Outsourcing and Trade Imbalances:

The U.S. – China Case

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Geneva, June 2007

This paper has been prepared for the *DEGIT - XII* conference in honor of Professor Max Corden to be held in Melbourne, Australia, June 29-30, 2007

1. Introduction

In many circles China is increasingly seen as a threat or even menace to the global economic system. The source of this peril is China's very success in liberalizing its economy, achieving stupendous rates of GDP growth and becoming a very dynamic exporter of ever increasing range of goods to ever increasing number of markets. The criticism originated in the United States; the recent build-up of its trade deficit has been linked with an extremely rapid Chinese export expansion to the United States unaccompanied by a matching growth of imports from that region. A purely economic issue, or non-issue as we shall argue, has become a real political problem.

American politicians speak with rising frequency and force about the need to solve the U.S.–China trade deficit problem. The Economist reported on May 19th, 2007 in an article entitled "America's fear of China":

"The itch to get tough with Beijing is urgent in Congress. Brandishing China's growing bilateral trade surplus as proof, congressmen from both parties have denounced the country as a currency manipulator, an illegal export-subsidiser, a violator of rights to intellectual property and all-round trade scoff-law. China-bashers have introduced a dozen bills in the new Congress. Some are bound to languish, but others may be passed—though there would then be further hurdles to jump, not least the president's power of veto (George Bush has other conflicts on his mind). The most threatening include proposals that would declare China's cheap currency an illegal subsidy and allow American firms to seek compensatory tariffs"

Just four days later The Wall Street Journal commented on a risk of U.S. – China trade conflict[1]:

"Is there another international conflict on America's horizon? Tension is steadily mounting between the United States and China over trade issues. The U.S. trade deficit with China accounted for almost one-third the record $765 billion U.S. trade deficit in 2006. Both sides agree that this large imbalance is unsustainable, but negotiations to reduce it are making little progress -- putting pressure on the negotiators in Washington at this week's Strategic Economic Dialogue meetings. If not managed properly, the trade imbalance could escalate into a trade war."

[1]Quoted from http:www.trouthabouttrade.org

European countries are beginning to follow the U.S. lead. The New York Times reported on April 29, 2006:

"A few years ago, as the United States discovered that its trade deficit with China was growing rapidly, there was more than a little smugness in Europe. Its deficit with China was very small, a sign that its residents were not like the profligate Americans who insisted on spending money they did not have on Chinese imports.
…… the euro zone's trade deficit with China, measured as a percentage of G.D.P., is growing at almost exactly the same rate the American deficit was growing five years ago. The difference may have been in timing, not in magnitude."

Not surprisingly, the language of European politicians has become quite similar to that of their North American colleagues. In fact, the European Union is taking concrete steps to slow down China's exports. Thus, the European Commission decided recently to impose a 19.4% tariff on imports of leather Chinese shoes.[2] Of course, the official explanation for this action is based on "disguised subsidies" allegedly received by Chinese shoe manufacturers from the government thus allowing them to set export prices below costs.[3]

Bilateral trade deficits can clearly cause concerns among policy makers and prompt them to take corrective measures. And yet the economic profession would be probably unanimous in agreeing that bilateral trade deficits, or surpluses for that matter, should be of no concern at all. There seems to be a disconnect on this issue, not for the first time, between the economic profession on the one hand and the policy makers and public opinion on the other hand. The latter fail, or don't wish to see, the wisdom and benefits stemming from trade. If the principle of balanced bilateral trade should have a general validity, then every country would have to balance its trade with every trading partner. It goes without saying, that overall trade surpluses and deficit could never materialize if the logic of balanced bilateral trade was fully applied. Under these conditions, benefits from intertemporal trade could not be obtained.

[2] It is interesting to note that a large part of the European exports to China takes the form of machinery needed to produce shoes, clothing and other products where European producers used to be competitive.
[3] This charge might be true but in no way should it connected with the EU trade deficit with China.

Recent macroeconomic debates about current account imbalances of the United States, Japan, China, Germany and the oil exporting countries show that macro-level trade disequilibrium can also be seen as a problem. With regard to overall trade imbalances, there is less of agreement among the economists, especially in reference to the size of trade deficits. Max Corden (2006) has expressed the view of the majority that trade deficits and surpluses can be perfectly rational phenomena expressing saving propensities of different countries, their actual and potential GDP, their level of competitiveness at present and in future, and even demographic conditions. Current account deficits and surpluses reflect intertemporal trade. Currently produced goods and services can be exchanged for financial claims. Surely, there must be room for this type of transactions in the world of different endowments, varying preferences, diverse growth prospects and dissimilar saving/spending trajectories followed by various countries. In principle, this type of trade should generate benefits to the participating countries. It is perhaps better understood that at the micro level an individual is not expected to spend exactly what he earns year in and year out.

