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by

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Abstract

We show that the standard concertina result for tariff reforms – i.e. lowering the highest tariff increases welfare – no longer holds in general if we allow for international capital mobility. The result can break down if the good whose tariff is lowered is not capital intensive. If the concertina reform lowers welfare it lowers market access as well, thereby compromising a second goal that is typically connected with trade liberalisation.

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Outline

1. *Introduction*
2. *The Model*
3. *A Link Between Welfare and Market Access*
4. *Conclusion*

Non-Technical Summary

On most people's lists of results from the trade theory literature with a direct impact on the policy-making community, the concertina theorem would occupy a prominent position: Under the assumption of substitutability between the goods, lowering the highest among a number of tariffs in an otherwise distortion-free small open economy with many goods and factors increases welfare, as does the increase in the lowest tariff. The concertina rule is widely used in practice, e.g. it underlies the well established World Bank recommendation that developing countries reduce the dispersion of tariffs when liberalising trade.

One aim of this paper is to explore the robustness of the concertina rule to the presence of international factor mobility. This seems an obvious undertaking given the prevalence of cross-border flows of factors of production (to which in this paper we collectively refer as capital). Yet, surprisingly, the question seems not to have been studied before. As one main result of our paper, we show that the concertina reform may indeed lower welfare in the presence of international capital mobility. It turns out that this possibility exists if the good with the highest tariff is not capital intensive.

We furthermore explore the role that international capital mobility has in determining the market access effects of the single-tariff reforms we consider, i.e. their effect on the value of imports. In doing so, we relate to the recent literature on trade liberalisation and market access. One important result of this literature is the finding that there is a potential conflict between the welfare and market access objectives of trade liberalisation, i.e. not every reduction in tariffs that increases welfare does increase the overall import value. However, under standard assumptions it is impossible for import value and welfare to fall at the same time as a consequence of trade liberalisation. We show that this "no-double-loss" (NDL) proposition can be overturned as well if international capital mobility is allowed. In the case of the concertina reform, this is again possible if the good with the highest tariff is not capital intensive. In addition we show that any concertina reform that lowers welfare will lower market access as well, while the reverse is not true. We are thus able to point out a close link between one of the core welfare results from the trade reform literature and an early core result in the still developing market access literature.

Intuitively, international capital mobility changes the results of the standard model because in its presence trade in goods is no longer balanced in general as there are now cross-border payments to capital owners. If trade liberalisation leads to capital inflows, domestic imports will increase by less than domestic exports. Capital inflows in turn occur in the course of a concertina reform if the good with the highest tariff is not capital intensive.

1 Introduction

On most people's lists of results from the trade theory literature with a direct impact on the policy-making community, the concertina theorem would occupy a prominent position. This is probably due to both its simplicity and intuitive appeal: Under the assumption of substitutability between the goods, lowering the highest among a number of tariffs in an otherwise distortion-free small open economy with many goods and factors increases welfare, as does the increase in the lowest tariff. The concertina rule is widely used in practice, e.g. it underlies the well established World Bank recommendation that developing countries reduce the dispersion of tariffs when liberalising trade. One aim of this paper is to explore the robustness of the concertina rule to the presence of international factor mobility. This seems an obvious undertaking given the prevalence of cross-border flows of factors of production (to which in the following we will collectively refer as capital). Yet, surprisingly, the question seems not to have been studied before.¹

To be sure, a (small) subset of contributions to the literature on trade policy reform does look at the question of international capital mobility, but with a different focus. Neary and Ruane (1988) show that unrestricted international capital mobility increases the cost of tariff protection because *ceteris paribus* the import reductions induced by a given tariff vector are bigger if capital is internationally mobile. The analysis by Neary

¹Abe (1992) analyses the concertina result in the presence of public goods, Lopez and Panagariya (1992) look at the case of imported intermediate inputs, Diewert et al. (1991) allow for the presence of multiple households, nontraded goods and domestic distortions, while Beghin and Karp (1992) look at the concertina result in the presence of producer specific subsidies.

and Ruane implies that a second standard result from the literature on tariff reforms – namely that proportional reductions of all tariffs are welfare increasing – does still hold when capital is internationally mobile. Neary (1993) extends the analysis to the case where international capital flows are subject to taxes and shows that a proportional reduction of taxes to goods and factor trade is welfare increasing. In addition, Neary analyses separate reforms of tariffs and investment taxes but does not look at the question of interest in this paper, i.e. changes in the tariff structure. As one main result of our paper, we show that the concertina reform may indeed lower welfare in the presence of international capital mobility. It turns out that this possibility exists if the good with the highest tariff is not capital intensive.

