AN EMPIRICAL STUDY ON ILLEGAL TRADE BETWEEN HONG KONG AND MAINLAND CHINA

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by

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Abstract

Smuggling is active after China has started its economics reforms. Smuggling becomes rampant with growing demand for foreign goods in China. It erodes the trade barriers and therefore disturbs China's development strategy. Effort is spent by the state in the fight against smuggling. However, smuggling does not vanish in the long term. It seems that smuggling is unavoidable.

Smuggling is an underground activity. Individual researchers have no direct access to its data. Estimations for its volume and costs are needed for the empirical study on it. From Simkin's idea, smuggling volume can be estimated by comparing the imports demand and the recorded imports. Moreover, the types of smuggled goods can also be identified by this method.

Hongkong provides costs advantage to smugglers. Thus goods are frequently smuggled into Mainland China through Hongkong. Since Hongkong is the major channel for smuggling in China, the empirical study concentrate on the impacts of this smuggling to China.

Smuggling incurs loss to the economy as it is an unproductive profit-seeking activity. On the other hand, it is beneficial to the private sectors in the economy by eroding trade barriers. The gain and loss from smuggling

is compared under Pitt's framework. A method for welfare analysis is suggested in this thesis such that the empirical works involved can be greatly simplified. Due to the lack of data, only smuggling of television sets is studied here. However, as television sets is a major smuggled commodity, the welfare impact of smuggling televisions sets plays an essential role in concluding about the welfare implication from smuggling.

From the welfare analysis, smuggling televisions sets into China seems to be harmful to China's economy. However, due to the changing demand patterns in China, the construction of the imports demand function, which is essential in finding the gain from price disparity, is rather ad hoc. Nevertheless, this study provides an illustrative example for welfare analysis. The empirical result here can be used as a reference for analysis on smuggling.

Content

Chapter 1

Introduction

The cause of smuggling

Smuggling is traditionally regarded as an illegal and immoral activity. Its occurrence is due to the restriction on trade imposed by the government. As we know, exchange can make the parties involved better off. However, it is not necessarily beneficial to the whole economy. Some of the commodities traded may be harmful to the economy if the trade volume is excessive. In economics term, the commodities traded have negative externality. Common examples are drugs and fire arms which are essential for the economy. However, they should be governed or monopolized by the authority. Otherwise, if these goods can be freely purchased in the private sector, they will be abused in such a way that society will be in chaos. Therefore, conflicts of interests exist between the private and the public sectors. Smuggling is then used by the private sector to overcome the barriers of trade for private interests. Even though the control from the government may not be correct, smuggling is a challenge to the authority. Therefore, evading the control of the government and carrying out this underground economic

activity should be dealt with and suppressed.

With the accumulation of knowledge, people become less prejudiced and find that smuggling may have positive effect on the economy. The major argument is that the control on trade may be due to the ignorance of the people or the protection of the privileged class. Smuggling can promote free trade and correct such distortion so that the economy can be better off. Thus they blame protectionism, rather than smuggling, as the origin of immorality.

Not withstanding the conflicts of interests between classes in an economy, trade barriers may be beneficial to the economy. For developing countries, trade barriers are mainly used to protect its growing infant industry from competition with products of developed countries. For a developed country which is a sufficiently large economy, imposing trade barriers can alter the terms of trade so that the welfare of the economy can be maximized. If restricted trade can function to achieve the above objectives, smuggling is obviously a welfare losing activity for the economy. However, due to the rigidity of government bureaucracy, the government may not respond in time to the changing economic environment. When the tariff imposed is out dated and the original goal cannot be reached, smuggling may enrich the economy by breaking down the tariff. In this sense, smuggling may contribute to the economy by correcting the development strategy.

From the above two counter view points, it is doubtful that whether smuggling is beneficial to the economy. In spite of the long history of smuggling, economics analysis about smuggling was only recently began by Bhagwati and Hansen (1973). Their analysis focused on the costs incurred from smuggling and the impact that smuggling makes on domestic prices. Here the costs do not correspond to the welfare loss as stated above since Bhagwati & Hansen had treated the tariff imposed as non-optimal to the economy. The "costs" means the additional resources used in smuggling to hide this illegal activity from detection by the government which is an unproductive profit-seeking activity. Tariff and quantitative restriction are the major tools for imposing barriers of trade to control foreign trade. Both of them will directly lead to the distortion of domestic prices. Smuggling can increase the trade volume and reduce the effect on domestic price by trade barriers. Their welfare implication then focused on this opposing effect of smuggling. Employing their analysis as a foundation, this thesis attempts to use the case of smuggling between China and Hongkong as a study to investigate the welfare implication of smuggling.

In China, smuggling has become a severe problem in recent years. It is not surprising for a developing country to have smuggling. Moreover, since Mainland China has been a closed economy for thirty years, smuggling

would not have been a strange phenomenon. But after the Party Third Plenum that determined to adapt economic reforms, increased international trade has become a consequence of the open-door policy. It should be expected that smuggling will be reduced since the restriction on imports has been released. However, there is significant rise of smuggling reported, partly because the national income of China has been increasing sharply after China has adopted the economic reforms. Another reason is the decentralization of the trade regime. Before the 80's, imports were limited, especially for consumer goods. With the possession of foreign goods being rare and the chances of being detected high, smuggling became a more difficult activity. With the liberalization of imports restrictions, many foreign goods that could be rarely purchased become available in domestic markets in China. This can facilitate smuggling by reducing the chance of being detected.

A brief description of smuggling between Hongkong and China

The smuggled imports of Mainland China originated mainly from the demand for products of developed countries which are far away from China. As smuggling must occur through the border of a nation, neighbouring countries of China must be involved in smuggling as an intermediaries.

These countries are divided into two groups. One is the inland underdeveloped countries that border China. The other is the coastal countries. Smuggling is detected in the former frontiers. Goods traded this way consists mainly of the domestic primary products of these countries. Impact of this type of smuggling is around the border areas and is insignificant in volume to the whole country. Because of poor transportation condition in these areas or their being closed economies, products from developed countries are seldom smuggled into China through these avenues.

On the other hand, smuggling from sea becomes the remaining possible way for large scale smuggling. Few smuggling routes with low costs and low risks are available for the smugglers if the products are directly transported from the countries of origin to China by sea. Places located near Mainland China and near the coast will best serve as bridgeheads for smuggling. Foreign goods are imported into this places legally and then smuggled into the coastal areas of China nearby so that the risks and the costs can be minimized. Hongkong, Macau and Taiwan are examples of this latter areas when accounting for physical distance. Under the special economic and political conditions of Hongkong, apart from being a gateway of legal external trade for China, Hongkong is also a convenient bridgehead for smuggling. Thus it is not surprising that smuggling activities between Hongkong and

China have existed for a long time.

Starting from the 50's, when the United Nation imposed trade embargo on Mainland China after China had joined the Korean War, the smuggling of strategic supplies from Hongkong into Mainland China was encouraged by Chinese officials. After this patriotic campaign of smuggling, smuggling was continued by individuals engagement. With the sustained low growth of the economy and the frequent political movements, the smuggling volume is believed to be small. After the Cultural Revolution and economic reforms at a later time, smuggling was found to be active again. The smuggling of antiques, gold and herbal medicine out of Mainland China was aimed at earning foreign exchange. In return, watches, electrical consumer goods of portable sizes and low prices were popular commodities to be smuggled into China. Later, with growing domestic exports under limited exports channels, many goods, especially those produced in the Special Economics Zones, were exported to Hongkong by bypassing the legal channel (the state owned FTCs). In return was the illegal imports and/or foreign exchange. This condition lasted until 1985. The inflationary pressure and massive trade deficit led to the determination of the authority to cool down the overheated economy. Large effort was put into anti-smuggling. In 1986, this type of smuggling activities had been restrained.

1988 seemed to be a turning point in smuggling. With the third reform drive in China, the trade regime was further decentralized and the retention rate of foreign exchange of domestic enterprise was raised.[1] Smuggling became active again. But contrast to the environment before 1986, smuggling activity were mainly carried out in one direction only. Goods were frequently smuggled into China while illegal exports from China decreased. Smuggled goods were paid for by foreign earnings from tourism, remittances, and inward foreign direct investment. The major smuggled items were expensive electrical appliances, tobacco and automobiles. These products were not made in Hongkong, but were imported. Moreover, illegal goods such as drugs and firearms were also increasingly smuggled into Hongkong from China. With the free trade policy in Hongkong, imports and exports are not subject to tariff. This tariff-free status gives smugglers a cost advantage. (Pai Shing Semi-Monthly 1991:239, pp.30-31)

Smuggling from Hongkong to China is mainly by sea. The popular places for goods delivery are Tai O and the areas around Tolo Channel. Figures stated by the smugglers show that approximately seven thousand television sets and similar numbers of video recorders are transported from the urban areas to Tai O per month. By high speed boats or fishing boats, goods are smuggled to the southeastern coastal areas of China such as Guangdong or Fujian. More

[1]See Sung (1991a).

than forty market-places for smuggled goods are found in these provinces. In the peak period, the value of smuggled goods per day has reached ten million HK dollars. (Ming Po September 26, 1991 and Next Magazine 1990:12)

However, in response to the severity of the problem of smuggling, both the Chinese and Hongkong governments have carried out extensive anti-smuggling operations. As a result, smuggling was suppressed in 1991. But this does not last long and smuggling soon became active again. In February 1994, Hongkong Customs discovered a smuggling case of largest value since the colonization of Hongkong. The value of seized goods was found to be around two hundred millions Hongkong dollars.

We find that after 1986, the major trend of smuggling is the increased smuggling of foreign products into China to satisfy increasing demands while Hongkong acts as a channel for smuggling. The analysis will then focus on the impact of these illegal imports in China welfare, whether it has beneficial or harmful effect for China's economy.

So far we have only considered the illegal trade whose purpose is to bypass the trade barrier. However, another form of illegal trade practice exists in China trade. This is the misinvoicing of exports and/or imports. The motivation of this type of illegal trade is different from smuggling.

In China, foreign exchange earned through exports must be turned over to the central government. The hoarding demand of foreign exchange under the strict control from the state creates strong incentives for the enterprise to misreport their trade volume so that part of the foreign exchange earned can be retained secretly for payment of imports, including smuggled goods. Misinvoicing can thus further induce smuggling.

Outline of this study

Therefore, the empirical works of my thesis will be mainly composed of two parts:

1) Estimation of the illegal trade volume

As illegal trade is a kind of underground economy, no statistical figures can be provided publicly to give a full picture of it. Estimations of these figures are then required. The two main illegal trade practices, smuggling and misinvoicing, are operated by different means. Since smuggling bypasses the legal channel of trade, its trade volume is completely missing in China's official records except for seized goods. Misinvoicing, by definition, will go through legal trade channels, though the value of trade is misrecorded. Thus we should estimate their respective volumes separately.

A direct way to obtain a rough view on smuggling is to obtain the data provided by the police or Customs. However, the data is inadequate as only the volume of confiscated goods is reported. On the other hand, we can know the categories of commodities that are frequently smuggled to Mainland China. As not all the exported/re-exported goods to China will involve smuggling, it is vital to identify the smuggled goods. Another method for identification is to plot the retained imports in Hong Kong against time. It they are increasing surprisingly during presenting years, we can suspect that the extra increase is due to the smuggling activity.

After the smuggled goods are identified, the smuggling volume will then be estimated. The retained imports are compared with the consumption demand in Hong Kong. If the recorded retained imports are significantly larger than the consumption demand in Hongkong, the differential should be the missing recorded amount of re-exports of Hongkong. It is assumed to be only caused by smuggling from Hongkong to China. The differential will then be the estimate for smuggled volume. By this method, the first step is to estimate the consumption demand function. Since Hong Kong is an open economy, we can estimate the demand function without considering the supply side if world prices are exogenous (i.e., we assume that Hong Kong is a small economy). It is obvious that smuggling becomes serious after Mainland China has adopted

the open-door policy. Thus, using past data, the various individual commodity consumption demand in Hong Kong can be estimated. Then by comparing the predicted quantity demand with the retained imports and/or domestic outputs net of exports, we can trace out the estimate of smuggling volume.

For the misinvoicing of imports/exports, we can simply compare the trade statistics between Mainland China and Hong Kong. Those commodities with significant differences in trade values (after accounting for f.o.b. values for Hongkong exports to China and c.i.f. values of China imports from Hongkong) provided by the official statistics of the two places can give strong evidence of the existence of these activities after taking transportation costs and insurance costs into account. The approximate value of misinvoicing can thus be obtained. This works has already been presented by S.C. Fung (1987) in which the data are provided up to 1986 and only the exports of China to Hongkong is covered. Some observations about the methodology of estimating misinvoicing are suggested in this thesis.

2) Welfare analysis and implication

Comparing with misinvoicing of import/export, smuggling incurs much higher costs as there are real resources input into the smuggling activities which are

unproductive. On the other hand, smuggling can circumvent the trade barriers. If the trade barriers is not optimal for the economy, it will be beneficial if domestic prices are lowered by the increasing inflow of foreign goods through illegal channels. Thus, the measurement of social gain/loss is mainly concentrated on the smuggling activity. The two opposing effects of real resource costs and domestic price disparity which jointly determine the net gain or loss to the economy will be analyzed so as to arrive at the welfare implication about Mainland China.

Chapter 2

LITERATURE REVIEW

The pioneering study on smuggling by economics analysis is the works of Bhagwati and Hansen (1973). Under the traditional two traded goods model, smuggling is considered to be a directly unproductive profit-seeking activity which is represented by a transformation curve less favourable than the terms of trade. This implies that smuggling will incur real resource costs (i.e., some smuggled goods are lost in the process of smuggling or the total real costs are accounted for in terms of smuggled commodities) to the small economy. On the other hand, the domestic prices of the economy may be lowered from tariff-included price by eroding the trade barriers imposed, so that the economy is better off. Different assumptions of the market structure and nature of the costs of smuggling (here meaning that whether the costs are increasing or constant) have different welfare implications. It is found that only when legal trade is completely eliminated by smuggling so that price disparity occurs will there be a chance for welfare improvement. When legal trade coexists with smuggling, the welfare of the economy must be worsen.

Based on Bhagwati and Hansen's works, Falvey (1978),

Pitt (1981), Martin and Panagariya (1984), and Thursby, Jensen and Thursby (1991) further analyzed the welfare implication with some modifications and/or border consideration.

In Falvey (1978), quantitative restriction on imports is considered instead of tariff rate. As imports premium is captured by the importers rather than by the government, price disparity as a result of smuggling will only reduce their rent. In consideration of competitiveness, legal trade always has the advantages of lower costs (since the world price is always lower than the domestic prices) when comparing with domestic output and/or costs involving smuggling. Smuggling will only compete with higher-cost domestic outputs. It is an reinforcement to imports rather than a replacement to legal trade. Thus increasing the availability of imported goods with lower domestic price can always lead to welfare improvement.

In Pitt (1981), legal goods have external effect which can lower the costs of smuggling by their camouflage effect on smuggling. Then, there will be room for legal trade when there is price disparity. Coexistence of legal trade and smuggling will no longer necessarily be welfare worsening.

In Martin and Panagariya (1984), based on Pitt, with

the factors of risks and uncertainty taking into account of smuggling, the effects of enforcement, tariff and world price are analyzed. Vigorous enforcement can lead to the reduction of share of smuggling in total trade but the impact on welfare is ambiguous. Raising the tariff rate will decrease the legal trade and welfare must be reduced. For changes in world price, the share of smuggling in total trade and the average costs of smuggling are constants.

Thursby, Jensen and Thursby (1991) further extend the works of Martin and Panagariya. Market structure of the products is introduced in their study. In Pitt, firms must be engaged in both smuggling and legal trade. No firms can survive if they are only engaged in legal trade. TJT allows that firms will face different risk costs and have monopolistic power in the domestic market. With the domestic market becoming more competitive and more firms participate in foreign trade, welfare will be improved.

In contrast to Bhagwati and Hansen, Sheikh (1974) treats the costs as consumption of primary resource instead of melting ice assumption as suggested by the former. Then smuggling will induce the same situation as immiserizing growth which will change the PPF of the economy. Again, coexistence of legal trade and smuggling is possible under welfare improvement.

Simkin (1970), Richter (1970) and Cooper (1974) had assessed the problems of detection of the smuggling volume. Two main methods of detecting unrecorded trade are suggested by Simkin (1970). One is to compare the trade partner countries statistics on trade with their own official data on trade. The other method is to estimate the normal trade volume which represents the actual trade volume and then compare the recorded value so as to trace out the amount of illegal (in the sense that the official channel is bypassed) trade. Richter (1970) points out the practical problems in employing these methods. Cooper (1974) studies the market impact of smuggling in Indonesia by comparing the effective rate of protection (i.e. the ratio of domestic price to world price) to the nominal rate of protection for various types of imported goods. Commodities with high nominal rate of protection is found to have their effective rate of protection far below the ad valorem tariff rate. This shows that high tariff rate induces enough revenue from smuggling to cover its costs.

Nature of the smuggling costs

The private costs

When discussing about smuggling, the costs related to smuggling may involve different meanings. There exist private costs and social costs of smuggling. For those

smugglers, their costs include the followings:

a) the purchasing cost which is the cost used to buy the foreign goods from the international market. Thus, the unit cost of purchasing will then be the free trade world price.[1]

b) the operation costs which are the costs used for hiding the smuggling activities from the government detection. These costs include:

i) the bribe which is only a kind of transfer between the economy.

ii) other resources costs used to cover the illegal action. Some factors input such as labour and capital will be involved in this unproductive activity. These includes the additional costs for smuggling when compared with normal legal trade. For example, the cost of employing high speed boats in smuggling is obviously higher than the normal transportation cost in legal trade.

c) the expected penalty costs and its related risks cost which are the costs involved when the smuggling activities have the chance of being detected by the governments. The penalty costs consist of the smuggled goods seized by the

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[1]Since both the legal trade and smuggling require purchasing costs, the term "smuggling costs" in the following paragraph will neglect this parts of smuggling costs except otherwise stated.

Customs and the subsequent penalty for committing smuggling, such as the loss of labour because the smugglers have been sentenced to jail or death, the destruction or forfeiture of the smuggling equipment and the fine for the crime.

The social costs

On the other hand, from the social point of view, the social costs account for the use of resources in this unproductive profit-seeking activities (i.e. excluding transfers such as bribes, fines, etc.). Furthermore, the externalities generated by smuggling are also considered as part of the social costs. Thus, the social costs include the following components:[2]

a) The erosion of moral standard in the economy will increase the transaction costs of other economic activities in the economy. Moreover, the induced enforcement of the law will lead to further attrition of resources.

b) The reduction of government revenues which may lead to the cutback in supply of public goods.

c) The distortion of optimal tariff due to the increase in the demand of foreign goods which leads to a less

[2]See Johnson (1974).

favourable term of trade. Even though the above effect can be neglected for a small economy, smuggling can affect the aim of a tariff and this can be viewed as a kind of social costs.

d) Part of the private costs should be included in the social costs, such as the purchasing cost and the resource cost. For the penalty costs, some of them are real loss. For example, because of the expected heavy punishment, in order to avoid being arrested, some smuggled goods may be damaged, destroyed or thrown into the sea by the smugglers before they are can be inspected. Moreover, except for the fine for smuggling, the punishment involves real loss. Goods are either seized by foreign customs or domestic customs. The former must be a loss. If the purpose of imposing tariff is to protect a domestic industry, the latter can also be viewed as a loss to the economy.

By comparing the private costs and the social costs, we know that the private costs is not thoroughly a subset of the social costs. We cannot know which one is larger than the other one. Then, difficulty arises in the study of the welfare impact of smuggling. In the welfare analysis, we are only interested in the social costs of smuggling. However, in order to know the conditions about smuggling, we must study the smugglers' decision according to their profit maximizing behaviour so as to arrive at the market equilibrium which determine the welfare impact

of smuggling to the economy. Then private costs have to be considered. Relative to the private costs, the social costs are much more unmeasurable. If the private costs is used as proxy of the social costs, it is uncertain whether the social costs are understated or overstated.

In the study by Bhagwati and Hansen and the succeeding works on theirs, social costs is only accounted when it is related to the economic efficiency of the smuggled commodities market. The social costs associated with the erosion of moral standard, government revenue reduction, opportunity costs of public goods and the distortion from optimal tariff are neglected. Then the remaining part of social costs that are taken into consideration will be the real resource costs directly involved in smuggling, which is part of the private costs of smugglers. Thus, apart from the part of private costs which is a transfer within the economy, the private costs can represent for the social costs. As a result, social costs becomes less than the private costs. We can conclude that the welfare implication made with this assumption will understate the social costs of smuggling.

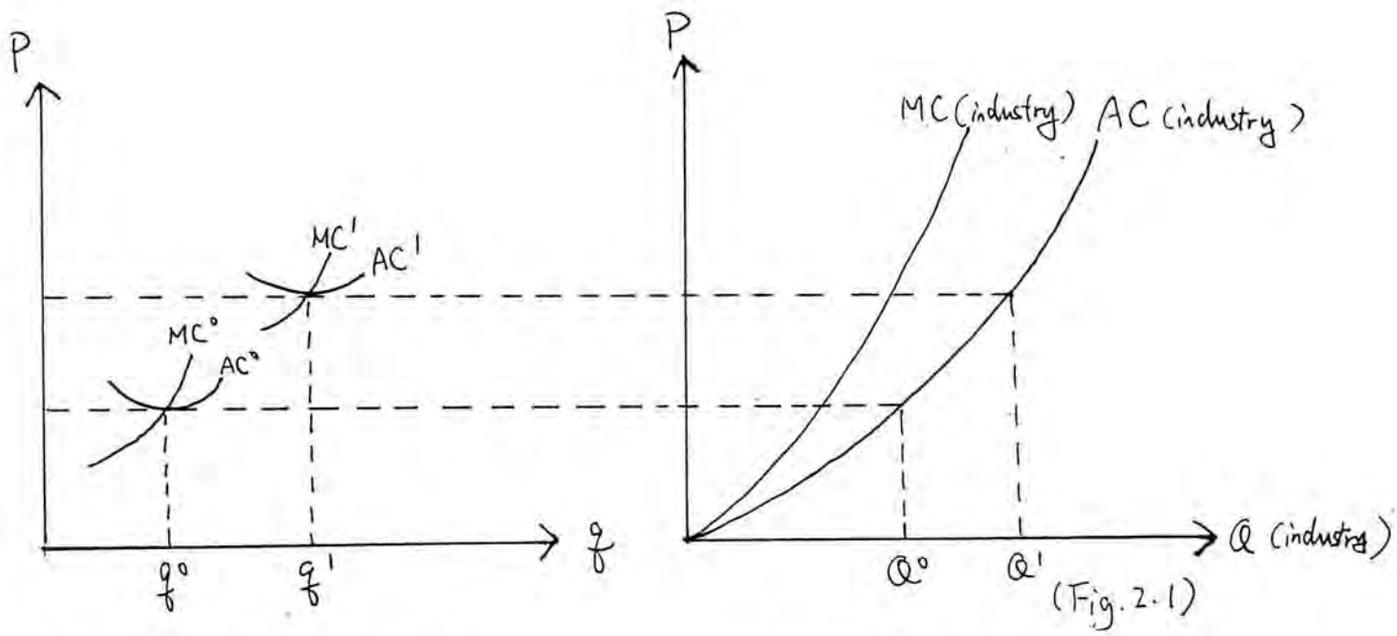
Once the relationship between the private costs and the social costs can be clarified, then the relationship between the private smuggling costs and the scale of smuggling is discussed. Three possibilities may be present in the costs function of smuggling, i.e. increasing costs,

constant costs and decreasing costs. In fact, a costs function may compose of one or more of the above. But for simplicity, we assume that the costs function is simply a constant costs, a strictly increasing costs or a strictly decreasing costs. In all cases, zero fixed cost is assumed.

Notice that here we are discussing about the industry costs of smuggling. The industry costs already internalize all the intra-industry externalities. For constant costs industry, each additional unit of smuggled goods will require the same costs as the previous output. Therefore the costs of one's goods will be independent of the other. This shows that no intra-industry externality exists in this industry. Then the profit maximization decision of individual smuggler will be identical to that of the smuggling industry since private marginal costs will be equal to industry marginal cost.