The most far-reaching conclusion of Corden's analysis is that in the age of globalization the opportunities for intertemporal trade should only increase. Thus, current account surpluses and deficits may well increase rather than subside in the future. It should signify the fact that globalization is working, not that it is failing.

This paper, honoring Professor Max Corden, will show that in the age of globalization bilateral trade surpluses can be expected to grow as well. A new type of trade, based on fragmentation of production and international outsourcing, has emerged in recent decades. A finer division of labor is being established as national borders become increasingly porous with regard to organization of the production process and the Internet, modern international banking and more and more efficient transportation shrink the distance between countries.

The principle contribution of this paper, however, is to demonstrate on the basis of U.S. – China trade that the available information about bilateral trade imbalances is highly

distorted. International trade statistics had been designed for the world in which trade takes place in the form of final goods. Today, we live in an era when parts and components, rather than final goods, are exchanged frequently even over long distances and when trade in intermediate products is more important that trade in finished products. In this new world the expression "Made in X" should really be replaced by a more appropriate term "Made in X, Y and Z". Or better still, it should disappear altogether.

There are serious implications of the described paradigm change: International trade flows should be measured on the basis of value-added in various participating countries. Here again, a connection of Max Corden's previous work is apparent. In the theory of effective protection the concept of value added plays the central role.[4]

2. Fragmentation of Production and Outsourcing

The theory fragmentation of production was put forward by Ronald W. Jones and Henryk Kierzkowski in a festschrift volume honoring Robert Baldwin (1990). The essential elements of the framework can be readily stated:

An alternative way of generating output is to divide the production process into two or more production blocs. Again, constant returns to scale are assumed at the level of individual segments. Production stages do not function independently, they are arranged in patterns determined to a large extent by engineers and existing technologies. An important feature of the fragmented technology is that services are called in to "connect" individual blocks. These services range from transportation, quality control, R&D and insurance to telecommunications and various activities related to the Internet. It seems reasonable to assume that service links require inputs of various factors in quantities that are independent of the scale of output of a final good.[5]

[4] The classic references are Corden (1966) and (1971).
[5] For some empirical and theoretical support for this assumption see Jones and Kierzkowski (2005 a,b)

The combination of constant returns to scale in production of individual blocks and increasing returns to scale is service links may lead to fragmentation and outsourcing.[6] Fragmentation allows producers to lower the marginal cost of the final good.[7] Cost savings achieved this way must be compared with fixed cost of service links. With a suitably large scale of output, fragmentation dominates integrated technology. And the cost minimizing degree of fragmentation increases as the scale of production expands. As famously stated by Adam Smith, the size of the market determines the extent of the division of labor. It should be pointed out that lowering of the service costs links works in the same direction.[8]

Fragmentation and outsourcing are not purely international phenomena. They can occur within a domestic economy. Indeed, a better knowledge of cost-reducing opportunities, lower costs of service links and a better protection of the local legal system tend to spur domestic fragmentation and outsourcing first. However, international deregulation of service industries, unification of international legal systems, liberalization of trade in services, technological progress in the tertiary sector, and increased awareness of production capabilities around the world, all lead to international fragmentation and outsourcing.

International differences in production costs at the level of individual blocks may have different origins.[9] The Ricardian model can be most helpful in explaining the phenomenon of outsourcing. However, the Heckscher-Ohlin model can just as well shed some light on this problem. It should be also pointed out that fragmentation and

[6] This implication stand in sharp contrast with one of the key result of the new geography and trade theory according to which an increase in the market size leads to agglomeration. This issue is discussed in depth in Jones and Kierzkowski (2005 a, b).
[7] Note that under assumed fixed costs of service links, lower marginal production costs of production blocs are a necessary condition for fragmentation to became viable method of production.
[8] Jones, Kierzkowski and Chen (2005) test the propositions that the size of output has a positive impact on fragmentation, outsourcing and, consequently, on the size of trade in parts and components. There is also empirical support for the thesis that lowering of the service links costs works in the same direction. Golub, Jones and Kierzkowski (2007) also find evidences that service links encourage trade in general and trade in parts and components (as well as flows of international direct investments)
[9] The idea of heterogeneous firms is becoming more and more accepted.

