

Calculating Cross-Strait Trade: An Analysis of Statistical Methods

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In recent years, the rapid development of trade between Taiwan and mainland China has made it essential that a reliable method be worked out for calculating trade values. This paper consists of a theoretical analysis of the different statistical methods so far devised and the contrasting and somewhat confusing data they have produced. An attempt has been made to integrate these methods to produce a more accurate estimate of the level of Taiwan-mainland trade.

Keywords: Taiwan-mainland trade, direct trade, indirect trade, transshipment, cargo in transit

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Over the past decade, the rapid development of economic and trade relations between Taiwan and mainland China has made Taiwan the mainland's fourth largest trading partner, after Hong Kong, the United States, and Japan. There is now a high degree of interdependence between the two sides in terms of national income, employment, trade, and capital flows. However, in spite of this growing interdependence and the increasing academic interest in cross-Strait trade relations, the most basic issue—i.e., the exact value of cross-Strait trade—has remained an enigma. While the statistics released by the Taipei government are self-contradictory and often confusing, researchers are reluctant to probe into this unfathomable issue. Although the government has begun to pay more attention to the problem, a precise and reliable statistical benchmark has yet to be developed. This paper surveys existing cross-Strait trade statistics in an attempt to locate some basic principles which will facilitate their interpretation. It also includes a synthesis of existing statistical methods that will hopefully facilitate the development of a more reliable method

of calculating cross-Strait trade. This will serve as a basis for the quantitative management of cross-Strait economic and trade policies.

The Structure of Commercial Methods

On the basis of international trade and contract law, bilateral trade can be divided into two categories in terms of the way ownership of the commodities is transferred. The first category is direct trade, under which the ownership of a commodity is directly transferred from the seller to the buyer via a specific mode of shipment in accordance with conditions agreed by the two sides. The second is indirect trade in which the seller sells a commodity to a middleman who resells it to the ultimate buyer. From an economic point of view, commodities go through a value-added process when they are transferred indirectly through a middleman. This process includes business contacts, marketing, financing, insurance, and other paperwork.¹

Most of mainland China's foreign trade is conducted directly (see table 1).² For instance, about 70 percent of trade between Tokyo and Beijing is conducted through direct contacts between Japanese and mainland Chinese businessmen, and the remaining 30 percent is entrepôt trade conducted through Hong Kong. Hong Kong, with its intimate knowledge of the mainland Chinese market and expertise in international marketing and banking, has played an important role as a middleman in trade with mainland China.³

In contrast to most other countries, the Taipei government insists that trade between Taiwan and mainland China be conducted indirectly.⁴ Both the seller and the buyer must be located in a third area other than the Chinese mainland and the commodities themselves must be shipped via a third area. The third area, although not specified, is usually Hong Kong. This is "transfer trade," in which

¹See Richard Schaffer, Beverley Earled, and Filiberto Agusti, *International Business Laws and Environment* (St. Paul: West Publishing, 1990), 121-53.

²Yun-Wing Sung, *The China-Hong Kong Connection: The Key to China's Open Door Policy* (Cambridge: Cambridge University Press, 1991); *China Trade Report* (Hong Kong), June 1995, 14-16.

³Nicholas Lardy, *China in the World Economy* (Washington, D.C.: Institute for International Economics, 1994), 73-79.

⁴Article 5 of the "Permit Measures for Trade between the Taiwan Area and the Chinese Mainland," promulgated in April 1993 and revised in 1994, states that cross-Strait trade, with the exception of certain specific cases, must be conducted indirectly. See *Liang'an jingmao baipishu* (White paper on cross-Strait economy and trade) (Taipei: Ministry of Economic Affairs, January 1996), 99.

Table 1
Mainland China's Indirect Trade as a Percentage of Total Trade

Unit: US\$100 million

Year	1993		1994		1995 (Jan.-June)	
	PRC exports	PRC imports	PRC exports	PRC imports	PRC exports	PRC imports
Japan	157.8 (29%)	232.5 (43.0%)	215.7 (26%)	263.2 (44.0%)	123.3 (25.6%)	122.4 (47.8%)
United States	169.6	106.9 (29.5%)	214.6	139.7 (26.3%)	112.0	71.5 (32.0%)
Germany	39.7	60.4 (23.0%)	47.6	71.4 (19.0%)	25.7	31.7 (18.5%)
Taiwan	14.6 (75%)	139.9 (54.0%)	22.4 (57%)	160.2 (53.0%)	15.8 (49.0%)	96.9 (50.0%)
South Korea	60.2 (14%)	29.7 (29.0%)	44.0 (18%)	73.2 (37.0%)	29.9 (14.7%)	43.1 (40.8%)
Singapore	22.4 (49%)	26.5 (46.0%)	25.6 (58%)	24.8 (40.0%)	15.9 (58.0%)	14.2 (70.0%)
Italy	13.0 (93%)	27.4 (22.0%)	15.9 (84%)	30.7 (26.0%)	9.8 (75.0%)	13.3 (36.0%)
France	12.9	16.5 (29.0%)	14.2	19.4 (28.0%)	8.4	8.4 (36.0%)

Notes:

1. Percentage in parentheses is ratio of entrepôt trade via Hong Kong to the total trade.
2. Figures for Taiwan based on Taipei government data.
3. Data for the United States, Germany, and France are insignificant so no percentages are provided.

