China's Export Expansion - A Threat to its Asian Neighbours?

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Abstract

The rise of China as an economic power during the course of the past three decades has led to concern in many counties that China's rapid development poses a serious threat to their own economic performance and in particular their ability to export. In this paper, we study the effect of the growth of Chinese exports on those by other Asian countries by using a theoretically consistent gravity model of Baldwin and Taglioni (2006). Generally, our findings do not show displacement effect by Chinese exports although the results do suggest declining market shares.

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Keywords: China; Asian countries; trade; gravity model

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1. Introduction

The rise of China as an economic power during the course of the past three decades has led to concern in many counties that China's rapid development poses a serious threat to their own economic performance and in particular their ability to export. This concern seems to be particularly acute for Asian countries that have similar trade structure with China. Despite this fear, empirical evidence has provided somewhat inconsistent support for which countries are most affected, or indeed whether other countries may benefit from increased Chinese trade. Using a gravity framework Eichengreen et al. (2007) find that the growth of Chinese exports had a positive effect on the exports of high-income Asian countries (Japan, Singapore, and South Korea) and middle-income countries (Malaysia and the Philippines) and a negative effect on exports by low-income Asian(Bangladesh, Cambodia, Sri Lanka, and Pakistan). Greenaway et al. (2008) reach the opposite conclusion. They find no evidence of export displacement for low-income countries (Bangladesh, Cambodia, India, Pakistan, Vietnam) whereas the exports of high-income economies (Korea, Singapore, Japan) are most adversely affected. Finally, Athukorala (2009) also using a gravity model, but for trade in parts and components and final goods as separate categories, also finds uneven effects across East Asian countries. Here the effects are positive for all East Asian countries, but are larger for Indonesia, Thailand, Malaysia and Philippines compared to Japan and South Korea.

Whilst all of the above studies use the gravity model as the starting point there are differences in the underlying estimating equation and none uses the theoretically consistent gravity model proposed by Baldwin and Taglioni (2006). This might suggest that part of the explanation for the inconsistency of evidence from this literature may result from the various biases that occur when the gravity model is specified in an a-theoretical manner (Baldwin and Taglioni, 2006). Baldwin and Taglioni (2006) describe three types of mistakes in gravity models, which they label bronze, silver and gold. The Bronze mistake is the inappropriate deflation of nominal trade values by the US

aggregate price index.[1] The silver mistake is the use of the log of the average rather than the average of the logs, and the gold mistake - the most serious and most commonly made mistake – occurs from the omission of relative price terms and bilateral trade costs.[2] They then demonstrate that the effects of these various bias are removed when including a full set of bilateral and origin-time, destination time dummies in the gravity model. Baier and Bergrstrand (2007) take a somewhat different route to the same solution.

The theoretically consistent gravity model has a somewhat inconvenient property when trying to model the effects of the rise of Chinese exports on other East Asian countries though. The variable of interest, Chinese exports to a given country destination, are perfectly collinear with the country-time dummies that Baldwin and Taglioni (2006) argue are the preferred method to control for omitted multilateral resistance parameters. The effect of Chinese exports on trade by third countries cannot therefore, be separated from the multilateral resistance parameters, or indeed any other country-time varying factor that the econometrician is concerned may be omitted from the regression and chooses to control for with a series of country-time dummies.

In this paper we contribute to the literature on the effect of the growth of Chinese exports on those by other Asian countries by using the theoretically consistent gravity model of Baldwin and Taglioni (2006). To identify the effects of Chinese exports on the exports of other Asian countries we exploit differences in the characteristics of Asian countries. The identifying assumption that we make is that the particular factor endowments of a country make it more (or less) vulnerable to Chinese exports in third-country markets. Motivation for such a possibility is relatively plentiful. Firstly it might be seen to draw directly from the evidence for parameter heterogeneity found in Eichengreen et al. (2007) and Greenaway et al. (2008), albeit where those studies use the

[1] Greenaway et al. (2008) do this. Eichengreen et al. (2007) also do this, but by then including time dummies they remove this effect (Baldwin and Taglioni, 2006).

