Tariffs and Imports Mis-invoicing under Oligopoly

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Abstract

Mis-match of trade statistics between developed and developing countries indicate a substantial mis-invoicing of trade figures, primarily by developing country traders. This is due to the inflexible exchange rate regimes, severe import restrictions and export subsidies prevailing in LDCs. In this paper we focus on the import under-invoicing due to high tariff barriers in a market where domestic producers compete with importers. Specifically, we examine how tariff levels, market structure and government intervention (in the form of intensity of monitoring and severity of penalties) affect the levels of under-invoicing. We also look at the optimal levels of import tariff and instruments of government intervention in these circumstances.

Keywords: Import tariff, under-invoicing, Cournot oligopoly.

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I. Introduction

Many developing countries impose high import tariff barriers to protect their domestic industries and precious foreign exchange reserves by restricting imports to the domestic economy. This induces importers in developing countries to underreport or 'under-invoice' their imports in order to evade tariffs. Governments in these countries respond by putting in place monitoring mechanisms to detect and penalize such importers. This paper examines the consequence of attempts to control import under-invoicing in a market where domestic producers and importers are engaged in Cournot competition. The optimal tariffs as well as the optimal intensity of monitoring and penalties are also investigated.

The technique of detecting faked invoicing through the cross-checking of domestic trade data with respect to the one obtained from the partner country statistics was initiated by Morgenstern (1963). He first tried to prove that there existed corrupt activities among the international traders and went on to measure the extent of misreporting using the partner country statistics. Naya and Morgan (1969) applied the technique of partner country data comparisons to Asian countries. In his paper on the invoicing of Turkish import, Bhagwati (1964) explicitly linked up the discrepancies between the import data of Turkey and the export data of her partner countries to the economic rationale that import duties higher than the black market premium on foreign exchange provided a systematic reason to under-invoice the import carrying those high duties. Possible techniques for detecting smuggling were also found in the paper on Indonesia by Simkin (1970) where the difficulties of accessing unrecorded trade were discussed. Cooper (1974) analyzed the smuggling phenomena by setting the market prices of imported goods against the tariff-inclusive prices. If the later price exceeded the former, it was presumed that the goods were being smuggled and tariffs evaded.

Recently, it has been shown in the context of a simple export under-invoicing model that under-invoicing in India fell significantly as a result of devaluation (Marjit et al). Biswas and Marjit (2005), shows, by comparing Indian official trade statistics with corresponding developed country figures, that India's export and import figures have

always been underreported during 1960-98, barring a few exceptional years. They show in the context of a trade mis-invoicing model that that the exporter will under (over) invoice exports if the gain from selling the unreported export at the market exchange rate outweighs (falls short of) the loss in export subsidy. Similarly, an importer will under (over)invoice imports if the benefits of escaping high tariffs outweighs (falls short of) the loss from buying the foreign currency at the market exchange rate. The paper also considers a punishment function that is increasing and convex in the size of misreporting.

Other works in this area (Zdanowich et al, 1995, Patnaik and Vasudevan, 2000 and Loungani and Mauro, 2000) have tried to relate trade mis-invoicing with illegal movements of foreign exchange termed 'capital flight'. In a three country preferential – non preferential trade model Biswas and Marjit (2006) show that the low tariff preferential trade channel induces capital flight while the high tariff non preferential trade channel is conducive to illegal foreign exchange transactions in the domestic market.

It is important to observe that over the past couple of decades many developing countries have shifted to a system of flexible exchange rate where the exchange rate is market determined with very little intervention by the Central Bank. An obvious consequence of this system has been the gradual loss in significance of the so called 'black market premium' (BMP) for foreign exchange. However, protectionist tariffs as well as export subsidies, although lowered substantially as a result of WTO commitments, remain significantly high, providing developing country traders with motivation to mis-invoice.

It may therefore be important to understand the consequences of government policies – both regular tariffs and monitoring and penalty levels chosen by the government to control mis-invoicing - on the level of trade as well as mis-invoicing in a flexible exchange rate regime.

