

“Currency Devaluation Led Export Under-invoicing: A Paradox”

Evidence from the Bangladesh-USA Trade Data Discrepancy

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Abstract

Govt. devalue its currency rates to reduce the black-market premium as well as to increase the export growth. In the early 1990s, Bangladesh has also taken some major policies for economic liberalization like India. From the early years of liberalization, export growth reported in Bangladesh official trade statistics is continuously under-reported which is reflected in partner country's (USA) trade statistics. For simplification we can say that, this is kind of plummet export growth for Bangladesh. The period of the study is 1973-2018, using USA import statistics from Bangladesh. The impact of currency devaluation in 1976, 1982, 1991, 2001, 2006 and 2012 in Bangladesh was not actually observed on officially reported exports to USA that means official report of exports were not increased to the expected level and continuous devaluation could not remove under-reporting also.

Introduction

USA is the top export partner which occupies 20% out of total export share of Bangladesh and its export value was near about \$6 billion in 2018. The rush in export growth rate of Bangladesh after several successive devaluation practices since 1980 did not stay very long. During 1980-89 and 1990-99 the average annual growth-rate of exports was 17.24% and 15.97% respectively, this came down sharply to 8.21% and 4.34% in 2000-09 and 2010-18 respectively. This led to hike the further expectation of devaluation of 'Bangladeshi Taka' (BDT). Although 'Taka' perpetually devaluated with respect to the US dollar (USD) since 1973, though export always did not retaliate to the falling of taka proportionately.

Bangladesh has already emerged as one of the biggest denim exporters to United States. Major global retailers like H&M, Uniqlo, Tesco, Walmart, Levi's, Diesel, Wrangler, G-Star, s. Oliver, Hugo Boss, and Gap are among its clients. Some other top export categories are woven garments, knitwear, home textile, miscellaneous textile articles, headgear, footwear,

leather & leather products, frozen food & frozen fish (like-shrimps, crabs) and some leading categories agricultural products are tobacco, snack foods, rice, raw jute & jute products, spices and tea (including herb) etc. For its cheap apparel destination tag though it's capturing US clothing market (BD minimum monthly wage approximately 65US\$) but some goods are registered negative growth rates in the recent times like tea, recreational products, promotional products etc and this market is captured by mainly China, Vietnam etc.

The last two decades (2000-09; 2010-18) fall in the export growth rate have been attributed to the sensational depreciation in the south-east Asian currencies and also for the economic disaster in these countries. The '**Asian Financial Crisis**' at first derailed Asian economy and then it became a global financial crisis when it spread into the Russian and Brazilian economies at the end of 1990s. In the 1997-98, the financial crisis began in Thailand and then madly spread into the neighbouring economies. In 1997-98 it was not only a financial crisis but also a crisis of good governance in the fields of national, global and regional politics. However, from 1997 to 1998 the export growth rate of Bangladesh with USA has sharply fall from 26.97% to 6.10%. The south-east Asian crisis has unquestionably affect Bangladesh exports to those markets. But as far as the currency devaluation is concerned, there are some other export markets also, where Bangladesh did not compete with those countries. In spite of having these stumbling blocks, it should be keep in our mind that Bangladeshi exporters have received many export related incentive schemes utterly unparallel before 1990.

To enhance the export growth, devaluation of exchange rate is a common procedure. In a small open economy, a normal exporter always expects a fall in the nominal exchange rate because in terms of local currency it increases his export earnings. But there is no assurance that with the nominal taka devaluation, the actual export will be increased.

The effect of taka devaluation on export earnings of Bangladesh is normally studied from the official data provided by the Bangladesh Bank and international agencies. There are two other agencies, namely, International Trade Statistics Yearbook published by the United Nations and Direction of Trade Statistics published by the International Monetary Fund, which provides bilateral trade statistics i.e. both exporting and corresponding importing country. There exists discrepancy between the export-import partner countries data. The data is need to be explained in terms of the so-called 'transportation costs' or fob (freight on board) and cif (cost, insurance and freight) values. Sometimes it has found that the discrepancies are huge to be wholly interpreted in terms of freight and insurance costs.

In this contemporary age, for every country trade data is very substantial for their policy making. Specially, in the developing countries, in case of policy making, sometimes they conserve only domestic economic activities data because of not having systematic and proper foreign-trade data. The GDP or the degree of current economic activity and its forecasts have important impact on business activity, profits, interest rates as well as inflation rates. Of course, it has some advantages that it deals with the local currency, customs, culture, regulations and tax systems. But, in spite of having these features the trustworthiness of trade statistics over the domestic economic data is questionable for various logical factors. Fundamentally, foreign trade is a well-defined set up and here goods move under the scanner of the customs officials. For the imposition of tax, tariffs and other rules-regulations goods are supposedly computed and/or measured systematically to serve such purposes. Generally, developing countries suffer from current account deficit where foreign currency is scarce. Since their import is higher than the export, so the single largest source of demand for and supply of foreign currency. In case of foreign trade, the data is recorded by both countries, so there is an opportunity to check the accuracy of data by comparing between the source country's export and destination/partner country's import and vice-versa. By the 'Corruption Perception Index', we also get that normally developing countries are more corrupt than developed countries. **So, for the poor characterization of developing countries data there prevails fascinating relation between the data and theory.**

In case of Bangladesh-USA trade, we observe vast difference between Bangladesh's export statistics and relative import figures of USA from Bangladesh. In our study period 1973-2018, Bangladesh's official export figures are always underreported excluding some exceptions. Devaluation/depreciation of taka decreased the gap between Bangladesh's official export and partner country's (USA) import data for some years. **Therefore, it's holding our attention to study the impact of exchange rate devaluation on official and actual export growth rates of Bangladesh.**

In this paper in Section I, we have presented a brief literature survey about illegal transaction in trade. A recent record of Bangladesh's export growth rates is introduced in Section II accompanying with some competing observations on slow-moving export performance in current time. In the Section III we discuss our prime analytical framework, methodology and empirical results. The final Section summarizes the discussion and assembles the conclusion.