We furthermore explore the role that international capital mobility has in determining the market access effects of the single-tariff reforms we consider, i.e. their effect on the value of imports. In doing so we relate to the recent literature on trade liberalisation and market access, most notably Ju and Krishna (2000) and Anderson and Neary (2006), who look at this question for a small open economy without factor mobility. Ju and Krishna (2000) have shown that – perhaps surprisingly – there is a potential conflict between the welfare and market access objectives of trade liberalisation, i.e. not every reduction in tariffs that increases welfare does increase the overall import value. Ju and Krishna show however that under standard assumptions it is impossible for import value and welfare to fall at the same time as a consequence of trade liberalisation. We show that this “no-double-loss” (NDL) proposition can be overturned as well if international capital mobility is allowed. In the case of the concertina reform, this is again possible if the good with

the highest tariff is not capital intensive. In addition we show that any concertina reform that lowers welfare will lower market access as well, while the reverse is not true. We are thus able to point out a close link between one of the core welfare results from the trade reform literature and an early core result in the still developing market access literature.

Intuitively, international capital mobility changes the results of the standard model because in its presence trade in goods is no longer balanced in general as there are now cross-border payments to capital owners. If trade liberalisation leads to capital inflows, domestic imports will increase by less than domestic exports. Capital inflows in turn occur in the course of a concertina reform if the good with the highest tariff is not capital intensive. In section 2 we develop the basic framework and derive the two main results with regard to the welfare effect (section 2.1) and market access effect (section 2.2) of tariff reforms. Section 3 links the two results. Section 4 concludes.

2 The Model

The analysis is conducted in the framework of a competitive small open economy producing $n + 1$ final goods using internationally mobile capital k as well a vector of internationally immobile factors of production v . Supply can be described by the restricted profit function

$$\pi(p, r) \equiv \max_{y_0, y, k} \{y_0 + p'y - rk \mid (y_0, y, k) \text{ feasible}\} \quad (1)$$

where p are the domestic prices of non-numeraire goods and y their supplies, y_0 is the supply of the numeraire good (with $p_0 \equiv 1$), r gives the domestic and foreign return to internationally mobile capital and k its domestic employment.² The vector of internation-

²All vectors are column vectors, and their transposes are denoted by a prime.

ally immobile factors is held constant throughout the analysis and therefore suppressed as an argument $\pi(\cdot)$, as is the price of the numeraire good. The tariff on the numeraire good is zero, and it can in fact be interpreted as a composite of potentially many export goods. Import goods with zero tariffs, on the other hand, are part of the vector of non-numeraire goods.³ The properties of $\pi(\cdot)$ are standard. Notably, it is homogenous of degree one in the price vector (p_0, p, r) . GNP is given by the mobile-capital GNP function

$$\tilde{\pi}(p, r) = \pi(p, r) + r\bar{k}, \quad (2)$$

where \bar{k} denotes the economy's endowment of mobile factors that is held constant throughout and hence suppressed as an argument of $\tilde{\pi}(\cdot)$.

Demand is summarized in the expenditure function

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

with (x_0, x) as the vector of compensated demand functions and $f(\cdot)$ as the direct utility function. We can now define the mobile capital trade expenditure function

$$E(p, r, u) \equiv e(p, u) - \tilde{\pi}(p, r), \quad (4)$$

and we have

$$E_p(\cdot) = e_p(\cdot) - \tilde{\pi}_p(\cdot) = m \quad \text{and} \quad E_r(\cdot) = -\tilde{\pi}_r(\cdot) = k - \bar{k} = \tilde{k}, \quad (5)$$

where m is the vector of (gross and net) imports of the non-numeraire goods, and \tilde{k} are

³The distinction between untaxed imports and exports is not not important for the welfare analysis but matters for the analysis of market access.

net capital imports. This allows us to write the economy's budget constraint as

$$E(p, r, u) = t'm, \quad (6)$$

where t is the vector of per unit tariffs. Differentiation for a constant value of r yields, after substituting for m , and using the small country assumption, the central equation describing the welfare change:

$$\mu^{-1}du = t'E_{pp}dt \quad (7)$$

where $\mu \equiv (E_u - t'E_{pu})^{-1}$ is the shadow price of foreign exchange which is assumed positive, by standard reasoning.⁴

