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The Study of Gap's Factor on Labor Force's Wage between Agriculture and Non-Agriculture Sectors in BIRCs Countries (Emphasis on International Trade)

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Abstract: In this article, recognition of effective factors upon wage ratio changes on labor force of agriculture sector to non-agriculture sector in BIRCs countries will bring under consideration as forerunner countries in development of world market which is including Brazil, India, Russia and China. 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. In under-studied countries, wage ratio of agriculture sector to non-agriculture sector had decreased during current years, in the other words; farmers' income in proportion to non-farmers had decreased. Therefore, through benefitting panel data, time series data (1997-2008), cross sector data (BIRCs countries) and using international trade economists' model (Haskel model), it is become specified that the major reason in decrease the wage ratio of agriculture sector to non-agriculture sector has been price decreases of agriculture products in proportion of the price of non-agriculture products, but productivity difference in two sectors has different effect over wage gap of two sectors.

JEL: J31, F16, R11.

Key word: Wage Gap · International Trade · Agriculture and Non-Agriculture Sectors

INTRODUCTION

In the current decade, much study has been performed concerning the change of wage inequality and wage gap in reaction to increase in world 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 non skilled labor force will antecede in producing non-skill products. Now, if these 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 price of these products.

Standard model of international trade (Hechscher-Ohlin and Stolper_Samuleson theories) 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 no skilled workers shall be increasing in advanced

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countries and shall be decreasing in developing countries. But some of experimental studies verify that these predictions have not observed in all countries [2].

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

But result of some studies were on contrary with the above mentioned result [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 inequality decrease of wage in different sectors of economy.

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

[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-industries 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.

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 these 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 non skilled 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 non skilled 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 non skilled 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 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 non skilled goods in international area. Whereas, such changes aren't in level of the international data of price.
- As the international trade model expressed, skilled and non skilled 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 non skilled 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 cannot have more effect upon income distribution. Therefore, what reason can describe the growth of wage gap between skilled and non skilled labor force in the USA.

[1]New Industries Economics (NIE)

MATERIALS AND METHODS

This article is looking for recognition of effective factors upon the wage gap between agriculture and non-agriculture sectors. In the other word, we are looking to answer this question that if we divide the economy in two agriculture and non-agriculture sectors, whether the wage in agriculture sector against non-agriculture sector 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 sector. 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 sector was descending to non-agriculture sector [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 non skilled 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 non skilled 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 non skilled labor force. Many researchers have performed by virtue of these theoretical principles toward recognition of effective factors upon wage gap between skilled and non skilled labor force [1-3, 8-10].

But most of these studies to get a result that only effective factor upon changes of wage gap between skilled and non skilled 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 non skilled labor force in the USA has been more attention to educational level and productivity of labor force during the time. But, 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 non skilled labor force and/or wage gap between two economy sectors is Haskel model [11] designed in 2001. This model which is known as international trade economists' model[2], which measures different factors upon wage gap between skilled and non skilled labor force in two economy sectors though supposing free movement of skilled and non skilled labor force in two sectors. It is noteworthy that the above mentioned model also can be used for recognition of effective factors upon wage gap between two sectors, which is used in this article for recognition of effective factors upon wage gap changes between two agriculture and non-agriculture sectors within the time.

If we divide economy in two sectors 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 sector; 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_s^i and v_s^j are the share of skilled labor force's wage from total wages of each sectors, W_s and W_u are equal for each sectors and because of this reason do not have any index, because the labor force in each sectors is moving freely. (TFP) means total production factors productivity and supposes that: $v_s^i > v_s^j$

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 sector (I) am negative and if price changes in non skilled sector (j) be negative ($\Delta \ln p^i < 0$), then relative wages $(\frac{W_s}{W_u})$ may be increased.

[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 non skilled labor force and are used inside one sector or industry, for further information, please refer to Burman & 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 sector" at Sciences & Researches branch of the Islamic Azad University.

In the meantime, regarding that two sectors are in the condition of complete completion and having zero profit, then price decrease in each sector leads profitability of the said sector and due this reason, relative wages will be modified upon reaching to zero profit in the above mentioned sector.

