

INTERPRETING TRADE STATISTICS IN REGULATED AND DEREGULATED MARKETS - AN ANALYTICAL EXERCISE BASED ON INDIAN EXPERIENCE

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Abstract

Trade statistics reported through the official sources may not provide the right information because a regulated system does not induce truthful revelation. Hence, policy prescriptions or evaluations based on official statistics can be misleading. We adopt the well-known methodology of utilising partner country statistics to reflect on the consequences of devaluations of Indian rupee in 1960s and 1990s on exports, imports and Balance of Trade. First tractable analytical results are developed and then attempts are made to match them with the empirical evidence.

Keywords: Black Market Premium, mis-invoicing of trade data.

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1. Introduction:

The problem of reliability of the official statistics stems from the fact that policy distortions generate multiple prices/incentives for similar goods/activities. Monitoring authorities may be hard put to contain the resultant "process of arbitrage", popularly known as "corruption". Mis-reporting of statistics is a natural outcome of this process¹. One possible way to crosscheck the data is to avail information from alternative sources. This is impossible in general because different agencies do not collect the same information. One notable exception is the trade statistics. We get information on two-way transactions from the Direction of Trade Statistics (DOTS) yearbook published by International Monetary Fund (IMF) (also from the International Trade Statistics Year book published by the United Nations). An attempt can be made to check the accuracy of the official statistics by consulting any two of the sources. Conceptually, when two countries A and B are trading with each other, after cif/fob adjustments, value wise,

A's export/ import to B $\equiv$ B's import/ export from A.

But comparison of the Indian official trade data with India's largest trade partners' (viz., US, UK, Japan and Germany) reveal discrepancies which cannot simply be explained by so-called 'transport costs', i.e., by c.i.f./f.o.b. ratio. Presuming that the Developed Countries (DCs) have relatively unregulated markets and better monitoring capabilities and it is extremely costly for the officials to coordinate their efforts in unearthing the illegal reporting, we may suggest that the Indian export/import data found in the official statistics of partner countries, is a close proxy of the 'actual' figure provided one is ready to make rough adjustment for 'transport' costs². We perform such corrective adjustment subsequently in this paper³.

The principal technique of detecting faked invoicing through the checking of domestic trade data vis-à-vis the one obtained from the partner country statistics, was initiated through a pioneering work by Morgenstern (1963). He first tried comprehensively 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. The technique of partner country statistics comparison was developed there with great mastery and elegance. A modern version of Morgenstern's work is the paper by Naya and Morgan (1969), which extends the technique of partner country data comparisons to Asian countries, again focusing on the statistical aspects of these discrepancies. The use of partner country data comparisons initiated specifically to the detection of faked invoicing can be explicitly found in the policy – oriented research of other economists. In his paper on the invoicing of Turkish imports, Bhagwati (1964) explicitly links 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 provide a systematic reason to under-invoice the imports carrying those high duties. Possible techniques for detecting smuggling are also found in the paper on Indonesia by Simkin (1970) where the difficulties of accessing unrecorded trade is discussed. Cooper (1974) analyses the smuggling phenomena by setting the market prices of imported goods against the tariff-inclusive prices and if the latter price exceeds the former, it is presumed that the goods are being smuggled and tariffs evaded. Dornbusch et al (1983) tried to examine the black market for foreign exchange in Brazil and analysed the exchange rate movements based upon the existing stocks of dollars and expectations about future currency devaluations. This exercise was extended to other Less Developed Countries (LDCs) in Kamin (1993). Jianping (1998) explored the different sources of demand and supply components in the black market for foreign exchange and observed that premium in the black market could never be completely wiped out even if the market exchange rate was taken as the official rate⁴.

Though faked invoicing and smuggling in trade activities are high in LDCs, hardly any thorough research has been initiated in the Indian contexts combining export and import mis-

invoicing and their impact on country's Balance of Trade (BoT). Only recently Marjit, Dasgupta and Mitra (2000) in their paper have tried to build up a simple export under-invoicing model and verified the fact that with devaluation the extent of under-invoicing fell significantly⁵. They have shown that there is significant differences between actual and official export values in India and the official export is more responsive than the actual one to the changes in the official exchange rate.

Till 1991 Indian foreign exchange market remained highly regulated and it has been characterised by the operation of 'Black Market' for foreign exchange. The term black market exchange rate, usually refers to the unofficial market exchange rate and includes a premium, called the 'Black Market Premium' (henceforth, BMP) that reflects pent-up excess demand pressures that foreign exchange restrictions are intended to contain. Since 1991 a relatively deregulated foreign exchange market with considerable devaluation and depreciation in the value of rupee has wiped out the premium to a large extent. Future expectations can be another reason for current premium. However, we do not bring in expectations in our framework of analysis.

If currency prices differ in official and illegal transactions, agents will rationally allocate their foreign exchange earnings in two alternative avenues. While the black market provides the premium, it entails a punishment cost following audits in the future. The 'overvalued' currency in official transactions put a 'legal' stamp on the export earnings. If there is any such interior solution, the officially reported export earnings will only reflect a part and not the whole of exports. A similar line of argument can be forwarded in case of imports. Hence, the official statistics will not give the right picture.

What we are trying to do in this paper is related to the literature mentioned above. We observe huge differences between official export figures and corresponding partner countries' statistics regarding imports from India. Similar things happen in case of India's official import figures also. For the period 1960-98, India's official export and import figures are always underreported barring few exceptional years. Here, taking together exports, imports, and merchandise trade balance data from both official and partner country sources, we try to measure this extent of divergence. Highly regulated 'overvalued' domestic currencies means high BMP, so there will definitely be incentives for exporters to under-invoice their export values and sell the rest of foreign currency earnings at market exchange rate. On the other hand if the unit export subsidy rates are sufficiently high, then exporters may even over-invoice if they find that subsidy gains outweigh BMP loss. In case of importers an overvalued exchange rate makes them to over-invoice but they will under-invoice if tariff rates are sufficiently high. In this paper, we have tried to build up theoretical models of exports, imports and BoT, in terms of simple comparative static framework to find out how the corresponding policy instruments are going to affect the extent of trade mis-invoicing. We also check the validity of the results of our models by tallying those with the empirical findings⁶.

The paper proceeds as follows. Section 2 builds up the export model, its results and empirical findings with analytical diagrams. Section 3 deals with the import model and the details of it. Section 4 briefly takes up the BoT model, discusses the results. Last section concludes the paper.

2. The Export Model:

When an exporter does not reveal his true value of exports, he may either under-invoice or over-invoice. The former case occurs when the official exchange rate is overvalued and the latter case is the outcome if the export subsidy is really very high and financially attractive. In our model we are taking the two cases together to form a general objective function for a typical rational

exporter. He underreports to gain the lucrative BMP by selling the unreported exports at the market exchange rate when he thinks that BMP gain will outweigh the subsidy loss. He over-reports the export values to gain some extra amount of financial benefits in the form of subsidy when it is anticipated that subsidy gain will outweigh the BMP loss. We use the following notations to build our model.

X_{ot} : Reported or official dollar value of Indian exports at time t ,

X_t : Actual dollar value of Indian exports at time t ,

e_t : Official exchange rate at time t ,

E_t : Market exchange rate at time t ,

s_t : Per unit subsidy on dollar value of official export at time t .

In our export model, where we combine both the problem of under and over-invoicing, the relationship between actual (X_t) and reported (X_{ot}) export can be expressed as:

$$X_{ot} = (1-\alpha) X_t, \quad \alpha \leq 1 \quad (\alpha \text{ is the rate of mis-invoicing}) \dots\dots\dots(1).$$

From (1) it is clear that whenever $\alpha \leq 0$, the case is over-reporting is occurred and if α lies between $(0, +1)$, it means he is under-reporting to the concerned authority.

The basic assumption of our model is that whenever there is an increase in the official exchange rate the gap between the market exchange rate and the official exchange rate falls. Hence, the change in the BMP and the change in the official exchange rate are inversely related. We introduce the term BMP, denoted as v_t and defined as

$$v_t = E_t - e_t, \quad v_t > 0 \text{ and } (dv_t/de_t) < 0 \dots\dots\dots(2).$$

Assume that there is a cost of mis-reporting, which includes the penalty charged on an exporter and consequential (if possible) bribe payments if caught⁷. Besides other things the cost depends upon the amount of mis-invoicing. First and second order derivatives of the cost functions are positive as the higher the extent of mis-invoicing, the larger will be the cost of punishment and monitoring will be more stringent.

