

## **When Monopoly Complements Monopsony: A Comparison Between a Zero Welfare Revenue Tariff and an Optimal Welfare Tariff**

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### **Abstract**

An optimal revenue tariff is designed by the government in the importing countries to collect revenue by exploiting both exporters and domestic consumers. The government exercises market power which generates a double distortion (monopoly and monopsony). The government as an institution in international trade plays a dual role simultaneously by imposing optimal revenue tariffs (Bieri & Schmitz, 1974; Schmitz et. al, 2023). Thus, the role of government resembles that of a ‘pure middleman’ who can distort prices with the imposition of tariffs and collect the necessary revenue. (This is opposite to the optimal welfare tariff where the government collects revenue but does not act as a monopolist). But in reality, governments are only able to impose tariffs that are below the theoretical optimal welfare tariff levels (Ossa, 2014). Thus, this statement also applies to the real world prices under the optimal revenue tariffs. Therefore, we develop a theory of a zero welfare revenue tariff that generates welfare equivalent to that of free trade. In this case, government still collects revenue but not as the same level as an optimal revenue tariff. By using the Excess Demand (ED) and Excess Supply (ES) framework we show that zero welfare revenue tariff distribution of welfare is entirely different than the distribution of welfare that exists under the free trade. Government gains at the expense of loss of domestic consumers and producers, but it guarantees that welfare is at least equal to free trade.

**Keywords:** Zero Welfare Revenue Tariff, Optimal Welfare Tariff, Monopoly, Monopsony and Trade Distortions

**JEL Classification:** F10, F12, F14, Q37.

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## **Introduction**

There has been a growing interest in the international trade theory to explain how the government should impose tariffs to collect revenue. The government often faces a tradeoff between collecting revenue and liberalizing trade. (Grunberg, 1998; Khattry and Rao, 2002). In the context of imperfect market power, the balance between tariff reduction and maximizing revenue is theoretically challenging. We feel there is not enough theoretical framework that could explain this tradeoff, especially in the context of imperfect market power. Hence, liberalizing efforts might produce a fiscal squeeze. We develop a new tariff that links welfare with a goal of collecting revenue. We call this tariff a zero-welfare revenue tariff which ensures the government earns specific revenue, but welfare is equivalent to free trade.

The role of importers or exporters of commodities as a monopolist is well-known in international trade (Abbott, 1979; Caves, 1985). In contrast, a large importing country can behave like a monopsonist buying from other countries and distorting prices whenever necessary (Enke, 1944; Love and Murniningtyas, 1992). The role of government in international trade puts it in an interesting proposition of acting simultaneously as a monopolist and monopsonist (Bieri & Schmitz, 1974). Thus, in this setting government has the power to influence price, revenue and welfare. The purview of this model also provides the government to prioritize its goal. A revenue tariff can maximize revenue, as a result, it is comparable with unconstrained maximization. However, it can lead to prohibitive tariffs when the revenue tariff is too large. On the contrary, a zero-welfare revenue tariff can be seen as a constrained maximization. It maximizes revenue subject to a given level of welfare which is equivalent to that of free trade.

Under a zero-welfare revenue tariff, the government works like an intermediary. Intermediaries in general have different objective functions and act differently based on their objectives (Just, Schmitz and Zilberman, 1979). It imports commodities according to the domestic demand and sells at a higher tariff-adjusted price than the importing price. It intends to accumulate revenue by imposing tariffs on the imported commodity. Thus, its role is similar to that of a pure middleman (Rubinstein and Wolinsky, 1987; Rust and Hall, 2003). However, this middleman has enormous market power to extract revenue according to its goal.

On the other hand, similar to a revenue tariff a zero-welfare revenue tariff can be identified as a model of double distortion. One of the distortions is Marginal Revenue (MR) and another is the Marginal Outlay (MO) of the commodity that is imported from other countries. Marginal outlay under imperfect competition is distorted and inherently erroneous in estimating additional cost (Howse, Eliason and Trebilcock, 2005).

