

**INTERNATIONAL TRADE AND MANUFACTURING EMPLOYMENT IN DEVELOPED ECONOMIES: AN EMPIRICAL STUDY**

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**Abstract**

This paper examines the effect of international trade on manufacturing employment in six developed economies: Denmark, France, the Netherlands, Sweden, the United Kingdom (UK), and the United States (U.S.). Our empirical strategy is based on the labor demand approach, and the results indicate manufacturing employment is negatively affected by international trade. However, the empirical models in the Netherlands and Sweden cannot fully capture the effects of control variables; therefore, the effects of international trade are not economically robust in these countries. In addition, the results in the U.S. are not robust for different estimation techniques. Further results show that the negative impact of international trade on manufacturing employment is mainly determined by the export orientation policy in Denmark and the import penetration in France and the UK.

**Key Words:** International trade; export orientation; import penetration; labor demand; manufacturing employment

**JEL Classification Codes:** F16; J23; C51

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**1. Introduction**

The ongoing globalization process opens up various debates on the effects of international trade, foreign direct investments (FDI), outsourcing, and offshoring on the labor market. International trade can foster productivity as well as the economic performance, and this can lead to more job-openings in general. However, some countries and economic actors look suspicious to free international trade, and the issue comes from the statement that international trade can negatively affect employment via transformation of labor to capital related to technology spillover. Indeed, if the structure of production changes from a labor-intensive form to a more capital-intensive form, jobs will destroy. In this context, it is widely known that the most open industry to the trade shocks is the manufacturing sector; and therefore, transformation in the structure of production—related to international trade—can negatively affect the jobs in manufacturing in particular. In this paper, I empirically examine the effect of international trade on manufacturing employment in six developed countries using a labor demand approach.

In his influential book, Rodrik (1997) illustrated new aspects of the effect of international trade on the labor market. In his seminal work, he argued that the globalization measure (trade openness) can significantly affect the labor-demand elasticities.<sup>1</sup> More specifically, Rodrik (1997) indicated that a more elastic labor

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<sup>1</sup> Indeed, the income and the wage elasticities are strong control variables to investigate the impact of international trade on employment. The labor demand approach of Hamermesh (1993)

demand that arises from the international trade yields to a higher volatility in the both real wages and employment; whereas the effect on the productivity volatility will remain constant. In addition, he pointed out that more elastic labor demand leads to a decline in the bargaining power of workers. Furthermore, when one considers the return of labor compared to the returns in other factors of production (e.g., capital and land), this process creates an inefficient surplus to the returns of other factor owners. This process finally tends to increase the non-wage costs of the production, and again suppress welfare of workers (Rodrik, 1997).

The Rodrik's hypothesis was substantially examined in the cases of developed countries via various empirical strategies, which are related to labor demand modeling.<sup>2</sup> The first papers empirically investigated the cases of the United Kingdom (UK) (Hine and Wright, 1998; Greenaway et al., 1999) and the United States (U.S.) (Slaughter, 2001).<sup>3</sup> These papers used the panel data sets with the exogenous wage and the industry-level fixed effects estimations. Hine and Wright (1998) and Greenaway et al. (1999) focused on short run; while Slaughter (2001) analyzed the intermediate-run. However, Hine and Wright (1998), Greenaway et al. (1999), and Slaughter (2001) found no robust evidence of validity of the Rodrik's hypothesis.<sup>4</sup>

Bruno et al. (2004) then examined the impact of international trade on labor demand elasticity for seven the Organization for Economic Co-operation and Development (OECD) countries: France, Italy, Japan, Spain, Sweden, the UK, and the U.S. They observed that the impact of international trade on the labor demand elasticity is only significant and robust in the UK. The empirical evidences in Italy and France were mixed, and they were not economically robust. In addition, their results

is one of the fundamental approaches to set the parameters in theoretical models of international trade (e.g., Rauch and Trindade, 2003).