Let us discuss the formulation of the objective function of the mis-invoicing exporter. Officially reported export in terms of dollar is X_{ot} . He evaluates it in terms of domestic currency at the official exchange rate and his gain is $e_t X_{ot}$. As he mis-invoices, the extent of mis-invoicing is $(X_t - X_{ot})$ and if it is negative then he gains through the extra amount of subsidy earned by over-invoicing. The exporter under-invoices when the gap is positive and he sells the unreported values of exports at the market exchange rate (greater than the official one) and gains $E_t(X_t - X_{ot})$. But whenever an exporter mis-invoices, he has to be aware of the punishment cost, which is a function of the extent of mis-invoicing and hence his cost would be $F(X_t - X_{ot})$ with $F', F'' > 0$. Thus, the objective function of this kind of exporter can be written as –

$$W(\alpha) = e_t X_{ot} + e_t s_t X_{ot} + E_t(X_t - X_{ot}) - F\{(X_t - X_{ot})\} \dots\dots\dots(3).$$

Incorporating (1) and (3), we can write,

$$W(\alpha) = e_t(1-\alpha) X_t + e_t s_t (1-\alpha) X_t + E_t \alpha X_t - F(\alpha X_t) \dots\dots\dots(3')$$

$$= [e_t X_t (1 + s_t)] + \alpha X_t \{v_t - e_t s_t\} - F(\alpha X_t) \dots\dots\dots(3'')$$

Scrutinizing (3''), it can be observed that the first term of the right hand side (RHS) demonstrates the ‘Honesty pay-off’, i.e., the amount the exporter might gain if he did not under-invoice.

The first order condition (FOC) of maximisation of the above equation with respect to (WRT) α gives us, $dW(\alpha)/d\alpha = 0$, i.e., $(v_t(e_t) - e_t s_t) = F'(\alpha X_t)$ [from (2) and (3'')] $\dots\dots\dots(4)$.

Assuming that the cost is covered, from (4), the dishonesty condition requires, $v_t \neq e_t s_t$. A rational exporter will under-invoice when $v_t > e_t s_t$ and both sides of (4) will be positive as α will also be positive. Here v_t is the additional income in local currency against one unit of dollar if that is not officially reported and $e_t s_t$ is the income in local currency forgone per unit of dollar if that dollar is officially reported. Thus, condition for under-invoicing implies when subsidy loss on per unit of officially reported exports is more than compensated by BMP, it is beneficial to under-invoice exports. Similarly he will over-invoice when the above condition is reversed, i.e., when $v_t < e_t s_t$. In that case both sides of (4) will be negative as α will also be negative.

Let us find the effects of policy instruments, on mis-invoicing. Further differentiation of the FOC yields,

$$(\delta[v_t - e_t s_t - F'(\alpha X_t)]/\delta\alpha) (d\alpha/de_t) + dv_t/de_t - s_t = 0 \text{ (we assume that } X_t \text{ is exogenous),}$$

$$\text{or, } d\alpha/de_t = \{s_t - dv_t/de_t\} / -\alpha X_t F''(\alpha X_t) \dots\dots\dots (5)$$

$$[\text{as } (\delta[v_t - e_t s_t - F'(\alpha X_t)]/\delta\alpha) = -\alpha X_t F''(\alpha X_t) < 0 \text{ as } F'' > 0].$$

In (5), as $dv_t/de_t < 0$, $d\alpha/de_t < 0$ or $d(-)\alpha/de_t > 0$. It implies that, on the one hand, through devaluation as official exchange rate depreciates, BMP falls and exporter will lose the incentive to under-invoice since the gap between v_t and $e_t s_t$ falls. On the other hand, $e_t s_t$ increases as e_t increases, then the exporter may be induced to over-invoice when he will find that subsidy given in terms of domestic currency at official exchange rate outweighs the BMP gain.

$$\text{Also, } (\delta[(\delta[v_t - e_t s_t - F'(\alpha X_t)]/\delta\alpha)]/\delta\alpha) (d\alpha/ds_t) - e_t = 0$$

$$\text{or, } d\alpha/ds_t = e_t / -\alpha X_t F''(\alpha X_t) \dots\dots\dots (6).$$

Equation (6) shows that $d\alpha/ds_t < 0$ or $d(-)\alpha/ds_t > 0$. It demonstrates the fact that as s_t increases again the gap between v_t and $e_t s_t$ falls. Hence, the extent of under-invoicing falls and like the devaluation case here also the exporter may be induced to over-invoice, as he would gain in terms of added aggregate subsidy.

The determination of the mis-invoicing component (α) is demonstrated in figure 1. Whenever a rational exporter mis-invoices his export values for financial gain, he must also take into account the cost of mis-reporting. We have made it clear that this comes in the form of punishment costs and depends upon the extent of mis-reporting and not upon the nature of mis-reporting (i.e., not upon under or over-invoicing). We assume that the cost is symmetric. The punishment cost is convex to the horizontal axis (α), the axis of mis-invoicing and both $F'(\alpha | X_t)$ and $F''(\alpha | X_t)$ are positive. When there is no mis-invoicing, the punishment cost is zero and both F' and F'' are equal to zero. In our model E_t , e_t and s_t are all exogenous and hence the marginal revenue (MR) is constant and parallel to the mis-invoicing (α) axis. In the figure, on the horizontal axis we measure the extent of mis-invoicing and on the vertical axis we have MR, MC (marginal cost). Whenever $v_t > e_t s_t$, it means for an exporter it is profitable to under-invoice and the larger the gap, the higher will be the extent of under-invoicing. This is shown in the first quadrant. If the gap falls through devaluation then the extent of under-invoicing and hence both MR and MC fall.

The case will be diametrically opposite when $e_t s_t > v_t$. Then the exporter will over-invoice and α will be negative. Again, the extent of over-invoicing and magnitude of MR and MC will depend upon the gap between $e_t s_t$ and v_t . If the subsidy falls, then the gap along with MR and MC falls. This is shown in the second quadrant.

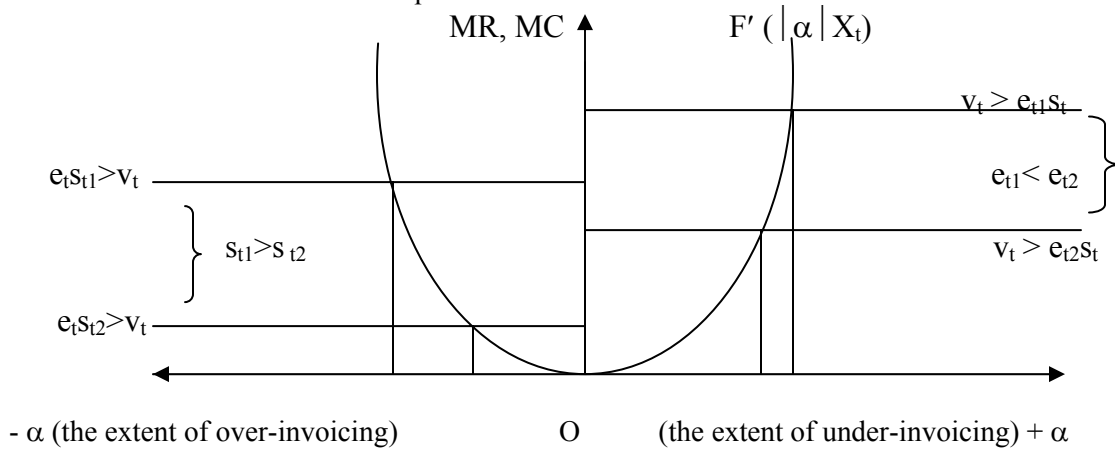


Figure 1: Equilibrium in the export mis-invoicing market

But when $v_t = e_t s_t$, it is hard for an exporter to take decisions on mis-invoicing export values because he may find it very hard to cover his punishment cost through any kind of mis-invoicing behaviour. This will lead him to stay on the minimum point on the MC curve, which is eventually tangent to the origin of the horizontal axis. At this point his extent of mis-invoicing is zero as he is compelled to proper-invoice by the market conditions.

Interestingly, the results of our model lead to the fact that changes in both e_t and s_t affect the mis-invoicing component in the same manner. Whenever these two variables are rising there are possibilities that under-invoicing will fall and over-invoicing will rise. The case will be just opposite when the two variables will tend to decrease.

2.1. Analytical Diagram:

In the first two diagrams we examine the curvature of both the actual and official export with respect to the change in official exchange rate and unit rate of subsidy respectively. We keep the actual export curve ahead of its official counterpart. Here discontinuous and continuous lines show the actual and official curves respectively.