outsourcing can take place within a single firm or be done at arms-length in market transactions.[10]

Figure 1. Integrated Production

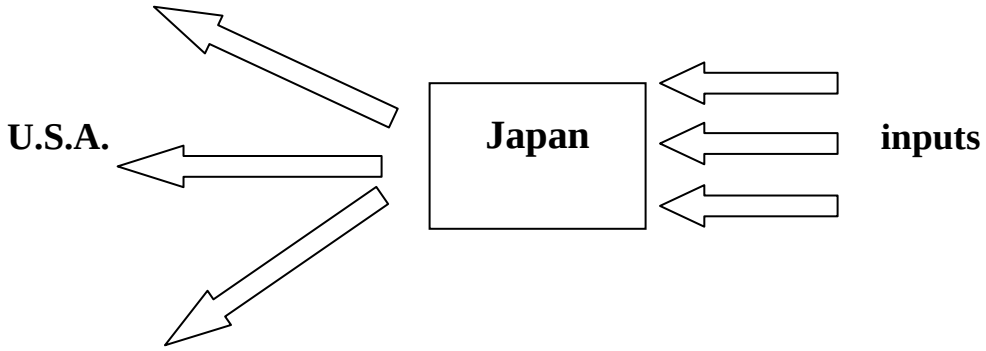
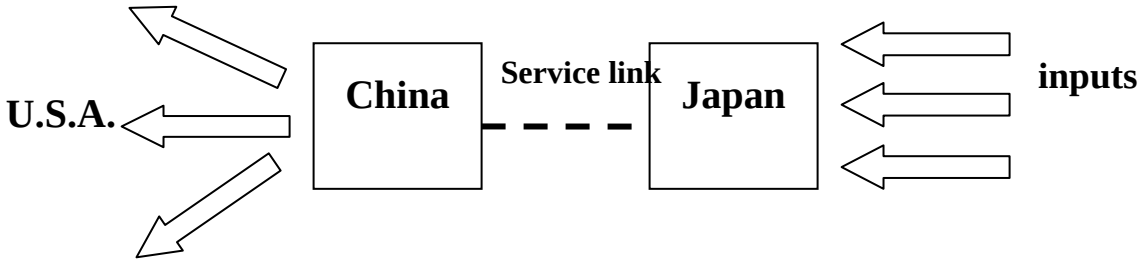
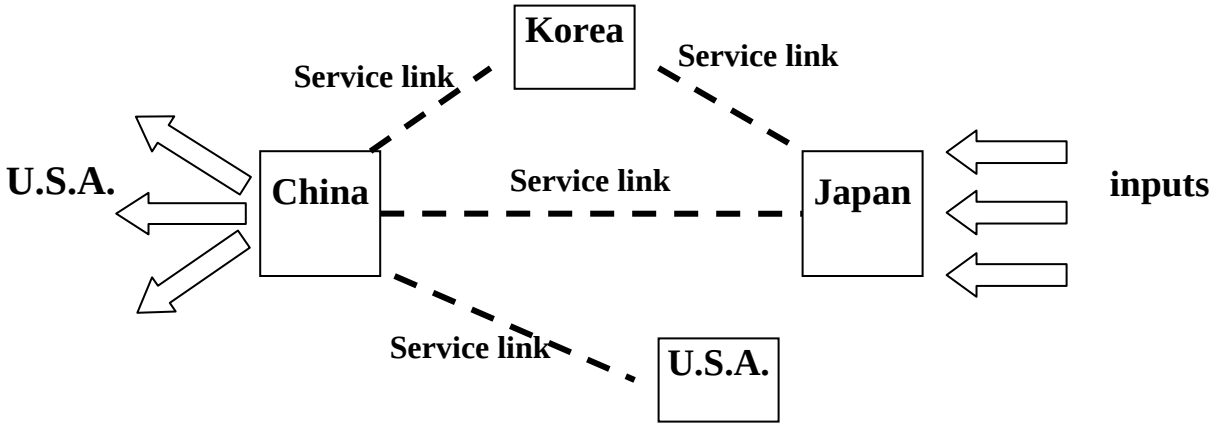


Figure 2. Fragmented Production



[10] Cheng and Kierzkowski (2001) contains some evidence on this point with regard to East Asia.