[2]Eichengreen et al. (2007), Greenaway et al. (2008) and Athukorala (2009) all do this. Additional criticism of the empirical approach used by Athukorala and Yamashita (2006) can be found in Baldwin and Taglioni (2011). They argue that gravity models on sub-components of trade such as that used by Athukorala and Yamashita (2006) should not include GDP as a measure of economic mass. Again they suggest that the bias that may result from such an assumption are important.

income level of different countries. A more important motivation comes from Schott (2008) who examines the rise of Chinese exports for developed economies by comparing the set of products China exports to the United States with the bundle of products exported by the OECD. Using the Heckscher-Ohlin model, Schott (2008) points out that with endowment driven specialization the effects of Chinese exports should be felt most keenly by countries with similar factor endowment, although he notes that China's export overlap with the OECD is much greater than one would predict given its low wages. A second motivation comes from the view that the trade in parts and components, the fragmentation of the production process, has increased dramatically amongst the East Asian countries (Kimura et al. 2007). Building on the model of fragmentation by Jones and Kierzkowski (1990) those authors show that fragmentation of trade builds on the complementarities that come from the differences between country characteristics. A similar type of argument can be found in Athukorala (2009).

Under a model with endowment driven trade we would therefore anticipate that countries with different factor endowments to China will be less adversely affected compared to countries that are more similar. In comparison, under a model of fragmentation we would anticipate that countries which have fewer similarities to China will benefit from increased trade in parts and components. In both cases we would therefore anticipate the country factor and Chinese trade to be positive, even though the total effect of Chinese trade in the first model is negative and zero in the second. The disadvantage of our methodology is that we cannot derive the overall magnitude of the effects of Chinese trade on exports by other Asian economies exports, the level effect, only whether a country is more or less affected than another, the relative effect.

We choose as the country variable a measure of human capital. Human capital represents of course one aspect of the factor endowment of countries that make and is highlighted by Schott (2008) as one aspect of factor endowment differences with China. It has long been established that the quality of trade products of a country is linked to its human capital stock. Human capital is a prerequisite for innovation activity and has direct influence on the capacity to adapt technological advances from abroad. These in turn will

determine the quality and the level of sophistication of trade products. In international fragmentation of vertical production chains, human capital also plays a vital role in determining at which stage of production a country specialises. Accordingly, human capital is an important factor in shaping the global patterns of trade.

The rest of the paper is organized as follows. Section 2 reviews the related studies on China impact. Section 3 describes the data and methodology adopted. Section 4 reports the results of our investigation on the impact of China's export expansion, using both the method adopted by the existing literature and our preferred specification. Section 5 concludes.

2. The Impact of China's Emergence - A Literature Review

In comparison to many of its Asian neighbours, in which their shares either contract or remain unchanged, China's share in global manufacturing exports has been rising continuously overtime (see Table 1). In 1994, Chinese exports accounted for just 3.30% of world manufacturing exports. By 2008, this share had increased to 13.05%. Not surprisingly, the growth rate of Chinese manufacturing exports is accordingly stronger than for other Asian countries. Since 2002, China's growth rate of exports has maintained at double digits following its accession to the WTO, despite a 10% point drop during the global financial crisis of 2007 and 2008.

Table 1
Shares in World Manufacturing Exports (%)

Year	China	Hong Kong	Indonesia	Japan	Malaysia	Philippines	Rep. of Korea	Singapore	Thailand
1994	3.30	4.67	0.69	12.53	1.44	0.19	2.95	2.64	1.08
1996	3.37	4.42	0.68	10.32	1.57	0.45	3.04	2.76	1.05
1998	3.96	4.02	0.53	9.02	1.42	0.65	2.82	2.29	0.97
2000	4.82	4.22	0.77	9.86	1.73	0.76	3.40	2.58	1.13
2002	6.24	4.10	0.66	8.27	1.60	0.69	3.18	2.25	1.08
2004	8.33	3.84	0.55	8.06	1.47	0.55	3.55	2.54	1.12
2006	10.97	3.73	0.54	7.19	1.44	0.50	3.56	2.62	1.20
2008	13.05	3.41	0.52	6.80	1.06	0.40	3.58	2.32	1.25

Note: Data are at the 1-digit level.
Source: Computed from UN Comtrade database.

Given such evidence it is perhaps no surprise that concern about the competitive threat posed by China is widespread. This can be seen from the growing number of literature examining the impact of China's emergence on African countries (Geda and Meskel, 2008; Giovannetti and Sanfilippo, 2009), Latin America (Jenkins et al., 2008; Lall and Weiss, 2005; Moreira, 2007) as well as Asian countries. In the context of Asian region a number of alternative methodologies have been employed where these include computable general equilibrium modelling (Ianchovichina and Martin, 2001; Ianchovichinaand Walmsley, 2005); measures of its revealed comparative advantage (Shafaeddin, 2004); or using RCA together with constant market share analysis (Holst and Weiss, 2004); comparisons of the degree of overlap in export structures(Lall and Albaladejo,2004); and econometric analysis of export growth equations (Ahearne et al., 2003). Here we focus only on those studies using gravity modelling.