For strictly increasing costs function (with zero fixed cost), the industry marginal costs is always larger than the industry average costs except when the output level is zero. This shows that there is intra-industry externalities among the producers. It is because when the industry marginal costs is equated to price, profit will not be zero which can be achieved only by monopolized industry. If the market is under perfect competition, since zero profit must be made, the individual marginal

costs must be equal to the individual average costs in market equilibrium. By neglecting outside industry externalities, the individual average costs will be the same as the industry average costs. Therefore, as the industry marginal costs is not equal to the average costs, the difference represents the intra-industry externalities. The industry average costs which is equal to the individual marginal costs will then determine the industry output level under perfect competition. (See Fig. 2.1)



(Fig. 2.1)

When comparing with the assumption of constant costs, increasing costs is more convincing. It is because there are always externalities within the industry. Apart from pecuniary economy or diseconomy, when smuggling becomes more intensive regardless whether it is due to individual increasing his smuggling activity or more people engaging in smuggling, the probability of being detected will increase. Moreover, the penalty for smuggling will commonly increase with increasing volume of seized goods,

including the fine for smuggling. Either more resources are needed to cover their illegal activities or the increasing expected penalty will lead to higher cost for each additional unit of smuggled goods. This increasing costs applies to all the smugglers whenever one of them desire to increase their smuggling volume. Nevertheless, constant costs is still possible in the case of nonexistence of intra-industry externalities.

However, how about the case of strictly decreasing costs? As economy of scale cannot last forever for rising volume of output due to scarcity of resources, the costs will soon become increasing. Thus strictly decreasing costs can rarely occur. Moreover, even costs function may exhibit economy of scale. If the market is perfectly competitive, the output level must occur at the increasing costs region. Only when the smuggling industry is monopolized may the portion of decreasing costs appear in the decision range of output.

Methodology of the empirical study

The estimation for smuggling volume is mainly based on the ideas of "normal" exports from Simkin (1970) with little modification. Not only the smuggling volume but also the type of smuggled goods can be concluded.

The welfare analysis is based on Pitt's framework (1984). This analysis is to investigate that whether smuggling is beneficial to the economy. The amount of gain or loss is not major concern of this study. As legal trade coexists with smuggling in China, the conclusion drawn about smuggling must be welfare worsening by smuggling in Bhagwati and Hansen's framework. Pitt's framework allows a possibility of welfare improvement by smuggling. If welfare worsening of smuggling is found under Pitt's framework, the conclusion can be more convincing.

When Pitt's framework is compared with the frameworks of Martin and Panagariya (1984), TJT (1991) or Sheikh (1974), it is much more simple for empirical analysis. The works of Martin and Panagariya (1984) and TJT (1991) are the extensions of Pitt's works with little modification. The general equilibrium framework of Sheikh (1974) requires a complete study of all the factors and products markets in the economy. It seems impossible for an empirical study. Although Pitt's framework is also a general equilibrium analysis, the two goods framework simplifies the empirical analysis.

Chapter 3

The Actual Real Loss of Smuggling

In the studies about the welfare of smuggling, most of the efforts were concentrated on the impacts of price disparity on welfare from different theoretical setting. The nature of costs of smuggling was overlooked, especially the difference between the real resource costs and the costs faced by smugglers. In order to get a clear picture about smuggling, the relationship between the real resource costs and the costs faced by smuggler is an essential topic.

The above literatures treated the industry costs of smuggling exactly the same as the social costs (real loss) of smuggling. But we know that at least part of the private costs is just a transfer rather than real loss. Only the resource costs can be viewed as a real loss to the economy.

Resources are employed to facilitate the smuggling activities. With larger scale of smuggling, it seems that more resources are needed to reduce the effectiveness of detection from government. Again, the resource costs are only part of the private costs of the smuggling industry

and individual smugglers. In fact, if the resource have only little camouflage effect, the share of resource costs in private costs may not necessarily increase. A simple model is set up to find out the relationships between the resource costs and the private smuggling costs.

Firstly, each unit of smuggled goods has a probability that will be seized by the customs. With larger smuggling volume, the marginal probability of being seized will also become larger. Since probability is at most equal to one, the marginal probability will be increasing with decreasing rate. On the other hand, with more resources engaged in smuggling, the probability will be reduced. Again, as probability cannot be negative, the effectiveness of decreasing the probability will decrease with increasing resources. Let the probability of s th unit of goods being seized be $\rho(s,R)$ where R is the amount of resources used by the smugglers. It has the following characteristics:

$$\rho(s=0,R) = 0 \qquad 0 \leq \rho(s,R) < 1$$
$$\rho_s > 0 \qquad \rho_{ss} < 0 \qquad \rho_{sR} < 0$$
$$\rho_R < 0 \qquad \rho_{RR} > 0$$

$\rho_s > 0$ and $\rho_{ss} < 0$ represent the assumption that increasing smuggling volume will increase the marginal probability of being seized with decreasing rate since probability is always bounded by 1. $\rho_R < 0$ and $\rho_{RR} > 0$ represent the assumption that increasing the resources input can decreases the probability of being seized with

increasing rate such that the probability will never be smaller than zero. $\rho_{sR} < 0$ means that Increasing R can reduce the marginal probability.[1]

Let the total amount of smuggled goods be S. The expected amount of seized goods is $\underline{S}$.

$$(3.1) \qquad \underline{S} = \int_0^S \rho(s,R)\, ds = F(S,R)$$

Neglecting the purchasing costs, the major smuggling costs will be the penalty costs, G, and the resources costs, R. Besides the seized goods, $P^f\underline{S}$, the penalty costs include the additional penalty such as the fine for smuggling and/or the destruction of input factors for smuggling. Let them be represented by $J(\underline{S})$.

$$(3.2) \qquad J(\underline{S}) = J\left(\int_0^S \rho(s,R)\,ds\right)$$

It means that this additional penalty depends on the expected amount of seized goods.[2]

Then the total smuggling costs will be TC. The smugglers will choose the correct amount of resources so as to minimize the total costs for each level of smuggling

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[1]This type of probability can be best represented by a logistic function. Nevertheless, implicit function is used to express the general idea.

[2]In fact, expected penalty is a better choice than penalty function which depends on the expected seized goods. However, if risks is not taken into account, the latter's functional form is much simpler than the former.

volume.

$$\min_{R} TC = P^f \underline{S} + J(\underline{S}) + R$$
$$= G(S,R) + R$$
$$\text{where } G(S,R) = P^f \underline{S} + J(\underline{S})$$

(For simplicity, we let $P_f = 1$ and there is no additional penalty, J, such that the total penalty, G(S,R), is equal to the expected seized goods, F(S,R).)

F.O.C.

$$(3.3) \qquad \frac{\partial G(S,R^*)}{\partial R} + 1 = 0$$
$$\Rightarrow \qquad G_R^* = -1$$

S.O.C.

$$G_{RR}^* > 0$$

G_R and G_{RR} are negative as they are equal to F_R and F_{RR} respectively.[3] Then both F.O.C. and S.O.C. can be satisfied. By totally differentiating the F.O.C. with respect to S, we can know the direction of change of resources for cost minimization if smuggling volume, S, increases.

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[3] F_R and F_{RR} can be found by differentiating equation (3.1). Obviously they are negative.

$$\frac{d}{dS} : G_R^* = -1$$

$$\Rightarrow \quad \frac{dG_R^*}{dS} = 0$$

$$\Rightarrow \quad G_{SR}^* + G_{RR}^* \frac{dR^*}{dS} = 0$$

$$(3.4) \Rightarrow \quad \frac{dR^*}{dS} = - \frac{G_{SR}^*}{G_{RR}^*} > 0$$

$$\frac{d^2R^*}{dS^2} = \frac{Z(S,R^*)}{G_{RR}^{*\,2}}$$

Where $Z(S,R^*) = - [G_{RR}^*(G_{SSR}^* + G_{SRR}^* \frac{dR^*}{dS}) - G_{SR}^*(G_{SRR}^* + G_{RRR}^* \frac{dR^*}{dS})]$

Since G^*_{SR} $(=\rho_R)$ < 0 and $G^*_{RR} > 0$, resources always increases with smuggling volume. However, we cannot be sure whether it is increasing at an increasing rate, constant rate or decreasing rate.

Furthermore, the response of the already minimized costs for each level of smuggling, C, to the changing smuggling volume can be found by differentiating it by S.

$$C = G^* + R^*$$

$$\frac{dC}{dS} = \frac{dG^*}{dS} + \frac{dR^*}{dS}$$
$$= G_S^* + G_R^* \frac{dR^*}{dS} + \frac{dR^*}{dS}$$
$$= G_S^* + (1 + G_R^*) \frac{dR^*}{dS} > 0$$
$$= G_S^* > 0 \quad (\because 1 + G_R^* = 0) \tag{3.5}$$

$$\frac{d^2C}{dS^2} = \frac{dG_S^*}{dS}$$
$$= G_{SS}^* + G_{SR}^* \frac{dR^*}{dS} \tag{3.6}$$
$$(+) \quad (-) \; (+)$$

It is not strange to find out that dC/dS is larger than zero. Since the effect of the resource on decreasing the probability is always counter balanced by the resource costs (G^*_R*dR*/dS + dR*/dS = 0), the marginal costs will then be the expected loss of the additional smuggled unit under new amount of resource. Besides, the slope of marginal costs is ambiguous. The only conclusion is that regardless of the sign of dR*/dS (even though it must be positive as shown before), the marginal costs is always positive. This means that the sign of marginal costs is independent of the second derivative of the penalty function G.(Recall equation 3.4.)

However, the marginal costs is found to be increasing only when G^*_{SS} is greater than -G^*_{SR}*dR*/dS. This implies that the direct effect of increasing the marginal probability by increasing smuggling is dominant on the

decreasing effect on marginal probability by the increasing resource. Therefore, we find that the marginal costs of smuggling is not necessarily increasing.

So far the resources costs is considered to be the only real loss to the economy. If the private smuggling costs is treated as the only real loss to the economy, the real loss will obviously be overestimated. However, if the resources costs occupies larger and larger portion of the smuggling costs when smuggling volume increases to the extreme that R/C tends to be one (i.e. when S tends to infinity, R tends to equal to C), the problem of overestimation can hopefully be minimized if we assume that smuggling occurs in large scale.

If the share of R in C is increasing with respects to S, the following requirement must be satisfied.

$$\frac{d(R^*/C)}{dS} = \frac{(G^*+R^*)\frac{dR^*}{dS} - R^*(\frac{dG^*}{dS}+\frac{dR^*}{dS})}{(G^*+R^*)^2} > 0$$

$$<=> \qquad G^*\frac{dR^*}{dS} > R^*\frac{dG^*}{dS}$$

This shows that there is no guarantee for increasing share of R in C. Further assumption about private smuggling costs is required. In fact, the penalty for smuggling is not entirely a transfer in the economy.

Firstly, not all of the seized goods are seized by domestic customs. There will be a loss to the domestic economy if the payment of the goods have been made by domestic smugglers (maybe we can treat it as the down payment) and the goods are seized by foreign customs. It is reasonable that if the volume of smuggling is very large, the down payment of the goods will also increases sharply such that the portion of real loss in seized goods will increase.

Moreover, when the volume of seized goods is quite large, the goods may be destroyed instead of being sold in the domestic market if the purpose of imposing tariff is to restrict the amount of imports rather than to collect revenue. Another way is to re-sell the goods in the international market at a lower price. In addition, seized goods may also represent the goods destroyed by the smugglers (such as dumping them into the sea) to avoid severe punishment before they are arrested. Thus with larger volume of smuggling, when smugglers sense that they will be arrested, real loss will then be involved. All of the above will raise the share of real loss in seized goods.

Secondly, the punishment of smuggling may include death penalty. As a result, there will be permanent loss of labour factors in the economy. Even if the smugglers are only jailed, the opportunity of participation in

production is also lost for the economy. This concept of loss of labour is somewhat different from the concept of R because R only includes the loss of labour in this period but the former will account for the labour loss in the future.

Therefore, when the above are considered as real loss, it is reasonable to assume that the share of R in C will increase with increasing smuggling. Nevertheless the problem of real loss overestimation still exists but its effect can be believed to be insignificant in our analysis. In the welfare analysis, the private smuggling costs is used to represent the real loss of smuggling.

Comment on Government Policy

The participants in the smuggling tournament includes consumers, smugglers (and/or other legal trader) and the government. Most of the literatures study the behaviour of consumers and smugglers while the government response is always neglected. The following is some efforts to investigate government behaviour in connection with smuggling.

From the government's point of view, their aim is to maintain the tariff goal. This means that it would try its best to reduce smuggling. Under neo-classical theoretic

framework, trade barriers imposed always reflects the conflict of interests between the government and the private sectors. The government must employ measures to maintain the trade barriers in order to achieve non-economic objectives or other long-term consideration (such as optimal tariff or protection of infant industry).

Obviously, the best results for the government is the complete elimination of smuggling. In the struggle against smuggling, government has the ability to affect the smuggling costs. The higher the (marginal) smuggling costs, the lower will be the smuggling level. In fact, smuggling costs is affected by two components: physical factors and government intervention. Physical factors include geographic characteristics of the smuggling routes, technology of smuggling, etc.. They are exogenous to government decision and therefore are beyond the government control. As a result, the complete elimination of smuggling may not happen.

Then the primary goal of government will adjust to the reduction of smuggling to an acceptable level. If tariff-included world price is the target for domestic price, the government will not be willing to see the appearance of price disparity. Its second best choice will be the suppression of smuggling to avoid price disparity.

In controlling the smuggling costs, resources must be

used by the government (Let it be R_g). The amount of resource needed to achieve government goal should be considered also. If maintaining the target price gets the first priority, the government has to set a cost schedule for smugglers that can maintain the target price. Then the government has to consider the amount of government resources, R_g. This means that the former is determined first. With the costs schedule for smuggling already set, the government then minimizes resources to combat smuggling. Recall that we have let:

$$(3.7) \qquad G(S,R) = P^f \underline{S} + J(\overline{S}) = p^f F(S,R) + J(F(S,R)).$$

Now the total expected penalty, G(S,R), is no longer equal to F(S,R). There are two ways for the government to intervene in smuggling activities. Apart from inputting more resource, R_g, to increase the effectiveness of detection which directly affect the function F(S,R), the government can increase the penalty by raising the punishment in addition to seizing the illegal goods, i.e. J. Nearly no expenditure is needed for the government to establish punishment for smugglers when comparing with maintaining the effectiveness of detection. The government can adjust the components of G such that the resource, R_g, needed can be minimized.

Furthermore, besides the primary goal of maintaining

target price, and the secondary goal of minimizing the government resource, R_g, the government has the tertiary goal of minimizing the total amount of resource employed by smugglers. To achieve this goal, the components of the costs schedule for the smugglers, J and F, can be adjusted by the government within its ability to minimize the resources employed by smugglers if possible.

To fight against smuggling, increasing the marginal costs of smugglers must reduce the smuggling volume. From equation 3.5, raising the effectiveness of detection such that the marginal probability of discovery of smuggled goods is raised will increase the marginal costs for smugglers. With higher marginal costs, smuggling must be reduced. Assume that there is no real loss to the economy in punishment as J only consists of the fine which is a transfer. If the marginal effect of resource on hiding smuggling is not altered, F_R^*, the resulting reduction in the total amount of real resource used by the smugglers, R, will only be due to the reduction in smuggling volume. At each level of smuggling, the optimal choice of resource remains the same, since the F.O.C. (equation 3.8) is not affected.

$$G_R^* = p^f F_R^* + J'(\underline{S}) F_R^* = -1 \qquad (3.8)$$

If the marginal effect of resource is also reduced (i.e. F_R^* becomes less negative), the optimal choice of resource used in each level of smuggling, R^*, will fall (since F_{RR}

> 0). As a results, R, still decreases.

On the other hand, increasing the marginal penalty of smuggling, J', will give an ambiguous result about the real loss of the economy. Although smuggling volume will fall as marginal costs rises, the optimal amount of resource used (R^*) for each level of smuggling, will increase to avoid the heavy punishment. (Since with larger J', the L.H.S. of equation is smaller than -1 if resource used unchange, meaning that the marginal benefit from resource is higher than the marginal costs of R.) Therefore, the resulting change in the total amount of resources used (R) is uncertain.

In conclusion, increasing the effectiveness of detection will require more R_g but R will decrease. Increasing the punishment will not require resources for the government but R may increase or decrease. As a result, there may be conflicts in reducing government's resource and smuggler's resources.

Decision choice for government if smuggling can be completely eliminated

In the case of complete elimination of smuggling, the trade policy can be maintained and the resource costs of the smugglers can disappear. The remaining problem is the construction of the potential costs schedule for the

smugglers by the government. Recall the two of way of combating smuggling, raising the effectiveness of detection and penalty. The former can be viewed as a ex-ante costs for the economy (or fixed in respect to smuggling) to fight against smuggling. It is because the expenditure for law enforcement exists regardless of the existence of smuggling. However, even if the penalty, J, requires costs for the government[4], it can be viewed as ex-post costs for the economy. It is because it will become a real loss only when smuggling really exists. Based on their expectation of the heavy punishment, smugglers will stop their smuggling activities. Thus no real loss is involved in this way. Therefore, it will be wise for the government to raise the expected penalty of smuggling so as to eliminate smuggling.

However, in reality, smuggling cannot be completely eliminated. This may be due to three major reasons.

Firstly, the two ways (detection and penalty) are not perfect substitutes for each others. Heavy penalties must at least rely on a minimum level of effective enforcement of law. Penalty alone cannot incur costs on smugglers.

Secondly, if the detection is not effective enough in raising costs, the penalty must become very severe. However, the limited liability of the smugglers lead to a

[4]For example, the expenditure in maintaining the prison.

limitation of the penalty. For richer smugglers, their opportunity costs will be very high. But for poorer smugglers, their costs of smuggling may have no changes when government increases the expected penalty. Under this situation, the enforcement of law relies on effective detection.

Thirdly, there may be limitation for the effectiveness of detection. A upper bound smaller than one may exists for the probability of being arrested.

As stated above, there are limitations for punishment to be effective. Then the best strategy to completely eliminate smuggling will be to set the punishment to its limit. As there is no smuggling, we do not have to worry about the impact of penalty on the resources used by the smugglers, R. Only consideration is to minimize R_g by setting high penalty. Under the highest possible extent of punishment, the next step is to raise the effectiveness of detection. Thus when there are exogenous impacts which lead to the reduction of effectiveness, the first government response is to raise the penalty to its limit, if possible. Then improvement of detection effectiveness should follow.

Decision choice for government if smuggling cannot be completely eliminated

On the other hand, if smuggling cannot be completely eliminated, it comes back to the second best choice for the government objective. The government can choose a optimal level of intervention so that both the real loss and smuggling are minimized. But since suppressing smuggling always receive the first priority, the remaining choice for government is to adjust the components of smuggling costs to minimize the total real loss (both the resources used by government and smugglers). Therefore, setting the highest possible punishment for the smugglers may not lead to minimization of real loss. (We have already shown that increasing the penalty , J, has ambiguous impact on R^*.)

Now, we assume that G is entirely real loss to the economy. This make no difference to the decision choice for government if smuggling can be completely eliminated. If smuggling cannot be avoided, increasing the marginal costs for smugglers to lower the level of smuggling, S, (the primary goal of government) must reduce the real loss (G+R) from smugglers as smuggling volume declines (since the private costs of smugglers is entirely a real loss now). The only remaining decision choices (the secondary

goal of government) will be the minimization of R_g.[5] Again, the heaviest punishment is required. The tertiary goal of government disappears because the real loss from smuggling, (G+R), is already determined by the level of smuggling.

Chinese practice in combating smuggling

In China, the penalty for smuggling is very harsh. The maximum penalty for smuggling is death penalty. On the other hand, when the wealth or opportunity costs of smugglers increase, their affordable punishment in terms of wealth rises. Using fine as the only means of punishment will always require readjustment with the growth of the economy. Since the death penalty is always the maximum possible penalty, this has the advantage of its effectiveness automatically catching up with the raising of smugglers' opportunity costs. Thus with death penalty, no adjustment is required to suit the changing smuggling environment. Therefore, the resources used by the government for detecting smuggling at each level of smuggling is automatically minimized.

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[5]Notice that the above suggestion drawn is only valid when there are priorities in the decisions for multiple objectives. If the objectives are commensurable, then one objection function for the government is enough. Tariff goal, R_g and R will be considered jointly. The optimal policy decision will depend on their importance in government consideration.

However, there is still drawback in employing death penalty, other than humanitarian reason. Firstly, it is the only largest possible penalty. The exercise of this punishment will depend on the final judgement. Death penalty may not be the final punishment. Death penalty may not be the final punishment. Moreover, since smuggling has been existing for a long period in China, this implies that smuggling is rarely eliminated. The opportunity costs of smugglers remains to be very low. Thirdly, with better economic environment, the costs of death penalty in terms of wealth, J, adjust automatically, so as the marginal penalty, J'. Since it has been illustrated that with J' increases, the changing resources loss is ambiguous. This argument is valid only when death penalty is not viewed as a real loss. Otherwise, this makes no difference to the real loss from smuggling as both the punishment and the resource costs of smuggling is real loss to the economy. However, if there is excessive labor supply, there may be no other opportunities for the smugglers. Rather, they may commit other criminal activities. Thus, death penalty is not necessarily viewed as real loss to the economy in this case.

List of symbols

S : the total amount of smuggled goods

$\underline{S}$: the expected amount of seized goods

R : the resources costs of smuggling

J : the additional penality for smuggling

ρ : the probability of s th unit of goods being seized

p^f : the world price of the goods

G : the total penalty costs for smuggling

R_g : the amount of resources employed by government in detecting smuggling

Chapter 4

The Estimation of the Illegal Trade Volume Between Hongkong and Mainland China

In the empirical study about smuggling, one major problem is the invisibility of the smuggling activity. Data about the smuggling volume and the total costs of smuggling is only known to the smugglers. The only data provided officially to the public is the volume of smuggled goods seized by the customs which seems useless since it is only part of the smuggled goods. Thus, to complete the welfare analysis, the smuggling volume must be estimated.

Estimation of Physical Smuggling

In Simkin (1970), the estimation of the amount of rubber smuggled out of Indonesia was suggested by the construction of the function for "normal export". "Normal export" is the export of rubber according to the supply and demand condition while the recorded export is the export through legal channel. If the "normal export" is significantly larger than the recorded export, it is probably that smuggling exists and the differential will be most likely the smuggling volume.

To construct the "normal export" function, it seems to require a lot of information about the domestic supply. But if the smuggling has only a short history, we can use the historical data of recorded export when smuggling has not yet appeared (or exists in small scale) to predict the normal export in the smuggling periods. Either a supply function for normal export or a time series of normal export can be used. By subtracting the recorded export from the forecasting value of the normal export, the differential can then act as the smuggling volume.

After opening policy was adapted by Mainland China, foreign goods from various countries were smuggled into Mainland China. Now finding the smuggling volume will require the "normal import" of China and the recorded import. Repeating the same method will find troubles. As China had been a closed and planned economy for a long time, the normal demand of foreign imports is quite difficult to be estimated. Thus, alternative method should be used for getting more satisfactory result.

Hongkong is the major place for smuggling of foreign produced goods into China as Hongkong has the advantages of geographic proximity and free trade. Thus by simply importing foreign goods legally into Hongkong, smuggling can be carried out. Therefore, we find that the imports of Hongkong not only fulfil Hongkong demand but also the demand from China. Therefore, by estimating the normal

import demand of Hongkong and compare with the recorded import of Hongkong, the smuggling volume of foreign good can be estimated by their differentials.[1] Since domestic product of Hongkong is rarely smuggled into China, the above calculated volume of smuggling can represent the majority of smuggling between Hongkong and China.

Thus, the estimation method for smuggling can change a little bit. Instead of estimating the normal import for China, the normal import of Hongkong is estimated. Then the difficulties of estimating for China's normal import can be bypassed. In order to ensure above method to be valid, further assumptions are needed.

1) Hongkong only provides channel for goods to be smuggled into China. This means that no good is smuggled to the other place, so that the difference between normal import and recorded import of Hongkong entirely represents the smuggling volume between Hongkong and China.

2) Hongkong is a small economy such that its has no power to influence in its terms of trade. Therefore, the unit value index of import can simply be viewed as the free trade price. Moreover, this can enhance the next assumption that Hongkong relies on imports due to the absence of domestic industries.

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[1]If the smuggling volume is in terms of value, value-added of smugglers should be included in it.