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 sector assimilate according to competitive market and having zero profit; for example, if technology changes decrease in skilled sector ($\Delta \ln p^i < 0$), therefore, relative wages $(\frac{W_s}{W_u})$ may be increased and if ($\Delta \ln p^i < 0$), $(\frac{W_s}{W_u})$ 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 sectors and in the result, it needs wage changes. Now, if the economy divide into two agriculture (i) and non-agriculture (j) sectors and supposed that the major of non skilled labor force are working in agriculture sector and major of skilled labor force are working in non-agriculture sector, then, we can consider the wage growth in agriculture sector W_s against non-agriculture sector W_u as a function of growth in index ratio of agriculture sector (P_i) to non-agriculture sector (P_j), also a function of productivity growth of agriculture sector (TFP_i) to non-agriculture sector (TFP_j):

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

But unfortunately, as indicated in data description part, the above mentioned data are very scattered and limited. Therefore, logarithms changes may not be used and in this article has been used from variables logarithms. And also, due to non-existence of data relevant to total factor productivity; labor force productivity had used as proxy. Therefore, Haskel model has modified in below form:

$$Ln(\frac{W_A}{W_{NA}}) = \alpha + \beta_1 Ln(\frac{P_A}{P_{NA}}) + \beta_2 Ln(\frac{PR_A}{PR_{NA}}) + u_i \quad (2)$$

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

Data Description: According to a model described in the previous part, at the first, data related to wage of agriculture and non-agriculture sectors for Brazil, Russia, India and China which are known as $BRIC_s$[5] had extracted from labor force data resources in International Labor Organization for 1997-2000. Data relevant to wage ratio of agriculture sector to non-agriculture sector in Brazil, Russia, India and China were indicated in Fig. 1. It is noteworthy that data relevant to wage of agriculture sector of India was not accessible in any of above mentioned years and has omitted under compulsion of the said country.

Considering that, this ratio in China has descending movement; in such a way that this ratio has decreased from 66% in 1997 to 44% in 2008. In the other word, in 1997, only farmers had received the wage 34% less than other wages; whereas it has been reaching 56% in 2008. It must say concerning the wage ratio of agriculture sector to non-agriculture sector in Brazil, unfortunately, data existing in the International Labor Organization (Labor Stat) did not relate to 2003-2008, therefore, in the above table, data relevant to 1997-2002 had drawn. As you seen later, the process is almost

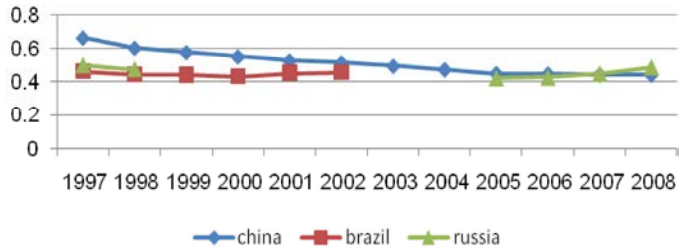

Fig. 1: Wage ratio trend of agriculture sector to non-agriculture sector (1997-2008)
Source:Research Findings

[4]Skill-Biased Technical Change (SBCT)
[5]Brazil, Russia, India & China (BRICs)

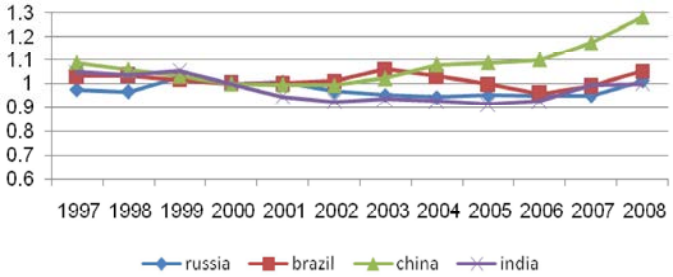

Fig. 2: Ratio of price indices of agriculture to non-agriculture (1997-2008)
Source:Research Findings