A bilateral monopoly can lead to monopsony. Both exporters and importers can be a monopoly. On the other hand, the role of the government as the sole authority to impose a tariff may act as a monopsonist. Even though monopoly and monopsony are opposite theoretical ideas, the government as an institution in international trade can play a dual role simultaneously. When the country imposes a tariff, it acts as a monopsonist on the buying of imports from another country. The role of government resembles that of a 'pure middleman' who can distort prices with the imposition of tariffs and collect the necessary revenue. Thus, the role of government is consistent as a monopolist as well as a monopsonist (Bieri & Schmitz, 1974).

A welfare revenue tariff may manifest as either an export tariff or an import tariff. Export tariffs can increase the level of welfare for the large exporting country by changing the terms of trade. Consequently, export tariffs can influence the global price, prompting the exporting nation to reduce its supply (Handley, Kamal and Monarch, 2020). This function is analogous to a monopolist who essentially has the market power to decrease supply, thereby increasing prices.

On the other hand, the role of a large importing country is similar to a monopsony. A large importing country can impose an import tariff to restrict the supply of foreign goods by making it expensive for domestic producers. Thus, it is a strategy to restrict output, depress domestic demand for foreign goods, and force the world price to fall eventually (Flaen and Pierce, 2019).

The welfare under the revenue tariff is worse than that of under any other tariff. This paper aims to develop a concept namely the zero-welfare revenue tariff that ensures the welfare of imposing tariff is at least equal to the welfare under free trade. Thus, welfare zero welfare revenue tariff is welfare improving compared to pure revenue tariff.

This study provides a comprehensive idea of the theoretical underpinning of zero welfare revenue tariffs and explores the implication of this new type of tariff on the welfare of the imposing country.

Though monopoly and monopsony are two entirely different ideas, the government can play a dual role simultaneously in the case of revenue tariffs (Lloyd, 1982). A monopoly is a market structure where the price is set to maximize the profit for the seller that requires the marginal outlay curve should intersect the marginal revenue curve of the related product. Likewise, under monopsony seller chooses an output level that equates marginal cost to the marginal revenue of selling an extra unit of product.

## **Literature Review**

The literature on revenue tariffs is extensive, diverse, and theoretically proven. The previous studies covered its effect on revenue collection, welfare, market power, and so on. However, revenue tariff is unambiguously welfare deteriorating compared to optimal welfare tariffs. On the other hand, due to the recent wave of liberalization countries compromising revenue tariffs at a lower level and yielding a lower total revenue.

Our work is pioneering as we introduce a new variety of revenue tariffs which is different from the conventional revenue tariffs. To the best of our knowledge, this is the first work on the zero welfare revenue tariff. Thus, our literature review focuses on the revenue tariff and its effect on govt. wallet, market and welfare.

Tariffs have traditionally been implemented with the objectives of generating revenue, safeguarding domestic industries, or acting as negotiation tools, rather than aiming for optimal social welfare. The ramifications for a world where tariffs, by and large, have not been implemented based on considerations of optimal social welfare. As a result, the maximum revenue tariff which in general is higher than the optimal welfare tariff is designed to generate the maximum possible revenue (Johnson, 1950).

Raising the tariff beyond the maximum revenue rate will lead to a decrease in tariff revenue and an increase in the price of imports, resulting in a reduction of consumer surplus. This will negatively impact welfare (Collie, 1991). An interesting version of tariff revenue is to test this trade policy under imperfect competition (Helpman and Krugman; 1989).

While imposing a revenue tariff it is needed to assess relative welfare gains, changed price, externality and terms of trade. However, the welfare function of the government is diverse in nature, inherently embedded with economic and political motives (Amador and Bagwell, 2012).

Tariffs in general can be justified on both distributional and revenue-raising grounds, especially when the government faces challenges in individually taxing all goods and services at separate rates. The optimal tariffs are explicitly derived in a special case of the general tariff model which is derived under a specific scenario or set of conditions. However, revenue tariffs always emphasize revenue collection rather than welfare (Heady and Mitra, 1987).

The revenue-raising argument focuses on the government's ability to generate income for the government. By imposing tariffs on imported goods, govt. collect revenue to finance public services, infrastructure, or other government expenditures (Baunsgaard, and Keen, 2010).