Three main studies using gravity modelling can be found in the literature. Eichengreen et al. (2007) examine the China impact on 13 Asian exporting countries at the aggregate level as well as at the SITC one- to three-digit level for the period 1990-2003. The main conclusions are that China's growth has a positive effect on the exports of high income Asian countries (Japan, Singapore, and South Korea) that are exporters of capital goods, and on the exports of middle income countries (Malaysia and the Philippines). A negative effect is observed on the exports of low-income Asian

(Bangladesh, Cambodia, Sri Lanka, and Pakistan) that are dependent on the production and sale of consumer goods.

The study by Greenaway et al. (2008) reaches the opposite conclusion. Using data at the aggregate level for period 1990-2003, the authors conclude that there is no evidence of export displacement for low-income countries (Bangladesh, Cambodia, India, Pakistan, Vietnam), which have comparative advantage in unskilled labour-intensive. Exports of the high-income economies (Korea, Singapore, Japan) are most adversely affected, which implies that China's comparative advantage has changed from production of low technology, low-skilled intensive goods to high value added and less labour-intensive manufacturing. Despite the fact that China's economic growth spurred higher imports from its neighbours, with more advanced Asian countries benefiting the most, this, however, did not rise sufficiently to offset the displacement effect in third markets.

The third related study is that conducted by Athukorala (2009). This work investigates the impact of China's rising exports during 1992-2005 using data at the SITC five-digit level. This study includes 39 importing countries which satisfy the criteria that each of which accounted for 0.1% or more of manufacturing trade in 2000/1. The author is of the view that the fear of export crowding-out has been exaggerated in the current debate. They argue instead that China's rapid integration into global production networks as a major assembly centre has created new opportunities for other East Asian countries to specialise in parts and components production and assembly. The impact of China's world market penetration in labour-intensive manufactured goods mainly should therefore be felt by the high-wage East Asian NIEs. The author also note that the share of parts and components in total machinery imports to China have grown much faster than exports of these products. Given that the production of parts and component is generally more capital and technology intensive than final goods, this suggests that China's export success has been underpinned largely by its relative abundance of labour. This is true especially when data on trade components is excluded, more than 80% of total China's manufacturing exports are in fact labour-intensive products.

3. Empirical Specification and Data

Following Baldwin and Taglioni (2006) and Baier and Bergstrand (2007), we estimate the regression model set out in Equation 1 below. In this regression exports from country *i* (one of Japan, South Korea, Singapore, Malaysia, Indonesia, Thailand, Philippines) to country *j* at time *t* is a function of a series of bilateral (*ij)* fixed effects, *i-time* and *j-time* dummies. The trade data are annual trade data for the period 1994-2008 based on the Standard International Trade Classification (SITC) Revision 3 taken from the UN Comtrade online database. We use exports which are valued in f.o.b (free on board). The trade data are in current US dollars, of which we deflate by the US CPI for all urban consumers (1982-1984=100) collected from http://www.bls.gov/ to generate a constant dollar series.

$$ln\ EXP_{ijt}=\beta_0 + \beta_1 ln\ ChEXP_{jt} \times int + \beta_{i,t}\ I_t + \beta_{j,t} J_t + \beta_p P + \epsilon_{ij,t} \quad (1)$$

where

EXP_{ijt}	Real export of country *i* to country *j* at time *t*
$ChEXP_{jt}$	China's real exports to country *j* at time *t*
I	Exporter fixed effect
J	Importer fixed effect
P	Country-pair fixed effect
int	A characteristic of exporting country

It is common that trade data contain zero-value observations. This is due to several reasons: trade does not take place between country pairs; the volume of trade is so small that they are rounded to zero; and the values in the trade data are missing. We adopt the conventional method of dropping country pairs with zero trade (Greenaway et al., 2008; Head et al.,2010; Linders and de Groot, 2006). A consequence of this is that we are unable to generalise our results as describing an effect of Chinese exports on all bilateral trade flows from East Asian countries. A summary on the data sources and the number of countries covered by each source is shown in Table 2. After dropping missing values

in some of the variables, our sample consists of 186 importing countries (excluding China). The list of importing countries covered in this study is presented in Appendix. Table 3 shows the descriptive statistics of our dataset.