<sup>2</sup> In here, I argue the papers in the literature that examined the effect of international trade on manufacturing employment. Several papers also examine the effects of other aspects of globalization on labor markets in developed economies, e.g., outsourcing (Feenstra and Hanson, 1999; Hijzen et al., 2005; Molnar and Taglioni, 2007); offshoring (Harrison and McMillan, 2011; Hijzen and Swaim, 2010; Senses, 2010; Hummels et al., 2014); and the FDI (Molnar and Taglioni, 2007). See also, Cancelo et al. (2001), Guisan (2004, 2006, and 2008), and Guisan and Aguayo (2005) for the impact of international trade on industrial and non-industrial production and employment. These studies for effects of international trade are interesting for the explanation of employment in industry (manufacturing), because the main impact of international trade on industrial and non-industrial employment is through the effect of international trade on the real output as well as the effect of real output on employment.

<sup>3</sup> There are also several papers in literature that analyzed the effect of international trade on manufacturing employment in developing economies; e.g., in Mexico (Revenge, 1997); Mauritius (Milner and Wright, 1998); Turkey (Krishna et al., 2001); Chile, Colombia and Mexico (Fajnzylber and Maloney, 2005); Bangladesh, Kenya, South Africa, and Vietnam (Jenkins and Sen, 2006; Sen, 2009); India (Hasan et al., 2007; Sen, 2009); Bulgaria, the Czech Republic, Hungary, Lithuania, Poland, Romania, Slovakia, and Slovenia (Onaran, 2008); South Korea (Mitra and Shin, 2012). Most of these papers used a labor demand approach.

<sup>4</sup> There also empirical studies that investigated the effects of globalization on manufacturing employment with the firm-level and industry-level data; such as, Bernard et al. (2006) and Gorg and Hanley (2005), respectively. Actually, the papers considering the industry-level data observed a little or no support for the Rodrik's hypothesis, but the papers using the firm-level data are in favor of it. For details, see the literature review of Crino (2009). In this paper, I consider the time-series estimation techniques. I suggest that aggregated data set can create an advantage to eliminate the heterogeneity might arise due to business cycle fluctuations and cross-industry variations.

showed that international trade does not significantly affect the labor demand elasticity in Japan, Spain, Sweden, and the U.S.

As illustrated by the previous papers in above, there is still a considerable disagreement about the impact of international trade on manufacturing employment in developed economies. On the other hand, the great global recession of 2008–9 has also negative effects on both employment and trade volumes in developed economies. The job-destroying impact of the great global recession of 2008–9 on total employment can mainly be explained by the decreasing volume of international trade in the G-7 economies (Gozgor, 2014). Indeed, the great global recession of 2008–9 is related to the sharp collapse in worldwide international trade, and this is significantly bigger than the decline in the world's gross domestic product (GDP) (Gopinath et al., 2012). Therefore, this paper aims to shed additional light on the impact of international trade on manufacturing employment with focusing on the cases in Denmark, France, the Netherlands, Sweden, the UK, and the U.S. To this end, I employ the robust and efficient estimation techniques.

The contributions of the paper are as follows. First, it is important to test the validity of Rodrik's hypothesis within the data set that captures the period of the great global recession 2008–9. I suggest that the recent global recession can shed additional lights on the impact of international trade on manufacturing employment in developed countries.

Second, I use two robust estimation techniques, i.e., the ordinary least squares estimations based on bootstrapped standard errors to avoid the size distortions and the robust least square estimations to deal with outliers. I also suggest that these estimation techniques are useful for analyzing the validity of Rodrik's hypothesis with including the period of the great global recession 2008–9.

Third, the previous literature looks at the effect of international trade on manufacturing employment with specially focusing on a potential import penetration from developing- to developed countries, e.g., from China to the U.S. (Autor et al., 2013). The effect of export orientation policy on manufacturing employment in developed economies can also be crucial, and this is largely neglected in developed countries. In other words, the effect of export orientation policy on manufacturing employment is only analyzed in developing economies (e.g., Fajnzylber and Maloney, 2005; Jenkins and Sen, 2006; Mitra and Shin, 2012). Therefore, this paper is the first that looks at the effect of both import penetration and export orientation on manufacturing employment in the related six developed countries.

The remainder of this paper is organized as follows. Section 2 explains the empirical model, the data, and the econometric methodology. Section 3 presents and discusses the empirical results. Section 4 provides robustness checks of the empirical results. Section 5 discusses the empirical findings and concludes.

