Uncovering Smuggling: Worldwide Evidence for Four Types of Trade Misinivoicing

by

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Abstract

We analyze the determinants of trade misinvoicing using data on 86 countries from 1980 to 2005. In a simple microeconomic framework we derive the determinants of four different types of trade misinvoicing taking into account that only the financial incentives determine *whether* and *how much* exports/imports to underinvoice or overinvoice, whereas the deterrents only affect the *extent* of misinvoicing. The hypothesized determinants are tested using data on discrepancies in bilateral trade with the U.S. We find that the black market premium and tariffs motivate illegal trading activities. Higher financial penalties effectively act as a deterrent to this crime.

JEL-Classification: O17, H26, K42, F14

Keywords: Trade Misinvoicing, Illegal Trade, Tax evasion, Tariff evasion, Black Market Premium, Smuggling

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Abstract

We analyze the determinants of trade misinvoicing using data on 86 countries from 1980 to 2005. In a simple microeconomic framework we derive the determinants of four different types of trade misinvoicing taking into account that only the financial incentives determine *whether* and *how much* exports/imports to underinvoice or overinvoice, whereas the deterrents only affect the *extent* of misinvoicing. The hypothesized determinants are tested using data on discrepancies in bilateral trade with the U.S. We find that the black market premium and tariffs motivate illegal trading activities. Higher financial penalties effectively act as a deterrent to this crime.

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1 Introduction

In this paper, we study the determinants of trade misinvoicing. We contribute to the literature in the following ways: firstly, we present a simple microeconomic framework which simultaneously analyzes the effect of microeconomic incentives and deterrents on the macroeconomic phenomenon of trade misinvoicing. This approach takes into account that the financial incentives for trade misinvoicing determine the decision as to *whether* and *how much* exports/imports to underinvoice or overinvoice, whereas the deterrents to trade misinvoicing only have an impact on the optimal *amount* of misinvoicing. Secondly, we test the derived theoretical hypotheses using a rich data set of 86 countries over the period 1980 to 2005.

Trade misinvoicing occurs if the true value of exports or imports deviates from the amount of exports or imports entrepreneurs report to the authorities. An interesting literature has emerged that studies the determinants of trade misinvoicing by analyzing bilateral trade partner statistics (for recent examples, see, e.g., Fisman and Wei (2007), Berger and Nitsch (2008), and Farzanegan (2008). Trade misinvoicing is typically motivated by financial incentives, for example by benefiting from a premium at the black market for foreign exchange or by evading tariffs or taxes. While the empirical literature has mainly focused on analyzing the incentives for that financial crime, we also test the relevance of deterrents to misinvoice, i.e. the risk of detection and the costs of punishment.

The microeconomic framework presented in this paper demonstrates that the financial incentives for trade misinvoicing, such as the black market premium (BMP) or taxes on trade or income, determine *whether* underinvoicing or overinvoicing exports/imports is profitable for entrepreneurs in a particular country *and which extent* of this type of misinvoicing is optimal. On the contrary, the deterrents to misinvoicing, such as the risk of detection or punishment costs, only have an impact on the decision *how much* exports/imports to misinvoice. For example, a high BMP and high export taxes will lead to export

underinvoicing, i.e. misinvoicers will report fewer exports to the authorities than they actually sold abroad thereby evading exports taxes and benefiting from selling the foreign currency-denominated export revenues at a (high) premium at the black market for foreign exchange. The risk of detection, on the contrary, will affect the decision *how much* exports to underinvoice only as the probability that this crime is detected is the higher the larger the scale of that fraud. In a case where export overinvoicing is optimal, for example because a negative BMP prevails and no taxes on exports are levied, the risk of detection has an effect on the absolute extent of export overinvoicing, but not on the decision whether to underinvoice or to overinvoice exports.

This dichotomy of the effect of financial incentives for misinvoicing and deterrents on misinvoicing implies splitting the data set into the respective types of trade misinvoicing. Within our empirical framework we consequently analyze four separate panels for each possible type of trade misinvoicing, namely import underinvoicing, import overinvoicing, export underinvoicing, and export overinvoicing, drawing on data on bilateral trade discrepancies *vis à vis* the U.S. Applying panel regressions for 86 countries for the period 1980 to 2005 we test the hypothesized microeconomic determinants of each particular type of trade misinvoicing.

Our results provide evidence for the validity of the theoretical hypotheses. We find robust evidence for the hypothesis that the BMP influences the level of trade misinvoicing. Thus, illegal traders seem to use the black market for foreign exchange to launder U.S. dollars earned through misinvoicing. We also find robust evidence that a major incentive for trade misinvoicing is the evasion of taxes on trade. Although tariffs protect domestic producers, they seem to provide an incentive for illegal trading activities. Thus, forming free trade areas and reducing tariffs could not only reduce this crime, it might be also beneficial for

government revenues.[1] The motivation to evade income taxes plays however only a minor role for misinvoicing exports or imports. With respect to the deterrents of misinvoicing our results suggest that higher direct financial penalties, measured as fines to GDP, effectively reduce the extent of trade misinvoicing, whereas the GDP per capita, measuring the opportunity cost of lost labor income in prison, plays no significant role.

The rest of the paper is organized as follows. Section 2 reviews the literature on illicit trade. Section 3 derives the determinants of trade misinvoicing in a simple microeconomic framework. Section 4 presents the empirical analysis. Section 5 concludes.

2 Literature

The theoretical literature on trade misinvoicing can be separated into two main strands. The first strand analyzes the welfare effects of trade misinvoicing and questions the classic view that illegal trade, by circumventing tariff distortions, increases welfare. In their seminal paper Bhagwati and Hansen (1973) assume that legal and illegal trade is conducted at the same world market price. While illegal traders avoid tariffs, they face a less favorable rate of transformation due to real costs incurred by smuggling. If the tariff rate equals the cost of trade misinvoicing, both types of trade can coexist, if not, each firm trades either legally or illegally. Illegal trade thus reduces tax revenues without the corresponding efficiency improvements. Bhagwati and Hansen therefore conclude that illegal trade does not improve welfare. Introducing a third non-traded good into this framework Sheik (1974) showed that the coexistence of illegal and legal trade can be welfare improving.

Pitt (1981) argues that the coexistence of legal and illegal trade is an empirical fact. Within an institutional framework he demonstrates that firms use legal trade to camouflage illegal trade and that the welfare consequences are ambiguous. In Pitt's model legal traders

[1] Farzanegan (2008) presents empirical evidence for the negative impact of trade misinvoicing on government revenues in Iran.

are driven out of the market when other firms trade legally and illegally. The interesting intermediate case of illegal trade by some, but not all, firms in the market had been picked up by Thursby et al. (1991). In a model where legal traders can coexist with firms that camouflage their illegal trading activities by legal trade they show that the coexistence can be welfare improving and that the welfare effects of illegal trade are related to the degree of competition, i.e. welfare is the higher the more firms are in the market.

The second strand of the theoretical literature analyzes the determinants of trade misinvoicing. Pitt (1981) argues that illegal trade responds to the price disparity, defined as the difference between the actual domestic price and the tariff-inclusive world market price. If, for example, the world market price of an exportable good is below its domestic price most of the actual export value is traded illegally because legal export would produce a loss. Consequently, the incentive to underinvoice exports is the higher the higher the price disparity. Pitt (1984) focuses on a further determinant of illegal trade: the BMP for foreign exchange. He shows that the black market equilibrates the supply of foreign exchange from illegal exports and the demand for it to purchase illegal imports. Barnett (2003) presents a model where smuggling is the means by which (home country) agents can acquire or sell foreign currency as currency restrictions – such as inconvertibility of home currency and portfolio restrictions – prevent them from doing the same at the official exchange rate. The BMP is then an important determinant of the illegal trade volume. Biswas and Marjit (2005, 2007) also contribute to this strand of the literature. Using the well-established concept of partner trade statistics they find a positive (negative) correlation between the BMP and export (import) underinvoicing since illegal traders sell (buy) the foreign exchange of unreported transactions on the black market.