When the conditions of smooth foreign offer curves, concave home trade indifference curves, and intersecting free trade offer curves are met, the maximum revenue tariff (the tariff that generates the most government revenue) will be higher than the optimum tariff (the tariff that maximizes overall economic welfare) (Tower, 1977).

The article proceeds as follows. We introduce the tradeoff between tariff distortion and the government's objective of collecting revenue. The background section clarifies the theoretical linkage of this tradeoff with relevant literature. In the next section, we present the new idea of zero welfare revenue tariff. The following section displays the sensitivity of optimal revenue tariffs and the resulting welfare of the country. In the estimation of welfare section, we provide the ramifications of imposing zero welfare tariff with associated consumer, producer and government revenue. The last section concludes by hinting at the policy implication of this new tariff.

### **Model:**

Our initial model builds upon the work of Amador and Bagwell (2012). However, we modify and extend the model by incorporating the market power, especially in the case of monopoly and monopsony instead of perfect competition. We assume that there are two countries in the world namely home ( $H$ ) and foreign ( $F$ ). We first start our model assuming that the home country is the sole importer, and the foreign country is the only exporter of the good ( $x$ ). Suppose the presence of a numeraire good ( $n$ ) in both home and foreign country helps us to compare the value of the good. The countries have similar utility functions that are additively separable across the two goods as follows-

$$U = u(x^i) + n, i = \{H \& F\}$$

$U$  is strictly increasing, strictly concave, and twice continuously differentiable. The consumer demand for any good depends on the local price of that good and the price of that good relative to the numeraire good. Initially, we assume that perfect competition prevails in the market. Later on we introduce what happens when there is no perfect competition.

Let  $P^H$  and  $P^F$  denote the relative prices of good  $x$  with respect to good  $n$  in home and foreign countries respectively. The associated supply curves for home and foreign countries are  $Q^H(P^H)$  and  $Q^F(P^F)$  respectively. We initially assume  $Q^H(P^H) = 0$  and the entire domestic demand is imported from the foreign countries.

Assuming  $\bar{x}$  is the volume of trade of good  $x$ . Let assume the inverse demand function for home country's import is  $P^H(\bar{x})$  and inverse supply function for export for foreign country is  $P^F(\bar{x})$ . We assume  $P^H(\bar{x}) < 0$  and  $P^F(\bar{x}) > 0$ .

Government of each country imposes a per unit tariff on import to collect revenue what we call optimal revenue tariff. If the government of home country imposes an import tariff equal to  $t$ , the associated import volume is  $\bar{x}$ . Import tariff ( $t$ ) by definition satisfies the condition:  $t = P^H(\bar{x}) - P^F(\bar{x})$ . A higher  $t$  results a lower  $\bar{x}$ . Under free trade  $t = 0$  and  $P^H(\bar{x}) = P^F(\bar{x})$ .

If  $CS(\bar{x})$  and  $PS(\bar{x})$  represents the sum of consumer and producer surplus at home and abroad, respectively. We further denote  $TR(\bar{x})$  is the tariff revenue generated by the imposing tariff  $t$ .

$$CS(\bar{x}) = u(Q^H(P^H(\bar{x})) + \bar{x}) - P^H(\bar{x})(Q^H(P^H(\bar{x})) + \bar{x}) + TR^H(\bar{x})$$

$$PS(\bar{x}) = u(Q^F(P^F(\bar{x})) + \bar{x}) - P^F(\bar{x})(Q^F(P^F(\bar{x})) + \bar{x}) + TR^F(\bar{x})$$

$$TR(\bar{x}) = (P^H(\bar{x}) - P^F(\bar{x}))\bar{x}$$

By aggregating consumer surplus, producer surplus and tariff revenue, we reach to the total welfare of the home country-

$$W(\bar{x}|\gamma) = SH(\bar{x}) + \gamma TR(\bar{x})$$

where  $\gamma$  is the weight tariff revenue.  $\gamma$  represent that value of the tariff revenue of the home government (Matschke, 2008).