## **2. Empirical Model, Data, and Econometric Methodology**

### **2.1. Empirical Model**

I estimate a standard labor demand model in the literature (e.g., Greenway et al., 1999; Hine and Wright, 1998; Jenkins and Sen, 2006) for six developed countries, separately. The empirical model can be written as follows:

$$MEP_t = \beta_0 + \beta_1 OUTPUT_t + \beta_2 WAGE_t + \beta_3 TRA_{t-k} + \varepsilon_t \quad (1)$$

In the equation (1),  $MEP_t$  is the log employment in manufacturing at time  $t$ ,  $OUTPUT_t$  is the log real output in manufacturing at time  $t$ ,  $WAGE_t$  is the log real wage in manufacturing at time  $t$ ,  $TRA_{t-k}$  is the log international trade measures in manufacturing at time  $t-k$ . The error term is also denoted by  $\varepsilon_t$ .

Then, following Greenway et al. (1999), Hine and Wright (1998), Jenkins and Sen (2006) and among many others, I split the degree of trade openness as the import penetration ratio (IPR) and the export–output ratio (EOR). These variables represent the impacts of import penetration (competition) and export orientation policy on manufacturing employment, respectively. Thus, I can write the related empirical model as follows:

$$MEP_t = \beta_0 + \beta_1 OUTPUT_t + \beta_2 WAGE_t + \beta_3 IPR_{t-k} + \beta_4 EOR_{t-k} + \varepsilon_t \quad (2)$$

At this stage, I can analyze the impact of international trade on manufacturing employment. In the estimations for each six developed economy, it should be expected that  $\beta_1 > 0$ ,  $\beta_2 < 0$ ,  $\beta_3 < 0$ , and  $\beta_4 < 0$ . Indeed, I also expect that  $\beta_4 < 0$ , and this is the main hypothesis of the paper. I elaborated on this issue in the introduction, keeping in mind that I am dealing with manufacturing employment in developed economies and the paper is directly testing the Rodrik (1997)'s hypothesis. I run all regressions in the first-differenced form (Jenkins and Sen, 2006: 304–305).

## 2.2. Data

As a dependent variable, I use total manufacturing employment in millions in logarithmic (log) form. These data are constructed by the official estimates or the labor force surveys. As explanatory variables, I use the following variables: i) the log real output is based on the value added in manufacturing (indexes for each country, 2005=100); ii) the real wage that is based on the real hourly compensation in manufacturing (the consumer price indexes, 2005=100). These data are obtained from the conference board of the international labor comparisons program. The data set covers the manufacturing data for 43 countries (most of them are developing countries). As mentioned, this paper focuses on six developed economies (Denmark, France, the Netherlands, Sweden, the UK, and the U.S.), and the issue comes from the fact that these six countries have only continuous and long time series (40 and more observations).<sup>5</sup> Indeed, the continuous and long time series are important for analyzing the effect of international trade on manufacturing employment in developed economies (Guisan, 2004 and 2006).

Following Alcalá and Ciccone (2004), I consider the real trade openness that is the imports plus the exports in manufacturing in the current US\$ prices relative to the output (value added) in manufacturing at constant 2005 US\$ prices. In addition, I use the "export orientation ratio" that is the total exports in manufacturing relative to the (real) output in manufacturing. In addition, I consider the "import penetration ratio"

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<sup>5</sup> I focus on the following periods for each country: Denmark (1966–2009), France (1962–2009), the Netherlands (1969–2009), Sweden (1962–2009), the U.K. (1962–2006), and the U.S. (1962–2010).

that is the imports relative to the (imports + real output – exports) in manufacturing. Following Jenkins and Sen (2006), I use the logarithmic form of the variables. I also consider the lagged international trade measures to avoid potential reverse causality, i.e., manufacturing employment can affect international trade. The related data on international trade measures are obtained from the world development indicators of the World Bank. These calculations are based on the World Bank staff estimations from the Comtrade database of the United Nations statistics division and the World Trade Organization (WTO) data. I report the details of the data set and the summary of descriptive statistics in Appendix I and figures for the industrial employment in Appendix II.