3) Import demand is derived from consumption. People can consume on foreign and domestic goods. Therefore, import demand is inter-related to consumption demand. Consumption demand may even takes the place of import demand in the estimation of smuggling volume. However, there is great difficulty in estimating the consumption demand. To find out the differential in observed and predicted demand, domestic output volume, import volume and consumption demand are needed. There is no data provided for the consumption demand for each type of commodities. Moreover, the classification in domestic industrial statistics is incompatible to the trade statistics. So we must assume that the domestic output and foreign product are not perfect substitutes. This assumption can be supported by the fact that Hongkong is highly specialized in tertiary industry. The trade pattern is primarily inter-industry trade in nature. Moreover, most of the smuggled goods into China are not made in Hongkong. Using consumption demand will imply that domestic output in Hongkong with unknown share in smuggling volume is smuggled into China.

In order to know the total volume of smuggling, the result may not be satisfactory if the estimation of the total amount of normal import of Hongkong is employed. It is because the data will be too aggregated that the contrast of the normal import and the recorded import may not be significant. Thus the estimation of the normal import should be specific on the types of imports which

are suspected to have smuggling existed. This comes to the problem of the degree of detailness of classification in traded commodities.

The trade data of Hongkong is classified according to the SITC system. With the digits of the code increase, the goods will be classified into more detail category. With more divided category, the estimated normal import will be more precise. But the number of category of goods also increases which will require much huge work. One more problem should be considered that whether the category of goods also is accompanied by their respective price data. Only the 1 digit SITC section provide the respective unit value index which can be used as the price data. For 6 digits classification, both the trade quantities and the trade value in H.K. dollars are available. By dividing the latter by the former, the trade unit value can be known which can function as a proxy for their respective prices. For those classification in between 1 digit classification and 6 digits classification, only the trade value is available. Thus no relevant data about their prices is provided.

Therefore, we start with estimating the normal import of the commodities which are classified by section in the SITC system. Although the trade data employed now is still too aggraegate, the estimation result is essential in two way. Firstly, eventhough the forecasting residuals may not

entirely be the smuggling amount, they can give an aprroximate upper boundary for the possible amount of smuggling. Secondly, this mehtod serves to find out the smuggling pattern, i.e., which types of goods are the popular smuggled items. Thus, with the identification of the smuggled items, it can provide a stronger support to the good chosen for the welfare analysis in the following chapters. At this stage, we can then proceed to estimate for more finely classified commodities which have their data of quantity.

For the classification of commodity by section, there are totally ten section range from 0 to 9. Thus ten normal import functions should have to be estimated, one for each sections. However, the trade data of the commodity by section is expressed only in value. To find out their respective quantity index, the imports value should be divided by their unit value index which act as their respective price. There is even no unit value index provide for the section 9. Although we can obtain it by residual as long as the unit value index of all the other sections and the total trade are provided, the value of its unit value index is found to be negative. But since section 9 include the miscellaneous and unclassified commodities, such as fire arms, gold...etc., and its volume only occupies a very small proportion of total trade, section 9 is omitted in our estimation for normal imports.

Furthermore, for the unit value index of the commodity by section, section 0 and section 1 have their unit value index combined together. The same thing also happens between section 2 and section 4. The best way to solve the problem is to estimate the combined normal import function for section 0 and section 1, and section 2 and section 4. Thus there will be totally seven number of import demand functions of Hongkong to be estimated.

One must notice that the normal import function represents the normal domestic demand for materials and consumption. The Hongkong imports data also include the commodities imports for re-exports. Thus, the normal domestic import demand should be the retained import which is the difference between the total imports and total re-exports.[2]

Here the imports demand (i.e. retained imports unless stated otherwise) function is constructed as log-linear function.

$$lnM_t = \alpha + \beta_1 lnY_t + \beta_2 lnP_t + \beta_3 lnY_{t-1} + \beta_4 lnP_{t-1} + \beta_4 lnM_{t-1} + D2_t + D3_t + D4_t + \epsilon_t$$

In general the import demand is considered to be

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[2]However, without the re-exports margin, the retained imports will be under-estimated. The official estimates for the re-exports margin is only provided in 1989. Nevertheless, if the re-exports margin is constant overtime, the time series data of retained imports in Hongkong will be consistent enough to estimate for smuggling. See Sung (1991) for details.

dependent on the real GDP of Hongkong and the relative price of the commodities. Lagged variables are also added into the estimation function. If the estimate of the explanatory variable's parameter is not significant, it will be delete from the function. Then the imports demand function of each commodities may be different.

It is a quite common practice that for the consumption demand to be dependent on the real income and the relative price of the commodities. But for those commodities which are semi-product, or resource for manufacturing, the explanatory variables should not only include the relative price of input, but also the demand of the final products must be considerate. If the final products are mainly consumed by domestic market, there is no problems to use the real GDP of Hongkong as a proxy for this factor. However, if the final products are mainly for export or re-export, this is complicate to include all the factors in the international trade. Moreover, external deficit exists in reality. Thus it seems that the domestic demand (i.e. GDP - net export) will be better to replace national income. Thus real domestic demand can be an alternative of GDP as the explanatory variable. As the data employed is quarterly data so as to get more observations, seasonal dummy variables ($D2_t$, $D3_t$ and $D4_t$) are added into the equation. At the same time we can run a time series model for it for forecasting the normal import demand if the estimation of the imports demand

function is not satisfactory.

Data Description[3]

Real GDP : The GDP in millions calculated on 1980 price

Relative price : The import unit value index divided by the GDP deflator

Import demand : $\frac{\text{Import Value}}{\text{U.V.Index(M)}} - \frac{\text{Re-export Value}}{\text{U.V.Index(RX)}}$

In the estimation of the imports demand function of Hongkong, it requires the time series data of the above variables. However, the data of yearly Hongkong GDP is only available after 1966. The number of observations seems not enough to support better estimations results. Fortunately, quarterly data of GDP is provided. So it can be employed in the following estimation. For price index and unit value index which are lack of quarterly data, average of their monthly data within the quarter then act as their respective quarterly data. For those retained import volume, their quarterly data are simply the sum up of their monthly data.

The availability of data of unit value indexes

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[3]Source: Hong Kong Trade Statistics, various issues.
Estimates of Gross Department, 1966-1991.
Hong Kong Trade Index Numbers, various issues.

greater hinder the number of observations employed in the estimation of the import demand function. The unit value indexes of imports is provided starting from 1976. On the other hand, only the unit value indexes of re-exports of 1979 and onwards are available. Thus, the observations can just start from 1979.

In addition, the observations in the periods that smuggling is predicted to be significant should be excluded because the normal imports demand do not include the imports for further smuggling by definition. With the historical description about the smuggling activities between Hongkong and China, 1986 and or 1987 is believed to be the starting period of serious smuggling. Two sets of normal imports demand function can then be estimated for forecasting normal imports for the severe smuggling periods by using the observations from 1979 to 1986 and 1979 to 1987 respectively. But with the difference in only four observations, there no significant difference between them. So the following works will only base on the assumption of 1988 as the starting periods of smuggling.

Estimation Result

1. Section 0 and 1

Section 0 composes of the food and live animal

chiefly for food. Section 1 composes of beverages and tobacco. Their combined import demand function is estimated as follow:

$$lnM_t^{01} = \underset{(21.239)}{11.828} - \underset{(-3.425)}{0.43}lnp_t + \underset{(9.693)}{0.511}lnY_t$$

$$+\underset{(5.027)}{0.064}lnD2_t + \underset{(7.36)}{0.105}lnD3_t + \underset{(11.583)}{0.153}lnD4_t$$

$$ADJUSTED\ R^2 = 0.926$$

$$\epsilon_t = \rho\epsilon_{t-1} + \mu_t$$

$$\mu_t \sim N(0, \sigma^2)$$

Using the estimated function which depends on its relative prices and GDP to forecast the normal import, significant difference is found between recorded import and normal import. Thus, smuggling is believed to be exist.

Table 4.1 The Forecasting Residuals of Section 0 & 1.

	SECTION 0 & 1				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	0.089	0.036	2.473	*	*
	0.100	0.041	2.434	*	*
	0.060	0.042	1.427	-	*
	0.044	0.044	1.000	-	-
1989	0.154	0.046	3.378	*	*
	0.069	0.047	1.456	-	*
	0.123	0.045	2.720	*	*
	0.075	0.046	1.619	-	*
1990	0.144	0.050	2.912	*	*

	0.193	0.051	3.781	*	*
	0.086	0.050	1.720	*	*
	0.121	0.051	2.365	*	*
1991	0.130	0.055	2.367	*	*
	0.207	0.058	3.564	*	*
	0.134	0.056	2.397	*	*
	0.105	0.059	1.774	*	*

Notes: '*' means that there is significant discrepancy from zero while '-' means that no significant discrepancy is found. The symbols of '*' and '-' carry the same meanings in Table 4.2, 4.4, 4.6, 4.7, 4.8 and 4.9.

With significant discrepancy found, foods are suspect to be smuggled into China, although China is a major food supplier to Hongkong. Foreign grown fruits are upscale goods in Mainland China. They are prohibited from imports. Examples of these are Sunkist oranges and Washington apples. Thus they are likely to be smuggled into China.

In Hongkong, alcoholic beverage and tobacco will be subject to duties according to their final sale. Heavy duties are imposed for domestic sales starting from 1991. Large scale of smuggling of cigarettes from China into Hongkong is found after 1991. Therefore, before 1991, the discrepancy in section 0 and 1 may include smuggling of cigarettes into China from Hongkong. In 1991, smuggling of cigarettes becomes a minority in section 0 and 1.

2. Section 2 and 4

Section 2 composes of the commodities of crude materials, inedible, except fuels and Section 4 composes of animal and vegetable oils, fats and waxes. As a whole, section 2 and 4 represents the organic raw materials. Their combined imports demand function is estimated as follow:

$$lnM_t^{24} = \underset{(3.913)}{8.591} - \underset{(-2.045)}{0.889}\,lnp_t + \underset{(3.295)}{0.457}\ln M_{t-1}^{24} - \underset{(-2.795)}{0.18}\,lnD3_t$$

$$ADJUSTED\ R^2 = 0.396$$

Table 4.2 The Forecasting Residuals of Section 2 & 4.

	SECTION 2 & 4				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	-0.069	0.174	-0.397	-	-
	-0.353	0.176	-2.005	-	-
	-0.110	0.183	-0.599	-	-
	0.070	0.185	0.380	-	-
1989	0.006	0.193	0.030	-	-
	-0.054	0.205	-0.266	-	-
	-0.267	0.205	-1.300	-	-
	0.003	0.204	0.015	-	-
1990	-0.295	0.209	-1.410	-	-

	-0.081	0.212	-0.382	-	-
	-0.009	0.215	-0.040	-	-
	-0.047	0.216	-0.219	-	-
1991	-0.334	0.223	-1.498	-	-
	-0.176	0.234	-0.752	-	-
	-0.085	0.230	-0.370	-	-
	-0.316	0.242	-1.306	-	-

With R^2 is only 0.396, the prediction power is not enough for forecasting the normal imports demand. Thus even using the above import demand function to forecast the normal imports for 1988 to 1991 and then compares the predicted value with the observed value, no residuals are found to be falling out of the positive side of the confidence interval. In order to have a more precise forecasting about the normal imports, a seasonal ARIMA model is used:

$$\Gamma(L^S)\,\Phi(L)\,(1-L)^2\,(1-L^S)^1 LN(M_t^{24}) = \Delta(L^S)\,\Theta(L)\,\epsilon_t \underset{(-0.548)}{-\ 0.007}$$

where,

$$\Phi(L) = 1 \underset{(2.791)}{+\ 0.151L} \underset{(2.227)}{+\ 0.173L^2} \underset{(2.778)}{+\ 0.149L^3} \underset{(123.9)}{+\ 0.999L^4}$$

$$\Theta(L) = 1 \underset{(-3.724)}{-\ 0.839L} \underset{(-0.356)}{-\ 0.087L^2}$$

$$\Gamma(L^S) = 1 + \underset{(1.256)}{0.183L^S} + \underset{(33.23)}{0.988L^{S2}}$$

$$\Delta(L^S) = 1 + \underset{(7.666)}{0.742L}$$

Table 4.3 The Actual and Forecasting Value of Section 2 & 4 by ARIMA model.

	SECTION 2 & 4			
	ACTUAL	LOWER	PREDICT	UPPER
1988	16.043	15.615	15.941	16.268
	15.759	15.454	15.918	16.381
	15.694	14.934	15.484	16.035
	16.050	15.006	15.622	16.238
1989	16.214	14.951	15.738	16.526
	16.273	14.538	15.510	16.482
	15.901	14.235	15.386	16.538
	16.182	14.300	15.621	16.942
1990	16.037	14.212	15.672	17.132
	16.193	13.847	15.433	17.020
	16.165	13.826	15.538	17.251
	16.300	13.928	15.774	17.620
1991	16.096	13.855	15.872	17.890
	16.196	13.386	15.580	17.775
	16.139	12.618	14.981	17.345

Note: The upper and lower limit is derived from 95%

confidence interval.

The forecasting from the ARIMA model shows that no significant discrepancy in Section 2 and 4. No smuggling is suspected in Section 2 and 4.

Section 3

Section 3 includes the mineral fuels, lubricants and related material. Its import demand functions is estimated as follow:

$$lnM_t^3 = \underset{(9.813)}{11.728} - \underset{(-2.928)}{0.996 lnY_t} + \underset{(3.629)}{1.492 lnY_{t-2}} + \underset{(2.063)}{0.078 lnD2_t} + \underset{(3.132)}{0.103 lnD3_t}$$

$$ADJUSTED\ R^2 = 0.419$$

Table 4.4 The Forecasting Residuals of Section 3.

	SECTION 3				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	0.005	0.086	0.060	-	-
	-0.053	0.092	-0.578	-	-
	0.044	0.093	0.477	-	-
	-0.078	0.092	-0.846	-	-
1989	0.277	0.091	3.057	*	*
	0.067	0.093	0.727	-	-
	0.042	0.093	0.455	-	-

	0.117	0.087	1.344	-	*
1990	0.106	0.097	1.094	-	-
	0.153	0.093	1.642	-	*
	-0.239	0.098	-2.424	-	-
	0.308	0.094	3.272	*	*
1991	0.286	0.093	3.088	*	*
	-0.025	0.096	-0.261	-	-
	-0.035	0.110	-0.320	-	-
	-0.218	0.104	-2.099	-	-

Again, the R^2 is only 0.419. This time, some of the residuals from predicted and observed value is significantly larger than zero, especially in 1990. But with the seasonal ARIMA model estimated,

$$\Gamma(L^S)\,\Phi(L)\,(1-L)^2(1-L^S)^2 LN(M_t^3) = \Delta(L^S)\,\Theta(L)\,\epsilon_t + \underset{(0.219)}{0.004}$$

$$ADJUSTED\ R^2 = 0.883$$

where,

$$\Phi(L) = 1 + \underset{(7.849)}{0.751}L + \underset{(10.24)}{0.94}L^2$$

$$\Theta(L) = 1 - \underset{(-7.281)}{1.329}L + \underset{(6.859)}{1.206}L^2 - \underset{(-4.936)}{0.745}L^3$$

$$\Gamma(L^S) = 1 + \underset{(29.71)}{1.886}L^S + \underset{(56.52)}{0.996}L^{S2}$$

$$\Delta(L^S) = 1 + \underset{(6.778)}{1.196L} + \underset{(3.329)}{0.463L^{S2}}$$

Table 4.5 The Actual and Forecasting Value of Section 3 by ARIMA model.

	SECTION 3			
	ACTUAL	LOWER	PREDICT	UPPER
1988	17.086	16.892	17.087	17.282
	17.014*	17.277	17.473	17.669
	17.347	17.058	17.292	17.526
	17.148*	17.219	17.559	17.899
1989	17.398	16.851	17.307	17.762
	17.228*	17.344	17.808	18.272
	17.339	16.742	17.387	18.031
	17.238	16.944	17.725	18.505
1990	17.130	16.580	17.585	18.590
	17.277	17.141	18.223	19.304
	17.120	16.232	17.614	18.997
	17.551	16.728	18.355	19.982
1991	17.446	16.109	18.058	20.006
	17.207	16.603	18.733	20.864
	17.412	15.598	18.148	20.698

Note: When the actual value has a superscript '*', the actual value is smaller than the lower limit of the 95% confidence interval.

It is found that only three period has significant derivation from forecasting value and their residuals are negative rather than positive. No smuggling is concluded in section 3.

Section 5

Section 5 is the chemicals and related products. Its import demand mainly depends on national income and import demand lagged one period:

$$lnM_t^5 = \underset{(0.791)}{1.236} + \underset{(2.628)}{0.472}lnY_t + \underset{(4.012)}{0.62}nM_{t-1}^5 + \underset{(3.788)}{0.178}lnD2_t$$

$$ADJUSTED\ R^2 = 0.758$$

The residuals show that no significant difference between observed and predicted value of normal imports demand. Thus we can conclude that no smuggling is found in Section 5.

Table 4.6 The Forecasting Residuals of Section 5.

	SECTION 5				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	-0.005	0.129	-0.037	-	-
	0.146	0.133	1.100	-	-

	0.054	0.135	0.400	-	-
	-0.039	0.134	-0.294	-	-
1989	-0.063	0.130	-0.479	-	-
	-0.088	0.133	-0.659	-	-
	-0.047	0.129	-0.363	-	-
	-0.127	0.129	-0.982	-	-
1990	-0.023	0.124	-0.187	-	-
	-0.005	0.132	-0.037	-	-
	0.143	0.131	1.091	-	-
	0.048	0.135	0.356	-	-
1991	-0.094	0.136	-0.694	-	-
	0.092	0.136	0.674	-	-
	-0.072	0.137	-0.527	-	-
	-0.043	0.134	-0.319	-	-

Section 6

Section 6 is the manufactured goods classified chiefly by materials. Its import demand is found to be dependent on current GDP and GDP and imports demand lagged one period:

$$lnM_t^6 = \underset{(9.813)}{5.734} - \underset{(-2.928)}{1.874}lnY_t + \underset{(3.629)}{1.579}\ln Y_{t-1} + \underset{(1.335)}{0.226}lnM_{t-1}$$

$$+ \underset{(1.215)}{0.492}nD2_t - \underset{(-4.523)}{0.208}lnD4_t$$

$$ADJUSTED\ R^2 = 0.842$$

Most of the residuals show no significant deviation of observed value from predicted value. Only several periods experience a positive of negative deviation from zero. So it is expected goods of section 6 are not the majority of smuggled commodities.

Table 4.7 The Forecasting Residuals of Section 6.

	SECTION 6				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	0.060	0.094	0.641	-	-
	0.137	0.088	1.561	-	*
	-0.063	0.094	-0.668	-	-
	0.377	0.089	4.215	*	*
1989	0.104	0.098	1.062	-	-
	0.036	0.097	0.374	-	-
	-0.240	0.095	-2.544	-	-
	-0.211	0.097	-2.170	-	-
1990	0.048	0.106	0.452	-	-
	-0.090	0.099	-0.910	-	-
	-0.262	0.103	-2.543	-	-
	-0.070	0.103	-0.675	-	-
1991	-0.036	0.104	-0.346	-	-
	-0.073	0.114	-0.642	-	-
	-0.281	0.113	-2.473	-	-
	-0.197	0.109	-1.816	-	-

Section 7

Section 7 composes of machinery and transport equipments. The import demand function is dependent on both its price and GDP:

$$lnM_t^7 = \underset{(5.177)}{6.438} - \underset{(-1.766)}{0.578}lnp_t + \underset{(9.151)}{1.071}lnY_t + \underset{(6.152)}{0.111}lnD2_t$$

$$ADJUSTED\ R^2 = 0.923$$

$$\epsilon_t = \rho\epsilon_{t-1} + \mu_t$$

$$\mu_t \sim N(0, \sigma^2)$$

From the forecasting residuals plot, there are only significant derivations from the forecasting value of the retained imports demand in the first half of 1989 and 1991 if 5% of significant level is used. However, if the significant level is relaxed to 10%, most of the time in the periods between 1988 and 1991 has their observed value significantly different from predicted value of imports demand. Moreover, all of the residuals are found to be positive except for the 4th quarter of 1989. Thus it is apparent that commodities included in section 7 has smuggling practising.

Machinery and transports equipment are bulky items which requires huge efforts to perform smuggling. Thus only with large demand in China will attract smugglers to perform the smuggling of these types of goods. Home-use

electrical appliance such as colour television sets, video recorders and automobile, which are included in section 7, are the popular items to be smuggled into China through Hongkong due to shortage in legal channel. So the smuggling of these commodities explain the discrepancy of the observed value and the predicted value.

Table 4.8 The Forecasting Residuals of Section 7.

	SECTION 7				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	0.033	0.097	0.338	-	-
	0.093	0.101	0.916	-	-
	0.160	0.107	1.497	-	*
	0.156	0.108	1.446	-	*
1989	0.177	0.102	1.738	*	*
	0.189	0.111	1.699	*	*
	0.062	0.115	0.535	-	-
	-0.051	0.118	-0.428	-	-
1990	0.173	0.117	1.474	-	*
	0.171	0.127	1.353	-	*
	0.173	0.127	1.358	-	*
	0.160	0.127	1.265	-	-
1991	0.343	0.131	2.615	*	*
	0.361	0.145	2.486	*	*
	0.311	0.147	2.113	*	*
	0.255	0.159	1.600	-	*

Section 8

Section 8 is the miscellaneous manufactures articles. The normal import demand function is dependent on its price, national income and the previous quarter imports demand.

$$lnM_t^8 = \underset{(0.331)}{0.289} - \underset{(-1.92)}{0.421}lnp_t + \underset{(4.507)}{1.076}lnY_t + \underset{(2.247)}{0.316}\ln M_{t-1}^8$$

$$+ \underset{(5.875)}{0.268}lnD2_t + \underset{(5.5449)}{0.174}lnD3_t + \underset{(6.941)}{0.281}lnD4_t$$

$$ADJUSTED\ R^2 = 0.9635$$

The forecasting residuals are found to be far below the positive upper limits. Thus it should conclude that no smuggling is suspected to be existed in section 8 from 1988 to 1991. However, all of the forecasting residuals have their value negative and is significantly deviated from zero. There are two possibilities to explain for this phenomenon. One is that the items in section 8 is smuggled from other area into Hongkong to satisfied its consumption demand. But this seems not reasonable since except from Mainland China, smuggling will incur high costs from other area due to the geographic characteristic of Hongkong. Moreover, due to its free trade policy except for a few items, it is odd to need smuggling as a means to satisfactory domestic demand in Hongkong. Thus this possibilities should be rejected.

The other explanation is that the goods in section 8 were the popular items for smuggling into China in the period in which the observations is used for estimated for normal import demand function. As a result, the normal import demand has included the smuggling demand. If from 1988 to 1991, smuggling of these types of goods has stopped, it will lead to the actual imports significantly lower than the predicted amount. From 1979 onwards, China has began its open door policy such that people living in coastal area become wealthier. But their consumption power are not high enough to purchase for high tech consumption goods as in section 7. Rather, some of the goods included in section 8 such as watches, clock and camera are believed to be parts of the above items described as smuggling items in the early 80's but stopped to be smuggled in late 80's.

Section 8 is the goods which are mainly the popular consumption items. In the past, when Hongkong people visited their home in Mainland China, they always bring back with gifts to their relatives. Most of the gifts are the commodities described in section 8. But with the improvement of living standard of their relatives, this kind of activities declines in late 80's. Thus this give another rationalisation for the above prediction results.

Table 4.9 The Forecasting Residuals of Section 8.

	SECTION 8				
	RESIDUAL	STD ERROR	t	t > 1.697	t > 1.310
1988	-0.046	0.061	-0.760	-	-
	-0.064	0.066	-0.961	-	-
	-0.206	0.066	-3.112	-	-
	-0.983	0.071	-13.930	-	-
1989	-0.135	0.074	-1.825	-	-
	-0.199	0.070	-2.854	-	-
	-0.461	0.067	-6.857	-	-
	-0.099	0.093	-1.070	-	-
1990	-0.224	0.085	-2.620	-	-
	-0.222	0.094	-2.366	-	-
	-0.507	0.084	-6.056	-	-
	-0.217	0.109	-1.990	-	-
1991	-0.497	0.102	-4.881	-	-
	-0.543	0.133	-4.082	-	-
	-1.206	0.130	-9.285	-	-
	-0.616	0.221	-2.790	-	-

Estimation of the smuggling Volume

Now we have found that commodities in section 0 & 1 and section 7 are goods most likely to be smuggled into China from Hongkong in the late 80's. The commodities classified in section 8 is suspected to be smuggled in

early 80's. All these goods are consumer goods. On the other hand, commodities classified in section 2 to section 6 are raw materials. No significant discrepancies are found in the above estimations. Since China imposes higher tariff on consumer goods than on raw materials, the restricted demand on consumer goods seems to induce smuggling. This can be supported by the above empirical results.

