Reforms of Quantitative Import Restrictions and Fair Wage Unemployment

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Abstract

This paper analyzes piecemeal reforms of quantitative import restrictions in an economy characterized by fair wage unemployment. Using an otherwise standard multi-sector dual general-equilibrium model, conditions are derived for welfare improving reforms. Among other things, it is shown that the existence of unemployment may lead to a situation where the economy is "trapped" in the sense that welfare increasing piecemeal reforms lead it away from the global welfare maximum.

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Key words: Trade Policy Reform, Import Quota, Fair Wages, Unemployment

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1 Introduction

Consecutive rounds of negotiation under the auspices of the GATT have led over the past decades to a considerable decrease in average tariff rates – at least in the developed countries. For the OECD countries, the collected tariff revenue amounted on average to less than 2 percent of the value of imports in 1995, down from nearly 6 percent in 1975 (Ebrill et al., 1999).[1] Their role as dominant means of protection has been taken over in the developed countries by a vast array of nontariff trade barriers (NTBs) and one of the tasks for future WTO rounds is clearly to deal with reducing these NTBs.

In this paper, the focus is on NTBs which restrict imports by imposing a binding upper limit on import quantities. This encompasses, *inter alia*, the cases of pure import quotas and voluntary export restraints (VERs). The paper analyzes the welfare effects of changes in these quantitative import restrictions. It differs from the existing literature on trade policy reforms in that it explicitly considers the existence of involuntary unemployment. In particular, a multi-sector efficiency wage model is used where unemployment arises in equilibrium because workers have a perception of what constitutes a fair wage rate and adjust their effort accordingly. The consideration of involuntary unemployment in the context of trade policy reform is arguably a worthwhile undertaking: The reluctance in many developed countries to consider further steps of trade liberalization may well be explained in part by concerns about the level of domestic employment.

The paper is organized as follows: Section 2 describes the equilibrium of the domestic economy, focusing in particular on the role played by the workers' fair wage consideration. In section 3, the welfare effects of piecemeal changes in the quantitative import restrictions are derived. Section 4 discusses an extension of the preceding analysis, namely the case of endogenous intersectoral wage differentials. Section 5 concludes.

2 Equilibrium in the Domestic Economy

Consider a competitive open economy, consuming and producing $n+1$ tradable goods. There is a single export good which is traded freely with the rest of the world.[2] In addition, there are n import goods which are subject to binding quantitative import restrictions. The export good serves as

[1] In many developing countries, there are still much higher tariff rates. For the Non-OECD countries, Ebrill et al. (1999, p. 14) report an average tariff share of almost 13 percent of the value of imports.

[2] Alternatively, the export good may be reinterpreted as a bundle of freely traded goods with constant relative world market prices. In this case, not all of them have to exported.

numéraire, and its domestic production is denoted by y_0. Production and domestic prices of the importables are denoted by the vectors y and p, respectively.[3] There are $m + 1$ internationally immobile factors of production, where the vector v comprises m factors for which fully flexible factor prices ensure full employment of the exogenously given respective endowments. In addition, there is labor L for which equilibrium unemployment exists.[4]

Unemployment is explained by a variant of the fair-wage effort hypothesis due to Akerlof and Yellen (1990). It is assumed that employees are able to choose their effort at work, and that the amount of effort supplied depends on their personal fairness conception. Following Agell and Lundborg (1995), the representative consumer is assumed to determine his supply of effort by maximizing the additively separable indirect utility function

$$V = v(p, I) + h(\varepsilon^n) \tag{1}$$

with

$$h(\varepsilon^n) = \max_{\varepsilon}\{-(\varepsilon - \varepsilon^n)^2\}. \tag{2}$$

Here, $v(\cdot)$ is the utility from consumption of goods, depending on prices of the non-*numéraire* goods p and income I. The second term, $h(\cdot)$, gives the maximum level of utility due to the choice of effort ε, given the effort norm ε^n. While the effort is a choice variable of the consumer, the effort norm captures the idea of "fair effort" (Agell and Lundborg 1995, p. 338). As will be set out in detail below, the effort norm of the representative consumer is increasing in the differential between his personal wage rate and a reference wage rate. What is important at this stage is the observation that from (2) utility maximizing workers will always choose $\varepsilon = \varepsilon^n$, consequently $h(\cdot) = 0$ for all values of ε^n. In words, the utility maximizing choice of the representative individual involves strict compliance with the effort norm (whatever it might be), and overall utility is independent from equilibrium effort.[5] Hence, (1) with $h(\varepsilon^n) = 0$ serves as the economy's welfare function.