Sources: *Zhongguo duiwai jingji maoyi nianjian* (Almanac of China's foreign economic relations and trade) (Hong Kong: China Resources Advertising Co., various years); Hong Kong customs data; *Liang'an jingmao tongji yuebao* (Monthly Report on Cross-Strait Economic and Trade Statistics) (Taipei, Mainland Affairs Council), various issues.

buyer and seller have no contact with one another: the Taiwan businessmen sell their products to a middleman in Hong Kong who then reexports them to mainland Chinese buyers. Ownership of the products thus changes hands twice. Thanks to its geographical position, superiority in economies of scale, and wide experience in international transportation and marketing, Hong Kong has developed into the main entrepôt for cross-Strait trade. According to Hong Kong government statistics, trade between Taiwan and the mainland via Hong Kong was worth US\$11.4 billion in 1995, of which US\$9.83 billion consisted of Taiwan's exports to the Chinese mainland and US\$1.57 billion was Chinese exports to Taiwan.

Apart from Hong Kong, Singapore, Japan, and South Korea also act as entrepôts for Taiwan-mainland trade. In the early period after Taipei relaxed its ban on trade with the mainland, the volume of trade passing through these countries was insignificant. Since 1993, however, they have become increasingly prominent on account of the rapid economic development of northern and northeast China.

Despite the official ban, there is some direct trade between Taiwan and the mainland, conducted by way of transshipment, cargo in transit, or illegal direct shipments. In the case of transshipment, products are sent by a specified carrier to a third port, where they are recontainerized and sent on by the same carrier or a different one to their destination. This is known as multimodal transport,⁵ and unlike indirect trade, it needs no middleman and does not involve the payment of customs duties in the third area (i.e., Hong Kong). Despite the fact that a third area is involved, transshipment should really be regarded as direct trade in that the seller and buyer are trade counterparts who cannot avoid contact with each other. Yet, because the shipment is divided into two stages and there is an element of value-added, the trade may be said to be conducted by indirect rather than direct shipment.

Cargo in transit is similar to transshipment except that it does not require repackaging or a change of carriers. Therefore, it is much less time-consuming and costly than transshipment. In the trade contract, buyer and seller are either from Taiwan or the mainland and the ownership of the products does not have to be transferred to a third party. Thus, this is a form of direct trade conducted by indirect shipment via a third port.

Illegal direct shipment is generally conducted in two ways. One is the smuggling of banned weapons and illegal drugs, the value of which is difficult to calculate, as in any transactions of this kind. The other is transactions conducted by Taiwan fishing boats. The latter, although illegal in Taiwan, is accepted by the Chinese mainland and known as "small-volume trade" (*xiaoe maoyi*).

According to existing data, each of the aforementioned modes of transport accounts for a significant proportion of total trade between Taiwan and the mainland. The interesting question is why

⁵Transhipped goods may actually be recontainerized and moved from one vessel to another, or from a ship to another type of carrier, such as train or truck.

traders use so many different modes of transport. Basically, mainland China's trade with Taiwan consists of voluntary transactions, just like the mainland's trade with any other country. In this case, an economist would expect at least one side to select the mode of transport with the lowest cost (including costs for the services of the middleman, trade financing, and insurance). One can also use imputed methods to calculate the cost for the time spent. It is therefore quite natural for either an exporter or importer to consider the relative costs of different kinds of shipment and choose the one which is most efficient and cost-saving. If we take r^h as the margin on re-exports, t_{th} as the transport cost from Taiwan to Hong Kong, and t_{hm} as the transport cost from Hong Kong to the Chinese mainland, then the cost of exporting commodities from Taiwan to the mainland via Hong Kong may be expressed as $(r^h + t_{th} + t_{hm})$.⁶ If we take $t_{th} + t_{hm}$ as the total cost of transshipment from Taiwan to Hong Kong and then on to the Chinese mainland, t_{thm} as the transport cost for cargo in transit from Taiwan to the Chinese mainland via Hong Kong, and t_{tm} as the cost of illegal direct shipment, these transport coefficients can be expressed by the following inequality:

$$t_{tm} \leq t_{thm} \leq t_{th} + t_{hm} \leq r^h + t_{th} + t_{hm}$$

Of the aforementioned types of shipment, entrepôt trade costs most because it incurs container-handling charges, Hong Kong customs charges, processing expenses, and the fees for changing vessels. Transshipment saves on middleman's expenses, while cargo in transit costs less still as there is no change of vessel involved. Of course, direct trade costs least of all because it is the least distorted mode of trade.