In figure 2, the official export curve is steeper i.e., more responsive than its actual counterpart. It follows from the fact that whenever there is an increase in the official exchange rate, the BMP falls. The exporter thus loses the incentive to under-invoice the export values because now it is less profitable to sell those exportables in the black market at market exchange rate. Besides, a cost element is also there in terms of getting caught and possible punishment or bribe payments. Hence, with the increment in e_t , greater truthful revelation of official exports will occur though the actual export will take its usual course of adjustment. Eventually, as e_t goes on increasing, BMP will be closer to zero and assuming that the unit subsidy remains unchanged, the official and actual export curve will come closer and may even coincide when official and market exchange rates are equal.

Unit subsidy rate is usually raised to encourage the exporters to increase their exports. So, the more the value of exports the higher will be the subsidy gain. As a result, with the increase in the subsidy rate, the exporters will decrease their extent of under-invoicing demonstrating the fact that official exports will again be more responsive to subsidy rate than its actual counterpart because the actual exports will take time to adjust. This is shown in figure 3. Naturally, the official export curve is steeper. Intuitively, if export subsidy is equal to or higher than a particular subsidy rate, s^* (i.e., sufficiently high) then it can be happened that official export outweighs the actual export as the exporters may get some incentives for over-invoicing to attract the lucrative subsidy. It is shown in this figure where beyond s^* , $X_{ot} > X_t$. One must note that even if actual export is totally insensitive to exchange rate or subsidy adjustments, official statistics may report otherwise.

2.2. Empirical Findings:

Let us now tally our theoretical results with the empirical findings comprising Indian and corresponding data of India's large DC partners and find out how mis-invoiced is Indian export statistics. Checking the reliability of data and the extent of error is not easy since the sources of

errors are many, ranging from difficulties of collection and organisation to plain falsification. According to Naya and Morgan (1969), the latter is a problem peculiar to the social science: the physical and biological sciences face the challenge of blunders, but seldom of intent and error.

In our empirical exercise we are treating the aggregation of US, Japan, Germany and UK official imports figures as actual Indian export figures. The sole reason behind this formulation is that US and any other DCs are almost absolutely unregulated countries and the 'all-important' BMP does not matter very much. Now regarding the adjustment of c.i.f. DC import into actual f.o.b. Indian exports and f.o.b. DC export into actual c.i.f. Indian import we have followed the rule suggested in the DOTS yearbook, published by the IMF. According to DOTS, when partner data are directly or indirectly used to derive domestic estimates, the data first are adjusted by a c.i.f./f.o.b. factor of 1.10 to allow for the cost of freight and insurance. Reported imports cif are divided by c.i.f./f.o.b. factor to give partner country export f.o.b. Given the absence of timely data on cost, insurance and freight, the 10% c.i.f./f.o.b factor represents a simplified estimates of those costs.

Let us evaluate the results of our empirical findings of the two highly significant devaluation periods viz., that of 1960s and '90s. The first major devaluation of rupees by 57.5% (from Rs. 4.76 to Rs. 7.50 per US \$) was announced in June, 1966. Since this was also accompanied by the elimination of export subsidy and reduction of import duties (though not thoroughly pronounced), the net devaluation after allowing for these changes was on an average less than the gross devaluation of 57.5% and varied among commodities. According to Bhagwati and Srinivasan (1975), the total net devaluation on the trade account was 21.6% for exports. Generally a devaluation works as a fuel for export growth. From table 1, where India's export data has been computed, we can see that immediately after devaluation both actual and official exports have increased but the growth rate of official exports is greater than the actual one. Desirably, the gap between actual and official exports experienced a fall from 87.81 million US \$ in 1966 to 66.8 million US \$ in 1967. But this trend was short-lived because two severe droughts resulted at that time forcing the government to go back to the tight monetary regime; and following our theory the gap between actual and official exports increased again and the growth rate of official export fell sharply to the actual one in the very next year (1968). But as subsidies were further reinstated the fall was not as vivid as it was in the earlier years. These findings confirm the results of our comparative static analysis.

The devaluation process of the 90s' was complicated by other trade related measures like export subsidies and tariff waivers for the imports meant for exports etc (Marjit & Raychaudhuri, 1997). Thus, the empirical results became a bit complicated one. It can be analysed in a phased manner. In the earlier years when devaluation occurred but subsidies were there, the growth rate of official exports was greater than the actual one. But expectation about future devaluation and removal of some of export subsidies compelled the growth rate of actual exports get past the official one. The trend was further reversed and official growth rate was again became higher as market exchange rate was adopted and the BMP fell significantly. Graphs (1), (2) and (3) demonstrate all these facts and the latest trend shows that the actual and official exports are going to converge.

3. Import Model:

Mis-invoicing of imports – a discrepancy between the stated value of imports and their actual value (payable to the exporters abroad) – may arise characteristically in two cases: firstly, when the imported commodity carries a tariff duty and secondly, when the BMP is high. An under-invoicing of imports may take place when the tariff gain outweighs the BMP gain and the case of

over-invoicing may occur when the latter exceeds the former. Like the previous export model however, a risk is attached to both under and over statement of the value of imports and importers have to take into account of that when forming the objective function. Here –
 M_{ot} : Reported or official dollar value of imports at time t ,

M_t : Actual dollar value of imports at time t ,

d_t : Per unit import duty on dollar value of imports at time t .

Combining the problems of both under-invoicing and over-invoicing, we form the relationship between actual and stated values of imports as

$$M_{ot} = (1-\beta) M_t, \beta \leq 1 \quad (\beta \text{ is the rate of mis-invoicing}) \dots\dots\dots(7).$$

Like the export model, equation (7) states that whenever $\beta \leq 0$, the case of over-reporting occurs and if β lies between $(0, +1)$, it means the importer is under-reporting to the concerned authority.

The formulation of the objective function of the mis-invoicing importer is formed in the following manner. His officially reported value is M_{ot} . To mitigate the expenditure on this import, foreign exchange is needed and equivalent amount of domestic currency is given to the exchange authority. So his cost is $e_t M_{ot}$ in terms of official exchange rate. The tariff duty, to be paid at official exchange rate, is denoted by $e_t d_t M_{ot}$ on his foreign currency augmented value of imports. If he under-invoices βM_t amount of imports, to buy it he has to pay the market exchange rate to acquire that amount of foreign exchange and his additional cost is $E_t \beta M_t$. There is also a punishment cost, which depends on the extent of mis-invoicing, like in the export model. We assume that the cost of punishment behaves similarly as in the case of exports, i.e., $F', F'' > 0$. Hence, the objective function of the importer can be written as:

$$V(\beta) = R(M_t) - e_t M_{ot} - e_t d_t M_{ot} - E_t (M_t - M_{ot}) - F (M_t - M_{ot}) \dots\dots\dots(8)$$

where $R(M_t)$ is the fixed revenue earned by the importer as M_t is fixed.

$$\text{From (7) and (8), } V(\beta) = R(M_t) - e_t (1-\beta) M_t - e_t d_t (1-\beta) M_t - E_t \beta M_t - F (\beta M_t) \dots\dots\dots(8')$$

$$= R(M_t) - [e_t M_t (1 + d_t)] + \beta M_t (e_t d_t - v_t) - F (\beta M_t) \dots\dots\dots(8'')$$

Evaluating (8''), we see that if the importer would remain honest the first term of RHS is his true cost. The FOC of maximisation of the above equation WRT β gives us,

$$dW(\beta)/d\beta = 0, \text{ i.e., } (e_t d_t - v_t(e_t)) = F'(\beta X_t) [\text{from (2) and (8'')}] \dots\dots\dots(9).$$

Assuming again that the cost of punishment is covered, from (9), the dishonesty condition requires, $v_t \neq e_t d_t$. A rational exporter will under-invoice when $e_t d_t > v_t$ and both sides of (9) will be positive as β will also be positive. This condition demonstrates that under-invoicing occurs when the domestic currency augmented tariff rate on per unit dollar value of import at official exchange rate is greater than the BMP. Similarly over-invoicing of imports occurs when the above condition is reversed, i.e., when $v_t > e_t d_t$. In that case both sides of (9) will be negative as β will also be negative. The over-invoicing condition is indicative of a more lucrative BMP.

