

# DISCUSSION PAPER SERIES

**Discussion paper No. 88**

## A Tariff-Tax Reform under Oligopoly and Free Entry

**Kenji Fujiwara**

School of Economics, Kwansei Gakuin University

**Ryoma Kitamura**

Graduate School of Economics, Kwansei Gakuin University

April, 2012



SCHOOL OF ECONOMICS

KWANSEI GAKUIN UNIVERSITY

1-155 Uegahara Ichiban-cho  
Nishinomiya 662-8501, Japan

# A Tariff-Tax Reform under Oligopoly and Free Entry\*

Kenji Fujiwara<sup>†</sup>

School of Economics, Kwansei Gakuin University

Ryoma Kitamura<sup>‡</sup>

Graduate School of Economics, Kwansei Gakuin University

April 27, 2012

## Abstract

Constructing a model of oligopoly with free entry, this paper examines the effects of a tariff reduction accompanied with a unit of consumption tax increase on welfare, government revenue, and market access. We show that the suggested policy reform reduces welfare while enhancing government revenue and market access by inducing further excess entry. Some implications of this finding are discussed in comparison with the case with a fixed number of firms, which involves a welfare loss and an ambiguous effect on government revenue and market access.

*Keywords:* tariff-tax reform, oligopoly, free entry, welfare, government revenue, market access.

*JEL classification:* F12, F13.

---

\*We gratefully acknowledge helpful comments from Tetsuya Shinkai. Any remaining error is our own responsibility.

<sup>†</sup>Corresponding author: Associate Professor, School of Economics, Kwansei Gakuin University. Uegahara 1-1-155, Nishinomiya, Hyogo, 662-8501, Japan. Tel: +81-798-54-7066. Fax: +81-798-51-0944. E-mail: kenjifujiwara@kwansei.ac.jp.

<sup>‡</sup>Graduate Student, Graduate School of Economics, Kwansei Gakuin University.

# 1 Introduction

The last half-century has witnessed substantial progresses of trade and financial liberalization that led to rapid growth of world trade.<sup>1</sup> As suggested in standard trade theory, trade liberalization is beneficial for both an individual country and the world. Despite such an advocacy of trade liberalization, a number of developing countries hesitate to liberalize trade for fear of the expected losses in tariff revenue.<sup>2</sup> In order to cope with such tariff revenue losses, the governments have an incentive to employ or raise a domestic tax, e.g., a consumption tax and a value-added tax (VAT). Baunsgaad and Keen (2010, p. 573) find evidence that suggests that ‘many low income countries do not appear to have easily recouped lost trade tax revenue from domestic taxation, and that this does leave some potential cause for concern. Aizenman and Jinjarak (2009) also empirically study the impacts of trade liberalization on government revenue, observing that a switch from trade taxes to domestic taxes has resulted in a net decline in a government revenue-GDP ratio. Furthermore, Moore and Zanardi (2010, p. 24), addressing a similar issue from a different perspective, report that ‘developing countries, in the past, have not altered the *pattern* of spending as a consequence of falling revenues from import and export taxes.’

This empirical literature motivates us to consider theoretical implications of trade liberalization and domestic taxation. The existing literature has exclusively examined a specific tariff-tax reform that consists of one unit of tariff reduction and one unit of a consumption tax reform since this reform is a standard guidance of the IMF and the World Bank. Assuming a perfectly competitive small open economy, Hatzipanayotou et al. (1994) and Keen and Ligthart (2002) establish a novel result that a country gain in both welfare and government revenue from the above reform. While this win-win

---

<sup>1</sup>See, among others, Baier and Bergstrand (2001) for an empirical study reporting the impacts of tariff reductions on world trade expansion.

<sup>2</sup>IMF (2005, p. 3) reports that ‘in sub-Saharan Africa, for instance, trade taxes accounted, on average, for about one-third of total tax revenue in the early 1980s; now they account for about one-quarter.

property of the reform is attractive from both a theoretical and empirical point of view, Kreickemeier and Raimondos-Møller (2008) draw a caution by proving that the same reform may have an adverse effect on market access, which is defined by the volume of imports evaluated at the world prices.

