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Methodology of U.S.-China-Hong Kong Triangular Merchandise Trade Statistic Reconciliation

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Abstract

This research note documents the methodology of U.S.-China-Hong Kong triangular merchandise trade statistic reconciliation. Instead of directly comparing the official trade statistics from the United States and China and calculating the discrepancies, the U.S-China-Hong Kong triangular reconciliation methodology takes into account of re-exports and transshipment via Hong Kong. This research note also documents the application of this methodology to advance technology product trade between the United States and China.

## Keywords

Trade discrepancy, advance technology product trade

Part One: Introduction

Merchandise trade statistics is one of the most valuable economic statistics that has been used widely in economic analysis. However, it is well known that trade statistics reported by importing and exporting countries are unlikely to be the same, and could vary greatly from each other even at very aggregate level. A variety of reasons contributing to discrepancies in merchandise trade data have been identified, such as valuation difference that exports are typically reported on a f.o.b. (freight on board) basis while imports are typically reported on a c.i.f. (cost, insurance, freight) basis, or under- or over-invoicing by importers or exporters for the purpose of tariff evasion or tax avoidance.

It has been long noticed that U.S. reported merchandise trade statistics with China are considerably different from China reported merchandise trade statistic with U.S., especially for the eastbound trade that China reported exports to U.S. while U.S. reported imports from China (Figure 1). In 2010 and 2011, the statistical discrepancies amounted to US$91 billion and US$89 billion, respectively. Although the discrepancies as the shares of averaged U.S. and China reported data have been decreasing markedly (Figure 2), the magnitude of the discrepancies between the world's largest two economies remains significant, demanding an appropriate methodology to reconcile.

Figure 1: Discrepancies between U.S. and China Reported Merchandise Trade Statistics

Figure 2: Discrepancies as the Share of U.S. and China Reported Merchandise Trade Statistics
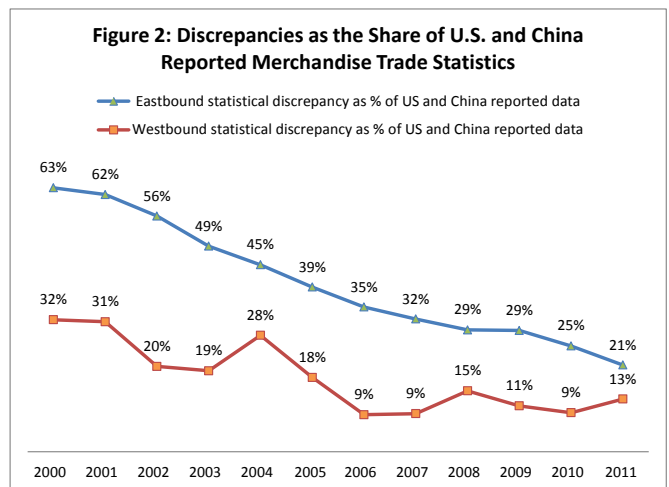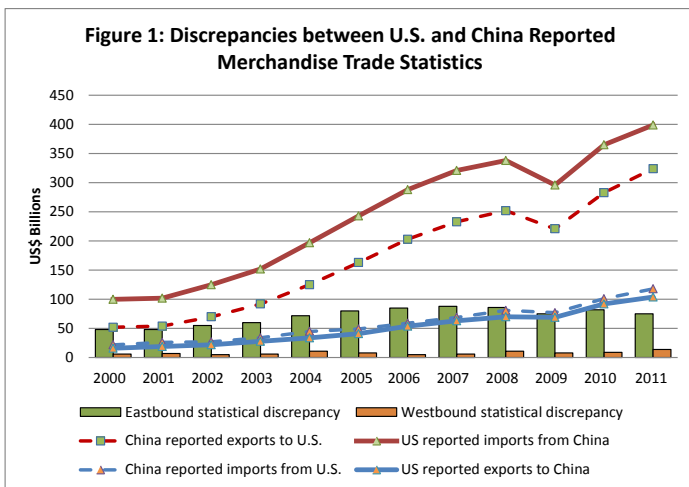
Ferrantino and Wang (2008) found that the standard methods for trade data reconciliation have generally not worked well for China's trade with the rest of the world. They identified most of China's trade discrepancies with its trading partners were explained by the large share of China's trade which is re-exported through the customs territory of Hong Kong.[2] For instance, China more likely records re-export to other countries via Hong Kong as exports to Hong Kong, while the final destination country, such as the U.S., likely records them as imports from China, based on the United Nation rules of origin. Thus Ferrantino and Wang developed a U.S.-China-Hong Kong triangular trade statistic reconciliation method that uses trade data from the United States on the one hand, and trade data from China and Hong Kong on the other, taking into account of the important role that Hong Kong plays in China's trade with the U.S. As

Figure 3: Discrepancies between U.S. and China-H.K. Reported Merchandise Trade Statistics

Figure 4: Discrepancies as the Share of U.S. and China-H.K. Reported Merchandise Trade Statistics
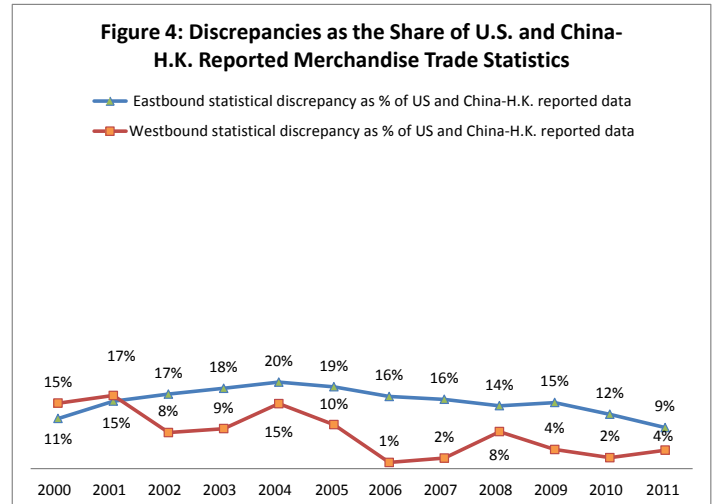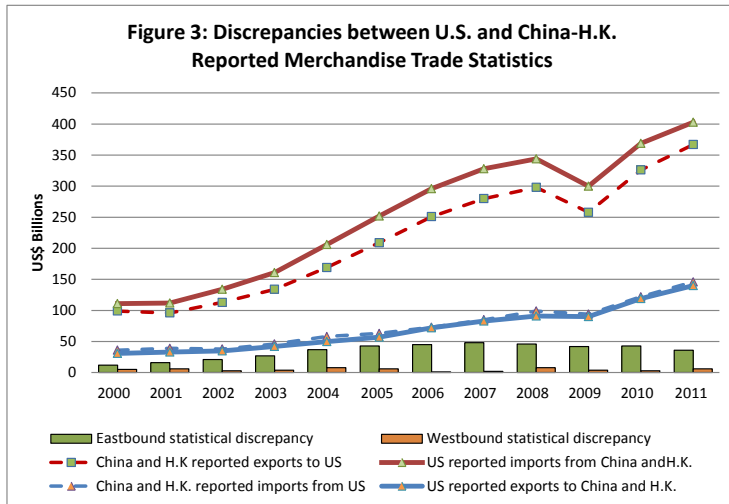
Figure 3 and Figure 4 show, simply by including Hong Kong-U.S. trade statistics on both sides, the discrepancies are cut by about an half, to US$46 billion in 2010 and US$42 billion in 2011, meanwhile their shares of averaged U.S., China, and H.K. reported data also decrease significantly (Figure 3 & 4).

However, Figure 3 also shows that even with the inclusion of H.K.-U.S. trade statistics, U.S. reported imports from China and H.K. have grown persistently larger than the sum of China and H.K. reported exports to the United States. Such discrepancies could not be explained by the failure of accounting for China's re-exports through Hong Kong, and thus propel further reconciliation in order to find some explanations.

In part two, we will discuss in details the reconciliation methodology, such as data sources, data adjustments, as well as the results.

Part Two: Reconciliation Methodology

2.1 Data sources

Four sets of trade statistics are used in this reconciliation exercise: U.S. reported trade data from USITC Data web at 10-digit HS level, U.S. reported shipping data from the U.S. Census Bureau at 6-digit HS level, China reported trade statistics from the Customs General Administration of China at 8-digit HS level, and

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[2] Michael J. Ferrantino and Zhi Wang, "Accounting for discrepancies in bilateral trade: the case of China, Hong Kong, and the United States", China Economic Review 19, 2008, 502-520.

Hong Kong reported trade and re-export statistics from the Census and Statistical Department of Hong Kong at 8-digit HS level.

