Middle-East Journal of Scientific Research 11 (3): 367-373, 2012
ISSN 1990-9233

Study of Gap's Factor of Labor Force's Wage Between Agriculture and Non-Agriculture Sectors in OECD Countries

[1]Shahriar Nessabian, [2]Saleh Ghavidel and [3]Marjan Damankeshideh

[1]Economics and Accounting, Faculty of the Islamic Azad University,
Central Tehran Branch, Tehran, Iran
[2]Islamic Azad University Firouzkooh Branch, Firouzkooh, Iran
[3]Faculty Member of the Islamic Azad University Central Tehran Branch, Tehran, Iran

Abstract: In this article, recognition of effective factors upon wage ratio changes of labor force of agriculture section to non-agriculture section in OECD countries will bring under consideration in countries including Australia, Austria, Belgium, Canada, Republic of Czech, Denmark, Finland, Germany, Ireland, Italy, Japan, Netherland, New Zealand, Norway, Sweden, Swiss, England and the USA. Theoretical principles consider the factors of wage gap changes in two agriculture and non-agriculture sectors in price gap of products and productivity gap of two sectors. Therefore, in this study, through benefitting time series data (1980-2008), cross section data (OECD countries) and using international trade economists' model (Haskel model), it is become specified that the major reason of changes in increase of wage gap of agriculture sector to non-agriculture sector has been changes of productivity growth in two sectors and changes in increase of price gap has not been the reason of changes in wage gap (rejection of Stolper_Samuleson theory).

JEL: J31 · F16 · R11
Key words: Wage Gap · International Trade · Agriculture and Non-Agriculture Sections · OECD

INTRODUCTION

In the current decade, much study has been performed concerning the change of wage inequality and wage gap in reaction to increase in universal trade. Development pattern which was admitted through some developing countries, have more consideration upon subjects of free trade and potential effects thereof over economy. Of course, it was reasoning in such a manner that liberty of economy and trade caused growth increment, but there is no agreement concerning the condition of trade's effectiveness upon wages [1].

Standard theory of trade presents a powerful framework for thinking and relation experiment between trade and wage. Hechscher-Ohlin theory was predicting that trade patterns were reflectors the frequency of relative factor. Developing countries with relative frequency of unskilled labor force will antecede in producing non-skill products. Now, if theses countries take up the liberty policy, then, they will increase their relative demands for skill products. Also, they will have export extra amounts of their non-skill products for payment the price of these products.

Standard model of international trade (Hechscher-Ohlin and Stolper_Samuleson Theorems theories, HOSS) had predicted more convergence effects of trade upon wage inequality. The above mentioned model considers two countries, two goods and two production factors; the first country has priority in production of a good that in production of which use a factor that is more abundant in the said country and thus concerning the second country. An industrial country has relative priority in producing skill goods and a developing country has relative priority in producing non-skill goods. When countries decrease trade obstacles and limitations, wage gap between skilled and unskilled workers shall be increasing in advanced countries and shall be decreasing in developing countries. But some of experimental studies verify that these predictions have not observed in all countries [2].

Corresponding Author: Shahriar Nessabian, Economics and Accounting Faculty of the Islamic Azad University, Central Tehran Branch, Tehran, Iran. Tel: +00982122369711, Fax: +982122369711. Mob: +98-9122003683.

This model also can consider for two economy sections. One section has relative priority in producing exportable goods and another section has relative priority n producing non-exportable goods. Therefore, the price of export goods will increase through trade liberty in proportion of non-export goods and following shall be increasing the profit for producer section of export goods' (in proportion of non-export section). Therefore, employers and owners of export section increase the demand for labor force toward more production and earning more profit and then increase the wage in this section.

But result of some studies were on contrary with the above mentioned result; Dorosh and Yanger [3], had expressed that in many countries, adjustment policies such as trade liberty while being permanent caused improvement of income distribution, decrease in wage gap and have converse effect upon poverty. Also, Demaio and his colleagues (1999) had stated that distributive effect of trade reforms will have caused decrease of wage inequality in different sections of economy.