Then by assuming that the forecasting residuals represent the smuggling amount, the smuggling volume in each year from 1988 to 1991 are estimated in Table 10. Three figures of smuggling volume are provided for each years. (5%) and (10%) columns are the smuggling volume in each year calculated by summing up the discrepancy from forecasting value of each quarter when it is significantly different from zero at 5% and 10% significant level respectively. 'ALL' column is the smuggling volume computed by summation of those discrepancies regardless of the level of significance.

Table 4.10 The Estimated Volume of Smuggling from 1988 to 1991. (HK$ million in c.i.f. value for China)

SECTION 1

	Estimated Smuggling volume			China's recorded total imports
Year	(5%)	(10%)	ALL	
1988	1595	2152	2596	29804

1989	2765	4276	4276	34265
1990	6060	6060	6060	54218
1991	7343	7343	7343	-

SECTION 7

	Estimated Smuggling volume			China's recorded total imports
Year	(5%)	(10%)	ALL	
1988	0	6510	8658	130174
1989	7892	7892	8165	142007
1990	0	12967	17237	131383
1991	30686	39061	39061	-

Note: 15% is used as re-exports margin to calculate the f.o.b. value of re-exports. Then 5% margin is added to convert the f.o.b. value to c.i.f. value.

Source: China's recorded total imports from Summary Surveys of China's Customs Statistics, various issues.

From Table 4.10, the smuggling volume of Section 0&1 is approximately the same regardless of the method of computation. The smuggling volume is found to be around 10% of the total imports. Moreover, the share of smuggling in total imports is rather constant in each year. It is quite reasonable as food is a non-durable good.

However, for Section 7, the smuggling volume varies greatly for different method of computation. In 1988 and 1990, smuggling even disappeared. However, there were

rampant smuggling activities during this period. Since goods in section 7 are mainly durable consumer goods, the demand on them is fluctuate over time. Thus a larger significant level is used. Then its largest possible smuggling volume is around 8 billion and 17 billion HK dollars in 1988 and 1990. In 1991, its volume even reached to 39 billion HK dollars. But in 1989, a small drop of to above 7.8 billion HK dollars is found. Furthermore, the ratio of smuggling volume to legal trade volume varies significantly. This may result from different year measures against smuggling activities being employed in different year.

From the above results, smuggling only occupies a small share in total imports. However, goods are likely to be smuggled to satisfy demand from the relatively more open and wealthier coastal areas in Mainland China. Then in these areas, the share of smuggling in imported goods may be larger. The impact of smuggling on these areas cannot be neglected.[4]

Since smuggling is also a kind of re-exports of Hongkong which is not reported in the official statistics, Hongkong can gain from smuggling by the value added

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[4]In the next chapter, estimates for smuggled television sets occupy about 75% of share in total imports. Thus the relatively lower share of smuggling in section 7 may be due to including of imported products without smuggling.

process. 15% re-exports margin is used in the calculation.[5] By multiplying the re-exports margin to the estimated smuggling volume, the contribution to Hongkong of smuggling can be found.[6]

Table 4.11 The Estimation of the Contribution to Hongkong of Smuggling. (HK$ million)

SECTION 1

Year	(5%)	(10%)	ALL
1988	199	269	324
1989	346	534	534
1990	758	758	758
1991	918	918	918

SECTION 7

Year	(5%)	(10%)	ALL
1988	0	814	1082
1989	987	987	1021
1990	0	1621	2155
1991	3836	4883	4883

[5]Annual survey of re-exports of Hongkong in 1991 by Hong Kong Census and Statistics Department provides the estimates of re-exports margin. It is found to be about 13.4% and the re-exports margin for China goods is even higher. However no estimate of it is provided. So 15% of re-exports margin in China trade is assumed.

[6]Notice that the estimated smuggling volume as China imports in Table 10 has already been converted into c.i.f. value.

From the estimation result, goods classified in section 7 have much greater contribution to Hongkong than in section 0&1. Their contribution is about 800 million to 4.8 billion of Hongkong dollars while the contributions from goods in sections 0&1 is only around 200 to 900 million. Smuggling of goods in section 7 seems to play an much essential in Hongkong economy.

Moreover, since Hongkong GDP is calculated by expenditure approach, with understated net exports, GDP will obviously be understated also. Official computation of the Hongkong GDP and its growth rate will be affected. After taking smuggling into account as re-exports (with re-exports margin included), GDP and its growth rate should be adjusted.

Table 4.12 The adjusted Hongkong GDP by expenditure components. (At constant (198) market price, HK$ million)

	Official data	Adjusted data '5%'	Adjusted data '10%'	Adjusted data 'ALL'
1988	247415	248287	252151	253568
1989	254434	259640	260378	260511
1990	262189	264928	270790	272720
1991	272480	288167	291622	291622

Source: Official data from Quarterly Estimates of Gross

Domestic Product 1966-1991.

The adjusted growth rate in 1988 and 1991 is different significantly from official data (See Table 3.12). In 1988, the 'actual' growth rate (assuming that smuggling starts at 1988) is understated by about 0.38% to 2.69%. In 1991, the 'actual' growth rate is understated by about 3% to 4.84%. In 1989 and 1990, the 'actual' growth rate may be understated or overstated, according to different choice of estimates of smuggling volume. Therefore, we find that smuggling plays a rather important role in Hongkong economy.

Table 4.13 The adjusted growth rate of Hongkong GDP. (%)

	Official data	Adjusted data '5%'	'10%'	'ALL'
1988	8.29	8.67	10.36	10.98
1989	2.84	4.57	3.26	2.74
1990	3.05	2.04	4.00	4.69
1991	3.93	8.77	7.69	6.93

Source: Same as Table 4.12.

Chapter 5

Misinvoicing in China trade with Hongkong

Misinvoicing may be motivated by two types of incentives. The first type is to use misinvoicing as an alternative of smuggling. Unlike smuggling, misinvoicing still go through legal channels but with under-reported volume or value so that less duties are charged. Hence, whether it is exports or imports, there will always be underinvoicing in foreign trade when dealing with smuggling purpose.

The second type is to hide its actual trade volume in order to avoid turning over the foreign exchange earned to the central government. In China, provincial governments and trade enterprises have to give up a portion of the foreign exchange earned through exports to the state by selling them to the Bank of China in exchange for renminbi according to the official exchange rate. The retention rate will be the remaining portion which can be held for further purchases of foreign goods that are subject to the approval of the state. If the retention rate is low, the enterprise will have more incentive to misinvoice its trade. Thus underinvoicing exports can hide its actual earning of foreign exchange whereas overinvoicing imports

can overemphasis its using up of foreign exchange earned. Then retaining more foreign exchange is the other goal of misinvoicing besides smuggling.

It is interesting to see how the firm decides on misinvoicing and to what extent the misinvoicing will be. Let retaining foreign exchange be the objection function of the firms to be maximized, π. Then,

$$(5.1) \qquad \Pi = (X-M) - (1-r)[(1+\theta_X)X-(1+\theta_M)M]$$

X and M is exports and imports in foreign currencies. r is the retention rate. θ_X and θ_M are the extent of misinvoicing of exports and of imports. θ with positive value represents overinvoicing whereas negative value represents underinvoicing. To maximize the objection function, the solution is unbounded as θ_X will tend to be zero and θ_M will tend to be infinity. However, this is impossible as it must be detected by the Customs. So the countering effect will be the risk costs in misinvoicing.

$$(5.2) \qquad \Pi = (X-M) - (1-r)[(1+\theta_X)X-(1+\theta_M)M] - XC(\theta_X) - MC(\theta_M)$$

$C(\theta)$ are the risk costs functions for each portion of dollars of foreign exchanges involved in faked invoice and is applicable to both misinvoicing of exports and imports. $C(\theta)$ has the properties that,

$$
\begin{aligned}
&(5.3a) && C(\theta) = C(-\theta) \\
&(5.3b) && C'(\theta) > 0 \quad \textit{if } \theta > 0 \\
&(5.3c) && C'(\theta) < 0 \quad \textit{if } \theta < 0 \\
&(5.3d) && C'(-\theta) = -C'(\theta)
\end{aligned}
$$

This means that the risk costs of the same extent of overinvoicing and underinvoicing will be the same, i.e., $C(\theta)$ is symmetric about the origin. Then the first order condition for maximizing retained foreign exchange will be,

$$
\begin{aligned}
&(5.4a) && -(1-r) = C'(\theta_X) \\
&(5.4b) && (1-r) = C'(\theta_M) \\
&\Rightarrow && \theta_X < 0,\ \theta_M > 0
\end{aligned}
$$

$$
\begin{aligned}
\therefore \quad & -C'(\theta_X) = C'(\theta_M) \\
\Rightarrow \quad & C'(-\theta_X) = C'(\theta_M) \\
\Rightarrow \quad & -\theta_X = \theta_M
\end{aligned}
$$

This implies that the extent of misinvoicing of exports and imports will be equal in the optimal solution. Thus, for a firm engaged in foreign trade, it will attempt to underinvoice its exports and overinvoice its imports by the same percentage.

However, for imported goods, one more consideration is added. If imported goods are subject to tariff, t, for each unit of over reported spent foreign exchange, it can benefit by the portion of r, (since r unit of foreign exchange can be retained), but at the same time, it has to pay for an additional t units of duties apart from the risk costs of faked invoice. The objective function then

changes to,

$$(5.5) \qquad \Pi = (X-M) - (1-r)[(1+\theta_X)X-(1+\theta_M)M] - XC(\theta_X) - MC(\theta_M) - tM$$

F.O.C.,

$$(6.6a) \qquad -(1-r) = C'(\theta_X)$$
$$(6.6b) \qquad (1-r) = C'(\theta_M) + t$$

$$\Rightarrow -C'(\theta_X) = C'(\theta_M) + t$$
$$\Rightarrow C'(-\theta_X) = C'(\theta_M) + t$$

Now the extent of underinvoicing of exports and overinvoicing of imports will no longer be the same. The tariff will obviously reduce the extent of misinvoicing of imports comparing with exports. To the extreme that tariff rate is larger than the turn over rate ,i.e., 1-r, imports may be underinvoiced to bypass the high tariff rate. It is because if t is larger than 1-r, $C'(\theta_M)$ must be negative, which implies that θ_M is negative also. Smuggling replaced misinvoicing for retained foreign exchange in the case of imports. Then the target for retaining more foreign exchange will be achieved by underinvoicing of exports.

However, the above consideration neglects the origin of misinvoicing in China foreign trade. In China, due to the strict control on foreign exchange, the black market exchange rate is much higher than the official one. The original goal of misinvoicing is to avoid the strict control of foreign exchange which not only limit the

holding of foreign exchange but also the use of it. The resulting disparity between the official and the black market exchange rates will alter the decision of misinvoicing if duties are paid by domestic currency. Hence, the objective function and F.O.C. are changed to:

$$(5.7)\quad \Pi = \{(X-M) - (1-r)[(1+\theta_X)X-(1+\theta_M)M]\}e_B + (1-r)[(1+\theta_X)X-(1+\theta_M)M]e_O - XC(\theta_X)e_O - MC(\theta_M)e_O - t(1+\theta_M)Me_O$$

$$(5.8a)\quad -(1-r)\frac{e_B-e_O}{e_O} = C'(\theta_X)$$

$$(5.8b)\quad (1-r)\frac{e_B-e_O}{e_O} = C'(\theta_M) + t$$

Thus we find that if the gap between the black market and official exchange rate widens, the effect of reduction in the overinvoicing of imports will be diluted.

By comparing the value of the tariff rate, t, with the effective rate of retaining foreign exchange, $(1-r)(e_B-e_O)/e_O$, the direction of misinvoicing of imports can be found. First of all, if the former is smaller than the latter, there will be overinvoice of imports:

$$(1-r)\frac{e_B-e_O}{e_O} - t = C'(\theta_M) > 0$$

$$\Rightarrow \quad \theta_M > 0$$

It is because for each dollars overinvoiced by the extent, θ_M, $\theta_M(1-r)$ unit of foreign exchange, which is worth $\theta_M(1-r)(e_B-e_O)$ in domestic currency, can be additional retained. At the same time, the additional duties needed to paid is worth $e_O t$,[1] then the overinvoice extend will reach its limits when the marginal risk costs, $C'(\theta)$, is equal to their gap.

However, if the effective rate of retaining foreign exchange is just equal to the tariff rate, there will be no benefits in misinvoicing, so no misinvoicing of imports will be the results:

$$(1-r)\frac{e_B-e_O}{e_O} - t = C'(\theta_M) = 0$$

$$\Rightarrow \quad \theta_M = 0$$

Notice that even if $C'(0)$ is not necessarily equal to zero, corner solutions will be the result when $C'(0)$ is larger than zero, such that there is no misinvoicing in imports.

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[1]It is because the amount of duties needed to be paid is calculated by Customs using official exchange rate.

If the tariff rate is larger than the effective rate of retaining foreign exchange, then underinvoicing can escape the tariff with the trade-off of losing foreign exchange holding.

$$(1-r)\frac{e_B-e_O}{e_O} - t = C'(\theta_M) < 0$$

$$\Rightarrow \quad \theta_M < 0$$

Comments on the comparison between China and Hongkong trade statistics

In the works of Fung (1987), the China's official exports data is compared with Hongkong's official imports data. By assuming that Hongkong data represents the actual trade volume, his major concern is to test whether faked invoice exists rather than to find the misinvoicing volume. Since the exports data of China is in f.o.b. value while the import data of Hongkong is in c.i.f. value, the assumption of 10% margin is adopted.[2] About 60 commodities in each years are compared from 1982 to 1986. $M_{HK}i/X_Ci$ is the ratio calculated by dividing the recorded exports in China by the recorded imports in Hongkong of commodity i. Thus there are 60 M_{HK} to X_C ratio in a year. Their mean and

[2]It seems to be too large when it is applied in China trade with Hongkong.

standard deviation of each year is calculated. A t-test is performed for each year to see whether there is significant discrepancy of the sample mean from 1.1.

However, there are certain problems in his approach. First of all, each division (2 digits) in each year is considered as a sample observation. The M_{HK} to X_C ratio of the 60 divisions then act as the sample to estimate for the population mean of M_{HK} to X_C ratio and to test for the existence of underinvoicing of exports (i.e. the sample means is significantly larger than 1.1.). Thus, each division is the elementary unit of the population. If the testing result is significant from 1.1, this only implies that the M_{HK} to X_C ratio of the divisions as a whole is larger than the trade value. In fact, the best way to reflect the general tendency of misinvoicing is to use transactions in trade as the elementary unit of the population to see the frequency of faked invoice in transactions. If the number of transactions of a division in a year is available, then the number of transactions of a division can be used as a weight to find out the weighted average of the ratio M_{HK} to X_C as the sample mean. One alternative is to use the share in total trade of the divisions as the weight. By this way, the weighted average will in fact be the M_{HK} to X_C ratio of the total trade of a year. Since,

$$\frac{\sum M_{HKi}}{\sum X_{Ci}} = \sum \frac{M_{HKi}}{X_{Ci}} \frac{X_{Ci}}{\sum X_{Ci}}$$

$$= \sum \frac{M_{HKi}}{X_{Ci}} W_i \quad \because W_i = \frac{X_{Ci}}{\sum X_{Ci}}$$

$$i=1,2,\ldots\ldots,n$$

But it comes to the problem of the standard error since the number of observations, n, is undefined. If each dollar of transactions is treated as one observation, the standard error will likely to be very small, such that the result of the t test will surely be significant from 1.1. In other words, the weighted average approaches the population mean. The significant test for the mean seems to be meaningless.

Moreover, according to Fung, even if the null hypothesis of population means of M to X equal to 1.1 is not rejected, there may still be some traded divisions that practise misinvoicing. Thus it lacks the ability to identify the type and volume of commodities in which faked invoice are involved. Again, the number of transactions of a division traded can provide a more precise conclusion about the misinvoicing of a division of goods. On the other hand, if Fung's method employs time series data of a division instead of cross-sectional data in a year, the judgement about misinvoicing of a division by his method can be valid only when the institutional setting and the trade environment remain constant over time.

Finally, M_{HK} to X_C ratio is bounded by zero. When reported exports value of a division is so large that M_{HK}/X_C is approaching zero, it can be easily outweighed by a M_{HK} to X_C ratio of a division that is larger than 2. As a result, taking the average of M_{HK}/X_C is not a appropriate method. It is better to use logarithm value of M_{HK}/X_C for the testing as it is symmetric in value when overinvoicing and underinvoicing are done by the same portion[3]. (eg. $\ln(1/2) = -\ln(2)$)

In comparing the trade statistics of China and Hongkong, problems arises in estimation for misinvoicing. In misinvoicing of China exports to Hongkong, the major problem is the different statistical classification of traded commodities in by the two places. Even though both of the them follow SITC system, all exports from processing/assembling operations in section 9 in Chinese statistics from 1985 to 1991 while Hongkong classifies those products into their respective sections according to their types. Thus, even if there is no misinvoicing in China's exports, the recorded exports volume of each sections/divisions in Chinese statistics will be smaller than in Hongkong statistics, except for section 9. Thus trade statistics between Hongkong and China can only be compared by the total exports from China to Hongkong.

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[3]Recalling the objective function of misinvoicing, the same problem happens to the risk costs function which depends on the extent of misinvoicing, θ. It is better to be replaced by $C(\ln(1+\theta))$. But it make no difference to the above conclusion drawn.

Table 5.1 The amount of underinvoicing in exports from China to Hongkong. (HK$ million)

	M_{HK}/X_C	Amount of Underinvoicing	China recorded Exports to HK
1988	1.092	5984	142495
1989	1.151	17265	170944
1990	1.136	17877	207871
1991	1.171	30331	250670

Source: China's data from China Customs Statistics
Hongkong's data from Hong Kong Trade Statistics

Assume that the margin for converting f.o.b. value to c.i.f. value is 5%. Then the trend of misinvoicing is increasing for recent years. In 1988, the misinvoicing volume is about 6 billions HK dollars. In 1989 and 1990, the misinvoicing volume is approximately the same, i.e. 17 billion HK dollars. In 1991, its volume reaches a high peak of about 30 billions HK dollars. Therefore, similar to smuggling, this illegal trade practice is rampant in recent years.

On the other hand, the discrepancy between trade statistics of the two places is much larger in China's imports. Since Chinese Customs often fails to ascertain the country of origin for the re-exports from Hongkong, part of these re-exports are regarded as imports from

Hongkong. Thus estimation for misinvoicing in China imports is very difficult, if not possible. But since misinvoicing is of little concern in this study, it is left out here. However, if misinvoicing (both exports and imports) can be estimated by better methods, the black market exchange rate may also be predicted.[4] It may be useful in other field of study.

[4]See Appendix A for details.

List of symbols

X : The amount of China exports

M : The amount of China imports

X_{HKi} : The Hongkong official recorded amount of China exports to Hongkong in division i

M_{Ci} : The Chinese official recorded amount of China exports to Hongkong in division i

θ_X : The extent of misinvoicing in China exports

θ_M : The extent of misinvoicing in China imports

e_O : The official exchange rate

e_B : The black market exchange rate

r : The retention rate of foerign exchange

t : The tariff rate

C : The risks costs of misinvoicing

Chapter 6

Welfare Analysis:

Theoretical Framework

Once the smuggling volume is estimated, we can turn to the welfare analysis. Recall the discussion in Chapter 2, smuggling can lead to gain and loss of the economy.[1] The gain is mainly due to the deviation of the domestic price of the good from the tariff-included price so that there will be consumption gain to the economy. The loss is mainly the smuggling costs incurred to the economy. From Bhagwati's study, for the economy to have welfare improvement from smuggling, it will only occur when legal trade is completely eliminated by smuggling. It is because when domestic price deviates from the tariff-included price, legal trade will lose in the competition with smuggling. As long as legal trade exists, the domestic price will still be the tariff-included price, so there will be no consumption gain to the economy but only with smuggling costs incurred. Thus, the elimination of legal trade is the necessary condition for welfare improvement. It is not the sufficient condition because the net effect of smuggling will still be determined by the amount of consumption gain and the smuggling costs.

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[1]For the normative judgement about the trade barrier, it is always doubt that it is beneficial.

In most of the smuggling cases, complete elimination of legal trade rarely occurs. It is quite reasonable because elimination of legal trade will provide a signal to the government that smuggling activities are rampant. If the government has the strong determination to fight against smuggling, its reaction will lead to the rise of smuggling costs to a level that legal trade appears. Then for the economy, there will always be real loss from smuggling.

In this situation, it is clear that there is no consumption gain. Accounting for the costs of smuggling which is assumed to be the total loss of the economy, it will easily be calculated by multiplying the smuggling value and the tariff rate of the commodity if smuggling industry is under perfect competition. It is because under perfect competition, the smugglers will earn zero profit. As a result, the total average costs for smugglers must be equal to the domestic price, i.e. tariff-included price. Thus,

$$AC + P^f = (1 + t)P^f$$

$$\Rightarrow \quad AC = P^f t$$

$$(6.1) \quad \therefore C = S * AC = S * P^f t = V * t$$

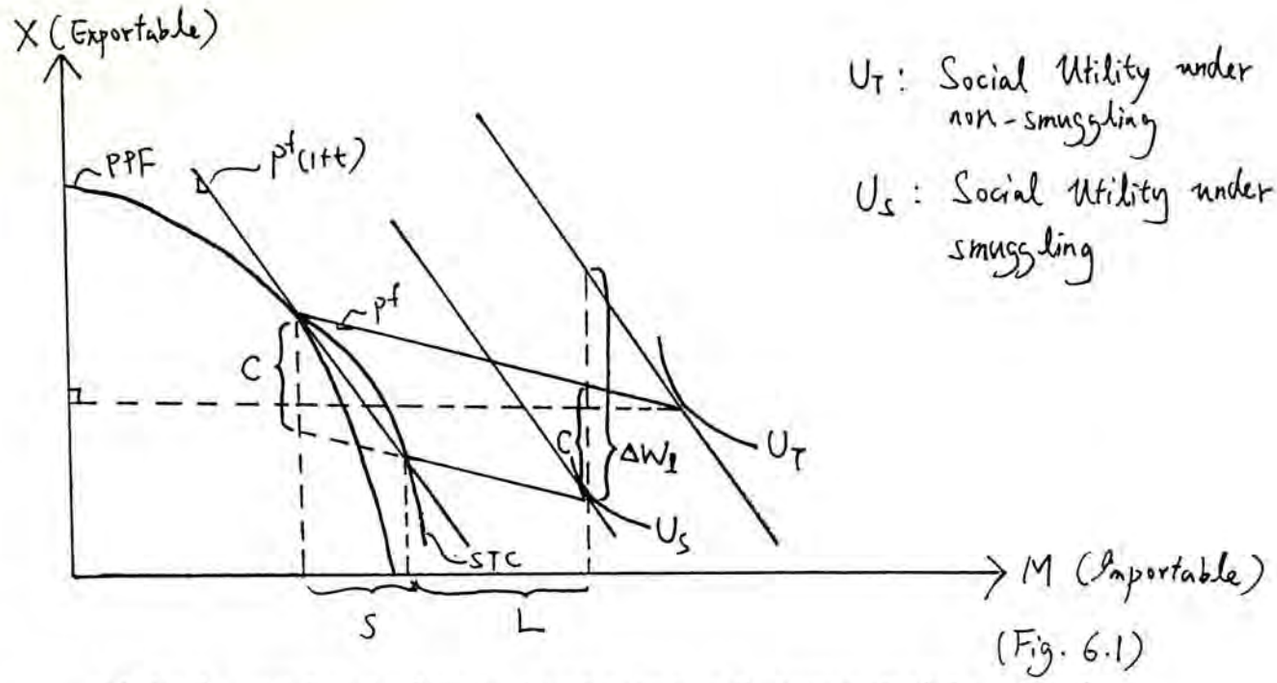
where t : tariff rate

V : value of the smuggling volume

S : smuggling volume in quantity

If the smuggling industry is monopolized, it is quite difficult to predict the costs of smuggling as AC will not be equal to $P^f tS$. It will require us to estimate for the marginal costs of smuggling in order to know the total smuggling costs. But at least we know that the smuggling costs will be bounded by the smuggling costs under perfect competition as calculated above.