The assumption of a single export good is only made for notational and terminological convenience.

[3]Unless stated otherwise, vectors are column vectors, transposes are denoted by a prime.

[4]It is assumed that $m \geq n$ – i.e., that there are at least as many factors as goods – in order to ensure differentiability of the restricted profit function introduced below.

[5]The assumption of the independence of utility from effort is not unreasonable in a fair wage framework. Agell and Lundborg (1995, p. 338) state this point in great clarity: "If a worker perceives herself as underpaid, she tries to get even. In a fair wage context, the way to get even is to reduce effort – countering unfair pay with low effort increases utility. But the argument also goes in the other direction. If the pay is good, workers derive utility from supplying more effort; they enjoy work, at least up to some point."

Inverting the indirect utility function yields the expenditure function

$$e(p,u) \equiv \min_{x_0,x}\{x_0 + p'x \mid f(x_0,x) \geq u\} \tag{3}$$

with x_0 and x as the demand for the *numéraire* and non-*numéraire* goods, respectively, and $f(\cdot)$ as the direct utility function belonging to $v(\cdot)$. In the following, (3) is used to describe the behavior of the representative consumer.

Denote the reference wage by $s = \Phi(w^e, \bar{w})$ where w^e is the expected wage rate and $\bar{w}$ is a fixed standard wage rate which may either be determined by collective bargaining or be equal to a minimum wage rate. Each worker – employed or unemployed – supplies one unit of labor, and hence the expected wage rate equals labor income per head. It includes an income of zero for the unemployed. Formally,

$$w^e \equiv \frac{1}{\bar{L}} \sum_{i=0}^{n} w_i L_i \tag{4}$$

with w_i as the wage rate in sector i, L_i as the number of workers employed in that sector, and $\bar{L}$ as the economy's labor endowment. $\Phi(\cdot)$ is assumed to be increasing in both arguments and to be linearly homogeneous in $(w^e, \bar{w})$. The relative wage rate $\gamma_i \equiv w_i/s$ determines the effort norm, as stated above. Hence,

$$\varepsilon_i^n = \varepsilon^n(\gamma_i), \qquad \varepsilon^{n\prime} \geq 0. \tag{5}$$

The higher ceteris paribus the average wage rate of the employed workers and the standard wage rate, respectively, and the lower the rate of unemployment, the lower is the effort norm for a given wage rate w_i.[6] In order to ensure the existence of a unique equilibrium, it is assumed that $\varepsilon(\cdot)$ assumes a value of zero up to some positive value of γ_i and is increasing and strictly concave above this threshold level. As workers choose to comply with the effort norm, i.e., supply effort ε equal to ε^n, actual effort is given by

$$\varepsilon_i = \varepsilon(\gamma_i), \qquad \varepsilon' \geq 0. \tag{6}$$

where $\varepsilon(\cdot)$ inherits all properties of $\varepsilon^n(\cdot)$.

As is common in efficiency wage models, profit maximizing firms set wages in stage one of the optimization process and determine the optimal level of employment in stage two. The optimal wage rate in sector i minimizes the

[6]This formulation of the effort norm has been suggested in Albert and Meckl (1998). A similar approach, using the average wage rate of the employed instead of w^e, is put forward by Schlicht (1992).

cost of employing an efficiency unit of labor in that sector, which is w_i/ε. The first order condition of this optimization problem is given by

$$\frac{\partial \varepsilon(\gamma_i)}{\partial \gamma_i} \frac{\gamma_i}{\varepsilon(\gamma_i)} = 1. \tag{7}$$

This is a variant of the familiar Solow condition (Solow 1979), according to which the optimal wage rate is such that the elasticity of the effort function is equal to one. Here, the argument of the effort function is the differential between the actual wage rate and the standard of reference rather than the wage rate itself as in Solow (1979). Therefore, the condition yields an optimal mark-up on the standard of reference $\Phi(\cdot)$, not an optimal wage rate.[7] With homogeneous labor, and therefore identical effort functions in all sectors, firms choose to pay equal wage rates in all sectors of the economy. Hence, $w_i = w$, $\gamma_i = \gamma$, and in equilibrium

$$w = \gamma^* \Phi(w^e, \bar{w}), \tag{8}$$

where γ^* is the profit-maximizing relative wage rate which depends solely on the effort function. It is assumed that γ^* is sufficiently large to make the labor endowment $\bar{L}$ a non-binding constraint to the production sector. Using the linear homogeneity of $\Phi(\cdot)$, (8) can be rewritten to give