### **2.3. Estimation Techniques**

First, I use the least squares (LS) estimations and the standard errors are generated by a bootstrap procedure with 10,000 repetitions. The ordinary least squares (OLS) estimation is not powerful in the small number of observations and using the bootstrapped standard errors can be a critical issue for small samples or variables that have not asymptotic normal distribution. Therefore, I calculate the bootstrapped  $p$ -values for the test statistic, i.e., I run the bootstrapped least squares estimation for each country.

Second, I use the robust least squares estimation technique. Actually, the ordinary least squares (OLS) estimation is sensitive to outliers in observations. The robust LS estimation methodology is less sensitive to outliers in observations. This issue is important for our empirical investigation, since I have long-time series that possibly include outliers. For instance, economic or financial crises can be a main reason of such outliers. Therefore, I use the robust estimation methodology that is called "MM-estimations" of Yohai (1987). The robust LS estimation of Yohai (1987) addresses outliers in both the dependent (manufacturing employment) and independent variables (real output, the real wage, and measures of international trade). I refer to the Eviews 8 user's guide II (chapter 29) for details of the estimation methodology for the robust LS.

### **3. Empirical Results**

In Table 1, I run the bootstrapped LS estimations and report the results for Denmark. The real output and the real wage have the expected signs, and the coefficients are statistically significant. I find the coefficient of international trade as  $-0.07$ . The results for Denmark show the validity of the Rodrik's hypothesis. The elasticity of real wage is  $-0.36$ , but when I consider the effect of international trade, the sum of effects on manufacturing employment would be as  $-0.43$ . Therefore, the impact of the real wage on manufacturing employment becomes more inelastic with the effect of international trade. In other words, the volatility in employment and real wage will be higher, and bargaining power of workers will be declined. In addition, I observe that the export orientation policy leads to a fall in manufacturing employment in Denmark.

In Table 2, I report the results for France. The real output and the real wage have the expected signs, and the coefficients are statistically significant. I find the coefficient of international trade as  $-0.18$ . The empirical findings from France also indicate the validity of the Rodrik's hypothesis. In addition, I observe that an increase in the import penetration is the main reason of a decrease in manufacturing employment in France. In Table 3, I report the results for the Netherlands. The

coefficients of the real output, the export orientation, and the import penetration measures are not statistically significant in the case of the Netherlands. Similarly, I report the results for Sweden in Table 4, and the coefficient of the real wage is statistically insignificant. Therefore, I conclude that the labor demand model cannot successfully explain manufacturing employment in both the Netherlands and Sweden.

Table 1. Results of the Bootstrapped LS Estimations for Denmark (1966–2009)

| Regressors                     | Bootstrapped LS (I) | Bootstrapped LS (II) |
|--------------------------------|---------------------|----------------------|
| Log Real Output                | 0.229 (0.06)***     | 0.223 (0.06)***      |
| Log Real Wage                  | −0.363 (0.04)***    | −0.372 (0.04)***     |
| Lagged Log Trade Openness      | −0.070 (0.01)***    | —                    |
| Lagged Log Import Penetration  | —                   | −0.220 (0.19)        |
| Lagged Log Exports Orientation | —                   | −0.341 (0.17)**      |
| Adjusted R-squared             | 0.938               | 0.941                |
| Observations                   | 43                  | 43                   |

Notes: Dependent variable is the log manufacturing employment. The constant term is also included in the regressions, but it is not reported. The bootstrapped standard errors (10,000 repetitions) are given in parentheses. \*\*\* and \*\* indicate significance levels at the 1% and 5%, respectively.

Table 2. Results of the Bootstrapped LS Estimations for France (1962–2009)

| Regressors                     | Bootstrapped LS (I) | Bootstrapped LS (II) |
|--------------------------------|---------------------|----------------------|
| Log Real Output                | 0.553 (0.09)***     | 0.521 (0.11)***      |
| Log Real Wage                  | −0.367 (0.09)***    | −0.324 (0.09)***     |
| Lagged Log Trade Openness      | −0.181 (0.01)***    | —                    |
| Lagged Log Import Penetration  | —                   | −0.670 (0.33)**      |
| Lagged Log Exports Orientation | —                   | 0.310 (0.34)         |
| Adjusted R-squared             | 0.952               | 0.960                |
| Observations                   | 47                  | 47                   |

Note: See footnote at Table 1.