The costs associated with illegal trade were investigated in Martin and Panagariya (1984) and Norton (1988). Besides real resource costs of illegal trade, such as special packaging to hide the smuggled good or payments to foreign firms in order to establish

business relations, Martin and Panagariya (1984) explicitly consider the risk of confiscation. They show that increasing the probability, or cost, of confiscation by intensifying law enforcement is a deterrent to illegal trade. Norton (1988) additionally accounts for transportation costs and considers competition among illegal traders. He finds that increasing fines reduces illegal trade.

To test the theoretical hypotheses about the determinants of trade misinvoicing, an empirical literature has emerged that mainly uses the trade discrepancy calculated from balance of payments data to measure the extent of trade misinvoicing. An overview of this rather diverse literature is presented in Table 1 where we summarize the research design and main findings of previous studies.

[Insert Table 1 about here]

Bhagwati (1964) analyzing trade data of Turkey and its major trading partners finds a strong indication for import underinvoicing in transport equipment and machinery as both product categories feature high tariffs. Naya and Morgan (1969) study trade statistics in seven Southeast Asian countries. Their main conclusion is that trade discrepancies in inter-Asian trade are significantly greater than discrepancies to developed countries. McDonald (1985) analyzes the trade discrepancy ratio between developing and industrialized countries finding that export underinvoicing is positively correlated with export taxes and the BMP. Yeats (1990) finds that trade data of African countries indicate large-scale smuggling activities depending on the examined product category. More recently, Bahmani-Oskooee and Goswami (2003), studying illegal trade in developed countries, show that smuggling accounts for deviations of the exchange rate from purchasing power parity. Pohit and Taneja (2003) conclude that informal trade between India and Bangladesh is motivated by circumventing the administrative burden. Fisman and Wei (2004) examine the gap of China's imports from Hong

Kong concluding that underreporting of import values and mislabeling of higher-taxed products as lower-taxed ones are widespread. Fisman and Wei (2007) analyze illicit trade in cultural properties and find that misinvoicing in such products is highly correlated with the extent of corruption in the exporting country, a finding confirmed by Berger and Nitsch (2008) using an extended set of product categories. Beja (2008) valuates the amount of China's unreported trade between 2000 and 2005 to be $1.4 trillion. Farzanegan (2008) applies a multiple indicators multiple causes (MIMIC) approach to study the determinants and extent of illegal trade in Iran. He finds that trade misinvoicing in Iran varies between 6 and 25 percent of total trade in the period 1970 to 2002.

3 The Determinants of Trade Misinvoicing

3.1 Export misinvoicing

A domestic entrepreneur exports a given amount of goods X to the U.S. Export misinvoicing means that the amount of exports reported to the authorities, $X - S^x$, does not equal the actual amount of exports, X. The misinvoicer has two options: on the one hand, she can underinvoice exports, which means that the reported amount of exports is lower than the actual amount of exports, i.e. $S^x > 0$ holds. On the other hand she can overinvoice exports, i.e. she reports more exports than she actually sold in the U.S., i.e. $S^x < 0$ holds.

The decision of the domestic exporter can be split into two steps: first, she decides whether to underinvoice or overinvoice exports, which depends on a set of financial incentives that determine the misinvoicing revenue. After the decision about the type of misinvoicing has been made, she decides, subject to her expected profit, about the optimal absolute amount of export misinvoicing, i.e. $\left|S^x\right|$, which is determined by the financial incentives and deterrents. Eq. (1) describes the revenue of the domestic exporter, R^x:

$$R^x = (1-t^{inc})(1-t^x)ep^{US}(X-S^x)+(1+v)ep^{US}S^x, \quad (1)$$

where t^{inc} denotes the domestic tax on income and profits, t^x represents the domestic tax on exports net export subsidies, e is the official exchange rate, i.e. the amount of domestic currency units payable for one U.S. dollar at the official foreign exchange market[2], p^{US} denotes the U.S. price, and v is the BMP, i.e. the percentage premium over the official exchange rate on the black market for foreign exchange.[3] Given the total amount of exports, X, the domestic exporter decides whether to underinvoice or overinvoice exports.

In the case of *export underinvoicing*, $S^x > 0$, the exporter reports understated exports $X - S^x$ to the authorities, sells them at p^{US} in the U.S., and converts the dollar-denominated proceeds at the official exchange rate e into domestic currency. After paying the tax on exports, t^x, and on income, t^{inc}, respectively, this generates a legal after-tax export revenue of $(1-t^{inc})(1-t^x)ep^{US}(X-S^x)$.[4] The unreported/underinvoiced exports, $S^x > 0$, are also sold at p^{US} in the U.S. But the dollar-denominated underinvoicing revenue is then converted into domestic currency on the black market where she realizes an illegal underinvoicing revenue of $(1+v)ep^{US}S^x$ thereby benefiting from a high/positive BMP, v, over the official exchange rate, e.

In the case of *export overinvoicing*, $S^x < 0$, the entrepreneur overstates the value of exports and generates a higher legal after-tax export revenue $(1-t^{inc})(1-t^x)ep^{US}(X-S^x)$ than she would have realized without misinvoicing. The fictitious overinvoiced export revenue is

[2] A rising exchange rate therefore means a depreciation of the domestic currency against the U.S. dollar.

[3] Note that the BMP and the export tax net export subsidies can take negative values.

[4] Of course, only the legal transactions $ep^{US}(X-S^x)$ are subject to taxation. For simplicity, we do not consider any production or procurement costs.

produced by buying the amount of domestic money $(1+v)ep^{US}S^x$ (cheaply) at the black market thereby benefiting from a low/negative BMP, v, over the official exchange rate, e.

Rearranging Eq.(1) yields:

$$R^x = (1-t^{inc})(1-t^x)ep^{US}X + [(1+v)-(1-t^{inc})(1-t^x)]ep^{US}S^x. \quad (1a)$$

The first term on the right-hand side of Eq.(1a) shows the legal export revenue, while the second term shows the revenue earned by misinvoicing. The domestic exporter opts for *export underinvoicing*, $S^x > 0$, if $(1+v)-(1-t^{inc})(1-t^x) > 0$ holds. *Export overinvoicing*, $S^x < 0$, is profitable if $(1+v)-(1-t^{inc})(1-t^x) < 0$ holds. Export underinvoicing is therefore probable if taxes and the BMP are high, whereas entrepreneurs likely overinvoice if taxes and the BMP are low.

Having decided whether to underinvoice or to overinvoice exports, the domestic entrepreneur determines the optimal absolute amount of misinvoiced exports, $|S^x|$, subject to her expected profit. To calculate the expected profit, the misinvoicer takes into account the expected costs associated with export misinvoicing, $E(C^x)$, displayed in Eq.(2):

$$E(C^x) = prob(|S^x|, H)F, \qquad \text{with } \partial prob/\partial S^x > 0,\ \partial^2 prob/(\partial S^x)^2 > 0, \text{ and}$$
$$\partial prob/\partial H > 0 \quad (2)$$

where $prob(|S^x|, H)$ denotes the probability of detection, F represents the punishment cost, and H is an exogenous variable that determines the risk of detection. We assume that the risk of detection, H, is the higher the larger the export quantity relative to the export good's value. This implies that it is easier to hide relatively small and expensive goods, such as antiques or jewelry, from the authorities than cheap bulky products.

The expected cost of export misinvoicing arises from the risk (with the corresponding probability $prob(|S^x|,H)$) that the misinvoicing will be detected by the authorities and that the exporter will subsequently face the punishment cost F, such as direct financial costs for fines or opportunity costs for lost labor income in the case of imprisonment. We assume that the probability of detection increases with the risk of detection and is assumed to be convex in the absolute amount of export misinvoicing.