Main subject of these issues have started since 1970s and then income inequality is increased in the USA. Now, this question propound that what were different factors of wage inequality?

Krugman [4], believes that most of this inequality has been due to increase in studies importance. In 1979, a person who has academic studies received a salary 21% more than a person who has secondary school studies. But in 2002, this rate reached 44%.

Many studies tried to analyze the international growth changes of trade, specially the growth in mill products' export in new-industried economies (NIE)[1] such as South Korea and China.

Before 1970s, the trade between wealthy countries and poor countries which known as north and south trade, generally was including exports of industrial goods from advanced countries to poor countries and imports of primary materials such as oil and agricultural goods from poor countries to advanced countries. Since 1970s, however the exporters of primary materials has been increased, but selling and exporting of industrial goods to countries with high wage such as USA has been started (4).

Just as NIE countries were forestalling in growth of exports from advanced countries, but it seen that the type of factor's intensity used in their exports goods were completely different with imports goods of these countries. The major import goods of theses countries from advanced countries are usually needs complicated technology (such as airplane) which mainly have many skilled labor force and the major export goods of countries which have many unskilled labor force to advanced countries are including clothes and shoe.

If theory of price equality of factors be continued in international trade, it may be increased the wage of skilled labor force against unskilled labor force in advanced countries within the course of time and on the contrary, in developing countries, wage's growth of the skilled labor force may be decreased against unskilled labor force. Whereas this theory had taken place completely in advanced countries; then, if only growth reason of wage inequality, trade growth were pending upon developing countries?

Most of experimental studies show that the international trade has been as a main factor of inequality, but there are other main reasons, that the trade isn't only factor of wage inequality through three reasons as below:

- As the theory of factors' price equality expressed, increase in price inequality of goods caused increment of inequality in factor's price. Therefore, if trade caused inequality in factor's price, then observations shall be taken in relation with price increase of skilled goods and price decrease of unskilled goods in international area. Whereas, such changes aren't exist in the level of international data of price.
- As the international trade model expressed, skilled and unskilled wages shall be keep aloof against each other during the time. Whereas in countries which have skill frequency, the wage of skilled labor force must be increased against unskilled labor force and also, vice versa in developing countries. There are different items that this issue did not take place in developing counties. For example in Mexico, studies show that in 1980s, Mexico with an open economy became major exporter of mill goods and the wage of skilled labor force had has more increase against average wage of labor force in Mexico. Therefore, wage inequality in Mexico was like USA but its gap has been less than USA.
- Although the trade between advanced countries and NIE countries had increased, but it was organizing a few percentage of advanced countries' trade. Therefore, this few commercial course can not have more effect upon income distribution. Therefore, what reason can describe the growth of wage gap between skilled and unskilled labor force in the USA.

[1]New Industried Economics (NIE)

MATERIALS AND METHODS

This article is looking for recognition of effective factors upon the wage gap between agriculture and non-agriculture sections. In the other word, we are looking to answer this question that if we divide the economy in two agriculture and non-agriculture sections, whether the wage in agriculture section against non-agriculture section was increasing or decreasing during the time? And which factors caused these changes? As explained in theoretical literature, in most countries of the world, the average wage of farmers is less than the average wage of handicraftsman and service section. But, within the time, the wage process of these two groups has been different in different countries, for example in Kenya, the process of wage ratio of agriculture section was descending to non-agriculture section [5]; but this process was ascending in the USA [6] and also this process was descending in Thailand [7].

Theoretical principles of wage gap return to Hechscher-Ohlin, Samuleson and factors' price equality theories; which apprehended international trade as one of the major factors of wage gap. For example, if a country has relative priority in one good which used from more unskilled labor force (agriculture goods), while entering the free trade, the price of the above mentioned good is increase due to external demand and caused increase in the wage of unskilled labor force, in case that skilled labor force's wage increase fewer during the liberty period.