The basic insight of the fragmentation theory is shown in Figure 1. In order to set the stage for the next section of the paper we use a hypothetical example of an industry which is initially located in Japan and its output is directed to the United States. The process of production is fully integrated. Suppose now that the Japanese producers find out that production can be divided into blocks and that the initial stage of production can be beneficially relocated to China leading to a reduction in the marginal cost. Exactly the same final product will be produced but cheaper. Of course, there will now be a need to establish a service link between producers of components in Japan and China. Figure 2 captures this simple example of fragmentation and outsourcing. It also show a more complex production arrangement with South Korea and the United States joining the production network. Although service links become more intense and costly, the higher degree of fragmentation may dominate integrated technology and two-block production set-up.

What are trade balance implications of fragmentation? Even the simple partial equilibrium analysis presented in Figure 1 and 2 shows that there can be an impact on imports undertaken by the United States and, especially, on bilateral trade. Since fragmentation and outsourcing help to bring production costs down, one should expect that, ceteris paribus, the U.S. would import a greater quantity of the good in question.

The important aspect of outsourcing is that Japan may disappear from the U.S. statistical radar screen, completely replaced by China. The more complex production arrangement depicted in Figure 2 suggest that what passes as Chinese exports to the United States hides exports of parts and components by Japan, Korea and indeed the United States itself. As Winston Churchill once said, statistics are not always reliable. (Actually, it was said much more bluntly.)

The statistical distortion resulting from outsourcing works in the opposite direction as well. The U.S. exports to China are likely to contain imports of parts and components from various countries, possibly including China itself.

It goes without saying that distorted values of exports and imports lead to a falsification of the current account balance. And the degree of the misrepresentation is likely to increase with globalization as more complex production networks are created with an ever increasing number of interacting countries. Also the range of industries practicing international fragmentation of production seems to increase with globalization.

Once again, the proper trade statistics should be based on the domestic value-added content at different stages of production. This would require a major overhaul of international system of collecting trade data.

The distortive effects of fragmentation have already been made remarked by several authors with reference to rules of origin and the imposition of tariffs [11]. Peter Lloyd (2001) points out that applying rules of origin is a straightforward matter only in an unrealistic world where all production processes were completely integrated. He calls for a replacement of present tariffs by a system based on value added.

Other authors have begun to draw implications of international outsourcing for trade flows and the way we measure them. J. P. Voon and Y. Y. Kueh (2000) focused on the

[11] Of course, Max Corden's entire work on effective protection deals with the world of fragmentation, outsourcing and international production networks without ever using those terms!

Hong Kong – China connection and point out that: "Owing to the SCO[12] rules, goods initially dispatched from Hong Kong to China for "outward processing" (OP) or assembling, and then either directly or indirectly exported from China to the United States (US) have been consistently counted by the United Sates entirely as imports from China rather than Hong Kong".[13] Professor Lawrence J. Lau (2003) also argues that global outsourcing and division of labor have falsified the true Chinese surplus vis-à-vis the United States.

3. An Empirical Study

This section attempts to measure the impact of outsourcing on China – U.S. trade flows and, consequently, trade balance between the two countries.

In order to proceed with empirical work a statistical equivalent of "a production block" has to be identified. Fortunately, trade in parts and components can now be extracted from the UN COMTRADE database. Bilateral trade flows of final products used in this paper come from the same source. All GDP series have been obtained from World Bank WDI database.

Let's start with U.S. imports from China. Our discussion of theoretical foundations of fragmentation suggested that the phenomenon can occur within any of the well-established trade models. We have decided to use a simple gravity-styled equation, U.S. and China's GDPs being the main explanatory variables[14]. However, this simple approach has been extended to capture the role played by flows of parts and components resulting from outsourcing.

Awe postulate that the bilateral China – U.S. trade is affected by imports of parts and components by these two countries from a number of third courtiers. The U.S. imports from China equation is specified as follows:

[12] Single Country of Origin.
[13] Cited from. Voon, . J. P and Y. Y. Kueh, (2000) p. 124.
[14] In another study of fragmentation and outsourcing a good use is made of the Ricardian model. See Golub., Jones, and Kierzkowski (2007).