$$w = \gamma^* \phi(a) w^e, \tag{9}$$

where $a \equiv \bar{w}/w^e$, $\phi(a) \equiv \Phi(1, a)$, $\phi_a > 0$ and $\phi_{aa} < 0$. From (4) and (9), it follows that

$$L = \frac{\bar{L}}{\gamma^* \phi(a)}, \tag{10}$$

using again $w_i = w$. It follows immediately that $\frac{dL}{da} < 0$ (and $\frac{d^2L}{da^2} > 0$). Equation (9) shows that the mark-up on the expected wage rate which is considered fair by the workers – and hence paid by the employers – increases whenever $\bar{w}/w^e$ increases. Clearly, when all workers strive for improving their situation relative to the expected value of their pay, not all can be successful. Given the constant labor endowment, this implies a decrease in employment, as shown in equation (10).

In stage two, the production sector maximizes profits by choosing the labor input as well as all output quantities, treating parametrically goods

[7] A related condition, using a different standard of reference, appears in Albert and Meckl (1998, 2001).

and factor prices, including w. The equilibrium can be described by the restricted profit function

$$\pi(p, v, L) = \max_{y_0, y} \left\{ p'y + y_0 \,|\, (y_0, y, L, v) \text{ feasible} \right\} \tag{11}$$

where the functional value of $\pi(\cdot)$ gives the value of domestic production. The employment of L is determined endogenously by the condition that its value marginal product in all sectors be equal to the efficiency wage rate, i.e., $p_i \, \partial y_i / \partial L_i = w$ for $i \in (0, \ldots, n)$.[8]

Using (11), the economy's budget constraint with quantitative import restrictions becomes

$$e(p, u) = \pi(p, v, L) + (1 - \beta)t'm, \tag{12}$$

where m is the vector of imports and t is the vector of implicit tariffs. Following Anderson (1994), β denotes the fraction of quota rent which is lost for redistribution to domestic consumers. The polar case $\beta = 0$ denotes the situation where the complete quota rent is captured by the domestic government and redistributed to the household sector. This is the textbook case of an import quota. With $\beta = 1$, the quota rent in its entirety is lost for domestic consumers. This is the case with VERs, where the rent accrues to the foreign suppliers of importables. Alternatively, the quota rent may be wasted domestically in the form of bureaucratic costs of quota administration or costly rent-seeking activities.[9] As VERs are hence not the only situation where the polar case of $\beta = 1$ might be relevant, the term "quota" is used in the following for quantitative import restrictions with all possible rent retention shares, including the polar cases just mentioned.

3 Welfare Effects of Quota Reforms

Throughout the paper, the focus is on the case of a small open economy which cannot influence the world market prices for traded goods. Totally differentiating (12) gives in a first step

$$e_p'dp + e_u du = \pi_p' dp + \pi_L dL + (1 - \beta)(t'dm + m'dt)$$

and eventually, using the derivative properties $\pi_L = w$, $\pi_p = y$, and $e_p = x$ as well as the small country assumption,

$$dI = -\beta m'dp + (1 - \beta)t'dm + wdL. \tag{13}$$

[8]Nothing would change if instead of L one would consider the demand for labor in efficiency units, εL, in which case the marginal value product would equal w/ε in equilibrium.

[9]See Krueger (1974) for the second argument.

Here, $dI \equiv e_u du$ denotes the change in real income which is the measure of welfare change employed below. Equation (13) shows that quota reforms in the present setting have three types of welfare effects. The first and second are the terms of trade effect and the volume of import effect, respectively, known from the full employment variant of the model (Anderson and Neary, 1992). With $\beta = 0$ (full rent retention), the terms of trade effect vanishes because price changes of the importables constitute a pure domestic redistribution effect. With $\beta = 1$ (zero rent retention), the volume of import effect vanishes because changes in the quota rents are not welfare relevant. The third effect in (13) is an employment effect which is absent in the standard model. It stands out among the three in that it is independent from the rent retention share. It is seen in (13) that in the intermediate case $0 < \beta < 1$ welfare increases *ceteris paribus* with an increase in employment, an increase in the volume of imports, and a decrease in the domestic prices of importables.