2.2 Mirror Triangular Trade Relations
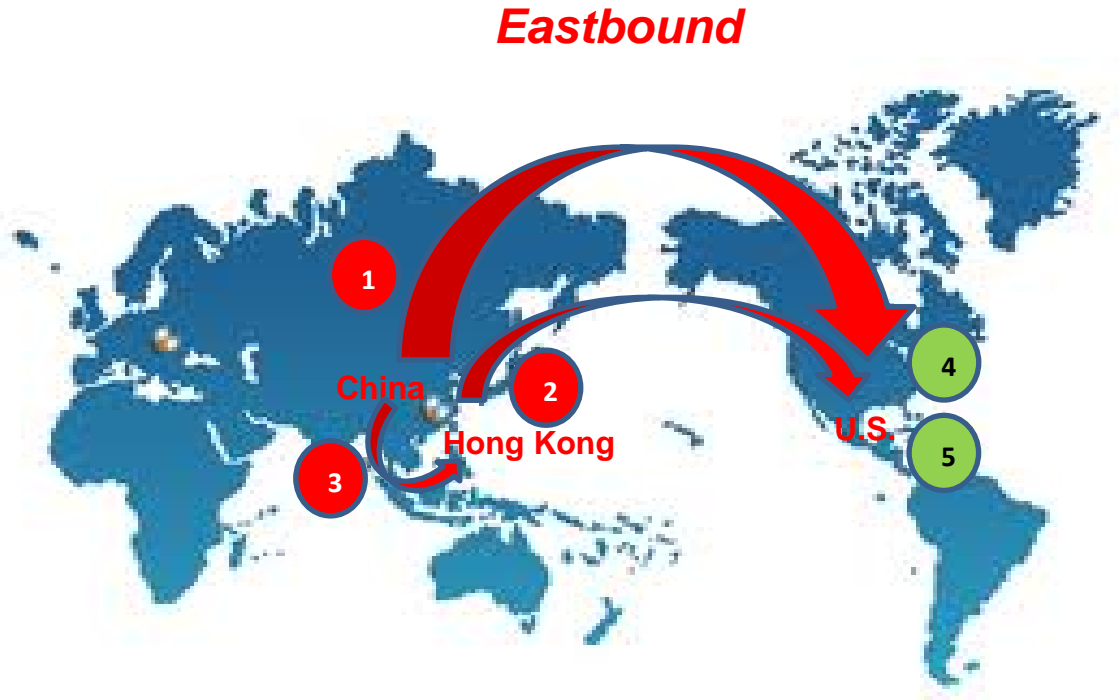
Eastbound (China-H.K. exports to U.S. vs. U.S. imports from China-H.K.)

Westbound (U.S. exports to China-H.K. vs. China-H.K. imports from U.S.)

1	2	3	4
China Reported Imports from U.S.	+ H.K. Reported Imports from U.S.	– H.K. Reported Re-exports of U.S.-origin Goods to China	– H.K. Reported Re-exports of U.S.-origin Goods to Third Countries

Discrepancy

5	6	4
U.S. Reported Exports to China	+ U.S. Reported Exports to H.K.	– H.K. Reported Re-exports of U.S.-origin Goods to Third Countries
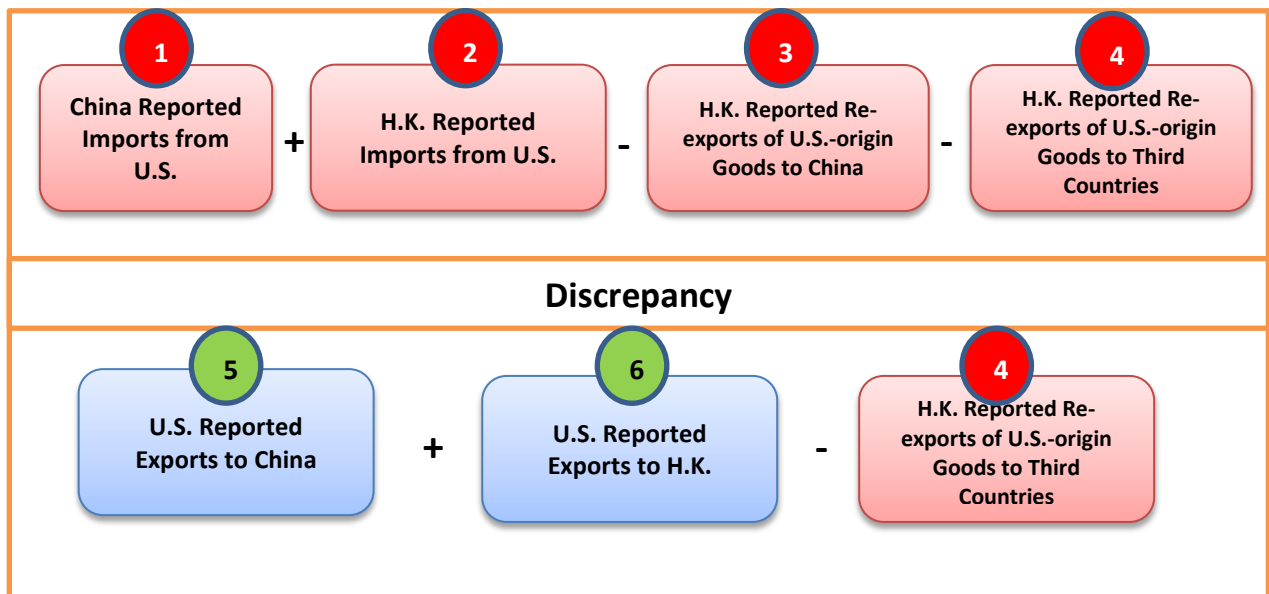
2.3 Data Adjustment

Ferrantino and Wang (2008) have identified the following data compatibility issues that require adjustments before calculating the discrepancies between U.S., China, and Hong Kong trade statistics.

1. *Geographic coverage difference*:
    The U.S. trade statistics include Puerto Rico and the U.S. Virgin Islands as a part of its statistical territory, while China and Hong Kong trade statistics treat them as the separate jurisdictions and exclude them in their trade data with the United States. To address this geographic coverage

differences, trade between China/Hong Kong and Puerto Rico and the U.S. Virgin Islands are taken out of the U.S.-China-Hong Kong trade statistics on the U.S. side.

2. *Valuation difference*:

In the eastbound trade, China and Hong Kong report their exports on an f.o.b. basis, and U.S. Census Bureau reports imports in general customs value, along with custom duty collected and cost of insurance and freight. General custom value, by definition is "value of the imports, as appraised by U.S. Customs, excluding U.S. imports duties, freight, insurance, and other charges incurred in bringing the merchandise to the U.S. for general imports", which is equivalent to the f.o.b. value. [3] Thus, for the eastbound trade, no valuation adjustment needs to be made.

In the westbound trade, China and Hong Kong report their imports on a c.i.f. basis, while U.S. reports its exports on an f.a.s. (free alongside ship) basis that does not include shipping costs. Thus, f.a.s./c.i.f. adjustment must be made. Because f.a.s. and f.o.b. values are very close, we substitute with f.o.b./c.i.f. ratios that are calculated directly from U.S. reported import data to make such adjustment. Because westbound transportation cost is generally lower than eastbound transportation cost due to supply and demand conditions, we apply 60% of eastbound f.o.b./c.i.f. ratios as westbound f.o.b./c.i.f. ratios.

3. *Re-exports through Hong Kong*:

Hong Kong trade statistics report exports in two categories: domestic exports, and re-exports. Since considerable U.S. and China re-exports go through Hong Kong, it is necessary to breakdown these re-exports in order to obtain more information and better accuracy.

In the eastbound trade, Hong Kong exports to U.S. are broken down into Hong Kong Domestic exports to U.S., and Hong Kong re-exports of China-origin goods to U.S. In the westbound trade, Hong Kong re-exports of U.S.-origin goods are broken down into Hong Kong re-exports of U.S.-origin goods to China, and Hong Kong re-exports of U.S.-origin goods to third countries. Since China is assumed to follow the UN rules of origin, China more likely records Hong Kong re-exports of U.S.-origin goods to China as its imports from the United States, while Hong Kong records them as its imports from the United States. To avoid double counting, Hong Kong re-exports of U.S.-origin goods to China are subtracted from the sum of China reported imports from the United States. Since Hong Kong re-exports of U.S.-origin goods to third countries are in fact the trade between U.S. and third countries, we subtract them from U.S. reported exports to Hong Kong, as well as from Hong Kong reported imports from the United States.

Wang, Gehlhar, and Yao (2010) estimate the markup rate for Hong Kong's re-exports of U.S.-origin goods to China at around 10%; however, no such estimates exist for Hong Kong's re-exports of U.S.-origin goods to third countries. [4] For Hong Kong re-exports of U.S.-origin goods to China, as China reported import data reflect the final value that includes the markup, it is not an issue. For
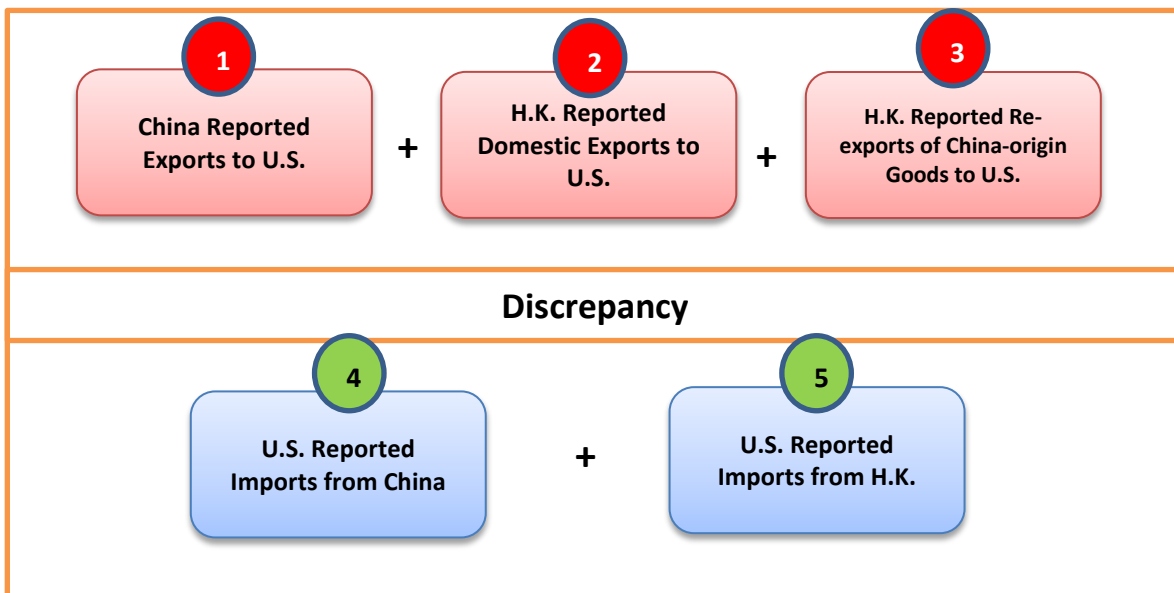
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[3] Michael J. Ferrantino and Zhi Wang, "Accounting for discrepancies in bilateral trade: the case of China, Hong Kong, and the United States", China Economic Review 19, 2008, 502-520.