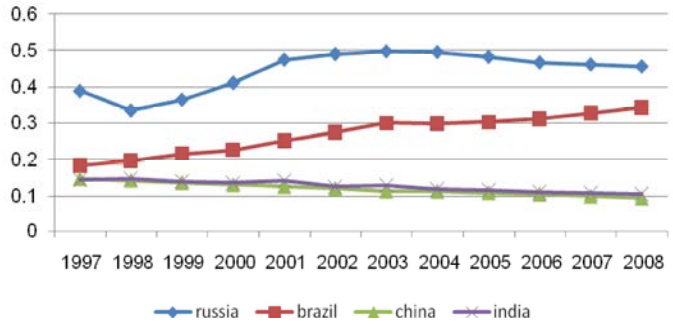

Fig. 3: The productivity ratio of agriculture to non-agriculture sector (1997-2008)
Source:Research Findings

amplitude; but, we can consider descending resultant thereof, because the above mentioned ratio has been decreased in most years. Finally, there is no data about Russia during 1999-2004 but we can say that it was ascending process.

As you seen, dependant variable data are not similar for each country during the same course and this issue can creates a problem in "Panel data" model of countries. But we can estimate the equation (2) through "Unbalanced Panel Data" model. But estimating most of parameters can flaw them without being bias.

The first descriptive variable required in equation (2) is index of goods' price of agriculture sector to non-agriculture sector. International Bank annually publishes user's price index of different countries through annual reports (WDR)[6]. On the other side, food and agricultural organization affiliated with United Nations Organization (FAO)[7] is publishing the price of agricultural products for different countries. The ratio of the above mentioned indices was indicated in Fig. 2.

It was considered that the ratio of price index of agriculture products against non-agriculture products has been decreased except China (especially in current years). For example, this ratio in Brazil had decreased from 1.03 in 1997 to 0.98 in 2007. And also this index in Russia and India had decreased respectively from 0.97 and 1.05 in 1997 to 0.94 to 0.99 in 2007. In the other word can say that in the current 10 years, the price of agriculture products had increased less than non-agriculture products. But it is noteworthy that this ratio has increased in these four countries in 2008. In the other word, the price of agriculture products has increased more than non-agriculture products.

The second descriptive variable required in equation (2) is the ratio of labor force productivity in agriculture sector to non-agriculture sector which is extracted from International Bank's reports for different years (Fig. 3).

It seen that the productivity ratio of agriculture sector to non-agriculture sector in India and China was decreasing but in Brazil and Russia was increasing. In the other word, nevertheless the productivity increase of agriculture in China and India in the said course, but speed of the productivity increase has been more in other sectors, while in Brazil; productivity growth of non-agriculture sector has been amplitude and also speed of the productivity increase of agriculture sector has been more than other sectors; and for this reason, the productivity ratio in agriculture sector has increased to non-agriculture sector. This issue also referred to Russia; but through difference that both process of agriculture

[6]World Development Report
[7]Food and Agricultural Organization

sector to non-agriculture sector in this country was ascending but in most years, the growth of agriculture sector was more than non-agriculture sector.

Therefore, productivity ratio of agriculture sector to non-agriculture sector in these countries has had inconstancy process and supposed that it did not have distinctive effect upon dependent variable. Then we expected that this ratio has various effects upon dependent variable in the said countries. Therefore, this variable exits from "common coefficients" in unbalanced panel data model and enters to "Cross-Sector Specific Coefficients".

RESULTS AND DISCUSSION

Equation (2) estimated through data described in previous part which its result indicated in Table 1. Before analysis said Table, notification of some points is necessary. As expressed, due to existing Missing Data among collected data and existing of sector and time, unbalanced panel data were used. The method of unbalanced panel data has different models and one of its major challenges in this method is selecting suitable model for analysis.

For this purpose, in the first stage "Limited F Test" performs for choosing between "Pooled Least Squares" and "Fixed Effects" methods. The result expresses the subject that fixed effects method is more proper.

In the next stage, "Hausman Test" is performed for choosing between "Fixed Effects" and "Random Effects" methods. The result expresses that fixed effects method is optimum method. Therefore, the results of two tests show that fixed effects method (F.E) is a method should be analyzed the results therein.