The expected profit of export misinvoicing, $E(\pi^x)$ is displayed in Eq.(3):

$$E(\pi^x) = (1-t^{inc})(1-t^x)ep^{US}X + [(1+v)-(1-t^{inc})(1-t^x)]ep^{US}S^x - prob(|S^x|,H)F \,. \qquad (3)$$

Dividing Eq.(3) by the domestic price index, p^{dom}, and using the definition of the real exchange rate, $\varepsilon = ep^{US}/p^{dom}$, yields the domestic exporter's expected profit in real terms, denominated in domestic goods:

$$E(\pi^x)/p^{dom} = (1-t^{inc})(1-t^x)\varepsilon X + [(1+v)-(1-t^{inc})(1-t^x)]\varepsilon S^x - prob(|S^x|,H)F/p^{dom} \,. \qquad (3a)$$

Optimization of the real profit over the amount of export misinvoicing yields the result that the marginal revenue and the marginal cost of export misinvoicing are equal:

$$[(1+v)-(1-t^{inc})(1-t^x)]\varepsilon = [\partial prob(|S^x|,H)/\partial S^x]F/p^{dom} \,. \qquad (4)$$

For the interpretation of our results we focus on the *absolute value* of export misinvoicing, $\left|S^x\right|$.[5] The hypothesized impact of the exogenous financial incentives and deterrents on the absolute value of both types of export misinvoicing is displayed in Table 2.

[Insert Table 2 about here]

A higher BMP should increase the absolute amount of export underinvoicing as the entrepreneur can convert the illegal U.S. dollar-denominated misinvoicing revenues into domestic currency at a higher price at the black market. Export overinvoicing decreases *ceteris paribus* if the BMP increases as the entrepreneur must buy U.S. dollars needed to overstate the amount of exports at a higher price at the black market making this type of export misinvoicing less profitable.

Tax fraud can also be an incentive to underinvoice exports: underinvoiced exports are not reported to the authorities and are, thus, not subject to taxation. Higher export or income taxes should therefore raise the profitability of tax evasion thereby increasing the optimal amount of export underinvoicing. With respect to overinvoicing we hypothesize the opposite relation. Overinvoicing exports increases the tax burden and should therefore be negatively correlated with taxes on income and exports.

[5] The rationale to focus on the absolute amount of misinvoicing can be described using the following example. An intuitive result is that a higher risk of detection increases the expected cost of misinvoicing thereby decreasing the optimal absolute value of both types of misinvoicing. In the case of export overinvoicing, however, negative values of S^x apply and, thus, the total differential $dS^x/dH > 0$ would be positive as the value of overinvoicing would be less negative if the risk of detection increases. We focus on the absolute value of misinvoicing and therefore come to the intuitive conclusion that the extent of misinvoicing, be it underinvoicing or overinvoicing, diminishes if the risk of detection increases, $d\left|S^x\right|/dH < 0$.

A real depreciation, i.e. a higher real exchange rate, increases the optimal amount of export underinvoicing *and* overinvoicing. A real depreciation of the domestic currency against the U.S. dollar means that the purchasing power parity-adjusted value of the U.S. dollar-denominated misinvoicing revenue rises and, thus, misinvoicing is more profitable in real terms.

A higher expected cost of misinvoicing should reduce the optimal amount of underinvoicing *and* overinvoicing. Higher punishment costs that misinvoicers have to bear in the case of detection, such as direct financial costs in the form of fines or opportunity costs like lost labor income in prison, should increase the expected costs and therefore reduce the absolute amount of export underinvoicing *and* overinvoicing. A higher risk of detection also increases the expected cost of export misinvoicing and should therefore lead to a lower absolute extent of export underinvoicing *and* overinvoicing.

3.2 Import misinvoicing

A domestic entrepreneur imports a given amount of goods M from the U.S. and decides how much imports to report to the authorities, $M - S^M$. Analogously to the case of export misinvoicing, the decision problem of the domestic importer consists of two steps. First she decides whether to underinvoice imports, $S^M > 0$, where the reported amount of imports is lower than the actual amount of imports, or to overinvoice imports $S^M < 0$, where she reports more imports than she actually bought in the U.S. Whether to underinvoice or overinvoice imports depends on the value of financial incentives that determine the misinvoicing revenue. In the second step, the entrepreneur determines the optimal absolute amount of import misinvoicing, $\left|S^M\right|$, that yields the highest expected profit, which is a function of the financial incentives *and* the deterrents to trade misinvoicing.

Eq. (5) displays the expected profit from import misinvoicing, $E\left(\pi^M\right)$:

$$E(\pi^M) = (1-t^{inc})[R(M) - (1+t^M)ep^{US}(M - S^M)] - (1+v)ep^{US}S^M - prob(|S^M|, H)F,$$

$$\text{with } \partial prob/\partial S^M > 0,\ \partial^2 prob/(\partial S^M)^2 > 0, \text{ and } \partial prob/\partial H > 0, \tag{5}$$

where t^{inc} denotes the domestic tax on income and profits, $R(M)$ is the exogenous revenue of the importer[6], t^M is the import tariff net import subsidies, e denotes the official exchange rate measured as domestic currency units per U.S. dollar at the official foreign exchange market[7], p^{US} measures the U.S. price, and v is the BMP. The expected cost of import misinvoicing arises from the risk (with the corresponding probability $prob(|S^x|, H)$) that the crime will be detected by the authorities and that the importer will subsequently face the punishment cost F. Analogously to the case export misinvoicing, we assume that the risk of detection, H, is the higher the larger the import quantity relative to the import good's value.

The domestic entrepreneur imports M goods from the U.S. and sells them at the domestic market earning $R(M)$ in domestic currency units. The tariff-inclusive import costs that she wants to write off against the tax and therefore reports to the authorities equal $(1+t^M)ep^{US}(M - S^M)$. After paying the domestic income/profit tax, t^{inc}, the importer realizes an after-tax profit of $(1-t^{inc})[R(M) - (1+t^M)ep^{US}(M - S^M)]$ on the reported transactions.

In the case of *import underinvoicing,* $S^M > 0$, the entrepreneur pays the unreported (underinvoiced) American imports using U.S. dollars bought at the black market whereby she spends $(1+v)ep^{US}S^M$ domestic currency units. In the case of *import overinvoicing,* $S^M < 0$,

[6] This exogenous revenue is produced by selling the goods imported from the U.S. on the home market. For the sake of simplicity we assume constant revenue.

[7] Again, rising values of e reflect a depreciation of the domestic currency against the U.S. dollar.

she overstates her import costs, thereby reducing the income tax burden, and hides that crime in following way: she reports the overstated import costs to the authorities and buys the U.S. dollar funds, needed to pay the fictitious imports, cheaply at the official foreign exchange market. But instead of buying the overinvoiced/fictitious imports, she actually converts these U.S. dollar funds into domestic currency thereby profiting from a high BMP.

Rearranging Eq.(5) we can determine if underinvoicing or overinvoicing prevails:

$$E(\pi^M) = (1-t^{inc})[R(M) - (1+t^M)ep^{US}M] + [(1-t^{inc})(1+t^M) - (1+v)]ep^{US}S^M - prob(|S^M|,H)F \,. \quad (5a)$$

The first term on the right-hand side of Eq.(5a) shows the net profit from selling the import goods legally on the home market, while the second term shows the net profit produced by misinvoicing. *Import underinvoicing,* $S^M > 0$, is optimal if $(1-t^{inc})(1+t^M) - (1+v) > 0$ holds. *Import overinvoicing,* $S^M < 0$, prevails if $(1-t^{inc})(1+t^M) - (1+v) < 0$ is true. Entrepreneurs therefore have an incentive to *underinvoice* (*overinvoice*) imports if income/profit taxes are low (high), import tariffs are high (low), and the BMP is low (high), respectively.