In this paper, we propose a simple model of Cournot competition between *m* domestic producers and *n* importers of a homogeneous good, where the importers have a propensity to under-invoice imports to avoid high tariffs. The government, in response, monitors imports through a system that detects under-invoicing with a probability depending on the level monitoring intensity (or expenditure). It also imposes a penalty that is increasing in the amount of under-invoicing.

We find that the rate of import under-invoicing is increasing in the tariff rate and decreasing in the monitoring intensity and severity of penalty. In our simple linear Cournot structure, the output produced in the domestic firms is increasing and the amount marketed by the importers is decreasing in the level of the import tariff. However, in our simple linear Cournot structure neither is affected by the level of monitoring intensity or the severity of the penalty. Further, while monitoring intensity and the rate of penalty negatively affect the importers' profits, it fails to influence the profitability of the domestic producers. More interestingly, while a higher tariff will raise the profits of domestic producers, it does not necessarily hurt the importers particularly if the number of domestic producers is small relative to importers. Finally, as the welfare initially rises and subsequently falls as a result of rising tariffs or monitoring intensity, it implies optimal tariff and monitoring intensity levels exist. But the welfare is monotonically increasing in the severity of penalty. Consequently, unless considerations other than optimality are introduced, it would be possible to make penalties increasingly severe which can completely wipe out the under-invoicing phenomenon.

The paper is organized as follows. Section II introduces the model. Section III studies the implications of Cournot competition on the rate of under-invoicing, prices, quantities and profits given the government policy variables like tariffs, monitoring intensity and the penalty function. Section IV introduces welfare considerations and investigates the optimal levels of the policy variables. Finally, section V concludes.

II. Model

There is a single homogeneous product q that may either be produced at home or imported from abroad. The domestic industry is assumed to have a constant unit cost of production is

$$c(q_d) = cq_d \tag{1}$$

while the international price is $\bar{p}$. We assume that the exchange rate is perfectly flexible with no difference between the official and the market exchange rate. The government can set an import tariff at the rate *t*. Then the domestic cost of obtaining q_f of the product for the importer, who does not under-invoice imports, becomes

$$c(q_f) = (1+t)\bar{p}q_f \tag{2}$$

We assume that there are *m* producers of the domestic good. If the number of importers is *n* and the firms compete in quantities, the (inverse) demand functions for the product can be written as

$$p = a - mq_d - nq_f \tag{3}$$

where *p is* the domestic price of the homogeneous domestic and foreign products.

The rate of under-invoicing α_j, is assumed to be the same, α, for all importers as they are identical in all respects. Thus if q_f and $\tilde{q}_f$ are the true and reported level of import (or output) by an importer, we have

$$\tilde{q}_f = (1-\alpha)q_f \tag{4}$$

The government, on its part, has a monitoring effort that allows it to choose the probability, φ, with which it can detect any arbitrary instance of under-invoicing of imports. φ *is a* function of the monitoring expenditure, *r*, and does not depend upon the amount of under-invoicing. Specifically, we assume that,

$$\varphi = \varphi(r) = \frac{r}{r+K}, \quad K > 0 \tag{5}$$

where K is an arbitrary constant. Note that the function $\varphi(r)$ has the following properties:

$$\varphi(0) = 0, \qquad \varphi(\infty) \to 1, \qquad \varphi' > 0, \qquad \varphi'' < 0 \tag{6}$$

as shown in figure 1.

The penalty for under-invoicing, if detected is assumed to be increasing and convex in the amount of evasion. In particular, it is assumed that the punishment cost, S, is

$$S = s.(\alpha.q_f)^2 \tag{7}$$

where *s* is a policy variable chosen by the government.