Be that as it may, when choosing the optimal method of transport, Taiwan businesses have to take into consideration not only the costs but also the legal risks involved. And in the case of Taiwan-mainland trade, the most efficient method—direct shipment—is also the most risky since it is illegal. On the other hand, if Taiwan traders abide by the law, they cannot maximize their profits. In other words, they face the problem of incentive incompatibility: the behavior which is most profitable carries moral hazards. Under these circumstances,

⁶Although some Hong Kong middlemen are actually set up by Taiwan companies, this should have little effect on the formula.

profits and risks become the two major factors in their decision-making.

In addition to insurable risks, such as accidents, each type of shipment carries a different degree of legal risk. Entrepôt trade, which relies on operators of third ports, carries no extra legal risks, but it is most expensive in terms of transaction costs. Transshipment also violates the government's demand that Taiwan-mainland trade go through a middleman, although in this case the law is vague and not strictly enforced. The legal status of cargo in transit is more clear-cut, as according to the Statute Governing Relations Between the People of Taiwan and Mainland Areas, all goods being transported between Taiwan and mainland China must stop at a third port. Ship owners or masters who violate these regulations risk a three-year prison term or a fine of up to NT\$15 million.⁷ However, because of the technical difficulties involved in tracking down offenders, the government has turned a blind eye to the transportation of bulk commodities such as coal or cement through the cargo in transit method. Finally, direct shipping, the method with the lowest cost, carries the highest degree of risk. It carries high legal penalties in Taiwan and in the case of accident, insurance companies may refuse to settle claims.

In brief, trade between Taiwan and mainland China involves a trade-off between cost and risk. The decisionmaking variables include destination, government regulations, the trader's attitude to risk, the penalties involved, and the law enforcement situation.⁸ Each individual trader calculates these risks and benefits differently, and thus selects the mode of transport that suits his/her business best.

A Comparison of Customs Statistics

Theoretically, cross-Strait trade can be estimated by adding together the volumes carried by each mode of transport. If X_i stands for the total value of Taiwan's exports to the Chinese mainland and M_i is the value of Taiwan's imports from the mainland, and if i includes a (entrepôt trade), b (transshipment), c (cargo in transit), and

⁷*Liang'an jingmao baipishu*, 75-76. These details were supplied courtesy of Mr. Pao Chia-yuan, an official of the Ministry of Transportation and Communications in Taipei. This regulation is applied to both domestic and foreign-owned carriers in order to protect the interests of domestic shipping companies.

⁸This can be proved using the well-known theory of expected utility.

d (direct shipment), while j indicates either h (via Hong Kong) or k (via other areas), Taiwan's exports to the Chinese mainland may be expressed in the formula:

$$(X) = (X_a^h + X_b^h + X_c^h) + (X_a^k + X_b^k + X_c^k) + X_d \quad (1)$$

and Taiwan's imports from the Chinese mainland may be expressed as:

$$(M) = (M_a^h + M_b^h + M_c^h) + (M_a^k + M_b^k + M_c^k) + M_d \quad (2)$$

These formulas, simple as they are, encounter a major obstacle in calculation; namely, all the variables, with the exception of X_a^h and M_a^h for which it is possible to get accurate figures from Hong Kong customs, lack systematic primary disaggregate data.

Hong Kong customs cannot provide any statistics concerning transshipment goods (X_b^h and M_b^h) or cargo in transit (X_c^h and M_c^h) as they have no bills of entry. And although detailed data are available for entrepôt trade, its share in total Taiwan-mainland trade has been declining in recent years as the use of transshipment and other methods has increased. This is obvious from the discrepancy between Hong Kong customs figures and those recorded by mainland China and Taiwan. For example, the Hong Kong figure for Taiwan's exports to the mainland in 1994 was only 60 percent of the figure for imports from Taiwan issued by the mainland customs authorities, while the Hong Kong figure for mainland exports to Taiwan was only 70 percent of that recorded by Taiwan customs (see table 2). Aside from changes in the mode of transport, the rapid development of Taiwan's trade with central and northern China has also affected the importance of entrepôt trade through Hong Kong and consequently the reliability of Hong Kong customs statistics as a guide to the level of Taiwan-mainland trade.