To determine the importer's expected profit in real terms we devide Eq. (5a) by the domestic price index, p^{dom}, and use the real exchange rate, $\varepsilon = ep^{US} / p^{dom}$:

$$\frac{E(\pi^M)}{p^{dom}} = (1-t^{inc})\left[\frac{R(M)}{p^{dom}} - (1+t^M)\varepsilon M\right] + [(1-t^{inc})(1+t^M) - (1+v)]\varepsilon S^M - prob(|S^M|,H)\frac{F}{p^{dom}} \,. \quad (5b)$$

Maximizing the real expected profit over the amount of import misinvoicing yields the optimal amount of import misinvoicing, where marginal revenue equals marginal cost:

$$[(1-t^{inc})(1+t^M) - (1+v)]\varepsilon = [\partial prob(|S^M|,H) / \partial S^M]F / p^{dom} \,. \quad (6)$$

Using Eq.(6) we can determine the hypothesized impact of the financial incentives and the deterrents on the optimal *absolute value* of import misinvoicing, $\left|S^M\right|$ displayed in Table 3.[8]

[Insert Table 3 about here]

A higher BMP decreases (increases) the incentive to underinvoice (overinvoice) imports as the entrepreneur must buy (can sell) the underinvoiced (overinvoiced) U.S. dollar-denominated imports at a higher price in domestic currency at the black market.

Tax fraud can be a motivation to overinvoice the value of imports. As costs for imports can be claimed as tax exempt, the entrepreneur can choose to overstate the value of imports to reduce her tax burden. The higher the domestic tax on income and profits, the lower (higher) the optimal amount of import underinvoicing (overinvoicing).

The evasion of tariffs is an incentive to underinvoice imports since authorities cannot levy tariffs on non-reported imports. Thus, the higher the tariff rate, the higher (lower) the optimal amount of import underinvoicing (overinvoicing).

The reasoning with respect to the real exchange rate and the expected costs is analogous to the export misinvoicing case. A real depreciation increases the optimal amount of both types of import misinvoicing as the purchasing power parity-adjusted value of the misinvoicing revenue rises. Higher punishment costs or a higher risk of detection increase the expected costs of import misinvoicing thereby decreasing the optimal amount of import underinvoicing *and* overinvoicing.

4 Empirical Analysis

[8] As in the case of export misinvoicing, we focus on the absolute value of misinvoicing to alleviate the interpretability of the results.

4.1 Data

In this section we test the theoretical hypotheses using panel regressions for a sample of 86 countries in the period 1980 to 2005.[9] To test the hypothesized determinants, we split the data set into the four types of illicit trade: export underinvoicing, export overinvoicing, import underinvoicing, and import overinvoicing.

The aim of our empirical analysis is to explain the determinants for the deviations of the true value of a country's exports (imports) from the reported amount of exports (imports). To define the extent of trade misinvoicing we use the discrepancies in the bilateral trade between country *i* and the U.S. We thus follow the literature by assuming that the U.S. authorities report their trade figures honestly while the authorities in country *i* do not.

Import misinvoicing is defined as the difference between the value of U.S. exports to country *i* (the true value of *i*'s imports) and the amount of *i*'s imports from the U.S. reported by *i*'s authorities divided by the U.S. exports to country *i* as outlined in Eq. (7):

$$MISIMP_i = \frac{U.S.\,EXP\,to\,i \; - \; i'\,s\;IMP \;\; from\,the\,U.S.}{U.S.\,EXP\,to\,i}. \tag{7}$$

If $MISIMP_i$ is positive (negative) import underinvoicing (overinvoicing) occurs, i.e. domestic importers report less (more) imports than they actually bought from the U.S.

Export misinvoicing is computed as the difference between U.S. imports from country *i* (the true value of *i*'s exports) and *i*'s exports to the U.S. reported by *i*'s authorities divided by the U.S. imports from *i* as outlined in Eq. (8):

$$MISEXP_i = \frac{U.S.\,IMP \;\; from\,i \; - \; i's\;EXP\,to\,the\,U.S.}{U.S.\,IMP \;\; from\,i}. \tag{8}$$

[9] The list of included countries can be found in the Appendix.

If $MISEXP_i$ is positive (negative) export underinvoicing (overinvoicing) occurs, i.e. domestic exporters report less (more) exports than they actually sold to the U.S.

The original trade data used to calculate import and export misinvoicing are taken from the International Monetary Fund's Directions of Trade statistics (DOTS) database.[10] To give an intuition about the development of the different types of trade misinvoicing in our samples, we present the average values of import and export misinvoicing in the period 1980 to 2005 in Figures 1 and 2, respectively.[11]

[Insert Figure 1 and 2 about here]

Figures 1 and 2 depict the average "raw" values of the different types of trade misinvoicing computed according to Eq. (7) and (8).[12] More negative values of import/export overinvoicing indicate a larger extent of this crime, while an increase in import/export underinvoicing volumes is indicated by more positive values.

The two figures reveal that import and export misinvoicing have different patterns. While the average size of import underinvoicing has steadily declined over time, import overinvoicing shows a more volatile behavior: it remained relatively stable in the early 80's but started to decrease in 1987. This trend reversed in 1992 when import overinvoicing began

[10] The export figures are in FOB (Free on Board) prices, and the import figures are in CIF (Cost, Insurance and Freight) prices. In order to make them comparable, we divide the export figures by an adjustment factor of 1.1 as suggested by the IMF (1993), taking into account transport and insurance costs.

[11] The average values are obtained in two steps. First, we split the import misinvoicing sample into an import underinvoicing sample (positive values) and an import overinvoicing sample (negative values). In the second step, we calculate the average value of the respective four misinvoicing types for each year. The datasets on export underinvoicing and export overinvoicing are obtained analogously.

[12] Note that we use the absolute values of trade misinvoicing in the regressions.

to rise again. Since the mid 90's the average size of import overinvoicing has declined steadily.

In contrast to import misinvoicing, the average size of export underinvoicing and export overinvoicing has remained fairly stable since 1980 although export underinvoicing trends downwards. Export overinvoicing fluctuates around values of about 10 percent indicating a relatively low extent of this type of misinvoicing.

In addition to the development of the average size of the particular type of trade misinvoicing, we also present evidence about the frequency of their occurrence over time. For this purpose, Figure 3 shows for each year the share of countries in the sample where either import underinvoicing or overinvoicing prevails. Figure 4 displays the share of countries where export under- or overinvoicing occurs.

[Insert Figure 3 about here]

Figure 3 shows that import underinvoicing and overinvoicing are almost equally distributed over the entire sample period although overinvoicing dominates in the second half of the 90's. In the case of export misinvoicing, the different types of misinvoicing show a much more volatile pattern. Export underinvoicing clearly dominated export overinvoicing throughout the whole sample, except for a few years in the early 90's where both types of export misinvoicing were equally frequent. The occurrence of export overinvoicing has, however, steadily increased while export underinvoicing has become less frequent.

[Insert Figure 4 about here]

Although this descriptive evidence gives an intuition about the size and development of trade misinvoicing in our sample, it cannot explain why the extent of illegal trade varies across countries and over time. Within our regressions, we test whether the occurrence and size of

the four types of trade misinvoicing – import underinvoicing and overinvoicing as well as export underinvoicing and overinvoicing – respond to the microeconomic incentive variables as hypothesized in our microeconomic framework of Section 3. In accordance with the derivation of our theoretical hypotheses, we use the size of misinvoicing in absolute values, i.e. the dependent variable is positive in each of the four types of misinvoicing. The determinants of trade misinvoicing, which are used as independent variables in the regressions, are discussed in the following. For the empirical identification, data sources, and definitions of the theoretical variables, see Table A.1 in the Appendix.