[4] Wang, Gehlhar, and Yao, "A globally consistent framework for reliability-based trade statistics reconciliation in the presence of an entrepot", China Economic Review 21 (2010), 161-189.

Hong Kong re-exports of U.S.-origin goods to third countries, we need to acknowledge that H.K. reported re-exports would be bigger than U.S. reported exports or Hong Kong reported imports, due to the markups. However, since such re-exports are deducted from trade data on both sides, the markups would have an insignificant impact on the discrepancy.

2.4 Step-by-step Reconciliation Methodology

Eastbound Trade

US reported imports from China (f.o.b.)	a
US reported imports from HK (f.o.b.)	b
Geographical coverage adjustment from China	c
Geographical coverage adjustment from HK	d
US reported imports from China and HK	IM=(a-c)+(b-d)

Mirror data:

China reported exports to US (f.o.b.)	m
HK reported domestic exports to US (f.o.b.)	n
HK reported re-exports of China-origin goods to US (f.o.b.)	o
China and HK reported exports to US	EX=m+n+o

Discrepancies:

Statistical Discrepancies (US IM-China/HK EX)	D=IM-EX=(a+b-c-d)-(m+n+o)

Westbound Trade

US reported Exports to China (f.a.s.)	a
US reported Exports to HK (f.a.s.)	b
Geographical coverage adjustment for China	c
Geographical coverage adjustment for HK	d
HK re-exports of US-origin goods to third countries	e
c.i.f. to f.a.s. adjustment for HK re-exports of US-origin goods to third countries	f
US reported exports to China and HK (f.a.s.)	EX=(a-c)+(b-d)-(e-f)

Mirror data:

China reported imports from US (c.i.f.)	m
HK reported imports from US (c.i.f.)	n
c.i.f. to f.a.s. adjustment for China import data	o
c.i.f. to f.a.s. adjustment for HK import data	p
HK reported re-exports of US-origin goods to China (f.o.b.)	q
China and HK reported imports from US	IM=(m-q-o)+(n-p)

Discrepancies:

Statistical Discrepancies (China/HK IM -US EX)	D=IM-EX=(m+n-o-p-q)-(a+b-c-d-e+f)

2.5 Results after the Adjustments

Table 1: Eastbound trade statistics reported by China, Hong Kong and the United States and statistical discrepancies

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
						Millions United States Dollars										
U.S. reported imports from China (f.o.b.)	51,495	62,552	71,156	81,786	100,063	102,280	125,168	152,379	196,699	243,462	287,773	321,508	337,790	296,402	364,944	399,335
U.S. reported imports from H.K. (f.o.b.)	9,867	10,297	10,538	10,531	11,452	9,650	9,328	8,850	9,314	8,893	7,943	7,030	6,485	3,567	4,304	4,298
Geographical coverage adjustment for U.S. reported data																
From China: (-)	132	145	152	195	216	256	299	369	414	510	648	653	742	653	774	843
From H.K.:(-)	67	50	60	43	35	26	18	24	25	27	16	14	14	7	18	10
Adjusted U.S. imports from China and H.K. (f.o.b.)	61,164	72,654	81,483	92,079	111,264	111,648	134,180	160,837	205,574	251,818	295,052	327,871	343,519	299,309	368,455	402,780
Statistical discrepancy	(1,734)	1,540	5,531	11,450	15,717	18,019	24,543	29,925	40,153	45,768	47,199	51,796	49,070	45,050	46,439	40,353
Adjusted China and H.K. exports to U.S. (f.o.b.)	62,897	71,114	75,951	80,629	95,547	93,629	109,637	130,913	165,421	206,051	247,852	276,075	294,449	254,259	322,017	362,427
China reported exports to U.S. (f.o.b.)	26,709	32,716	37,965	42,016	52,142	54,273	69,951	92,474	124,948	162,900	203,472	232,700	252,312	220,624	283,287	324,453
H.K. reported domestic exports to U.S. (f.o.b.)	6,964	7,113	7,082	6,620	6,986	6,103	5,374	5,027	4,960	4,858	4,269	3,061	2,423	944	1,076	921
H.K. reported re-exports of China-origin goods to U.S. (f.o.b.)	29,225	31,285	30,904	31,993	36,419	33,254	34,313	33,412	35,513	38,294	40,112	40,314	39,713	32,691	37,654	37,053
Statistical discrepancy as % of U.S. reported imports	(2.83)	2.12	6.79	12.44	14.13	16.14	18.29	18.61	19.53	18.17	16.00	15.80	14.28	15.05	12.60	10.02
Statistical discrepancy as % of the mean of U.S., China and H.K. reported data	(2.79)	2.14	7.03	13.26	15.20	17.56	20.13	20.51	21.65	19.99	17.39	17.15	15.38	16.28	13.45	10.55

Table 2: Westbound trade statistics reported by China, Hong Kong and the United States and statistical discrepancies

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
						Millions United States Dollars										
U.S. reported exports to China (f.a.s.)	11,978	12,805	14,258	13,118	16,253	19,235	22,053	28,418	34,721	41,837	55,224	65,238	71,457	69,576	91,878	103,879
U.S. reported exports to H.K. (f.a.s.)	13,956	15,115	12,923	12,647	14,625	14,072	12,612	13,542	15,809	16,323	17,779	20,121	21,633	21,119	26,569	36,513
Geographical coverage adjustment for U.S. reported data																
To China: (-)	3	4	12	6	15	32	52	77	74	76	103	220	163	220	600	586
To H.K.:(-)	10	17	11	15	16	18	18	27	31	54	57	53	126	271	411	803
U.S. reported exports to China and H.K. (f.a.s.)	25,921	27,899	27,158	25,743	30,847	33,257	34,594	41,856	50,425	58,029	72,843	85,085	92,802	90,203	117,437	139,001
H.K. reported re-exports of US-origin goods to third countries	2,176	2,125	1,747	1,941	2,294	1,893	1,868	1,873	2,144	2,240	2,434	2,687	3,839	3,665	3,827	4,953
c.i.f. to f.o.b. adjustment for H. K reexports of US-origin goods to third countries	51	46	39	50	61	49	52	54	63	60	61	65	80	71	76	90
H.K. reported re-exports of US-origin goods to third countries (f.o.b.)	2,125	2,079	1,708	1,890	2,233	1,845	1,816	1,819	2,081	2,180	2,373	2,622	3,760	3,594	3,751	4,862
Adjusted U.S. exports to China and H.K.	23,796	25,820	25,450	23,853	28,615	31,412	32,779	40,037	48,343	55,849	70,470	82,463	89,042	86,609	113,685	134,139
Statistical discrepancy	(294)	(1,684)	(2,076)	482	(819)	(862)	(2,639)	(2,687)	1,272	(1,651)	(6,158)	(6,924)	(2,435)	(5,939)	(3,595)	(2,036)
Adjusted China and H.K. imports from U.S.	23,502	24,136	23,374	24,335	27,796	30,550	30,140	37,350	49,615	54,198	64,312	75,539	86,607	80,670	110,090	132,103
c.i.f. to f.o.b. adjustment for China and H.K. reported data																
China: (-)	339	315	377	595	705	790	807	1,134	1,574	1,656	1,907	2,097	2,337	1,756	2,692	2,973
Hong Kong: (-)	316	304	265	279	324	297	275	311	359	352	339	365	322	286	383	406
H.K. reported re-exports of US-origin goods to China	5,866	5,964	5,295	5,373	6,108	6,467	6,197	6,240	5,786	6,031	6,525	6,902	8,091	7,145	8,627	9,348
H.K. reported re-exports of US-origin goods to third countries	2,176	2,125	1,747	1,941	2,294	1,893	1,868	1,873	2,144	2,240	2,434	2,687	3,839	3,665	3,827	4,953
China and H.K. reported importsfrom U.S. (c.i.f.)	31,831	32,494	30,755	32,193	36,841	39,652	38,959	46,543	59,057	64,065	75,117	87,160	100,795	93,165	125,160	149,287
China reported imports from U.S. (c.i.f.)	16,179	16,301	16,997	19,488	22,365	26,195	27,230	33,861	44,679	48,726	59,209	69,370	81,426	74,827	102,099	122,129
H.K. reported imports from U.S. (c.i.f.)	15,653	16,193	13,758	12,705	14,476	13,457	11,729	12,683	14,378	15,338	15,908	17,790	19,369	18,338	23,061	27,158
Statistical discrepancy as % of China and H.K. reported imports	(1.25)	(6.98)	(8.88)	1.98	(2.95)	(2.82)	(8.76)	(7.19)	2.56	(3.05)	(9.58)	(9.17)	(2.81)	(7.36)	(3.27)	(1.54)
Statistical discrepancy as % of the mean of U.S., China and H.K. reported data	(1.24)	(6.74)	(8.50)	2.00	(2.90)	(2.78)	(8.39)	(6.95)	2.60	(3.00)	(9.14)	(8.76)	(2.77)	(7.10)	(3.21)	(1.53)

Part Three: The Decomposition of Trade Discrepancies

Due to classification difference between U.S. and China/H.K. trade statistics, mainly the treatment of HS chapter 98 and 99, the decompositions of trade discrepancies are conducted with the trade data covering HS1-97 only. [5]

3.1 The Decomposition of Trade Discrepancies by HS Sections

The reconciliation methodology remains the same as the above. At 2-digit HS level, trade discrepancies are grouped into HS sections defined by U.S. International Trade Commission;[6] the discrepancy as the percentage of each HS section is calculated, both on the bases of U.S. reported imports, as well as the mean of U.S., China and H.K. reported trade data.