I. Brief Survey of Literature

In context of Bangladesh there hardly presents any literature about export under-invoicing and exchange rate devaluation.

Hassan and Tufte (1998) suggested that ‘in the long run, Bangladeshi export growth is driven by the volume of world trade, and is negatively, and inelastically related to the volatility of Bangladeshi exchange rates’.

Nusrate Aziz (2008) estimated the effect of exchange rate on the balance of trade of Bangladesh during the period of 1972-2005. With a model and empirically supported based approach the study ultimately showed that the devaluation/depreciation of domestic currency (i.e. Bangladeshi Taka) was beneficial to increase the volume of world exports of Bangladesh as well as for the improvement of balance of payment of the country in the long run.

In 1964, Bhagwati also showed that during 1960s, Turkey’s import was under-reported with France and Italy due to high tariff rates.

In 1969, in the context of Pakistan Winston showed that an artificial exchange rate may fix by developing country and can do some high profitable transactions and simultaneously by making laws they can declare those transactions are illegal also.

Naya and Morgan (1969) argued about the manipulation/distortion of the ‘South-East-Asian Economics’ trade statistics during 1960s and they also gave an estimation of under-reporting of the above said economics.

In his classic work Morgenstern (1974) showed the discrepancy between French exports and British imports. According to author the discrepancy reveals because of transportation cost, divergence of routes, complications in recording value, presence of several exchange rates and variation of quality of the same products etc. In each and every step checking the scale of errors is next to impossible.

In 1974, a bulletin published by Oxford University, Institute of Statistics which is contributed by Bhagwati about the ‘fiscal policies, the faking of foreign trade declarations and the balance of payments’.

Bhagwati, Krueger and Wibulswasdi (1974) contributed a study about the statistical evaluation of capital flight from the less developed countries using partner country’s trade data during 1960s.

In 1974, Bhagwati confected some research articles about the illicit transactions in international trade and the difficulty of exactly estimating trade related statistics. The author showed that actual value and/or volume of trade may disappeared for it- (i) Trade takes place through unlawful channels and (ii) Actual value and/or volume of trade may not be reported by the traders. **Here, our attention goes with the second point**, because the trade which takes place through illicit channels, in that case even after using partner country's trade statistics, it is almost impossible to identify the actual value/volume of trade. So there are so many steps which can be blameworthy for over and under reporting problems.

In the Indian context, a classic study by Prof. Marjit, Dasgupta and Mitra (2000) examined the impact of devaluation on actual and official export performance of India with USA and their study is undertaken for the period 1951-94. Devaluation always reduce the gap between market exchange rate and official exchange rate i.e. devaluation reduces black market premium and as a result tendency of underinvoicing of exports starts diminishing. The impact of currency depreciation is clearly prominent on the officially reported data than 'actual' statistics reflected in the partner country's trade statistics. They conclude that during devaluation India's official export figures is overestimated on account of export growth than partner country's data.

In 2010, two Nigerian researchers named Benson U. Omojimi and Godwin Akpokodje, during the period 1986-2006 with an empirical comparison they showed that the adverse effect of exchange rate volatility on the exports between the *Communauté Financière Africaine* (CFA) countries with the non-CFA counterparts of Africa. They have found that exchange rate volatility in the panel of the non-CFA countries is almost double than the CFA countries. In Africa exchange rates are very unstable particularly after moving to a floating exchange rate regime which provides negative result for trade, investment and growth in Africa.

In context of Iran, Mohsen Ahmadi (2013) showed that domestic currency's appreciation or depreciation have some significant effects on the macroeconomic variables like national income, oil exports and inflation of the country.

Khaled Alotaibi (2016) provided a general micro-economic model that how exchange rate influence a country's import and export and how businesspersons take the advantage of currency appreciation and depreciation for their profit maximizations.

II. Bangladesh Export Performance:

As we said before that Bangladesh export growth **rates** in current time are subject to uninterruptly down falling. Where Table-1 depicts the situation that during these decades from 1974-79, 1980-89, 1990-99, 2000-09 and 2010-18 average annual growth rate was 4.42, 17.24, 15.97, 8.21 and 4.34 percent respectively. Where during 1974-79, 1980-89, 1990-99, 2000-09 and 2010-18 average annual devaluation rate was 13.39, 7.80, 4.31, 3.51 and 2.25 respectively. As we said before that from 1997 to 1998 the export growth rate of Bangladesh with USA has sharply fall from 26.97% to 6.10%. This downswing is unabated in spite of several successive devaluation from 1990-1997. The positive impact of these devaluations was prominent on the official export growth rates during 1985, 1987, 1990, 1992, 1997, 2000, 2006, 2011 when Bangladesh's export to USA grew at 39.46, 53.14, 37.68, 63.32, 26.57, 26.11, 27.39 and 17.76 percent per annum respectively. After 2006, during the global financial crisis (2007-2009), from 2006-09 the export growth rates sharply down from 27.39 to 8.41, 2.01 and 3.11 respectively.