We find that the welfare loss of the economy by smuggling will exactly be the loss of government revenue from tariff by smuggling when it is under perfect competition. The tariff revenue (which is a transfer within the economy) is replaced by the resources used in smuggling. However, we know that even if the total real loss (social costs) is represented by the smuggling cost C, there is further welfare loss for the society. Since the resource costs is unproductive for the economy, the real income of the economy will decrease. The direct effect of this lump sum reduction of real income will lead to the decline of imports demand which shrinks the foreign trade volume if balance trade is assumed (See Fig. 6.1). As a result, domestic exports will be reduced. Then the real income of the economy will further be reduced. Thus, if the real income is used to represent the welfare of the economy, the loss of real income will not only include the resource costs of smuggling but also the induced reduction of exports which will decrease the gain in trade. Fig. 6.1 shows the resulting welfare situation.



(Fig. 6.1)

ΔW_1 : Total welfare loss in terms of exportable goods.

C : Smuggling costs.

S : Smuggling volume.

L : Legal imports volume.

STC : Smuggling Transformation Curve.

P^f : Free trade world price.

So far we have only considered the case that the government reaction will finally lead to welfare reduction. In fact, if the smugglers can expect the response of the government, apart from carrying out their smuggling activities, they will also import some goods legally to the extent that the signalling from reduction in imports (or to the extreme that legal imports is completely eliminated) disappeared. In this sense, legal imports can reduce the detecting power of the government. Or in other words, legal trade can provide camouflage for smuggling which can reduce the smuggling costs from government reaction. Then the domestic price may still have a chance to deviate from the tariff-included price.

If the amount of legal goods required for covering the smuggling activities is not too large, the loss from legal trade by the smugglers (the difference between the revenue from legal trade and the legal import costs, i.e. $(P^s - P^f(1+t))L$ can be compensated by the gain in smuggling. It is possible for the domestic price to be lower than the tariff-included world price with the existence of legal trade. Once the domestic price can deviate from the tariff-included price, smuggling may not necessarily come to the welfare loss situation. We should notice that in this situation, all the legal traders must be engaged in smuggling if deviation of domestic price from tariff-included price is the final result. If some of the legal traders has no connection with smugglers and they can still exist in the market, the domestic price must still be equal to the tariff-included price which indicates that the economy must be suffering a loss from smuggling.

The above idea is best expressed in Pitt (1984). He modified Bhagwati's framework on smuggling by adding the camouflage effect of legal trade in smuggling.[2] The following is the summary of his work:

$\underline{s} = g(l,s)$: the quantity of smuggled goods that successfully exit the domestic economy

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[2]However, his camouflage effect is somewhat different from the above. This covering effect on smuggling by legal goods is functioning within the same period, rather than based on the consideration on government reaction in the future.

s : the quantity of smuggled goods prepared for exiting the countries. It can be viewed as the input for smuggling. The difference between s and s will then be the smuggling costs.

l : the quantity of legally traded goods.

q^s : the domestic price of the exportable goods.

q^f : the international price of the exportable goods.

The function g has the following properties:

$$(6.2a) \qquad g_l \geq 0$$
$$(6.2b) \qquad 1 \geq g_s \geq 0$$
$$(6.2c) \qquad s \geq \underline{s}$$

Assumption (4.2a) ensures that l can reduce the costs of smuggling. Assumption (4.2b) ensures that the marginal costs of smuggling is positive and assumption (4.2c) ensures that smuggling costs can never be negative.

To maximize profit,

$$\Pi = q^f g(l,s) + q^f(1-t)l - q^s(l+s),$$

with F.O.C.

$$q^f g_l + q^f(1-t) = q^s$$
$$q^f g_s = q^s$$

Under perfect competition, zero profit is earned,

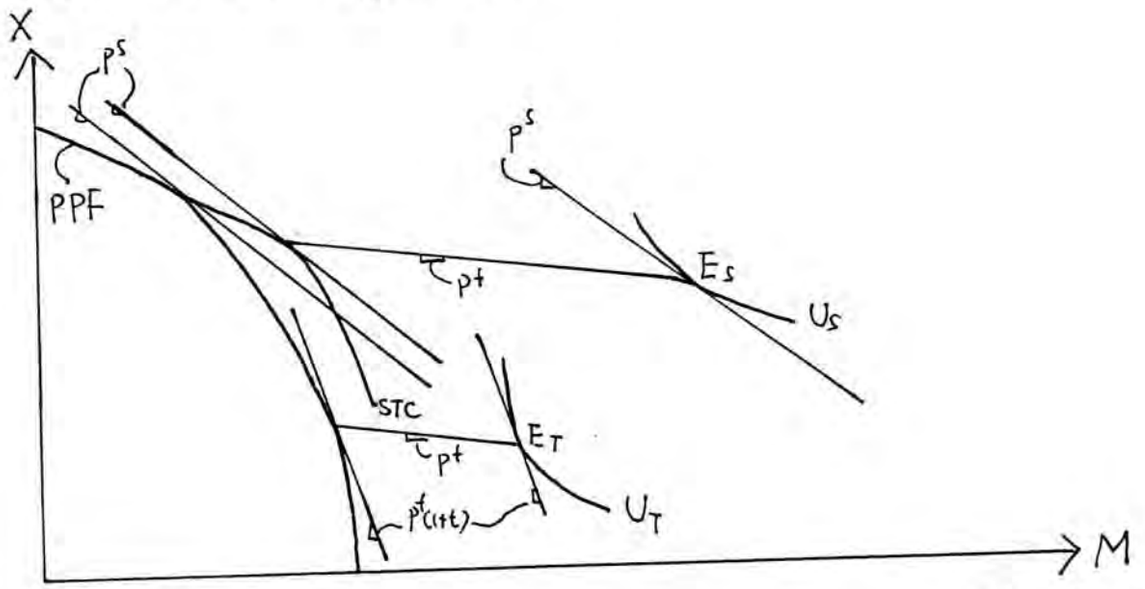
$$(6.3) \qquad q^s = q^f \frac{s}{l+s} + q^f(1-t)\frac{l}{l+s}$$

Thus we find that the domestic price of the exportable goods will be the weighted average of the free trade price and the tariff-included price.

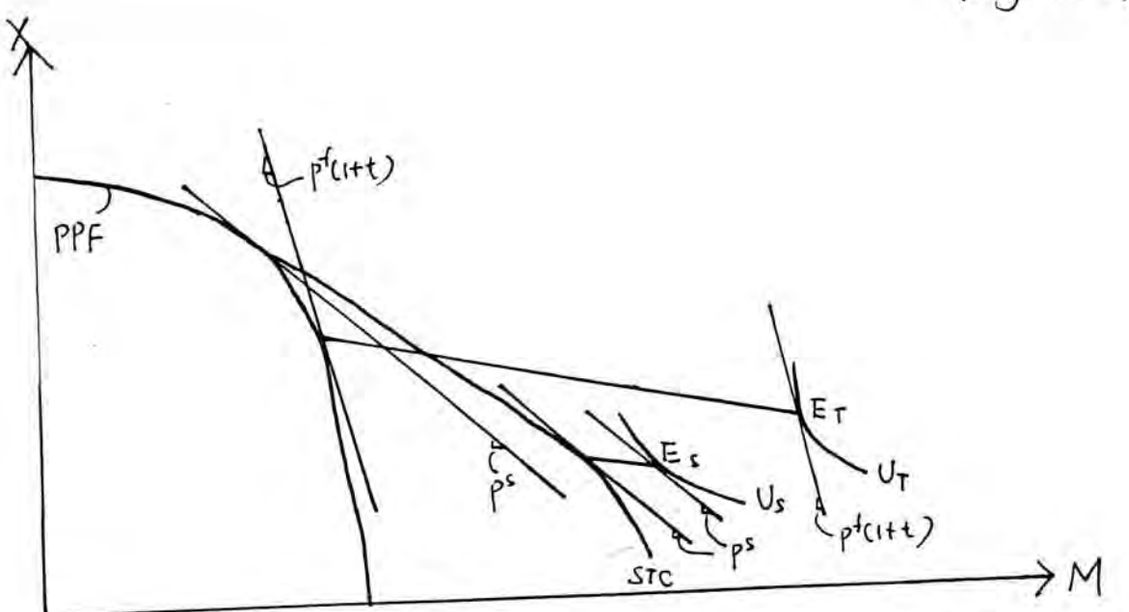
In the following paragraph, Pitt's framework will be the basis for the welfare analysis with the following modification. Firstly, his framework is for the case study of smuggling activity in Indonesia where the major smuggling item is the exports of rubber. But turning to the case in China, smuggling occurs mainly in imports, thus the term 1-t will become 1+t. Secondly, he assumed that the smuggling costs will be represented by the goods sunk into the sea. This means that the costs is accounted in terms of the smuggling commodities. However, the smuggling costs will be very dependent on the price of the smuggling goods. When the price doubles, the smuggling costs will double as well. This will be acceptable if the loss of seized goods is the only costs of smuggling. But the real loss is the resources used in smuggling which may not vary directly with the prices of the smuggled commodities. Thus, instead of using initial smuggled volume, s, as an input of finally successfully smuggled volume, $\underline{s}$, a cost function is used to replace it in the profit function of the smuggler.

From Pitt's works, there will be no unique welfare-rank for smuggling when domestic price can be lowered through smuggling. Smuggling must lead to welfare loss

when domestic price remains the same as tariff-included price. In fact, the conclusion is no different from Bhagwati suggestion except that legal trade may coexist with smuggling when domestic price deviates from tariff-included price. The welfare comparison is summarized in the Fig. 6.2a and Fig. 6.2b.



(Fig. 6.2a)



(Fig. 6.2b)

P^s : Domestic prices with smuggling.

E_S : Equilibrium position with smuggling.

E_T : Equilibrium position with non-smuggling.

In order to simplify our analysis, we assume that the smuggled imported commodities in China are products that are not produced domestically. This can be rationalized by the fact that the quality of these import commodities are quite different from that of domestic outputs. Some examples are automobiles and household electrical appliances. Their demand in China is mainly due to their foreign origin, which is a symbol of superior quality. Through this assumption, the domestic supply sides will be no longer needed to be considered in our welfare analysis. In addition, the domestic supply may not respond to the domestic price as in a market economy since the economy of China has not yet thoroughly transformed to a market economy. Some industries that have foreign competition, such as the automobile industry, are still state-owned enterprises. Thus we assume that no import-competing production of that good. We can then remove the PPF from the two goods diagram.

Furthermore, Pitt employed the two goods framework in his analysis. The two goods are the importable and the exportable goods. But in our empirical study, it is quite difficult to use the aggregate data for exports and imports as the two goods since smuggling exists in limited types of commodities. The contrast of smuggling and legal trade volume will be blunt. Thus we let a particular imported commodity as one of the goods and the national income as the other goods in the two goods model. Then we

must assume that the welfare analysis compares only the welfare between smuggling and non-smuggling of that particular commodity, i.e. the smuggling condition (with or without smuggling) of other commodities is kept constant.

Here we found that the X-axis represents the quantity of a particular commodity, X, in which smuggling is involved. Notice that from the previous assumption, the imported commodity has no corresponding domestic output, thus X can simply represent the import demand quantity of this commodity and consumption on domestic product can be neglected.

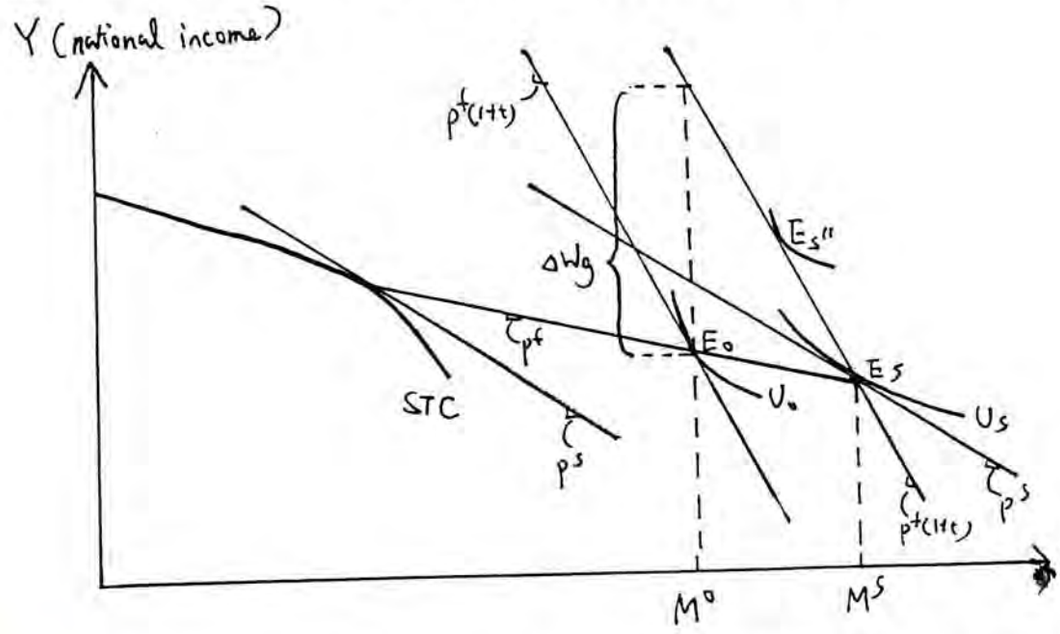
The Y-axis in fact represents the expenditure on other goods. The Y-coordinate of every point on the budget line represents the real income minus the consumption expenditure on X under general equilibrium. Then the vertical intercept of the hypothetical budget line will be the national income, Y, which can represent the welfare in welfare comparison.

By comparing the real income of the economy under smuggling and non-smuggling of this commodity X, we can conclude that this particular smuggling activity is beneficial to the economy or not.

With the present existence of smuggling, the national

income is represented by the data of national income provided, i.e. Y^s. But the national income of non-smuggling, Y^T, in this period is not known as this situation does not occur. Some more work is needed so that welfare comparison is feasible.

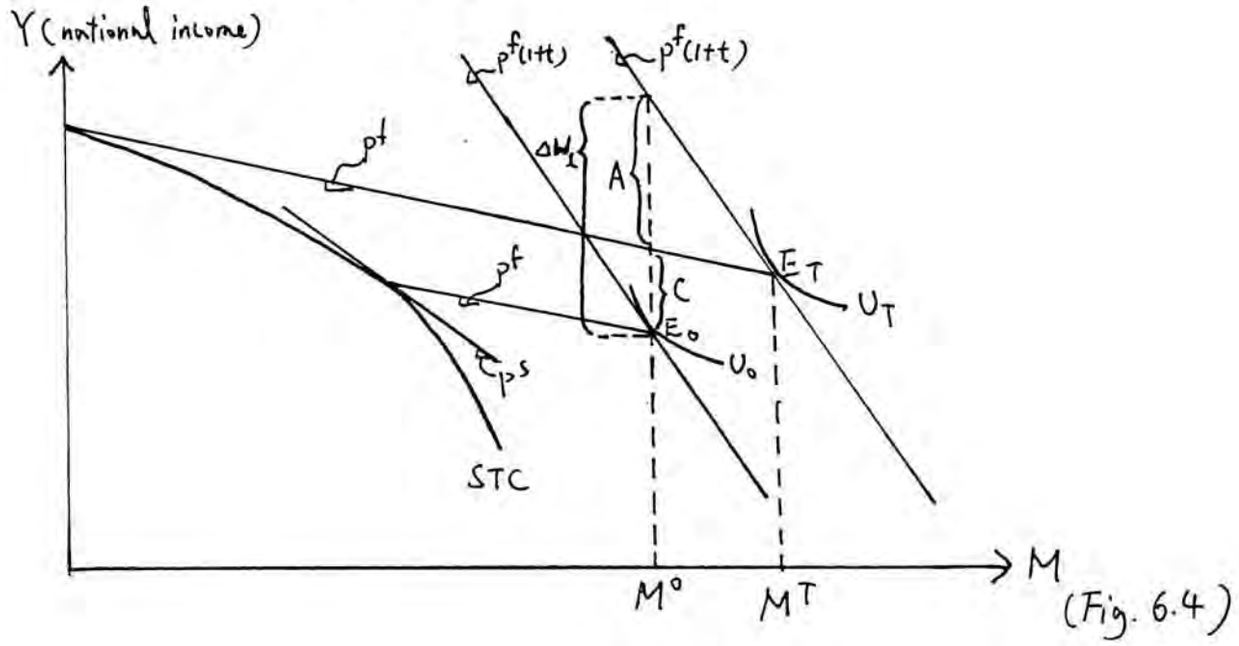
In order to perform the welfare analysis, i.e. to see whether smuggling will lead to net gain or net loss to the economy, the effects of welfare improvement and welfare reduction by smuggling should be isolated. By finding their corresponding magnitude separately, the net gain or loss can be verified. We first assume that the domestic price has not deviated (i.e. with smuggling costs remains here) and changed from p^s back to $p^f(1+t)$. The equilibrium position will move from point E_s to point E_0. Then the welfare change will be $-\Delta W_g$. This is the welfare gain from smuggling because reversing the process, ΔW_g is the welfare gain from domestic price deviation. (Fig. 6.3)



(Fig. 6.3)

Secondly, then the smuggling activity is completely

eliminated such that the equilibrium position moves from E_0 to E_T which is the equilibrium of non-smuggling. This can be done by adding back the smuggling costs to the national income at E_0, Y^0. The welfare change will be ΔW_1 which is the welfare loss of smuggling which is induced by the smuggling costs. (Fig. 6.4)



(Fig. 6.4)

Let us consider the gain from smuggling. From Fig. 6.3, the welfare gain, ΔW_g, is due to the consumption gain from the deviation of domestic price from tariff-included price. The consumption gain is then represented by the increasing exports for the payment of the imports which lead to a rise in national income.[3] To measure the magnitude of ΔW_g, we must firstly construct a imports demand function for the commodity.

$$M = F(Y, P^d) \qquad (6.4)$$

[3]In the general equilibrium framework, balance trade is always assumed.

The domestic relative price of the commodity, p^d, is computed by dividing the nominal price of the commodity by the general price level of the economy.

With the import demand function, we can solve for M^0, which is the import demand at E_0, by the equation:

$$M^0 = F(Y^S - \Delta W^g, p^f(1+t)) \qquad (6.5)$$

Since when using income as an welfare index for welfare comparsion, income at different utility levels should face equal price for feasible comparsion, therefore, Y^s will be the national income at price $p^f(1+t)$. ΔW^g is the amount of reduction/increase in import value times the tariff rate, i.e.,

$$\begin{aligned} \Delta W_g &= (M^s - M^0)p^f(1+t) - (M^S - M^0)p^f \\ &= (M^s - M^0)p^f t \end{aligned} \qquad (6.6a)$$

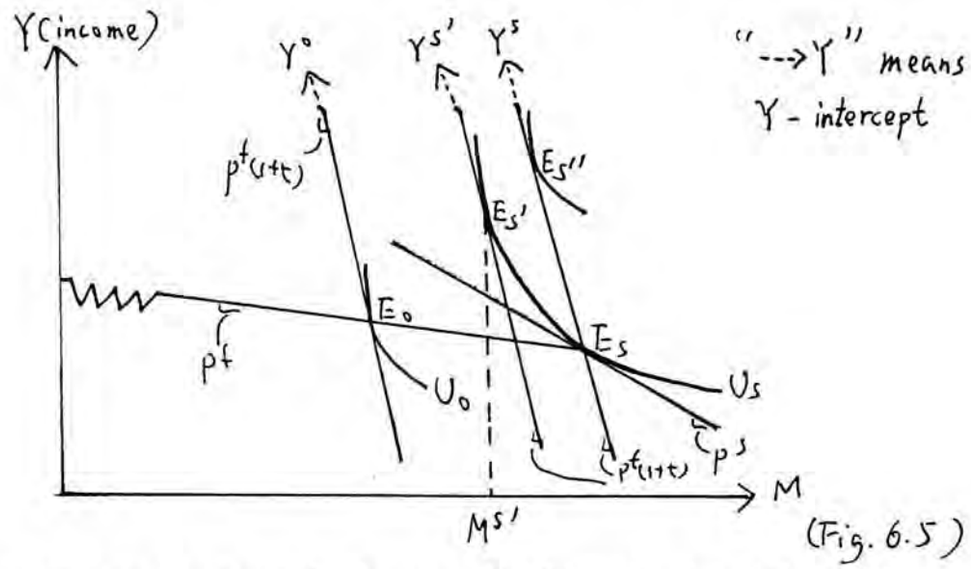
M^s is the imports demand under smuggling. Therefore,

$$M^0 = F(Y^S - (M^S - M^0)p^f t, p^f(1+t)) \qquad (6.6b)$$

Once we can solve for M^0, by equation 6.6b, ΔW^g can also be solved. As a result, Y^0 can be calculated.

Obviously, this method has a little drawback because with this calculation, the welfare gain is overestimated

since the budget line, Y^s, is not tangent to the social indifference curve, U_s. The actual welfare gain should be the difference between $Y^{s'}$ (income at which budget line is tangent to U_s facing the tariff-included world price) and Y^0. (Fig. 6.5)



(Fig. 6.5)

However, the position of $E_{s'}$ is difficult to identify because both of the $Y^{s'}$ and $M^{s'}$ are unknown. Therefore using Y^s for welfare analysis will overstate the welfare gain. How can Y^s be determined? Y^s can be obtained by adding the product of total import (both legal and illegal) and price disparity $(p^f(1+t) - p^s)$ to compensate for the reported national income so that the original consumption bundle can be determined.

Now, we can turn to the loss from smuggling. The loss from smuggling is mainly due to the real cost from smuggling when national income in real terms is used as a measure of welfare. But from Fig. 6.4, we find that the loss should be the distance A+C which is larger than C, the smuggling costs. It is because when real costs is involved, the reduction in income will lead to the decline

of the import demand at constant prices. Decreasing import will in turn decrease export which will cause further decrease of national income.

From Fig. 6.4, A in fact is the amount of tariff revenue reduced due to the induced decline of import demand by the smuggling costs.

Thus, for welfare loss,

$$\Delta W^{l} = A+C \qquad (6.7)$$

where A = subsequent loss of consumption gain in trade

$= (M^T - M^0)p^f t$

C = smuggling costs

$$M^T = F(Y^0+\Delta W^{l}, P^f(1+t)) = F(Y^0+C+(M^T-M^0)P^f t, P^f(1+t)) \qquad (6.8)$$

$$where\ Y^0=Y^S-\Delta W^g$$

M^T is the imports demand under non-smuggling. From the computation of welfare gain, the value of M^0 and Y^0 are calculated. Then if the smuggling costs, C, can be known, we can solve for the equation 6.8 and get M^T. With M^T and C known, welfare loss can be obtained. To obtain C, recall the equation 6.3 that the domestic price is the weighted average of the free trade price and the tariff-included price. Once we know their values together with the trade volume of both legal and smuggling, the smuggling costs

can be obtained.

Finally, the net impact of smuggling on welfare can be known.

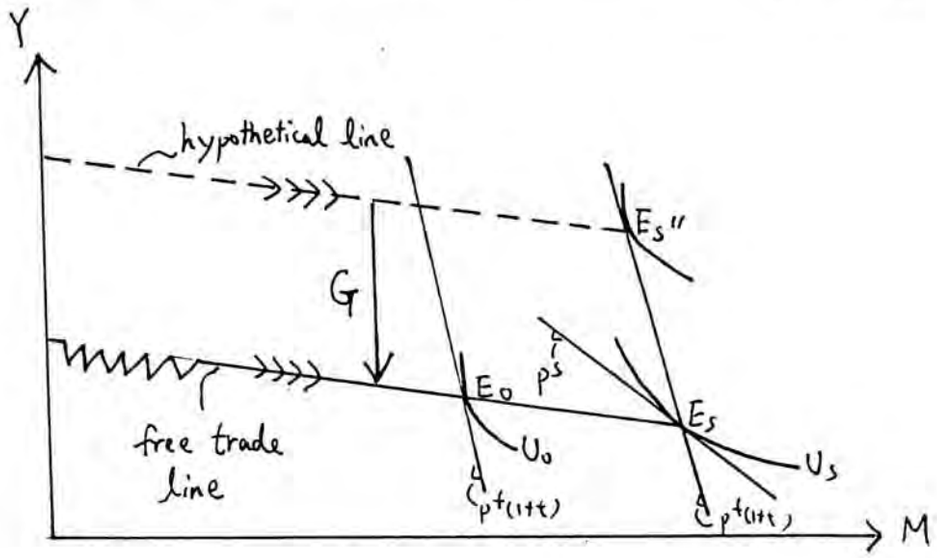
$$\Delta W = \Delta W^g - \Delta W^l \begin{matrix} > \\ = \\ < \end{matrix} 0$$

Thus, the key point for this method of welfare analysis is the import demand function. There are two major problems to deal with. One is the estimation of these import demand functions. The other will be the functional form of the import demand functions.