Keen and Ligthart (2005) develop a simple duopoly model where a domestic and a foreign firms compete in a domestic market to reexamine the welfare and revenue effects of two tariff-tax reforms.<sup>3</sup> They show that (i) the policy reform suggested above reduces welfare, and (ii) a tariff reduction and a consumption tax increase that leave the consumer price unchanged also reduces welfare.<sup>4</sup> While Keen and Ligthart (2005) greatly contribute to the literature by demonstrating that imperfect competition can reverse the results under perfect competition, their results deserve further investigations since they rest on a simplest duopoly model, and lack generality.

This paper considers how general the striking results of Keen and Ligthart (2005) are. In particular, we pay special attention to the role of free entry into an oligopolistic industry to address the effects of the point-by-point policy reform on welfare, government revenue, and market access.<sup>5</sup> We prove that one unit of tariff reduction accompanied by the same unit of consumption tax increase leaves a country worse off, but enhances government revenue and market access.<sup>6</sup> Although the finding of losses from reform parallels with that of Keen and Ligthart (2005), the underlying intuition is quite different from them. In the Keen-Ligthart (2005) model with restricted entry, profit-shifting abroad gives rise to welfare losses. On the other hand, in our model with free entry, the policy reform induces excessive entry into the oligopolistic industry, from which welfare falls.<sup>7</sup> Our result could provide another theoretical insight on the tariff-tax reform, which is worth being tested empirically.

---

<sup>3</sup>Naito and Abe (2008) seek a tariff-tax reform that increases both welfare and government revenue in a vertically related model of imperfect competition.

<sup>4</sup>Note that the two reforms are equivalent under perfect competition.

<sup>5</sup>In Appendix, the case of an arbitrary but fixed number of firms is briefly sketched.

<sup>6</sup>The point-by-point policy reform will be shown to be equivalent to the (consumer-) price-neutral reform as in the perfectly competitive case.

<sup>7</sup>Mankiw and Whinston (1986) and Suzumura and Kiyono (1987) are the seminal works on the ‘excess entry’ theorem in a free entry oligopoly.

This paper is planned as follows. Section 2 presents a model. Section 3 proves and discusses the main results. Section 4 concludes. The case of restricted entry is briefly outlined in Appendix only for comparison with the free entry case.

## 2 A model

Suppose a market of a country, say Home, in which one Home firm and  $n \geq 1$  Foreign firms play a Cournot-Nash game. Letting  $x$  and  $y_i$  be an output of the Home firm and a representative Foreign firm, the inverse demand function is defined by  $p(x + \sum_{i=1}^n y_i)$ , with  $p'(\cdot) < 0$ . All firms have the identical cost  $cx + f$  and  $cy_i + f$ , where  $c > 0$  is a marginal cost, and  $f > 0$  a fixed cost. The Home government imposes a consumption tax  $\tau \geq 0$ , and a specific import tariff  $t \geq 0$ . Under these assumptions, the profit of the Home firm and a representative Foreign firm (firm  $j$ ) is defined as

$$\begin{aligned} \text{Home firm} & : \left[ p\left(x + \sum_{i=1}^n y_i\right) - c - \tau \right] x - f \\ \text{Foreign firm} & : \left[ p\left(x + \sum_{i=1}^n y_i\right) - c - \tau - t \right] y_j - f. \end{aligned}$$

The first-order conditions for profit maximization are

$$xp'(x + ny) + p(x + ny) - c - \tau = 0 \quad (1)$$

$$yp'(x + ny) + p(x + ny) - c - \tau - t = 0, \quad (2)$$

by assuming a symmetry among  $n$  Foreign firms. The second-order conditions for profit maximization are assumed to be satisfied:  $xp'' + 2p' < 0$  and  $yp'' + 2p' < 0$ . Moreover, free entry into the oligopolistic industry drives any Foreign firm's profit to zero:

$$[p(x + ny) - c - \tau - t]y - f = 0. \quad (3)$$

The free entry equilibrium is characterized by the system of (1), (2) and (3), which contains three endogenous variables  $x$ ,  $y$  and  $n$ , given the two tax rates  $\tau$  and  $t$ .