Table 1: Actual and Officially Reported Exports of Bangladesh to USA; USD Million (1973-2018)

Year	X _t (cif)	AX _t	X _{ot}	AX _t X _{ot}	E _t
1973	78.00	73.58	72.81	0.77	7.85
1974	73.00	68.87	52.45	16.42	8.23
1975	66.00	62.26	53.25	9.01	12.19
1976	79.00	74.53	64.50	10.03	15.40
1977	70.30	66.32	67.08	-0.76	15.38
1978	95.70	90.28	78.99	11.29	15.02
1979	105.50	99.53	86.94	12.59	15.55
1980	100.20	94.53	73.19	21.34	15.45
1981	104.60	98.68	80.07	18.61	17.99
1982	88.00	83.02	78.31	4.71	22.12
1983	109.40	103.21	104.17	-0.96	24.62
1984	159.00	150.00	129.40	20.60	25.35
1985	227.20	214.34	180.46	33.88	27.99
1986	264.20	249.25	210.60	38.65	30.41
1987	419.30	395.57	322.52	73.05	30.95
1988	412.30	388.96	335.58	53.38	31.73
1989	474.66	447.79	370.51	77.28	32.27
1990	593.80	560.19	510.11	50.08	34.57
1991	571.80	539.43	449.46	89.97	36.60
1992	899.60	848.68	734.04	114.64	38.95
1993	953.00	899.06	764.66	134.40	39.57

1994	1,160.70	1095.00	886.07	208.93	40.21
1995	1,345.30	1269.15	998.63	270.52	40.28
1996	1,423.00	1342.45	1,018.80	323.65	41.79
1997	1,780.60	1679.81	1,289.52	390.29	43.89
1998	1,946.60	1836.42	1,368.23	468.18	46.91
1999	2,051.40	1935.28	1,411.02	524.27	49.09
2000	2,528.50	2385.38	1,779.49	605.89	52.14
2001	2,504.30	2362.55	1,696.62	665.93	55.81
2002	2,286.20	2156.79	1,504.41	652.38	57.89
2003	2,213.30	2088.02	1,488.64	599.38	58.15
2004	2,464.70	2325.19	1,697.52	627.66	59.51
2005	2,881.20	2718.11	2,003.48	714.63	64.33
2006	3,496.80	3298.87	2,552.25	746.62	68.93
2007	3,634.60	3428.87	2,766.84	662.03	68.87
2008	3,982.80	3757.36	2,822.57	934.79	68.60
2009	3,886.60	3666.60	2,910.41	756.19	69.04
2010	4,540.90	4283.87	3,247.49	1036.38	69.65
2011	4,877.10	4601.04	3,824.25	776.79	74.15
2012	4,915.57	4637.33	3,702.39	934.94	81.86
2013	5,353.44	5050.41	3,948.05	1102.36	78.10
2014	5,277.62	4978.89	4,052.55	926.34	77.64
2015	5,985.43	5646.63	4,164.91	1481.72	77.95
2016	5,912.28	5577.62	3,962.32	1615.30	78.47
2017	5,688.14	5366.17	3,839.76	1526.40	80.44
2018	6,104.12	5758.60	4,178.82	1579.78	83.80

Notes:

X_t (cif) = Actual exports from Bangladesh to US including cif values.

AX_t = Actual exports of Bangladesh to USA **adjusted** for cif values.

X_{ot} = Official exports from Bangladesh to USA as reported in Bangladesh official statistics.

$AX_t - X_{ot}$ = Extent of misreporting/Discrepancy

E_t = Official exchange rate of BDT i.e. Bangladeshi taka per US dollar.

Source: Direction of Trade Statistics (DOTS), Exports and Imports by Areas & Countries, IMF

Now various factors are held accountable for this slow export performance in different times. From different years of Bangladesh Economic Review, (Ministry of Finance, 2007,2008, 2009) and from various research articles we have noted some following factors:

- a) Fall in the world export growth during the global financial crisis in 2007-09, it impacts negatively on Bangladesh exports. On the other hands some developed countries also reduced their imports for their crisis.

- b) The big floods have caused great destruction in Bangladesh throughout history, especially in 1988 and 1998, during that time export growth rate (GR) was 4.05 and 6.10 percent per annum respectively. For this agricultural export badly affected. In 2007 South Asian floods also largely affected Bangladesh and GR was 8.41. But, during 1997-98 and 2007 the GR were mainly affected by Asian Financial Crisis and Global Financial Crisis respectively. In the coastal areas shrimp, crab and other sea food cultivation set-up and these exports are affected by the cyclones, historically on an average within every 3 years their cultivation & export are affected by a cyclone.
- c) Bangladesh's top export partners like US, UK, France and EU also slowed down their imports during recession times, comparatively woven garments and knitwear are less affected 1997-98, 2007-09 (Taslim & Haque, 2011).
- d) Appreciation Bangladeshi Taka in real terms during 1998's against the currencies of Bangladesh's major trading partners were also adversely affected its exports.
- e) Some other factors that also affects Bangladesh's export growth like exportable items are limited, shortage of capital, poor quality product and packaging, corruption and excessive bureaucratic control, transport & ware housing problem, some non-tariff barriers like environment friendly leather effluents and prawn farming, child labour issues related to jute products, smashing of single channel supplies, growing competition and consequent uncertainty in the global markets etc are the principal causes of sluggish export growth rates.

There is no question that these factors are responsible for the sluggish export growth of Bangladesh. Now, one has to reveal that the spurt in export growth during 1992-98 was largely determined by the external factors. Some internal factors are also significant with this argument. Here we draw some points of Bangladesh's trade liberalization like reduces the tariff, provides duty free access to imported inputs, promote non-traditional export through Export Performance Benefit Scheme, reduce and rebate the taxes on export income, concessionary duties on imported capital, eliminate the quantitative restrictions, overall simplification of trade procedures. At first, Bangladesh accompanied with 'fixed exchange rate' up to 1979. By liberalizing the policy, from 1979-2003 it maintained 'floating exchange rate' regime. From May 2003, with the capital account controls it inaugurated absolutely a 'clean floating exchange rate policy' by assembling it totally convertible on the current account also. The prime concern was to increase the exports and to boost up the 'balance of trade'. To sustain a steady real exchange rate and