With import quotas, dp as well as dL are endogenous. In order to derive the relation between the welfare change and changes in the policy instruments, appropriate substitution must be made for both endogenous variables in (13). From (10), the price derivatives of L are given by

$$\frac{dL}{dp} \equiv \left(\frac{dL}{dp_1}, \ldots, \frac{dL}{dp_n}\right)' = L_\phi \phi_a a_p, \tag{14}$$

and substituting into (13) gives

$$dI = \left(w\frac{dL}{dp} - \beta m\right)' dp + (1-\beta)t' dm$$

At this stage, it remains to substitute for dp. From $m = e_p - \pi_p$, it follows that changes p and m are related in the following way:

$$dm = \mathrm{S}dp + e_{pu}du - \pi_{pL}\left(\frac{dL}{dp}\right)' dp$$

with

$$\mathrm{S} \equiv e_{pp} - \pi_{pp}$$

and $\frac{dL}{dp}$ being given by (14). The matrix S, which denotes the price derivatives of compensated net import demand functions with L constant, is negative semidefinite (Dixit and Norman, 1980). Solving for dp gives

$$dp = \Psi^{-1}\big(dm - e_{pu}du\big) \tag{15}$$

with

$$\Psi \equiv \mathrm{S} - y_L \left(\frac{dL}{dp}\right)'.$$

The elements of the matrix Ψ are the price derivatives of compensated net import demand, taking into account the output effects of the optimal change in L. The latter are captured by the matrix $y_L(\frac{dL}{dp})'$ which is positive definite, as shown in the appendix. Hence, the adjustment in L increases the price responsiveness of net import demand and Ψ is negative definite.[10]

Substituting (15) into (13) eventually gives the central equation for assessing the welfare effects of quota reforms:

$$\mu^{-1} dI = \left(\left((w\frac{dL}{dp} - \beta m\right)' \Psi^{-1} + (1-\beta)t'\right) dm \qquad (16)$$

with

$$\mu \equiv \left(1 + \left(w\frac{dL}{dp} - \beta m\right)' \Psi^{-1} x_I\right)^{-1}, \qquad x_I = \frac{e_{pu}}{e_u}.$$

Here, x_I is the income derivative of demand and μ is the shadow price of foreign exchange. The latter measures the domestic welfare change effected by the transfer on one unit of the *numéraire* good from abroad and – following standard practice – is assumed to be positive. This assumption is most easily justified by noting that with a negative shadow price of foreign exchange, the small open economy would gain by giving transfers to the rest of the world. Clearly, in such a situation paradoxical results would be forthcoming.[11] The three welfare effects from equation (13) reappear on the right hand side of (16). One can see that the employment effect of a change in import quotas operates via the induced change in domestic goods prices measured by the matrix Ψ^{-1}. Clearly, as in the standard model of Neary (1988), the same holds true for the terms-of-trade effect while the volume of import effect directly depends on the change in import quotas.

Of central importance for the following is the interpretation of the elements of $\frac{dL}{dp}$. In analogy to the definition of Dixit and Norman (1980, p. 57) for the standard full employment model, sector i is said to be labor intensive

[10] This result is remarkable because it does *not* follow from the Le Châtelier principle which assumes a constant factor price. In contrast, w varies endogenously.

[11] See, e.g., Neary (1995, p. 540) for different justifications of this assumption, including the one given above. The derivation of the shadow price of foreign exchange in a similar but slightly simpler model with minimum wage unemployment is given in Kreickemeier (2001).

in a general-equilibrium sense if and only if $\frac{dL}{dp_i} > 0$. In fact, it follows from (8) and (10) that

$$\text{sign}\left(\frac{\partial w}{\partial p_i}\right) = \text{sign}\left(\frac{\partial w^e}{\partial p_i}\right) = \text{sign}\left(\frac{dL}{dp_i}\right) \tag{17}$$

and that hence all these terms can interchangeably be used as measures of labor intensity. Intuitively, an increase (decrease) in aggregate labor income – and hence the expected wage rate w^e – is brought about in the present model by a combined increase (decrease) in the wage rate *and* the level of employment. It is assumed in the following that all $\frac{dL}{dp_i}$ keep their respective signs in the course of the reforms considered. That is, the analysis presumes the absence of factor intensity reversals.