Table 2

Summary on the Data Sources and the Countries Coverage of Each Source

Variable	Source	Coverage
EXP_{ijt} $ChEXP_{jt}$	UN Comtrade online database	255 countries
GDP_i CAP_i GDP_j CAP_j	World Bank World Development Indicators	190 countries
$Dist_{ij}$ $Areap_{ij}$ $Landl_{ij}$ $Contig_{ij}$ $ComLang_{ij}$ $ComCol_{ij}$ $Colony_{ij}$	CEPII database	217 countries
$Island_{ij}$	Rose (2004) and CIA World Factbook	194 countries

Table 3

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$ln\ EXP_{ijt}$	16916	15.935	3.242	2.243	25.097
$ln\ ChEXP_{jt}$	16916	17.869	2.787	9.040	25.369
$ln\ GDP_{it}$	16916	26.283	1.393	24.814	29.280
$ln\ CAP_{it}$	16916	8.535	1.377	6.655	10.614
$ln\ GDP_{jt}$	16916	23.255	2.355	17.735	30.075
$lnCAP_{jt}$	16916	7.722	1.613	4.127	11.193
$ln\ Distw_{ij}$	16916	9.081	0.563	6.226	9.886
$ln\ Areap_{ij}$	16916	23.585	3.353	10.441	31.128
$Landl_{ij}$	16916	0.178	0.383	0	1
$Island_{ij}$	16916	0.612	0.635	0	2
$Contig_{ij}$	16916	0.009	0.095	0	1
$ComLang_{ij}$	16916	0.079	0.270	0	1
$ComCol_{ij}$	16916	0.080	0.271	0	1
$Colony_{ij}$	16916	0.008	0.090	0	1

The effect of competition from Chinese exports on exports by other Asian countries is measured on a destination specific basis. That is, we measure Chinese exports to destination *j* at time *t*. As this variable is collinear with the *j-time* dummies which are also included in the model, we add an interaction term between Chinese exports and the human capital endowment of country *i*. We specify human capital using:

i. Sec_i : Average years of secondary schooling in the exporting country (country i), age 25+ (1990)
ii. Sec_i/Sec_c: Ratio of country i to China's average years of secondary schooling, age 25+ (1990)

Here we use average years of secondary schooling as proxy for human capital. These data are extracted from the World Bank Education Statistics that are originally constructed by Barro and Lee (1993; 1996; 2000). Since the schooling data are only available at five-year intervals, data for 1990 - the latest year prior to our sample year 1994-2008, is selected and we keep this exporter's characteristic constant across the sample period.

In previous work on this topic a point of debate has been whether to include Hong Kong exports with those for China. This is justified on the ground that many Hong Kong's exports use Chinese labour and Hong Kong management and distribution skills. In other words, Hong Kong is the main conduit of China's exports to third markets. Our interest in the relative effect from Chinese exports means we do not take this approach in this paper for the practical reason of the difficulty of combining data on human capital of these two countries. We have tested the robustness of our results to this point and find that it has no bearing on the conclusions that we draw.

Table 4 lists the top six major destinations of Chinese exports in 1994, 1999, 2004 and 2008 respectively. There are only few changes throughout these years. Netherlands replaced the United Kingdom as one of the top six China main export destinations and USA emerged as the most important export market since 1999. For the top three export destinations since 1999: USA, Hong Kong and Japan, shares of total Chinese manufacturing exports to these markets have dropped over time. This shows that Chinese export destinations are becoming more diverse and less dependent on few countries as

before. This is possible as there have been significant change in the China's export bundle. In recent years, parts and components instead of apparel exports have been the main mover of Chinese export expansion. This is consistent with the view that East Asia is becoming a hub for fragmentation of the production process as reported by Kimura, et al. (2007).

