 =  0.126
    Difference (null H = exogenous): chi2(2)    =   2.88  Prob > chi2 =  0.237
  gmm(Kshare, collapse lag(3 5))
    Hansen test excluding group:     chi2(2)    =   1.72  Prob > chi2 =  0.423
    Difference (null H = exogenous): chi2(4)    =   8.37  Prob > chi2 =  0.079
  gmm(delta_n, collapse lag(2 4))
    Hansen test excluding group:     chi2(2)    =   3.80  Prob > chi2 =  0.150
    Difference (null H = exogenous): chi2(4)    =   6.29  Prob > chi2 =  0.179
```

Figure B.7: Labor Abundant Countries Regression (7)

```
Arellano-Bond test for AR(1) in first differences: z =  -2.75  Pr > z =  0.006
Arellano-Bond test for AR(2) in first differences: z =   1.31  Pr > z =  0.192
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(15)   = 177.28  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(15)   =  32.16  Prob > chi2 =  0.006
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(10)   =  22.91  Prob > chi2 =  0.011
    Difference (null H = exogenous): chi2(5)    =   9.25  Prob > chi2 =  0.100
  gmm(Kshare NarrowOFF, collapse lag(3 5))
    Hansen test excluding group:     chi2(7)    =  21.35  Prob > chi2 =  0.003
    Difference (null H = exogenous): chi2(8)    =  10.81  Prob > chi2 =  0.213
  gmm(PriceKG lnProd delta_n, collapse lag(2 4))
    Hansen test excluding group:     chi2(3)    =   7.14  Prob > chi2 =  0.067
    Difference (null H = exogenous): chi2(12)   =  25.01  Prob > chi2 =  0.015
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(2)    =   0.16  Prob > chi2 =  0.925
    Difference (null H = exogenous): chi2(13)   =  32.00  Prob > chi2 =  0.002
```

B.2 Diagnostic Check-Capital Abundant

Figure B.8: Capital Abundant Countries Regression (1)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.97  Pr > z =  0.049
Arellano-Bond test for AR(2) in first differences: z =  -1.59  Pr > z =  0.112
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(11)   =  58.13  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(11)   =  19.16  Prob > chi2 =  0.058
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(10)   =  15.16  Prob > chi2 =  0.126
    Difference (null H = exogenous): chi2(1)    =   4.00  Prob > chi2 =  0.046
```

Figure B.9: Capital Abundant Countries Regression (2)

```
Arellano-Bond test for AR(1) in first differences: z =  -2.04  Pr > z =  0.042
Arellano-Bond test for AR(2) in first differences: z =  -1.36  Pr > z =  0.175
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   = 109.73  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  47.56  Prob > chi2 =  0.001
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(20)   =  46.07  Prob > chi2 =  0.001
    Difference (null H = exogenous): chi2(2)    =   1.50  Prob > chi2 =  0.473
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(9)    =  16.86  Prob > chi2 =  0.051
    Difference (null H = exogenous): chi2(13)   =  30.70  Prob > chi2 =  0.004
```

Figure B.10: Capital Abundant Countries Regression (3)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.41  Pr > z =  0.157
Arellano-Bond test for AR(2) in first differences: z =  -0.96  Pr > z =  0.336
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   = 104.74  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  48.68  Prob > chi2 =  0.001
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(20)   =  46.70  Prob > chi2 =  0.001
    Difference (null H = exogenous): chi2(2)    =   1.98  Prob > chi2 =  0.371
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(9)    =  12.61  Prob > chi2 =  0.181
    Difference (null H = exogenous): chi2(13)   =  36.07  Prob > chi2 =  0.001
```

Figure B.11: Capital Abundant Countries Regression (4)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.95  Pr > z =  0.052
Arellano-Bond test for AR(2) in first differences: z =  -1.57  Pr > z =  0.116
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)    =  67.84  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)    =  32.58  Prob > chi2 =  0.113
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)    =  32.10  Prob > chi2 =  0.076
    Difference (null H = exogenous): chi2(2)     =   0.48  Prob > chi2 =  0.786
  gmm(Kshare, collapse lag(3 .))
    Hansen test excluding group:     chi2(12)    =  19.80  Prob > chi2 =  0.071
    Difference (null H = exogenous): chi2(12)    =  12.78  Prob > chi2 =  0.386
  gmm(PriceKG, collapse lag(1 .))
    Hansen test excluding group:     chi2(10)    =  11.36  Prob > chi2 =  0.330
    Difference (null H = exogenous): chi2(14)    =  21.22  Prob > chi2 =  0.096
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)    =  13.87  Prob > chi2 =  0.240
    Difference (null H = exogenous): chi2(13)    =  18.71  Prob > chi2 =  0.132
```