In Table1, India has omitted from observations because of non-existence of the information relevant to the wage of agriculture sector in the under-evaluated years. And also the above table shows that the coefficient "price index ratio of agriculture sector to non-agriculture sector" is positive and it is meaningful from statistical point of view. In the other word, through decrease in the price index of agriculture sector to non-agriculture sector during the time, wage ratio of agriculture sector is also decreased against non-agriculture sector in under-studied countries; that this subject is due to the fewer speed of price index increase of agriculture sector to price index increase of other economy sectors. As expressed, the above mentioned ratio is inserted in specific coefficient parts of each country due to heterogeneousness of agriculture productivity ratio to productivity of other sectors in these countries and whereas it was supposed

Table 1: Estimation of wage gap between labor force of agriculture and non-agriculture sectors (1997-2008)

Variable	Least Squares	Fixed Effects	RandomEffects
C	-0.77	0.35	-0.09
	(-11.8)	(7.23)	(-0.17)
Log (CPI_A/CPI_{NA})	-0.44	0.48	0.41
	(-1.67)	(3.38)	(1.11)
$Log\ (CPI_{A,BRAZIL}/PR_{NA,BRAZIL})$	0.01	0.04	0.09
	(0.22)	(0.6)	(0.4)
$Log\ (CPI_{A,CHINA}/PR_{NA,CHINA})$	-0.06	1.07	0.95
	(-1.71)	(13.9)	(5.01)
$Log\ (CPI_{A,RUSSIA}/PR_{NA,RUSSIA})$	0.01	-0.29	-0.25
	(0.13)	(-2.08)	(-1.08)
R^2	0.35	0.95	0.81
F	2.65	65.29	21.07

Number of Countries: 3

Numbers in brackets are estimated coefficients of t.

Source:Research Findings

that this ratio has different effects upon wage. As observed, the coefficient of "productivity index ratio of labor force" is not meaningful in all countries from statistical point of view; so that it is meaningful in China and Russia and is not meaningful in Brazil. The sign of meaningful coefficients in two countries is different. In the other word, decrease in productivity ratio in China caused decrease in wage, but increase in productivity ratio in Russia caused decrease in wage ratio. And also in fixed effects model, intercept coefficient is meaningful from statistical point of view that this subject has been based upon the meaningful difference of countries from management, structural, political, cultural and etc point of view.

In the other word, the result shows that in Brazil, wage gap changes of agriculture sector to non-agriculture sector is resulted from price gap changes of agriculture sector to non-agriculture sector and productivity gap in two sectors has had no explanation for wage gap in these sectors; it means that, more growth in productivity of agriculture sector to non-agriculture sector caused not any changes in wage gap of agriculture sector to non-agriculture sector and only variable can explain the decrease in wage gap is more growth in price of agriculture products to non-agriculture products. While the productivity gap in addition to price gap has been effective in China and Russia; with this difference, this gap in Russia has negative effect but in China has positive effect. As observed in Fig. (3), agriculture productivity growth in Russia has been more than the productivity growth of other sectors in the country, therefore, it has negative effect upon wage gap in this country and this subject has completely been reverse in China.

CONCLUSION

Standard theories of international trade are emphasized in 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 has effect upon wage inequality; which can refer to inequality increase in goods price and productivity as one of these factors.

Revealed facts express that the wage ratio of agriculture sector was descending process against non-agriculture sector in 1997-2008 in $BRIC_S$ countries. And also price index ratio of agriculture products was ascending process against non-agriculture sector during the above mentioned years in these countries, which indicates positive effect of this index upon increase in wage gap in under-surveyed countries. But otherwise, productivity ratio of labor force in agriculture sector against non-agriculture sector has not the same process in these countries; in such a way that this ratio has had descending process in China and India but has had ascending process in Brazil and Russia. Therefore, as expected, this index has not distinct and same effect upon wage gap in these countries; according to result of the model, the effect of productivity ratio of labor force in agriculture sector be positive against non-agriculture sector in China and in Russia be negative and in Brazil is not meaningful.

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) cannot explain the wage gap changes in two economy sectors 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.

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, El., 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, 8: 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. Deardorff, Alan V. and D. Hakura, 1994. Trade and Wages: What are the Questions? In Trade and Wages Leveling Wages Down? eds. Jagdish Bhagwati and Marvin Kosters. Washington: American Enterprise Institute.
10. 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.
11. Haskel, Jonathan E. and Matthew J. Slaughter, 2003. Have Falling Tariffs and Transportation Costs Raised US Wage Inequality? Review of International Economics, 11(4): 630-650.