(1) $Imports_{USA,\ China,\ t} = GDP_{USA,t}^{\alpha}\ GDP_{China,t}^{\beta}\ [(1+PC_{China,1,t})^{\gamma 1}\ (1+PC_{China,2,t})^{\gamma 2}\ \ldots(1+PC_{China,i,t})^{\gamma i}]$

where $Imports_{USA,\ China,t}$ denotes the U.S aggregate imports from China in year t, $GDP_{USA,t}$ and $GDP_{China,t}$ denote the annual U.S GDP and the annual China's GDP respectively, $PC_{China,i,t}$ denotes China's annual imports of parts and components from country *i* in year *t*.[15] Please note that the imports of parts and components, from whatever direction, are augmented by 1.0. This is a useful feature of our extended gravity model which will readily allow us to calculate trade flows without outsourcing.

Transforming the above model into a linear equation yields:

(2) $Log(Imports_{USA,China,t}) = \alpha \cdot log(GDP_{USA,t}) + \beta \cdot log(GDP_{China,t}) + \gamma_1 \cdot log(1+PC_{China,1,t}) + \gamma_2 \cdot log(1+PC_{China,2,t}) + ... + \gamma_i \cdot log(1+PC_{China,i,t})$

China imports parts and components from, literally, dozens of countries. A priori there is no way of telling which of these imports, and to what extent, will end up disguised as exports to the United States and which will be re-exported somewhere else. It could happen that some of imported parts and components will not be re-exported at all but rather used domestically as consumption or investment goods. They would need some local transformation and processing, just like the final goods that will be exported. The degree of transformation of imported parts and components may vary depending whether the final destination of a good will be the domestic market or export .

China imports parts and components primarily from Japan, China Hong Kong SAR, the U.S., EU15, Republic of Korea, and ASEAN. Having tried various combinations of explanatory variables, we found out that equation (3) performed best.

(3) $Log(Imports_{USA,China,t}) = \alpha \cdot log(GDP_{USA,t}) + \gamma_1 \cdot log(1+PC_{China,Japan,t}) + \gamma_2 \cdot log(1+PC_{China,HongKong,t}) + \gamma_3 \cdot log(1+PC_{China,USA,t}) + \gamma_4 \cdot log(1+PC_{China,Korea,t})$

The OLS estimators are displayed in the first column of Table 1.[16]

Table 1. Regressions of U.S. total imports from China

[15] When there is no imports on parts and components from country i, we will get value 1 in the equation, which means there is no impact from this country.
[16] Based on Ramsey RESET, we conclude that the model has no omitted variables.

	OLS	ML	GLS
Constant	-25.82 (1.65)	-26.15 (1.48)	-26.14 (0.71)
$\log(GDP_{USA,t})$	3.23*** (0.20)	3.27*** (0.17)	3.27*** (0.09)
$\log(1+PC_{China,USA,t})$	-0.37*** (0.08)	-0.39*** (0.08)	-0.38*** (0.04)
$\log(1+PC_{China,Japan,t})$	0.23** (0.07)	0.25*** (0.06)	0.22*** (0.04)
$\log(1+PC_{China,HongKong,t})$	0.35*** (0.08)	0.33*** (0.07)	0.36*** (0.04)
$\log(1+PC_{China,Korea,t})$	-0.25*** (0.04)	-0.26*** (0.03)	-0.26*** (0.02)
R^2	0.99	0.99	0.99
D-W	2.87	2.69	

Before interpreting the coefficients of the estimators, we have to face the non-stationary issue brought about by running regressions on time series variables. We find that the time series have unit roots and therefore conclude that the trends of the variables are stochastic.

In our empirical work reported here we do not try to generate stationary time series via differentiation of the variables. However, we test for possible co-integration. Following the Engle-Granger test, we get a τ value of -5.61, which is in absolute terms larger than the 1% critical value computed by Davidson and MacKinnon (1993)[17]. Therefore we treat the variables as co-integrated time series and run the regression. The long-run correlation is reflected by the estimators listed in Table 1. We also apply the error correction mechanism (ECM) to show the short term dynamics. [18] The coefficient of the

[17] $\Delta\hat{u}_t = -1.46 \cdot u_{t-1}$
t = (-5.61)
R^2 = 0.72

[18] ECM estimation: R^2=0.95

	Coefficients	Standard Error
$\Delta\log(GDP_{USA})$	3.21	0.56
$\Delta\log(1+PC_{China,Japan,t})$	0.20	0.06
$\Delta\log(1+PC_{China,HongKong,t})$	0.33	0.06

error correction term is negative and highly significant. Loosely speaking, China's imports of parts and components affect its exports to the U.S. in both the short run and the long run.