### **Zero Welfare Revenue Tariff:**

A zero Welfare Revenue tariff is defined as a tariff rate at which the country's welfare after imposing a revenue tariff is equal to the welfare under free trade. Theoretically, it can be at best equal to the revenue tariff. The price with zero welfare revenue tariff lies below the revenue tariff price but is greater than the free trade price.

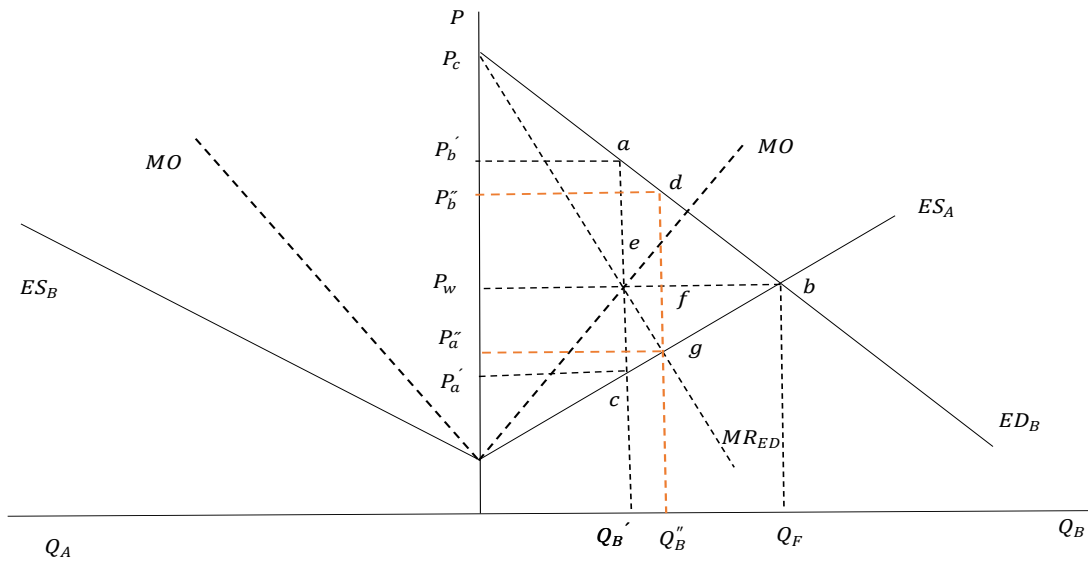


Figure 1: Optimal Revenue Tariff and Zero Welfare Revenue Tariff

The objective of imposing an optimal revenue tariff is to generate income for the government. The government makes foreign goods expensive for the consumers. The excess demand ( $ED$ ) and excess supply ( $ED$ ) framework determines the optimal revenues tariff as shown in figure-1. The marginal outlay curve ( $MO$ ) represents the cost of buying additional imports while the  $MR_{ED}$  is the revenue received from the sale of the last unit of good sold.

The optimal revenue tariff is determined at point  $e$  where the marginal outlay curve ( $MO$ ) and marginal revenue curve ( $MR_{ED}$ ) intersect each other. The optimal revenue tariff is  $(P'_b - P'_a)$  per unit of import. Total tariff revenue collected is equivalent to  $(P'_a P'_b ac)$ . The zero welfare revenue tariff is  $(P''_a P''_b)$ . The zero-welfare revenue tariff is defined as the tariff at which  $(P''_a P_w fg)$  is equal to  $(dbf)$ . It requires the generated welfare under zero welfare revenue tariff is equal to the welfare under free trade. Thus, it must satisfy the welfare under free trade  $(P_c P_w b)$  must be equal to the total welfare under zero welfare revenue tariff  $\{(P_c P''_b d) + (P''_b dg P''_a)\}$ . As the optimal revenue tariff aims to collect the revenue by making import costlier, the import is located left  $(Q'_B)$  of those under free trade  $(Q_F)$ . However, the imported quantity under the zero welfare revenue tariff  $(Q''_B)$  is higher than the quantity imported under optimal revenue tariff but lower than that of under the free trade.