In the other word, the wage ratio of skilled labor force decreases against unskilled labor force. Many researches have performed by virtue of these theoretical principles toward recognition of effective factors upon wage gap between skilled and unskilled labor force [1-4, 8, 9].

But most of theses studies to get a result that only effective factor upon changes of wage gap between skilled and unskilled labor force during the time is not international trade; for example Krugman 2006 express that the major reason of increase in wage gap between skilled and unskilled labor force in the USA has been more attention to educational level and productivity of labor force during the time. Nevertheless, the importation of goods which have less skill from developing countries such as China, Korea and etc. had has effect (commercial effect) but it was trivial.

One of the famous models which were recognizing effective factors upon wage gap between skilled and unskilled labor force and/or wage gap between two economy sections is Haskel model designed in 2001. This model which is known as international trade economists' model[2], which measures different factors upon wage gap between skilled and unskilled labor force in two economy sections though supposing free movement of skilled and unskilled labor force in two sections. It is noteworthy that the above mentioned model also can be used for recognition of effective factors upon wage gap between two sections, which is used in this article for recognition of effective factors upon wage gap changes between two agriculture and non-agriculture sections within the time.

If we divide economy in two sections and instating the condition for complete competition, total expense in each part is equal to total income[3]:

$$P^i Y^i = C^i$$
$$P^j Y^j = C^j$$

Which P^i, P^j are the prices of each product in each section; in this case, changes in relative wages may be writing as below:

$$\Delta Ln(\frac{W_s}{W_u}) = \frac{1}{v_s^i - v_s^j}[\Delta Ln\,(\frac{P_i}{P_j}) + \beta_2\,\Delta Ln\,(\frac{TFP_i}{TFP_j})]$$

Which v^i_s and v^j_s are the share of skilled labor force's wage from total wages of each sections, W_s and W_u are equal for each sections and because of this reason do not have any index, because the labor force in each sections is moving freely. (TFP) means total factors productivity and supposes that: $v^i_s > v^j_s$

Above equation is usual in trade literature. First, this equation considers the Stolper_Samuleson theory, because it shows the effect of products' price $(\frac{p_i}{p_j})$ over relative wages $(\frac{W_s}{W_u})$. For example, if the products' price changes in skilled section (i) be negative (Δ In $p^i < 0$), then relative wages $(\frac{W_s}{W_u})$ may be decreased and if price

[2] Wage gap models are two types, models which related to labor market economists which consider technology changes as factor of wage gap between skilled and unskilled labor force and are used inside one section or industry, for further information, please refer to Burman and Others (1994) and models of international trade economists which has used in this article.

[3] This part is extracted from dissertation of Mr. Saleh Ghavidel directing by Mr. Akbar Komeijani under title of "the role of globalization of economy in employment of services and Iran Non-Petroleum Exports section" at Sciences and Researches branch of the Islamic Azad University.

changes in unskilled section (j) be negative ($\Delta \text{ In } p^i < 0$), then relative wages $(\frac{W_S}{W_u})$ may be increased. In the meantime, regarding that two sections are in the condition of complete completion and having zero profit, then price decrease in each section leads profitability of the said section and due this reason, relative wages will be modified upon reaching to zero profit in the above mentioned section.

Second part in right side of the equation shows effects of technology upon relative wages which is total factors productivity of production. In this case like price changes, the effect of total factors productivity of each section analyzed according to competitive market and having zero profit; for example, if technology changes decrease in skilled section ($\Delta \text{ In } p^i < 0$), therefore, relative wages $(\frac{W_S}{W_u})$ may be increased and if ($\Delta \text{ In } p^i < 0$), $(\frac{W_S}{W_u})$ may be increased because expenses get decreased.