Table 3. Results of the Bootstrapped LS Estimations for the Netherlands (1969–2009)

| Regressors                     | Bootstrapped LS (I) | Bootstrapped LS (II) |
|--------------------------------|---------------------|----------------------|
| Log Real Output                | 0.088 (0.07)        | 0.073 (0.08)         |
| Log Real Wage                  | −0.387 (0.07)***    | −0.405 (0.07)***     |
| Lagged Log Trade Openness      | −0.020 (0.01)***    | —                    |
| Lagged Log Import Penetration  | —                   | −0.031 (0.03)        |
| Lagged Log Exports Orientation | —                   | 0.042 (0.05)         |
| Adjusted R-squared             | 0.861               | 0.865                |
| Observations                   | 40                  | 40                   |

Note: See footnote at Table 1.

Table 4. Results of the Bootstrapped LS Estimations for Sweden (1962–2009)

| Regressors                     | Bootstrapped LS (I) | Bootstrapped LS (II) |
|--------------------------------|---------------------|----------------------|
| Log Real Output                | 0.231 (0.05)***     | 0.231 (0.05)***      |
| Log Real Wage                  | 0.067 (0.06)        | 0.078 (0.06)         |
| Lagged Log Trade Openness      | −0.071 (0.01)***    | —                    |
| Lagged Log Import Penetration  | —                   | 0.014 (0.03)         |
| Lagged Log Exports Orientation | —                   | −0.153 (0.06)**      |
| Adjusted R-squared             | 0.901               | 0.902                |
| Observations                   | 47                  | 47                   |

Notes: Note: See footnote at Table 1.

I also report the results for the UK in Table 5. I find that the labor demand approach captures the effects of real output, the real wage, and international trade. Furthermore, I

find the statistically significant and negative effect of the import penetration on manufacturing employment in the UK. The coefficient of the import penetration is found as  $-0.62$ .

Table 5. Results of the Bootstrapped LS Estimations for the UK (1962–2006)

| Regressors                     | Bootstrapped LS (I) | Bootstrapped LS (II) |
|--------------------------------|---------------------|----------------------|
| Log Real Output                | 0.461 (0.07)***     | 0.426 (0.08)***      |
| Log Real Wage                  | -0.389 (0.05)***    | -0.338 (0.06)***     |
| Lagged Log Trade Openness      | -0.262 (0.01)***    | –                    |
| Lagged Log Import Penetration  | –                   | -0.621 (0.30)*       |
| Lagged Log Exports Orientation | –                   | 0.053 (0.32)         |
| Adjusted R-squared             | 0.984               | 0.981                |
| Observations                   | 44                  | 44                   |

Note: See footnote at Table 1.

Finally, I report the results for the U.S. in Table 6, and obtain the similar results; i.e., the labor demand approach can successfully explain the determinants of manufacturing employment. I observe that the effect of the import penetration on manufacturing employment is negative and statistically significant. I obtain the coefficient of the import penetration as  $-1.96$ . Thus, these empirical results for the UK and the U.S. are in line with the empirical findings for France.

Table 6. Results of the Bootstrapped LS Estimations for the U.S. (1962–2010)

| Regressors                     | Bootstrapped LS (I) | Bootstrapped LS (II) |
|--------------------------------|---------------------|----------------------|
| Log Real Output                | 0.736 (0.14)***     | 0.842 (0.21)***      |
| Log Real Wage                  | -0.498 (0.29)*      | -0.571 (0.27)**      |
| Lagged Log Trade Openness      | -0.672 (0.06)***    | –                    |
| Lagged Log Import Penetration  | –                   | -1.961 (0.46)**      |
| Lagged Log Exports Orientation | –                   | 0.516 (0.46)         |
| Adjusted R-squared             | 0.748               | 0.626                |
| Observations                   | 48                  | 48                   |

Note: See footnote at Table 1.

#### 4. Robustness Checks

I now report the results of robust LS estimations for Denmark in Table 7. The results in here are less sensitive to outliers in both dependent and independent variables. Again, the real output and the real wage have the expected signs, and the coefficients are statistically significant. In addition, I observe that an increase in the exports leads to a fall in manufacturing employment in Denmark. The coefficient is found as  $-0.29$ . In Table 8, I report the results for France.