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[5] The U.S. includes certain special programs and transactions in HS chapter 98 and 99
[6] http://www.usitc.gov/tata/hts/bychapter/index.htm.

Research Note

Table 3: Discrepancy indexes of trade statistics reported by China, Hong Kong and the United States in major HS sections (eastbound trade, HS1-97, percentage)

HS Sections	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Statistical discrepancy as % of U.S. reported imports																
Live animals and animal products	6.1	20.3	17.3	15.2	21.2	29.4	23.7	25.4	24.0	18.5	33.9	40.1	45.7	19.0	99.0	14.6
vegetable products	14.4	21.0	25.6	30.9	34.3	26.6	27.8	21.3	24.5	23.7	14.5	20.5	23.0	12.6	79.2	2.7
Animal and vegetable fats and oils	44.4	8.9	17.2	(4.9)	20.5	11.7	(1.1)	6.7	2.5	(4.5)	11.3	20.4	23.0	14.4	(14.1)	(54.4)
Prepared foodstuffs, beverages and tobacco	1.4	(3.4)	(6.6)	1.6	(22.8)	(16.7)	(16.0)	(10.2)	3.5	0.9	(16.0)	(24.3)	(30.9)	(18.5)	(18.3)	(20.6)
Mineral products	4.4	15.1	5.7	11.0	7.5	8.6	9.2	(5.4)	12.4	(2.4)	(9.1)	(34.3)	(6.3)	(59.8)	(40.3)	(87.2)
Products of the chemical or allied industries	0.4	(1.3)	0.1	7.3	0.4	(1.3)	(6.0)	(6.2)	(4.7)	0.6	2.2	2.2	6.8	7.7	(15.9)	4.1
Plastics and rubber	(24.0)	(20.5)	(24.9)	(19.3)	(16.7)	(6.2)	0.5	7.8	10.3	13.3	11.0	13.6	17.1	17.6	13.5	5.0
Raw hides and skins, leather, fur skins	(14.8)	(5.7)	(2.3)	(1.7)	0.2	0.7	4.2	7.7	8.4	11.9	13.9	14.3	14.2	10.3	2.6	(9.8)
Wood and cork articles	(13.6)	(3.7)	11.1	14.2	15.2	16.2	14.3	15.8	12.0	13.9	11.7	12.5	15.3	11.6	7.6	7.7
Wood pulp, paper and paperboard articles	17.0	10.2	14.3	18.0	23.4	23.0	24.0	26.5	26.0	28.2	25.9	25.5	24.0	23.5	21.1	9.1
Textiles	1.2	5.3	3.8	4.7	3.5	4.9	7.0	8.1	10.5	0.1	(2.0)	0.4	0.9	(4.3)	(8.2)	(10.1)
Footwear, headgear and umbrellas	(23.4)	(16.4)	(0.5)	7.6	7.9	14.4	18.3	20.6	21.4	23.2	24.5	22.3	18.3	19.3	16.1	14.3
Articles of stone, plaster, cement, ceremic and glass	7.9	15.9	20.0	29.6	37.3	39.7	41.0	39.2	35.1	32.5	29.2	31.7	30.8	25.3	10.4	(4.1)
Pearls, precious stones and metals	14.5	13.4	11.2	8.7	12.4	9.4	5.2	(0.4)	1.1	3.9	4.3	(0.9)	4.8	(5.3)	(22.1)	(7.8)
Base metals	(6.9)	(3.8)	(7.0)	4.3	5.9	11.4	8.9	11.3	8.8	10.6	7.3	10.5	11.6	18.8	9.7	6.7
Machinery and mechanical appliances	6.1	7.0	11.2	25.9	29.9	27.8	27.4	20.0	25.8	24.5	19.8	14.7	11.2	10.3	10.2	10.5
Electrical machinery and equipment	(0.1)	5.4	10.9	11.8	10.3	9.8	12.4	11.8	12.8	13.6	12.2	13.0	13.4	16.7	18.9	19.1
Vehicles, aircraft, vessels and other transport equipment	(53.4)	(23.9)	(41.1)	(28.4)	7.5	(11.3)	(10.6)	(34.7)	(46.7)	(43.0)	(35.9)	(32.9)	(35.2)	(14.5)	(36.8)	(36.3)
Medical instruments, musical instruments, clocks and watches	(11.3)	(7.5)	(2.8)	(2.9)	(1.8)	(5.3)	(3.8)	8.6	6.9	(10.4)	(22.5)	(4.1)	(10.9)	(10.2)	(18.8)	(13.9)
Arms and ammunition	52.8	49.6	28.0	43.3	68.3	68.8	82.3	86.2	84.1	81.0	78.9	70.5	63.2	69.9	62.5	61.7
Miscellaneous manufactured articles	0.1	5.4	12.8	19.2	22.1	29.0	31.8	36.9	36.7	38.0	38.1	37.1	31.9	33.5	31.7	23.8
Works of art, collectors' pieces and antiques	51.7	50.9	65.8	71.2	77.7	79.5	64.0	77.6	63.6	53.1	65.8	75.5	64.6	68.0	60.7	18.9
Statistical discrepancy as % of averaged U.S., China and H. K. reported trade data																
Live animals and animal products	6.3	22.6	18.9	16.4	23.8	34.4	26.9	29.1	27.2	20.4	40.7	50.2	59.3	21.0	196.2	15.8
vegetable products	15.6	23.5	29.3	36.5	41.4	30.7	32.3	23.8	28.0	26.9	15.7	22.9	26.0	13.5	131.2	2.8
Animal and vegetable fats and oils	57.1	9.3	18.8	(4.8)	22.9	12.4	(1.1)	6.9	2.5	(4.4)	12.0	22.7	25.9	15.5	(13.2)	(42.8)
Prepared foodstuffs, beverages and tobacco	1.4	(3.4)	(6.4)	1.6	(20.4)	(15.4)	(14.9)	(9.7)	3.5	0.9	(14.8)	(21.6)	(26.8)	(16.9)	(16.8)	(18.7)
Mineral products	4.5	16.3	5.9	11.7	7.8	9.0	9.7	(5.2)	13.3	(2.4)	(8.7)	(29.3)	(6.1)	(46.0)	(33.6)	(60.7)
Products of the chemical or allied industries	0.4	(1.3)	0.1	7.6	0.4	(1.2)	(5.8)	(6.0)	(4.6)	0.6	2.2	2.2	7.0	8.0	(14.7)	4.2
Plastics and rubber	(21.4)	(18.6)	(22.2)	(17.6)	(15.4)	(6.0)	0.5	8.2	10.9	14.3	11.6	14.6	18.7	19.3	14.5	5.1
Raw hides and skins, leather, fur skins	(13.8)	(5.6)	(2.3)	(1.7)	0.2	0.7	4.3	8.0	8.8	12.7	14.9	15.4	15.3	10.9	2.7	(9.3)
Wood and cork articles	(12.8)	(3.6)	11.8	15.3	16.5	17.7	15.4	17.2	12.7	15.0	12.4	13.3	16.5	12.4	7.9	8.0
Wood pulp, paper and paperboard articles	18.6	10.8	15.5	19.8	26.6	25.9	27.2	30.6	29.9	32.9	29.7	29.3	27.3	26.6	23.6	9.5
Textiles	1.2	5.4	3.9	4.9	3.6	5.0	7.2	8.4	11.0	0.1	(2.0)	0.4	0.9	(4.2)	(7.9)	(9.6)
Footwear, headgear and umbrellas	(21.0)	(15.2)	(0.5)	7.9	8.2	15.6	20.2	23.0	23.9	26.3	27.9	25.1	20.1	21.4	17.5	15.4
Articles of stone, plaster, cement, ceremic and glass	8.2	17.2	22.2	34.7	45.8	49.5	51.5	48.8	42.6	38.8	34.2	37.7	36.4	28.9	11.0	(4.0)
Pearls, precious stones and metals	15.7	14.3	11.8	9.1	13.3	9.9	5.4	(0.4)	1.1	3.9	4.3	(0.9)	4.9	(5.1)	(19.9)	(7.5)
Base metals	(6.7)	(3.7)	(6.7)	4.4	6.0	12.1	9.3	12.0	9.2	11.2	7.6	11.0	12.3	20.7	10.2	6.9
Machinery and mechanical appliances	6.3	7.2	11.8	29.7	35.2	32.4	31.7	22.3	29.6	28.0	21.9	15.9	11.8	10.9	10.8	11.1
Electrical machinery and equipment	(0.1)	5.5	11.5	12.6	10.9	10.3	13.2	12.6	13.7	14.5	13.0	13.9	14.4	18.2	20.8	21.2
Vehicles, aircraft, vessels and other transport equipment	(42.1)	(21.3)	(34.1)	(24.9)	7.8	(10.7)	(10.0)	(29.6)	(37.9)	(35.4)	(30.4)	(28.2)	(29.9)	(13.5)	(31.1)	(30.7)
Medical instruments, musical instruments, clocks and watches	(10.7)	(7.3)	(2.7)	(2.9)	(1.8)	(5.2)	(3.8)	9.0	7.2	(9.9)	(20.2)	(4.0)	(10.3)	(9.7)	(17.2)	(13.0)
Arms and ammunition	71.8	65.9	32.6	55.3	103.8	104.9	139.7	151.3	145.1	136.2	130.3	108.8	92.4	107.5	91.0	89.3
Miscellaneous manufactured articles	0.1	5.5	13.6	21.3	24.8	34.0	37.8	45.2	44.9	46.9	47.1	45.6	37.9	40.2	37.7	27.1
Works of art, collectors' pieces and antiques	69.8	68.2	98.0	110.6	127.0	132.0	94.2	126.9	93.2	72.4	98.0	121.2	95.4	102.9	87.2	20.9