2.1 Welfare Effects of Trade Liberalisation

Rewriting the welfare equation for the case where only the tariff on good k is altered gives

$$\mu^{-1}du = \sum_{i \neq 0} t_i E_{ij} dt_j \quad (8)$$

where E_{ij} is short for $E_{p_i p_j}$. We now rewrite this equation in terms of ad valorem tariffs, where for convenience we use ad valorem tariffs τ defined as a proportion of the domestic price, hence $\tau_i \equiv t_i/p_i$. We then get

$$\begin{aligned} \mu^{-1}du &= \left(\tau_j + (p_j E_{jj})^{-1} \sum_{i \neq 0, j} t_i E_{ij} \right) p_j E_{jj} dt_j \\ &= \left(\tau_j + \sum_{i \neq 0, j} \frac{p_i E_{ij}}{p_j E_{jj}} \tau_i \right) p_j E_{jj} dt_j \\ &= \left(\tau_j - \sum_{i \neq 0, j} \omega_{ij} \tau_i \right) p_j E_{jj} dt_j \end{aligned} \quad (9)$$

⁴See Neary (1995, 539-40) for a collection of arguments justifying this assumption.

where

$$\omega_{ij} \equiv -\frac{p_i E_{ij}}{p_j E_{jj}}, \quad \omega_{rj} \equiv -\frac{r E_{rj}}{p_j E_{jj}}, \quad \sum_{i \neq 0, j} \omega_{ij} = 1 - \omega_{0j} - \omega_{rj},$$

using the linear homogeneity of the mobile capital trade expenditure function in (p_0, p, r) .

Lowering the tariff on good j increases welfare if and only if the term in brackets is positive.

The constrained optimal tariff on good j for given values of the other tariffs is given by

$$\tau_j^o = \sum_{i \neq 0, j} \omega_{ij} \tau_i. \quad (10)$$

It is instructive to compare (9) with the analogous formula in the model without international factor mobility, as given in equation (8) of Neary (1998). The formula in this case is identical to (9) but for the fact that ω_{rj} is excluded. In order to see what difference this makes, it is helpful to rewrite (9) as

$$\mu^{-1} du = \left(\sum_{i \neq 0, j} \omega_{ij} (\tau_j - \tau_i) + (\omega_{0j} + \omega_{rj}) \tau_j \right) p_j E_{jj} dt_j. \quad (11)$$

Consider the case where τ_j is the largest ad valorem tariff. Under the usual assumption that all goods are net substitutes for good j in import demand (and hence all ω_{ij} are positive), the first summation term is strictly positive. Note that ω_{rj} is positive if and only if good j is capital intensive in a general equilibrium sense, i.e. if a decrease in p_j decreases the economy-wide employment of internationally mobile capital. Hence, the concertina result “from above” (lowering the highest tariff increases welfare) holds if good j is capital intensive. It does not necessarily hold if good j is not capital intensive. It is easily seen from (11) that a necessary condition for the concertina result to break down is $\omega_{0j} + \omega_{rj} < 0$.

What leads to the breakdown of the concertina result from above if good j , the good with the highest tariff, is not capital intensive? With good j a substitute for all other goods, reducing the tariff on j increases imports of this good and decreases net imports of all other goods (which for the numeraire good amounts to an increase in exports). Consider first the case where capital mobility is absent and therefore the changes in net imports at domestic prices sum to zero. With an increase in exports, this implies that the increase in import value at domestic prices of good j exceeds the combined decrease in import value of all the other import goods. With τ_j the highest tariff, this translates into an increase in tariff revenue at constant domestic prices and hence a welfare increase. With international capital mobility and good j not capital intensive, lowering τ_j leads to a capital inflow into the country. For simplicity, set $E_{0j} = 0$, i.e. lowering the tariff on good j leaves exports unchanged. Then the sum of the increase in import value of good j and capital inflows at domestic prices equal the decrease in import value of all other goods, and hence the import value at domestic prices falls. Even with τ_j the highest tariff it is now possible that tariff revenue – and hence welfare – decreases. With $E_{0j} > 0$ this becomes less likely, but is still a possibility.