**Empirical Case : ( $\epsilon_{D_d} = 1.11$  &  $\epsilon_{S_f} = 1.59$ )**

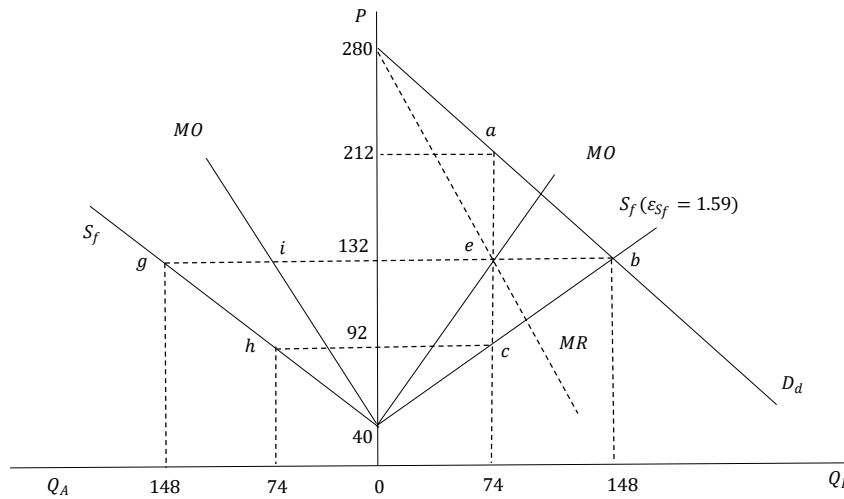


Figure 2: Effect of an Optimal Revenue Tariff ( $\epsilon_{D_d} = 1.11$  &  $\epsilon_{S_f} = 1.59$ )

$D_d$  is the domestic demand and  $S_f$  is the foreign supply (figure 2). The free trade price is 132 determined at point b. We assume there is no domestic supply of the commodity and the home country imports the entire amount from the foreign country.  $MO$  is the marginal outlay curve and  $MR$  is the marginal revenue curve. Optimal revenue tariff is determined at point e where  $MO$  curve intersects  $MR$  curve. Revenue tariff equal to 120 (equal to the vertical distance of ac) is imposed on the imported item. The price after imposing revenue tariff is 212. Government gain in revenue is equal to 8,840 ( $120 \times 74$ ). Area of the Herberger triangle is 4,400  $\{(1/2) \times 120 \times 74\}$ . So, the importing country enjoys a net gain of 4,440 by imposing optimal revenue. The forgone part of the consumer surplus in Herberger triangle is equal to 2,960. Importers portion of surplus which is accumulated to government is equal to 2,960 ( $40 \times 74$ ). The forgone part of the consumer surplus is equal to the importers portion of surplus that is collected by the government as tariff. So, the revenue tariff is also a zero welfare revenue tariff in this case.

In the following figure, we compare optimal welfare tariff and zero welfare revenue tariff. Moreover, we derive the free trade equilibrium in order to show the deviation of the market parameters under previous two tariffs.

Figure 3 juxtaposes the market outcome under zero welfare revenue tariff and optimal welfare tariff. The free trade price is determined at point b where  $S_f$  intersects with  $D_d$ . The free trade price is 133 and the imported quantity is 148. The optimal revenue tariff is determined at point e where  $MO$  curve intersects with  $MR$  curve.