Let us find the effects of policy instruments, on mis-invoicing. Further differentiation of the FOC yields,

$$(\delta[e_t d_t - v_t - F'(\beta M_t)] / \delta\beta) (d\beta/de_t) + d_t - (dv_t/de_t) = 0 \text{ (we assume that } M_t \text{ is exogenous),}$$

$$\text{or, } (d\beta/de_t) = [(dv_t/de_t) - d_t] / -\beta M_t F''(\beta M_t) > 0 \dots\dots\dots(10),$$

$$\text{where } (\delta[e_t d_t - v_t - F'(\beta M_t)] / \delta\beta) = -\beta M_t F''(\beta M_t) < 0 \text{ as } F'' > 0.$$

Equation (10) shows that as e_t increases and BMP falls, it is now less costly for an importer to buy foreign exchange (say, dollar) at market exchange rate. Also with the increase in e_t , the tariff duty, d_t , to be paid in terms of domestic currency, exchanged at the official exchange rate, $e_t d_t$, increases. This will induce him to under-report more amount of import values as his gain increases through tariff evasion. Thus, devaluation compels a dishonest importer to increase his extent of under-invoicing.

$$\text{And, } (\delta[e_t d_t - v_t - F'(\beta M_t)] / \delta\beta) (d\beta/dd_t) + e_t = 0,$$

$$\text{Or, } (d\beta/dd_t) = -e_t / -\beta M_t F''(\beta M_t) > 0 \dots\dots\dots(11).$$

The result of equation (11) is obvious. It implies as tariff increases, the importer will increase his rate of under-invoicing to evade the higher than before tariff hurdle.

Like the export model, here also we can find that the policy instruments are working in the same direction. Both currency devaluation and increase in tariff rate will induce an importer to under-invoice his import values. Import over-invoicing can only take place when an importer finds that the BMP is unusually high. In that type of market condition, firstly it will be hard for him to buy the unreported import basket at market exchange rate. Secondly, he may find that the loss he is making by paying tariff on the amount of imports, which he is not actually importing, is more than compensated by selling that extra foreign exchange (value of imports in terms of foreign currency, which is over-reported) in the domestic market at market exchange rate (BMP gain).

The determination of the import mis-invoicing rate β , can also be demonstrated through a similar kind of diagram like the export model. So, we are not illustrating this in this section.

3.2. Analytical diagrams:

In figure (4), the actual and official import curves are measured in the vertical axis and official exchange rate is plotted in the horizontal axis. We know that as the exchange rate rises BMP falls. It means that buying importable at market exchange rate is not as costly as before devaluation. Hence, assuming that unit tariff rate is unchanged, the importers will now increase their extent of under-invoicing just with the sole objective to evade the tariff costs. As usual the actual import values will take its own time to adjust and the official import curve will be steeper than its actual counterpart. This implies that the gap will be widened over time.

In figure (5), as d_t increases, M_{ot} will fall more steeply than M_t because with the increase of duty the importer will go on increasing their extent of under-invoicing to evade the tariff with the official exchange rate remains same. The actual import will slowly adjust to fall in response to high duty rate. Of course, the gap between the actual and official imports increases at least in the short period of time before both of it adjusts slowly.

3.3. Empirical findings:

According to Bhagwati and Srinivasan (1975), the total net devaluation for the import was 42.3% in 1966 following nominal devaluation and removal of import tariff. We examine the impacts of devaluation and other related measures in the periods of 60s' and 90s' for the mis-invoicing of Indian imports. The complete result is shown in table 2.

In 1966 when devaluation occurred with the partial removal of import tariffs, the gap between actual and official imports fell from 136.43 (1966) to 85.24 (1967) to even (-) 103.21 (1968) million US \$. This was just the reflection of our comparative static analysis as previously import tariffs were very high. But immediately as tariff duties were reinstated in 1968 following tough economic condition at home, the said gap again became positive to 23.1 (1969) to further 121.11 (1970) to even a whipping 312.4 million US \$ in 1971.

In the 90s', the effects of policy instruments on the import mis-invoicing are as complex as in the case of exports. Here too we can identify two or three distinct phases depending upon the rate of devaluation, speculation about future exchange rate and rate of import tariff changes. When in

the early years of devaluation the BMP was high, it was costly for the importers to buy their importables at market exchange rate. Hence at that time the growth rate of official imports was high. But as slowly BMP fell with unchanged tariff rate, the actual growth rate became higher. In the third or present phase when BMP falls continuously and tariff structure is also rationalised, immediately the official growth rate outweighs the actual one. In the last quarter of the 90s' both actual and official imports converge. These empirical findings are shown in graphs (4), (5) and (6).

4. The Balance of Trade Model:

In this section we are to formulate the BoT model combining both the export and import. By definition the official BoT is the difference between official export and official import values.

Let B_{ot} be the official balance of trade and $B_{ot} = X_{ot} - M_{ot}$ (12).

Following equations (1) and (7), $B_{ot} = (1-\alpha) X_t - (1-\beta) M_t$ (12').

We differentiate (12') with respect to e_t, s_t, d_t to get,

$$(dB_{ot}/de_t) = (1-\alpha) (dX_t/de_t) - X_t (d\alpha/de_t) - (1-\beta) (dM_t/de_t) + M_t (d\beta/de_t) \dots\dots\dots (13).$$

Assuming as before that X_t and M_t are exogenous and with (5) and (10) we get:

$$(dB_{ot}/de_t) = -X_t [\{s_t - (dv_t/de_t)\} / -\alpha X_t F''(\alpha X_t)] \\ + M_t [\{(dv_t/de_t) - d_t\} / -\beta M_t F''(\beta M_t)] \dots\dots\dots (13'),$$

and following the symbols, $(dB_{ot}/de_t) > 0$.

$$(dB_{ot}/ds_t) = -X_t (d\alpha/ds_t) = -X_t [e_t / -\alpha X_t F''(\alpha X_t)] > 0, \dots\dots\dots (14) \text{ [from (6)]}.$$

$$\text{And } (dB_{ot}/dd_t) = M_t [-e_t / -\beta M_t F''(\beta M_t)] > 0, \dots\dots\dots (15) \text{ [from (11)]}.$$

Equation (13), (14) and (15) signify the effects of policy instruments on official BoT. From the results of our export and import models we have seen that when devaluation occurs under-invoicing of exports falls and under-invoicing imports rises. Obviously, these results will make the official BoT better off than the actual BoT situation. Similarly, when unit subsidy on exports rises, either under-invoicing of exports falls or over-invoicing of exports rises. Either of the results again will make the official BoT situation better off assuming imports are unchanged. Also when unit tariff duty on imports is raised, the under-invoicing of imports increases which implies that official BoT will improve given the value of exports. Hence, undoubtedly all the three (e_t, s_t & d_t) policy instruments should be positively related to B_{ot} as shown in equations (13) to (15).

4.1. Analytical Diagram:

Figure (6) examines the behaviour of actual and official merchandise BoT curves in relation to the official exchange rate assuming subsidy and tariff rates are unchanged. With gradual fall in the BMP through exchange rate devaluation, exporters will disclose more amounts of under-invoiced exports and at the same time, fall in BMP induces importers to under-invoice their import volumes (i.e., importers increase their extent of under-invoicing). As a result, the official statistics looks more impressive than the actual figures and the official BoT curve lies above the actual one.

In figure (7), the horizontal axis measures the effects of subsidy and tariff rates instead of devaluation. We know when subsidy rises, revelation of official export goes up and when tariff is

raised under-invoicing of import takes place. Hence, again the official BoT will show some good results and it may overtake the actual BoT situation, given the official exchange rate. In the figure when both tariffs and subsidies are sufficiently high at $d = d^*$ and $s = s^*$, the official BoT is greater than the actual BoT.

4.2. Empirical Findings:

The complete result of actual and official BoT comprising India and her DC partners (US, UK, Japan and Germany) is at disposal in table 3. The actual BoT is the difference between the actual exports and imports while the official BoT is the difference between official exports and imports. Following our model, when there is devaluation without changes in export subsidy and/or import tariff, export under-invoicing falls and import under-invoicing increases. It suggests that the official BoT will stay above its actual counterpart. This very case is shown in graph (7). But the 1966 devaluation, though in a less pronounced manner, decreased both export subsidy and import tariff for a period of two years (1966 to 68) before reinstating them. We know lowering of export subsidy along with devaluation can make an exporter to reduce his extent of under-invoicing while lowering of import tariff can also make an importer to reveal more amount of under-invoiced imports. So, the actual – official gap came down significantly in 1968 and 69 when even the gaps were positive (see table). But with further tightening measures things came back to square one and gap further became negative from 1970 onwards.

The same trend continued in the 90s' though in a less smooth manner and it was expected following the adoption of a complicated reform package. To start with, the pace of the reform process was a bit slow and started only with nominal devaluation and other export and import related measures remained unchanged. Hence, no doubt that official BoT remained ahead of the actual BoT. But export subsidy and import tariff were both slowly rationalised with the continuation of reform process and more importantly following GATT and WTO norms. Accordingly, the gap closed slowly but erratically and in 1998 it became positive (see table 3). Interestingly, though the 'J-curve' effect could not be experienced in the 60s' for either official or actual BoT, it can be seen in the later part of the 90s' and expectedly the loop of official 'J' is much less than that of actual 'J' (see graph: 8).