It is striking that, on the basis of our results, China's GDP does not seem to have any significant effect on its total exports to the United State. One would expect a rather different result. It can be readily imagined that China's rapid economic growth favors export-oriented industries. Indeed, the creation of the special export zones back in the late 1970s and through 1980s was said to serve this purpose. And yet, the flow of exports to the U.S. are driven by the demand factor represented by the U.S. GDP

The positive values of coefficients γ_1 and γ_2 support our presumption that China's imports of parts and components from Japan and Hong Kong serve as intermediate goods to be enriched with Chinese labor, capital and other factors of production and send on the market of the United States. An increase in China's imports on parts and components from Japan by one percent will increase U.S. aggregate imports from China by about quarter of one percent.. The elasticity of total U.S. imports from China is even larger in the case of Japan-China flows of parts and components

The results presented in Table 1 suggest a negative relationship between China's imports of parts and component from the U.S. and South Korea and China's aggregate exports to the United States. In order to explain this finding one may wish to think of a multitude of foreign markets where Chinese exports of final goods can be placed. With exports capabilities fully utilized, simultaneous expansion in all the markets for final goods may not be possible. Thus, imports of parts and components from the U.S. and South Korea could be undertaken to export final goods to, say, the European Union.

$\Delta \log(1+PC_{China,USA,t})$	-0.34	0.06
$\Delta \log(1+PC_{China,Korea,t})$	-0.22	0.05
Error Correction Coefficient	-1.47	0.38

Trade diversion could take place as some Chinese factors of production have to be moved from "the U.S. desk" to "the E.U. desk".

An alternative scenario could be advanced in which U.S. multinationals change to a more complex system of global production *and* distribution. Instead of importing a final good from China to the United States market (possibly for further distribution throughout the world) they switch to outsourcing, supply Chinese sub-contractors with some components and ship the final good directly from China to various foreign destinations.

Given the fact that coefficients γ_1 and γ_2 are positive while coefficients γ_3 and γ_4 are negative, is it possible that the combined effect of outsourcing reduces the total flow of goods from China to the U.S.? It will be shown shortly that in aggregate China's imports on parts and components do have a significantly positive impact on its exports to the U.S..

In column (2) and column (3) of Table 1 the basic equation is re-estimated using Maximum Likelihood (ML) and General Lease Squares (GLS) respectively. The results are very close to those based on OLS.

Turning to the question of an overall impact of outsourcing on trade flows, the following exercise is proposed: Set Chinese imports of parts and components equal to zero and calculate the implied value of U.S. total imports from China. Table 2 shows what U.S. imports from China would be like under "no-fragmentation".

Table 2. Estimated U.S. imports from China assuming China's imports of parts and components are equal to zero

Year	U.S. aggregate imports from China (billion US dollars)	Estimated imports from China assuming no Chinese imports of parts and components (billion US dollars)	U.S. imports from China related to Chinese imports of parts and components (billion US dollars)	The share of U.S. imports from China related to China's imports of parts and components
1990	16.3	8.6	7.7	47.4%

1991	20.3	9.5	10.8	53.2%
1992	27.5	11.4	16.1	58.6%
1993	33.7	13.3	20.3	60.4%
1994	41.4	16.2	25.1	60.8%
1995	48.5	18.8	29.8	61.3%
1996	54.4	22.4	32.0	58.7%
1997	65.8	27.3	38.5	58.5%
1998	75.1	32.4	42.7	56.9%
1999	87.8	39.1	48.7	55.5%
2000	107.6	47.1	60.5	56.2%
2001	109.4	51.7	57.7	52.7%
2002	133.5	58.3	75.2	56.3%
2003	163.3	68.2	95.1	58.2%

Table 2 shows a spectacular growth of the United State's imports from China. However, already in 1990 as much as 47.4% of those imports were parts and components that China had imported herself. The share of foreign parts and components in China's exports to the U.S has risen to 58.2% by 2003. Clearly, China and the United States know a thing or two about fragmentation and outsourcing.

One of the predictions put forward in Jones and Kierzkowski (1990) was that international fragmentation of production creates a unique opportunity for developing countries and new players[19] in the global economy to reach the markets of developed countries through the back doors, so to speak. When Nike, Toys "R" Us or Walmart placed China in their global production networks these actions opened Chinese producers access to markets that are not quite competitive. Huge advertising and R&D expenses would have to be incurred by newcomers wishing to establish presence in markets for sports footwear, toys, clothing or electronics. China has recognized and took advantage of a unique opportunity of integrating itself into the global economy. Outsourcing to China must have been also beneficial to American producers or otherwise they would not have been doing it.