In order to facilitate intuitive explanations of the results, the focus is on the case of a single non-*numéraire* good.[12] In this case, Ψ is a negative scalar, and $\frac{dL}{dp} > 0$ if and only if the importable is labor intensive. Furthermore, in order to derive clear-cut results, the formal analysis is confined to the polar cases of either zero or full rent retention. With full rent retention, (16) collapses to

$$\mu^{-1} dI = \left(w\frac{dL}{dp}\Psi^{-1} + t\right) dm \tag{16'}$$

with

$$\mu \equiv \left(1 + w\frac{dL}{dp}\Psi^{-1}x_I\right)^{-1}.$$

In this case, it is straightforward to see the following:

Proposition 1. *With full rent retention, the piecemeal relaxation of an import quota up to the free trade level increases welfare continuously if and only if the importable is not labor intensive. If the importable is labor intensive, partial quota relaxation may be welfare increasing for a sufficiently low initial level of imports.*

If the importable is not labor intensive, the term in brackets on the right hand side of (16′) is positive, and hence a reform of the type $dm > 0$ must lead to a welfare increase. Intuitively, the increase in imports leads to a decrease in the domestic price of the importable, implying an increase in the expected wage rate, a decrease in the wage differential w/w^e and hence an increase in

[12]Modifications of the results which must be made in the case of many import quotas are mentioned in footnotes.

employment. In addition, there is the positive volume of trade effect. In the opposite case of the importable being labor intensive, the volume of trade effect is unaltered but now the employment effect is negative. The price decrease of the importable leads to a decrease in the expected wage rate, an increase in the wage differential and hence a decrease in employment. For sufficiently high import levels, the volume of trade effect becomes negligible because the implicit tariff t approaches zero, and it is therefore sure that the employment effect dominates in this case. It is conceivable that the volume of trade effect dominates for a lower level of imports – implying a higher implicit tariff – and that hence a partial relaxation of the import quota increases welfare with the importable being labor intensive. *Ceteris paribus*, this is more likely the higher the implicit tariff of a prohibitive import quota.[13]

With zero rent retention and a single importable, (16) collapses to

$$\mu^{-1} dI = \left(w \frac{dL}{dp} - m \right) \Psi^{-1} dm \tag{16''}$$

with

$$\mu \equiv \left(1 + \left(w \frac{dL}{dp} - m \right) \Psi^{-1} x_I \right)^{-1}.$$

In this case, the central result is the following:

Proposition 2. *With zero rent retention, the piecemeal relaxation of an import quota up to the free trade level increases welfare continuously if the importable is not labor intensive. If the importable is labor intensive, a piecemeal quota relaxation decreases welfare for a sufficiently low initial level of imports but may be welfare increasing for higher import levels.*

If the importable is not labor intensive, the term in brackets on the right hand side of (16″) is negative, and hence a reform of the type $dm > 0$ must lead to a welfare increase. Besides the employment effect, which is identical to the case of full rent retention, the increase in imports has a positive terms of trade effect. With a labor intensive importable, the labor income effect changes its sign, as above, while the terms of trade effect is unaltered. The terms of trade effect becomes negligible for sufficiently low import levels, and hence the employment effect dominates in this case. The higher the level of

[13]In the case of many import quotas, the results are unaltered if either all importables or none of them are labor intensive (all elements in $\frac{dL}{dp}$ are of equal sign) and furthermore all importables are net substitutes in import demand (all elements of Ψ^{-1} are negative).

imports, the larger is the terms of trade effect, i.e., the welfare impact of a change in the terms of trade. It is therefore conceivable that it outweighs the employment effect for sufficiently high import volumes and that hence, once a certain critical import level is reached, further relaxations of the quota increase welfare.[14]

Now, let a "trap" in the present context denote a situation where a welfare increasing piecemeal reform leads the economy away from the global welfare maximum. Then, it is straightforward to see the following:

Proposition 3. *Consider the case of zero rent retention and a labor intensive importable. Then, the economy may be caught in a low import trap if welfare with a prohibitive quota is lower than welfare with free trade. The economy may be caught in a high import trap if the opposite is true.*

