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Outsourcing under Threat: Estimated Impact of Potential Tariffs on US Imports from Mexico

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In this paper, I discuss the effects of certain trade policy measures, mostly import tariffs, presently contemplated by the US government, aimed at enhancing domestic employment in a number of targeted industries. I intend to show that insofar as such measures restrain free trade among NAFTA member-countries, they run counter to a basic rule suggested by conventional theory, stating that, following changes in the tariff structure, resources will shift toward activities that enjoy the highest rate of effective protection. I try to demonstrate that erecting barriers against inside-NAFTA trade, aside from hurting industries that use outsourcing extensively, has little chances to create incentives for labor shifts in the desired direction.

***Keywords**: outsourcing, effective protection, labor mobility*

***JEL Classification**: F13, F15, F16*

1. Outsourcing to Mexico: a boon for US manufacturing firms

The North American Free Trade Agreement (NAFTA) gave impetus to intraregional trade, not least to trade in intermediate inputs. The removal of intra-bloc customs barriers stimulated US manufacturers to outsource production, in part or in whole, to Mexican firms, the resulted finished products or components being either imported back to be distributed on the US market or exported overseas. In the course of time, the shift of chunks of production to Mexican maquiladoras (Aguilar, 1995) gradually advanced from marginal tasks such as final assembly to more skill-intensive intermediate products that could be reimported tariff-free. Foreign manufacturers headquartered in the US also outsource intermediate products to Mexico, thus obviating the need to import them from their home countries. Uneven development, reflected in wage rates being lower in Mexico than in US across all industries and skill levels (Note 1) has been the decisive factor behind this mutually beneficial production sharing, which nevertheless has a downside: a noticeable shift of jobs from US to Mexico, especially in the medium and low skilled categories. The southward flow of jobs has been fueling widespread public distress, which gradually turned into anger against NAFTA as a whole. Eventually, grievances sparked a swing in the political mood, heralding a possible future closing of the US market through

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the imposition of tariffs and other barriers, especially on imports from NAFTA member countries, chiefly Mexico (Note 2).

2. Study's Objectives, Structure and Methodology

The introductory note calls for a disclaimer: this paper is not aimed at either making value judgments about the current US trade policy options or discussing the opportunity of potential anti-NAFTA steps contemplated by US authorities. In Krueger (1997)'s phrasing, I do not "seek to find reasons why…an exception to free trade should be made". Instead, I discuss the impact of a potential phasing in of trade barriers inside NAFTA on US manufacturing industries. My specific goal is to draw an inference as to the odds that such measures will lead to an increase in employment in industries that are deterred from outsourcing production to cheaper-labored Mexico. My estimations are based on predictions of the theory of effective protection, as formulated by Max Corden (1984) hereafter called the basic theory, which deals with potential effects of changes in the effective protection upon variables such as output, value added, resource allocation etc. The basic theory's underlying principle was summarized by Ramaswami and Srinivasan (1971): "if there are two activities, the levy of a tariff will pull resources toward the activity enjoying the higher effective protective rate." Correspondingly, if outsourcing to Mexico is to blame for a massive loss of jobs by US industries – although a solid correlation between international trade and the fall in western countries' manufacturing employment "has not been convincingly demonstrated" (Revenga, 1992) – then adopting measures aimed at raising the effective protection of the respective industries could be the remedy.

Three important observations though: first, the predictive power of the basic theory is generally considered "severely limited in regard to primary factor reallocation and gross output changes." (Bhagwati and Srinivasan, 1983) Second: the basic theory must be used with circumspection in the case of regional trade blocs, which promote discriminatory policy against third parties. The theory assumes that "all tariffs and other trade taxes and subsidies are non-discriminatory as between countries of supply or demand." (Corden, 1984) Supposing the US government invokes a NAFTA safeguard clause to impose high tariffs on imports of both finished and intermediate goods from Mexico, it will most likely not extend them to similar imports from other countries, otherwise risking getting involved in nasty trade disputes with the rest of the world (Note 3). Still, this inconvenient can be overcome by simply considering the intra-NAFTA trade as domestic trade for US producers. Accordingly, tariffs on imported intermediate goods from Mexico can be viewed as consumption taxes for industries that use the respective goods as inputs. Such taxes, just like tariffs on inputs, reduce the effective rate of protection (ERP) for the respective industries. Third, the basic theory assumes perfect competition and constant returns to scale, implying, among other things, that in equilibrium, the marginal revenue product of a factor equals its price. Although these assumptions are somewhat unrealistic, I trust they are not restrictive to such a degree as to fundamentally distort the core of the analysis.