Table 4
Major Destinations of Chinese Manufacturing Exports 1994 - 2008

Year	Destinations	Share (%)
1994	1. United Kingdom	2.31
	2. Rep. of Korea	2.84
	3. Germany	4.49
	4. Japan	15.37
	5. USA	21.27
	6. China, Hong Kong SAR	29.66
1999	1. Netherlands	2.80
	2. Rep. of Korea	3.24
	3. Germany	4.38
	4. Japan	15.35
	5. Hong Kong	19.96
	6. USA	24.27
2004	1. Netherlands	3.26
	2. Rep. of Korea	3.97
	3. Germany	4.37
	4. Japan	11.55
	5. Hong Kong	17.98
	6. USA	23.00
2008	1. Netherlands	3.23
	2. Rep. of Korea	4.63
	3. Germany	4.67
	4. Japan	8.07
	5. Hong Kong	12.80
	6. USA	19.51

Note: Data are at the 5-digit level.
Source: Computed from UN Comtrade database.

Table 5 describes the average years of Secondary schooling (age 25+) of exporting countries as well as their ratio to China's in 1990. Japan and Korea are at the top of the list that with highest average years of secondary schooling. The average schooling years of these countries are three times higher than that of China. Among the exporters examined in this paper, only Thailand and Indonesia are below China. The coincidental result that the average years of secondary schooling in the population in

China aged over 25 is just one year, means that our transformation of the data to measure relative schooling will have little effect on the estimated coefficients.

Table 5
Human Capital of Exporting Countries in 1990

Exporter	Average years of secondary schooling, age 25+	Ratio of Country_i to China's average years of secondary schooling, age 25+
China	1.030	1.000
Indonesia	0.874	0.848
Japan	3.497	3.395
Malaysia	2.159	2.095
Philippines	1.600	1.553
Rep. of Korea	3.184	3.091
Singapore	1.382	1.341
Thailand	0.628	0.610

Source: World Bank Education Statistics.

4. Results

4.1 Replication of Previous Findings

In Table 6 we demonstrate that we can replicate the main results from Eichengreen et al. (2007), Greenaway et al. (2008) and Athukorala (2009). In these regressions we include a standard set of gravity variables, including the GDP and the distance between the origin and destination countries, as well various combinations of year, exporter, importer and export-importer fixed effects. Regression (a) includes no dummy variables, regression (b) adds time dummies, in regression (c) we add exporter and importer fixed effects alongside the time dummies and regression (d) includes country-pair fixed effects alongside the year dummies. The standard control variables behave as expected. The value of exports from East Asian countries to destination countries are increasing in the economic mass of the importer and exporter (GDP_{it}, GDP_{jt}), their economic wealth (CAP_{it}, CAP_{jt}), if they share a border ($Contig_{ij}$) and had the same colonizer ($ComCol_{ij}$). Exports are lower in value the greater is the distance between countries ($Distw_{ij}$), to island economies ($Island_{ij}$), landlocked ($Landl_{ij}$) and geographically large countries ($Areap_{ij}$). Similar evidence for these variables can be found in Greenaway et al. (2008).

In all cases the coefficient on Chinese exports is positive and statistically significant, although the magnitude of this effect falls across the various regressions as we add more control variables. At its largest the regressions suggest that for every 1% increase in exports from China, exports from other East Asian economies grow by 0.49% (regression (b)), while at its smallest the effect is 0.17% (regression (c)). These strongly suggest that complementarities from Chinese exports on the exports of other East Asian countries to the same destination.

Table 6
The Impact of China's Export on Asian Countries' Exports to the Third Markets

Dependent variable: $ln\ EXP_{ijt}$				
Explanatory variables	**(a) OLS**	**(b) Specification (i)**	**(c) Specification (ii)**	**(d) Specification (iii)**
$ln\ ChEXP_{jt}$	0.319***	0.488***	0.171***	0.187***
	(0.026)	(0.035)	(0.027)	(0.028)
$ln\ GDP_{it}$	0.749***	0.786***	1.512***	1.896***
	(0.051)	(0.050)	(0.414)	(0.420)
$ln\ CAP_{it}$	0.314***	0.300***	-1.531***	-2.052***
	(0.056)	(0.054)	(0.548)	(0.558)
$ln\ GDP_{jt}$	0.629***	0.459***	-0.629**	-0.467
	(0.041)	(0.047)	(0.302)	(0.297)
$ln\ CAP_{jt}$	0.112***	0.158***	1.675***	1.632***
	(0.038)	(0.037)	(0.303)	(0.302)
$ln\ Distw_{ij}$	-1.150***	-1.064***	-1.864***	-
	(0.071)	(0.072)	(0.193)	
$ln\ Areap_{ij}$	-0.108***	-0.111***	-0.298**	-
	(0.024)	(0.023)	(0.129)	
$Landl_{ij}$	-1.051***	-0.922***	11.729***	-
	(0.101)	(0.100)	(1.678)	
$Island_{ij}$	-0.769	-0.792***	3.936***	-
	(0.080)	(0.078)	(1.268)	
$Contig_{ij}$	1.019***	1.045***	-0.199	-
	(0.307)	(0.312)	(0.432)	
$ComLang_{ij}$	0.170	0.178	0.194	-
	(0.173)	(0.172)	(0.136)	
$ComCol_{ij}$	0.387***	0.401***	0.118	-
	(0.145)	(0.145)	(0.117)	
$Colony_{ij}$	0.156	0.156	-0.246	-
	(0.413)	(0.406)	(0.510)	
Constant	-14.024	-14.429***	-3.367	-21.517**
	(1.167)	(1.159)	(7.921)	(8.982)
Year fixed effects	No	Yes	Yes	Yes
Exporter and importer fixed effects	No	No	Yes	No
Country pair fixed effects	No	No	No	Yes
No. of observations	16916	16916	16916	16916
R-squared	0.771	0.785	0.869	0.938