6. Conclusion:

We have tried to build up a simple framework where international traders rationally mis-report the value of their transactions to the official sources. The incentives are many when governments pursue proactive trade and exchange rate policies. This tends to pollute official statistics. Unfortunately, such information is later utilised for policy prescriptions and evaluations. Statistics gathered from India's major trading partners bears evidence of such mis-reporting even after corrective adjustment for transport costs. Hence, we conclude that the use of partner country statistics should be mandatory for any kind of analysis of trade policies, particularly in the LDCs.

There are several extensions of the present analysis. First, we can repeat the exercise for other developing countries and check historically the pattern of such divergence. Second, we believe that mis-invoicing either leads to capital flight into the local illegal markets or into the international market. Typically, 'capital flight' implies that 'capital' which leaves the country for external destinations illegally. Allocation of illegal 'capital' can be an interesting exercise to look at. For example, if imports are under-invoiced, there may be illegal demand for actual import, which may draw upon mis-invoiced exports. Third, we have not explicitly introduced 'expectations' in this analysis. Role of expectations in affecting the divergence between the official and actual can be a fruitful exercise.

Footnotes:

- 1) Besides, we can sharpen our argument of taking any LDC, particularly Indian trade data as official and DC data as actual to check and correct the official LDC trade data. The simple proposition is that when two countries A and B are trading with each other and if A scores highly in terms of Trade Openness Index (TOI) and the Corruption Perception Index (CPI) then A's official trade data has little scope of suspicion and B's trade data can be checked and corrected with respect to A's data. Since, in terms of TOI and CPI India's scores are much lower than those of US, UK, Japan and Germany, we take these DC trade data as actual. Notably, a high score in TOI means that country is more open in the external sector and a high score in the CPI means the country is less corrupt (for details see, Gwartney et al (2000, 2002) and transparency international website).
- 2) Though in our paper we are attributing the difference between actual and official trade statistics to the intentional miss reporting by the trading agents, there may be some other reasons of distortions. They are:- coverage of statistics and definitions of commodities; detailed definitions used in connection with a given method; methods of valuation and exchange conversion; time lags and transit trading etc.
- 3) Occurrence of violent fluctuations in the exchange rate and introduction of exchange controls involving multiple rates greatly obscure the valuation of goods moved across national borders. The decreasing importance of import duties and their substitution by complicated licensing systems strengthens the tendencies towards more numerous and probably large errors in foreign trade statistics.
- 4) Also see Bhagwati (1967), Kemp (1976), Sheikh Munir (1976), Falvey (1978), Mark Pitt (1981 & 84), Martin & Panagariya (1984), McDonald (1985), Agénor (1990), Phylaktis (1992).
- 5) For journalistic appraisal of this paper, see Abheek Barman's 'folk theorem' "This is not an export boom" in the Economic Times on 24th May, 2000, Vol. 40, No. 77. Also see Patnaik & Vasudevan (2000).
- 6) In a way the problem of policy formulation in the presence of mis-specified data is consistent with the well-known "Lucas Critique" of econometric policy evaluations argued brilliantly by Lucas (1976). Announced changes in policies alter the behavioural pattern of agents and therefore the underlying model has to be specified for the correct outcome. We basically argue that policy evaluation in 'regulated' markets is a natural candidate for the "Lucas Critique".
- 7) 'Punishment', even very severe ones, may not deter 'corruption'. For a accent treatment of the topic one may refer to Marjit and Shi (1998) and Mukherjee and Png (1995).

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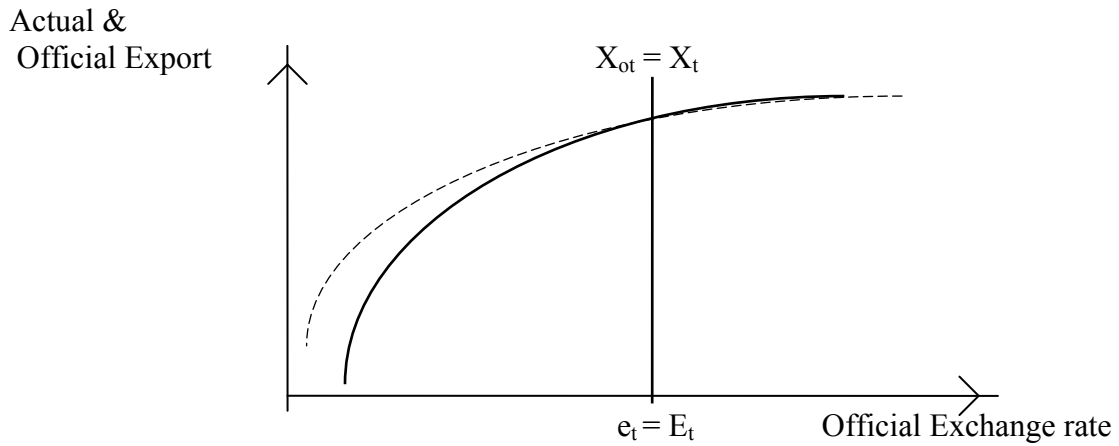