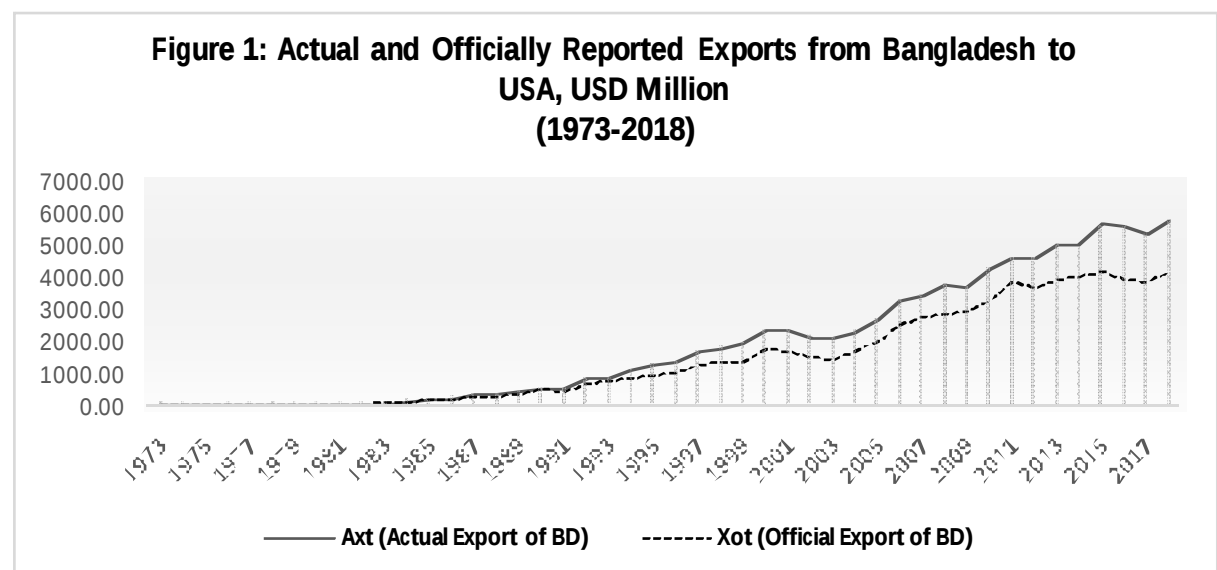
to prevent the overvaluation of the domestic currency, Bangladesh continuously devalued its domestic currency against foreign currency as well as USD.

In case of Bangladesh till 1998, the foreign exchange market was particularly controlled by the black-market premium. Since the black-market premium is nothing but the difference between the value of a currency on the black market and its official exchange rate, so from 1990 to 1998 continuous devaluation and depreciation of taka actually wiped-out the 'black-market premium' to a great extent.

Since devaluation of 'Taka' brought officially exchange rate closer to the market exchange rate and that's why the inducements for under-invoicing should have decreased. The net result of export growth was reflected in the officially reported statistics which was not genuine, that's why this excitement of export growth evaporated after some years. Now the result can be judged in a better way if we take the comparative data of Bangladesh's trading partner statistics i.e. USA imports (Actual export of Bangladesh) from Bangladesh by comparing them with Bangladesh's officially reported exports to USA.

III. Analytical Framework:

In our figure-1 we notice that Bangladesh continuously under-reporting their export (BD Official report) with USA compare to actual export (USA official import from BD).



Now, **why (Bangladeshi) exporters are doing so?** The beginning of our analysis mention to the presence of black market premium in a controlled foreign exchange

market. An exporter divides his foreign earnings into two parts because of the difference of currency prices between market and official exchange rates. A rational economic agent always tries to maximise his foreign exchange earnings in terms of local currency. For this reason, a normal exporter tends to under-report his actual export earnings to the govt. On the other hand, by under-reporting his actual exports, an exporter can flight his capital to abroad also.

Capital flight can happen for so many reasons like, external debts of the country, interest rate differentials with partner countries, due to domestic inflation portfolio holders and other investors will move their assets into a low-inflation country because it reduces the real purchasing power, as we said earlier that an initial devaluation increases the future expectation of devaluation so that an exporter can increase his domestic income and that's why a country's change of real exchange rate and the change of capital flight is positively related etc.

Now, the question is, to what extent, an exporter will under-report his actual earnings? It depends on two things- (a) the expense of black market premium and (b) The cost/penalty of under-reporting. One can illegally earn more by changing his foreign currency through the market exchange rate which he didn't report to the govt. but for this non-reporting he may face penalty in the future in terms of his actual earnings. On the other side, the exporter always tries to be secured himself by getting a legal stamp from the govt. on his earnings and for this he reports a part of his actual export earnings which he gets only through the official foreign exchange market. Thus, we get a distorted image of actual export growth because only reported portion of actual earnings is captured by official statistics.

To maximize the export earnings an exporter always tries to equalize the marginal benefit (from the portion of under-report) with the marginal cost. Actually, the existing black-market premium (K_t) is equal to the marginal benefit of under-reporting per unit of actual exports. On the other hand, marginal cost of under-reporting is a function of fraction of actual export which is not reported. Now, α is the fraction of the under-reported amount of the actual export earnings which varies also directly with the black-market premium (K_t). Here, we developed a model which was initially introduced by Prof. Marjit, Dasgupta and Mitra (1999). The model as follows -

$$OX_t = AX_t E_t [(1 - \alpha)B_t] \text{-----} (1)$$

Where,

OX_t = Officially reported exports at time 't'

AX_t = Actual export at time 't'

E_t = Official exchange rate

α = Fraction of the actual export earnings i.e. under reported by the exporter

K_t = Prevailing black market premium at time 't'

$$\text{Now, } OX_t^* = G_t E_t^*$$

$$\text{Or, } G_t = \frac{OX_t^*}{E_t^*} \text{-----} (2)$$

Where,

OX_t^* = Proportionate growth rates of official exports

E_t^* = Rate of devaluation of domestic currency

G_t = Growth rates of official exports

$$\text{Now, } G_t = [\rho_t - \left(\frac{\alpha}{1-\alpha}\right) \varepsilon_t \gamma_t] \text{-----} (3)$$