Notes: Significance level is denoted as ***1%, **5%, and *10% respectively. Figures in parentheses are robust standard errors (clustered by country-pairs).

In Table 7 we compare whether the effect differs according whether the East Asian country is considered by the World Bank to be a high (Japan, South Korea and Singapore) or middle income (Indonesia, Malaysia, Philippines, Thailand). There is some evidence from these regressions that the effects are slightly stronger for the middle income group. For this group the evidence of complementarities from Chinese trade are strongest. In that regard our results support those found in Athukorala (2009).

Table 7
The Impact of China's Export on Asian Countries' Exports to the Third Markets

Dependent variable: $ln\ EXP_{ijt}$				
Explanatory variables	**(a) OLS**	**(b) Specification (i)**	**(c) Specification (ii)**	**(d) Specification (iii)**
$HI_i \times ln\ ChEXP_{jt}$	0.315***	0.476***	0.149***	0.118***
	(0.029)	(0.037)	(0.029)	(0.034)
$MI_i \times ln\ ChEXP_{jt}$	0.343	0.499	0.190**	0.241***
	(0.023)	(0.023)	(0.019)	(0.030)
Year fixed effects	No	Yes	Yes	Yes
Exporter and importer fixed effects	No	No	Yes	No
Country pair fixed effects	No	No	No	Yes
No. of observations	16916	16916	16916	16916
R-squared	0.773	0.782	0.867	0.939

Notes: Significance level is denoted as ***1%, **5%, and *10% respectively. Figures in parentheses are robust standard errors (clustered by country-pairs).

Finally in Table 8 we consider the instrumental variable approach used by Eichengreen et al. (2007), Greenaway et al. (2008) and Athukorala (2009). An issue raised by each of these studies is the possibility that there exists some omitted time varying characteristics of country *j*, for example some difficult to measure aspect of trade costs, that have caused exports from country *i* as well as those from China to rise over time.

One method of dealing with this problem would of course to be include country *j*-time dummies in the regression, but with the cost that the effect of the variable of interest could no longer be identified. Eichengreen et al. (2007), Greenaway et al. (2008) and Athukorala (2009) use an instrumental variable approach as an alternative. The common instrument used across the three studies is the distance between China and the importer country, to which Eichengreen et al. (2007), Greenaway et al. (2008) add China's real

GDP and Athukorala (2009) a measure of common language and MNE presence in Chinese exports.

We require that the selected instruments fulfil two requirements: (i) it or they must be correlated with the endogeneous variable (instrument relevance), and (ii) it or they must uncorrelated with the error term (instrument exogeneity or instrument orthogonality). The first requirement can be formerly tested using the first-stage t-test of an instrument or F-test of the joint significance of the instruments. In a case in which the error process does not satisfy the homoskedasticity assumption, the Hanson J-Statistic can be utilised to test for instruments orthogonality of overidentified models. A rejection of null hypothesis means the overidentifying restriction is invalid and therefore OLS will be preferred. It is to be noted that 2SLS estimator is only suitable when errors are homoskedastic. The IV based GMM estimator will be more appropriate when errors are heteroskedastic. Accordingly, one must also check for the presence of heteroskesdacity by conducting the Pagan-Hall test.[3]Heteroskedasticity is present when the null hypothesis under this test is rejected.