To test the microeconomic determinants of trade misinvoicing we transform each macroeconomic variable into measures that can be interpreted at the individual level. We calculate the average income tax rate of the economy by dividing the total macroeconomic amount of taxes on income by the GDP to measure the incentive to evade income taxes. Taxes on exports and imports are transformed analogously. Our tax measures can thus be interpreted as a proxy for an average individual tax rate.

The real exchange rate *vis à vis* the U.S. is computed by using data on the nominal exchange rate and the consumer price indices of the domestic economy and the U.S., respectively. Higher values indicate that (illegal) U.S. dollar funds are worth more in terms of domestic consumer goods.

To capture the probability of detection we employ data on the index of quantity to quality of trade. If, for example, the value of misinvoiced exports or imports is high relative to its quantity, such as in the case of antiques or jewels, the probability of detection is low as hiding such illegally traded goods from authorities is relatively easy compared to bulky mass products. Therefore we expect that higher values of quantity to the quality of exports/imports will lead to a higher probability of detection and, thus, to a lower absolute amount of exports/imports misinvoicing, *ceteris paribus.*

Two variables are used to measure punishment costs: fines to GDP and GDP per capita. The logic behind these two variables is that if authorities raise fines, misinvoicers will have to bear higher direct financial costs if the crime is detected. In the case of imprisonment, the punishment cost represents the amount of lost income in prison which is the higher the higher the GDP per capita is. Hence, the higher the fines to GDP or the GDP per capita, the higher the punishment costs, and, thus, the lower the absolute value of misinvoiced exports and imports, *ceteris paribus*.

The BMP measures the percentage premium of the black market exchange rate over the official exchange rate. Unfortunately, the BMP is only available thru 1998. Therefore we test two time periods for each type of trade misinvoicing: 1980 to 1998 and 1980 to 2005. While the BMP is included in the former sub-period sample, it is not in the latter.

4.2 Estimation results

For each type of misinvoicing, we regress the absolute value of the trade discrepancy on the hypothesized (microeconomic) determinants discussed in Section 3. We start our empirical analysis by pre-testing the data for stationarity using the panel unit root test of Choi (2001). The unit root tests are performed for the two periods – 1980 to 1998 and 1980 to 2005 – for each type of misinvoicing. The unit root test results for each variable are reported in Table A.2 and A.3 in the Appendix. Those variables found not stationary at the 5 percent level are transformed into first differences, re-examined, and consequently used in first differences in the empirical analysis.

We estimate four specifications for each type of misinvoicing. In each panel specification we include the tax on income, the tax on exports/imports, the real exchange rate, and the index of quantity to quality of exports/imports. In addition to these variables, we include the BMP and the fines to GDP in specification I of each misinvoicing type. In specification II we substitute fines to GDP by GDP per capita. Thus, specifications I and II

use the same data sample but test the impact of punishment costs on trade misinvoicing by either using fines to GDP or GDP per capita. As the BMP is only available thru 1998, specification I and II cover the period 1980 to 1998 only. In specifications III and IV the BMP is not included which means that the data set covers the entire period 1980 to 2005. While specification III uses fines to GDP to identify punishment costs, specification IV employs GDP per capita. Table 4 and 5 show the estimation results for import underinvoicing and import overinvoicing, respectively.

[Insert Table 4 and 5 about here]

In general, the estimation results provide evidence for the validity of the theoretical hypotheses derived in the microeconomic framework of Section 3. For the case of import misinvoicing we have hypothesized that a higher BMP decreases (increases) the incentive to underinvoice (overinvoice) imports as the entrepreneur must buy (can sell) the underinvoiced (overinvoiced) U.S. dollar denominated imports at a higher price in domestic currency on the black market. The results presented in Table 4 and 5 confirm this hypothesis as the BMP has a significantly negative (positive) coefficient in the case of import underinvoicing (overinvoicing).

We find no significant evidence that tax fraud is an incentive to misinvoice imports. By contrast, we find robust evidence that tariff evasion is an important driver of import misinvoicing. As hypothesized in the theoretical model, we find that higher import tariffs significantly increase (decrease) the incentive to underinvoice (overinvoice) imports. Thus, the higher the tariff rate, the higher the optimal absolute amount of import underinvoicing, *ceteris paribus*. For import overinvoicing we observe the opposite effect, i.e. the lower tariffs the higher the optimal absolute amount of import overinvoicing, *ceteris paribus*.

A variation in the real exchange rate has a significant influence on import underinvoicing only while we find no significant impact on import overinvoicing. A real depreciation increases the amount of import underinvoicing significantly, as the U.S. dollar denominated profit from import underinvoicing is worth more in domestic currency.

We find mixed evidence with respect to the influence of higher punishment costs or a higher risk of confiscation on the optimal amount of import misinvoicing, respectively. A higher risk of confiscation, measured by a higher value of import quantity to quality, significantly affects the extent of import overinvoicing in specifications III and IV. The GDP per capita, which aims to measure the punishment costs trade misinvoicers have to bear when imprisoned, is insignificant in all specifications. Seemingly, trade misinvoicers do not consider the cost of lost income in prison when deciding how much imports to misinvoice.

The fines to GDP variable which accounts for the direct financial costs of misinvoicing in the case of detection of that crime has a significantly negative impact on the absolute amount of imports underinvoicing. By increasing the level of fines to GDP by one percent, authorities can decrease the share of underinvoiced imports by 17 to 18 percent. Direct financial penalties seem to act as an effective deterrent to import underinvoicing. Thus, authorities may increase the level of fines to counter the fiscal losses induced by tariff evasion.

The results of the regressions testing the determinants of export under- and overinvoicing are presented in Table 6 and 7, respectively. Again, specification I and II cover the period 1980 to 1998 while specification III and IV span the entire period 1980 to 2005.

[Insert Table 6 and 7 about here]

We find that a one percent increase of the BMP decreases the extent of export overinvoicing significantly by half a percent. A higher BMP increases the costs to buy the U.S. dollars for

the fictitious overinvoiced exports on the black market for foreign exchange thereby decreasing the incentive to overinvoice exports. We can, thus, confirm the theoretical hypothesis of Section 3 for export overinvoicing, while we find no significant empirical support for export underinvoicing.

We find significant evidence for tax evasion for the case of export underinvoicing in specifications I and II, while we find no significant coefficients for that variable for the export overinvoicing regressions. In the case of export underinvoicing for the period 1980 to 1998, we can confirm our hypothesis that tax evasion is an incentive to underinvoice exports as illegal/unreported exports are not taxed and are therefore more competitive. Thus, countries with higher income taxes suffer under a higher extent of export underinvoicing motivated by income tax evasion, *ceteris paribus.* With respect to export overinvoicing we find the opposite causality. Overinvoicing exports increases the tax burden and is therefore negatively correlated with tax rates. This result is, however, not statistically significant.

Analogously to the case of import misinvoicing, tariff evasion plays an important role in misinvoicing exports. In specifications I and II export taxes are significantly positively correlated with export underinvoicing, while export taxes have a significantly negative coefficient in specifications III and IV of the export overinvoicing regressions. A one percent increase of taxes on exports thus induce an increase (decrease) of export underinvoicing (overinvoicing) by five percent (six percent) *ceteris paribus*, as the profitability of underreported (overreported) exports increases (decreases).

The coefficients testing the effect of a real depreciation on export misinvoicing has a positive but insignificant sign in all specifications. Although not statistically significant this result suggests that a real depreciation increases the incentive for export misinvoicing as the purchasing power parity adjusted value of the U.S. dollar denominated misinvoicing profits increases in real terms.