Where,

$$\rho_t = \text{Actual export elasticity} = \left\{ \frac{\Delta AX_t}{\Delta E_t} \times \frac{E_t}{AX_t} \right\}$$

$$\varepsilon_t = \text{Elasticity of } \alpha \text{ with respect to } K_t = \left\{ \frac{\Delta \alpha}{\Delta K_t} \times \frac{K_t}{\alpha} \right\}$$

$$\gamma_t = \text{Elasticity of } K_t \text{ with respect to } E_t = \left\{ \frac{\Delta K_t}{\Delta E_t} \times \frac{E_t}{K_t} \right\}$$

From equation (3), we can re-write that –

$$G_t = \left\{ \frac{\Delta AX_t}{\Delta E_t} \times \frac{E_t}{AX_t} \right\} - \left(\frac{\alpha}{1-\alpha} \right) \times \left\{ \frac{\Delta \alpha}{\Delta K_t} \times \frac{K_t}{\alpha} \right\} \times \left\{ \frac{\Delta K_t}{\Delta E_t} \times \frac{E_t}{K_t} \right\} \text{-----} (4)$$

Now, the tendency of under-reporting will always varies inversely with the devaluation of domestic currency, here α and E_t are negatively related that means devaluation of exchange

rate(E_t) will always exercise a downhill force on α . By above stated definition we know that, black-market premium is nothing but the difference between the value of currency on the black market and its official exchange rate, hence currency devaluation will always diminish the scope of black market premium (BMP) i.e. exchange rate elasticity of black market premium will be negative. On the other hand, we already explain it that devaluation diminish the BMP, since α and K_t are positively related, first, devaluation of official exchange rate will reduce the BMP, that's why the exporter's tendency of under-reporting will also reduce, because a typical exporter always tries to maximise his export earnings in terms of domestic currency. So, theoretically devaluation of official exchange rate will again apply a downward pressure via K_t on α .

But paradoxically your figure-1 is showing that exporters are still under-reporting. Now, What could be the reasons behind that? Our study suspect that these could be – future expectation of devaluation, capital flight and some amount of dollar they can stock which they don't report, because in Bangladesh balance of payments is negative i.e. import is much higher than export. For their export, they have to import raw materials from abroad, for this they need huge amount of US\$, and for the continuous devaluation of BD taka when they want to buy USD or foreign currency they have to pay a huge amount of domestic currency, note that here sometimes the same guy plays a dual role as an exporter and importer simultaneously, so for buying foreign currency (USD) they have to incur a huge amount of loss in terms of domestic currency. **So, in case of Bangladesh this is a paradox that devaluation couldn't reduce the expected amount of under-reporting and we suspect that may be 'high import of Bangladesh' is one of the prime reasons.** On the other hand, for importing huge amount of raw materials they need liquid cash like dollar and here they also want to avoid import tax & tariffs, for the sake of their import-profit-maximization, they perform under and over report here also, so if they collect USD officially/legally, then it is tough to misreport about their imported goods and services after getting a legal stamp on the entire amount of dollar.

Now, in the financial year 2018, Bangladesh exports was 41 bill. USD and imports 46.02 bill USD. Its major export goods are Textiles, Garments (2nd largest exporter in the world), Leather & Leather Goods, Pharmaceuticals and other Chemical products, Ceramic Products, Bicycles, Jute and Jute Goods, IT, Agricultural Products, Frozen Food (Fish and Seafood) etc. Major export partners are EU, US, Japan, Canada, India, Australia, China, Southeast Asia etc.

For the production of textiles, garments and other final products and for domestic consumption Bangladesh has to import much like – raw materials of textiles and Textile Articles, Machinery and Mechanical Appliances, Electrical Equipment, Mineral Products, Vegetable Products, Metal & metal products, Chemicals & Allied Products, Vehicles & Aircraft etc. Major import partners are China, India, Singapore, Hong-Kong and others.

Corrupt practicing is comparatively easy in a developing country like Bangladesh. The ‘Corruption Perception Index’ data we can compare Bangladesh position also (CPI Data, Transparency International, Appendix).

So, with partly violating the ‘devaluation led export-growth idea’, except few sectors, overall it is actually increased Bangladesh’s ‘export volume’ not ‘sustainable export growth rate’ rather it has already created a possibility to capital flight also.

IV. Methodology and Empirical Results

In this section we have assumed that, Bangladesh’s exports to USA as the officially reported exports (X_{ot}) and US imports from Bangladesh is considered as Bangladesh’s actual exports to USA (AX_t). Individually US is the Bangladesh’s top trading partner. Our fundamental consideration is that USA’s Statistics is subject to less contaminate, as they have better customs monitoring infrastructure, protection strategy, technology and comparatively a free & fair foreign exchange market. Our data source is, Direction of Trade Statistics (DOTS), Bilateral Trade, published by the International Monetary Fund (IMF).

The data dissimilarity between the source country’s officially reported export and destination country’s import may be because of transportation cost. Bangladesh’s export figures are in ‘fob’ values and US’s Import figures are in ‘cif’ values. Now, cif stands for ‘cost, insurance and freight’ (named port of destination) and fob stands for ‘free on board’ (named port of shipment). So, there prevails normal discrepancy because of transportation cost. Now, according to the ‘New Estimates for Direction of Trade Statistics’ it is exactly said that “A CIF/FOB adjustment of 6 percent is used for non-reporting countries. The value of exports is equal to the value of imports from a partner divided by 1.06; the value of imports is equal to the value of exports multiplied by 1.06” (Marini, Dippelsman & Stanger, 2018). We convert US’s imports dividing them by 1.06 and reach at modified import values of US from Bangladesh which we entitle as actual exports from Bangladesh to US. We notice that the discrepancy between actual and official reported exports still remain (Table-1 and Figure-1).