For all its limitations, I believe the basic theory is helpful enough in determining, if not precisely the direction and magnitude of shifts in resources following a change in tariff structures, at least chief trends thereof. More importantly still, it allows the researcher to tackle the effective protection issue in two different ways, depending on whether non-traded inputs are treated as tradable inputs or as primary factors. I believe this differentiation is fit to the particular context of the US economy, in which a potential demise of outsourcing might render US producers unable to use imported parts but only non-traded inputs and primary factors.

The analysis is centered on the automotive industry for a pragmatic reason: for one thing, reportedly, it ranks among the industries that are most obsessively targeted for repatriation, a goal authorities wish to achieve expediently by imposing restraints on intra-bloc free trade; for another, automobiles production is heavily dependent on outsourcing, auto parts currently accounting for a sizable share of US automotive imports from Mexico, even exceeding the final autos share (Note 4). This peculiarity makes it all the more vulnerable to a potential reinstitution of intra-regional barriers to trade.

The remainder of paper is organized as follows: section 3 is an outline of the theoretical framework, with focus on the role of effective protection. In section 4, I expound the evolution of US trade policy in the automobiles field. In section 5 and 6, I analyze the boom and bust of outsourcing respectively: in section 5, I try to emphasize the effects of outsourcing expansion in the aftermath of the emergence of NAFTA, with the aid of Ronald Jones (1971)'s influential theory of specific factors. Jones' model, as Markusen et al. (1994) noted, helps one to understand how government policy changes such as trade protection affect factor owners. In section 6, I estimate the effects of a potential demise of outsourcing following a restrictive turn in US trade policy against NAFTA partners, particularly Mexico, which are likely to trigger changes in the ERP of the targeted industries. Specifically, I draw on Max Corden (1984)'s basic theory of tariff structure and effective

protective rates to ascertain the extent to which the measures contemplated by the US government might attain their stated purpose, namely to increase employment in industries that are subject to the respective measures.

3. Landmarks of Theory

3.1. On Outsourcing

The expansion of vertical specialization within industries has changed the pattern of international trade and income distribution within industries. (Krugman, 2008) Moreover, the booming international trade in intermediate products has rendered the production process of firms "increasingly fragmented internationally". (Bond, 2001) Production sharing aka outsourcing refers to "the delivery of products or services by an external provider that is, one outside the boundaries of the firm" (Manning et al., 2008). Grossman and Rossi-Hansberg (2008) use the term "task trade" to distinguish it from goods trade. If the subcontractor is located in a foreign country, the firm "engages in foreign (offshore) outsourcing, or arm's-length trade". (Antràs and Helpman, 2004).

The decision to outsource is subject to both financial and technological motivations. Financially, outsourcing fosters firms' competitiveness and profitability (Grossman and Helpman, 2002); sometimes it is even critical for their survival. (Kohler, 2004) From the technological perspective, outsourcing is virtually correlated with jobs routineness (Ebenstein et al., 2009): as production becomes standardized, firms tend to transfer it, partly or entirely, offshore, while keeping home mostly non-routine tasks, which use knowledge and high skills intensively.

An issue intensely dealt with by theorists is related to the impact of outsourcing on wages. Feenstra and Hanson (1996) and Feenstra (1998) find that outsourcing of intermediate inputs by US-based multinationals to Mexican manufacturing firms increases relative wage of skilled labor in both countries. Hsieh and Woo (2005) find evidence about outsourcing to China favoring skilled workers in Hong Kong. Yet viewpoints do not necessarily converge in respect to the impact of outsourcing on unskilled workers' wages (Geishecker and Görg, 2008; Grossman and Rossi-Hansberg, 2006).