Figure 2: Actual and official export in relation with the Official Exchange rate

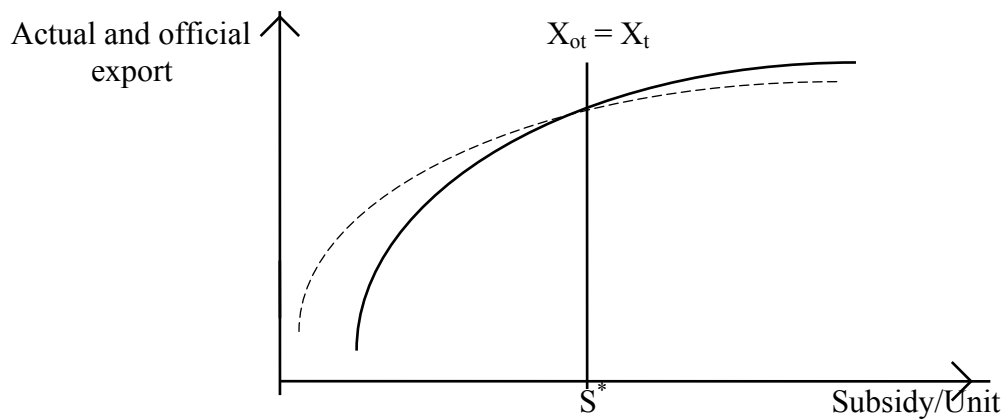


Figure 3: Actual and official export in relation with the unit subsidy rate

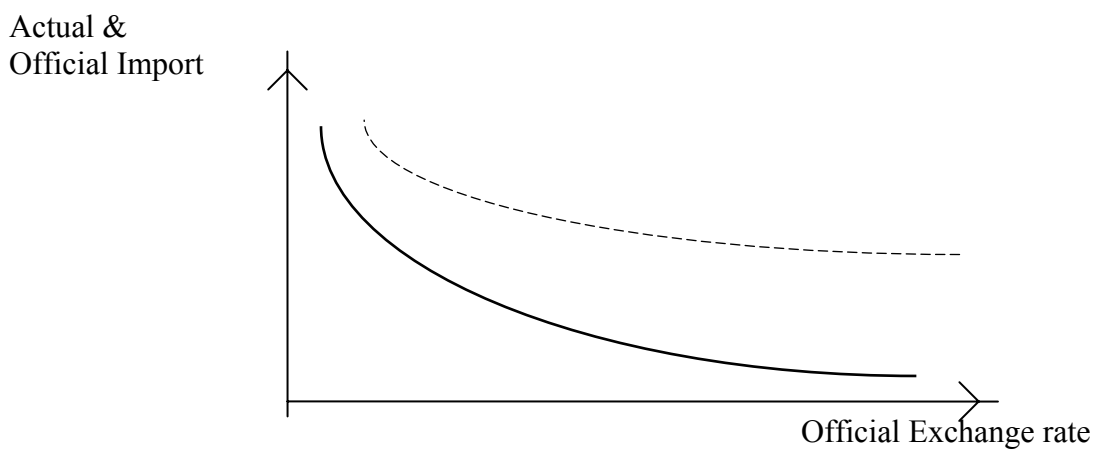


Figure 4: Actual and official import in relation with the Official Exchange rate

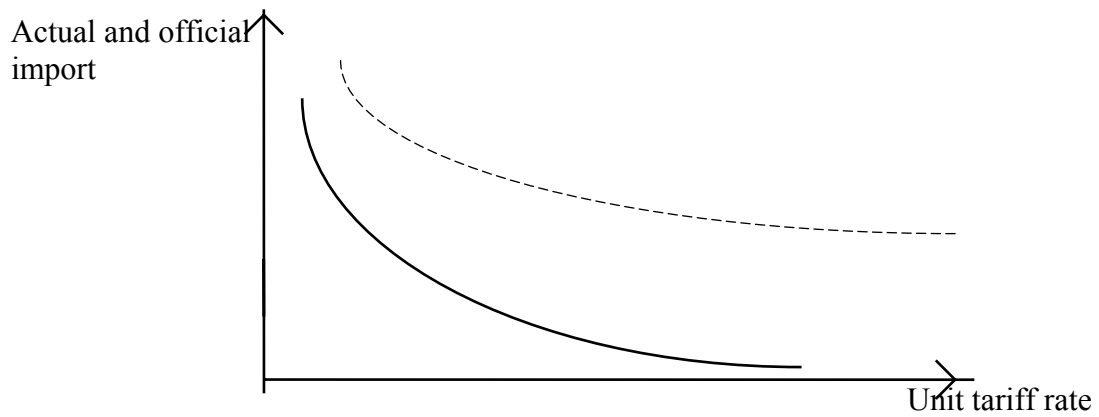


Figure 5: Actual and official import in relation with the unit tariff rate

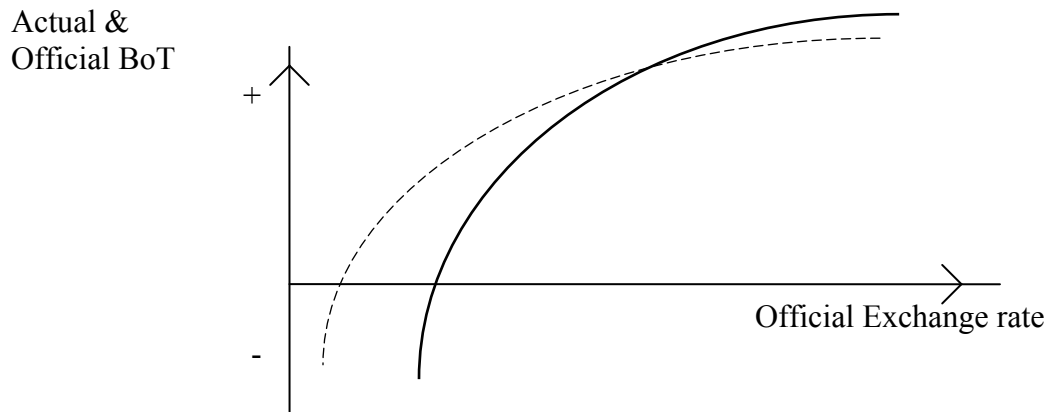


Figure6: Actual and official BoT in relation with the Official Exchange rate

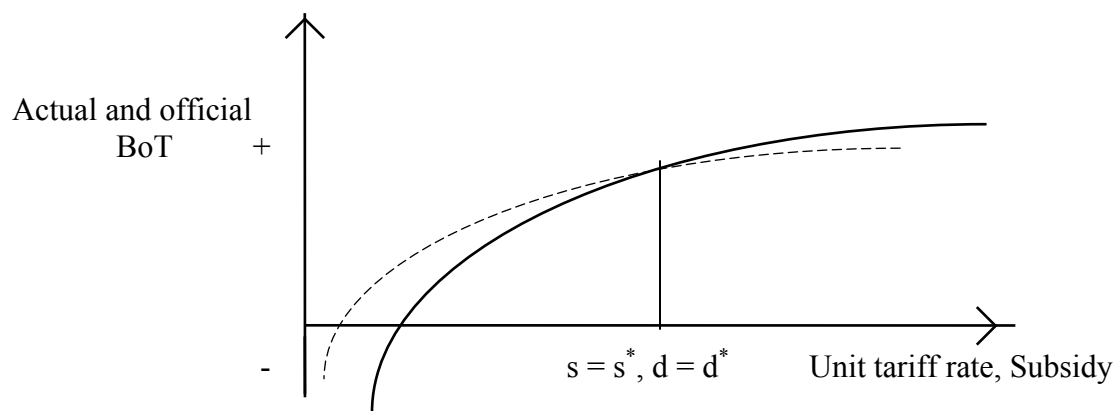


Figure 7: Actual and official BoT in relation with the unit tariff rate and subsidy

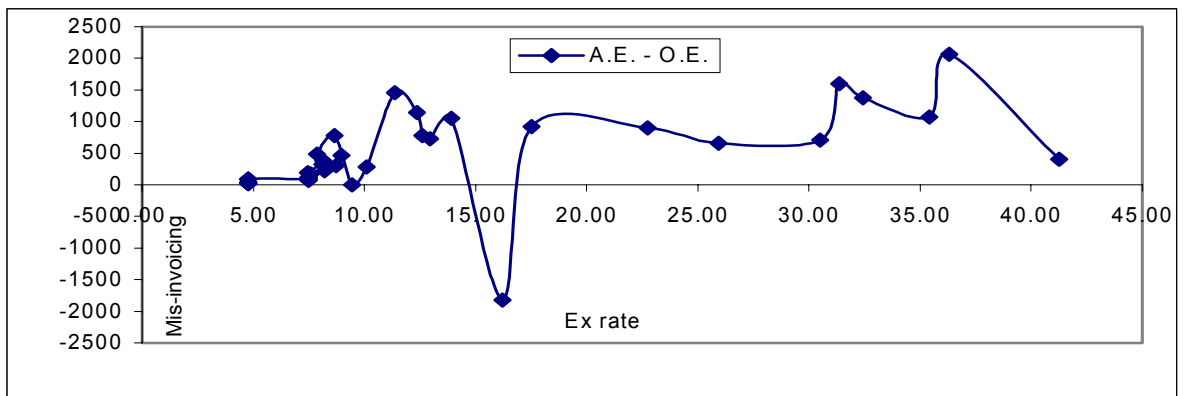
Table 1: Comparison between actual and official export statistics* (million US dollar)

Year	Exchange rate	Actual Export (A.E.)	% ch in A.E.	Official Export (O.E.)	% ch in O.E.	A.E. - O.E.
1960	4.76	720.73	0.04	692.10	0.05	28.63
1961	4.76	752.18	0.01	727.30	-0.08	24.88
1962	4.76	757.91	0.10	671.10	0.18	86.81
1963	4.76	833.09	0.03	791.20	0.07	41.89
1964	4.76	861.64	0.01	843.80	-0.08	17.84
1965	4.76	866.00	-0.03	777.80	-0.03	88.2
1966	7.50	843.91	0.02	756.10	0.05	87.81
1967	7.50	862.00	0.04	795.20	0.02	66.8
1968	7.50	894.55	0.02	814.20	-0.01	80.35
1969	7.50	913.64	0.03	803.90	0.04	109.74
1970	7.50	938.73	0.04	834.90	0.03	103.83
1971	7.49	973.64	0.15	856.00	0.12	117.64
1972	7.59	1124.55	0.24	957.00	0.26	167.55
1973	7.44	1394.55	0.24	1202.10	0.17	192.45
1974	8.10	1728.18	0.05	1408.30	0.08	319.88
1975	8.38	1815.45	0.27	1524.00	0.21	291.45
1976	8.96	2307.27	0.06	1843.00	0.16	464.27
1977	8.74	2434.55	0.08	2134.00	0.12	300.55
1978	8.19	2617.27	0.22	2392.00	0.18	225.27
1979	8.13	3197.27	0.02	2812.00	-0.01	385.27
1980	7.86	3264.55	-0.01	2783.00	-0.12	481.55
1981	8.66	3218.18	0.08	2440.00	0.43	778.18
1982	9.46	3490.00	0.18	3490.00	0.09	0
1983	10.10	4101.82	0.14	3821.00	-0.16	280.82
1984	11.36	4671.82	-0.08	3214.00	-0.02	1457.82
1985	12.37	4297.27	0.07	3149.00	0.22	1148.27
1986	12.61	4610.91	0.19	3832.00	0.24	778.91
1987	12.96	5496.36	0.16	4763.00	0.12	733.36
1988	13.92	6369.09	0.12	5314.00	0.69	1055.09
1989	16.23	7162.73	0.08	8989.00	-0.24	-1826.27
1990	17.50	7730.91	0.02	6811.00	0.03	919.91
1991	22.74	7881.82	0.08	6984.00	0.12	897.82
1992	25.92	8488.18	0.07	7830.00	0.06	658.18
1993	30.49	9047.27	0.25	8334.00	0.16	713.27
1994	31.37	11304.55	0.11	9704.00	0.15	1600.55
1995	32.43	12535.45	0.05	11157.00	0.09	1378.45
1996	35.43	13204.55	0.07	12130.00	0.00	1074.55
1997	36.31	14159.09	0.00	12090.00	0.14	2069.09
1998	41.26	14224.55	N.A.	13815.00	N.A.	409.55