The Taiwan customs authorities started to collect statistics on trade with mainland China in 1991. According to regulations, "mainland China" should be specified as the country of destination or country of origin of indirect exports to and imports from the mainland, respectively. However, in an effort to avoid tiresome government restrictions on trade with the mainland, most companies falsify these details on customs documents, making Taiwan customs statistics a very unreliable source of information on Taiwan-mainland trade. Many companies specify the country of destination of their exports as Hong Kong or some other "third area," and this has inflated

Table 2
Taiwan-Mainland Trade as Recorded by Taiwan, Mainland, and Hong Kong Customs

Unit: US\$ millions

Year	Hong Kong Customs			Taiwan Customs			Mainland Customs		
	Exports	Imports	Total	Exports	Imports	Total	Exports	Imports	Total
1989	2,896.5	568.9	3,483.4	—	—	—	—	—	—
1990	3,278.3	765.4	4,043.6	—	—	—	2,255.0	319.7	2,574.6
1991	4,667.2	1,126.0	5,793.1	—	597.5	597.5	3,639.0	594.8	4,233.9
1992	6,287.9	1,119.0	7,406.9	1.1	747.1	748.1	5,881.0	698.0	6,579.0
1993	7,585.4	1,103.6	8,689.0	16.2	1,015.5	1,031.7	12,933.1	1,461.8	14,394.9
1994	8,517.2	1,292.3	9,809.5	131.6	1,858.7	1,990.3	14,084.8	2,242.2	16,327.0
1995	9,882.8	1,574.2	11,457.0	376.6	3,091.4	3,468.0	14,783.9	3,098.1	17,882.0

Note: "Exports" indicates exports from Taiwan to the Chinese mainland, and "imports" indicates imports from the mainland to Taiwan.

Source: *Liang'an jingmao tongji yuebao* (Monthly Report on Cross-Strait Economic and Trade Statistics) (Taipei, Mainland Affairs Council), no. 41 (January 1996): 23.

Taiwan customs figures for Taiwan's exports to Hong Kong.⁹ In 1995, for example, the figure for exports to the mainland issued by the Taiwan customs authorities was only 38 percent that issued by Hong Kong customs and 2.5 percent of that recorded by the mainland Chinese customs. In other words, Taiwan customs statistics have been seriously distorted by the moral hazards encountered by Taiwanese firms doing business with the mainland.

The value of imports from the Chinese mainland recorded by Taiwan customs is also far lower than the real level, as many importers of prohibited mainland Chinese goods falsify the country of origin or smuggle the goods into Taiwan. This is apparent in the approximately US\$400 million difference between the mainland figure for exports to Taiwan and the Taiwan customs authorities' own figure for imports from the mainland in 1993 and 1994. This problem began to recede in 1995, however, after Taipei started relaxing its controls on imports from the Chinese mainland. As importers' incentive incompatibility has been reduced, so the reliability of Taiwan customs statistics has increased.

Before 1993, mainland Chinese customs classified imports and exports according to the country from which or to which the goods

⁹Although according to Taiwan customs regulations, exporters have to declare the final port of destination of their goods, in practice they only declare the first port of destination.

were shipped, instead of the country of origin or country of destination. Thus mainland customs statistics tended to overestimate trade with Hong Kong and underestimate trade with other countries or areas. Then in 1991, as part of Beijing's bid to join the General Agreement on Tariffs and Trade (GATT), the internationally accepted classifications—country of origin and country of destination—were adopted in accordance with the Standard International Trade Classification (SITC). Since then, mainland customs data has become much more reliable, although of course it is difficult to make meaningful comparisons of data before and after 1993. In addition, the general accuracy of mainland customs data has often been questioned.

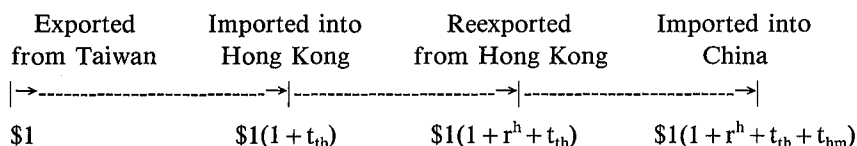
Yet, judging from the aforementioned US\$400 million discrepancy between Taiwan and mainland Chinese customs statistics and discounting normal statistical errors, mainland statistics seem to have been little affected by distortions of moral hazards. In other words, mainland data after 1993 is a much more reliable reflection of the real level of Taiwan-mainland trade than either Taiwan or Hong Kong customs figures.

Estimating Taiwan's Exports to the Mainland

Aside from customs statistics, two other sets of data are useful in estimating Taiwan's exports to the Chinese mainland: Taiwan's total exports to Hong Kong and Hong Kong's total imports from Taiwan. Given the deficiencies of the three sets of customs statistics, we can only make an approximation of trade volumes, at least for trade with Hong Kong.

First of all, we can divide Taiwan-mainland trade via Hong Kong into two kinds, direct trade and indirect trade. For the former, we can use Hong Kong customs data ($E_H(X_a^h)$); the latter must be calculated by some other method. Since 1989, Taiwan customs figures for exports to Hong Kong ($E_T(X^H)$) have been conspicuously higher than those for Taiwan's imports into Hong Kong recorded by Hong Kong customs ($E_H(X^H)$) (see table 2). Since there would be no reason for Taiwan exporters to disguise the country of destination of goods destined for either the Hong Kong market itself or for a country other than mainland China, we may assume that, aside from normal statistical discrepancies between the figures issued by the two customs authorities, the difference between these two sets of figures represents transshipment trade or cargo in transit between Taiwan and mainland China, which may be expressed as $\beta_i(0 < \beta_i \leq 1)$.