Research Note

Table 4: Discrepancy indexes of trade statistics reported by China, Hong Kong and the United States in major HS sections (westbound trade, HS1-97, percentage)

HS Sections	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Statistical discrepancy as % of China-H.K. reported imports																
Live animals and animal products	(43.0)	(49.7)	(53.6)	(8.8)	(5.5)	3.6	24.3	23.7	8.9	1.3	(11.4)	(9.1)	(2.8)	(2.7)	(302.9)	6.3
vegetable products	3.4	32.0	21.4	22.3	9.0	10.6	2.1	(24.4)	24.7	21.9	2.5	(0.4)	9.3	(9.3)	(1.2)	11.1
Animal and vegetable fats and oils	(75.4)	(11.5)	(14.0)	53.0	42.9	28.4	14.4	(30.7)	(125.0)	(73.4)	(132.4)	(35.9)	26.7	(46.7)	(58.1)	38.9
Prepared foodstuffs, beverages and tobacco	10.1	11.4	10.1	21.4	18.8	23.0	24.1	17.7	17.5	4.4	9.5	1.7	4.7	(4.7)	15.3	1.7
Mineral products	(12.1)	(23.8)	4.4	13.7	(4.5)	(25.7)	28.8	11.8	24.5	22.4	8.2	13.8	31.1	14.0	8.7	8.0
Products of the chemical or allied industries	11.6	(8.5)	11.1	17.8	10.8	14.0	18.9	26.5	26.3	22.7	20.3	17.6	20.0	10.0	20.9	18.8
Plastics and rubber	3.1	2.5	0.6	5.8	(8.9)	(7.4)	(21.8)	(20.5)	(10.8)	(11.3)	(14.8)	(6.3)	(1.9)	(5.9)	5.1	6.9
Raw hides and skins, leather, fur skins	12.4	(1.5)	4.8	9.6	(27.7)	(32.5)	(29.5)	(32.9)	(18.4)	(13.7)	(16.3)	(11.7)	(11.0)	(16.5)	(27.8)	(19.4)
Wood and cork articles	2.3	12.5	(1.3)	(16.5)	(42.0)	(59.7)	(41.8)	(35.9)	(45.7)	(34.6)	(28.7)	(19.2)	(11.5)	(22.7)	(10.3)	(2.7)
Wood pulp, paper and paperboard articles	13.2	14.4	5.9	15.6	21.7	9.8	10.2	17.3	19.3	17.4	6.6	8.3	21.6	(4.4)	10.5	12.7
Textiles	1.9	7.1	(4.6)	(7.5)	(15.4)	(13.7)	(36.8)	(22.7)	6.7	(4.8)	(1.3)	(1.6)	(5.7)	(6.6)	(3.7)	3.1
Footwear, headgear and umbrellas	(14.8)	0.5	(23.2)	(13.0)	(22.8)	(44.8)	(48.1)	(15.6)	0.1	(5.9)	(6.4)	(16.8)	(15.6)	(5.4)	(5.5)	(10.5)
Articles of stone, plaster, cement, ceremic and glass	(7.3)	(13.7)	(15.2)	(13.3)	(51.2)	(30.4)	(49.0)	(23.7)	(19.1)	(10.4)	(17.6)	(12.7)	4.9	1.6	6.1	(0.9)
Pearls, precious stones and metals	(70.0)	(70.1)	(37.2)	(35.5)	(26.5)	(35.7)	(15.7)	(29.8)	(45.3)	(59.3)	(62.2)	(70.1)	(82.2)	(89.5)	(109.9)	(286.7)
Base metals	8.8	5.5	(5.8)	4.3	(7.4)	(22.3)	(33.6)	(31.1)	(26.0)	(53.3)	(113.3)	(80.7)	(78.0)	(49.1)	(34.8)	(36.7)
Machinery and mechanical appliances	12.3	(6.5)	(0.3)	14.8	(0.6)	1.5	0.9	1.9	6.1	8.3	7.0	6.7	8.8	8.6	9.5	11.9
Electrical machinery and equipment	(5.1)	(3.8)	5.6	(3.0)	(3.9)	3.8	(11.7)	(23.9)	(8.8)	(3.9)	(6.6)	(3.7)	0.9	(4.5)	8.2	10.4
Vehicles, aircraft, vessels and other transport equipment	(20.8)	(37.3)	(83.7)	(32.6)	(15.0)	(22.2)	(53.4)	(7.7)	10.3	(27.7)	(13.3)	(34.3)	(16.0)	(9.0)	(14.4)	(18.4)
Medical instruments, musical instruments, clocks and watches	17.2	3.6	2.2	9.3	18.5	10.7	10.5	15.2	17.0	15.5	9.8	11.6	11.2	8.7	7.8	12.9
Arms and ammunition	(146.9)	(161.6)	(109.2)	(876.1)	(1,529.0)	(143.3)	(309.9)	(238.3)	(1,075.1)	(1,591.4)	(332.9)	(351.8)	(554.1)	(430.9)	(486.7)	(400.4)
Miscellaneous manufactured articles	(17.9)	(43.1)	(44.6)	(39.8)	(51.9)	(60.3)	(84.3)	(61.2)	(57.5)	(58.6)	(52.9)	(71.2)	(37.6)	(48.4)	(103.9)	(120.0)
Works of art, collectors' pieces and antiques	(99.6)	(206.7)	(27.4)	(52.2)	4.5	(25.8)	(19.1)	38.2	(34.3)	10.7	(24.7)	(5.3)	(17.2)	(0.3)	(42.3)	(66.6)
Statistical discrepancy as % of averaged U.S., China and H. K. reported trade data																
Live animals and animal products	(35.4)	(39.8)	(42.3)	(8.4)	(5.3)	3.7	27.7	26.9	9.3	1.3	(10.8)	(8.7)	(2.8)	(2.7)	(120.5)	6.5
vegetable products	3.4	38.0	23.9	25.1	9.4	11.2	2.1	(21.8)	28.2	24.7	2.5	(0.4)	9.8	(8.9)	(1.2)	11.7
Animal and vegetable fats and oils	(54.8)	(10.9)	(13.1)	72.1	54.6	33.1	15.5	(26.6)	(76.9)	(53.7)	(79.7)	(30.4)	30.8	(37.8)	(45.0)	48.2
Prepared foodstuffs, beverages and tobacco	10.7	12.0	10.6	24.0	20.7	26.0	27.4	19.4	19.2	4.5	10.0	1.7	4.8	(4.6)	16.6	1.7
Mineral products	(11.4)	(21.3)	4.5	14.8	(4.4)	(22.8)	33.7	12.6	28.0	25.3	8.5	14.8	36.8	15.0	9.1	8.3
Products of the chemical or allied industries	12.3	(8.2)	11.7	19.6	11.4	15.0	20.9	30.6	30.2	25.6	22.6	19.3	22.3	10.5	23.4	20.7
Plastics and rubber	3.2	2.5	0.7	6.0	(8.5)	(7.1)	(19.7)	(18.6)	(10.2)	(10.7)	(13.8)	(6.1)	(1.9)	(5.7)	5.2	7.1
Raw hides and skins, leather, fur skins	13.2	(1.5)	4.9	10.1	(24.4)	(28.0)	(25.7)	(28.2)	(16.9)	(12.8)	(15.1)	(11.0)	(10.5)	(15.2)	(24.4)	(17.7)
Wood and cork articles	2.3	13.3	(1.3)	(15.2)	(34.7)	(46.0)	(34.6)	(30.5)	(37.2)	(29.5)	(25.1)	(17.6)	(10.9)	(20.4)	(9.8)	(2.7)
Wood pulp, paper and paperboard articles	14.1	15.5	6.0	16.9	24.3	10.3	10.7	19.0	21.3	19.0	6.9	8.7	24.2	(4.3)	11.1	13.6
Textiles	1.9	7.3	(4.5)	(7.3)	(14.3)	(12.9)	(31.1)	(20.4)	6.9	(4.7)	(1.3)	(1.6)	(5.5)	(6.4)	(3.7)	3.2
Footwear, headgear and umbrellas	(13.8)	0.5	(20.8)	(12.2)	(20.5)	(36.6)	(38.8)	(14.5)	0.1	(5.8)	(6.2)	(15.5)	(14.5)	(5.2)	(5.4)	(10.0)
Articles of stone, plaster, cement, ceremic and glass	(7.0)	(12.8)	(14.1)	(12.5)	(40.7)	(26.4)	(39.3)	(21.2)	(17.4)	(9.9)	(16.2)	(12.0)	5.1	1.6	6.3	(0.9)
Pearls, precious stones and metals	(51.9)	(51.9)	(31.4)	(30.2)	(23.4)	(30.3)	(14.6)	(26.0)	(37.0)	(45.7)	(47.5)	(51.9)	(58.3)	(61.8)	(70.9)	(117.8)
Base metals	9.2	5.7	(5.6)	4.4	(7.2)	(20.0)	(28.7)	(26.9)	(23.0)	(42.1)	(72.3)	(57.5)	(56.1)	(39.4)	(29.6)	(31.0)
Machinery and mechanical appliances	13.1	(6.3)	(0.3)	15.9	(0.6)	1.5	0.9	1.9	6.3	8.7	7.2	6.9	9.2	8.9	10.0	12.7
Electrical machinery and equipment	(4.9)	(3.7)	5.7	(2.9)	(3.8)	3.9	(11.0)	(21.3)	(8.4)	(3.8)	(6.4)	(3.6)	0.9	(4.4)	8.5	10.9
Vehicles, aircraft, vessels and other transport equipment	(18.8)	(31.4)	(59.0)	(28.0)	(14.0)	(20.0)	(42.2)	(7.4)	10.9	(24.3)	(12.4)	(29.3)	(14.8)	(8.6)	(13.5)	(16.8)
Medical instruments, musical instruments, clocks and watches	18.8	3.6	2.2	9.7	20.4	11.3	11.0	16.5	18.6	16.8	10.3	12.3	11.9	9.1	8.1	13.8
Arms and ammunition	(84.7)	(89.4)	(70.7)	(162.8)	(176.9)	(83.5)	(121.6)	(108.8)	(168.6)	(177.7)	(124.9)	(127.5)	(147.0)	(136.6)	(141.8)	(133.4)
Miscellaneous manufactured articles	(16.4)	(35.5)	(36.5)	(33.2)	(41.2)	(46.3)	(59.3)	(46.8)	(44.7)	(45.3)	(41.9)	(52.5)	(31.6)	(39.0)	(68.4)	(75.0)
Works of art, collectors' pieces and antiques	(66.5)	(101.6)	(24.1)	(41.4)	4.6	(22.9)	(17.5)	47.2	(29.3)	11.4	(22.0)	(5.2)	(15.9)	(0.3)	(34.9)	(50.0)