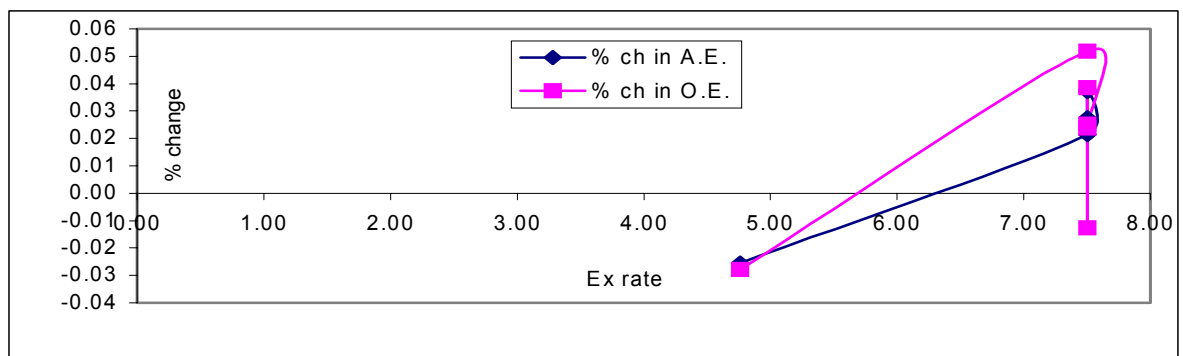
Note: Year 1982 data of India for table 1 is based upon partner data. Data for the year 1998 is provisional.

Exchange rate = amount of domestic currency (rupee) needed to buy one unit of US Dollar in the official market.

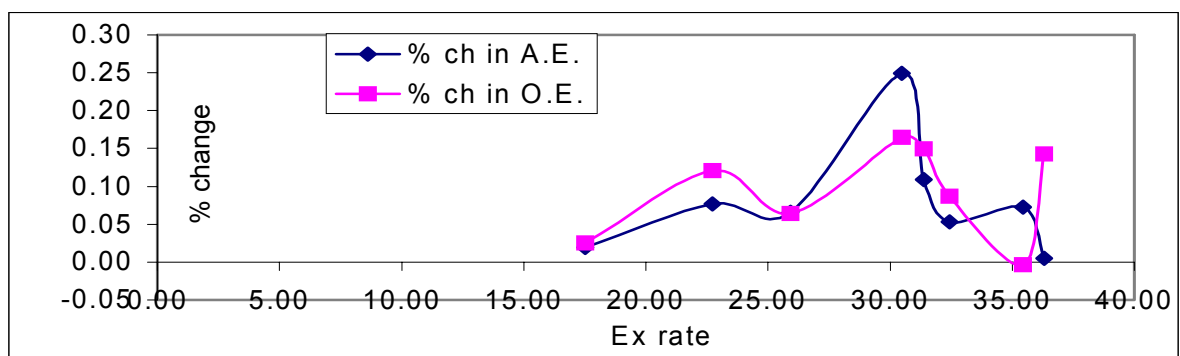
* Source of tables are DOTS yearbook (by IMF), various issues.



Graph 1: Relation between exchange rate and extent of export mis-invoicing



Graph 2: Relation between pc change in actual and official export (1965-70)

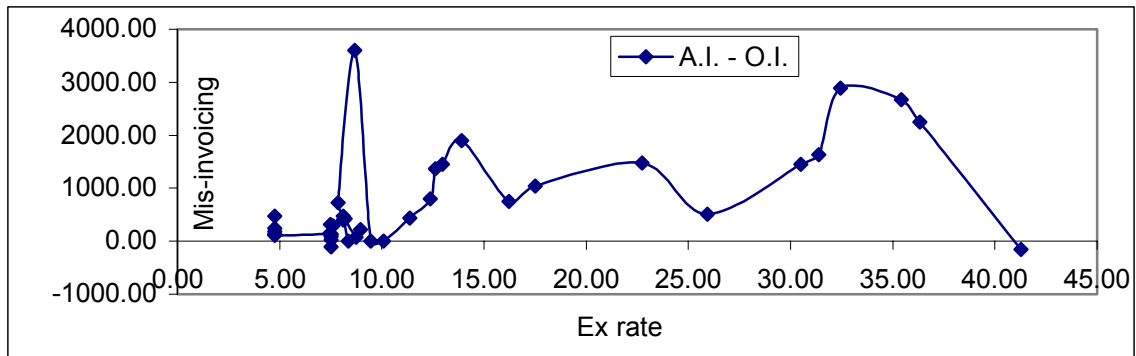


Graph 3: Relation between pc changes in actual and official export (1990-97)

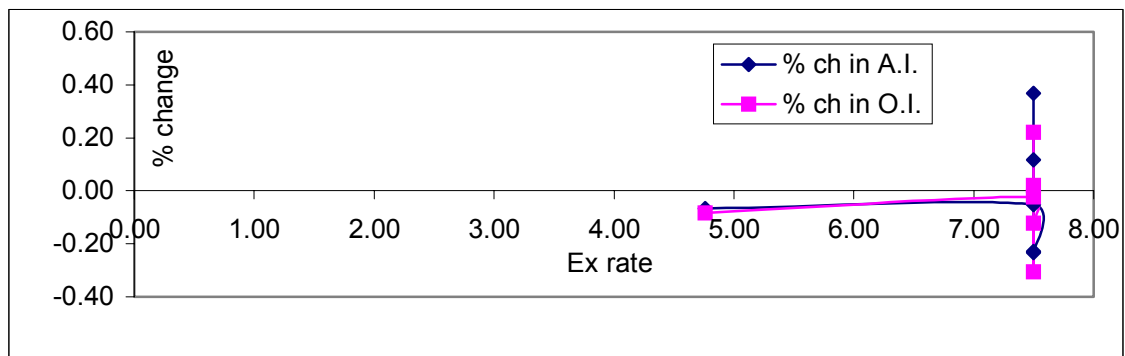
Table 2: Comparison between actual and official Indian import (data million US \$)

Year	Exchange rate	Actual Import (A.I.)	% ch in A.I.	Official Import (O.I.)	% ch in O.I.	A.I. - O.I.
1960	4.76	1525.92	-0.11	1277.70	-0.05	248.22
1961	4.76	1352.34	0.07	1214.30	0.09	138.04
1962	4.76	1447.27	0.17	1327.10	-0.08	120.17
1963	4.76	1692.13	0.11	1224.70	0.38	467.43
1964	4.76	1874.40	0.01	1695.10	0.05	179.30
1965	4.76	1892.33	-0.07	1779.10	-0.08	113.23
1966	7.50	1765.83	-0.05	1629.40	-0.02	136.43
1967	7.50	1675.74	-0.23	1590.50	-0.12	85.24
1968	7.50	1292.39	-0.23	1395.60	-0.31	-103.21
1969	7.50	991.10	0.12	968.00	0.02	23.10
1970	7.50	1107.81	0.37	986.70	0.22	121.11
1971	7.49	1516.90	-0.15	1204.50	-0.16	312.40
1972	7.59	1296.90	0.24	1009.90	0.44	287.00
1973	7.44	1602.70	0.37	1457.00	0.23	145.70
1974	8.10	2196.70	0.24	1795.00	0.51	401.70
1975	8.38	2726.90	-0.09	2719.00	-0.17	7.90
1976	8.96	2477.20	0.01	2262.00	0.07	215.20
1977	8.74	2492.60	0.32	2422.00	0.19	70.60
1978	8.19	3296.70	0.21	2872.00	0.22	424.70
1979	8.13	3973.20	0.27	3499.00	0.24	474.20
1980	7.86	5058.90	0.49	4337.00	-0.09	721.90
1981	8.66	7549.70	-0.23	3952.00	0.47	3597.70
1982	9.46	5813.50	0.00	5811.00	0.01	2.50
1983	10.10	5841.00	-0.11	5841.00	-0.19	0.00
1984	11.36	5171.10	0.18	4736.00	0.12	435.10
1985	12.37	6120.40	0.19	5319.00	0.11	801.40
1986	12.61	7268.80	0.06	5902.00	0.06	1366.80
1987	12.96	7730.80	0.17	6275.00	0.14	1455.80
1988	13.92	9042.00	0.02	7143.00	0.18	1899.00
1989	16.23	9191.60	-0.02	8441.00	-0.06	750.60
1990	17.50	8980.40	-0.17	7936.00	-0.24	1044.40
1991	22.74	7469.00	0.01	5992.00	0.18	1477.00
1992	25.92	7574.60	0.06	7062.00	-0.07	512.60
1993	30.49	8042.10	0.15	6593.00	0.16	1449.10
1994	31.37	9270.80	0.39	7642.00	0.31	1628.80
1995	32.43	12857.90	-0.01	9974.00	0.00	2883.90
1996	35.43	12683.00	-0.04	10007.00	0.00	2676.00
1997	36.31	12233.10	-0.08	9986.00	0.14	2247.10
1998	41.26	11261.80	N.A.	11413.00	N.A.	-151.20