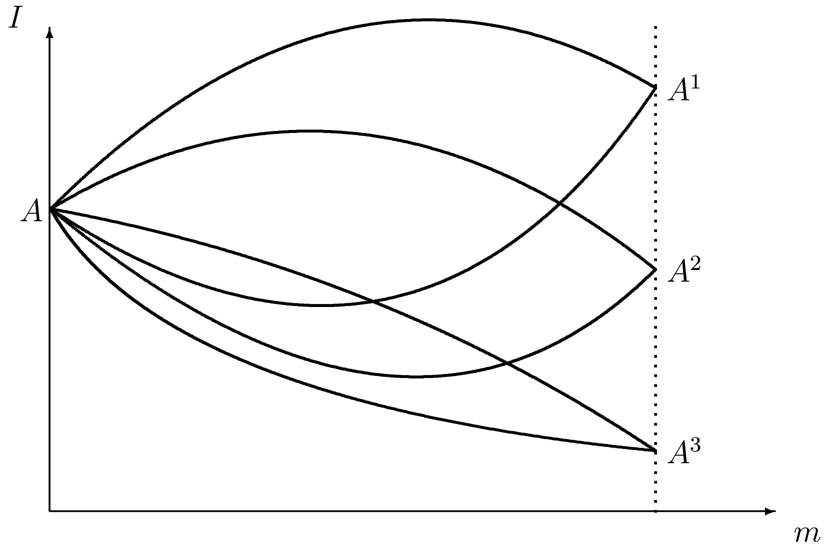
Assume that the above mentioned critical level of imports is relevant in the sense that it is below the free trade import level. Then, welfare increasing piecemeal reforms will lead the economy to a prohibitive import quota if imports are below the critical level initially and to free trade if imports are above this level initially. Clearly, the former reform path leads into the "wrong" direction – and the economy is therefore in a low import trap – if and only if free trade is welfare superior to a prohibitive quota. Similarly, the latter reform path leads into the "wrong" direction – and the economy is therefore in a high import trap – if and only if a prohibitive quota is welfare superior to free trade.

4 A Graphical Illustration

The above results lend themselves to a straightforward graphical illustration. To this end, possible runs of the function $I(m)$ are drawn for the cases $\beta = 1$ and $\beta = 0$, respectively – following Neary (1988), who derived this function for the standard case of a small open economy with full employment. Neary showed that with full rent retention and a single importable, welfare is a concave function of the quota level, while with zero rent retention it is "approximately" a convex function of the quota level. As the respective quota is the only distortion in Neary's model, it is obvious that in addition both functions must be monotonously increasing in the quota level. Furthermore, they coincide for the autarky and free trade points because the quota rent is zero in these cases.

[14]With many import quotas, the critical level of imports is a vector, but the results are otherwise unaltered if all elements of $\frac{dL}{dp}$ are of equal sign and all elements of Ψ^{-1} are negative – which are the same qualifications as in the above case of full rent retention.

Figure 1: Possible quota effects on welfare with $\frac{dL}{dp} > 0$



In the present context, the slope and curvature of $I(m)$ are derived as follows: As in Neary (1988), the results are derived under the assumption that Ψ and x_I are constant. The same assumption is made here with respect to the employment effect $w\frac{dL}{dp}$.[15] In this case, the slope and curvature of $I(m)$ in the case of full rent retention can be derived from (16′) as

$$\frac{dI}{dm} = \mu\left(w\frac{dL}{dp}\Psi^{-1} + t\right) \tag{18}$$

$$\frac{d^2I}{dm^2} = \mu\frac{dt}{dm} < 0 \tag{19}$$

Hence, one can see that welfare is a strictly concave function of the import quota. In addition, there is an optimum implicit tariff

$$t^o = -w\frac{dL}{dp}\Psi^{-1}$$

which is positive if and only if the importable is labor intensive.

[15]It is shown in the appendix that $w\frac{dL}{dp}$ may be increasing or decreasing in p – and that hence it is acceptable to assume it being constant – but it is more plausible that it increases. In this case, the results derived for the more interesting case of zero rent retention are strengthened, while those for the case of full rent retention are weakened.

With zero rent retention, the analogous results follow from (16″) as

$$\frac{dI}{dm} = \mu\Psi^{-1}\left(w\frac{dL}{dp} - m\right) \tag{20}$$

$$\frac{d^2 I}{dm^2} = -\mu^2\Psi^{-1} > 0 \tag{21}$$

where the derivation of (21) is given in the appendix. Welfare is a strictly convex function of the import level in this case, and there is a welfare minimizing critical import

$$m^m = w\frac{dL}{dp}$$

which is positive if and only if the importable is labor intensive.

Three possible runs of the function $I(m)$ are given in figure 1 for the more interesting case of $\frac{dL}{dp} > 0$.[16] The thin lines denote the case of zero rent retention and the bold lines denote the case of full rent retention. With zero rent retention, $I(m)$ is decreasing in the neighborhood of the autarky point, while with full rent retention it decreases in the neighborhood of the free trade point – these being, as set out above, the points where the respective non-employment effects vanish. The reform paths AA_1 and AA_2 show situations where the optimum implicit tariff and the critical import level, respectively, lie between the free trade and the autarky point. The reform path AA_3 on the other hand shows a situation where the optimum implicit tariff exceeds the prohibitive tariff and the critical import level exceeds the free trade level of imports. The difference between the cases of zero and full rent retention is obvious from figure 1: With full rent retention, the small open economy cannot be caught in a high or low import trap because of the concavity of the reform path. This is different with zero rent retention. A low import trap exists if the reform path is AA_1 and the economy starts off with an import level below the critical level which is illustrated by the minimum of AA_1. In contrast, AA_2 in combination with a starting point to the right of the reform path's minimum denotes a high import trap. Finally, no trap of any sort exists in the case of the monotonously decreasing reform path AA_3.