For entrepôt trade, it is also necessary to take into account the difference between FOB (free on board) price as recorded by the Taiwan customs and the CIF (cost, insurance, and freight) price recorded in Hong Kong, which may be expressed as $1 + t_{th}$. When the goods are reexported to the Chinese mainland, this becomes $1 + r^h + t_{th}$, in which r denotes the added value for the Hong Kong middleman. The CIF price of the goods when they arrive in the Chinese mainland may be expressed as $1 + r^h + t_{th} + t_{hm}$. This increase in value during the shipping process may be illustrated by the following figure:



We have to use interspatial coefficients to convert the three sets of customs data before we can make a significant comparison between them. Thus, the value of Hong Kong's imports from Taiwan (at CIF port of Hong Kong) may be converted, using the coefficient $1/(1 + t_{th})$ in order to compare it with the value of Taiwan's exports to Hong Kong (at FOB port of Taiwan). Similarly, the value of goods from Taiwan shipped out of Hong Kong to the Chinese mainland may be converted, using the coefficient $1/(1 + r^h + t_{th})$. After conversion, it is possible to calculate the values of both indirect and direct trade between Taiwan and the mainland based on FOB port of Taiwan. The sum of the two values may be expressed in the following equation:¹⁰

$$E^G(X) = \alpha_t E_H(X_a^h) + \beta_t \{E_T(X^H) - \gamma_t E_H(X^H)\} \quad (3)$$

in which

$E^G(X)$ = Estimated figure for Taiwan's exports to the Chinese mainland

$E_H(X_a^h)$ = Hong Kong customs figure for indirect exports from Taiwan to the Chinese mainland

$E_T(X^H)$ = Taiwan customs figure for exports to Hong Kong

$E_H(X^H)$ = Hong Kong customs figure for imports from Taiwan

β_t = the proportion of the difference between Taiwan and Hong Kong customs data accounted for by transshipment trade and cargo in transit to mainland China

¹⁰Taiwan customs requires FOB price quotes for exports and CIF price quotes for imports.

$$\alpha_t = 1/(1+r^h+t_{th})$$

$$\gamma_t = 1/(1+t_{th})$$

In the interspatial coefficients adjustment formula, α_t , β_t , and γ_t are dynamic coefficients which are not time invariant. The advantage of this assumption is that it varies according to changes in the shipment structure.

Formula 3 is widely used by government and research institutions in Taiwan, each of which has its own definition of the coefficients α_t , β_t , and γ_t . Thus, the Board of Foreign Trade (BOFT) under the Ministry of Economic Affairs (MOEA) assumes that $\alpha_t = 1 + \phi$, $\beta_t = 0.80$, and $\gamma_t = 1$, and $\phi = E_T(X)/E_H(X_a^h)$. It then calculates the value of exports (defined as $E^1(X)$) according to the following formula:

$$E^1(X) = E_T(X) + E_H(X_a^h) + 80\% [E_T(X^H) - E_H(X^H)] \quad (4)$$

Formula 4 is obviously a special case of formula 3. In it, the total value of Taiwan's exports to the Chinese mainland consists of three elements: (1) value of Taiwan's exports to the mainland as recorded by Taiwan customs ($E_T(X)$); (2) the value of Taiwan's indirect exports to the mainland as recorded by Hong Kong customs ($E_H(X_a^h)$); and (3) the BOFT's estimation of Taiwan's exports to the Chinese mainland via transshipment or cargo in transit. The BOFT assumes that this final element equals 80 percent of the discrepancy between the other two.

The BOFT's method was the earliest attempt by a Taiwan government department to estimate the value of Taiwan-mainland trade. It is relatively easy to calculate, but it does have some blind spots. For one thing, it might involve some double accounting since it is very likely that Hong Kong customs data includes data released by the Taiwan customs. There is also a problem with inconsistency of prices. $E_T(X)$ and the first part of element (3), $E_T(X^H)$, are calculated according to FOB port of Taiwan, while element (2), $E_H(X_a^h)$, is calculated on the basis of the reexport price from Hong Kong and $E_H(X^H)$ of element (3) is calculated on the basis of CIF port of Hong Kong. Finally, the assumption that 80 percent of the difference between (1) and (2) equals the value of Taiwan's exports via transshipment trade and cargo in transit was made by the BOFT two years ago on the basis of an informal survey of exporters. Thus, the BOFT's method of calculation has often been criticized for its lack of empirical precision.