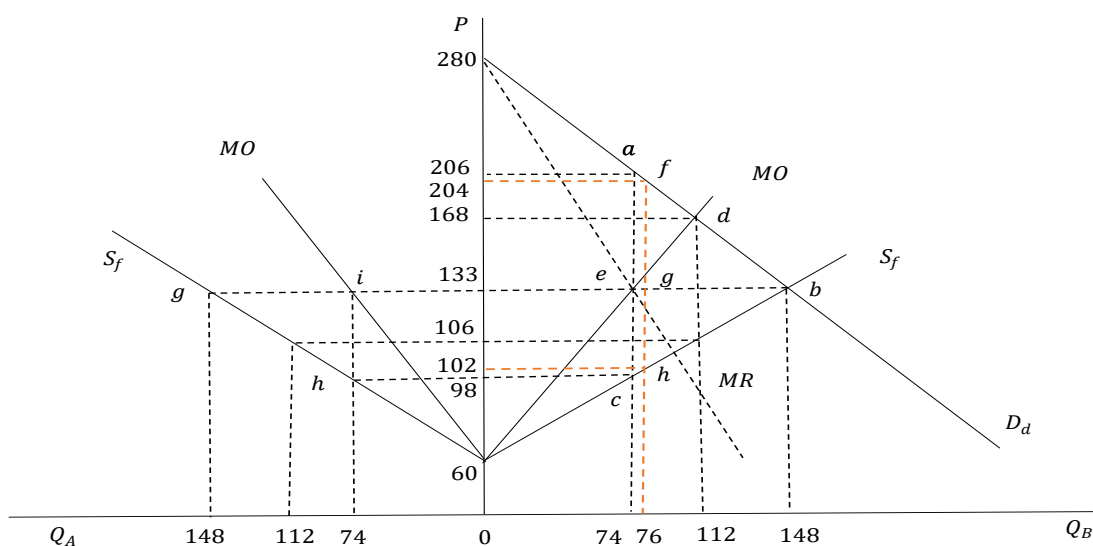


Figure 3: Comparison of Zero Welfare Revenue Tariff and Optimal Welfare Tariff

The optimal revenue tariff price is 206. The zero welfare revenue tariff price is 204 and equilibrium quantity is 76. The optimal welfare tariff price is determined at point  $d$  where  $MO$  intersects  $D_d$ . The optimal welfare tariff price is 168 and the corresponding quantity is 112. The price with optimal revenue tariff is highest compared to the zero welfare revenue tariff price, optimal welfare tariff price and free trade price. The quantity imported under zero welfare revenue tariff is higher than the quantity under optimal revenue tariff but lower than that of under optimal welfare tariff.

Table 1 shows the comparison of various economic parameters under free trade, optimal welfare tariff and zero welfare revenue tariff. We find that tariff price is highest under zero welfare revenue tariff. As a price rises under different types of tariff total import falls. For example, home country imports 148 unit under free trade. Import falls to 74 unit under optimal revenue tariff as price is higher (206) under this tariff. Tariff in absolute term is highest under optimal revenue tariff i. e. 108 per unit in our case. However, we propose zero welfare revenue tariff (102) which is lower than optimal revenue tariff. The zero welfare revenue tariff price is 204. Government collects 7,752 as total revenue under zero welfare revenue tariff. The revenue collection is highest under optimal revenue tariff than that of under any other tariff arrangements i.e. 7,792. Total welfare of the world comprises of not only consumer surplus and revenue of the home country but also the exporters' loss or gain of the foreign country. The world total welfare is 16,280 that is highest under free trade. On the contrary, the total world welfare is lowest under optimal revenue tariff (12,084). The government under optimal revenue tariff exploits monopoly and monopsony power simultaneously to maximize revenue. As a result, under optimal revenue tariff the deadweight loss is maximum.



**Table 1: Welfare Under Free Trade, Optimal Welfare Tariff and Zero Welfare Revenue Tariff**

	Home Country ( <i>d</i> )					Foreign Country ( <i>f</i> )	World Total Welfare ( <i>TW</i> )	
	Price ( <i>P</i> )	Imports ( <i>M</i> )	Tariff ( <i>T</i> )	Consumer Surplus( <i>CS</i> )	Govt. Revenue ( <i>R</i> )	Home Country Total	Exporter Surplus ( <i>PS</i> )	
Free trade price ( $P_F$ )	133	148	0	10, 878	0	<b>10,878</b>	5,402	16,280
Optimal Welfare tariff price ( $P_T$ )	168	112	71.5	6,272	6,720	12,992	2,576	15, 568
Optimal Revenue Tariff ( $P_{ORT}$ )	206	74	108	2,738	7,792	10,530	1,554	12,084
Zero welfare revenue tariff ( $P_{R0}$ )	204	76	102	2, 888	7,752	<b>10,640</b>	1,596	12,236