3.2. On Protection

When governments intervene in order to protect domestic industries from foreign competition, resources tend to move from low protection to high protection sectors. It is American scholars W. Stolper and P. Samuelson (1941) who highlighted this effect more than seventy years ago: the increase in the relative price of the protected good triggers the increase in the relative price of the factor intensively used in the respective good and correspondingly, a drop in the relative price of other factors. If, for example, the factor the protected industry uses intensively is labor, wages in the respective sector will rise. Concomitantly, firms in the protected industry will, at least in the short run, reap a higher marginal revenue product of labor and implicitly higher profits thanks exclusively to the rise in the price of labor caused by border protection.

Protection is costly regardless of type. Tariffs for instance, are measured "in terms of the compensation that would leave the country as well off, under the tariff, as previously under free trade." (Bhagwati, 1964) If quotas are used instead of tariffs, financial effects are equivalent, except the case "when foreign retaliation is taken into account". (Rodriguez, 1974) However, the effects of more complex measures like those involving orderly marketing arrangements are less clear cut. VERs for example generated two types of costs: deadweight loss and rents respectively. Theorists e.g. Neary (1988) found that VERs had been more costly to the US economy and US consumers than conventional protection tools.

Border protection has a different determination if domestic industries can use internationally traded intermediate inputs. Because output no longer coincides with value-added, protection is more accurately measured by the rate of effective protection than by the nominal rate. As Max Corden (1975) noted, "the effective rate of protection makes it possible to describe neatly very complicated systems of trade and other interventions in many countries." The landmarks of the theory of effective protection were established by Balassa (1965), Johnson (1971) and Corden (1969 and 1984). The essentials were spelled out by Bhagwati and Srinivasan (1973): "the theory deals with the relation between changes in the tariff structure and changes in value-added, when domestic producers are free to use internationally traded physical inputs." The peculiarity of the rate of effective protection lies in that it captures the influence of two additional factors: nominal rates on traded inputs respectively the share of value added in the final good's price. (Balassa, Schydlowsky, 1975) Furthermore, in an analytical approach, Corden (1969) shows that changes in nominal protection affect both the "quantity" and the "price" of value added.

The effects of border protection upon internal production and resource allocation usually differ from the case when all inputs are produced domestically, because: for one thing, changes in nominal protection do

not always translate into changes of the same sign (let alone magnitude) in the effective protection; for another, the resource shifts associated with an increase (decrease) in the nominal rate of protection may or may not be in accord with those associated with the expected increase in the ERP. Theorists have been investigating the ability to predict, with sufficient accuracy, the sign and magnitude of potential changes in a number of variables such as value of output, resource allocation, real and nominal value-added etc., caused by changes in the effective rate of protection. Batra (1973) found "a close link between the sign of the ERP and the direction of the change in the output of the import-competing final product", while magnitude depends, according to Corden (1984), on the scale of effective rates (Note 5) as well as on production-substitution elasticities. Moreover, Bhagwati and Srinivasan (1983) underscore the necessity of "defining an index which, in the presence of tariff structures involving the imports of intermediates, will perform the same tasks as nominal tariffs do in the nominal tariff theory." On the other hand, it is no less true that there is a dose of skepticism in the predictive power of the effective rate of protection in regard to primary factor reallocation and gross output changes. Anderson (1996) for example, questions the power of conventional indexes to predict "changes in output or other economically interesting variable", while focusing on the effects on rents to factor owners. This different perspective is meant "to avoid the problems which complicate the link between specific factors return on the one hand and measures of effective protection on the other hand."

4. Protection of US Automobiles Industry. A Winding Road

Prior to NAFTA, the border protection of US automobiles industry included a miscellaneous collection of tools. Until the 1980s, import tariffs held preponderance although the level of nominal protection steadily declined. Significantly, protection for the auto industry was dismantled more drastically as compared to other sectors: whereas the overall tariff level fell from 20 percent in 1947 to 5 percent in 1992 (Hufbauer and Elliot, 1994), the duty for imported motor vehicles was, with a few exceptions, reduced to 2.5 percent ad valorem (Note 6). In a later stage (the 1980s and early 1990s), tariffs were virtually supplanted by non-tariff measures, mostly by voluntary export restraints (VERs). According to empirical evidence, in the particular automobiles sector VERs yielded 0.2-1.2 billion dollars deadweight loss and 2.2-7.9 billion dollars' worth of rents. (Feenstra, 1995) Apparently, VERS' effects are similar to quotas'. Yet, theorists (e.g. Neary, 1988) contended that VERs had turned out to be more harmful than tariffs and quotas to domestic consumers because "the rents generated by VERS are assumed to be lost to the home country and to accrue exclusively to foreign consumers."