The Mainland Affairs Council (MAC), in its estimation of Taiwan's exports to the mainland (defined as $E^2(X)$), assumes that $\alpha_t = 1$, $\beta_t = 1$, and $\gamma_t = 1$. The MAC's formula is therefore as follows:¹¹

$$E^2(X) = E_H(X_a^h) + \{E_T(X^H) - E_H(X^H)\} \quad (5)$$

Formula 5 consists of two parts. One is the value of Taiwan's exports to the mainland as recorded by Hong Kong customs ($E_H(X_a^h)$), and the other is the MAC's estimate of Taiwan's exports via transshipment or cargo in transit, which is assumed to be 100 percent of the difference ($\beta_t = 1$) between (1) and (2) in formula 4. In this way, the MAC has avoided the possibility of double accounting. Nevertheless, it has also simultaneously excluded other possibilities, such as the occurrence of spillover from Hong Kong to markets other than the Chinese mainland, for instance, Vietnam. In short, the assumption $\beta_t = 1$ could be modified by using a more empirical method. Moreover, formula 5 still suffers from the problem of inconsistency of prices.

A third method, the trading partner method (in which the value of Taiwan's exports to the mainland is defined as $E^3(X)$), was developed by Kao Charng of the Chung-Hua Institution for Economic Research in Taipei and Sung Yun-Wing of the Chinese University of Hong Kong. Taking data on entrepôt trade between Taiwan and mainland China via Hong Kong released by the Hong Kong Trade Development Council and the Hong Kong Statistics Department in 1991, Kao and Sung made the following two assumptions:¹²

Assumption A: The cost of one-way shipment from Taiwan (or the mainland) to Hong Kong is 6 percent.

Assumption B: The Hong Kong middleman takes a 15 percent profit, namely the average difference between FOB port of Taiwan and the price of Hong Kong reexports.

With these two assumptions, we can obtain the coefficients $\alpha_t = 1/1.5$, $\beta_t = 1$, and $\gamma_t = 1/1.06$. Thus, the formula would be:

¹¹"A Comparative Analysis of Cross-Strait Trade Statistics and Their Methods of Calculation" (Mainland Affairs Council internal document, June 1995).

¹²Kao Charng, *Liang'an sandi jianjie maoyi de shizheng fenxi* (An empirical study of indirect trade involving Taiwan, the mainland, and Hong Kong) (Taipei: Mainland Affairs Council, September 1995), 12-14; Kao Charng, "On the Problem of Calculating Cross-Strait Trade," *Zhongguo dalu yanjiu jiaoxue tongxun* (Mainland China Studies Education Newsletter), September 1995, no. 8:5.

Table 3
Taiwan-Mainland Trade as Estimated According to Three Different Methods

Unit: US\$ millions

Year	Exports to the Chinese Mainland			Imports from the Chinese Mainland		
	BOFT	MAC	Kao & Sung	BOFT	MAC	Kao & Sung
1991	6,928.3	7,493.5	7,476.0	597.5	1,125.9	1,680.0
1992	9,696.8	10,547.6	10,214.0	747.1	1,119.0	2,396.0
1993	12,727.8	13,993.1	13,681.0	1,015.5	1,103.6	3,016.0
1994	14,653.0	16,022.5	15,679.0	1,858.7	1,858.7	4,203.0
1995	17,898.2	19,433.8	—	3,091.4	3,091.4	—

Notes:

BOFT = Board of Foreign Trade, Ministry of Economic Affairs, Taipei.

MAC = Mainland Affairs Council, Executive Yuan, Taipei.

Sources: *Liang'an jingmao tongji yuebao* (Monthly Report on Cross-Strait Economic and Trade Statistics) (Taipei, Mainland Affairs Council), various issues; *Liang'an maoyi xingshi fenxi* (Analysis of cross-Strait trade situation) (BOFT); Kao Charng, *Liang'an sandi jianjie maoyi de shizheng fenxi* (An empirical study of indirect trade involving Taiwan, the mainland, and Hong Kong) (Taipei: Mainland Affairs Council, September 1995), 67.

$$E^3(X) = (1/1.5)E_H(X_a^H) + \{E_T(X^H) - (1/1.06)E_H(X^H)\} \quad (6)$$

In formula 6, Kao and Sung have avoided inconsistency in prices by adopting FOB port of Taiwan as the basis for calculating the values of direct and indirect trade between Taiwan and the mainland. Nonetheless, their two assumptions are not entirely consistent or accurate. This is because their 15 percent middleman's profit includes the 6 percent shipment cost. In other words, the net profit on reexports is assumed to be 9 percent. This differs from an official Hong Kong survey of reexporters which revealed that the former did not include the latter.¹³ The other problem lies in the fact that both the Hong Kong government and Kao and Sung based their research on a survey of companies in Hong Kong. The inclusion of Taiwan companies and forwarders would have enhanced the credibility of the coefficients. Finally, it should also be ascertained whether the coefficients are dynamic or time invariant.