The variables testing the effect of punishment costs on the extent of export misinvoicing are insignificant in almost all specifications. One notable exception is the variable fines to GDP which has a significantly negative coefficient in specification I of export underinvoicing. A one percent increase of fines to GDP yields a decrease in the extent of export underinvoicing of almost 17 percent.

5 Summary and Conclusions

This paper examines the determinants of trade misinvoicing in a sample of 86 countries over the period 1980 to 2005. Working out the microeconomic determinants of export and import misinvoicing, we hope to improve the understanding of this phenomenon. We show that financial incentives determine the decision as to *whether* and *how much* exports/imports are underinvoiced or overinvoiced, whereas the deterrents to trade misinvoicing only affect the optimal *amount* of misinvoicing. To test the impact of the microeconomic incentives and deterrents on the extent of trade misinvoicing simultaneously, we split – according to our theoretical considerations – the sample in four sub-samples including observations on the absolute amount of the respective type of trade misinvoicing: import underinvoicing, import overinvoicing, export underinvoicing, and export overinvoicing.

The results of our panel estimations provide evidence for the validity of our theoretical hypotheses. We find robust evidence that the BMP influences the absolute level of trade misinvoicing in the hypothesized direction. Thus, illegal traders use the black market for foreign exchange to launder monies earned from misinvoicing the value of traded goods. To counter trade misinvoicing policymakers could adopt measures to hinder the functioning of this market. We also find robust evidence that the evasion of taxes on trade is a major incentive for trade misinvoicing. Authorities can fight trade misinvoicing by eliminating the incentive of tariff evasion. Forming free trade agreements and reducing tariffs, as propagated by the World Trade Organization (WTO), could be the remedy fighting this crime.

We only find weak evidence that the evasion of income taxes plays a role in misinvoicing exports or imports. Also a real depreciation of the domestic currency against the U.S. dollar affects the level of import underinvoicing only but not the other types of trade misinvoicing. The risk of detection, measured by the import/export quantity to quality variable, is mostly found to be insignificant. Trade misinvoicers seem to trade all different kinds of goods illegally not taking into account the risk of detection. We find mixed evidence whether punishment costs affect the extent of trade misinvoicing. While the GDP per capita is insignificant in all specifications, higher fines to GDP significantly reduce the extent of misinvoicing. This result suggests that higher direct financial penalties effectively act as a deterrent to trade misinvoicing.

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Table 1. *Review of the empirical literature on trade misinvoicing*

Study	Object of investigation	Setup	Main findings
Bhagwati (1964)	Import underinvoicing in Turkey	Descriptive analysis of trade data from Turkey to its major trading partners France, Germany, Italy, Netherlands and U.S.	Import underinvoicing in transport equipment and machinery as tariffs in both categories exceed the BMP by far
Naya and Morgan (1969)	Analysis of the quality of trade data in Southeast Asian countries	Descriptive analysis of trade data in Burma, Ceylon, Indonesia, the Federation of Malaya, the Philippines, Singapore, and Thailand.	Frequent and large discrepancies except for Thailand and the Philippines; higher discrepancies in intra-regional than for trade with developed countries; the BMP encourages misreporting; export under- and import overinvoicing are most frequent
McDonald (1985)	Incentives for export misinvoicing	Dependent variable: trade data discrepancy ratio between developing and industrial countries; independent variables: BMP and export taxes	Mediocre statistical evidence that smuggling incentives, i.e. BMP and export taxes, explain variations in trade discrepancies
Yeats (1990)	Assessing the accuracy of trade statistics in African countries	Descriptive analysis of trade data among African countries and between African and non-African trade partners.	Underreporting of petroleum, coffee, and cocoa to circumvent international quotas; import overinvoicing for high-value and low-volume

			products (like pearls, precious stones); export underinvoicing for oilseeds and iron ore.
Bahmani-Oskooee and Goswami (2003)	Illicit trade as a reason for exchange rate deviations from PPP	Panel for 33 developed countries form 1982 to 1995; dependent variable: real exchange rate; independent variables: productivity, two proxies for smuggling (average tariffs or the average of average tariffs and an enforcement index)	Smuggling induces exchange rate deviations from PPP; in particular, a real appreciation hurts the economy (loss of international competitiveness)
Pohit and Taneja (2003)	Informal trade between India and Bangladesh	Direct survey approach encompassing 100 traders in each country	Anonymous trading transactions characterize informal trade; motivations are the quick realization of payments, less paper work and procedural delay
Fisman and Wei (2004)	Study the effects of tax rates on tax evasion	Analysis of trade discrepancies between Hong Kong and China for 2,043 product categories at the six-digit level; dependent variable: trade discrepancy measures; independent variables: tax rate, tax on similar products, tariff exemption, interaction terms.	A 1 percent tax rate increase yields 3 percent increase in the gap between reported exports and imports; this gap is positively correlated with tax rates; widespread evidence for underreporting and mislabeling of high-taxed to low-taxed products in trade between Hong-Kong and China.

Fisman and Wei (2007)	Illicit trade in cultural properties	Unbalanced panel for 1996-2005; dependent variable: discrepancies in trade with cultural object and antiques; independent variables: corruption, GDP per capita, dummies	Highly positive correlation between trade discrepancies and corruption, i.e. more corrupt countries are more likely to misreport their data
Beja (2008)	Trade misinvoicing in China	Descriptive analysis of trade discrepancies in the official trade sector	Bulk of Chinese misinvoicing occurs in trade with Hong Kong an the U.S.
Berger and Nitsch (2008)	Bilateral trade discrepancies at the 4-digit product level	OLS regressions for imports to the U.S., Germany, China, United Kingdom, Japan; dependent variable: trade discrepancies; independent variables: corruption, GDP per capita, distance measure, dummy variables	Product-specific trade discrepancies differ widely across importers; export underinvoicing is prevalent in antiques and bulky products; strong association of trade discrepancies with the level of corruption in the source country
Farzanegan (2008)	Illicit trade in the Iranian economy from 1970 to 2002	MIMIC approach, i.e. illicit trade is treated as an unobservable variable; causes: fines, BMP, tariffs, GDP per capita, openness, education; indicators: government revenues, import price index, gasoline consumption	Illicit trade is positively related to tariffs and negatively to fines and the unemployment rate; illicit trade adversely affects government revenues and the import price index and varies between 6 and 25% of total trade

Table 2. *Hypothesized impact of the determinants on export misinvoicing*

	Export underinvoicing, $d\left\|S^x\right\|/d\ldots=$	Export overinvoicing, $d\left\|S^x\right\|/d\ldots=$
BMP (v)	+	-
Tax on income and profits (t^{inc})	+	-
Tax on exports net export subsidies (t^x)	+	-
Real exchange rate (ε)	+	+
Intensity of prosecution (H)	-	-
Punishment costs (F/p^{dom})	-	-

Table 3. *Hypothesized impact of the determinants on import misinvoicing*

	Import underinvoicing, $d\left\|S^M\right\|/d\ldots=$	Import overinvoicing, $d\left\|S^M\right\|/d\ldots=$
BMP (v)	-	+
Tax on income and profits (t^{inc})	-	+
Import tariffs net import subsidies (t^x)	+	-
Real exchange rate (ε)	+	+
Intensity of prosecution (H)	-	-
Punishment costs (F/p^{dom})	-	-

Table 4. *Regression results import underinvoicing*

	I 1980-1998	**II 1980-1998**	**III 1980-2005**	**IV 1980-2005**
BMP	-0.028*	-0.026*	---	---
	(-1.88)	(-1.75)		
Income tax	0.293	0.300	-0.183	-0.118
	(0.47)[a]	(0.48)[a]	(-0.48)	(-0.31)
Import tax to GDP	2.813***	2.878***	1.985***	2.032***
	(3.30)	(3.35)	(3.02)	(3.08)
Real exchange rate	0.026*	0.027*	0.030**	0.032**
	(1.86)	(1.89)	(2.01)	(2.14)
Import quantity to	-0.046	-0.044	-0.013	-0.043
quality	(-0.80)[a]	(-0.72)[a]	(-0.26)[a]	(-0.79)[a]
Fines to GDP	-16.988**	---	-18.188**	---
	(-2.01)		(-2.49)	
GDP per capita	---	-0.009	---	0.027
		(-0.33)[a]		(1.16)[a]
Constant	0.005	-0.111	-0.076	-0.109
	(0.05)	(-1.04)	(-0.63)	(-0.91)
Country fixed effects	YES	YES	YES	YES
F-statistic	14.77***	14.49***	10.95***	10.76***
Adj. R-squared	0.675	0.671	0.609	0.604
No. of observations	331	331	493	493
No. of countries	45	45	73	73

t-statistics in parentheses; *, **, *** denotes 10%, 5%, 1% level of significance.