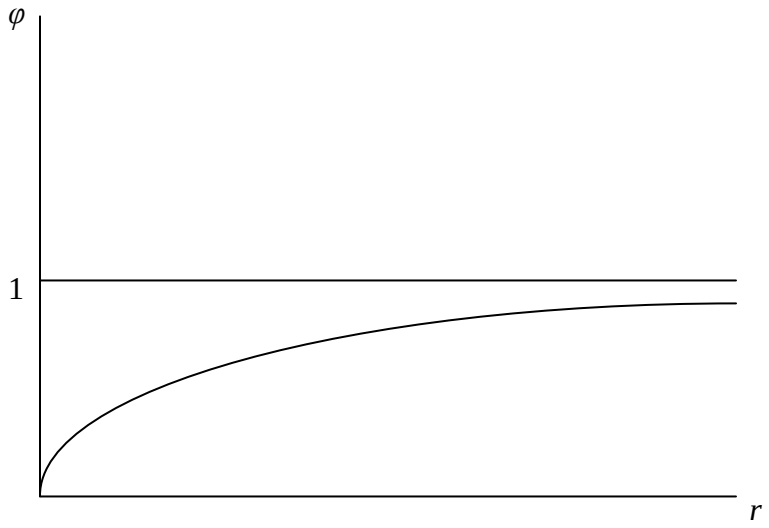

Figure 1: **Probability of detection as a function of monitoring expenditure**

Note that the above structure implies that (i) if there are several small evasions that add up to the size of one large evasion, there is a much larger probability of being detected, and (ii) the penalty for the large evasion, if detected, is larger than the probabilities of the small evasions.

Initially, the government sets the tariff rate, *t*, the monitoring expenditure, *r* and the penalty variable, s to maximize welfare. The domestic firm chooses its output, $q_{d,}$ while the importers simultaneously choose q_j and $\tilde{q}_j$, the amount of actual and reported imports (if there is quantity competition).

III. Import under-invoicing, outputs and profits

In this section, we analyze the market outcomes – i.e., prices, quantities and profits – as well as the amount of under-invoicing following the assumptions of given market

structure (price or quantity competition, number of importers etc) and values of policy variables, *t, s* and *r*. This is in keeping with the familiar method of solving a multistage game by a process of backward induction.

We initially assume that the *m* domestic firms and the *n* importers of the foreign product compete in quantities. Given values of the policy variables, *t, m* and *r*, they choose q_d, q_f and α to maximize;

$$\Pi^d = q_d\left(a - mq_d - nq_f\right) - cq_d \tag{8}$$

$$\Pi^f = q_f\left(a - mq_d - nq_f\right) - \left[(1-\alpha)(1+t) + \alpha\right]\overline{p}q_f - \varphi(r)s\left(\alpha.q_f\right)^2 \tag{9}$$

The first order conditions of the problem are:

$$a - (m+1)q_d - nq_f - c = 0 \tag{10}$$

$$a - mq_d - (n+1)q_f - \left[1 + t - t\alpha\right]\overline{p} - 2\varphi(r)s\alpha^2.q_f = 0 \tag{11}$$

$$t.\overline{p}q_f - 2\varphi(r)s\alpha.q_f^2 = 0 \tag{12}$$

From (12) we readily obtain

$$\alpha^* = \frac{t\overline{p}}{2\varphi(r)sq_f} \tag{13}$$

resulting in the following:

$$q_d^* = \frac{a - (n+1)c + n(1+t)\overline{p}}{m+n+1} \tag{14}$$

$$q_f^* = \frac{a - (m+1)(1+t)\overline{p} + mc}{m+n+1} \tag{15}$$

And from (14) and (15), we ultimately obtain

$$\alpha^* = \frac{t.\overline{p}(m+n+1)}{2\varphi(r)s\left\{a - (m+1)(1+t)\overline{p} + mc\right\}} \tag{16}$$

This immediately leads our first proposition.

Proposition 1: *An increase in import tariff causes*

(a) rise in production of each domestic firm;

(b) fall in import made by each importer and

(c) rise in the rate of under-invoicing of imports, i.e.,

$$\frac{dq_d}{dt} > 0, \frac{dq_f}{dt} < 0 \qquad and \qquad \frac{d\alpha}{dt} > 0 \tag{17a}$$

An increase in monitoring intensity (or expenditure) and stiff penalties have no effects on either domestic output or actual imports. However, it lowers the rate of under-invoicing.

$$\frac{dq_d}{ds} = \frac{dq_f}{ds} = \frac{dq_d}{dr} = \frac{dq_f}{dr} = 0 \tag{17b}$$

$$\frac{d\alpha}{ds} < 0, \ \frac{d\alpha}{dr} < 0 \tag{17c}$$

It is easy to see that a higher price of the importable as well as a higher tariff rate raises the cost of imports and hence lowers imports along with raising domestic production (by shifting their reaction functions outward). It is also evident that (with no change in monitoring efforts or penalties) raising the tariff rate induces the importers to increase the rate of under-invoicing as the benefits increase by more than costs. For the same reason (given the same tariff rate) increase in monitoring intensity and penalties reduces under-invoicing.