A comparison of the values estimated by these three methods yields a normal distribution (see table 3), namely,

¹³Kao, *Liang'an sandi jianjie maoyi*, 15.

$$E^1(X) < E^3(X) < E^2(X)$$

(BOFT's estimate) (Kao & Sung's estimate) (MAC's estimate)

And we find that in 1994, $E^2(X)$ exceeded $E^3(X)$ by 1.3 percentage points and $E^1(X)$ by 7.7 percentage points. However, each of these three sets of data are useful for obtaining an overall approximation of Taiwan-mainland trade.

Be that as it may, it would be less confusing if the three methods could be integrated to form a common basis for calculating Taiwan-mainland trade. One way of doing this would be to take formula 3 as the basis, then to obtain reliable values for the various coefficients, thereby obtaining a comparatively accurate estimate of Taiwan's exports to mainland China.

In the meantime, we should bear in mind that none of the aforementioned calculations includes Taiwan's increasingly important trade with central and northern China.

Estimating Taiwan's Imports from the Mainland

The calculation of Taiwan imports from the Chinese mainland is much less complicated. Taiwan customs data has become much more reliable since 1995, thanks to the Taipei government's ongoing relaxation of import restrictions. The method used by the BOFT and the MAC can be expressed as follows:

$$E^1(M) = E(M) \tag{7}$$

The calculation of imports prior to 1995 is more difficult, as Taipei's ban on the import of semifinished and finished products from the mainland caused many importers to falsify the documentation of their imports. Scholars have adopted different methods for comparing data before and after 1995.

Kao and Sung, for example, have used the trading partner method and made the following two assumptions:

- Assumption C: The Hong Kong middleman takes a 15 percent profit (which includes freight costs from the mainland to Hong Kong).
- Assumption D: Transshipment expenses from Hong Kong to Taiwan account for 20 percent.

Kao and Sung obtained the value of their coefficients from official Hong Kong statistics on reexports from the Chinese mainland

to Taiwan. The value of indirect imports from the Chinese mainland to Taiwan at CIF port of Taiwan would therefore be

$$E^3(M_a^h) = E_H(M_a^h) \times (120/115) \quad (8)$$

The values for Taiwan's direct imports from the mainland were obtained from Hong Kong customs statistics on the weight of transshipped goods. First, Kao and Sung estimated the values of Taiwan's imports via transshipment from 1983 to 1987 from the difference between Hong Kong and Taiwan official data before 1988. Then they divided the obtained values by the total transshipment weight in the same period. From this, they obtained an average price per metric ton at 1990 prices. Based on the price and the weight in 1988, Kao and Sung developed the following formula for estimating the value of "direct imports":

$$E^3(M_a^h) = \text{the weight of transshipment from the Chinese mainland to Taiwan via Hong Kong} \times \text{the average price per metric ton} \quad (9)$$

in which

the estimated values for direct trade in 1983-87 = Hong Kong customs figure for exports to Taiwan — Taiwan customs figure for imports from Hong Kong (9-1)

the average price per metric ton in base year 1990 = {the estimated value of direct trade in 1983-87 ÷ 1983-87 transshipment weight} = \$5,638 (9-2)

the average price per metric ton = the price for the base year 1990 × the unit price index for Hong Kong imports from the Chinese mainland (9-3)

A combination of formulas 8 and 9 will yield the following formula for calculating Taiwan's imports from the Chinese mainland:

$$E^3(M) = E_H(M_a^h) \times (120/115) + \text{the weight of transshipment via Hong Kong from the mainland in metric tons} \times \text{the average price per metric ton} \quad (10)$$

In theory, formula 10 should have no shortcomings at all. But due to limitations of the data, the values it yields (for instance, US\$3.0016 billion for 1993) deviate from Taiwan customs data by up to 200 percent and from mainland customs data by 100 percent. These deviations make it hard to prove the superiority of this formula over official statistics. From a theoretical point of view, the problem probably lies in formulas 9-1 and 9-3, which rely on sample weights collected by Hong Kong customs and may therefore be subject to a

certain degree of error. There may also be a structural error in the price estimation resulting from possible changes in the structure of trade before and after 1988. In short, Kao and Sung's method is not accurate enough to be useful for anything but a reference.¹⁴

Another method, based on interval estimate, was proposed by Yuh-jiun Nancy Lin, a colleague of Kao's at the Chung-Hua Institution for Economic Research. Lin built up a method of estimation similar to a confidence interval by taking Hong Kong customs figures for reexports to Taiwan from the mainland as the lower bound, mainland customs figures for exports to Taiwan as the middle bound, and the sum of the two figures as the upper bound.¹⁵ In 1994, for instance, the lower bound for Taiwan's imports from the Chinese mainland was US\$1.2 billion, the middle bound was US\$2.4 billion, and the upper bound was US\$3.5 billion.