Figure B.12: Capital Abundant Countries Regression (5)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.90  Pr > z =  0.057
Arellano-Bond test for AR(2) in first differences: z =  -1.44  Pr > z =  0.150
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)    = 135.87  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)    =  63.13  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(20)    =  56.48  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(2)     =   6.64  Prob > chi2 =  0.036
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(9)     =  15.29  Prob > chi2 =  0.083
    Difference (null H = exogenous): chi2(13)    =  47.84  Prob > chi2 =  0.000
```

Figure B.13: Capital Abundant Countries Regression (6)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.90  Pr > z =  0.058
Arellano-Bond test for AR(2) in first differences: z =  -1.46  Pr > z =  0.144
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(33)    = 145.01  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(33)    =  76.05  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(30)    =  72.52  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(3)     =   3.53  Prob > chi2 =  0.317
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(20)    =  29.98  Prob > chi2 =  0.070
    Difference (null H = exogenous): chi2(13)    =  46.07  Prob > chi2 =  0.000
```

Figure B.14: Capital Abundant Countries Regression (7)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.31  Pr > z =  0.191
Arellano-Bond test for AR(2) in first differences: z =  -0.79  Pr > z =  0.427
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(33)    = 159.95  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(33)    =  80.83  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(30)    =  75.79  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(3)     =   5.04  Prob > chi2 =  0.169
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(20)    =  29.31  Prob > chi2 =  0.082
    Difference (null H = exogenous): chi2(13)    =  51.52  Prob > chi2 =  0.000
```

B.3 Diagnostic Check-segments for skillness

Validity tests implied the instruments are valid except to the regression (2).

Figure B.15: The impact of skillness (1)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.38  Pr > z =  0.168
Arellano-Bond test for AR(2) in first differences: z =  -0.39  Pr > z =  0.694
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)    = 126.00  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)    =  25.70  Prob > chi2 =  0.368
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)    =  24.03  Prob > chi2 =  0.346
    Difference (null H = exogenous): chi2(2)     =   1.67  Prob > chi2 =  0.433
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)    =  12.02  Prob > chi2 =  0.362
    Difference (null H = exogenous): chi2(13)    =  13.69  Prob > chi2 =  0.396
```

Figure B.16: The impact of skillness (2)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.97  Pr > z =  0.049
Arellano-Bond test for AR(2) in first differences: z =  -0.95  Pr > z =  0.343
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)    = 143.31  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)    =  41.94  Prob > chi2 =  0.013
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)    =  41.80  Prob > chi2 =  0.007
    Difference (null H = exogenous): chi2(2)     =   0.14  Prob > chi2 =  0.932
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)    =  14.92  Prob > chi2 =  0.186
    Difference (null H = exogenous): chi2(13)    =  27.02  Prob > chi2 =  0.012
```

Figure B.17: The impact of skillness (3)

```
Arellano-Bond test for AR(1) in first differences: z =  -0.59  Pr > z =  0.553
Arellano-Bond test for AR(2) in first differences: z =  -1.84  Pr > z =  0.066
Arellano-Bond test for AR(3) in first differences: z =  -1.44  Pr > z =  0.149
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)   =  44.39  Prob > chi2 =  0.007
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)   =  31.59  Prob > chi2 =  0.137
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)   =  31.22  Prob > chi2 =  0.092
    Difference (null H = exogenous): chi2(2)    =   0.37  Prob > chi2 =  0.830
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)   =  16.37  Prob > chi2 =  0.128
    Difference (null H = exogenous): chi2(13)   =  15.22  Prob > chi2 =  0.294
```

Figure B.18: The impact of skillness (4)

```
Arellano-Bond test for AR(1) in first differences: z =  -0.52  Pr > z =  0.605
Arellano-Bond test for AR(2) in first differences: z =  -1.88  Pr > z =  0.060
Arellano-Bond test for AR(3) in first differences: z =  -1.42  Pr > z =  0.156
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)   =  40.61  Prob > chi2 =  0.018
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)   =  29.67  Prob > chi2 =  0.196
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)   =  29.36  Prob > chi2 =  0.135
    Difference (null H = exogenous): chi2(2)    =   0.32  Prob > chi2 =  0.854
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)   =  13.12  Prob > chi2 =  0.285
    Difference (null H = exogenous): chi2(13)   =  16.55  Prob > chi2 =  0.221
```

B.4 Diagnostic Check-segments for labor market

Figure B.19: Anglo Countries regression (1)