In figure-1, the gap between actual and official exports are considered here as expanse of under-invoicing. **Note that from 1972-1991 the under invoicing was very negligible and after the liberalization (1991)** of Bangladesh where trade restrictions were mostly eliminated, the exporters are continuously under-reporting their exports in spite of devaluation of exchange rates. Here figure-1 depicts the actual and official export figure from Bangladesh to US during 1973-2018.

Our study period is 1973-2018, we have 4 variable/series like actual export of Bangladesh to USA (AX_t), Officially reported export of Bangladesh (X_{ot}), Misreporting/Discrepancy of Bangladesh i.e. difference between actual and official export ($AX_t - X_{ot}$), Official exchange rate of Bangladesh with USD (E_t).

Since, our data skewed heavily, so to remove or reduce skewness and to make the data conform to normality, first we have taken log-transformation. We always keep in mind that in order to use time series forecasting models, it is necessary to convert any non-stationary series to a stationary series first.

Now, to determine stationarity we have done visual (Appendix) test and for this we have used the 'Autocorrelation Function' (ACF) because it is one of the most widest used tools in time-series analysis. Simply by looking at each plot, we can identify that the series mean and variance were changing with time, so series is non-stationary, because stationary series have a constant value over time. This visual approach might not always give accurate results. It is better to confirm the observations using some statistical tests.

Now, we can use unit root stationary tests. To understand the series is stationary or not, the Dickey Fuller test is one of the most popular statistical tests. Our null hypothesis is: The series is non-stationary (i.e. the series has a unit-root) and alternative hypothesis is: The series is stationary (i.e. the series has no unit root).

If the test statistic is greater than the critical value, we reject the null hypothesis (series is not stationary). If the test statistic is less than the critical value, we fail to reject the null hypothesis (series is stationary).

In the case of 3 series like actual export, official export and discrepancy (misreporting) we have failed to reject the null hypothesis that means 3 series are non-stationary, this implies we need to do differencing. On the other hand, in case of exchange rate, we reject null hypothesis

i.e. we accept alternative hypothesis that means the series is stationary, it implies that we need not to differencing.

ADF test is also known as a difference stationarity test. In this method, we compute the difference of consecutive terms in the series. Differencing is typically performed to get rid of the varying mean. Thus, we finally moved on to actually making our series stationary and when difference series are integrated of difference orders, it rules out the possibility of cointegration that means Engle-Granger cointegration test can't be performed. So our final variables are $(D.\ln_AX_t)$; $(D.\ln_X_{ot})$; $(D.\ln_AX_t - X_{ot})$ and (E_t) i.e. growth rate (GR) of actual exports, growth-rates of official exports, growth rates of misreporting and official exchange rates respectively. After converting all the series in stationary forms and to demonstrate our principal argument that the official report should be proper or over-reported on account of actual export growth with the devaluation of exchange rate but it did not happen properly in the case of Bangladesh and it's a paradox. We have done simple OLS regression tests of actual and official exports on official exchange rate during 1973-2018.

Now, we regress $(D.\ln_AX_t)$ and $(D.\ln_X_{ot})$ on (E_t) respectively. The outcome showed table-2 is not significant. We notice that the estimated coefficient is higher for one period difference of log values (0.012) of official exports than that of log values of actual exports (-0.279). In both cases of actual and official exports, the low R^2 is an indication that exports are less affected by currency devaluation especially official exports and there must have some other factors which affects official exports and those are not included in our analysis. Here, some non-price factors which also significantly affect our official exports. Marjit and Raychaudhuri (1997) and Sarkar (1994) also point out like this and this statement is true for table 2, 3, 4 & 6 also.

Table-2: Period 1973-2018; Independent Variable: Log(E_t)				
Dependent Variable	Coefficient		R^2	DW
	Constant	β		
D.ln_AXt	1.193	-0.279	0.080	1.669
t	2.080	-1.840		
P> t	0.044	0.073		
D.ln_Xot	0.460	0.012	0.002	1.906
t	0.330	0.320		
P> t	0.744	0.753		

Now, we regress $(D.\ln_AX_t)$ and $(D.\ln_X_{ot})$ on (E_{t-1}) respectively. That means we regress growth rates of actual exports and growth rates of official exports on one period lag of exchange rate respectively. The outcome showed table-3 is also not significant. In both cases of actual and official exports, the low R^2 is an indication that exports are less affected by currency devaluation especially official export.

Table-3: Period 1973-2018; Independent Variable: $\text{Log}(E_{t-1})$				
Dependent Variable	Coefficient		R^2	DW
	Constant	β		
D.ln_AXt	0.915	-0.208	0.051	1.689
t	1.710	-1.450		
$P> t $	0.096	0.154		
D.ln_Xot	0.059	0.009	0.001	1.908
t	0.450	0.240		
$P> t $	0.658	0.809		

Now, we regress $D.D.\ln_AX_t$ (i.e. GRs of GRs of actual exports) and $D.D.\ln_X_{ot}$ (i.e. GRs of GRs of official exports) on $D.\ln_E_t$ (GRs of exchange rates). The result showed that table-4 is significant. Like previous here we also get the similar result. In both cases of actual and official exports, the low R^2 is an indication that exports are less affected by currency devaluation.

Table-4: Period 1973-2018; Independent Variable: $\text{Log}(E_t) - \text{Log}(E_{t-1})$				
Dependent Variable	Coefficient		R^2	DW
	Constant	β		
D.D.ln_AXt	0.203	-6.078	0.403	2.589
t	1.730	-4.930		
$P> t $	0.092	0.000		
D.D.ln_Xot	-0.033	0.794	0.081	3.341
t	-0.860	1.930		
$P> t $	0.394	0.061		

We next regress the GRs of misreporting $(D.\ln_AX_t - X_{ot})$ on GRs of exchange rates $(D.\ln_E_t)$. Table-5 provides the results of the regression of three sub-periods 1973-1992, 1993-2018 and 1973-2018. Now, interestingly it is expected that under-invoicing would fall with the depreciation of exchange rates i.e. the estimated coefficients are negative for all three periods.