3.2 The Decomposition of Eastbound Trade Discrepancies by Subcategory of Flows

Even after accounting for the role of Hong Kong and making necessary adjustments, the eastbound trade statistical discrepancies remain large in terms of magnitude as well as the shares of the trade. Thus, decomposing the discrepancies by subcategory of flows will give us a better picture as where the most discrepancies come from.

On the U.S. side, the U.S. Census Shipping data are used, utilizing 2-digit code identifying exporting country that merchandises go through its customs, and 5-digit foreign port code identifying ports that merchandises are shipped from. Thus, U.S. imports from China can be broken down into the following subcategories: 1) direct imports from Chinese ports, 2) Chinese transshipment through Hong Kong, 3) re-export of China-origin goods to U.S. via third countries, and 4) H.K. re-export of China-origin goods to U.S. U.S. imports from H.K. based on the trade statistics makes the fifth flow subcategory.

U.S. Census Shipping Data (U.S. Reported Imports from China)	Code	Country of Exportation	Foreign Port
U1-Direct imports from Chinese ports	U1=a+b+c		
	a	All	570*
	b	CN*	XXX***
	c	XX***	all (except 570 and 582)
U5-Re-export of China-origin goods to U.S. via H.K.	U5=d+e+f		
	d	HK**	582**
	e	HK	XXX
	f	XX	582
U2-Chinese transshipment through H.K.	U2=g		
	g	all (exclude HK and XX)	582
U3-Re-export of China-origin goods to U.S. via third countries	U3=Total-U1-U2-U5		
U.S. Trade Statistics (U.S. Reported Imports from Hong Kong)			
U4-Imports from Hong Kong			

*570 and CN present China   **582 and HK present Hong Kong
*** XX presents unidentified country; XXX presents to unidentified foreign port.

On the China side: utilizing the information on "the Country of Destination" and "The Country of Consumption", China Customs Trade Statistics are broken down into three flow subcategories: 1) China's direct exports to U.S., 2) China's exports to U.S. via Hong Kong, and 3) China's exports to U.S. via third countries. The remaining two subcategories are Hong Kong domestic exports to U.S. and Hong Kong re-exports of China-origin goods to U.S., using the official Hong Kong trade and re-exports statistics without further manipulation, but only for HS1-97.

China Customs Trade Statistics: (China Reported Exports to U.S.)	Country of Destination	Country of Consumption
C1-China's direct exports to U.S.	502*	502
C2-China's exports to U.S. via Hong Kong	110**	502
C3-China's exports to U.S. via third countries	All except 502 and 110	502
Hong Kong Trade Statistics:		
C4-Hong Kong domestic exports to U.S.		
C5-Hong Kong domestic exports to U.S.		

*502 presents the United States   **110 presents Hong Kong

Since China reported exports to U.S. via Hong Kong (C2) could partially overlap with H.K. reported re-exports of China-origin goods to U.S. (C5), Hong Kong data (C5) is chosen as the measure of H.K. re-exports of China-origin goods to U.S., taking the Hong Kong data to be more accurate. In the case of C2 is larger than C5, we identify a portion of C2 could be Chinese transshipment through Hong Kong. Thus the last step on China-H.K. side is to estimate Chinese transshipment through Hong Kong (C2*) when C2 is larger than C5.

To estimate Chinese transshipment through Hong Kong, we first adjust the unit measurement if necessary, then aggregate China and Hong Kong trade statistics to 6-digit HS level, and last compare the quantities by both sources. For each HS6 category, if China reports quantities but Hong Kong reports none, or if the quantities reported by China are larger than those reported by Hong Kong with the same unit of measurement, we attribute the differences to Chinese transshipment through Hong Kong. Using the unit
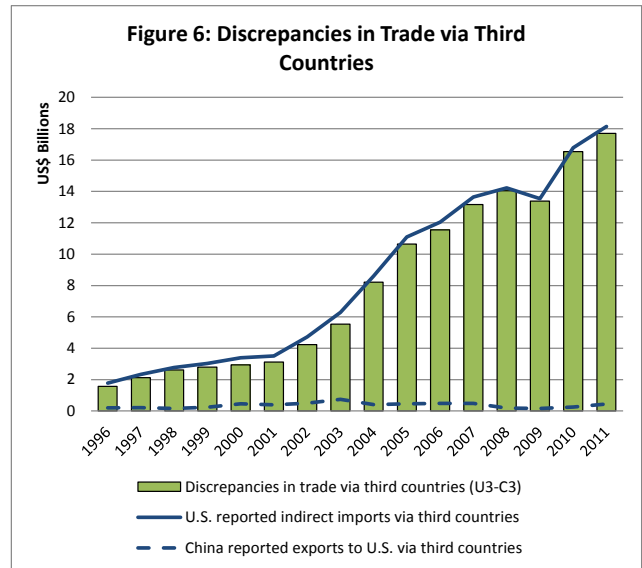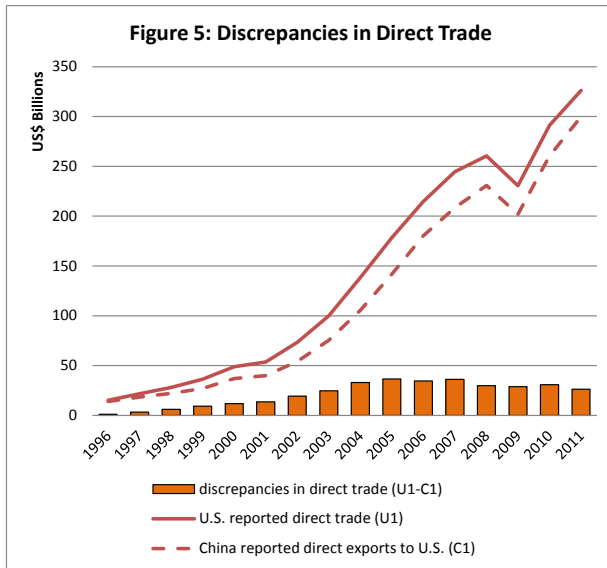
value from China data and the quantity difference for each HS6 category, we then calculate and aggregate the value of transshipment that is labeled as C2*.

Once the five subcategories of trade flows are identified and estimated, we calculate statistical discrepancy for each subcategory.