```
Arellano-Bond test for AR(1) in first differences: z =  -0.50  Pr > z =  0.618
Arellano-Bond test for AR(2) in first differences: z =  -0.99  Pr > z =  0.324
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)    =  62.81  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)    =  18.78  Prob > chi2 =  0.094
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(11)    =  13.87  Prob > chi2 =  0.240
    Difference (null H = exogenous): chi2(1)     =   4.91  Prob > chi2 =  0.027
```

Figure B.20: Anglo Europe Countries regression (2)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.21  Pr > z =  0.227
Arellano-Bond test for AR(2) in first differences: z =   0.05  Pr > z =  0.959
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)    =  69.47  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)    =  33.07  Prob > chi2 =  0.103
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)    =  31.55  Prob > chi2 =  0.085
    Difference (null H = exogenous): chi2(2)     =   1.52  Prob > chi2 =  0.468
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)    =  15.49  Prob > chi2 =  0.161
    Difference (null H = exogenous): chi2(13)    =  17.58  Prob > chi2 =  0.174
```

Figure B.21: Anglo Europe Countries regression (3)

```
Arellano-Bond test for AR(1) in first differences: z =  -0.62  Pr > z =  0.538
Arellano-Bond test for AR(2) in first differences: z =  -1.03  Pr > z =  0.303
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)   = 119.45  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)   =  41.16  Prob > chi2 =  0.016
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)   =  38.49  Prob > chi2 =  0.016
    Difference (null H = exogenous): chi2(2)    =   2.67  Prob > chi2 =  0.263
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)   =  21.05  Prob > chi2 =  0.033
    Difference (null H = exogenous): chi2(13)   =  20.11  Prob > chi2 =  0.093
```

Figure B.22: Anglo Europe Countries regression (4)

```
Arellano-Bond test for AR(1) in first differences: z =  -0.90  Pr > z =  0.367
Arellano-Bond test for AR(2) in first differences: z =  -1.60  Pr > z =  0.109
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(25)   =  68.19  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(25)   =  26.53  Prob > chi2 =  0.380
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(23)   =  19.05  Prob > chi2 =  0.698
    Difference (null H = exogenous): chi2(2)    =   7.47  Prob > chi2 =  0.024
  gmm(Kshare, collapse lag(2 .))
    Hansen test excluding group:     chi2(12)   =   6.51  Prob > chi2 =  0.888
    Difference (null H = exogenous): chi2(13)   =  20.02  Prob > chi2 =  0.095
  gmm(delta_n, collapse lag(1 .))
    Hansen test excluding group:     chi2(11)   =  11.48  Prob > chi2 =  0.404
    Difference (null H = exogenous): chi2(14)   =  15.04  Prob > chi2 =  0.375
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(12)   =   7.88  Prob > chi2 =  0.794
    Difference (null H = exogenous): chi2(13)   =  18.64  Prob > chi2 =  0.135
```

Figure B.23: Continental Europe Countries regression (1)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.96  Pr > z =  0.050
Arellano-Bond test for AR(2) in first differences: z =  -0.16  Pr > z =  0.872
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)    =  34.92  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)    =  11.84  Prob > chi2 =  0.458
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(11)    =  11.50  Prob > chi2 =  0.402
    Difference (null H = exogenous): chi2(1)     =   0.34  Prob > chi2 =  0.560
```

Figure B.24: Continental Europe Countries regression (2)

```
Arellano-Bond test for AR(1) in first differences: z =  -2.00  Pr > z =  0.046
Arellano-Bond test for AR(2) in first differences: z =  -0.32  Pr > z =  0.751
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)    =  47.73  Prob > chi2 =  0.003
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)    =  28.71  Prob > chi2 =  0.231
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)    =  27.91  Prob > chi2 =  0.179
    Difference (null H = exogenous): chi2(2)     =   0.80  Prob > chi2 =  0.671
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)    =  12.20  Prob > chi2 =  0.349
    Difference (null H = exogenous): chi2(13)    =  16.51  Prob > chi2 =  0.223
```

Figure B.25: Continental Europe Countries regression (3)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.35  Pr > z =  0.177
Arellano-Bond test for AR(2) in first differences: z =  -0.58  Pr > z =  0.561
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(24)   =  37.34  Prob > chi2 =  0.040
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(24)   =  29.21  Prob > chi2 =  0.212
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(22)   =  26.43  Prob > chi2 =  0.234
    Difference (null H = exogenous): chi2(2)    =   2.78  Prob > chi2 =  0.249
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(11)   =   8.09  Prob > chi2 =  0.705
    Difference (null H = exogenous): chi2(13)   =  21.12  Prob > chi2 =  0.071
```