Ironically, the border protection of US automobiles industry turned out to be not only ineffective but also poorly profitable. Estimations by Hufbauer and Elliot (1994) are compelling enough: "the potential consumer gains if the Unite States eliminated all tariffs and quantitative restrictions on imports are in the neighborhood of $ 70 billion – about 1.3 percent of the US GDP in 1990"…Ensuing layoffs "would increase the national unemployment rate by about 0.15 percent." In view of this conspicuous gap, it is no surprise that protectionist policies were seldom backed by cost-benefit-type arguments. More often than not, the imposition of barriers, of either tariff- or non-tariff-type, was used as a second best policy, aimed at correcting market distortions or protecting (or creating) employment, both with questionable results.

To summarize, I would point out that until the early 1990s the border protection of US automobiles industry was indeed ineffective and hardly useful. Somewhat paradoxically, it is the advent of NAFTA that made protection effective by laying the foundation for profitable production sharing. Although outsourcing is not inherently linked to regional blocs, goods and factor mobility across member countries as well as low transport costs within an integrated region are perfect ingredients thereto. Producers' ability to import cheap and tariff-free physical inputs from neighboring countries raises their effective protection and implicitly, adds to their competitiveness. By using a word play, I would say it is the increase in the effective protection that made protection effective.

5. Effects of NAFTA-Induced Intra-Regional Trade Liberalization on the US Automobiles Industry

Suppose the US economy consists of two productive sectors, automobiles and food respectively, using three primary inputs: capital (K), land (T) and labor (L). Capital is a specific factor to the automobiles production, following that it is exclusively employed in the respective sector, while land is specific to the food sector and implicitly, used exclusively therein. Capital and land are in fixed amounts and immobile between sectors. Labor is an input in both sectors and it can move freely from one sector to the other.

The impact on the US economy of NAFTA-induced intra-regional trade liberalization can be assessed with the aid of the diagram in figure 1. The quantity of labor employed in automobiles production sector is measured on the horizontal axis $O_A\ O_F$, from $O_A$rightward, while in food production labor is measured from O_F leftward. The income from labor is the wage rate (denoted by W), measured on the vertical axes. The return of specific factors' owners is the rental rate (r for capital, R for land). In equilibrium, the following relations hold:

$$p_A MP_l^A = p_F MP_l^F = W \quad (1)$$
$$p_A MP_k^A = r \quad (2)$$
$$p_F MP_t^F = R \quad (3)$$

where:

MP_k^A, MP_t^F = the marginal physical product of specific factors, capital and land (terrain) respectively;

MP_l^A, MP_l^F = the marginal physical product of the mobile factor, labor, in automobiles and food production respectively;

p_A, p_F = the price of automobiles and food respectively.

Equations (1) to (3) express the equality between factor returns and the respective factors' marginal revenue product (that is the value of the marginal product). By dividing any of the three equations by the price of the final good, one could easily infer that the marginal physical product of a factor equals the real return of the respective factor in terms the good it produces.

The (λ) and (μ) curves illustrate the marginal revenue product of labor in the automobiles respectively food sector. Since the stocks of specific factors are presumed fixed, the two curves are downward sloping, in accordance with the law of diminishing returns: as more labor is added to the same amount of another factor, the marginal product of labor decreases. Point E_0 designates the equilibrium state, in which all factors of production are fully employed. In equilibrium the wage rate in both sectors is equal to the measure of the vertical distance E_0H.

Suppose for the moment that the economy is in external equilibrium too, implying there is no excessive surplus or deficit that might influence the price ratio of the two goods. Yet equilibrium is disturbed by the emergence of NAFTA: liberalization of the intra-region trade leads to increased competition on the US domestic market. Furthermore, the removal of inner barriers to trade offers US automobiles producers the opportunity to outsource production, mostly low skilled tasks, to Mexican maquiladoras. Since outsourcing enables the former to economize on production costs, thereby gaining a competitive edge against foreign rivals, the price of automobiles on the US market declines and so does the marginal revenue product of labor in the automobiles sector. On the diagram in figure 1, this is illustrated by the downward shift of the (λ) curve. Surely, food producers can equally avail themselves of outsourcing opportunities. Still, since outsourcing is reportedly more strongly embedded in automobiles than in food production, the impact on the latter is assumed negligible.