Source: Author’s Estimation

**Table 2: Net Welfare Under Free Trade, Optimal Welfare Tariff and Zero Welfare Revenue Tariff**

	Gain	Loss	Net
Free trade	<ul style="list-style-type: none"> <li>• Producer surplus 5,402</li> <li>• Consumer surplus 10,878</li> <li>• Total surplus 16,280</li> </ul>	0	Maximum Gain
Optimal welfare tariff	Government gain=6,944	<ul style="list-style-type: none"> <li>• Loss of the exporter=3,510</li> <li>• Loss of consumer surplus=6,272</li> <li>• Harberger triangle=630</li> <li>• Total loss= (3,510+6,272+630)=10,412</li> </ul>	Loss compared to free trade=712
Optimal revenue tariff	Government gain=7,792	<ul style="list-style-type: none"> <li>• Loss of the exporters=1,406</li> <li>• Loss of consumer surplus=2,738</li> <li>• Harberger triangle=2,701</li> <li>• Total loss= (1,406+2,738+2,701)=6,845</li> </ul>	Loss compared to free trade=4,196
Zero welfare revenue tariff	Government gain=7,752	<ul style="list-style-type: none"> <li>• Loss of the exporter=3,472</li> <li>• Loss of consumer surplus=2,888</li> <li>• Harberger triangle=2,701</li> <li>• Total loss=(3,472+2,888+2,701)=9,061</li> </ul>	Loss compared to free trade=4,044

The zero welfare revenue tariff ensure the welfare of the importing country under free trade is equal to that of under this tariff. In our empirical estimation the welfare of the importing country under free trade is 10,878 while the welfare under zero welfare revenue tariff is 10,640. These are approximately equal and the numbers converges depending on the elasticity of import supply function and the domestic demand.

Table 2 represents net welfare under an optimal welfare tariff and a zero welfare revenue tariff. Moreover, we compare these outcomes with the free trade scenario. Compared to the free trade exporter loses 3,510, consumer loses 6,272, society loses 630 under an optimal welfare tariff. The total loss of the home county is equal to 10,412. Aggregating the gain and loss together we find that the world as a whole suffers loss equal to 712 under optimal welfare tariff compared to free trade.

The world welfare deteriorates under a zero welfare revenue tariff compared to an optimal welfare tariff or free trade. Exporters lose 3,472, consumers suffer a loss equal to 2,288. Deadweight loss is equal to 2,701. Together, total loss under zero welfare revenue tariff is 9,061. Under zero welfare revenue tariff, we estimate a net loss of 4,044 compared to the free trade. As a result, government gains the revenue at the expense of depressed market parameters, consumers, producers and society as a whole under a zero welfare revenue tariff.

### Extended Theoretical Model

A more complex version of the model incorporates the domestic supply with the foreign supply (figure 4). In this case Excess demand is a derived demand represents the difference between domestic demand and domestic supply.