Table-5: Independent Variable: $\text{Log}(E_t) - \text{Log}(E_{t-1})$				
Dependent Variable	Coefficient		R^2	DW
$D.\ln_AXt_Xot$	Constant	β		
Sub-Period: 1973-1992	0.613	-3.884	0.191	0.920
t	1.930	-1.750		
$P> t $	0.076	0.103		
Sub Period: 1993-2018	0.108	-0.330	0.003	2.552
t	2.060	-0.280		
$P> t $	0.051	0.782		
Sub Period: 1973-2018	0.276	-2.340	0.094	1.239
t	2.530	-2.010		
$P> t $	0.015	0.052		

We notice that after the independence (1971-2018) and with their economic liberalization policy (1990s), Bangladesh continuously depreciate ‘Taka’ for the purpose of increase exports and reduce under-reporting. Bangladesh continued its depreciation policy along with transformation to a market determined exchange rate regime which almost wiped out black market premium in 2002. But figure-1 shows that under-reporting has increased year after year and its partly violates the popular theory that exchange rate devaluation increase exports and reduce under-reporting. Now, we suspect that probably with an expectation regarding future devaluation/depreciation of exchange rate exporters can perform under-reporting/misreporting also. In some cases, one can hold his present ‘exportable bulk’ and increase the price for same quantity of that product to export in the next period by expecting that the domestic currency will depreciate more and he will increase his exportable income in terms of domestic currency. To check this, we next regress $(D.D.\ln_AX_t)$ and $(D.D.\ln_X_{ot})$ on $(D.F.\ln_E_t)$ [i.e. $\log E_{t+1} - \log E_t$]. Table-6 provides the result that under-invoicing would not fall with the depreciation of exchange rates i.e. the estimated coefficient is positive in case of official exports. Also, the low R^2 (s) are another indication that exports are less affected by currency devaluation especially official exports. So, in case of Bangladesh’s exports with USA it is a paradox that currency devaluation couldn’t wipe out underinvoicing/misreporting.

Table-6: Period 1973-2018; Independent Variable: $\text{Log}(E_{t+1}) - \text{Log}(E_t)$				
Dependent Variable	Coefficient		R^2	DW
$D.D.\ln_AXt$	Constant	β		
$D.D.\ln_AXt$	0.202	-7.284	0.291	2.198
t	1.450	-3.790		

	P> t	0.157	0.001		
D.D.In_Xot		-0.033	0.879		
	t	-0.790	1.500	0.052	3.271
	P> t	0.436	0.141		

V. Conclusion:

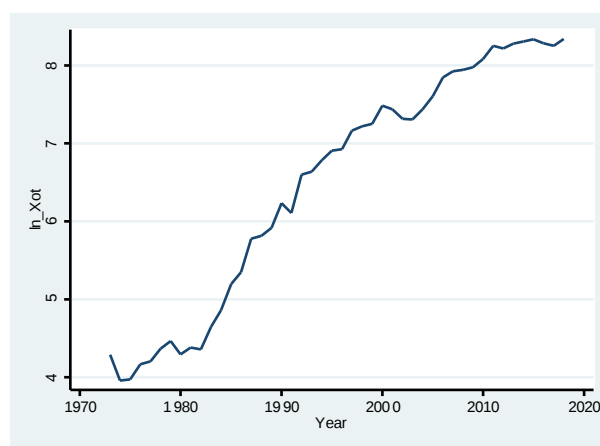
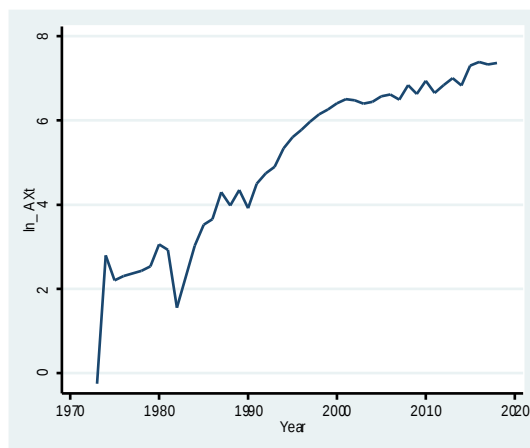
The present analysis in the context of Bangladesh's export to USA shows that the impact of exchange rate devaluation was not strongly realised on the officially reported export data which much differs from the actual exports to USA. Now with this common strategy that devaluation of exchange rate and by reducing the black-market premium, we often want to increase official reported export sales as well as to reduce under-reporting of exports. But in our developing country like Bangladesh where foreign exchange markets are always based on rigorous rules and regulations, official exports may not increase and under-reporting may not decrease to the expected level with the impact of currency devaluation/depreciation. Other price and non-price factors must be responsible for this which are not included in our current studies. Further study is necessary to find out the factors which are actually responsible for this paradox.