Totally differentiating the above system, we have

$$\begin{bmatrix} xp'' + 2p' & n(xp'' + p') & y(xp'' + p') \\ yp'' + p' & nyp'' + (n+1)p' & y(yp'' + p') \\ yp' & nyp' + p - c - \tau - t & y^2p' \end{bmatrix} \begin{bmatrix} dx \\ dy \\ dn \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ y \end{bmatrix} d\tau + \begin{bmatrix} 0 \\ 1 \\ y \end{bmatrix} dt.$$

As mentioned in Introduction, we focus on a specific tariff-tax reform suggested by Hatzipanayotou et al. (1994) and Keen and Ligthart (2002, 2005): one unit of tariff reduction is accompanied by one unit consumption tax increase. This reform requires that  $d\tau = -dt > 0$ , and straightforward manipulations yield the comparative statics outcomes of this reform:

$$\frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} = \frac{1}{p'} < 0 \quad (4)$$

$$\frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} = 0 \quad (5)$$

$$\frac{\partial n}{\partial \tau} - \frac{\partial n}{\partial t} = -\frac{1}{yp'} > 0. \quad (6)$$

In other words, the suggested policy reform decreases the Home firm's output, and increases the number of firms, leaving the Foreign firm's output unchanged. These comparative statics results are used in deriving the effects on welfare, government revenue, and market access.

### 3 Effects of the policy reform

#### 3.1 Welfare and government revenue

The arguably most important criterion to assess this point-by-point policy reform is welfare. The Home welfare  $W$  consists of consumer surplus  $CS$ , the Home firm's profit  $\pi$ , and tax revenue  $T$  each of which is defined by

$$CS = \int_0^{x+ny} p(X)dX - (x+ny)p(x+ny) \quad (7)$$

$$\pi = [p(x+ny) - c - \tau]x - f \quad (8)$$

$$T = \tau(x+ny) + tny, \quad (9)$$

where  $x, y$  and  $n$  satisfy (1), (2) and (3). Note that  $\tau(x+ny)$  denotes consumption tax revenue, and  $tny$  denotes tariff revenue.

The welfare effects of the point-by-point tariff-tax reform is simply

$$\frac{\partial W}{\partial \tau} - \frac{\partial W}{\partial t} = \left[ \frac{\partial CS}{\partial \tau} - \frac{\partial CS}{\partial t} \right] + \left[ \frac{\partial \pi}{\partial \tau} - \frac{\partial \pi}{\partial t} \right] + \left[ \frac{\partial T}{\partial \tau} - \frac{\partial T}{\partial t} \right],$$

each of which is obtained from (7), (8) and (9):

$$\begin{aligned} \frac{\partial CS}{\partial \tau} - \frac{\partial CS}{\partial t} &= -(x + ny) \left[ \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} + n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) + y \left( \frac{\partial n}{\partial \tau} - \frac{\partial n}{\partial t} \right) \right] p' \\ \frac{\partial \pi}{\partial \tau} - \frac{\partial \pi}{\partial t} &= -x + \left[ \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} + n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) + y \left( \frac{\partial n}{\partial \tau} - \frac{\partial n}{\partial t} \right) \right] xp' \\ &\quad + (p - c - \tau) \left( \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} \right) \\ \frac{\partial T}{\partial \tau} - \frac{\partial T}{\partial t} &= x + \tau \left( \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} \right) + (\tau + t) \left[ n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) + y \left( \frac{\partial n}{\partial \tau} - \frac{\partial n}{\partial t} \right) \right]. \end{aligned}$$