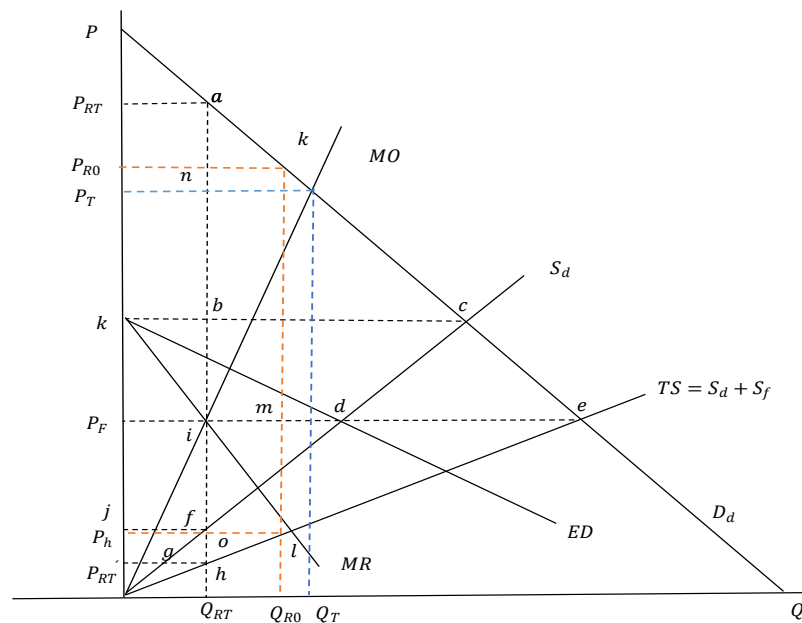


Figure 2: Zero Welfare Revenue Tariff with domestic and foreign supply

Figure 2 presents the zero-welfare revenue tariff after incorporating domestic and foreign supply.  $D_d$  represents the domestic demand and  $S_d$  represents domestic supply. The total supply curve ( $TS$ ) consists of the summation of domestic supply ( $S_d$ ) and the foreign supply ( $S_f$ ) (not shown). The excess demand curve ( $ED$ ) is derived from the difference between domestic supply ( $S_d$ ) and domestic demand ( $D_d$ ).

An optimal revenue tariff is determined where the Marginal Revenue ( $MR$ ) curve intersects Marginal outlay curve ( $MO$ ) as shown in  $i$ .  $P_{RT}$  is the price with revenue tariff. On the other hand,  $P_F$  is the free trade price which resulted at the point of intersection between total supply and domestic demand. An optimal revenue tariff affects consumers, producers as well as government. The loss in consumer surplus is equal to  $(P_{RT}abk + kbiP_F + acb + bc di + ced)$  due to the imposition of an optimal tariff. On the other side, the loss in producer surplus is equal to  $(ifj + idf)$ . The gain in government revenue is equal to  $(P_{RT}abk + kbiP_F + P_Fifj + jfgP'_{RT} + fhg)$ . A zero welfare revenue tariff is a tariff which makes the gain in government revenue is equal to the losses of consumer and producer together so that the welfare is equal to that of under free trade.

A zero welfare revenue tariff price is  $P_{R0}$  and the associated quantity supplied  $Q_{R0}$ . Under a zero welfare revenue tariff the gain in consumer surplus is equal to area  $(P_{RT}akP_{R0})$ . The gain in producer surplus is  $(P_hlhP'_{RT})$ . The gain in government revenue  $\{(P_{R0}klP_h) - (P_{RT}afj)\}$ . The sum of gain in government revenue, consumer surplus and producer surplus by imposing a zero welfare revenue tariff should be equal to the deadweight loss  $(kel)$  under this tariff. In that case the total welfare under the zero welfare revenue tariff will be equal to that of under free trade and the definition of zero welfare revenue tariff satisfies.

An optimal welfare tariff is determined at point  $p$  where  $MO$  curve intersects  $D_d$ . The optimal welfare tariff price is marked at  $P_T$  and the associated quantity is  $Q_T$ . The optimal welfare tariff price is lower than the price under the zero welfare revenue tariff. However, the welfare under the optimal welfare tariff is higher than the welfare under the zero welfare revenue tariff.

## Conclusion and Policy Implication

The optimal revenue tariffs are strategically designed by the government to exploit both exporters and domestic consumers. The revenue tariff in contrast to an optimal welfare tariff also generate revenue with higher welfare losses. However, the collection in reality critically depends on many economic, management and ethical issues. Revenue tariff is often characterized as elevated and connotated as welfare depressing compared to an optimal welfare tariff. Thus, the optimal welfare tariff is welfare enhancing compared to a zero welfare revenue tariff.

Despite the contrasting theoretical concepts of monopoly and monopsony, governments, as key players in international trade, can concurrently assume a dual role by imposing optimal revenue tariffs. In this context, the government functions akin to a 'pure middleman,' capable of distorting prices through tariff imposition and collecting essential revenue. In our exploration, we introduce a theory of the zero-welfare revenue tariff, aiming to achieve welfare equivalent to that of free trade. Employing the Excess Demand (ED) and Excess Supply (ES) framework, we demonstrate

that the distribution of welfare under the zero-welfare revenue tariff is distinctly different from that under free trade. Our analysis reveals that government gains occur at the expense of a reduction in consumer and producer surplus. However, it ensures that welfare is at least equivalent to that of free trade.

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