It is noteworthy that in this equation, technology changes or SBCT[4] are not specified directly, maybe SBCT in this model is part of $\Delta LnTFP$ and total factors productivity changes of production is including all types of technical changes such as SBCT. Anyhow, total factors productivity changes of production will cause decrease in expenses and increase in profitability among sections and in the result, it needs wage changes. Now, if the economy divide into two agriculture (i) and non-agriculture (j) sections and supposed that the major of unskilled labor force are working in agriculture section and major of skilled labor force are working in non-agriculture section, then, we can consider the wage growth in agriculture section W_s against non-agriculture section W_u as a function of growth in index ratio of agriculture section (P_i) to non-agriculture section (P_j), also a function of productivity growth of agriculture section (TFP_i) to non-agriculture section (TFP_j):

$$\Delta Ln(\frac{W_S}{W_u}) = \alpha + \beta_1 \Delta Ln\,(\frac{P_i}{P_j}) + \beta_2 \Delta Ln\,(\frac{TFP_i}{TFP_j}) + u_i \qquad (1)$$

In order that to evaluating the above mentioned model, it needs data of wage ratio in agriculture section to non-agriculture section $(\frac{W_A}{W_{NA}})$, price index ratio of agriculture section to non-agriculture section $(\frac{P_A}{P_{NA}})$, labor force productivity index ratio of agriculture section to non-agriculture section $(\frac{PR_A}{PR_{NA}})$.

Data Description: In order to evaluating Model (I), we need information of the wage of agriculture and non-agriculture sections, price index of agriculture and non-agriculture goods, productivity of agriculture and non-agriculture sections. The major problem of data collection is related to wage information of agriculture section. This information extracted from LABORSTA section of International Labor Organization (ILO), regarding that the wage data of agriculture section for different years are very scattered; therefore, access to similar years for all countries was not accessible. On the other side, measurement units also were different for various countries. For example, it may be "Earning per hours/ currency price" for country A and "Earning per week/ currency price" for country B. Regarding that our mentioned variable is wage ratio of agriculture section to non-agriculture section, then, measurement units have no importance, but another problem is the change of base period that in this case, we divided some countries (like Australia, Austria, Japan, Italy and Netherland) into two groups, for example; Australia from 1976 to 1984 called as Australia No. 1 and from 1985 to 1995 called as Australia No. 2.

The information relevant to the wage of agriculture section was extracted from LABORSTA Information Bank at International Labor Organization (ILO). This information has been setting in accordance with accessibility of the wage information of agriculture section. It used from wage information of all sections in some cases and from the wage of industry section in another cases, but in most of cases used from the wage of agriculture section.

The information relevant to price index of agriculture and non-agriculture goods was extracted from KILM Information Bank of International Labor Organization (ILO) website. The considerable point is that the data relevant to this ratio has been converging during 1979-2010 in all countries. In the other word, the price index gap process of agriculture section is already decreasing against non-agriculture section, for example; data relevant to this ratio for Australia, Austria, Belgium and Canada are demonstrated in Figure (1).

The information relevant to productivity of countries is not available in differentiation group of agriculture and non-agriculture sections, therefore, labor forces productivity is substituted for TFP. Labor forces productivity of agriculture section estimated through the value-added ratio of agriculture section of OECD countries (resource: OECD.STAT) in proportion of

[4] Skill-Biased Technical Change (SBCT)

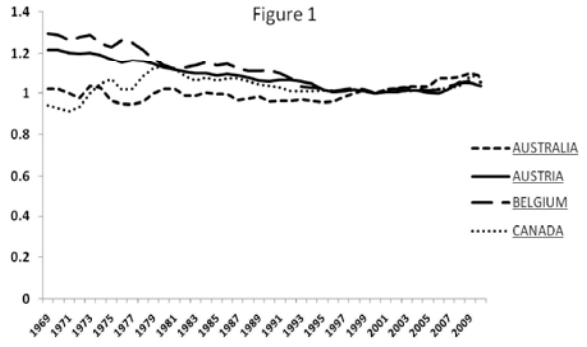

Fig. 1: Source: ILO

employees in agriculture section (resource: ILO-KILM). The information of Labor forces productivity of non-agriculture section extracted from KILM Information Bank.