Substituting (4), (5) and (6) into these, the change in each component is derived as

$$\frac{\partial CS}{\partial \tau} - \frac{\partial CS}{\partial t} = 0 \quad (10)$$

$$\frac{\partial \pi}{\partial \tau} - \frac{\partial \pi}{\partial t} = -x + \frac{p - c - \tau}{p'} < 0 \quad (11)$$

$$\frac{\partial T}{\partial \tau} - \frac{\partial T}{\partial t} = x - \frac{t}{p'} > 0. \quad (12)$$

Summing up (10), (11) and (12) yields the effect on welfare:

$$\frac{\partial W}{\partial \tau} - \frac{\partial W}{\partial t} = \frac{p - c - \tau - t}{p'} < 0. \quad (13)$$

From (12) and (13), we have arrived at:

**Proposition 1.** *A tariff reduction accompanied with a consumption tax increase (point-by-point tariff tax reform) improves government revenue, but reduces welfare.*

(Figure 1 around here)

The intuitions behind Proposition 1 are considered by using Figure 1 in which the reaction curves of each firm are depicted. The effects of the point-by-point reform on the reaction curves are decomposed as follows. First, a tariff reduction and a consumption tax increase raise the marginal cost of the Home firm, but have no impact on that of the Foreign firm. Hence, only the Home firm's reaction curve shrinks. Under free entry, not only the above effect but also another effect arises, which is known as a business-stealing effect in the literature of the 'excess entry theorem.'<sup>8</sup> That is, an increase in the number of Foreign firms caused by the reform decreases the output of all firms, and hence the reaction curve of both firms shifts inward. As a result of these two effects, the post-reform equilibrium becomes  $N'$  at which  $x$  decreases but  $y$  remains unchanged.

Based on these observations, let us look at the intuitions behind Proposition 1. As Eq. (10) tells, the tariff-tax reform has no impact on consumer surplus because an decrease in  $x$  is exactly offset by an increase in  $ny$ . Hence, the sign of the welfare effect is determined by the sign of the effect on the Home firm's profit, and the sign of the government revenue effect. The business-stealing effect naturally reduces the Home firm's profit. On the other hand, an increase in  $n$  yields a larger government revenue. To know the reason for this, let us note that the change in government revenue is decomposed as

$$\begin{aligned}
 dT &= \tau d(x + ny) + (x + ny)d\tau + td(ny) + nydt \\
 &= (x + ny)d\tau + td(ny) + nydt \\
 &= xd\tau + td(ny),
 \end{aligned}$$

where the second equation follows the fact that the reform has no effect on the aggregate consumption, i.e.,  $d(x + ny) = 0$ , and the last equation uses  $d\tau = -dt$ . In view of that  $d\tau > 0$  and  $d(ny) = ydn > 0$  from (6), the increase in  $n$  caused by the point-by-point tariff-tax reform necessarily leads to an revenue increase.

---

<sup>8</sup>The term 'business-stealing effect' is borrowed from Mankiw and Whinston (1986).

Proposition 1 claims that since the negative effect on the Home firm's profit dominates the positive effect on government revenue, Home loses from the reform. In other words, the tariff-tax reform expands an inefficiency from further 'excess entry' into the oligopolistic market, and thus necessarily leads to welfare losses. Note that this reasoning of losses from the tariff-tax reform is quite different from the reason in the restricted entry case.

**Remark.** In view of that  $\partial x/\partial\tau - \partial x/\partial t = 1/p'$ ,  $\partial y/\partial\tau - \partial y/\partial t = 0$ , and  $\partial n/\partial\tau - \partial n/\partial t = -1/(yp')$ , the reform of  $d\tau = -dt$  is equivalent to the (consumer) price-neutral reform since the reform-induced price change becomes

$$\begin{aligned} \frac{\partial p}{\partial\tau} - \frac{\partial p}{\partial t} &= \left[ \frac{\partial x}{\partial\tau} - \frac{\partial x}{\partial t} + n \left( \frac{\partial y}{\partial\tau} - \frac{\partial y}{\partial t} \right) + y \left( \frac{\partial n}{\partial\tau} - \frac{\partial n}{\partial t} \right) \right] p' \\ &= \left( \frac{1}{p'} - \frac{1}{p'} \right) p' = 0. \end{aligned}$$