Let's turn to U.S. exports to China and how they are influenced by U.S. imports of parts and components from its main trading partners. Table 3 contains the regression results.

[19] At the time of writing the article we had no clue that the new players would also include countries of Eastern Europe and former republics of the Soviet Union. Indeed, some of those countries have perused the option with great success.

GDPs of both countries appear now relevant suggesting that demand and supply factors are in operation. Imports of parts and components from China, Japan and South Korea lead to expansion of American exports to the most populous country in the world. It is worth pointing out that Japan is the biggest exporter of parts and components in the world and it affects Sino-U.S. trade in both directions.

The data suggest that a trade diversion effect operates in case of Canada. Again, one can imagine an integrated production process under which a good is produced in the United States and partly or wholly exported to China. Suppose now that the original producer switches to a fragmented production process, imports some parts from Canada, takes it through another production stage, and sends it back to Canada for final finishing, packaging, and export to various markets, including Chinese.[20]

Table 4 contains the value of implied U.S. exports to China without outsourcing. Those exports would be 18.4% smaller in 1990 then the actual figures and 27.5% smaller in 2003. Fragmentation is a global process. One would expect that most market economies would respond to new opportunities and rearrange their production patterns. And, it is of course a two-way street. It means that if China is practicing outsourcing, the United States and/or some other countries engage in it as well.

Going beyond the information contained in Tables 2 and 4, it could be speculated that developing countries could in general get a boost to their exports through fragmentation and outsourcing. This is a very good news for the Third World. The dominant trade paradigm in the XIX century placed the South in the center of international commerce. This role was marginalizes in the second part of the XX century when North-North flows became dominant through an expansion of intra-industry trade between developed countries. The new XXI century trade paradigm is based on a finer division of labor and offers a chance to developing countries to get into the game in a big way. Table 2 and 4 show that this is indeed happening. However, China's experience can not be

[20] This line of reasoning suggest that a multi-country framework should be used to evaluate the impact of fragmentation on bilateral trade flows.

automatically replicated by other developing countries. As stressed and documented in Golub, Jones and Kierzkowski (2007) national service links constitute entry membership fees to the XXI century global trading club.

As stressed in the introduction to this paper, international fragmentation of production leads to misrepresentation of bilateral trade deficits. Without importing parts and components, the U.S. aggregate exports to China would decrease by about 20% to 30%. Similarly, Chinese exports to the U.S. would shrink by about 50 – 60% with no outsourcing. The "no-outsourcing" scenario alters the trade balance picture in a major way as shown in Figure 3. U.S. – China trade deficit is shown based on the UN COMTRADE data as well as using U.S. government statistics. Roughly about two thirds of the deficit would disappear in 2003 in the absence of imports of parts and components by both countries. Would this make the United States better off? Clearly not, although the negative press publicity would likely subside.