It is easily checked also in (11) that the concertina result “from below” (introducing a tariff on a previously freely traded good increases welfare) holds irrespective of the capital intensity of this good: With $\tau_j = 0$, the term in brackets becomes strictly negative, which gives the stated result. Intuitively, this is because increasing τ_j from zero increases imports of all other goods, thereby increasing tariff revenue at constant domestic prices unambiguously. The results can be summarized as follows.

Proposition 1. *Let good j be a net substitute for all other goods. Then, if j is the good with the highest ad valorem tariff, lowering this tariff may lower welfare if and only if j is not capital intensive. If j is freely traded initially, introducing a small tariff on its imports increases welfare irrespective of whether j is capital intensive or not.*

The mechanism leading to the possible breakdown of the concertina result in the present framework is analogous at a formal level to the one that may invalidate the concertina result in the standard model when complementarities between goods are present. This is most easily seen by assuming a complementarity between good j and the export good 0, and therefore $\omega_{rj} = 0$ and $\omega_{0j} < 0$. With goods j and 0 complements in net import demand, lowering the tariff on j increases domestic demand for good 0, thereby reducing aggregate exports and hence aggregate imports. In the case considered in the present paper, where we stick to the standard assumption of substitutability between good j and all other goods, exports increase as a consequence of trade liberalisation, but imports need not.

2.2 Market Access Effects of Trade Liberalisation

Market access is measured by the volume of gross imports, evaluated at world market prices p^w . Given that we have assumed that m contains all import goods (and only import goods), we can write market access as

$$M = p^{w'} m. \tag{12}$$

We introduce the following notation: A diagonal matrix with the elements of vector x on the main diagonal is denoted by \underline{x} , ι denotes a vector of ones, and $\hat{\tau}$ is the vector of ad

valorem tariffs as a proportion of the world market price (i.e. $\hat{\tau}_i = t_i/p_i^w$). Differentiation gives

$$\begin{aligned}
dM &= p^{w'} (E_{pp}dp + E_{pu}du) \\
&= \left[p^w + \frac{p^w E_{pu}}{p^w E_{pu} + E_{p_0u}} t \right]' E_{pp} dt \\
&= [p^w + \beta t]' E_{pp} dt \\
&= p^{w'} [\underline{t} + \beta \hat{\underline{t}}] E_{pp} dt,
\end{aligned} \tag{13}$$

where we have used $E_u = pE_{pu} + E_{p_0u}$ (and hence $\mu^{-1} = p^w E_{pu} + E_{p_0u}$) in line two, and $\beta \equiv (p^w E_{pu}) / (p^w E_{pu} + E_{p_0u})$ is the marginal propensity to spend on importables. We will assume $0 < \beta < 1$ throughout. Rewriting the market access equation for the case where only the tariff on good j is altered gives

$$\begin{aligned}
dM &= \sum_{i \neq 0} p_i^w (1 + \beta \hat{\tau}_i) E_{ij} dt_j \\
&= \sum_{i \neq 0} \frac{p_i^w}{p_i} (1 + \beta \hat{\tau}_i) p_i E_{ij} dt_j \\
&= \sum_{i \neq 0} \frac{1 + \beta \hat{\tau}_i}{1 + \hat{\tau}_i} p_i E_{ij} dt_j \\
&= \sum_{i \neq 0} [1 - \tau_i (1 - \beta)] p_i E_{ij} dt_j \\
&= -(1 - \beta) \left(\tau_j - \sum_{i \neq 0, j} \omega_{ij} \tau_i - \frac{\omega_{0j} + \omega_{rj}}{1 - \beta} \right) p_j E_{jj} dt_j
\end{aligned} \tag{14}$$

with ω_{ij} , ω_{rj} and $\sum_{i \neq 0, j} \omega_{ij}$ defined as above.⁵ Using (10) this can be rewritten as

$$dM = -(1 - \beta) \left(\tau_j - \tau_j^o - \frac{\omega_{0j} + \omega_{rj}}{1 - \beta} \right) p_j E_{jj} dt_j. \tag{15}$$

⁵Note that we have used $\hat{\tau} = \tau / (1 - \tau)$ in line four. Equation (14) is identical to equation (45) from the NBER working paper version of Anderson and Neary (2006) but for the addition of ω_{rj} .