Figure B.26: Continental Europe Countries regression (4)

```
Arellano-Bond test for AR(1) in first differences: z =  -2.03  Pr > z =  0.042
Arellano-Bond test for AR(2) in first differences: z =  -0.31  Pr > z =  0.758
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(25)   =  78.37  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(25)   =  30.75  Prob > chi2 =  0.198
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(23)   =  30.69  Prob > chi2 =  0.131
    Difference (null H = exogenous): chi2(2)    =   0.06  Prob > chi2 =  0.971
  gmm(Kshare, collapse lag(2 .))
    Hansen test excluding group:     chi2(12)   =  11.07  Prob > chi2 =  0.523
    Difference (null H = exogenous): chi2(13)   =  19.68  Prob > chi2 =  0.104
  gmm(delta_n, collapse lag(1 .))
    Hansen test excluding group:     chi2(11)   =  11.52  Prob > chi2 =  0.401
    Difference (null H = exogenous): chi2(14)   =  19.22  Prob > chi2 =  0.157
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(12)   =  19.78  Prob > chi2 =  0.071
    Difference (null H = exogenous): chi2(13)   =  10.96  Prob > chi2 =  0.614
```

Figure B.27: Nordic Countries Countries regression (1)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.26  Pr > z =  0.209
Arellano-Bond test for AR(2) in first differences: z =  -1.77  Pr > z =  0.077
Arellano-Bond test for AR(3) in first differences: z =  -0.27  Pr > z =  0.789
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(11)   =  23.63  Prob > chi2 =  0.014
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(11)   =   6.96  Prob > chi2 =  0.802
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(10)   =   6.84  Prob > chi2 =  0.741
    Difference (null H = exogenous): chi2(1)    =   0.13  Prob > chi2 =  0.722
```

Figure B.28: Nordic Countries Countries regression (2)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.03  Pr > z =  0.302
Arellano-Bond test for AR(2) in first differences: z =  -1.30  Pr > z =  0.194
Arellano-Bond test for AR(3) in first differences: z =  -1.34  Pr > z =  0.182
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  29.32  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   9.28  Prob > chi2 =  0.158
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =   6.37  Prob > chi2 =  0.173
    Difference (null H = exogenous): chi2(2)    =   2.91  Prob > chi2 =  0.233
```

Figure B.29: Nordic Countries Countries regression (3)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.44  Pr > z =  0.150
Arellano-Bond test for AR(2) in first differences: z =  -1.85  Pr > z =  0.064
Arellano-Bond test for AR(3) in first differences: z =   0.04  Pr > z =  0.965
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =  14.26  Prob > chi2 =  0.007
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   3.33  Prob > chi2 =  0.504
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   3.04  Prob > chi2 =  0.219
    Difference (null H = exogenous): chi2(2)    =   0.29  Prob > chi2 =  0.863
```

Figure B.30: Nordic Countries Countries regression (4)

```
Arellano-Bond test for AR(1) in first differences: z =  -1.31  Pr > z =  0.190
Arellano-Bond test for AR(2) in first differences: z =  -1.99  Pr > z =  0.047
Arellano-Bond test for AR(3) in first differences: z =  -0.30  Pr > z =  0.768
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(25)   =  68.38  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(25)   =  28.04  Prob > chi2 =  0.306
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(23)   =  22.90  Prob > chi2 =  0.466
    Difference (null H = exogenous): chi2(2)    =   5.14  Prob > chi2 =  0.077
  gmm(Kshare, collapse lag(2 .))
    Hansen test excluding group:     chi2(12)   =  14.43  Prob > chi2 =  0.274
    Difference (null H = exogenous): chi2(13)   =  13.61  Prob > chi2 =  0.402
  gmm(delta_n, collapse lag(1 .))
    Hansen test excluding group:     chi2(11)   =  13.37  Prob > chi2 =  0.270
    Difference (null H = exogenous): chi2(14)   =  14.67  Prob > chi2 =  0.401
  iv(yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11 yr12 yr13 yr14, eq(level))
    Hansen test excluding group:     chi2(12)   =  10.46  Prob > chi2 =  0.576
    Difference (null H = exogenous): chi2(13)   =  17.58  Prob > chi2 =  0.174
```