US reported imports (U.S. Census shipping data):	
Direct imports from Chinese ports	U1
Transshipment via Hong Kong	U2
Indirect imports via third countries	U3
Re-exports to U.S. via Hong Kong	U5
US reported imports (U.S. ITC Trade data):	
Imports from Hong Kong	U4
U.S. Geographical adjustment from China	U6
U.S. Geographical adjustment from Hong Kong	U7
Sum of Hong Kong Based flows	U2+U4+U5

Mirror data:

China reported trade statistics:	
China's direct exports to U.S.	C1
China's exports to U.S. via Hong Kong	C2
China's exports to U.S. via third countries	C3
HK reported trade statistics:	
Domestic exports to U.S.	C4
Re-exports of China-origin goods to U.S.	C5
Adjusted China-Hong Kong statistics:	
Estimated transshipment from China to U.S. via Hong Kong	C2*
Sum of Hong Kong based flows	C2*+C4+C5

Statistical discrepancies:

Discrepancies in direct trade	U1-C1
Discrepancies in transshipment	U2-C2*
Discrepancies in trade via third countries	U3-C3
Discrepancies in H.K. domestic exports	U4-C4
Discrepancies in H.K. re-exports of China-origin goods to U.S.	U5-C5
Total Discrepancies	(U1+U2+U3+U4+U5-U6-U7)-(C1+C2*+C3+C4+C5)

As Table 5 shows, "direct trade" and "trade via third countries" are the two largest sources of discrepancies, together accounting for almost 100 percent of statistical discrepancies between U.S.-China/H.K. trade statistics in 2011.

"Direct trade" contributes the most trade discrepancies, as it is the major form of trade flow (in 2011, 84% of eastbound trade was in direct trade). However, as Figure 5 shows, the discrepancies in direct trade did not grow as fast as direct trade value (the annual growth rate of 8% vs. 20%). On the other hand, U.S. data

Figure 5: Discrepancies in Direct Trade

- discrepancies in direct trade (U1-C1)
- U.S. reported direct trade (U1)
- China reported direct exports to U.S. (C1)

Figure 6: Discrepancies in Trade via Third Countries

- Discrepancies in trade via third countries (U3-C3)
- U.S. reported indirect imports via third countries
- China reported exports to U.S. via third countries

reported a robust growth of "trade via third countries", from US$1.8 billion in 1996 to US$18.1 billion in 2011, while China data reported much more modest increase. As a result, we see substantial increase in discrepancies in this subcategory (Figure 6). In 2011, discrepancies in trade via third countries reached US$17.7 billion.

Research Note

Table 5: Decomposition of discrepancy in eastbound trade (1996-2011, in millions U.S. dollars)

year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
China reported trade statistics:																
Direct exports to US (C1)	14,057	18,401	22,043	27,087	37,042	39,986	54,104	75,424	105,495	141,943	180,343	208,526	230,691	201,841	260,446	299,942
Exports to US via Hong Kong (C2)	12,455	14,106	15,766	14,692	14,632	13,893	15,346	16,296	19,006	20,410	22,538	23,563	21,264	18,623	22,436	23,900
Exports to US via third countries (C3)	196	209	156	236	453	388	494	745	410	459	490	481	183	159	253	444
Hong Kong reported trade statistics:																
Domestic exports to US (C4)	6,925	7,081	7,065	6,611	6,983	6,099	5,368	5,021	4,954	4,851	4,259	3,057	2,419	941	1,073	918
Re-exports to US with China origin (C5)	29,172	31,233	30,858	31,961	36,410	33,249	34,303	33,402	35,499	38,279	40,092	40,290	39,678	32,658	37,614	37,024
Adjusted China_Hong Kong Statistics:																
Estimated transshipment from China to US via HK (C2*)	7,463	8,653	10,725	9,760	9,042	8,709	6,700	7,756	8,390	8,530	8,859	12,579	11,019	11,113	13,883	15,290
Sum of Hong Kong based flows (C2*+C4+C5)	43,560	46,966	48,649	48,332	52,435	48,057	46,372	46,179	48,843	51,660	53,210	55,926	53,116	44,712	52,571	53,233
US reported trade statistics																
Direct Import from Chinese ports	15,119	21,613	28,124	36,290	48,844	53,502	73,343	99,996	138,387	178,426	214,812	244,688	260,564	230,592	291,216	326,259
Transshipment via Hong Kong (U2)	7,647	8,033	8,543	8,676	10,702	10,295	10,262	11,045	11,920	12,294	12,748	12,528	12,912	9,544	10,827	10,825
Indrect imports via third countries (U3)	1,772	2,334	2,775	3,029	3,391	3,511	4,727	6,289	8,620	11,099	12,040	13,649	14,230	13,546	16,791	18,149
Imports from Hong Kong (U4)	9,375	9,712	10,001	9,898	10,697	9,025	8,708	8,248	8,682	8,128	7,278	6,228	5,403	2,858	3,305	3,061
Re-exports to US via Hong Kong (U5)	27,287	31,035	32,155	34,051	39,010	35,554	37,503	35,611	38,612	42,770	44,713	46,717	45,948	38,998	42,200	39,956
US geographic adjustment for China (U6)	132	145	151	195	216	256	299	369	414	510	645	653	741	652	773	841
US geographic adjustment for Hong Kong (U7)	67	50	60	43	35	24	18	24	24	27	16	14	13	6	10	10
Sum of Hong Kong based flows (U2+U4+U5)	44,308	48,780	50,699	52,625	60,409	54,874	56,473	54,904	59,214	63,192	64,739	65,472	64,262	51,400	56,333	53,842
Statistical discrepancies																
discrepancies in direct trade (U1-C1)	1,062	3,212	6,082	9,203	11,802	13,516	19,240	24,572	32,891	36,484	34,468	36,162	29,873	28,750	30,769	26,318
discrepancies in transshipment (U2-C2*)	183	(620)	(2,182)	(1,084)	1,660	1,586	3,562	3,289	3,530	3,764	3,889	(52)	1,893	(1,569)	(3,056)	(4,465)
Discrepancies in trade via third countries (U3-C3)	1,575	2,125	2,619	2,793	2,937	3,123	4,233	5,544	8,210	10,640	11,550	13,168	14,047	13,387	16,537	17,706
Discrepancies in HK domestic exports (U4-C4)	2,450	2,631	2,936	3,287	3,714	2,926	3,340	3,227	3,727	3,277	3,019	3,171	2,984	1,917	2,232	2,142
Discrepancies in re-export (U5-C5)	(1,885)	(198)	1,296	2,090	2,600	2,304	3,200	2,209	3,113	4,491	4,621	6,427	6,270	6,341	4,586	2,932
discremancies in sum of HK based flows	748	1,813	2,050	4,293	7,974	6,817	10,102	8,725	10,371	11,532	11,529	9,546	11,146	6,688	3,762	609
Adjusted China/HK reported exports to US (C1+C2*+C3+C4+C5)	57,813	65,577	70,847	75,656	89,930	88,430	100,969	122,349	154,748	194,061	234,044	264,933	283,990	246,713	313,270	353,618
Adjusted US reported imports from China and HK (U1+U2+U3+U4+U5-U6-U7)	61,000	72,532	81,387	91,707	112,393	111,607	134,227	160,797	205,781	252,181	290,930	323,143	338,302	294,880	363,556	397,399
Total discrepancy	3,187	6,956	10,539	16,051	22,463	23,177	33,258	38,449	51,034	58,120	56,886	58,210	54,312	48,167	50,286	43,781
Statistical discrepancy as % of US reported imports																
Total	5.22	9.59	12.95	17.50	19.99	20.77	24.78	23.91	24.80	23.05	19.55	18.01	16.05	16.33	13.83	11.02
Direct trade	1.74	4.43	7.47	10.04	10.50	12.11	14.33	15.28	15.98	14.47	11.85	11.19	8.83	9.75	8.46	6.62
HK transshipment	0.30	(0.85)	(2.68)	(1.18)	1.48	1.42	2.65	2.05	1.72	1.49	1.34	(0.02)	0.56	(0.53)	(0.84)	(1.12)
Trade via third countries	2.58	2.93	3.22	3.05	2.61	2.80	3.15	3.45	3.99	4.22	3.97	4.07	4.15	4.54	4.55	4.46
HK domestic exports	4.02	3.63	3.61	3.58	3.30	2.62	2.49	2.01	1.81	1.30	1.04	0.98	0.88	0.65	0.61	0.54
Hkre-exports	(3.09)	(0.27)	1.59	2.28	2.31	2.06	2.38	1.37	1.51	1.78	1.59	1.99	1.85	2.15	1.26	0.74

Part Four: Application—U.S.-China Advanced Technology Product Trade

4.1 ATP Trade Discrepancies

The advanced technology product (ATP) trade has been growing rapidly between the United States and China. However, two countries have reported rather different ATP trade statistics. Besides the factors that have been identified to contribute to the discrepancies in merchandise trade, different ATP classification in the two countries is the main cause of U.S.-China bilateral ATP trade discrepancies.

China: Chinese government issued various ATP-related catalogues for different policy purposes, such as High and New Technology Product (HNTP) catalogue, HNTP Export catalogue, and HNTP catalogue for Foreign Investment. Each catalogue has a different product list, and the revision of each catalogue is more correlated with China's economic development objectives and industrial policies at the time.[7] Its 2006 HNTP Export catalogue

Code	China HNTP Classification
01	Digital Information
02	Software
03	Aerospace
04	Opto-Electronics
05	Biotechnology and medical instrument\equipment
06	New materials
07	New energy and energy-saving products
08	Environmental protection
09	Modern agriculture

lists nine fields, and 1,601 products with their corresponding 10 or 8 digit HS codes. [8]

The United States: The U.S. Census introduced an ATP classification system in 1989. The ATPs are grouped into ten broad fields that are considered as advanced technology, and these fields remain largely unchanged from year to year. However, products on ATP import and export lists are revised every year, based on the assessment of technology. In 2012, there are 612 products at 10 digit HS level on the U.S. Census ATP list, with 389 products on the ATP export list and

Code	U.S. ATP Classification
01	Biotechnology
02	Life Science
03	Opto-Electronics
04	Information and Communications
05	Electronics
06	Flexible Manufacturing
07	Advanced Materials
08	Aerospace
09	Weapons
10	Nuclear Technology

511 products on the ATP import list (some of them are overlapping).