Table 3. Regressions of the U.S. exports to China

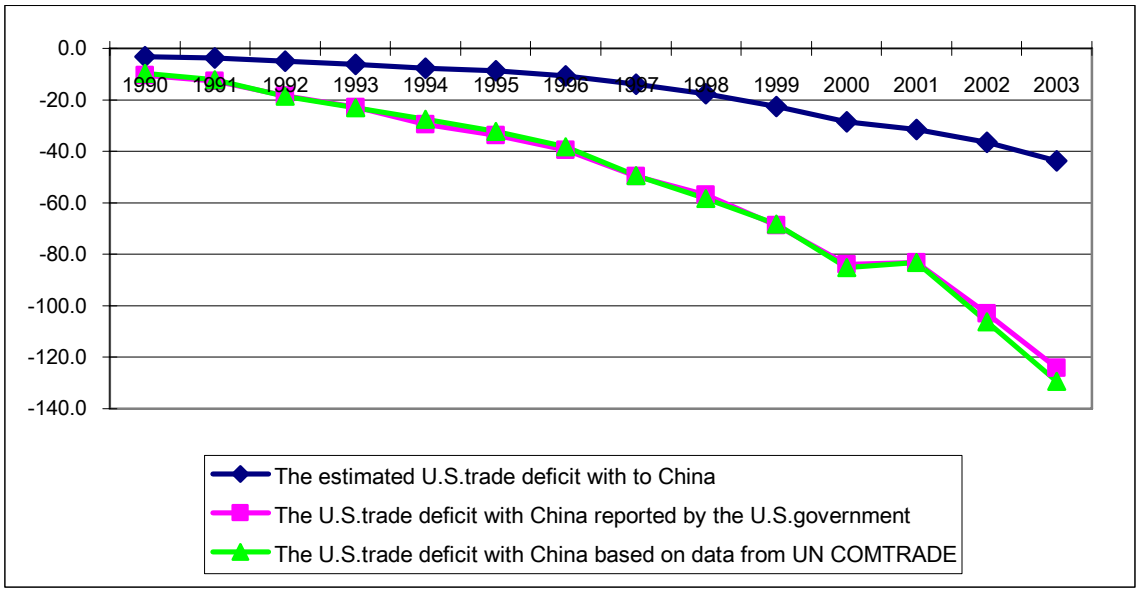
	OLS	ML	GLS
Constant	-13.73 (2.80)	-11.49 (1.45)	-14.44 (2.69)
$\log(GDP_{USA})$	1.51*** (0.37)	1.23*** (0.19)	1.59*** (0.36)
$\log(GDP_{China})$	0.40*** (0.11)	0.42*** (0.06)	0.38*** (0.11)
$\log(1+PC_{USA,Japan,t})$	0.86*** (0.13)	0.80*** (0.06)	0.90*** (0.11)
$\log(1+PC_{USA,Canada,t})$	-0.93*** (0.11)	-0.86*** (0.06)	-0.94*** (0.10)
$\log(1+PC_{USA,Korea,t})$	0.21** (0.08)	0.27*** (0.04)	0.19** (0.08)
R^2	0.99	0.99	0.99
D-W	2.95	2.58	

Table 4. Estimated U.S. exports to China assuming no imports of parts and components

Year	U.S. aggregate exports to China (billion US dollars)	Estimated exports to China assuming no U.S. imports of parts and components	U.S. exports to China related to the U.S. import of parts and components	The share of U.S. exports to China related to the U.S. import of parts and components

		(billion US dollars)	(billion US dollars)	
1990	6.6	5.4	1.2	18.4%
1991	8.0	5.8	2.2	27.9%
1992	8.9	6.5	2.4	26.5%
1993	10.7	7.1	3.6	33.3%
1994	13.9	8.6	5.3	38.3%
1995	16.1	10.2	6.0	37.0%
1996	16.2	11.8	4.4	27.3%
1997	16.3	13.4	2.9	17.9%
1998	16.9	14.8	2.1	12.4%
1999	19.5	16.5	3.0	15.6%
2000	22.4	18.6	3.8	16.9%
2001	26.2	20.1	6.1	23.4%
2002	27.3	21.9	5.4	19.6%
2003	33.9	24.6	9.3	27.5%

Figure 3. U.S. trade balance with China assuming no trade flows of parts and components to the two countries



The exercise reported in Figure 3 may be useful but it should be supplemented by another question: Given that outsourcing is a fact of life, how big is the U.S. trade deficit based on value added in China and the United States? In order to answer this question one requires some information about the extent of processing undergone by imported intermediate goods in both countries. Lau (2003) suggests that "….the domestic value-added content of Chinese exports to the U.S. is low – it may be estimated at 20%." On the other hand, the U.S. domestic value-added of U.S. exports to China easily surpasses this figure, it is assumed by Lawrence Lau to be about 60%.

Applying these numbers to 2003 trade figures would suggest that exports of China to the United States amounted to $ 87.2 billion in domestic value-added terms while "purified" trade flows in the opposite direction reached $30.2 billion.

The U.S. – China "true" trade deficit in that year equaled $57.0 billion, about half of what is reported. It is a simple matter to redo the calculations for the entire period under the analysis.

4. Conclusions

Fragmentation of production has taken international trade into a new realm. The decisions how much to produce and for which markets have to be combined with decisions where to produce and with what degree of intra-product specialization.

In this new world the concept of domestic value-added re-emerges as being appropriate for calculating international trade flows and trade deficits. The designation "made in…" should disappear as statistical reporting systems catch-up with the new world.

The above considerations have been applied to Sino – U.S. trade and the hotly debated trade deficit between the two countries. Taking into account imports of parts and components by both courtiers reduces this deficit by about half. It would be worthwhile to repeat the analysis of this papers for other countries and trading blocs - Japan and the European Union are natural candidates.

The main idea advanced in this paper has a wider application. In fact, it has long been recognized in domestic taxation and statistical reporting. There is no reason why we should stop at national borders as they become less well-defined and relevant.

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