That is, all of the results in this paper apply not only to the point-by-point reform but also the price-neutral reform. While this coincidence between the two reforms is naturally true of perfect competition, the same does not survive oligopoly with restricted entry. Keen and Ligthart (2005) show that in a duopoly model, the price-neutral reform as well as the point-by-point reform reduces welfare.

### 3.2 Market access

Let us next turn to market access, which is the last criterion to assess the policy reform. Following Kreickemeier and Raimondos-Møller (2008, p. 87), we define market access as 'the value of imports at world market prices.' Since  $p(\cdot)$  represents a consumer price that the Home consumer faces, the world price is given by  $p(\cdot)$  minus the tariff and consumption tax. Thus, market access  $M$  is defined by

$$M = [p(x + ny) - \tau - t] ny. \quad (14)$$

A change in the consumption tax and tariff affects (14) as follows.

$$\begin{aligned}\frac{\partial M}{\partial \tau} &= \left[ \left( \frac{\partial x}{\partial \tau} + n \frac{\partial y}{\partial \tau} + y \frac{\partial n}{\partial \tau} \right) p' - 1 \right] ny + (p - \tau - t) \left( n \frac{\partial y}{\partial \tau} + y \frac{\partial n}{\partial \tau} \right) \\ \frac{\partial M}{\partial t} &= \left[ \left( \frac{\partial x}{\partial t} + n \frac{\partial y}{\partial t} + y \frac{\partial n}{\partial t} \right) p' - 1 \right] ny + (p - \tau - t) \left( n \frac{\partial y}{\partial t} + y \frac{\partial n}{\partial t} \right).\end{aligned}$$

To look for the effect of the point-by-point reform, let us take a difference between these terms:

$$\begin{aligned}\frac{\partial M}{\partial \tau} - \frac{\partial M}{\partial t} &= \left[ \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} + n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) + y \left( \frac{\partial n}{\partial \tau} - \frac{\partial n}{\partial t} \right) \right] nyp' \\ &\quad + (p - \tau - t) \left[ n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) + y \left( \frac{\partial n}{\partial \tau} - \frac{\partial n}{\partial t} \right) \right].\end{aligned}\quad (15)$$

Substituting (4), (5) and (6) into (15), we obtain

$$\begin{aligned}\frac{\partial M}{\partial \tau} - \frac{\partial M}{\partial t} &= \left( \frac{1}{p'} - \frac{1}{p} \right) nyp' + (p - \tau - t)y \cdot \frac{-1}{yp'} \\ &= -\frac{p - \tau - t}{p'} > 0\end{aligned}\quad (16)$$

which immediately leads to:

**Proposition 2.** *A tariff reduction accompanied with a consumption tax increase (point-by-point tariff tax reform) improves market access.*

The interpretation of Proposition 2 is straightforward. The tariff-tax reform we have considered has no impact on both  $p - \tau - t$  and  $y$ , while increasing  $n$ . Therefore, the tariff-tax reform unambiguously enhances market access.

What is worth stressing is that the point-by-point tariff-tax reform makes both  $p$  (consumer price) but also  $p - \tau - t$  (world price) unchanged. In a pioneering work, Bagwell and Staiger (1999) show that the world price and Foreign welfare are both fixed if the principle of reciprocity of the GATT/WTO is observed. Relating their argument to our finding, the suggested reform is a non-beggar-thy-neighborhood policy as well as it improves market access, and thus Foreign is willing to accept it.

## 4 Concluding remarks

We have sought implications of oligopoly with free entry for the welfare, revenue, and market access effects of a point-by-point tariff tax reform, which has been frequently guided by the IMF and the World Bank. It is shown that trade liberalization accompanied by a consumption tax increase necessarily reduces welfare while it has a positive impact on government revenue and market access. Our result could complement the seminal work of Keen and Ligthart (2005) since they use a simplest model of duopoly with restricted entry.