For the first problem, the data involved in the estimation of the import demand function should include both the data from the period with and without smuggling. Moreover, with the assumption of a small economy, there is no need to consider the supply side as the free trade price and tariff rate are given. But because national income is one of the explanatory variables, the data should at most only be yearly data. Then with limited yearly observation, the number of explanatory variables is also limited for achieving a satisfactory result.

The other problem will be the functional form of the import demand function. Since M^0 and M^T are needed to be solved by the function, if the functional form is too

complicated, there will be great difficulty in solving them. However, these problems can be avoided. Recalling Fig. 6.3, it can be presented in another way. (Fig. 6.6)



(Fig. 6.6)

For the welfare gain in smuggling, the initial impact is the price disparity which stimulates foreign trade. From Fig. 6.6, G represents this initial impact. (Notice that here the domestic price is change from P^s to $P^f(1+t)$, G should in fact represents the initial loss if price disparity disappears.)

$$G = P^f t(M^s - M^{s''}) \qquad (6.9)$$

Let's draw a hypothetical line which is parallel to world price and passes through point $E_{s''}$. We find that G is the vertical distance between this hypothetical line and the free trade line. When this initial impact, G, is deducted from the income Y^s to arrive at E_0, it follows exactly the same way as the initial impact of smuggling costs, C, deducting from Y^T to arrive at E_0, except with a different magnitude. If C is larger (smaller) than G, Y^T

must be larger (smaller) than Y^s under certain income elasticity requirement.[4] Therefore, without getting Y^0, conclusion about the direction of welfare change by smuggling can be drawn by simply comparing C and G. Thus the analysis method can be simplified.

So far we have considered the impact of smuggling has effect on the trade volume, i.e. the exports/imports stimulated in general equilibrium. One may question that for a particular type of good, the increasing demand may not necessarily stimulate exports. Rather, the trade balance is worsened and vice versa. This leads to the partial equilibrium analysis. Then the harm from smuggling will only be due to the smuggling costs. The benefit will be from the gain in consumer surplus. To compute the net gain, consumer surplus derived from the import demand function is compared with the costs. In the following paragraph, the welfare analysis will also employ this method as a supplement to the former.

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[4]See Appendix B for details.

List of symbols[5]

p^f : world price

p^d : domestic price

p^s : domestic price under smuggling

t : tariff rate

S : smuggling volume

L : legal import volume

C : costs of smuggling

G : see pp.105

STC : smuggling transformation curve

U_S : social utility level under smuggling

U_T : social utility level without smuggling

ΔW^g : welfare gain from smuggling

ΔW^l : welfare loss from smuggling

E_S : equilibrium position under smuggling

E_T : equilibrium position without smuggling

E_0 : equilibrium position with smuggling costs incurred only

$E_{S'}$: equilibrium position (see Fig. 6.5)

$E_{S''}$: equilibrium position (see Fig. 6.3 and Fig. 6.5)

Y^S : income at E_S

Y^T : income at E_T

Y^0 : income at E_0

$Y^{S'}$: income at $E_{S'}$

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[5]Please notice that the symbols employed by Pitt (pp.93 - pp.95) are somewhat different to the symbols listed below.

M^S : total import at E_S

M^T : total import at E_T

M^0 : total import at E_0

$M^{S"}$: total import at $E_{S"}$

Chapter 7

Welfare Analysis:

The Empirical Study

Welfare Analysis on smuggling of Television Sets: a typical case of smuggling between Hongkong and China

In the smuggling activities between Hongkong and China, the most popular items are tobacco, automobile, television set and video recorder. These goods are items most frequently seized by the Customs. Moreover, the empirical works in Chapter 4 has shown that the commodities classified in section 0&1 and section 7, in which the above items are included, have smuggling existed. Thus they are considered to be the major commodities of smuggling. With a lower living standard in China, these goods are luxuries there. But with rapid economic development, especially in the coastal areas, the demand for them are huge. However, domestic outputs cannot satisfy the growing demand. One major factor is the lower quality of domestic products when compared with foreign ones. As a result, people prefer foreign products. But with the government policy of protecting the domestic industry and reducing trade deficit, trade barriers are imposed on these goods. In 1985, with already high tariff, additional Imports Adjustment Duties are imposed such that

the effective tariff rate for television sets and automobiles reach 170% and 230% respectively (see Table 7.1). With this trade barriers, most of the consumers cannot afford the items.

Table 7.1 Tariff rate of China in 1985 to 1991

	Tariff rate	Imports Adjustment Duties rate
Television sets	100%	70%
Automobile	150%	80%
Tobacco	180%	-

Source: Almanac of China's Foreign Relations and Trade, various issues.

To complete the welfare analysis on smuggling between Hongkong and China, it will be wise to estimate the welfare impacts of these popular smuggled goods. However, difficulties arise when dealing with tobacco,[1] automobiles and video recorders. One major problem is the lack of domestic prices data. Without domestic price, not only that the price disparity cannot be known, but also the smuggling costs will become a mystery. The only way is to estimate the maximum possible loss by smuggling by employing Bhagwati's framework of calculating the

[1]Before 1991, cigarette is believed to be smuggled from Hongkong into China. However, in 1991, the duty imposed on cigarette is raised to a level of about 200% by Hongkong government. The direction of smuggling seems to reverse.

smuggling costs using equation 6.1.

Furthermore, smuggled automobiles are found to be stolen cars from Hongkong. The theoretical framework discussed before therefore cannot be used. Since stolen cars require no purchasing, then if smuggling costs is significantly low, the domestic price of smuggled cars may even fall below the world price. The economy of China then benefits from smuggling. Due to the comparative high risk faced by the smugglers and the consumers, it is reasonable to believe that the market of the legal products and the illegal products will be separated. The illegal goods will most likely be monopolized. The welfare condition becomes rather complicated. Nevertheless, whether it is beneficial to China's economy, it is worse off for Hongkong.

On the other hand, video recorders become consumer item in China only in recent years. Thus the lack of time series data makes the construction of import demand function for it difficult. However, since television set is a complement of video recorder and have similar smuggling costs and tariff, their respective welfare impacts are believed to be identical.

Fortunately, the above problems are absent in the welfare analysis on smuggling of television sets. Its demand in China has lasted since the beginning of 80's. Relatively long time series data are available (1980

onwards). Moreover, and most important, its domestic price is available. Thus welfare comparison can be performed.

There are three major steps in the following welfare analysis. Firstly, employing the same method as in Chapter 4, the smuggling volume of television sets is predicted. Then the import demand on televisions sets in China is estimated. Finally, the smuggling costs, C, and the initial gain, G, will be computed and compared by the two methods discussed before.

Prediction of Smuggling Volume of Television Sets

In the late 80, the demand on colour television sets is relatively higher than that of monochrome ones. Also, most of the seized goods of television sets are the colour type. It is believed that they form the majority of smuggled television sets. Moreover, since households in Hongkong now rarely purchase monochrome television sets, it is hard to estimate the retained import demand of Hongkong for these. Thus the following estimation will focus only on colour television sets for the prediction of smuggling volume of television sets. (We assume that no monochrome television sets are smuggled into China from Hongkong in the late 80's.)

Since the quantity of the commodity is directly

available this time, the problem of price data can be solved by dividing the trade value by trade quantity. Thus we can estimate the normal retained import demand starting from 1976 (since quarterly data of Hongkong GDP is available starting from 1976). Again, it is assumed that there is no smuggling of colour television sets before 1988.[2] The following is the estimation results and the forecasting residuals.

$$\begin{array}{c} lnM_t = -31.189 + 3.5467 lnY_t + 1.8465 lnP_t \\ \quad (4.145) \quad (6.079) \quad (3.466) \\ + 0.29747 D2_t + 0.17571 D4_t \\ \quad (2.651) \quad (1.562) \\ ADJUSTED\ R^2 = 0.6936 \end{array}$$

From the estimated function, the price elasticity is found to be positive. It can be explained by the improving quality of colour television. Thus price function as a signal of quality. With higher quality/technology, the demand will obvious be higher following the higher price.

The R^2 is only about 0.7, the predictive power of this imports demand function is not high enough. We find that with 5% significant level, less than half of the periods

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[2]In fact, the assumption of 1987 and 1986 as the starting year of rampant smuggling has been tried. Due to unsatisfactory results (the R^2 are too low), they have been abandoned. Moreover, in 1988, the price reforms allows greater flexibility of domestic price to deviate from official target price so that gain is possible.

have smuggling.

Table 7.2 The Forecasting Residuals of Retained Imports Demand on Colour Television Sets of Hongkong.

	RESIDUAL	STD ERROR	t	t > 1.684	t > 1.303
1988	0.53395	0.32574	1.639190	-	*
	0.136	0.33831	0.401998	-	-
	0.76434	0.34244	2.232040	*	*
	0.36842	0.34989	1.052959	-	-
1989	0.4485	0.33285	1.347453	-	*
	0.45941	0.33742	1.361537	-	*
	0.16518	0.33803	0.488654	-	-
	-0.08371	0.33831	-0.24745	-	-
1990	0.37682	0.33107	1.138188	-	-
	0.44346	0.33904	1.307987	-	*
	0.60116	0.34459	1.744566	*	*
	0.68833	0.34335	2.004747	*	*
1991	1.0775	0.33075	3.257747	*	*
	1.0392	0.34601	3.003381	*	*
	0.93287	0.34311	2.718865	*	*
	0.49064	0.35149	1.395886	-	*

Note: "*" means that the residual passes the significant level while "-" means that the residual is insignificant from zero.

However, we find that the predicted pattern is quite similar to the prediction results of Section 7, especially the forecasting residuals are both found to be negative in 4th quarter of 1989. Moreover, the trend of deviation from forecasting residuals is very strong after 1990. Nevertheless, three sets of predicted smuggling volume are computed, i.e., with 5%, 10% and 100% significant level of rejecting zero residuals. (For simplicity, we call these as "5%", "10%" and "ALL" estimation results of smuggling volume.)

Table 7.3 The Estimated Smuggling Volume (no.) of Television Sets from Hongkong to China.

	(5%)	(10%)	ALL
1988	257047	350060	516012
1989	0	206715	224885
1990	479374	590262	646306
1991	951589	1168151	1168151

We find that the smuggling volume increased from 1988 to 1991 except for a drop in 1989. In 1988, the smuggling volume for television sets ranged from 257 thousand to 516 thousand. In 1989, the maximum possible number of smuggling television sets was only about 225 thousand which is smaller than the "5%" estimation of smuggling volume in 1988. Thus, it seems that the smuggling was not

rampant in this year. One reason may be due to the political crisis in China in 1989 which led to the strengthening of security along the border. Then in 1990, the smuggling volume rose again to between 479 thousand and 646 thousand. A sharp rise of smuggling in 1991 brought the number to 952 thousand or even 1.168 million. With the consistency and significance of the figures, we can believe that the smuggling problem in 1991 was the most serious one within the four years.

The Estimation of Import Demand on Colour Television Sets of China

From the official data provided, the import demand for colour television sets in China has fluctuated markedly. The first peak years of importing television sets were 1980 and 1981, with the import volume of 2.45 and 3.98 million. The first drive of economic reforms occurred at that time and income of the coastal areas rose rapidly. Then the imports volume dropped to 1.04 million in 1983. The second peak year was 1985 with an import volume of up to 5.09 million. Then the volume quantity dropped to around one million per year from 1986 to 1989. This was the period after China strengthens her trade barriers by sharply raising the effective tariff rate. However, the recorded import further dropped to 670 and 330 thousand in 1990 and 1991. In comparison, the smuggling volume accounted for about one third of the

total import volume in 1988. But in 1990 and 1991, its weight in total import rose to about one half and over 70% respectively. Thus the official data also support the above estimates on the smuggling of the television sets.

Table 7.4 The Recorded Imports of Television Sets in China.

	QUANTITY	VALUE
1980	2450	196020
1981	3980	314240
1982	1040	109770
1983	540	49920
1984	1470	254920
1985	5090	993900
1986	1390	305490
1987	1070	185870
1988	1290	237030
1989	1300	230110
1990	670	103460
1991	330	56200
	Unit:1000	Unit:US$1000

Source: China's Foreign Economic Statistics 1979-1991.

The predicted smuggling volume is then added to legal trade volume to get the total import demand. Since we have three sets of estimated smuggling volume, three sets of total import demand are available, then three separate

import demand functions will be estimated.

It is apparent that the import demand function of television sets depends on income and price. With the strategy of "allowing somebody to be wealthier first", the income distribution in China has become very uneven during the economic reforming period. The television set is therefore treated as either luxury or normal good depending on the development pace of different area. It is obvious that the major demand for foreign television sets, which are not affordable for the poorer area in China, is from the coastal areas. As so far Guangdong has played a leading role in the economic reform in China, the national income of Guangdong can best be used as a proxy to represent the income of the wealthier class in China. Furthermore, because of proximity, smuggling goods from Hongkong enter mainly into Guangdong. Thus the national income of Guangdong is used in the estimation of the import demand on television sets under the assumption that most of the imports will be consumed in Guangdong.[3]

As a result, the domestic price data (both the general price index and the price of television sets) in Guangdong will be employed in the estimation of import demand function. The official data on the domestic price

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[3]Using GNP of China in the estimation for imports demand function has been tried. With low value of R^2, the estimates for the income and price elasticities are found to be negative and positive respectively. So Guangdong GNP is employed for more satisfactory results.

in Guangdong is provided starting from 1984. The domestic price data before 1984 are missing. However, this problem can be overcome as the price was still under strict control by the state before 1988. With the international price and tariff rate provided, the domestic price can then be computed to solve the problem.

On the other hand, the data of domestic price is for domestic outputs only. Fortunately, in 1984, the domestic prices of various foreign brands of foreign made television sets are available. This can serve as a reference for adjusting the price of domestic output to represent the prices of foreign output. As Japanese made television sets are the popular consumer choice, their prices are used for the adjustment. In 1984, the price was around $1400 (reminbi) per set. At the same time, dividing the total import value by the import volume of television sets in China gets the international price (without any mark up). When it is multiplied by the tariff rate, the result is about $864. This shows that there is a mark up of about 60% if the tariff is effective. Using 60% as the mark up, the domestic price of foreign output before 1988, the free trade world price, and the tariff-included world price after 1987 are computed.

With the liberalization of prices control in 1988, the domestic price of Chinese made television sets after 1987 is directly employed with little modification. The

ratio between the domestic price of foreign output and domestic output in 1984 is used to adjust the domestic price of domestic output to represent the domestic price of foreign output after 1987.

With the assumption of constant elasticity, Cobb Douglas function is used to represent the import demand function of television sets.

$$M = KY^{\alpha}P^{\beta}$$

Again, log-linear function is used as the function for estimation. However, with only two dependent variables, national income and relative price, the estimation result is not satisfactory. Although the elasticity of income and price are positive and negative respectively, they are not significant. Furthermore, the R^2 is too small (around 0.02). This happening is due to rapid shifts in the demand pattern in China as a result of rapid economic development as well as frequent policy changes. Thus, it requires some dummy variables to be added into the demand function to give significant result. The demand functions with dummy variables are then estimated as follow:[4]

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[4]Date Source: Guangdong Statistical Yearbook, various issues.
Gunagdong Price Yearbook, various issues.
China Foreign Economic Statistics 1979-91.

(ALL)

$$lnM_t = 6.9357 + 2.4012lnY_t - 0.97209lnP_t$$
$$(14.15) \quad (3.127) \quad (-3.984)$$
$$- 0.9036D1_t - 2.1451D2_t - 1.8922D3_t lnY_t$$
$$(-3.429) \quad (-5.959) \quad (-6.153)$$
$$+ 0.90589D4_t + 1.808D5_t + 2.3852D6_t$$
$$(7.012) \quad (4.806) \quad (5.853)$$

$$ADJUSTEDR^2 = 0.9721$$

(10%)

$$lnM_t = 7.0101 + 2.301lnY_t - 0.9926lnP_t$$
$$(21.39) \quad (4.48) \quad (-6.082)$$
$$- 0.8656D1_t - 2.0889D2_t - 1.8361D3_t lnY_t$$
$$(-4.913) \quad (-8.678) \quad (-8.93)$$
$$+ 0.9121D4_t + 1.8279D5_t + 2.4436D6_t$$
$$(10.56) \quad (7.268) \quad (8.967)$$

$$ADJUSTEDR^2 = 0.9875$$

(5%)

$$lnM_t = 7.1724 + 1.8479lnY_t - 0.82037lnP_t$$
$$(12.84) \quad (2.111) \quad (-2.95)$$
$$- 0.95189D1_t - 2.179D2_t - 1.8579D3_t lnY_t$$
$$(-3.17) \quad (-5.311) \quad (-5.301)$$
$$+ 0.85249D4_t + 1.8587D5_t + 2.4187D6_t$$
$$(5.787) \quad (4.336) \quad (5.208)$$

$$ADJUSTEDR^2 = 0.9648$$

Table 7.5 The Dummy Variables used in the Estimation of Imports Demand on Television Set of China

	D1	D2	D3	D4	D5	D6
1980	0	0	0	0	0	0
1981	0	0	0	1	0	0
1982	1	0	0	1	0	0
1983	1	0	0	0	0	0
1984	0	1	0	0	1	0
1985	1	0	0	0	0	1
1986	0	1	0	0	0	1
1987	0	1	0	0	1	0
1988	0	1	0	0	1	0
1989	0	1	0	0	1	0
1990	0	0	1	0	1	0
1991	0	0	1	0	1	0

The dummies are set according to the changes in economic environment in Guangdong.[5] D1, D2 and D3 represent the three stages of development in the 80's to early 90's. Zero value is assigned to D1, D2 and D3 of 1980 and 1981 which are the periods of the first reforms drive. Value of one is assigned to D1 of 1982 to 1985 which are the period of second reforms drive. D2 is one in 1986 to 1989 which is the latter stage of economics

[5]The following interpretation of the dummy variables is only suggestive. Other interpretations are possible.

reforms in the 80's. From the estimation results, we find that the estimates of parameters of D1 and D2 are both negative. Moreover, the magnitude of D2 is larger than D1. This means that the constant term of the Cobb-Douglas function is decreasing overtime. This implies that the demand is shrinking overtime. However, the income elasticity is still very elastic. One explanation is that the income disparity in China become more serious in the late 80's than in the beginning. Thus only a relatively fewer wealthier households can afford to replace their old television sets with new ones. This phenomena can be further supported by the dummy D3 which alters the income elasticity in 1990 and 1991. In this period, the income elasticity becomes less than 1. Thus, television sets become a necessity for the wealthier class.

D4, D5 and D6 represent the changes in demand for quality of television sets. From 1980 to 1983, demand was mainly for monochrome ones. After 1984, people can afford colour television sets. Thus the import demand for television sets is firstly divided into two segments, from 1980 to 1983 and from 1984 to 1991. But there are sharp rises in the demand within both of these periods. From 1980 to 1983, the sharp rise happened in 1981 and 1982; while from 1984 to 1991, the sharp rise occurred in 1985 and 1986. These sharp rises can be explained by the fact that when income increases, people have a strong desire to improve their living standard. As television set is

leisure good, the demand for it will experience a sharp rise when people become more affluent. However, since television set is durable consumer good, the demand for it will become stable again after a short time. Thus, D4, D5 and D6 will have the value of one when the year is 1981 to 1982, 1984 to 1991 (except 1985 and 1986) and 1985 to 1986 respectively.

Due to the very erratic shifts in demand patterns in China, the use of ad hoc dummy variables is unavoidable. The estimated demand function and the estimates of welfare impacts of smuggling should be regarded as suggestive rather than definitive. As the economic system in China settles down and becomes more stable in the future, better estimates of China's imports demand and better estimates of the welfare impacts of smuggling can hopefully be made with the present methodology.

Comparison between Gain and Costs

Method 1: The general equilibrium framework

Costs is computed first.[6] By equation 6.2, smuggling costs can be found by the price disparity from smuggling. As smuggling between Hongkong and China chiefly occur in imports, equation 6.2 is changed to:

[6]It makes no difference in the computation of smuggling costs in method 1 and method 2 as it does not depend on the imports demand function.

$$P^s = P^f \frac{s}{1+s} + \frac{C}{1+s} + P^f(1+t)\frac{1}{1+s}$$

The costs of smuggling and average costs have been calculated as follows:

Table 7.6 The Estimation of Total Costs and Average Costs of Smuggling.

		($1000)	($ per set)
		C	AC
ALL	1988	730534	1416
	1989	403467	1793
	1990	943834	1461
	1991	1125326	963
		C	AC
(10%)	1988	442689	1265
	1989	371189	1793
	1990	846006	1434
	1991	1125326	963
		C	AC
(5%)	1988	281427	1095
	1989	-	-
	1990	652097	1361
	1991	845447	888

The computation result shows that the average costs for the smuggling of television sets is around $1500 per set from 1988 to 1990. But there is a significant drop to below one thousand dollars in 1991. In 1989, the domestic price is even a little bit higher than the tariff-included world price. Then the average costs of smuggling must be equal to the domestic price (tariff-included world price) and the total costs of smuggling will then be the amount equal to $P^f tS$ if smuggling really exists in 1989.

To compute the gain from smuggling, G, which is equal to $P^f t(M^S - M^{S"})$, $M^{S"}$ must first be found by the imports demand functions.

$$M^{S''} = F(Y^S + M^S(P^f(1+t) - P^S), P^f(1+t))$$

$M^{S"}$ is the import demand when price changes from P^S to $P^f(1+t)$. The term $M^{S"}(P^f(1+t) - P^S)$ is used to compensate the income so as to maintain the same income level.[7] Moreover, since $M^{S"}$ is calculated from the estimated import demand function, there exists a problem that whether the residuals got from the estimation of China's import demand function, which will directly affect the constant term of the Cobb-Douglas function, should be included in the

[7]In a Cobb Douglas function and with a small volume in imports comparing to the national income, the impact of adding this term to the national income is extremely small.

computation.[8] Thus two sets of $M^{S"}$ are calculated, with and without the residuals.

Table 7.7a The Estimation of Gain from Smuggling, with the consideration of residuals. ($1000)

		Ms"	G
ALL	1988	1730.538	140448
	1989	1525	0
	1990	1206.340	221772
	1991	1059.771	1083267
		Ms"	G
(10%)	1988	1570.058	130174
	1989	1507	0
	1990	1152.888	216620
	1991	1052.061	1102328
		Ms"	G
(5%)	1988	1492.266	101869
	1989	1300	0
	1990	1067.654	164510
	1991	957.2917	802655

[8]If residuals are included, it implies that there is no relationship between the residual and smuggling activity in this peroid, and vice versa.

Table 7.7b The Estimation of Gain from Smuggling, without the consideration of residuals. ($1000)

		Ms"	G
ALL	1988	1524.714	523525
	1989	1525	0
	1990	1182.130	270733
	1991	1078.676	1036537
		Ms"	G
(10%)	1988	1473.900	309142
	1989	1507	0
	1990	1160.494	201238
	1991	1045.799	1117807
		Ms"	G
(5%)	1988	1383.696	303939
	1989	1300	0
	1990	1097.930	103281
	1991	933.8766	860535

Again, since there is no price disparity by smuggling, the gain in 1988 must be zero. Thus comparing the gain and costs, there must be loss incurred by smuggling if it really exists in 1989. Using the method with the consideration of residuals in estimating the gain, there are always significant net loss in 1988 and

1990. The costs are at least two times larger than the gain. Only in 1991, the costs and gains are found to have less than 4% difference.

Table 7.8a The Comparison between Costs and Gain, with the consideration of residuals. ($1000)

		C	G	NET GAIN
ALL	1988	730534	140448	-590086
	1989	403467	0	-403467
	1990	943834	221772	-722062
	1991	1125326	1083267	-42059
		C	G	NET GAIN
(10%)	1988	442689	130174	-312515
	1989	371189	0	-371189
	1990	846006	216620	-629386
	1991	1125326	1102328	-22998
		C	G	NET GAIN
(5%)	1988	281427	101869	-179558
	1989	-	-	-
	1990	652097	164510	-487587
	1991	845447	802655	-42792

The picture has changed if the residuals are not included in the computation of gain. In 1988, the

difference between gain and loss is only about 30% if "10%" or "ALL" estimated smuggling volume are used. There is even net gain if "5%" estimation is used. In 1990, the net loss situation is more stable that the costs is around 4 to 6 times the gain. In 1991, the welfare implication is somewhat similar as before. With "5%" estimation method, there is even net gain in 1991 but with still insignificant difference between costs and gain.