As a result, China's HNTP list is much broader than U.S. ATP list, and more policy-oriented rather than technology-oriented.

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[7] 2009 Chinese government documents indicated that HNTP Export catalogue and HNTP catalogue would be combined and replaced by HNTP Directive Catalogue.
[8] The Ministry of Science and Technology of the People's Republic of China, "China High and New Technology Product Export Catalogue (2006)", http://www.most.gov.cn/tztg/200603/t20070620_50580.htm

4.2 Reconciliation Methodology

To make ATP trade statistics from U.S. and China more compatible, Ferrantino, Koopman, Wang etc. (2007) developed a methodology that applies the U.S. Census ATP classification to China Customs Data.[9] From China trade data, further information on U.S.-China ATP trade were derived, such as firm types (e.g. state-owned, foreign-owned, or joint venture), or trade regimes (e.g. process trade). Here we apply the similar methodology, but to both China and Hong Kong trade statistics. U.S.-China/H.K. triangular ATP trade is calculated, and adjusted with the reconciliation methodology used in Part Two.

Step one: ATP Classification Adjustment

The U.S. Census ATP products are defined at 10-digit HS level. However, we could not apply these 10-digit HS codes directly to China and Hong Kong trade statistics. The Harmonized System classification is standard at 6-digit level around the globe, but for more disaggregated classification at 10-digit HS level, countries differ from one to another. To circumvent this problem, we use U.S. trade statistics and U.S. ATP lists to calculate the share of ATP trade at 6-digit HS level with respective trading partners first, then we aggregate China and Hong Kong trade statistics to 6-digit HS level, and apply the ATP shares to each HS6 category to get the mirror ATP trade data.

Step two: Triangular ATP Trade Statistics Reconciliation

U.S. ATP Trade with China- Hong Kong

US reported ATP exports to China (f.a.s.)	a
US reported ATP exports to HK (f.a.s.)	b
HK reported re-exports of US-origin ATP to non-China	c
c.i.f. to f.a.s. adjustment for HK re-export data	d
US reported ATP exports to China and HK	ATP_EX=a+b-(c-d)
US reported ATP imports from China (f.o.b.)	e
US reported ATP imports from HK (f.o.b.)	f
US reported ATP imports from China and HK	ATP_IM=e+f
US reported ATP net exports to China and HK	ATP_net=(a+b-C*_d)-(e+f)

Mirror data: China-Hong Kong ATP trade with U.S.

China reported ATP exports to US (f.o.b.)	f
HK reported domestic ATP exports to US (f.o.b.)	g
HK reported re-exports of China-origin ATP to US	h
China and HK reported ATP exports to US	ATP_EX=f+g+h
China reported ATP imports from US (c.i.f.)	i
HK reported ATP imports from US (c.i.f.)	j
c.i.f. to f.a.s. adjustment for China data	k
c.i.f. to f.a.s. adjustment for HK data	l
HK reported re-exports of U.S.-origin ATP to China	m
HK reported re-exports of U.S.-origin ATP to third countries	n
China and HK reported ATP imports from US	ATP_IM=(i-m-k)+(j-n-l)
China and HK reported ATP net exports to US	ATP_net=(f+g+h)-(i+j-k-l-m-n)

We apply the same reconciliation methodology from part two to U.S.-China/H.K. ATP trade statistics, as shown below.

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[9] Ferrantino M., Koopman R., Wang Z., Yinug F., Chen L., Qu F., and Wang H. "Classification of trade in advanced technology products and its statistics reconciliation: the case of China and the United States", Brookings-Tsinghua Center for Public Policy, 2007.
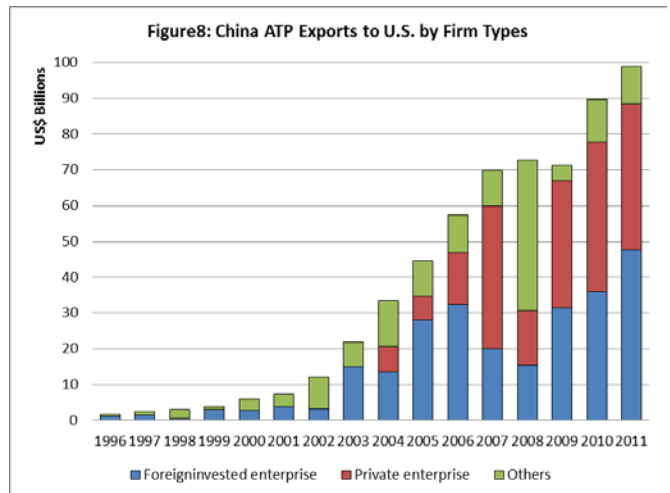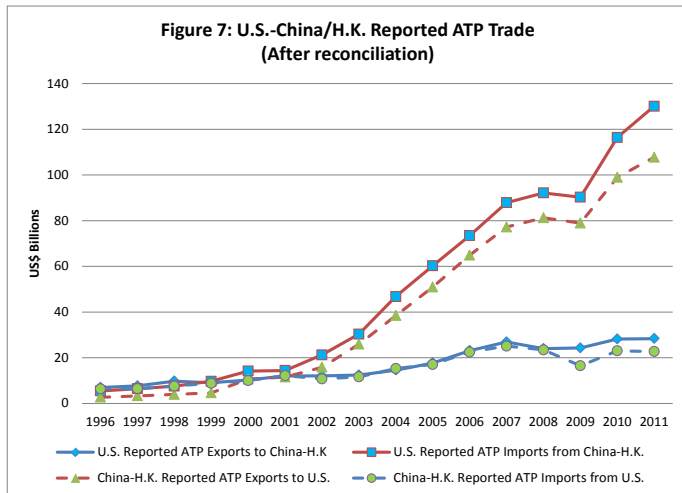
4.2 Results

Table 6: U.S. reported ATP imports from China and Hong Kong by sectors (1996-2011, US$ in millions)

Code	ATP_sector	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
01	Biotechnology	10	11	9	14	8	11	13	17	16	39	47	48	55	45	59	49
02	Life Science	170	110	250	277	359	358	436	475	555	355	628	777	1,056	1,272	1,244	1,791
03	Opto-Electronics	351	405	559	581	688	809	909	779	693	615	598	420	435	277	340	253
04	Information and Communicatio	3,440	4,098	4,938	6,648	10,717	11,511	18,152	27,323	43,091	56,302	68,771	82,696	86,879	85,335	108,878	119,774
05	Electronics	1,352	1,680	1,687	1,961	2,144	1,445	1,332	1,225	1,776	2,231	2,491	2,728	2,427	2,198	4,312	6,163
06	Flexible Manufacturing	27	35	41	42	68	62	152	183	271	346	429	641	628	527	765	807
07	Advanced Materials	32	37	22	46	82	78	44	78	102	85	119	124	151	111	167	180
08	Aerospace	79	63	72	55	75	105	117	139	186	173	249	355	395	405	504	633
09	Weapons	30	32	31	43	52	32	37	55	58	67	114	101	131	133	169	167
10	Nuclear Technology	0	2	1	73	0	11	95	100	74	73	48	3	3	1	1	292

Table 7: U.S. reported ATP exports to China and Hong Kong by sectors (1996-2011, US$ in millions)

Code	ATP_sector	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
01	Biotechnology	7	11	9	8	10	8	10	10	9	45	51	83	116	146	192	224
02	Life Science	255	302	363	419	455	585	535	703	727	846	1,020	1,129	1,344	1,721	1,649	2,438
03	Opto-Electronics	12	14	53	40	74	98	104	126	183	214	331	406	365	198	534	311
04	Information and Communicatio	2,039	2,709	2,859	2,858	4,110	4,454	3,340	3,238	3,557	4,411	5,282	5,478	5,875	5,726	6,649	7,237
05	Electronics	1,772	1,785	1,913	2,678	3,116	2,889	3,628	4,897	6,364	6,629	8,582	9,375	9,105	7,555	9,269	7,085
06	Flexible Manufacturing	325	295	272	230	385	571	700	702	1,399	865	1,296	1,772	1,503	1,149	2,718	2,505
07	Advanced Materials	83	140	136	83	130	446	84	135	100	82	159	264	325	279	260	258
08	Aerospace	2,459	2,402	4,125	2,753	2,000	2,997	3,620	2,563	2,148	4,617	6,402	8,399	5,302	7,468	6,882	8,240
09	Weapons	40	45	21	20	17	28	38	50	58	2	2	1	2	2	2	3
10	Nuclear Technology	7	5	15	10	12	21	13	12	13	14	19	21	38	39	42	81

The results confirm the growing ATP trade between U.S. and China/H.K. between 1996 and 2011. The United States had enjoyed a modest ATP trade surplus with China and Hong Kong until 2000. Since then, U.S. ATP trade deficit with China and Hong Kong has increased significantly (Figure 7). Information and communication technology dominated U.S. ATP imports from China and Hong Kong -91 percent in 2011 (Table 6). U.S. ATP exports to China and Hong Kong are relatively broad, with aerospace, information and communication, and electronics being the top three fields (Table 7). China ATP trade data show private enterprises have caught up with foreign invested enterprise to become China's major ATP exporters to the United States (Figure 8).

Figure 7: U.S.-China/H.K. Reported ATP Trade (After reconciliation)

Figure8: China ATP Exports to U.S. by Firm Types

Research Note

Reference:

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