This paper contributes to the literature in the above sense, but admittedly leaves much unexplored. For instance, we have at this stage no idea about the robustness of our results in another type of market structure, e.g., monopolistic competition in which a variety expansion/contraction plays a central role for welfare. It is our future research agenda to make further elaborations along this line of direction.

## Appendix: the case of restricted entry

The main text has focused on the case of free entry since our primary purpose is to seek how it affects the effects of a tariff-tax reform on welfare, government revenue, and market access. However, it makes sense to briefly look at the case of restricted entry, i.e., an exogenous number of firms, for comparing the two cases.

What differs between the two cases is that Eq. (3) is missing in the case of restricted entry: the equilibrium is described by (1) and (2) given  $n$ . Totally differentiating them, we have

$$\begin{bmatrix} xp'' + 2p' & n(xp'' + p') \\ yp'' + p' & nyp'' + (n+1)p' \end{bmatrix} \begin{bmatrix} dx \\ dy \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} d\tau + \begin{bmatrix} 0 \\ 1 \end{bmatrix} dt.$$

Straightforward manipulations allow us to find the output changes associated with the tariff-tax reform  $d\tau = -dt > 0$ :

$$\frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} = \frac{nyp'' + (n+1)p'}{\Delta}, \quad \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} = -\frac{yp'' + p'}{\Delta} \quad (17)$$

where  $\Delta = [(x + ny)p'' + (n + 2)p']p' > 0$ .

Making use of these results, let us first examine the government revenue effect. Using (9) and (17), we obtain

$$\begin{aligned}
\frac{\partial T}{\partial \tau} - \frac{\partial T}{\partial t} &= x + \tau \left( \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} \right) + n(\tau + t) \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) \\
&= x + \frac{\tau[ny p'' + (n + 1)p']}{\Delta} - \frac{n(\tau + 1)(y p'' + p')}{\Delta} \\
&= x + \frac{\tau p' - nt(y p'' + p')}{\Delta}, \tag{18}
\end{aligned}$$

which is just an  $n$ -firm extension of Eq. (10) in Keen and Ligthart (2005, p. 388).

The change in consumer surplus, and the Home firm's profit is

$$\begin{aligned}
\frac{\partial CS}{\partial \tau} - \frac{\partial CS}{\partial t} &= -(x + ny) \left[ \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} + n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) \right] p' \tag{19} \\
\frac{\partial \pi}{\partial \tau} - \frac{\partial \pi}{\partial t} &= -x + \left[ \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} + n \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) \right] x p' \\
&\quad + (p - c - \tau) \left( \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} \right). \tag{20}
\end{aligned}$$

Therefore, aggregating (18), (19), and (20), the welfare effect is derived as

$$\begin{aligned}
\frac{\partial W}{\partial \tau} - \frac{\partial W}{\partial t} &= (p - c - ny p') \left( \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} \right) + n(\tau + t - ny p') \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) \\
&= \frac{(p - c - ny p')[ny p'' + (n + 1)p'] - n(\tau + t - ny p')(y p'' + p')}{\Delta} \\
&= \frac{(p - c - ny p')[ny p'' + (n + 1)p'] - n(y p' + p - c - ny p')(y p'' + p')}{\Delta} \\
&= \frac{[p - c - ny(y p'' + 2p')]p'}{\Delta} < 0, \tag{21}
\end{aligned}$$

where the third equation uses the first-order condition of a Foreign firm,  $y p' + p - c - \tau - t = 0$ , and the negativity of (21) follows from the second-order condition of a Foreign firm,  $y p'' + 2p' < 0$ .

The above findings on the welfare and government revenue effects of the reform are just a rehabilitation of Keen and Ligthart's (2005) results in an

$n$ -firm model. The point-by-point policy reform necessarily reduces welfare, but can increase government revenue if  $\tau$  is small enough.