What is interesting, however, is that the neither the quantity of output produced by domestic firms nor the quantity imported and marketed by importers is affected by a change in the monitoring intensity or the stiffness of penalty. This indicates that the entire impact of the rise in penalties or monitoring intensity is absorbed by the importers through lowering the rate of under-invoicing, α, without any change in the level of imports. Consequently, there is no change in their reaction functions and the equilibrium outputs of both parties remain unaltered. This is also clear from the first order condition of equation (12). We can write this as

$$t.\overline{p} = 2\varphi(r)s\alpha.q_f \,. \tag{12a}$$

If *r* or s changes, it does not affect the LHS. In the RHS, α must change in the opposite direction to respond any change in *r* or s. This is required to keep marginal benefit equal to marginal cost in (12a).

Intuitively, as q_f is the actual quantity of imports, it should not be affected by the monitoring intensities or the severity of punishment. These two government policy instruments are required to monitor and subsequently punish the dishonest importers, if

caught. The probability of getting caught will depend upon the rate and amount of under-invoicing and not on actual value of imports. Hence, if *r* or s increases, α would fall, keeping q_f unchanged as it can only be affected by the tariff rate't'.

Next, substituting (14), (15) and (16) into (8) and (9) we obtain:

$$\Pi_d = (q_d^*)^2 \tag{18}$$

$$\Pi_f = (q_f^*)^2 + \frac{(tp)^2}{4\varphi(r)s} \tag{19}.$$

This leads to our second proposition.

Proposition 2: *Profit of the domestic firm varies directly with the rate of import tariff; however, it does not depend either on the monitoring intensity or the stiff penalty cost,*

$$\frac{d\Pi_d}{dt} > 0, \frac{d\Pi_d}{ds} = \frac{d\Pi_d}{dr} = 0. \tag{20a}$$

Profit of importers varies inversely with the monitoring intensity and stiffness of the penalty; however it may increase or decrease with import tariff depending upon α.

$$\frac{d\Pi_f}{ds} < 0, \frac{d\Pi_f}{dr} < 0; \ \frac{d\Pi_f}{dt} \ \begin{matrix} > \\ < \end{matrix} \ 0 \ \textit{according as} \quad \alpha \begin{matrix} > \\ < \end{matrix} \frac{2(m+1)}{m+n+1}. \tag{20b}$$

Intuitively, from Proposition 1, changes in the monitoring intensity or stiffness of penalties do not affect the output marketed by either the importers or the domestic producers. Hence it is easy to see that the profits of the domestic firms are not affected by the intensity of monitoring or stiffness of penalties. An increase in the tariff rate, of course lowers imports and benefits domestic producers whose costs go up.

Again, Proposition 2 shows that the importers would lower the rate of under-invoicing without any change in the quantity of imports given any increase in monitoring intensity or stiffness of penalties. It is then easy to justify that this situation leads to a lower profit for them.

What is most remarkable in this model is that an increase in the tariffs does not necessarily hurt the importers. An increase in tariffs lowers imports for each importer while at the same time the rate of under-invoicing increases. If the number of domestic producers (*m*) is low relative to the number of importers (*n*), the domestic output rises

much less than the contraction in the amount of imports. As a result the domestic price of the commodity would experience a greater hike than the anticipated one following a tariff escalation. The importers then may benefit more from higher price as well as higher under-invoicing compared to the loss due to lower quantity imported.