The impact of the boom in outsourcing goes beyond the decline in automobiles' prices. Production sharing has a shrinking effect on the automobiles sector as a whole, including the specific factor. On the one hand, the transfer of a number of tasks to Mexico is tantamount to the loss of the respective jobs for US workers. The ensuing labor vacuum causes the labor-capital ratio (L/K) to drop, which causes the marginal revenue product of labor to rise and the marginal revenue product of capital to drop. On the other hand, the transfer of a part of production from domestic plants to Mexican maquiladoras entails capital investments by US manufacturers in the neighbor country, which means that a part of the capital employed in automobiles production flows to Mexico. The stock of capital therefore decreases, compensating the labor shortage and restoring the initial (L/K) ratio.

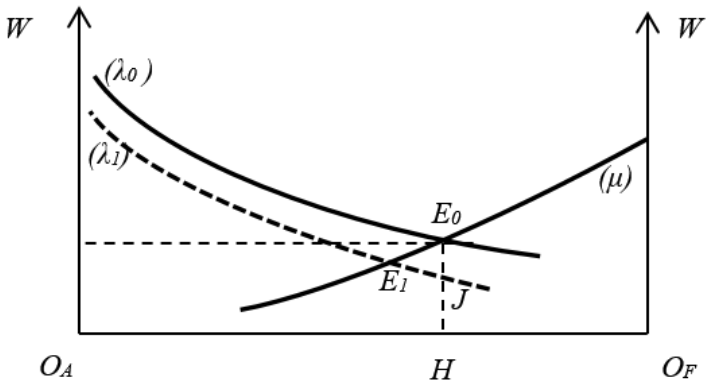

Figure 1.

On the diagram in figure 1, the final equilibrium is in point E_1. The amount of labor employed in automobiles production decreased by the horizontal distance between E_0 and E_1. One can notice that the wage rate level in E_1 has come to be higher than in J, the US economy having moved from J to E_1 along the (λ_1) curve. Actually, the effect on labor is somewhat ambiguous. It is reasonable to admit that the equilibrium wage rate stabilizes somewhere between the E_0 and E_1levels, measured vertically.

6. Reinstitution of Nominal Tariffs inside NAFTA: Possible Effects on Labor

Obviously the state indicated by point E_1 in figure 1 is not one of contentment for US authorities and for a good reason: the automobiles sector lost a number of jobs, most of them having drifted to Mexico. The question is: could these jobs be retrieved by erecting import barriers inside NAFTA? Apparently yes: admitting the free intra-regional trade ushered in by the intra-regional agreement is the chief cause of the diminished employment in the automobiles sector, then overturning NAFTA rules might redress the situation, on condition that the measures lead to a higher rate of effective protection for the respective sector.

To ascertain if this rationale holds in the case under discussion, I refer back to the data set in section 7 , to which I add a third sector that produces a non-traded good, energy, using either conventional dirty inputs (coal, oil etc.) or unconventional clean inputs (wind, solar power etc.). In the new setting, I ignore the specific factors, capital and land, and only consider labor and energy as primary inputs in both the automobiles respectively food sectors. Labor is not an input to energy production, while inputs to the energy production cannot be used directly in either automobiles or food production. Labor and energy inputs are assumed as being mutually substitutable. Energy produced by using dirty inputs is hereafter called dirty energy; energy produced by using clean inputs is hereafter called clean energy.

If the US government institutes a prohibitive tariff on imports of automobiles and parts from Mexico, both import flows will be brought to a crashing halt. There is still a difference: whereas the US can continue to import finished automobiles from elsewhere, it cannot do the same thing with parts: Mexican producers thereof can hardly be supplanted by other sources because of transport costs. As I emphasized in section 2, tariffs on imports of auto parts from Mexico are equivalent to a consumption tax on inputs to the US automobiles industry, which is thus compelled to use more expensive domestic inputs instead of the cheaper ones from Mexico. The US automotive industry actually reverts to the state prevailing before the emergence of NAFTA, in which imports of both automobiles and parts were subject to tariffs.