The market access effect is computed as follows. Differentiating (14) with respect to  $\tau$  and  $t$ , and taking a difference, we have

$$\begin{aligned}
\frac{\partial M}{\partial \tau} - \frac{\partial M}{\partial t} &= n \left[ \left( \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} \right) yp' + (nyp' + p - \tau - t) \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) \right] \\
&= \frac{n \{ [nyp'' + (n+1)p']yp' - (nyp' + p - \tau - t)(yp'' + p') \}}{\Delta} \\
&= \frac{n \{ [nyp'' + (n+1)p']yp' - (nyp' + p - yp' - p + c)(yp'' + p') \}}{\Delta} \\
&= \frac{n[(yp'' + 2p')yp' - c(yp'' + p')]}{\Delta}, \tag{22}
\end{aligned}$$

where the third equation again uses the relationship  $\tau + t = yp' + p - c$ . The sign of (22) is strictly positive if  $yp'' + p' > 0$ , which is a necessary and sufficient condition for  $\partial y/\partial \tau - \partial y/\partial t > 0$ , namely, profit-shifting occurs. In the Keen-Ligthart model with linear demand, (22) is necessarily positive.

Finally, let us address the effect on Foreign welfare which equals the aggregate profit of the Foreign firms. Letting  $\pi^* \equiv [p(n+ny) - c - \tau - t]y - f$  be the profit of each Foreign firm, it is obtained as follows.

$$\begin{aligned}
\frac{\partial(n\pi^*)}{\partial \tau} - \frac{\partial(n\pi^*)}{\partial t} &= \left[ \frac{\partial x}{\partial \tau} - \frac{\partial x}{\partial t} + (n-1) \left( \frac{\partial y}{\partial \tau} - \frac{\partial y}{\partial t} \right) \right] nyp' \\
&= \left[ \frac{nyp'' + (n+1)p'}{\Delta} - \frac{(n-1)(yp'' + p')}{\Delta} \right] nyp' \tag{23} \\
&= \frac{(yp'' + 2p')nyp'}{\Delta} > 0
\end{aligned}$$

where (23) uses (17), and the positivity in the right-hand side comes from the second-order condition for the Foreign firm's profit maximization:  $yp'' + 2p' < 0$ . Thus, the tariff-tax reform unambiguously increases Foreign welfare. To summarize the results in the restricted entry case, we can claim:

**Proposition 3 (Generalization of Keen and Ligthart, 2005).** *In the case of restricted entry, A tariff reduction accompanied with a consumption*

tax increase (point-by-point tariff tax reform) (i) unambiguously reduces welfare, (ii) enhances government revenue if  $\tau$  is small enough, (iii) improves market access if  $yp'' + p' < 0$  (profit-shifting occurs), and (iv) improves Foreign welfare.

## References

- [1] Bagwell, K. and R. W. Staiger (1999), 'An economic theory of GATT,' *American Economic Review*, 89, 215-248.
- [2] Baier, S. L. and J. H. Bergstrand (2001), 'The growth of world trade: tariffs, transport costs, and income similarity,' *Journal of International Economics*, 53, 1-27.
- [3] Baunsgaard, T. and M. Keen (2010), 'Tax revenue and (or?) trade liberalization,' *Journal of Public Economics*, 94, 563-577.
- [4] Hatzipanayotou, P., M. S. Michael and S. M. Miller (1994), 'Win-win indirect tax reform: a modest proposal,' *Economics Letters*, 44, 147-151.
- [5] International Monetary Fund (2005), 'Dealing with the revenue consequences of trade reform,' Background Paper for Review of Fund Work on Trade.
- [6] Keen, M. and J. E. Ligthart (2002), 'Coordinating tariff reduction and domestic tax reform,' *Journal of International Economics*, 56, 489-507.
- [7] Keen, M. and J. E. Ligthart (2005), 'Coordinating tariff reduction and domestic tax reform under imperfect competition,' *Review of International Economics*, 13, 385-390.
- [8] Kreickemeier, U. and P. Raimondos-Møller (2008), 'Tariff-tax reforms and market access,' *Journal of Development Economics*, 87, 85-91.
- [9] Mankiw, N. G. and M. D. Whinston (1986), 'Free entry and social inefficiency,' *Rand Journal of Economics*, 17, 48-58.