Lowering the tariff on good j increases market access if and only if the term in brackets is negative. We can therefore define the constrained market access minimizing tariff on good j , given the tariffs on the other goods, as

$$\tilde{\tau}_j = \tau_j^o + \frac{\omega_{0j} + \omega_{rj}}{1 - \beta}, \quad (16)$$

and lowering τ_j increases market access if and only if $\tau_j < \tilde{\tau}_j$. The NDL proposition of Ju and Krishna (2000) can be illustrated by setting $\omega_{rj} = 0$ in (16). In the borderline case considered by them where exports do not react to a change in tariffs, ω_{0j} is zero and the constrained welfare maximizing and market access minimizing tariffs coincide. Hence, a tariff decrease – and indeed any tariff change – either increases welfare or market access but not both. In the general case where export goods are net substitutes for good j we have $\tilde{\tau}_j > \tau_j^o$, and lowering τ_j increases both market access and welfare if $\tilde{\tau}_j > \tau_j > \tau_j^o$.

It is easy to see that a double loss situation, where lowering τ_j decreases both market access and welfare, requires $\tilde{\tau}_j < \tau_j^o$. From (16), a necessary and sufficient condition for this to occur is $\omega_{0j} + \omega_{rj} < 0$. Clearly, given $\omega_{0j} > 0$, this requires $\omega_{rj} < 0$, i.e. a situation where good j is not capital intensive. Then, lowering τ_j decreases both market access and welfare if $\tilde{\tau}_j < \tau_j < \tau_j^o$. We therefore have:

Proposition 2. *Consider the case where good j is not capital intensive. It is then possible for a double loss scenario to exist with a range of values for the tariff on good j where lowering this tariff decreases both welfare and market access. No double loss can occur if good j is capital intensive.*

3 A Link Between Welfare and Market Access

For the standard model where capital mobility is absent, Anderson and Neary (2006) have pointed out a number of links between welfare increasing and market access increasing tariff reforms that go beyond the NDL result of Ju and Krishna (2000). In this section, we explore this issue for the model with international capital mobility, focusing on the concertina reform.

Note from the previous section that $\omega_{0j} + \omega_{rj} \geq 0$ is a sufficient condition for the concertina theorem to hold, and a necessary and sufficient condition for the NDL proposition. Hence we know immediately that whenever the concertina result does not hold there is the possibility for a double loss scenario as well. To say something more specific than this, let τ_1 be the highest tariff and τ_2 be the second-highest tariff. Using this notation, a necessary and sufficient condition for the concertina result to break down is $\tau_1^o > \tau_2$. In this case, lowering τ_1 will decrease welfare if $\tau_1^o > \tau_1 > \tau_2$, i.e. for the highest tariff sufficiently close to the level of second highest tariff. Lowering τ_1 will furthermore decrease market access if $\tilde{\tau}_1 \leq \tau_2$. We find that this double loss situation necessarily follows whenever the concertina reform does not hold:

Proposition 3. *If lowering the highest tariff decreases welfare it reduces market access as well.*

Proof. The necessary and sufficient condition for the breakdown of the concertina result, $\tau_1^o > \tau_2$, can be re-written, using (10), as

$$(\omega_{01} + \omega_{r1})\tau_2 + \sum_{i \neq 0,1,2} \omega_{i1}(\tau_2 - \tau_i) < 0. \quad (17)$$

The sufficient condition for a decrease in the highest tariff to yield a fall in market access, $\tilde{\tau}_1 \leq \tau_2$, can be re-written, using (10) and (16), as

$$(\omega_{01} + \omega_{r1}) \left(\frac{1}{1 - \beta} - \tau_2 \right) \leq \sum_{i \neq 0,1,2} \omega_{i1} (\tau_2 - \tau_i). \quad (18)$$

Eq. (17) requires $\omega_{01} + \omega_{r1} < 0$, under which condition eq. (18) holds as well. \square

4 Conclusion

The concertina result from the theoretical literature on tariff reform has been influential in real-world trade liberalisation strategies. In this paper we show that under otherwise standard assumptions the existence of international capital mobility can render this reform welfare decreasing. This possibility exists if the good whose tariff is lowered is not capital intensive, and hence trade liberalisation, by shifting resources to other sectors of the economy, triggers an inflow of internationally mobile capital. We furthermore show that if the concertina reform lowers welfare it lowers market access as well, thereby compromising a second goal that policy makers typically connect with trade liberalisation.

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