[a] Variable used in first differences.

Table 5. *Regression results import overinvoicing*

	I 1980-1998	**II 1980-1998**	**III 1980-2005**	**IV 1980-2005**
BMP	0.498***	0.499***	---	---
	(13.94)	(13.95)		
Income tax	-0.138	-0.041	-1.057	-0.995
	(-0.12)	(-0.04)	(-1.18)	(-1.12)
Import tax to GDP	-6.982***	-6.932***	-5.289***	-5.190***
	(-2.85)	(-2.81)	(-3.08)	(-3.01)
Real exchange rate	0.042	0.044	-0.001	0.001
	(0.50)	(0.52)	(-0.05)	(0.03)
Import quantity to	-0.018	0.010	-0.370**	-0.400**
quality	(-0.09)[a]	(0.05)[a]	(-2.24)[a]	(-2.32)[a]
Fines to GDP	11.301	---	11.448	---
	(0.62)[a]		(0.58)[a]	
GDP per capita	---	0.004	---	0.031
		(0.07)[a]		(0.52)[a]
Constant	0.106	0.099	0.457	0.204
	(0.32)	(0.30)	(1.01)	(0.57)
Country fixed effects	YES	YES	YES	YES
F-statistic	12.85***	12.83***	5.99***	5.99***
Adj. R-squared	0.593	0.593	0.362	0.362
No. of observations	399	399	564	564
No. of countries	44	44	60	60

t-statistics in parentheses; *, **, *** denotes 10%, 5%, 1% level of significance.

[a] Variable used in first differences.

Table 6. *Regression results export underinvoicing*

	I 1980-1998	**II 1980-1998**	**III 1980-2005**	**IV 1980-2005**
BMP	0.018	0.018	---	---
	(1.00)	(1.00)		
Income tax	1.169*	1.173*	0.711	0.710
	(1.74)	(1.75)	(1.53)	(1.52)
Export tax to GDP	4.840*	5.020*	1.877	1.896
	(1.87)	(1.94)	(0.83)	(0.84)
Real exchange rate	0.014	0.005	0.012	0.008
	(0.62)	(0.23)	(0.53)	(0.34)
Export quantity to	0.059	0.060	0.046	0.048
quality	(0.75)[a]	(0.76)[a]	(0.70)[a]	(0.73)[a]
Fines to GDP	-16.714*	---	-13.493	---
	(-1.77)		(-1.39)	
GDP per capita	---	-0.063	---	-0.031
		(-1.54) [a]		(-0.81)[a]
Constant	0.167	-0.043	-0.007	-0.027
	(0.96)	(-0.24)	(-0.04)	(-0.15)
Country fixed effects	YES	YES	YES	YES
F-statistic	14.15***	14.10***	14.19***	14.14***
Adj. R-squared	0.666	0.665	0.624	0.623
No. of observations	370	370	590	590
No. of countries	51	51	70	70

t-statistics in parentheses; *, **, *** denotes 10%, 5%, 1% level of significance.

[a] Variable used in first differences.

Table 7. *Regression results export overinvoicing*

	I 1980-1998	**II 1980-1998**	**III 1980-2005**	**IV 1980-2005**
BMP	-0.479***	-0.475***	---	---
	(-4.51)	(-4.46)		
Income tax	-0.874	-0.946	-0.194	-0.153
	(-0.96)	(-1.04)	(-0.37)	(-0.29)
Export tax to GDP	-3.691	-3.903	-6.161*	-5.929*
	(-0.54)	(-0.56)	(-1.77)	(-1.70)
Real exchange rate	0.057	0.058	0.002	0.003
	(1.24)	(1.26)	(0.25)	(0.05)
Export quantity to	0.092	0.089	0.072	0.077
quality	(0.73)[a]	(0.69)[a]	(0.81)[a]	(0.84)[a]
Fines to GDP	-7.207	---	-10.466	---
	(-0.91)		(-1.25)	
GDP per capita	---	0.001	---	-0.005
		(0.15)		(-0.24)[a]
Constant	1.580***	1.568***	0.025	0.017
	(4.40)	(4.35)	(0.19)	(0.13)
Country fixed effects	YES	YES	YES	YES
F-statistic	10.02***	9.96***	5.33***	5.28***
Adj. R-squared	0.678	0.676	0.451	0.448
No. of observations	227	227	365	365
No. of countries	44	44	66	66

t-statistics in parentheses; *, **, *** denotes 10%, 5%, 1% level of significance.

[a] Variable used in first differences.