- [10] Moore, O. M. and M. Zanardi (2010), ‘Does trade liberalization affect the composition of government spending in developing nations?’, Working Papers ECARES, 2010-013.
- [11] Naito, T. and K. Abe (2008), ‘Welfare- and revenue-enhancing tariff and tax reform under imperfect competition,’ *Journal of Public Economic Theory*, 10, 1085-1094.
- [12] Suzumura, K. and K. Kiyono (1987), ‘Entry barriers and economic welfare,’ *Review of Economic Studies*, 54, 157-167.

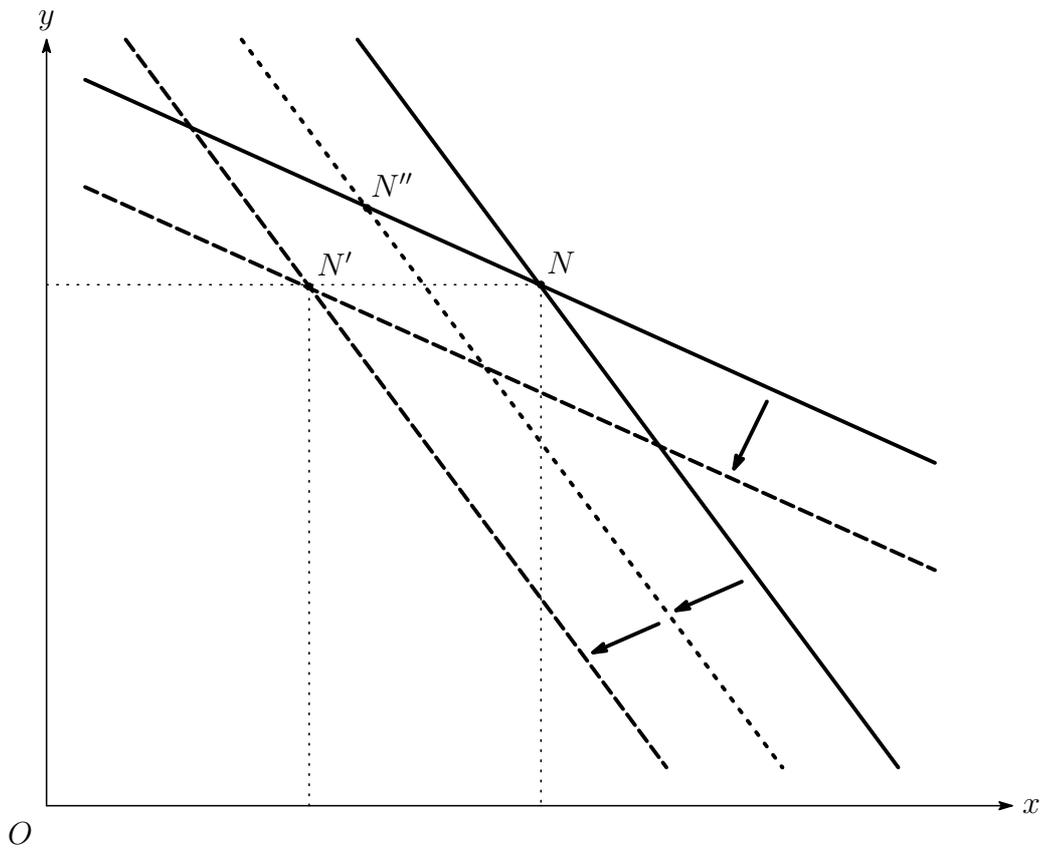


Figure 1: The effect of the reform