Table 7.8b The Comparison between Costs and Gain, without the consideration of residuals. ($1000)

		C	G	NET GAIN
ALL	1988	730534	523525	-207009
	1989	403467	0	-403467
	1990	943834	270733	-673101
	1991	1125326	1036537	-88789
		C	G	NET GAIN
(10%)	1988	442689	309142	-133547
	1989	371189	0	-371189
	1990	846006	201238	-644768
	1991	1125326	1117807	-7519
		C	G	NET GAIN
(5%)	1988	281427	303939	22512
	1989	-	-	-

1990	652097	103281	-548816
1991	845447	860535	15088

Method 2: The partial equilibrium framework

Now, the effect of stimulating trade from smuggling is neglected. The only change in the method is the computation of the gain. To Find out the gain, the import demand function will change to a function of domestic price which represents the marginal utility:

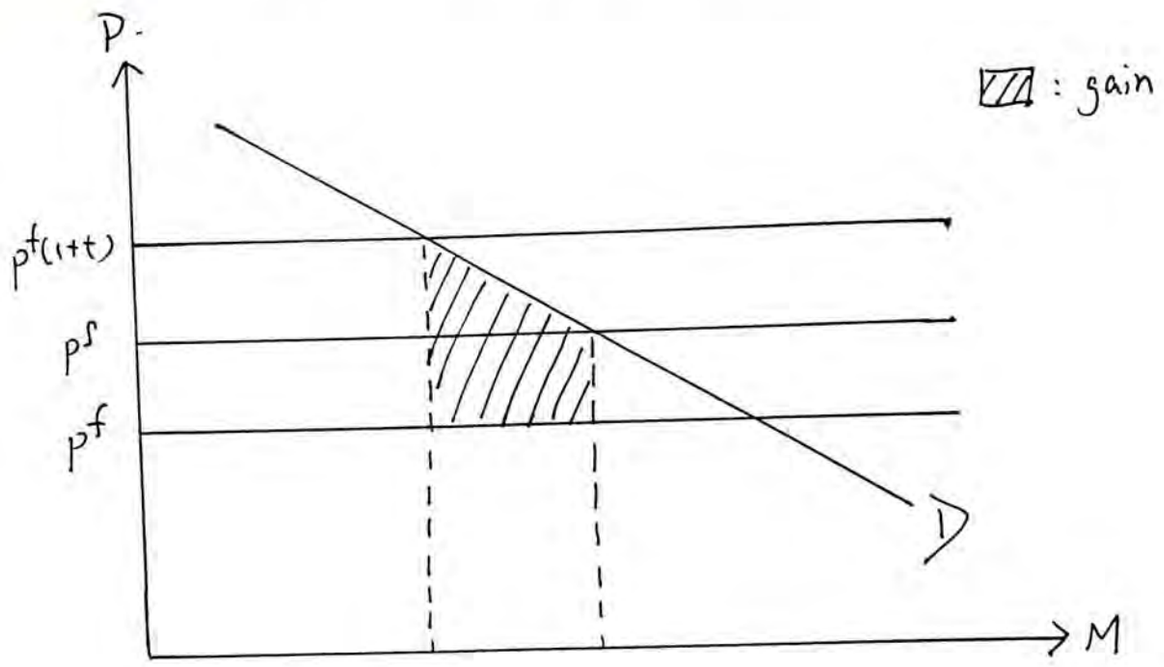
$$(7.1) \qquad P^d = \left(\frac{M}{KY^{\alpha}}\right)^{-\frac{1}{\beta}}$$

With the deviation of domestic price from tariff-included price to the smuggling price, the import demand will change from M^T to M^S. Then by integrating the marginal utility from M^T to M^S and then subtracting it by the purchasing costs of additional imports, the increase of consumer surplus can be found.(See Fig. 7.1)

$$(7.2) \qquad G = \int_{M^S}^{M^T} \left(\frac{M}{KY^{\alpha}}\right)^{-\frac{1}{\beta}} dM - P^f(M^S - M^T)$$

$$= \frac{(KY^{\alpha})^{-\frac{1}{\beta}}}{1-\frac{1}{\beta}} (M^{S^{1-\frac{1}{\beta}}} - M^{T^{1-\frac{1}{\beta}}}) - P^f(M^S - M^T$$

(7.3) $$M^T = KY^{\alpha}(P^f(1+t))^{\beta}$$



(Fig. 7.1)

The gain calculated here is smaller than in method 1. It is obvious that The estimation results of net loss is quite similar to the previous one. However, in 1991, the net gain computed without the consideration of residual is replaced by net loss.

Table 7.9a The Comparison between Costs and Gain, without the consideration of residuals. ($1000)

		C	G	NET GAIN
ALL	1988	730534	135606	-594928
	1989	403467	0	-403467
	1990	943834	206254	-737580
	1991	1125326	795572	-329754

		C	G	NET GAIN
(10%)	1988	442689	125683	-317006
	1989	371189	0	-371189
	1990	846006	201457	-644549
	1991	1125326	809254	-316072

		C	G	NET GAIN
(5%)	1988	281427	98358	-183069
	1989	-	-	-
	1990	652097	153021	-499076
	1991	845447	591176	-254271

Table 7.9b The Comparison between Costs and Gain, without the consideration of residuals. ($1000)

		C	G	NET GAIN
ALL	1988	730534	453283	-277251
	1989	403467	0	-403467
	1990	943834	247458	-696376
	1991	1125326	774464	-350862

		C	G	NET GAIN
(10%)	1988	442689	283221	-159468
	1989	371189	0	-371189
	1990	846006	188180	-657826
	1991	1125326	815918	-309408

		C	G	NET GAIN
(5%)	1988	281427	271993	-9434
	1989	-	-	-
	1990	652097	98784	-553313
	1991	845447	616059	-229388

Testing for the Significance of the Predicted Loss

One may notice that the welfare implication is greatly affected by the estimation of the price elasticity of the import demand. If the actual demand is elastic in respect to price change, the gain in consumption surplus due to the reduction of price will be relatively larger. Net welfare gain by smuggling may be possible. The larger the actual price elasticity, the larger the net welfare gain will be and vice versa.

With the smuggling costs given, we can find out the price elasticity such that the gain from smuggling will be equal to the costs, i.e., the net welfare gain is zero. Thus if the estimate of the price elasticity is significantly different from this price elasticity, with which the net welfare change by smuggling is zero, there will be strong evidence to support the welfare implication from our prediction.

To get the price elasticity of the turning point of welfare implication, the amount of increase of import demand resulting from price disparity according to this price elasticity must be found first. Let $M_s"'$ be the import demand when domestic price changes back from P^s to $P^f(1+t)$ while other things are kept constant. Since at this time, the smuggling costs, C, must equal to the gain, G,

$$C = G = P^f t(M^S - M^{S'''})$$

$$=> \quad (7.4) \qquad M^{S'''} = M^S - \frac{C}{P^f t}.$$

Once we get the value of $M^{S}"'$, its corresponding value of the price elasticity can be found.

$$M^S = KY^{S\alpha}P^{S\beta'''}$$

$$M^{S'''} = KY^{S\alpha}(P^f(1+t))^{\beta'''}$$

Dividing $M^{s}"'$ by M^s, we get:

$$\frac{M^{S'''}}{M^S} = (\frac{P^f(1+t)}{P^S})^{\beta'''}$$

$$=> \beta''' = \frac{\ln(M^{S'''}/M^S)}{\ln(P^f(1+t)/P^S)}$$

In order to test for the significance of the welfare implication drawn (i.e., there are net loss by smuggling in 1988, 1990 and 1991), the following hypotheses apply.

H_0 : ß < ß"′ (The actual elasticity is large enough that there will be net welfare gain by smuggling.)

H_A : ß > ß"′ (The actual elasticity is small enough that there will be net welfare loss by smuggling.)

From Table 7.10, the null hypothesis is rejected in 1988 and 1990 while it cannot be rejected in 1991.

Table 7.10 Result of the hypothesis testing for the significance of the welfare implication.

		Ms"′	ß"′	t
ALL	1988	1413.489	-5.58032	18.88620
	1990	849.3030	-4.89285	16.06872
	1991	1042.757	-1.01753	0.186242
(10%)	1988	1402.146	-3.56817	10.55563
	1990	841.6760	-4.50780	14.40658
	1991	1042.757	-1.01753	0.102185
(5%)	1988	1395.791	-2.34222	6.237123
	1990	826.5580	-3.67997	11.71971
	1991	939.9804	-0.87162	0.210078

Concluding remark

From the above welfare analysis, we can conclude that the smuggling of television sets is not beneficial to China's economy. There seems to be strong evidence to suggest that smuggling leads to welfare loss in 1988 and 1990. In 1989, if smuggling really exists, it also create net loss to the economy. But in 1991, no conclusion can be drawn about the welfare implication of smuggling. Smuggling generally worsens the welfare in the period 1988 to 1991.

From Table 7.11, we find that the effective tariff rate decreases over time. One may suggest the smuggling of television sets begins to be beneficial to China's economy. But if the response of government is taken into account, this may not be true.

Table 7.11 The prices comparison and effective tariff rate of imported television sets.

	Ps	Pf(1+t)	Effective Tariff rate
1988	2829	2956	158%
1989	2891	2848	174%
1990	2937	3212	147%
1991	2750	3926	89%

Source: Guangdong Price Year Book, various issues.

In this welfare analysis, several limitations are present. Firstly, we assume that Hongkong is the only channel for smuggling into China. In fact, Taiwan and Macau also play the role of smuggling bridgeheads but with believably smaller smuggling volume than Hongkong.[9] Nevertheless, the smuggling volume of television sets must be underestimated. However, it does not change our conclusion that net loss is the result of smuggling. It is because if the actual smuggling volume is larger than our predicted value, it "should" have a larger impact on price disparity. Thus the actual contribution from smuggling on price disparity is even smaller. The predicted net loss will be understated.

Secondly, we have assumed that before 1988, there was no smuggling of television sets into China. But if significant scale of smuggling existed, the imports volume before 1988 is understated which will affect the estimation of the imports demand function.

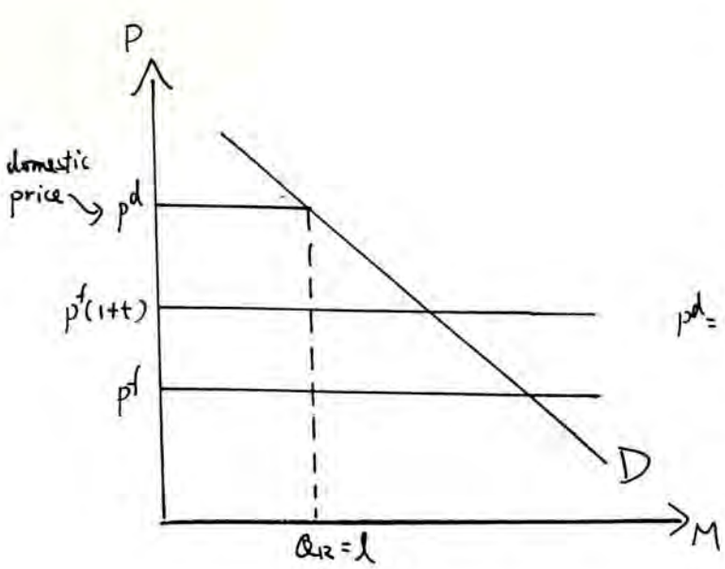
Thirdly, we assume that China (or Guangdong) is a small economy so that its demand for imports will have no influence on the terms of trade. If world price is raised due to growing demand in China through smuggling, the welfare will further worsen.

---

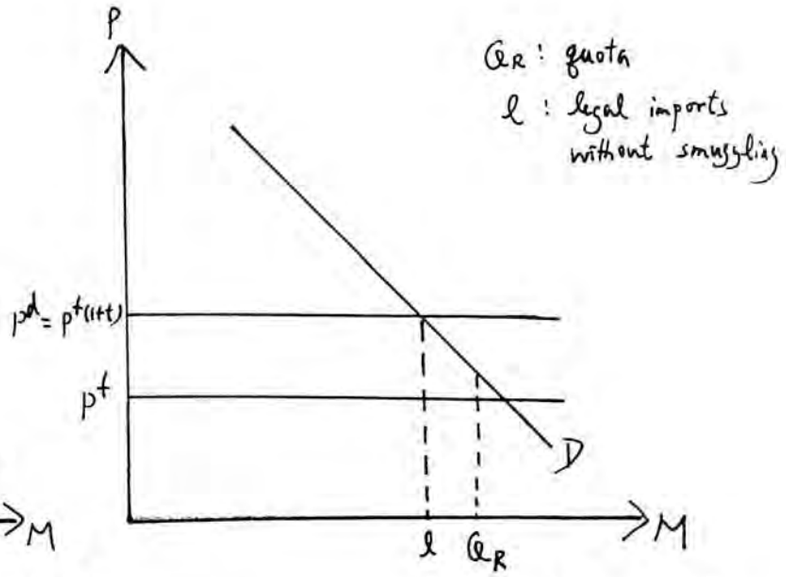
[9]The hostile relationship between the Mainland and Taiwan makes smuggling difficult. Transportation facilities in Macau is comparatively inferior to Hongkong's.

Fourthly, the problem of quantitative restriction on imports have been neglected in our study. Quantitative restriction on foreign trade is another tool of trade barrier. According to Falvey (1978), smuggling will lead to welfare improvement. This conclusion is valid only when tariff is absent. The domestic price distortion from quantitative restriction provides premium to the trade enterprises possessing imports quota. As a result of smuggling, decline of domestic price will not decrease legal trade. The rent of legal importers will be reduced instead. Therefore, the economy must be better off by the price disparity.

In China, the story is somewhat different. Quantitative restriction and tariff are employed together to restrict the imports demand. The former limit the quantity of goods imported legally while the latter sets a price floor for the foreign goods if quantitative restriction is not effective. Then, there are two market situations if no smuggling exists. In the first situation, the quantitative restriction may be so tight that the domestic price is even higher than the tariff-included world price (See Fig. 7.2a). The rent of foreign trade will be shared by the government and the enterprises. In addition, the effective tariff rate is higher than the ad valorem tariff rate.



(Fig. 7.2a)

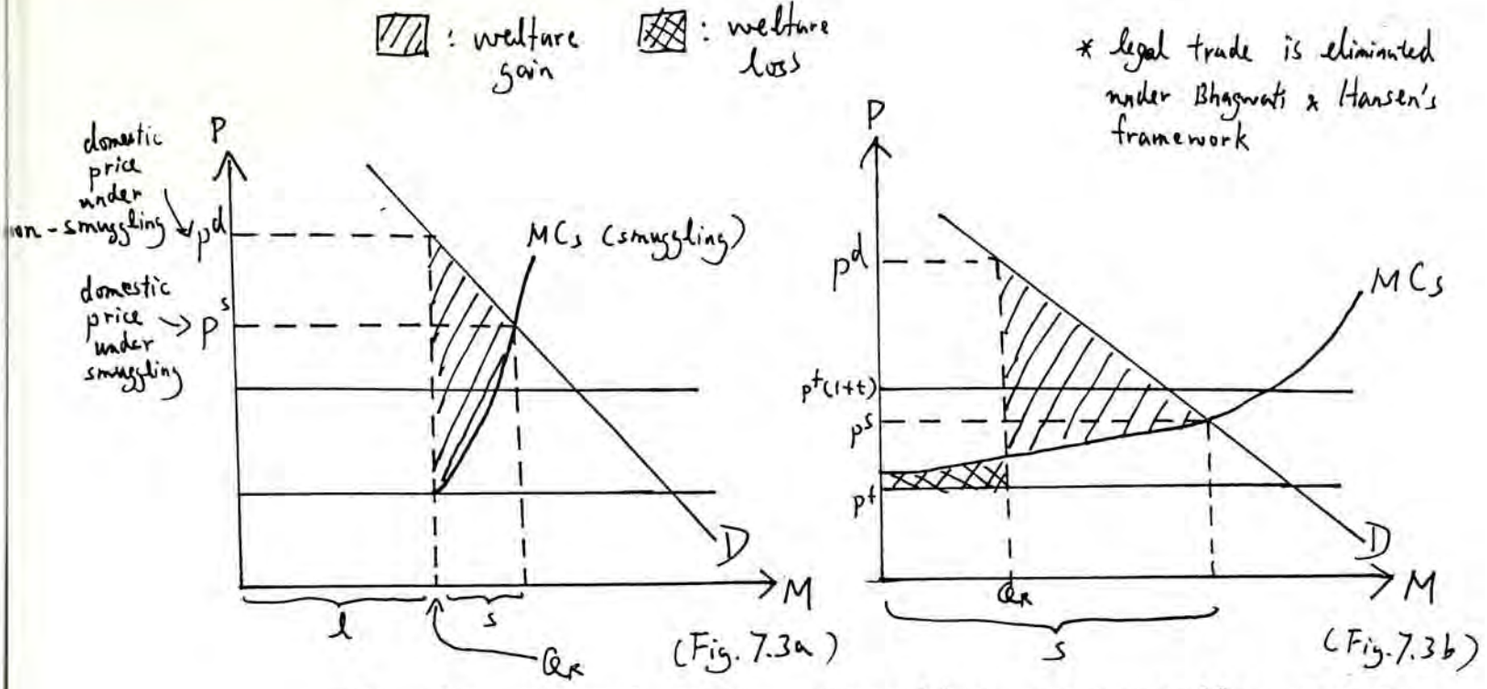


(Fig. 7.2b)

* domestic supply is left out here for simplicity.

On the other hand, if the quantitative restriction is very liberal, the minimum possible domestic price is the tariff-included world price. The actual imports volume will be smaller than the official restricted amount (see Fig. 7.2b). Tariff functions as a backup support for trade barriers. Now the rent is completely captured by government.

Consider the above situation when smuggling appears. In the first case, smuggling may make the final domestic price either higher than or lower than the tariff-included world price. If the final domestic price is higher than the tariff-included price, smuggling is necessarily welfare improving. Legal trade volume is not altered. The only effect is the reduction of rent of the legal importers. However, if the final domestic price falls below the tariff-included price, some or all of the legal trade will be eliminated. The welfare implication of smuggling is ambiguous. (See Fig. 7.3a and 7.3b)



In the second case, smuggling necessarily cause decline of legal imports. The same welfare implication is the same as without quantitative restriction (since quantitative restriction is not effective at the beginning).

In China, many imported goods are still under quantity restriction. They are mainly the consumers goods. Household electrical appliances, transportation equipment, acholic beverages and tobacco are included in this category. To import these goods, imports licenses are required so that the government is able to control the imports quantity. Therefore, we find that the quantity restriction on imports will affect our empirical analysis of the television sets smuggling by two ways. One is the domestic price data while the other is the conclusion of the welfare analysis.

It will pose no problem to our study if domestic

price data of foreign goods is provided. However, recalling that except for the data in 1984, the domestic price of television sets from 1980 to 1987 is represented by the tariff-included world price. Since it is possible for the domestic price to be higher than the tariff-included price, the above data cannot reflect the actual domestic price. The accuracy of the domestic price data (1980 to 1983, 1985 to 1987) will affect the estimation of the import demand function and the smuggling costs.

However, in the calculation of the domestic price from 1980 to 1987, the domestic price of television sets in 1984 is used as a reference for adjustment. 60% mark up is found in 1984. This mark up represents partly the effective tariff rate caused by quantitative restriction. So this problem is partly overcome.

For the welfare analysis, previous welfare implication about smuggling will be reversed, if the quantitative restriction is effective in 1988 to 1991. In 1989, as domestic price is approximately the same as tariff-included world price, obviously no legal trade is substituted by smuggling. It is most likely that smuggling is welfare improving in 1989. In 1988, 1990 and 1991, the domestic price is below the tariff-included world price. The welfare implication is ambiguous.

However, with the decentralization of trade regime,

it is doubtful that quantitative restriction functions as effectively a trade barrier than as tariff. Moreover, the practice of using administrative means to replace the market is mostly replaced by interventions through the market. The assumption of ineffective quantitative restriction for 1988 to 1991 is required for the validity of our welfare analysis.

Lastly, the estimation of import demand in China creates difficulty of the welfare analysis very much. With erratic demand pattern over time in China, a lot of dummy variables are required. The dummy variables are a little bit arbitrary. The previous rationale for the dummy is only a possible suggestion.

From the previous welfare analysis, the smuggling of television sets is found to have worsening effect on economic open areas in China. Since in recent years, television set is the most typical type of smuggled commodities, its welfare implication is suggestive of the general welfare impact from smuggling, i.e. smuggling is likely not to be beneficial to China economy, if not harmful. Consumers in China seem to have little gain from the price disparity as it happens to be too small in the case of smuggling television sets.

Apparently, Chinese government succeeds in maintaining its target price for imported goods before 1991. The trade-off is the net loss in the private sectors.

As we know, China's development strategy is exports-oriented. Trade barriers are essential in protecting infant industry. From communists' angle, present consumption is always needed to be scarified for future development. Equity judgement always questions the idea of substitution of present wealth by future wealth. But with the uneven income distribution in the present economic development environment in China, the sudden sharp rise in wealth of high income group causes a surge in the demand for foreign luxury goods. If imports demand is not restricted, only a few people is better off at the expense of the development of infant industries. Smuggling will be harmful under this consideration. Trade barriers, and smuggling as a consequence, are likely to exist in the near future.

However, not only the imports of final products but also intermediate products is restricted. From recent reports (Hong Kong Economic Journal, July 29, 1993), the quality of domestic output is still far below foreign standard. The excuse may be the deep-rooted institutional inefficiency in domestic enterprises. Another reasons will be the trade barriers imposed on intermediate products

which hinders the technology imports. Smuggling of this products is reported in few years ago. (Pai Shing Semi-monthly 1991:239, pp.30-31) This type of smuggling seems to be beneficial if it can reach the objective of technology transfer. In recent years, a successive cut down and a significant drop in tariff rate on these products are carried out. This shows that Chinese government has corrected her strategy on restricting imports of intermediate products. Smuggling of this types of goods will decrease.

Smuggling is an alternative way of re-exports in Hongkong. It has been shown that smuggling plays an important role in Hongkong economy. However, it does not mean that smuggling is beneficial to Hongkong. First of all, the smuggled goods from Hongkong are sometimes exchanged for drugs and fire arms. With the inflow of these things, the order of Hongkong society will be disturbed. Moreover, smuggling will involve the theft of property. Stolen cars is a good example to illustrate that smuggling incurs loss to Hongkong economy. Finally, smuggling does not necessarily facilitate trade with China. If the finding in previous analysis is accepted without any question, non-smuggling may imply larger imports demand than smuggling (since net loss is found in 1988 to 1990 from the analysis). Hongkong will trade more with China through legal channels under non-smuggling.

In conclusion, the empirical works in this thesis provide a way to analyze the welfare impact. Although there is great difficulty in estimation for Chinese import demand, such as its erratic demand and insufficiency of data, it can act an illustrative example for welfare comparison. Much better result about the welfare impact of smuggling is expected if more data is available.

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Appendix A

An indirect way to obtain the black market exchange rate

Recall equations 5.8a and 5.8b:

$$-(1-r)\frac{(e_B-e_O)}{e_O} = C'(\theta_X)$$

$$(1-r)\frac{(e_B-e_O)}{e_O} = C'(\theta_M) + t$$

Combining the two equations gives:

$$(A.1) \qquad C'(\theta_X) + C'(\theta_M) = -t$$

Assume that the marginal risk costs is a linear function of extent of misinvoicing. Then the marginal risk costs can be estimated by regressing on tariff rate. With the estimates of marginal risks costs, the black market exchange rate can be predicted by equation (A.1), with known retention rate and official exchange rate. Practically, time series data of a traded commodity can be used for estimation if constant risk costs over time is assumed. Otherwise, cross-sectional data will be used under the assumption of identical risk costs across sections of commodities.