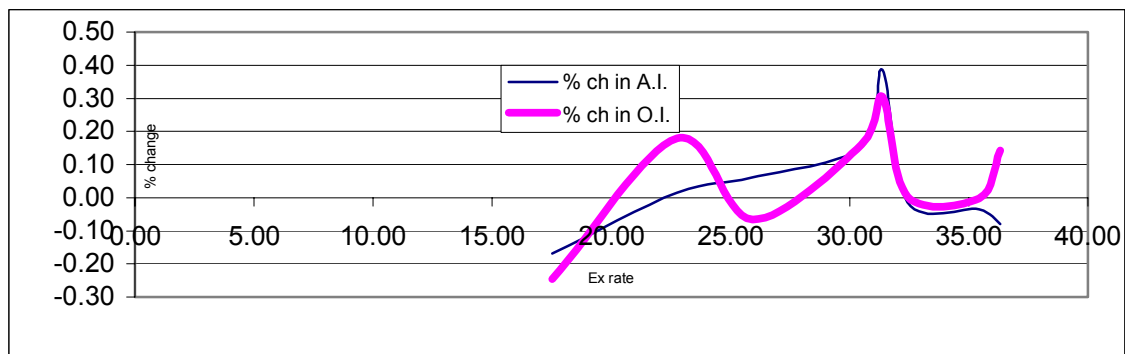
Note: Year 1982 & 83 data of India for table 2 is based upon partner data. Data for the year 1998 is provisional. (Source same as table1).



Graph 4: relation between exchange rate and import mis-invoicing



Graph 5: relations between pc change in actual and official import (1965-70)

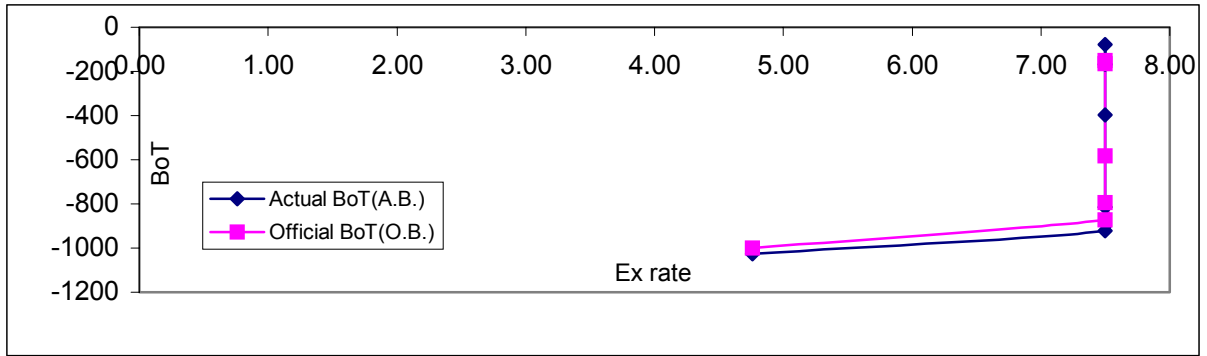


Graph 6: Relationship between pc change in actual and official imports (1990-97)

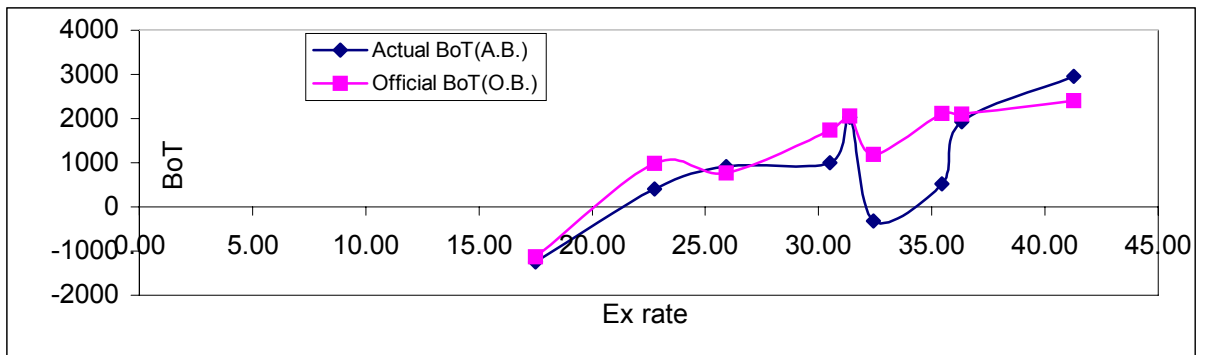
Table 3: Comparison between actual and official BoT (data in million US \$).

Year	Exchange rate	Actual BoT (A.B.)	% ch in A.B.	Official BoT (O.B.)	% ch in O.B.	A.B. - O.B.
1960	4.76	-805.19	-0.25	-585.6	-0.17	-219.59
1961	4.76	-600.16	0.15	-487	0.35	-113.16
1962	4.76	-689.36	0.25	-656	-0.34	-33.36
1963	4.76	-859.04	0.18	-433.5	0.96	-425.54
1964	4.76	-1012.76	0.01	-851.3	0.18	-161.46
1965	4.76	-1026.33	-0.10	-1001.3	-0.13	-25.03
1966	7.50	-921.92	-0.12	-873.3	-0.09	-48.62
1967	7.50	-813.74	-0.51	-795.3	-0.27	-18.44
1968	7.50	-397.84	-0.81	-581.4	-0.72	183.56
1969	7.50	-77.46	1.18	-164.1	-0.07	86.64
1970	7.50	-169.08	2.21	-151.8	1.30	-17.28
1971	7.49	-543.26	-0.68	-348.5	-0.85	-194.76
1972	7.59	-172.35	0.21	-52.9	3.82	-119.45
1973	7.44	-208.15	1.25	-254.9	0.52	46.75
1974	8.10	-468.52	0.95	-386.7	2.09	-81.82
1975	8.38	-911.45	-0.81	-1195	-0.65	283.55
1976	8.96	-169.93	-0.66	-419	-0.31	249.07
1977	8.74	-58.05	10.70	-288	0.67	229.95
1978	8.19	-679.43	0.14	-480	0.43	-199.43
1979	8.13	-775.93	1.31	-687	1.26	-88.93
1980	7.86	-1794.35	1.41	-1554	-0.03	-240.35
1981	8.66	-4331.52	-0.46	-1512	0.54	-2819.52
1982	9.46	-2323.5	-0.25	-2321	-0.13	-2.50
1983	10.10	-1739.18	-0.71	-2020	-0.25	280.82
1984	11.36	-499.28	2.65	-1522	0.43	1022.72
1985	12.37	-1823.13	0.46	-2170	-0.05	346.87
1986	12.61	-2657.89	-0.16	-2070	-0.27	-587.89
1987	12.96	-2234.44	0.20	-1512	0.21	-722.44
1988	13.92	-2672.91	-0.24	-1829	-1.30	-843.91
1989	16.23	-2028.87	-0.38	548	-3.05	-2576.87
1990	17.50	-1249.49	-1.33	-1125	-1.88	-124.49
1991	22.74	412.82	1.21	992	-0.23	-579.18
1992	25.92	913.58	0.10	768	1.27	145.58
1993	30.49	1005.17	1.02	1741	0.18	-735.83
1994	31.37	2033.75	-1.16	2062	-0.43	-28.25
1995	32.43	-322.45	-2.62	1183	0.79	-1505.45
1996	35.43	521.55	2.69	2123	-0.01	-1601.45
1997	36.31	1925.99	0.54	2104	0.14	-178.01
1998	41.26	2962.75	N.A.	2402	N.A.	560.75

Note: Table 3 has been constructed combining tables 1&2.



Graph 7: Actual and official BoT and the exchange rate (1965-70)



Graph 8: Actual and official BoT and the exchange rate (1990-97)