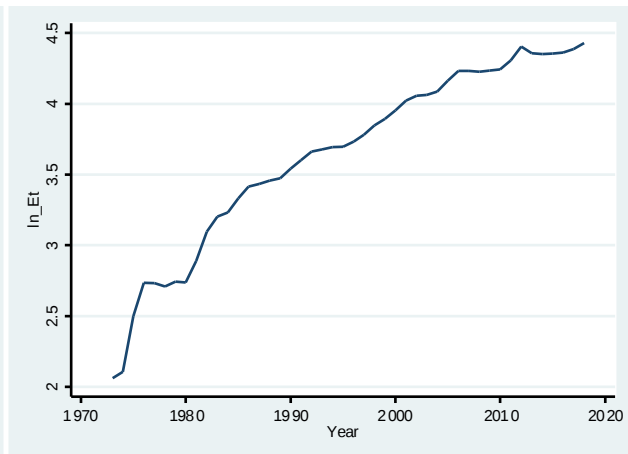
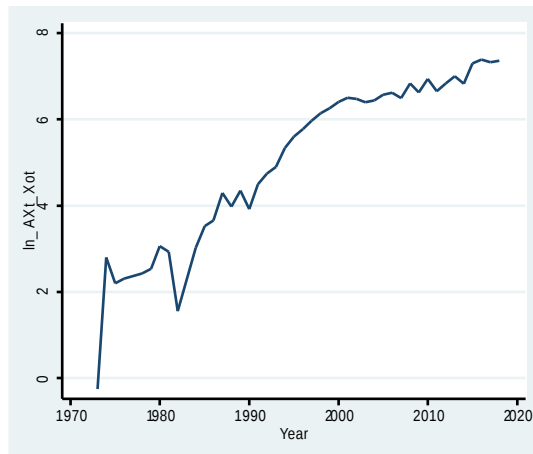
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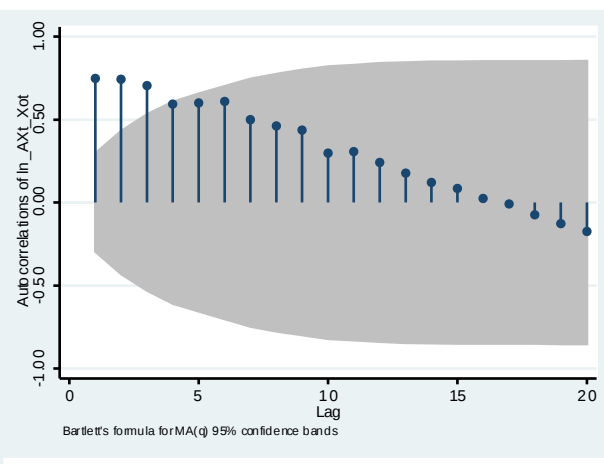
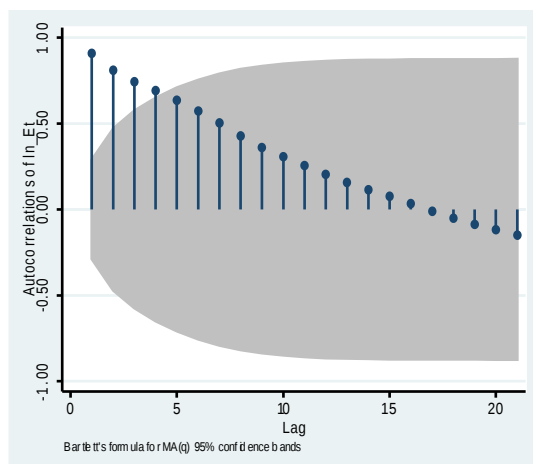
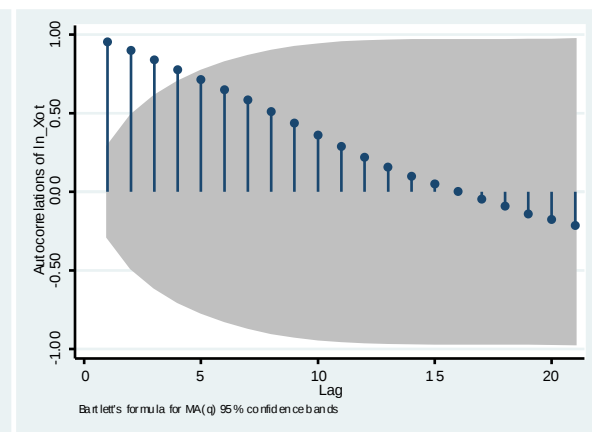
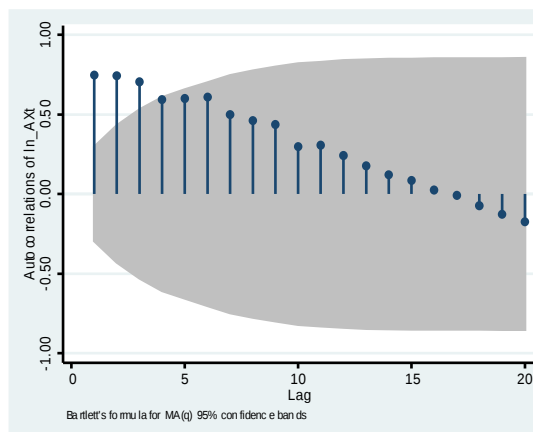
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Appendix





Stationarity Test



Unit root test (Dickey Fuller)

. dfuller ln_Axt // NS

Dickey-Fuller test for unit root Number of obs = 41

Test Statistic	Interpolated Dickey-Fuller			
	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-2.380	-3.641	-2.955	-2.611
MacKinnon approximate p-value for Z(t) = 0.1475				

. dfuller ln_Xot // NS

Dickey-Fuller test for unit root Number of obs = 45

Test Statistic	Interpolated Dickey-Fuller			
	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-0.805	-3.614	-2.944	-2.606
MacKinnon approximate p-value for Z(t) = 0.8176				

. dfuller ln_Et // S

Dickey-Fuller test for unit root Number of obs = 45

Test Statistic	Interpolated Dickey-Fuller			
	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-3.872	-3.614	-2.944	-2.606
MacKinnon approximate p-value for Z(t) = 0.0023				

. dfuller ln_Axt_Xot // NS

Dickey-Fuller test for unit root Number of obs = 41

Test Statistic	Interpolated Dickey-Fuller			
	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-2.380	-3.641	-2.955	-2.611
MacKinnon approximate p-value for Z(t) = 0.1475				

Now, we need to do differencing

MacKinnon approximate p-value for Z(t) = 0.0000