RESULTS AND DISCUSSION

From the above mentioned 23 countries, 20 countries except UK were selected. It is noteworthy that, the assessment of this model is performed through Unbalance Panel Data method; it means that the data of all countries during years are not equal, for example; it may be that data of the USA be related to 1990-2008 but data of Sweden be related to 1980-1995.

We are looking forward estimation model (1) that i=1...20 is including countries such as Sweden, Norway, Germany, Belgium, Austria 2, Netherland 2, Japan 2, Japan 1, Australia 1, Swiss, Australia 2, Denmark, Austria 1, Republic of Czech, Italy 2, Canada 1, Finland, Italy 1, Canada 2 and the USA. Considering the time series data of each country, total used (observation) data is 259 items. Estimated model is as below:

$$Log\left(\frac{WAgri}{Wnon-Agri}\right)=-0/24555+0/4999Log\left(\frac{PAgri}{Pnon-Agri}\right)$$

(0/0163) (0/0298)

[-15/056] [1/6729]

$$+0/06699dLog\left(\frac{\text{Pr}oducnonAgri}{Producnon-Agri}\right)$$

(0/01652)

[4/0553]

R^2 = %99 n = 259

In this model, the coefficient of price and productivity ratio is in accordance with which was in prospect, but this model has two fundamental problems, first: according to theoretical principles of Haskel, changes percentage in wage ratio of agriculture section against non-agriculture section $dLog\left(\frac{WAgri}{Wnon-Agri}\right)$ is a function of changes percentage in price index ratio of agriculture section against non-agriculture section $dLog\left(\frac{PAgri}{Pnon-Agri}\right)$ and changes percentage of productivity ratio of agriculture section against non-agriculture section is $dLog\left(\frac{ProducnonAgri}{Producnon-Agri}\right)$. Second: regarding that data of each country is as time series data, we can use this model only when this data be stationary, otherwise, if we estimate the coefficient through non-stationary data, the above mentioned coefficients would be incompatible (WOOLDRIDGE 2009-P377).

The below model is estimated for solving these two problems:

$$dLog\left(\frac{WAgri}{Wnon-Agri}\right)=0/00136-0/010315dLog\left(\frac{PAgri}{Pnon-Agri}\right)_{it}$$

(0/00196) (0/02479)

[-0/6948] [-0/41608]

$$+0/048543dLog\left(\frac{ProducnonAgri}{Producnon-Agri}\right)_{it}$$

(0/026182)

[1/854037]

R^2 = %5 D.W = $\frac{1}{9}$ n = 188

First: This model is in accordance with wage gap changes of Haskel and Others model. Second: because of using the data as growth, possibility of being non-stationary of variables decreased extremely. Estimating of this model is about 16 countries (Sweden, Germany, Austria 2, Japan 1, Australia 1, Swiss, Japan 2, Australia 2, Italy 2, Italy 1, the USA, Norway, Austria 1, Canada 2 and Republic of Czech and Netherland 2).

It was considered that, growth coefficient of prices ratio is not meaningful, but growth coefficient of labor forces productivity of agriculture section is meaningful against non-agriculture section. Therefore, the growth factor of productivity of agriculture section against non-agriculture section among OECD countries, it means that the technology factor is more important than market factor is the growth of price index ratio of agriculture section to non-agriculture section.