Table 7. Results of the Robust LS Estimations for Denmark (1966–2009)

| Regressors                     | Robust LS (I)    | Robust LS (II)   |
|--------------------------------|------------------|------------------|
| Log Real Output                | 0.252 (0.08)***  | 0.243 (0.08)***  |
| Log Real Wage                  | -0.358 (0.05)*** | -0.369 (0.06)*** |
| Lagged Log Trade Openness      | -0.073 (0.01)*** | –                |
| Lagged Log Import Penetration  | –                | 0.165 (0.20)     |
| Lagged Log Exports Orientation | –                | -0.297 (0.18)*   |
| Adjusted R-squared             | 0.961            | 0.960            |
| Observations                   | 43               | 43               |

Note: See footnote at Table 1.

The empirical findings from robust LS estimations for France are also in favor of the Rodrik's hypothesis. I again observe that a hike in the import penetration is the main reason of a decrease in manufacturing employment in France. The coefficient is found as  $-0.77$ . I also report the results for the UK in Table 9. I find that the labor demand approach successfully explains the determinants of manufacturing employment. I observe the statistically significant effect of the import penetration on manufacturing employment in the UK. The coefficient is also found as  $-0.61$ .

Table 8. Results of the Robust LS Estimations for France (1962–2009)

| Regressors                     | Robust LS (I)    | Robust LS (II)   |
|--------------------------------|------------------|------------------|
| Log Real Output                | 0.313 (0.09)***  | 0.488 (0.11)***  |
| Log Real Wage                  | −0.568 (0.08)*** | −0.295 (0.09)*** |
| Lagged Log Trade Openness      | −0.112 (0.01)*** | –                |
| Lagged Log Import Penetration  | –                | −0.773 (0.25)**  |
| Lagged Log Exports Orientation | –                | 0.392 (0.25)     |
| Adjusted Rw-squared            | 0.978            | 0.967            |
| Observations                   | 47               | 47               |

Notes: See footnote at Table 1.

Table 9. Results of the Robust LS Estimations for the UK (1962–2006)

| Regressors                     | Robust LS (I)    | Robust LS (II)   |
|--------------------------------|------------------|------------------|
| Log Real Output                | 0.492 (0.08)***  | 0.431 (0.09)***  |
| Log Real Wage                  | −0.414 (0.04)*** | −0.341 (0.05)*** |
| Lagged Log Trade Openness      | −0.254 (0.01)*** | –                |
| Lagged Log Import Penetration  | –                | −0.612 (0.29)**  |
| Lagged Log Exports Orientation | –                | −0.044 (0.29)    |
| Adjusted Rw-squared            | 0.991            | 0.988            |
| Observations                   | 44               | 44               |

Notes: See footnote at Table 1.

Finally, I report the results of robust LS estimations for the U.S. in Table 10. However, the coefficient of real wage is now statistically insignificant. This result implies that the effect of international trade on manufacturing employment is not robust to outliers in the observations. Therefore, I conclude that the labor demand model cannot successfully explain manufacturing employment in the U.S. Nevertheless, I find the negative and statistically significant effect of the import penetration on manufacturing employment in the U.S. economy. The coefficient is also found as  $-1.17$ .

Table 10. Results of the Robust LS Estimation for the U.S. (1962–2010)

| Regressors                     | Robust LS (I)    | Robust LS (II)   |
|--------------------------------|------------------|------------------|
| Log Real Output                | 0.506 (0.07)***  | 0.508 (0.07)***  |
| Log Real Wage                  | −0.113 (0.14)    | −0.031 (0.12)    |
| Lagged Log Trade Openness      | −0.498 (0.04)*** | –                |
| Lagged Log Import Penetration  | –                | −1.174 (0.19)*** |
| Lagged Log Exports Orientation | –                | 0.215 (0.18)     |
| Adjusted Rw-squared            | 0.742            | 0.626            |
| Observations                   | 48               | 48               |

Notes: See footnote at Table 1.