IV. Welfare and Public Policy

Welfare of a country under the setup of our model will depend upon the following variables: consumer surplus, profit of the domestic firms, earning from the tariff revenue, cost of monitoring for tariff evasion by the importers and earning from penalty drawn on the under-invoicing importers. The following equation captures the welfare function:

$$W = CS + m\Pi_d + pt(1-\alpha)nq_f - r + s\phi(r)(\alpha q_f)^2 \tag{21}$$

Differentiating (21) with respect to s, r and t we have,

$$\frac{dW}{ds} = \varphi(r)(2q_f)^2 n \tag{22}.$$

$$\frac{dW}{dr} = s\varphi'(r)(\alpha.q_f)^2 n - 1 \tag{23}.$$

$$\frac{dW}{dt} = \frac{n\bar{p}}{m+n+1}(mq_d - nq_f) + \bar{p}(1-\alpha)q_f + n\bar{p}(1-\alpha q_f) - \frac{nt\bar{p}^2}{q_f(m+n+1)}(q_f - 1) \tag{24}.$$

This leads to our next proposition.

Proposition 3. *Welfare is increasing in the severity of the penalty, s. However, increasing monitoring intensity, r, or the tariff rate, t, increases welfare only up to a point, beyond which any increase in r or t reduces welfare.*

Equation (22) indicates $\frac{dW}{ds} > 0$ as all terms in the right hand side are positive. Raising the stiffness of penalties does not affect domestic producers. It only negatively affects importers profits without lowering their actual output. The government as a result benefits by collecting higher penalties. Since welfare in our structure includes government revenues but not importers' profits, a rise in the penalty rate clearly raises welfare.

But this also means that unlike many models of pecuniary punishment there is no optimal severity of penalty in this structure. In fact, from (7) and (16), it is easy to see that making *s* infinitely large would reduce the rate of under-invoicing, α to zero, which is clearly the optimal solution. This is shown in Figure 2. The reason, we cannot impose such extremely high penalties in practice, is that the legal system places more emphasis on the "fairness" than on the "optimality" of the punishment – i.e. it attempts to ensure that "the punishment fits the crime". In other words there is usually an external constraint on the punishment that would be "justified" for any given amount of under-invoicing.

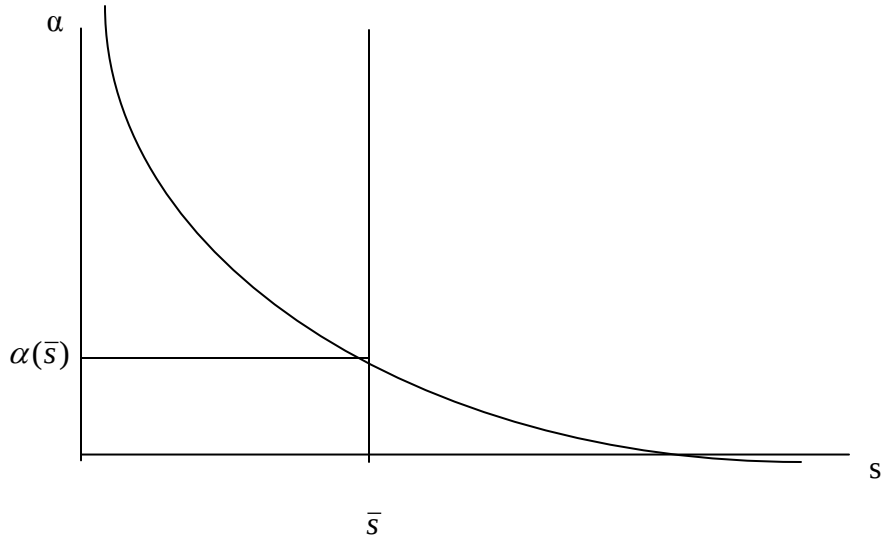

Figure 2: The maximum severity of penalty considered "fair"

By contrast, equations (23) and (24) have ambiguous signs. Following (23), it comes out that $\frac{dW}{dr} > < 0$ as $\frac{nt^2 p^2}{4\{\phi(r)\}^2 s} > < 1$. It implies that unlike s, W is not monotonically increasing in r. A rise in monitoring intensity hurts only the importers at the cost of government revenue – much in the same fashion as the penalty rate. However, unlike the case of the penalty rate, raising monitoring intensity is costly for the government. A rise in r (i) lowers the rate of under-invoicing, α (ii) raises the probability of detection, $\varphi(r)$ as well as (iii) the cost of monitoring. It is easy to check that, since from (5) and (13) that $\varphi'(r)$ and α are positive and very high for $r = 0$, we have from (23) that

$$\frac{dW}{dr}(r=0) > 0$$

while at the same time

$$\frac{d^2W}{dr^2} = nsq_f{}^2\ \alpha^2\varphi''(r) - n.\alpha.t.pq_f\varphi'(r)\frac{\varphi'(r)}{\varphi^2(r)} \quad < 0$$

This means that although welfare is increasing in monitoring intensity when monitoring intensity is low, there is an optimum value for r beyond which any increase in r would cause domestic welfare to fall as shown in the following figure.