The specific-factors model is of little usefulness in predicting a potential labor shift following a restrictive turn in US trade policy because it is no longer a mere relation between goods prices and factor prices that is at issue: rather, it is about a change in the ERP of various industries that are expected to trigger changes in a range of variables: output, value added, resource allocation etc. According to the underlying principle, for labor to move back into the automobiles sector, ERP must be higher for automobiles than for food.

The imposition of high tariffs on automotive imports from Mexico clearly restrains free trade within the NAFTA territory, thereby driving the price of automobiles up. Moreover, outsourcing being thwarted, automobiles manufacturers are compelled to turn out the product in whole, using only non-traded inputs. On the other hand, by relaxing the external equilibrium assumption, one can admit the price of food may also fluctuate. Suppose the value of the US dollar assumes an ascending course, which causes the price of US exports of food to soar on alien markets. The US government might wish to restore the competitiveness of food exports by granting an export subsidy to US farm producers. The measure is equivalent, in terms of effects, to an import tariff, namely it raises the price of food on the US internal market. Suppose, just for the sake of simplicity, that the domestic price of food rises in the same proportion in which the price of automobiles does, so that the price ratio of final goods does not change.

The peculiarity of the new state of affairs resides in the impossibility of both industries to make use of cheap traded inputs from Mexico due to restrictions imposed by the government; consequently, they use non-traded inputs exclusively. As I emphasized earlier, the ERP issue can be tackled in two different ways, depending on how non-traded inputs are treated: as primary factors or traded inputs. Accordingly, US industries could use only primary inputs, namely labor respectively clean energy or, alternatively, they could use a combination of a primary input (labor) and a traded input, dirty energy. The two types of approach are discussed below:

i) If both sectors use two primary inputs, labor respectively clean energy, the latter is part of the value added. The ERP measures the increase in the value added of a good due to import tariffs (or equivalent measures) relative to its value added under free trade. Mathematically, the ERP is given by the following formula:

$$ERP_j = \frac{q_j\, p_j^t}{q_j\, p_j^w} - 1 = \frac{p_j^t}{p_j^w} - 1 \qquad (4)$$

where:
p_j^t = average price of good *j* when foreign trade with the respective good is subject to government measures (import tariffs, export subsidies etc.);
p_j^w = average price of good *j* under free trade;
q_j = unit of output of good *j*.

If the relative price of final goods does not change, the increase in absolute prices due to tariffs or equivalent measures triggers a proportionate increase in value added. Letting t_j stand for the intensity of the restrictive government measure on good *j*, we have:

$$\frac{\partial p_j^w}{\partial t_j} = \frac{\partial \frac{p_j^t}{p_j^w}}{\partial t_j} = \frac{\partial ERP_j}{\partial t_j} \qquad (5)$$

In brief, equation (5) shows that if US industries use only primary inputs, any government intervention that leads to a rise in goods prices but leaves relative prices unchanged results in a proportionate increase in (nominal and real) value added and implicitly in a proportionate increase in ERP for all goods. No resource shifts will ensue as a result. In the particular case under discussion, since potential trade policy measures are likely to lead to equal increases in the ERP for either of the two goods, there are no incentives for primary factors to move across sectors.

ii) If both sectors use labor as primary input and dirty energy as a traded input, the ERP measures the proportionate increase in the "price" of value added. The production function can be written in partial composition form, as follows:

$$Q_j = f_j(g_j(L), E_j^d) \qquad (6)$$

where:
Q_j = output of good *j*;
f_j = homogenous function of degree 1 in g_j and E_j^d;
$g_j(L)$ = homogenous labor function of degree 1 in *L*;
E_j^d = dirty energy, considered a traded input to production of good *j*.