5 Intersectoral Wage Differentials

The results derived can be extended in a straightforward way to incorporate stable intersectoral wage differentials for homogeneous labor.[17] To this end,

[16] With $\frac{dL}{dp} < 0$, all reform paths are strictly increasing in the level of imports.

[17] See the influential study by Krueger and Summers (1988) who find large intersectoral differentials for equally skilled workers.

a variant of the efficiency wage model by Albert and Meckl (1998, 2001) is employed. Following their suggestion, it is assumed that the productivity of effort is sector specific due to differences in the production technology between the sectors. This gives rise to sector specific functions

$$g_i(\gamma_i) = G_i[\varepsilon(\gamma_i)], \tag{22}$$

where it is assumed that $G_i' > 0$ and $G_i'' \leq 0$. The so-called efficiency functions $g_i(\cdot)$ translate physical labor units into efficiency units in the same way as effort function does this in the model employed above. The optimal wage differential γ_i for sector i is now given by the solution to

$$\frac{\partial g_i(\gamma_i)}{\partial \gamma_i} \frac{\gamma_i}{g_i(\gamma_i)} = 1 \tag{23}$$

which is another variant of the Solow condition.[18] Depending only on the functional form of $g_i(\cdot)$ in all sectors i, there are sector specific optimal mark-ups γ_i^*, and hence stable intersectoral wage differentials. As labor is paid its marginal value product, the latter is not equalized either between sectors. Clearly, the same result would follow if one assumed sector specific effort functions, as in Schweinberger (1995). The two-step approach chosen here has the advantage that it is compatible with identical attitudes towards fairness in all sectors.

From the employers' point of view, labor in efficiency units instead of physical units is the relevant production factor. Efficient labor in sector i is given by $L_i^\varepsilon \equiv g_i(\gamma_i^*)L_i$, and it is paid the wage rate $\gamma_i^* s/g_i(\gamma_i^*)$. As the fraction $\gamma_i^*/g_i(\gamma_i^*)$ is sector specific, efficient labor is paid sector specific wages as well. The analysis is simplified considerably if instead of efficient labor proper a transformed variable N_i is considered which in the following is called "normalized efficient labor". It is defined as follows:

$$N_i \equiv \frac{\gamma_i^*}{g_i(\gamma_i^*)} L_i^\varepsilon$$

This operation transforms efficient labor in different sectors into units for which the marginal value product in all sectors and hence the wage rate is equalized. It follows immediately that because of the particular transformation chosen, normalized efficient labor is paid the reference wage s in all

[18] The assumptions made on $G_i[\cdot]$ and $\varepsilon(\cdot)$ ensure the existence of unique sector-specific wage differentials γ_i^*.

sectors.[19] The aggregate employment of normalized efficient labor is given by N. Now, the second stage of the optimization process can be described by a restricted profit function similar to (11), namely:

$$\pi(p, v, N) = \max_{y_0, y} \left\{ p'y + y_0 \,|\, (y_0, y, v, N) \text{ feasible} \right\} \tag{24}$$

The only difference between (11) and (24) lies in the substitution of normalized efficient labor for physical labor. Hence, all the results derived above continue to hold, provided that the appropriate substitution is made.

While the statement of the modified results would be mostly repetitive and is therefore omitted here, two points are worth emphasizing. Firstly, the role of labor intensity from the model with a single efficiency wage rate is taken over by the "intensity with respect to normalized efficient labor" in the present context. Secondly, an increase in the employment of physical labor which was *ceteris paribus* welfare increasing in the preceding model, does not necessarily continue to be welfare increasing here. Again, the change in the employment level of normalized efficient labor is relevant for the welfare effect, and it is conceivable that $\frac{dL}{dp_i}$ and $\frac{dN}{dp_i}$ have opposite signs.[20]