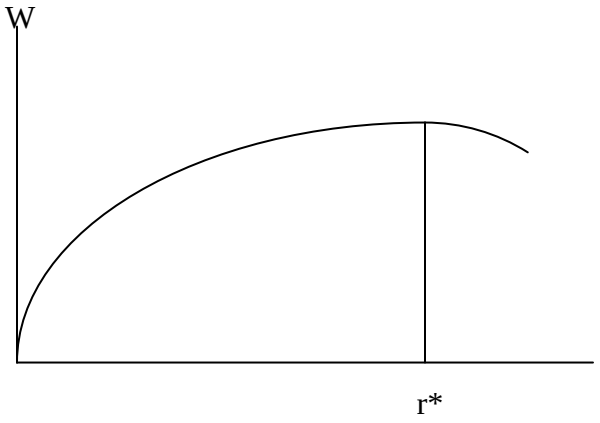

Figure 3: Relationship between monitoring expenditure and welfare.

Similar argument can be put forward for equation (24) as well. It is easy to verify that as usual welfare is initially increasing and subsequently declining in tariff so that it is possible to work out the 'optimal' tariff level.

V. Conclusion

We study the implications of government policies to control import under-invoicing in a simple linear Cournot model that leads to some interesting results. Among these are the results that (a) raising the tariff levels do not always hurt the importers and (b) in the absence of any exogenous or "social' bounds on the severity of penalty for under-invoicing it would be possible to raise penalties to wipe out under-invoicing altogether. However, more general models would be needed to confirm the robustness of these results.

References:

- Biswas A K. & Marjit, S., 2005 "*Mis-invoicing and Trade Policy*", The Journal of Policy ReformVol. 8, No. 3, 189–205
- .Biswas A K. & Marjit, S., 2006 "*Preferential Trade and Mis-invoicing: Some Analytical Implications*", forthcoming in International Review of Economics & Finance.
- Bhagwati, J. N. (Ed.) (1974), "*Illegal Transaction in International Trade, Studies in International Economics",* Vol. 1 (Amsterdam: North Holland).
- Cooper, R. N. (1974) Tariffs and smuggling in Indonesia, in: J. N. Bhagwati (Ed.) *Illegal Transaction in International Trade, Studies in International Economics,* Vol. 1, pp. 183–192 (Amsterdam: North Holland Publishing Company).
- Loungani, Prakash, and Paolo Mauro, 2000, "*Capital Flight from Russia*", IMF Policy Discussion Paper, International Monetary Fund, June.
- Marjit, S., Dasgupta, B. and Mitra, S., 2000, "*Currency Devaluation and Exports: Separating Actual from Statistical*", Economic and Political Weekly, Vol. XXXV, No. 18, pp 1553-1558.
- Morgenstern, O. (1963), "*On the Accuracy of Economic Observations: Foreign Trade Statistics",* Chapter IX, The Accuracy of Economic Observations, reprinted in Bhagwati (1974), pp. 87–122.
- Naya, S. & Morgan, T. (1969), "*The accuracy of international trade data: the case of South East Asian countries*", Journal of American Statistical Association, June, reprinted in Bhagwati (1974), pp. 123– 137.
- Patnaik, I. & Vasudevan D. (2000), "*Trade mis-invoicing and capital flight from India*", Journal of International Economic Studies, 14, pp. 99–108.
- Simkin C.G.F., 1970, "*Indonesia's Unrecorded Trade*", Bulletin of Indonesian Economic Studies, March, reprinted in Bhagwati (Ed.), pp 157-171.
- Zdanowich, John, William W. Welch and Simon J. Pak, 1995, "*Capital Flight from India to the US Through Abnormal Pricing in International Trade*", Finance India, Vol. 9 (September), pp. 609-27.