Aside from the above two methods, mainland Chinese customs data for 1993-95 is also helpful for estimating Taiwan's imports from the Chinese mainland. As mentioned earlier, mainland customs data during this period is much more reliable than that of Taiwan. From table 2, we can also see that the value of the mainland's exports to Taiwan is 20 percent higher than that of Taiwan's imports from the mainland, and we can assume that this discrepancy results from the moral hazards experienced by Taiwan importers. If this is so, we can also assume that Taiwan customs data already includes indirect imports from Hong Kong, and we can therefore apply the following formula to obtain the value ($E^4(M)$) of Taiwan's imports from the mainland at CIF port of Taiwan, using pre-1995 official data from Taiwan, Hong Kong, and the mainland:¹⁶

¹⁴The author wishes to thank Professor Kao Charng for sharing his insights on this question.

¹⁵See Yuh-jiun Nancy Lin, "The Mainland Chinese Macroeconomy and Cross-Strait Trade: Retrospect and Prospects," *Dalu jingji yanjiu* (Mainland China Economic Studies) 17, no. 4 (September 1995): 87-105; Yuh-jiun Nancy Lin, "A Review of Cross-Strait Trade Development," *Issues & Studies* 32, no. 4 (April 1996): 46-59.

¹⁶The three sets of customs data can be converted thus:

	Exported from Chinese mainland	Imported to Hong Kong	Reexported from Hong Kong	Imported to Taiwan
	→-----→ -----→ -----→			
Indirect trade:	\$1	$\$1(1 + t_{mh})$	$\$1(1 + r^h + t_{mh})$	$\$1(1 + r^h + t_{mh} + t_{ht})$
Trans- shipment:	\$1	→ (bypasses Hong Kong Customs)		$\$1(1 + t_{mh} + t_{ht})$

$$E^4(M) = E_T(M) + (1 - s)(1 + t_{mh} + t_{ht})[E_m(M) - E_H(M_a^h)/(1 + t_{mh} + r^h)] \quad (11)$$

In which s represents the share of Taiwan's imports from the mainland via transshipment or cargo in transit which are recorded in Taiwan customs data. This coefficient can be calculated from the three sets of customs data using the following formula:

$$s = [E_T(M) - (1 + t_{ht})E_H(M_a^h)] / (1 + t_{mh} + t_{ht})[E_m(M) - E_H(M_a^h)/(1 + t_{mh} + r^h)]$$

Conclusion

The Taipei government's ban on direct trade with the Chinese mainland has prevented Taiwan businesses from maximizing their efficiency and profits in Taiwan-mainland trade. The factor of incentive incompatibility has distorted trade activities and forced businesses to make false customs declarations. This constitutes the biggest problem in calculating the value of Taiwan-mainland trade. In recent years, both scholars and government agencies have become aware of the urgent need for more reliable trade data, and this author has therefore reviewed existing statistical methods and suggested how they might be integrated into a new approach.

This analysis reveals that although direct trade accounts for a much lower percentage of Taiwan-mainland trade than it does of trade between the Chinese mainland and many other countries, it is on the rise,¹⁷ and by the first half of 1995, it accounted for over half of total trade (see table 1). These figures are reflected in the behavior of Taiwan businesses. With the continuous expansion of Taiwan-mainland trade and the expectation that the ban on direct trade will be lifted soon, many companies have adjusted their trading methods and techniques to save shipping and customs costs and container-handling charges. This adjustment has further exposed the declining credibility and effectiveness of the indirect trade policy.

Thus, mainland China's exports to Taiwan via Hong Kong at CIF port of Taiwan may be expressed thus:

$$E_{m.cif}(M) = (1 + t_{ht})E_H(M_a^h) + (1 + t_{th} + t_{mh})\{E_m(M) - E_H(M_a^h)/(1 + t_{mh} + r^h)\}$$

In which t_{th} represents the shipping cost of goods reexported from Hong Kong to Taiwan, and t_{mh} is the shipping cost of exports from mainland China to Hong Kong. To facilitate calculation, we can assume that the shipping costs for transshipment and cargo in transit are the same. In theory, the two could be calculated separately and then substituted in the formula, but the difference should not affect the results.

¹⁷See *China Trade Report*, June 1995, 14-16.

Judging from the foregoing analysis, the only way to reestablish the credibility of cross-Strait trade policy and facilitate the calculation of accurate statistics is to normalize trade between Taiwan and mainland China. But as most scholars have recognized, the normalization of trade relations is not just an economic issue; it also involves political factors. Yet, as assignment theory tells us, a single policy instrument cannot achieve two different goals. In other words, if the Taipei government wants to reestablish the credibility of its trade policy and safeguard national security and dignity, it will have to adjust policies in other related areas.