## 5. Conclusion

In this paper, I examined the impact of international trade on manufacturing employment in six developed economies: Denmark, France, the Netherlands, Sweden, the UK, and the U.S. Our empirical strategy is based on the labor demand approach, and the results indicate manufacturing employment is negatively affected by international trade. However, the empirical models in the Netherlands and Sweden cannot fully capture the effects of control variables; therefore, the effects of international trade are not economically robust in these countries. In addition, the results in the U.S. are not robust for different estimation techniques. Further results show that the negative impact of international trade on manufacturing employment is mainly determined by the export orientation policy in Denmark and the import penetration in France and the UK.

In this paper, I found that international trade is negatively related to manufacturing employment in all six developed economies. The labor demand approach successfully explains the results in Denmark, France, and the UK; however the results for the Netherlands, Sweden, and the U.S are not robust.

The results for Denmark are related to the export orientation policy and they refer to either a significant hike in the labor productivity in the manufacturing sector of Denmark or a structural transformation of labor to capital in the production process of the Danish manufacturing sector. I find that 10% increase in the exports of Danish manufacturing leads to 3% decline in manufacturing employment. This paper is the first to represent the empirical results for the effect of export orientation on the Danish manufacturing employment. This result is somehow in line with the previous findings of Hummels et al. (2014), who obtain similar results for the impacts of offshoring on the real wage in the Danish firms.

Although labor market regulations (flexibility) are quite different in France and the UK, I observe that the negative impact of import penetration on manufacturing employment in both economies. The results for the UK are in line with the previous findings of Bruno et al. (2004). I find that 10% increase in the imports of manufacturing in the UK causes to approximately 6% suppress in manufacturing employment in the UK. Similarly, I observe that 10% increase in the imports of French manufacturing yields to approximately 7% decrease in manufacturing employment. The result in France is somewhat in line with the previous findings of Bruno et al. (2004). Shortly, I obtained the robust evidences of the validity of the Rodrik's hypothesis in Denmark, France, and the UK. However, I suggest that a future study should also examine the issue via industry (four digit level) or even a firm level data set to get a more satisfactory comparison with the previous findings.

Furthermore, my findings can also be related to structural transformation, i.e., international trade leads to employee transfers from manufacturing to other sectors. It is known that agriculture has not a significant share of total employment in developed economies. Therefore, the effect of international trade on employment transformation can only exist in the shifting from manufacturing to services. This issue can mainly be related to the labor productivity convergence in manufacturing among countries. For possible implications for the labor productivity convergence in manufacturing, I refer to the recent paper of Rodrik (2013), and the related references therein. On the other hand, the effect of structural transformation, i.e., the impact of employment shifting

from manufacturing to services, on the economic and social indicators needs to be examined by a future paper.

Finally, a future paper can use the time series techniques, such as cointegration, the Vector Autoregression (VAR), and the Bayesian VAR to analyze the effect of international trade shocks on manufacturing employment. In addition, not only the effect of trade openness, but also the trade policy (such as, tariffs and hidden import barriers) or other aspects of economic globalization (such as the FDI, outsourcing, and offshoring) can also analyze via these econometric techniques.

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#### Appendix I. Details of Data Set and Summary Descriptive Statistics

| Variables<br>(unit: Logrithmic form) | Mean  | Standard.<br>Deviation | Minimum | Maximum | Observa<br>tions |
|--------------------------------------|-------|------------------------|---------|---------|------------------|
| Employment in Manufacturing          | 7.850 | 1.267                  | 5.930   | 9.954   | 275              |
| Real Output in Manufacturing         | 4.177 | 0.393                  | 3.071   | 4.711   | 275              |
| Real Wage in Manufacturing           | 4.248 | 0.316                  | 3.208   | 4.688   | 275              |
| Trade Openness in Manufacturing      | 4.506 | 1.211                  | 1.558   | 6.634   | 275              |
| Import Penetration in Manufacturing  | 3.817 | 1.301                  | 0.336   | 6.190   | 275              |
| Exports Orientation in Manufacturing | 3.802 | 1.186                  | 1.133   | 5.965   | 275              |

#### Appendix II. Graphs for Manufacturing (Industrial) Employment Data (Thousands)