Figures

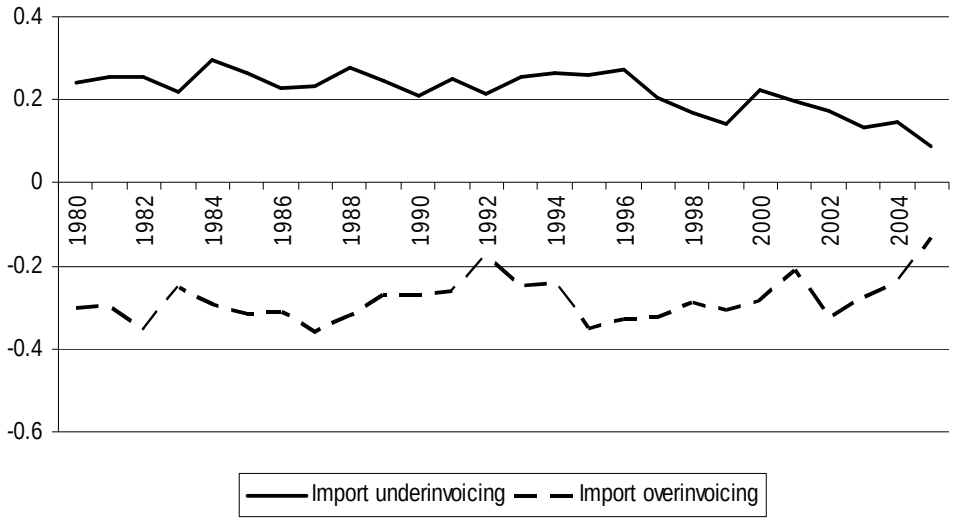

Figure 1

Average size of import misinvoicing

Figure 2

Average size of export misinvoicing

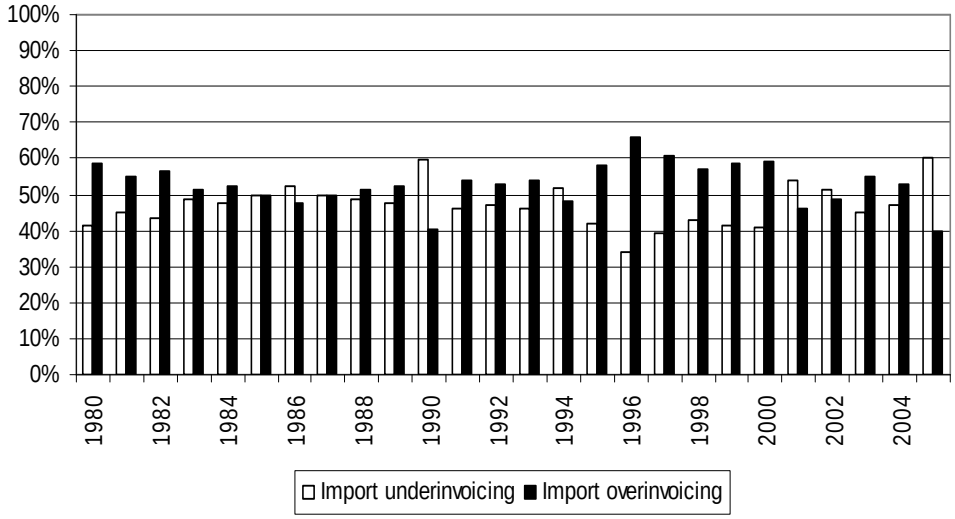

Figure 3

Share of countries with import under- and overinvoicing in the sample

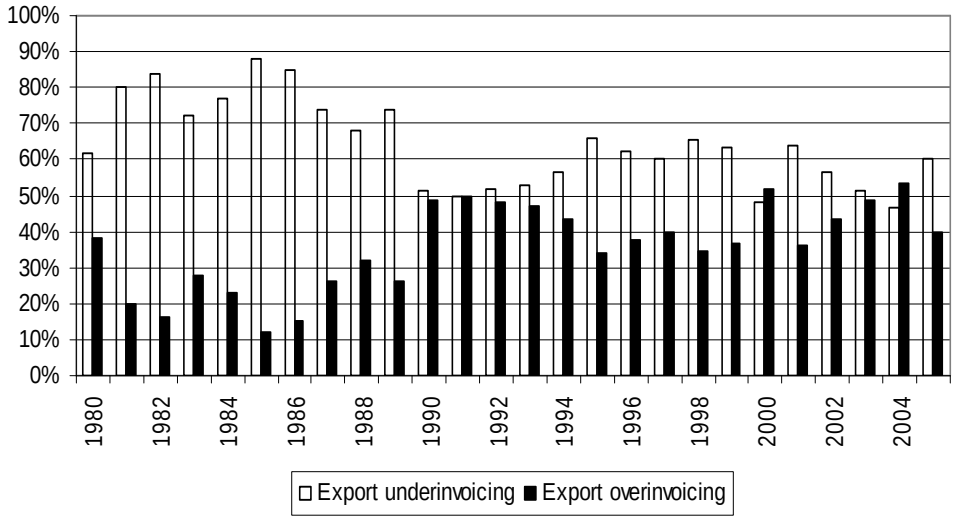

Figure 4

Share of countries with export under- and overinvoicing in the sample

Appendix

Country list

Algeria, Argentina, Australia, Austria, Bahrain, Bangladesh, Belgium, Bolivia, Brazil, Burkina Faso, Burundi, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Republic of Congo, Costa Rica, Cote d'Ivoire, Denmark, Dominican Republic, Ecuador, Egypt, Ethiopia, Fiji, France, Gabon, Gambia, Greece, Grenada, Guatemala, Honduras, Hungary, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Kuwait, Latvia, Madagascar, Malaysia, Maldives, Mauritius, Mexico, Mongolia, Morocco, Nepal, Netherlands, New Zealand, Nicaragua, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Senegal, Seychelles, Singapore, South Africa, Spain, Sweden, Switzerland, Syria, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, Uruguay, Venezuela, Zambia, Zimbabwe.

Table A.1. *Definitions and data sources*

Variable	**Definition**	**Source**
Export misinvoicing	- [U.S. imports minus domestic exports] divided by U.S. imports - U.S. imports CIF FOB adjusted	IMF Directions of Trade Statistics (DOTS)
Import misinvoicing	- [U.S. exports minus domestic imports] divided by U.S. exports - domestic imports CIF FOB adjusted	IMF DOTS
BMP (black market premium)	[Black market exchange rate minus official exchange rate] divided by official exchange rate	1980-1982: Pick, Franz, Pick's Currency Yearbook, various issues. 1983-1998: Pick, Franz, World Currency Reports, various issues.
Real exchange rate	- Nominal official exchange rate (domestic currency/U.S. dollar)*U.S. CPI /domestic CPI) - Normalized to 1 in 2000	IMF International Financial Statistics (IFS)
Taxes on income/profit	% of Gross Domestic Product (GDP)	Taxes in income/profit: IMF Government Finance Statistics (GFS) GDP: World Development Indicators (WDI)
Taxes on exports net subsidies	% of GDP	Taxes on exports net subsidies: IMF GFS; GDP: WDI

Taxes on imports net subsidies	% of GDP	Taxes on imports net subsidies: IMF GFS; GDP: WDI
Export quantity to quality	Index, higher value indicates lower average value per quantity	WDI
Import quantity to quality	Index, higher value indicates lower average value per quantity	WDI
Fines to GDP	Total fines and forfeits/GDP	Total fines and forfeits: IMF GFS; GDP: WDI
GDP per capita	Gross domestic product (in 1000's constant 2000 U.S. dollars)/total population	WDI

Table A.2. *Unit Root Tests Import Misinvoicing*

	Import Underinvoicing 1980-1998	**Import Underinvoicing 1980-2005**	**Import Overinvoicing 1980-1998**	**Import Overinvoicing 1980-2005**
Dependent variable				
Import underinvoicing / import overinvoicing	124.060***	175.631***	169.857***	193.603***
Independent variables				
BMP	146.850***	---	251.270***	---
Income tax	52.287 (250.982***)	113.486***	113.586***	144.684***
Import tax	324.090***	355.458***	116.512***	175.027***
Real exchange rate	85.926***	114.901***	121.595***	119.285***
Import quantity to quality	9.988 (128.121***)	33.345 (184.227***)	75.519 (192.973***)	51.412 (262.819***)
Fines to GDP	78.006***	115.653***	74.965 (281.380***)	80.434 (442.902)***
GDP per capita	33.673 (162.134***)	68.417 (160.458***)	78.063 (148.183***)	78.310 (225.569***)
No. of observations	331	493	399	564
No. of countries			33	41

*, **, *** denotes rejection of the null at 10%, 5%, 1% level of significance.

Note: The PP Fisher Chi-square statistic of the Choi (2001) panel unit root test is reported. Values in parentheses show the test statistic of the variable in first differences. Under the null the series has a unit root.

Table A.3. *Unit Root Tests Export Misinvoicing*

	Export Underinvoicing 1980-1998	**Export Underinvoicing 1980-2005**	**Export Overinvoicing 1980-1998**	**Export Overinvoicing 1980-2005**
Dependent variable				
Export underinvoicing / export overinvoicing	136.272***	218.237***	100.733***	145.704***
Independent variables				
BMP	233.619***	---	182.634***	---
Income tax	97.983**	138.809**	77.295**	97.822***
Export tax	161.068***	217.130***	135.457***	133.805***
Real exchange rate	101.626**	154.281***	96.945***	110.274***
Export quantity to quality	45.840 (195.508***)	69.393 (377.784***)	57.959 (83.406***)	52.868 (128.979***)
Fines to GDP	114.560***	185.527***	88.006***	134.687***
GDP per capita	86.621 (205.833***)	117.081 (287.873***)	77.493**	71.326 (151.554***)
No. of observations	370	590	227	365
No. of countries	51	70	44	66

*, **, *** denotes rejection of the null at 10%, 5%, 1% level of significance.

Note: The PP Fisher Chi-square statistic of the Choi (2001) panel unit root test is reported. Values in parentheses show the test statistic of the variable in first differences. Under the null the series has a unit root.