6 Conclusion

This paper has shown a straightforward way in which involuntary unemployment can be incorporated into an otherwise standard multi-sector model of trade policy reform. Despite the complexity of the model with variable but non-market-clearing wages, the central results are clear. In particular, the important role played by the labor intensity of the import competing sector, which is familiar from standard trade models, is retained – although the chain of reasoning is completely different here. If the importables are not produced labor intensive domestically, piecemeal quota liberalization poses no problems. This is different with labor intensive importables, where the case for quota liberalization is weakened – but not necessarily eliminated. What the analysis makes transparent is the fact that employment effects matter, but they constitute in all cases only a part of the total welfare effect. One

[19] Albert and Meckl (1998, 2001) define the variable "labor absorption" $N_i \equiv \gamma_i^* L_i$ which – because of $L_i^\varepsilon \equiv g_i(\gamma_i^*) L_i$ – is formally identical to the variable "normalized efficient labor" introduced here. In the model of Albert and Meckl, N is constant because of an assumption on the formation of the effort norm which differs from the one made here. In particular, the authors assume $s = w^e$.

[20] This generalizes a result by Albert and Meckl (1998, 2001), where $\frac{dN}{dp_i}$ is equal to zero throughout while $\frac{dL}{dp_i}$ may have either sign.

last aspect highlighted in the preceding analysis is the crucial role played by the rent retention share. It has been shown that if for some reason the rent is not distributed to domestic consumers, there exist plausible scenarios where welfare increasing piecemeal quota reforms lead the economy into the wrong direction, i.e., away from the optimum level of imports. Put differently, if the economy strives for the global welfare maximum, there may exist situations where there is no way around a "valley of tears" with intermediate reform stages involving welfare losses. This case cannot occur in the standard model with full employment.

Appendix

Positive Definiteness of the Matrix $y_L(\frac{dL}{dp})'$

From Young's theorem, $y_L = w_p'$, where y_L is an $(n \times 1)$ matrix and w_p is a $(1 \times n)$ matrix. Using $w = \gamma^* \Phi(w^e, \bar{w})$, it follows that

$$y_L = \gamma^* \Phi_{w^e} \left(w_p^e\right)' . \tag{25}$$

Using (14) as well as the definition of a, it follows that

$$\frac{dL}{dp} = -L_\phi \phi_a \frac{\bar{w}}{\left(w^e\right)^2} \left(w_p^e\right)' \tag{26}$$

and hence

$$y_L \left(\frac{dL}{dp}\right)' = \left(w_p^e\right)' \mathrm{M} w_p^e \tag{27}$$

with

$$\mathrm{M} \equiv -\gamma^* \Phi_{w^e} L_\phi \phi_a \frac{\bar{w}}{\left(w^e\right)^2} > 0$$

The matrix $\left(w_p^e\right)' \mathrm{M} w_p^e$ is a quadratic form in a positive scalar and therefore positive definite.

Convexity of $I(m)$ with zero rent retention

Differentiating (20) w.r.t. m gives, under the assumption that Ψ, $w\frac{dL}{dp}$ and x_I are constant,

$$\frac{d^2 I}{dm^2} = \frac{-\left(\Psi + \left(w\frac{dL}{dp} - m\right) x_I\right) + \left(w\frac{dL}{dp} - m\right) x_I}{\left(\Psi + \left(w\frac{dL}{dp} - m\right) x_I\right)^2}$$

$$= \frac{-\Psi}{\mu^{-2}\Psi^2} = -\mu^2\Psi^{-1} > 0$$

The employment effect $w\frac{dL}{dp}$ with a single importable

The welfare relevant employment effect of a change in the price of the importable, $w\frac{dL}{dp}$, does in general vary with the price level. Differentiation with respect to p gives

$$\frac{d(w\frac{dL}{dp})}{dp} = \underbrace{w_p\frac{dL}{dp}}_{+} + \underbrace{w\frac{d^2L}{dp^2}}_{?} \tag{28}$$

where

$$\frac{d^2L}{dp^2} = \underbrace{L_{\phi\phi}\phi_a^2 a_p^2}_{+} + \underbrace{L_\phi \phi_{aa} a_p^2}_{+} + \underbrace{L_\phi \phi_a}_{-} \underbrace{a_{pp}}_{?}$$

and

$$a_{pp} \equiv \frac{d^2\left(\frac{\bar{w}}{w^e(p)}\right)}{dp^2} = \underbrace{\frac{\bar{w}}{(w^e)^2}}_{+}\left(\underbrace{2\frac{\left(w_p^e\right)^2}{w^e}}_{+} - \underbrace{w_{pp}^e}_{?}\right).$$

One can see that the sign of (28) is indeterminate in general because w_{pp}^e can have either sign.

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