Admitting production can be split into two separate sequential stages – first, primary inputs are combined to produce the value added; second, the value added is combined with the traded input to produce the final good – the argument of the f_j function consists of two separate independent variables, namely the $g_j(L)$ function respectively E_j^d. Since the former expresses variations in the primary factor, labor, it is a measure of the "quantity" of value added. Taking account of the competitive equilibrium condition (the marginal return product of labor must equal the wage rate), the "price" of a unit of value added is then given by the equation:

$$P_j = p_j \frac{\delta f_j}{\delta g_j} = p_j \frac{\delta f_j}{\delta g_j}\frac{\delta g_j}{\delta L} \qquad (7)$$

where:
$\frac{\delta f_j}{\delta g_j}$ = partial derivative of the *f* function with respect to the first variable, indicating variation of output of good *j* depending on the primary factor function;
$\frac{\delta g_j}{\delta L}$ = variation of the primary factor function in sector *j*, depending on the single factor *L*;
P_j = price of a unit of value added in the output of good *j*;
p_j = price per unit of output of good *j* in terms of some numeraire.

If energy is a traded input, it can be either bought domestically or imported from abroad. Assuming the US economy is in both internal and external equilibrium, production is located in point *M* on the production possibility frontier (PPF), plotted in figure 2, b. In the box diagram (figure 2, a) *M* is located on the contract curve (not drawn), as the tangency point of isoquants that illustrate the production of automobiles (measured from the top right-hand corner) respectively of food (measured from the bottom left-hand corner). In the equilibrium state indicated by point *M* (corresponding to point E_1 in figure 1), the wage rate is equal in the two sectors.

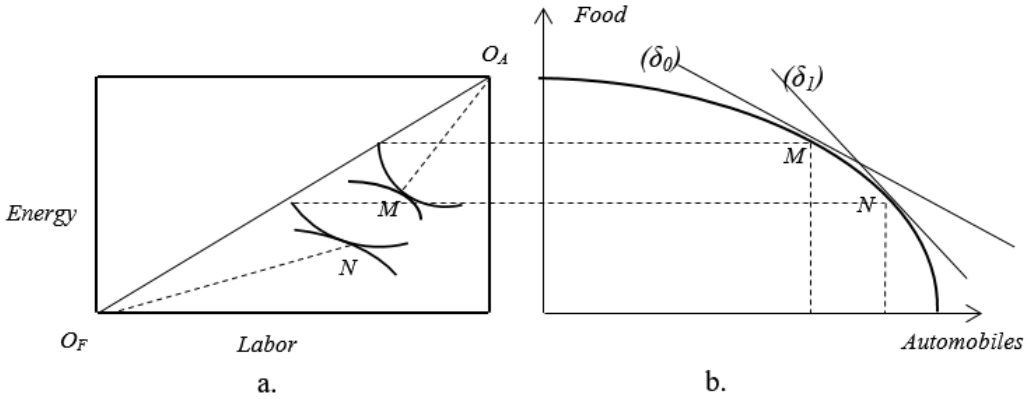

Figure 2.

The diagram clearly shows that food production is labor intensive relative to automobiles. The relative price of final goods is measured by the slope of the (δ_0) tangent to the PPF in point *M*. The imposition of the consumption tax on inputs hampers automobiles producers to outsource production to Mexico, thereby driving the price of automobiles up. Equilibrium shifts to point *N* on the PPF respectively the contract curve. The higher price of automobiles is shown by the greater slope of the (δ_1) tangent as compared to the initial (δ_0) tangent. The subsidization of food exports raises the domestic price of food, so that equilibrium shifts back to point *M*. Thus apparently, the US government's intervention has no effect since the relative price of goods is unchanged and so are outputs of final goods respectively inputs of *L* and E_j^d. Still, the measures do have effect because they alter the effective protection of both automobiles and food industries, due to differences in factor intensity between the two sectors. Because food is labor intensive relative to automobiles, the former has higher proportion of value added (in terms of wages) than the latter. Then according to equation (7), admitting the quantity of energy used is the same, the increase in prices translates into a higher price of value added in automobiles than in food production. Denoting by g_A, g_F the "quantity" of value added in automobiles respectively food sectors, if the proportionate increase in g_A is higher than in g_F, then, given that the relative price of goods is unchanged, the increase in the "price" of a unit of value added will also be higher in automobiles than in food. Mathematically, given that $p_A = p_F$, if:

$$\frac{\delta g_F}{\delta L} < \frac{\delta g_A}{\delta L} \tag{8}$$

then:

$$p_F \frac{\delta f_F}{\delta g_F}\frac{\delta g_F}{\delta L} < p_A \frac{\delta f_A}{\delta g_A}\frac{\delta g_A}{\delta L} \tag{9}$$

equivalent to:

$$P_F < P_A \tag{10}$$

Inequality (10) indicates that ERP is higher in automobiles than in food, a result that apparently refutes the conclusion reached earlier. However, the result is misleading because I mistakenly treated energy as a traded input. In doing so, I failed to abide by the underlying assumption stating that labor is not an input to energy production. Since dirty energy is indeed labor consumption, the result of the second model is unreliable.

In conclusion, energy should be treated as a primary factor and not as a traded input.

7. Conclusions

For all its intrinsic discriminatory nature, regional integration still enjoys widespread promotion due to important advantages it provides to insiders. Outsourcing opportunities, by means of which firms in equally developed and developing economies inside a regional bloc can turn to good account their human and technological capabilities, are doubtless a great benefit. There is still a downside, especially to donor countries: jobs may drift toward their less developed receiving neighbors, arousing discontent and even anger among politicians, business people and the public at large within the former. Outsourcing may then easily turn from a boon into a culprit, fueling the general conviction that reverting to inside trade barriers might set things right.

I discuss the issue with the aid of two influential economic theories that deal with cross-sectoral labor movement: the specific-factors model respectively the effective protection theory. The former can provide an insight into labor shifts triggered by outsourcing but it is of little help in explaining whether and how a demise of outsourcing could generate a movement in reverse. In the particular case of the US economy, the boom in outsourcing within the automobiles industry, generated by the emergence of NAFTA caused a fall in the

relative price of automobiles and a drain on US jobs. Ostensibly, putting an end to outsourcing by raising barriers to trade inside NAFTA might help automobiles producers to retrieve the lost jobs. However, this depends on the sign and magnitude of changes in the effective protection of the sector, relative to similar changes that might occur in other sectors with large involvement in international trade, for example, in food production. The latter model can provide more insight into this problem.

Notes

1. In the automotive industry for instance, which relies heavily on outsourcing, Mexican workers, whose numbers have risen by 100,000 since 2008, are paid about $16 a day, more than $4 less than what the average U.S. autoworker is paid every hour. More than half of all Mexican workers earn less than $15 a day, according to Mexico's census agency. (*More U.S. car imports coming from Mexico*, Associated Press February 23, 2014, http://thedailyrecord.com/2014/02/23/more-u-s-car-imports-coming-from-mexico/)
2. US authorities might invoke the global safeguard clause provided in the NAFTA articles, which enables them to impose quotas or tariffs on Mexico and/or Canada as part of a multilateral safeguard action, when imports from that country account for a substantial share of total imports and contribute importantly to the serious injury or threat thereof. (NAFTA Key Provisions, http://www.iatp.org/files/NAFTA_Key_Provisions.htm)
3. In the economic integration theory jargon, this is an external trade creation. The dichotomy trade creation-trade diversion (the terms were coined by Canadian economist Jacob Viner) helps explain why regional trade blocs in the form of free trade areas and customs unions are discriminatory arrangements vis-à-vis third parties. Viner's purpose was "to disturb the common view among economists and policymakers that a customs union must be a move in the direction of free trade."(Paul Oslington, *Introduction* to *The Customs Union Issue* by Jacob Viner, Oxford University Press, 2014, p. XXXIX)
4. In the 10 months ended in October 2016, automotive vehicle and parts imports from Mexico totaled $89.6 billion, of which, more than half ($46.8 billion) were vehicle parts. U.S. government data show that car parts imports into the U.S., nearly doubled in the past five years. ("Trump is mad about 'made in Mexico' cars — but this is bigger", http://www.cnbc.com/2017/01/03/trump-is-mad-about-made-in-mexico-cars--but-this-is-bigger.html
5. A concept coined by Max Corden: if several activities within an economy are subject to protection, their effective rates can be ordered on a continuous scale to zero.
6. Harmonized Tariff Schedule of the United States, chapter 87 (vehicles other than railway or tramway rolling stock, and parts and accessories thereof), https://hts.usitc.gov/current

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