Because of not being meaningful of the ratio of prices growth, then each factor caused price gap in agriculture and non-agriculture products such as international trade cannot be a factor for wage gap among agriculture section and non-agriculture section. The factor explains the gap of agriculture section against non-agriculture section is labor forces productivity gap in two agriculture and non-agriculture sections, in the other word, whereas:

$$dLog\left(\frac{ProducAgri}{ProducnonAgri}\right) = dLog(ProducAgri) - dLog(ProducnonAgri)$$

Therefore, the positiveness of growth coefficient of productivity ratio means that in courses which:

$$dLog(ProducAgri) > dLog(ProducnonAgri)$$

(Labor forces productivity growth in agriculture section is larger than labor forces productivity growth in non-agriculture section).

$$(dLog(Wgri) > dLog(Wnon - Agri))$$

As per the result of this research, we cannot accept the (H-O-S) hypothesis based upon that international trade as one of the wage gap factors among agriculture section against non-agriculture section (through price gap). By virtue of observations performed by Krugman (2006), other factors, especially the factor of change in technology or productivity gap are explanatory factors in wage gap among agriculture section against non-agriculture section.

CONCLUSION

Standard theories of international trade are emphasized in relation of trade between countries and wage. Hechscher-Ohlin, Stolper_Samuleson and Haskel express that more convergence due to trade caused wage inequality in under-trading countries. But most experimental studies show that international trade is not an only factor for increase in wage gap and there is another important factor which have effect upon wage inequality; which can refer to inequality increase in productivity as one of theses factors.

Revealed facts express that, in OECD countries selected in this research including Australia, Austria, Belgium, Canada, Republic of Czech, Denmark, Finland, Germany, Ireland, Italy, Japan, Netherland, New Zealand, Norway, Sweden, Swiss, England and the USA, the wage ratio of agriculture section against non-agriculture section during the time is relevant with growth changes of labor forces productivity ratio of agriculture section against non-agriculture section and growth fluctuations of relative prices (agriculture section against non-agriculture section) is not a factor of growth fluctuations of relative wages of agriculture section against non-agriculture section (rejecting of Stolper_Samuleson theory).

If we compare the result of this article with others works such as Krugman (2006), Lawrence (2010) and etc.; it has observed and specified in this article that only international trade (which may be resulted from price difference in different countries) can not explain the wage gap changes in two economy sections and there is another factors which can explain price gap, as most scientists of international trade such as Krugman were indicating, international trade is not ineffective upon wage gap changes and can explain wage gap changes through relative price that Haskel also indicated it. However, in this research, the said factor not be developed and the factor of productivity gap is more visible than wage gap.

REFERENCES

1. Lawrence, Edwards and Robert Z. Lawrence, 2010. US Trade and wages: The misleading implications of conventional trade theory; National Bureau of Economic Research, pp: 16106.
2. Borghi Elisa, 2005. Trade openness and wage distribution in Chile; University Commercial of Luigi Bocconi, CESPRI, pp: 25.
3. Dorosh, P.A. and S.D. Younger, 1996. Exchange rate, fiscal and agricultural policies in Africa: Does adjustment hurt the poor? World Development, 24(4): 719-748.
4. Krugman Paul, R., 2006. Growing World Trade: Causes and Consequences. Brookings Papers on Economic Activity 1995, 1: 327-377.

5. Bigsten, A. and D. Durevall, 2005. Openness and Wage Inequality in Kenya, 1964-2000; World Development 34(3): 465-480.
6. Benjamin, N. and B. Talan, 2007. Productivity growth and agricultural out-migration in the United States; Structural Change and Economic Dynamics, 18: 52-74.
7. Motonishi Taizo, 2006. Why has income inequality in Thailand increased? An analysis using surveys from 1975 to 1998; Japan and the World Economy, 18: 464-487.
8. Leamer Edward, E., 1998. In Search of Stolper-Samuelson Effects On US Wages. In Imports, Exports and the American Worker, ed. Susan Collins. Washington: The Brookings Institution.
9. De Maio, L., F. Stewart and R. Van der Hoeven, 1999. Computable general equilibrium models, adjustment and the poor in Africa. World Development, 27(3): 453-470.