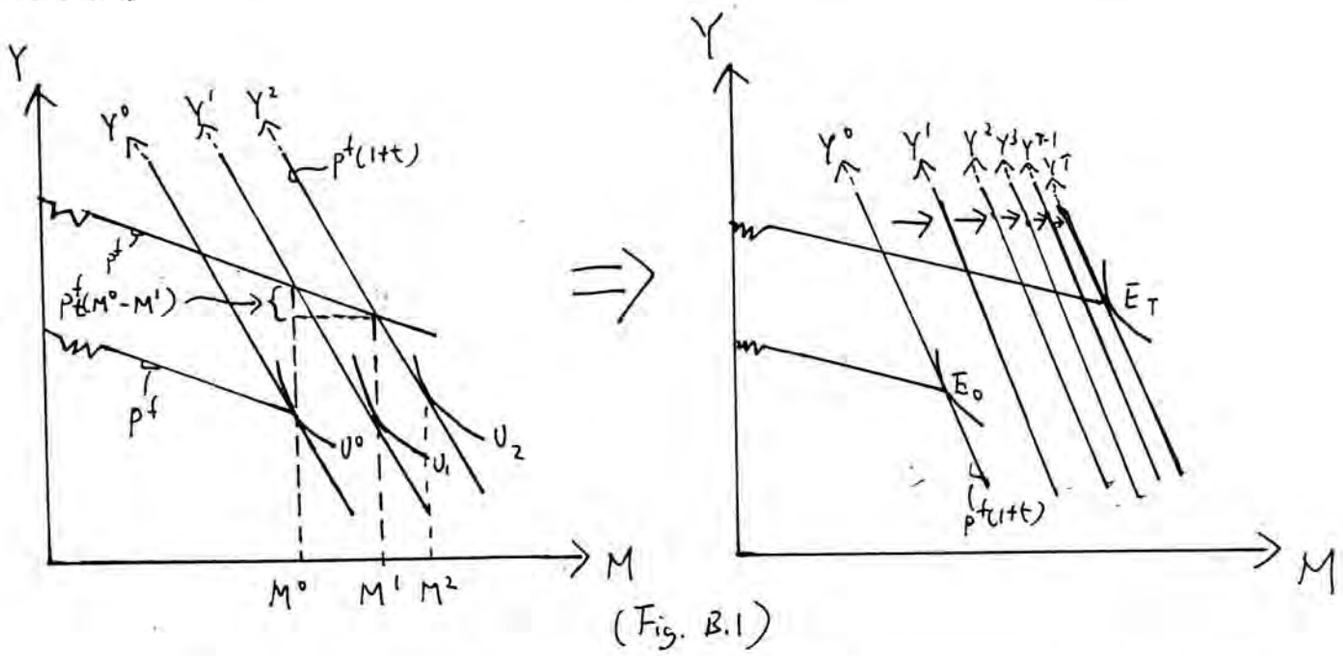
A little modification is needed for the estimation. As discussed before, LN(1+θ) will be a much satisfactory explanatory variable for the symmetry of marginal risk costs than θ. Then the equations changes to:

$$\frac{C'(LN(1+\theta_X))}{(1+\theta_X)} + \frac{C'(LN(1+\theta_M))}{(1+\theta_M)} = -t$$

The marginal condition can still be linear if C'(LN(1+θ)) is linear to LN(1+θ). Linear regression remains as a convenient way for estimation of marginal risks costs and the black market exchange.

Appendix B

Suppose that it is impossible to solve the imports demand function directly to get M^0 and M^T. However, they can be solved by a recursive calculation method. Let use the computation of welfare loss as an example. (See Fig. B.1.)



(Fig. B.1)

We firstly add back the smuggling costs, C, to the national income (the new income is then Y^1) and get the corresponding import demand, M^1.

$$(B.1) \qquad M^1=F(Y^1,p^f(1+t)) \ \textit{where} \ Y^1=Y^0+C$$

Then we found that with income Y^1, the economy will demand for M^1 amount of import. But from Fig. B.1, they only need to pay the amount $P^f(M^1-M^0)$ for the additional import, instead of the amount $P^f(1+t)(M^1-M^0)$. Then the economy will have the gain which is equal to $tp^f(M^1-M^0)$. Adding this to the national income will have a

corresponding demand on import, M^2.

$$M^2=F(Y^2,p^f(1+t)) \quad where \quad Y^2=Y^1+tp^f(M^1-M^0)$$
$$=Y^0+C+tp^f(M^1-M^0)$$

We find that when this process continues, the national income will be increasing until the further increase of import demand between each generation converses to zero. Then the national income with the non-smuggling, Y^T, can be found.

$$M^3 = F(Y^3,p^f(1+t)) \quad where \quad Y^3=Y^2+tp^f(M^2-M^1)$$
$$\cdots\cdots\cdots\cdots\cdots\cdots$$
$$\cdots\cdots\cdots\cdots\cdots$$
$$\cdots\cdots\cdots\cdots$$
$$M^T = F(Y^T,p^f(1+t)) \quad where \quad Y^T = Y^{T-1}+tp^f(M^{T-1}-M^{T-2})$$
$$\approx Y^{T-1}$$
$$\because M^{T-1} - M^{T-2} \approx 0$$

However, in order to achieve the convergence of Y^T, there must exist some restrictions on the parameters of the function. The most important factor affecting this problem is the income elasticity of the commodity imported. If the imported commodity is very elastic, the raise of income will result in much more import. In return, the exports must increase which will lead to much larger national income so that income will approach

infinity.[1] But in reality, it cannot happen. Either the income elasticity will decreases with increasing demand or the free trade price will finally increase. Thus if we assume that it is a small economy, under the condition that the free trade price will not be altered, the elasticity will be under some restriction to achieve satisfactory result.

Now, let us assume that the import demand has constant elasticity of income, ϵ. Since,

$$\epsilon = \frac{\Delta M/M}{\Delta Y/Y}$$

$$\Rightarrow \quad \epsilon \frac{C+\Delta M p^f t}{Y^0} = \frac{\Delta M}{M^0}$$

$$\Rightarrow \quad \epsilon M^0 C+\epsilon \Delta M M^0 p^f t = Y^0 \Delta M$$

$$\Rightarrow \quad \Delta M = \frac{\epsilon M^0 C}{Y^0-\epsilon M^0 p^f t}$$

As $\Delta M = M^T - M^0$, therefore,

$$(B.2) \qquad M^T = \frac{\epsilon M^0 C}{Y^0-\epsilon M^0 p^f t} + M^0$$

Let ϵ be positive. We find that for the convergence

[1]Correctly speaking, the economy will spend all her income on this particular goods. The income will be bounded by the corner solution. It may be possible for an economy to consume entirely on imports. But spending all the income on a particular goods seems to be unimaginable.

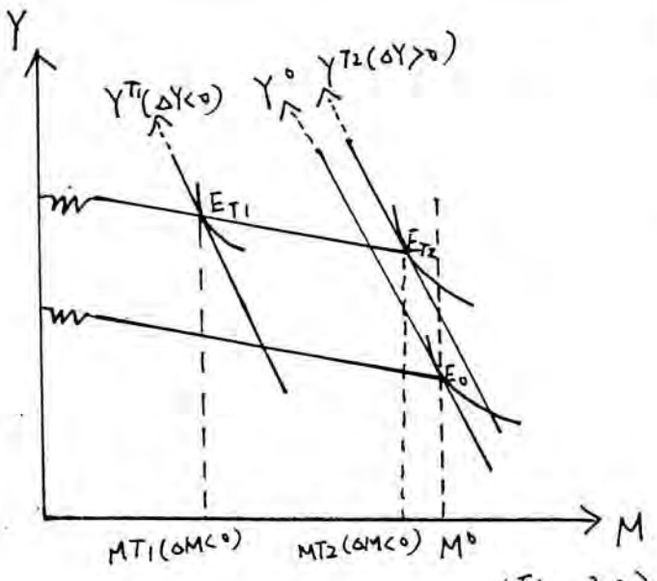
of Y^T and M^T, it must satisfy the following condition.

$$(B.3) \qquad Y^0 - \epsilon M^0 p^f t > 0$$
$$\Rightarrow \qquad Y^0 > \epsilon M^0 p^f t$$

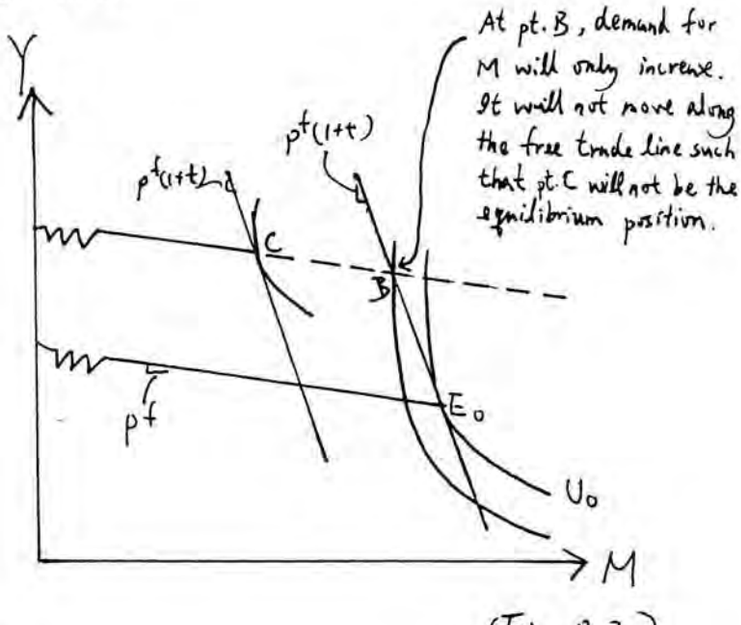
From equation B.2, with larger the income elasticity, ϵ, M^T will be larger. Since higher imports demand will consequently lead to higher exports which stimulate higher national income if trade deficit is not allowed (under general equilibrium). If ϵ is too large that the above expression ($Y^0 - \epsilon M^0 p^f t$) is smaller than zero, ΔM will be negative. It is not possible to have decreasing demand for increasing income if income elasticity is positive. Thus this means that Y^T and M^T will not converge.

If the above happens, increasing the income (adding back the smuggling costs) will generate larger imports demand and then further increase in income. To reach equilibrium with the violation of inequality B.3, either corner solution or shrink of imports will be the result. If imports demand decreases, income will decrease ($\epsilon > 0$) or increase ($\epsilon < 0$). See Fig. B.2. E_{T1} and E_{T2} in Fig. B.2 are the equilibrium positions when income decreases and increases respectively. But since ϵ is positive, import demand will decrease only when income decreases. Therefore E_{T2} will not be the possible equilibrium position for positive income elasticity. For E_{T1}, it is quite strange

that the national income will decrease because it will violate the mechanism of the consumption choice, i.e., consumption decreases when MRS larger than relative price at point B in Fig. B.3. Thus this type of equilibrium is not feasible and therefore rejected.



(Fig. B.2)



(Fig. B.3)

The remaining case will be corner solution. But with its exploding trade volume, it is believably that the free trade price will increase as a result. Moreover, it will be impossible for an economy to spend all their income on imported goods. In addition, before adding back the smuggling costs, the equilibrium will not be stable as little derivation will cause either zero import or spending totally on imports. Therefore, if the estimates of income elasticity is so large that Y^T and M^T do not converge, the estimation for the income elasticity is considered to be failure.

Thus, we believe that the elasticity will not always be constant. Finally it will decrease and lead to

convergence.

With varying elasticity with income, the requirement for the elasticity will somewhat similar. For the first generation,

$$\Delta Y^1 = Y^1 - Y^0 = C \qquad \Delta M^1 = M^1 - M^0$$

$$\epsilon_0 \frac{\Delta Y^1}{Y^0} = \frac{\Delta M^1}{M^0}$$

$$\Rightarrow \quad \Delta M^1 = \frac{\epsilon_0 M^0 C}{Y^0}$$

$$\Rightarrow \quad M^1 = M^0 + \frac{\epsilon_0 M^0 C}{Y^0}$$

For the second generation,

$$\Delta Y^2 = Y^2 - Y^1 = tp^f \Delta M^1 \qquad \Delta M^2 = M^2 - M^1$$

$$\epsilon_1 \frac{\Delta Y^2}{Y^1} = \frac{\Delta M^2}{M^1}$$

$$\Rightarrow \quad \Delta M^2 = \frac{\epsilon_1 M^1 \Delta Y^2}{Y^1} = \frac{\epsilon_1 M^1 tp^f \Delta M^1}{Y^1}$$

$$\Rightarrow \quad M^2 = M^1 + \Delta M^2 = M^0 + \Delta M^1 + \frac{\epsilon_1 M^1 tp^f \Delta M^1}{Y^1} = M^0 + \Delta M^1 \left(1 + \frac{\epsilon_1 M^1 p^f t}{Y^1}\right)$$

For the third generation,

$$\Delta Y^3 = Y^3 - Y^2 = tp^f \Delta M^2 \qquad \Delta M^3 = M^3 - M^2$$

$$\epsilon_2 \frac{\Delta Y^3}{Y^2} = \frac{\Delta M^3}{M^2}$$

$$\Rightarrow \quad \Delta M^3 = \frac{\epsilon_2 M^2 \Delta Y^3}{Y^2} = \frac{\epsilon_2 M^2 tp^f \Delta M^2}{Y^2}$$

$$\Rightarrow \quad M^3 = M^2 + \Delta M^3$$

$$= M^0 + \Delta M^1 + \frac{\epsilon_1 M^1 tp^f \Delta M^1}{Y^1} + \frac{\epsilon_2 M^2 p^f t \Delta M^2}{Y^2}$$

$$= M^0 + \Delta M^1 + \frac{\epsilon_1 M^1 p^f t \Delta M^1}{Y^1} + \frac{\epsilon_2 M^2 p^f t \frac{\epsilon_1 M^1 p^f t \Delta M^1}{Y^1}}{Y^2}$$

$$= M^0 + \Delta M^1 \left(1 + \frac{\epsilon_1 M^1 p^f t}{Y^1} + \frac{\epsilon_1 M^1 p^f t}{Y^1} * \frac{\epsilon_2 M^2 p^f t}{Y^2}\right)$$

With further generation,

$$M^* = M^0 + \Delta M^1 \left(1 + \frac{\epsilon_1 M^1 p^f t}{Y^1} + \left(\frac{\epsilon_1 M^1 p^f t}{Y^1}\right)\left(\frac{\epsilon_2 M^2 p^f t}{Y^2}\right) + \left(\frac{\epsilon_1 M^1 p^f t}{Y^1}\right)\left(\frac{\epsilon_2 M^2 p^f t}{Y^2}\right)\left(\frac{\epsilon_3 M^3 p^f t}{Y^3}\right) + \ldots\ldots\ldots\right)$$

$$= M^0 + \Delta M^1 \left(1 + R_1 + R_1 R_2 + R_1 R_2 R_3 + \ldots\ldots\right)$$

in which,

$$R_1 = \frac{\epsilon_1 M^1 p^f t}{Y^1}$$

$$R_2 = \frac{\epsilon_2 M^2 p^f t}{Y^2}$$

$$R_3 = \frac{\epsilon_3 M^3 p^f t}{Y^3}$$

$$\ldots\ldots\ldots\ldots\ldots\ldots$$

Then,

$$Let\ R_{max} = MAX\{R_1, R_2, R_3, \ldots\ldots, R_T\}$$

$$\begin{aligned} & M^0 + \Delta M^1 (1 + R_1 + R_1R_2 + R_1R_2R_3 + \ldots\ldots) \\ \leq\ & M^0 + \Delta M^1 (1 + R_{max} + {R_{max}}^2 + {R_{max}}^3 + \ldots\ldots \\ =\ & M^0 + \frac{\Delta M^1}{1 - R_{max}} \qquad (*) \end{aligned}$$

If (*) is finite, M^T must be finite. Thus if R_{max} is smaller than one, it will be a sufficient condition for M^T to be finite. Thus it requires that:

$$R_{max} < 1 \Rightarrow R_i < 1 \quad for\ i=1,2,3,\ldots,T$$

$$\because R_{max} = MAX\{R_1, R_2, R_3, \ldots\ldots, R_T\}$$

$$\begin{aligned} & R_i < 1 \\ \Rightarrow\ & \frac{\epsilon_i M^i p^f t}{Y^i} < 1 \\ \Rightarrow\ & \epsilon_i M^i p^f t < Y^i \end{aligned}$$

$$i = 1,2,3,\ldots\ldots,T$$

Since R_i is:

$$\begin{aligned} & Y^i > \epsilon_i M^i p^f t \\ \Rightarrow\ & Y^i \frac{\Delta Y^{i+1}}{Y^i} > \frac{\Delta M^{i+1}}{M^i} M^i p^f t \\ \Rightarrow\ & \Delta Y^{i+1} > \Delta M^{i+1} p^f t = \Delta Y^{i+2} \end{aligned}$$

This means that the elasticity must be small enough that the next generation of income must be smaller than the previous stage.

Therefore, in order to achieve the computable welfare change in empirical work, income elasticity is a critical factor, regardless varying or constant income elasticity is assumed. This also applies for the welfare gain by price disparity in smuggling, as both the computation is done by the same mechanism.

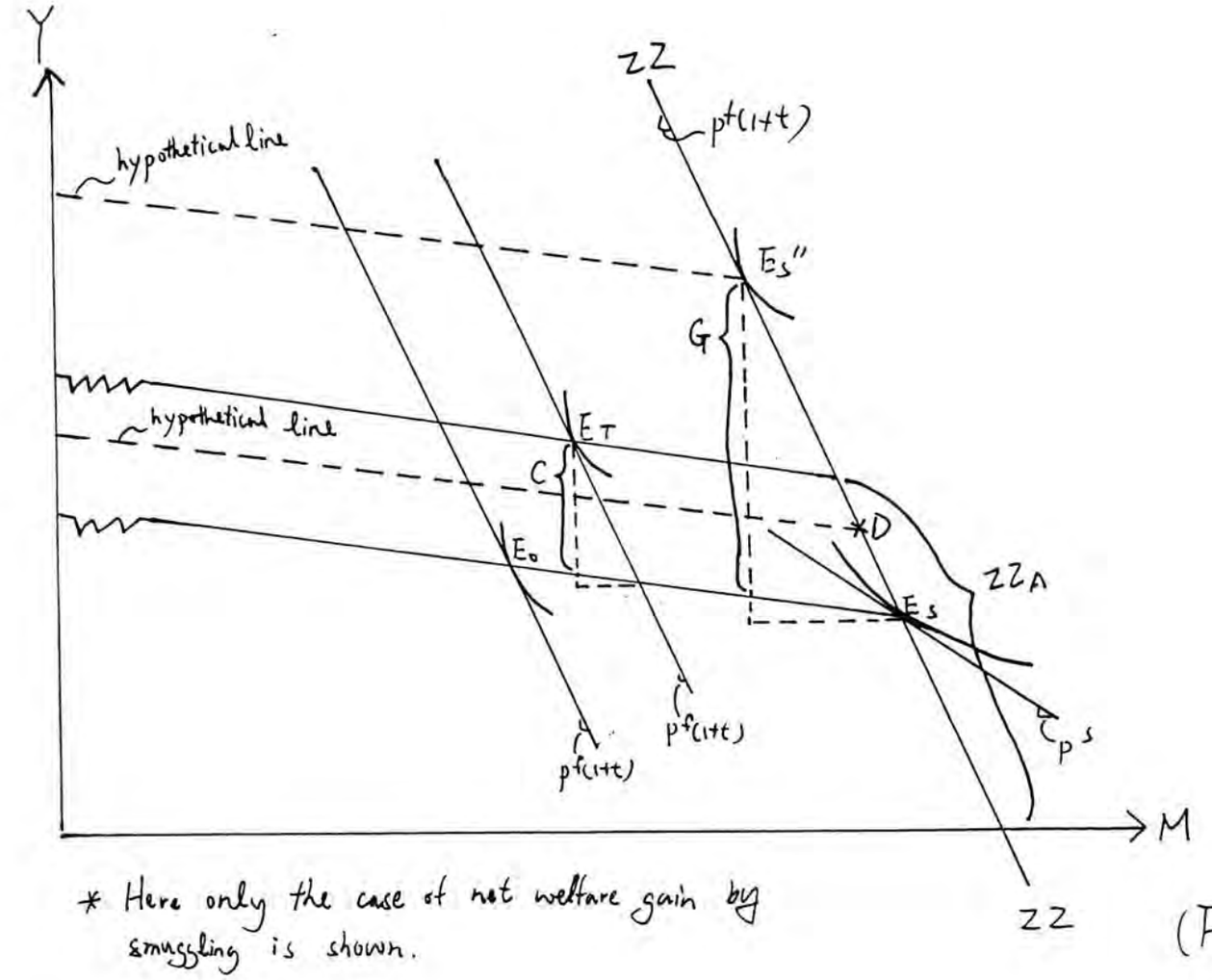
In applying the above method for our welfare analysis, the income elasticity requirement for convergence of imports demand can rarely be violated. It is because when only one type of smuggling commodity is studied, the induced reduction/addition effect on income is very small comparing with the national income, as its trade volume is incomparable to both the total trade volume and national income. It will only be a problem when the aggregate foreign trade is used as the studying target of smuggling.

Once the requirement for income elasticity is guaranteed, if smuggling lead to a net welfare gain to the economy, the consumption choice, $E_{s''}$ along the line ZZ (see Fig. B.4) will never fall in the region ZZ_A. Recall that we have let G be the initial impact of price disparity in Chapter 4. By drawing a hypothetical line parallel to the

terms of trade through point $E_{s''}$, removing G will give a similar impact on the economy as if removing C in analyzing the loss from smuggling. If $E_{s''}$ falls in the region ZZ_A, such as point D in which G will be smaller than C, it will violate our previous requirement for income elasticity. (Comparing point D and E_T, their relative position is similar to the relative position of E_0 and point C ($\Delta Y<0$) in Fig. B.3. Recall that even when final demand for import decline, the possibility for income to decline is rejected as it violate the mechanism of consumer choice.) G must be larger than C. If smuggling lead to a net welfare loss, G must be smaller than C. Therefore, we can simply compare G and C to draw conclusion on the direction of the welfare impact of smuggling (i.e., whether there is welfare improvement or worsening) but not its magnitude. M^0 and M^T are required to calculate the amount of net gain/loss. Then in the empirical study, we assume that income elasticity of the imports demand can satisfy the above requirement.

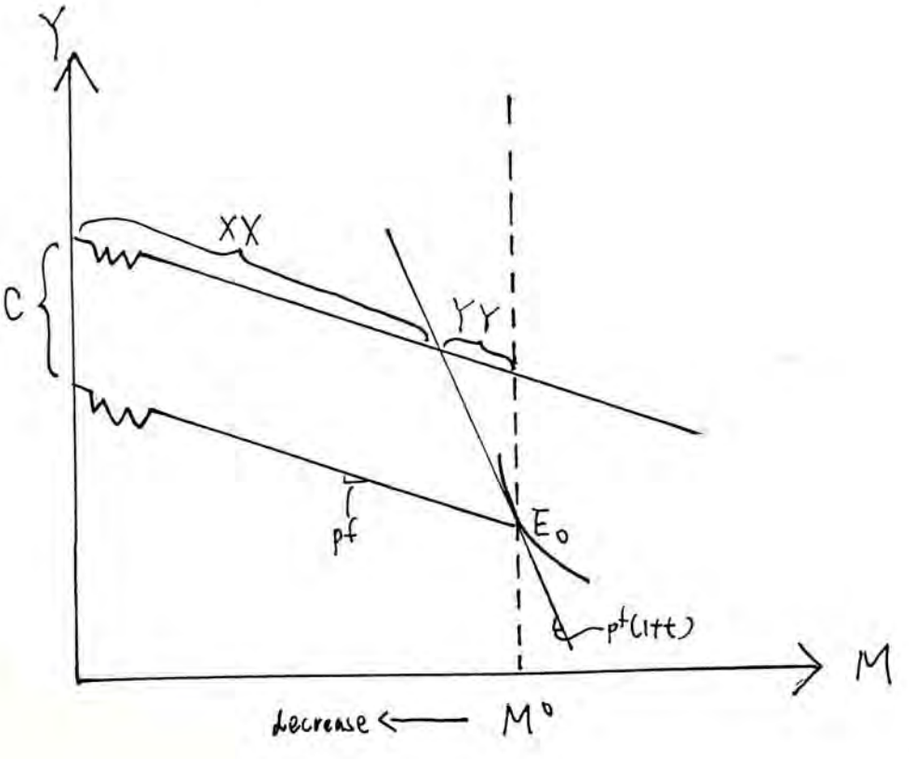
So far we have only consider the case with positive income elasticity. If income elasticity is negative, import demand will always decline when income decreases and vice versa. The new equilibrium position will always be bounded in the region YY in Fig. B.5. Since the equilibrium position will not occurr in region XX, $E_{s''}$ will also not fall in the region ZZ_A in Fig. B.4. Therefore, simply comparing C and G for welfare analysis is still

valid when income elasticity is negative.



* Here only the case of net welfare gain by smuggling is shown.

(Fig. B.4)



(Fig. B.5)

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