Whilst each of the studies provides evidence of the power of their chosen instruments it is difficult to provide convincing evidence that Chinese GDP, or FDI affects exports to destination *j* only through its effects on exports from China. We choose not to use either as an instrument. Distance is more plausibly exogenous, but has the disadvantage of being time invariant. With reference back to the idea that trade costs for country *j* have fallen over time we interact distance between China and destination *j* with time dummies. The instruments pass the standard validity tests both when using IV or GMM. Moreover the time varying distance instruments behave sensibly and appear to confirm the idea that trade costs have fallen over time. The coefficient on distance falls from 0.76 in 1994 to -0.49 in 2008 in a reasonably smooth fashion. However they do not pass the test of orthogonality with the error term, the overidentification test. Distance is a valid instrument in this context if the changes in trade costs that it captures are caused by

[3]Baum et al. (2003).

reductions in trade costs within China. If they instead also capture, in part, changes in trade costs in the destination country j, or a world-wide reduction in trade costs, they are likely to be highly correlated with Chinese exports in the first stage regression, but fail the overidentification test. Jacks et al. (2011) report evidence of world-wide declines in trade costs up to the year 2000, where these declines are particularly strong in the Asian region.

When we continue to instrument Chinese exports there is also an interesting effect on the China export variable from using an IV approach. The second-stage results, in both the simple IV and IV based GMM estimations, show that the coefficient for the log of Chinese exports is negative and statistically significant. Chinese exports now appear to crowd out exports by other Asian countries.

Table 8
The Impact of China's Export on Asian Countries' Exports to the Third Markets – IV approach

Dependent variable: $ln\ EXP_{ijt}$				
	IV		**IV/GMM**	
	1st stage	**2nd stage**	**1st stage**	**2nd stage**
$ln\ ChEXP_{jt}$	-	-0.126*** (0.021)	-	-0.037* (0.019)
$ln\ ChDistw_j \times year$ 1994	-0.763*** (0.156)	-	-0.763*** (0.156)	-
$ln\ ChDistw_j \times year$ 1995	-0.744*** (0.156)	-	-0.744*** (0.156)	-
$ln\ ChDistw_j \times year$ 1996	-0.754*** (0.156)	-	-0.754*** (0.156)	-
$ln\ ChDistw_j \times year$ 1997	-0.746*** (0.156)	-	-0.746*** (0.156)	-
$ln\ ChDistw_j \times year$ 1998	-0.730*** (0.156)	-	-0.730*** (0.156)	-
$ln\ ChDistw_j \times year$ 1999	-0.727*** (0.156)	-	-0.727*** (0.156)	-
$ln\ ChDistw_j \times year$ 2000	-0.700*** (0.156)	-	-0.700*** (0.156)	-
$ln\ ChDistw_j \times year$ 2001	-0.689*** (0.156)	-	-0.689*** (0.156)	-
$ln\ ChDistw_j \times year$ 2002	-0.670*** (0.156)	-	-0.670*** (0.156)	-
$ln\ ChDistw_j \times year$ 2003	-0.638*** (0.156)	-	-0.638*** (0.156)	-
$ln\ ChDistw_j \times year$ 2004	-0.597*** (0.156)	-	-0.597*** (0.156)	-
$ln\ ChDistw_j \times year$ 2005	-0.571*** (0.155)	-	-0.571*** (0.155)	-
$ln\ ChDistw_j \times year$ 2006	-0.542*** (0.155)	-	-0.542*** (0.155)	-
$ln\ ChDistw_j \times year$ 2007	-0.515*** (0.155)	-	-0.515*** (0.155)	-
$ln\ ChDistw_j \times year$ 2008	-0.487*** (0.155)	-	-0.487*** (0.155)	-
No. of observations	16916	16916	16916	16916
R-squared	0.820	0.732	0.820	0.746
First stage F stat [p-value]:	350.990 [0.000]			
Endogeneity test [p-value]:	302.354 [0.000]			
Heteroskesdacity test [p-value]:	816.753 [0.000]			
Hansen J-Statistic [p-value]:	214.221 [0.000]			

Notes: Significance level is denoted as ***1%, **5%, and *10% respectively. Figures in parentheses are robust standard errors (clustered by country-pairs).

In Table 9 we report the results from separating Asian countries into high and middle income groups. Whilst none pass the Hansen tests for orthogonality, the second stage results suggest some interesting differences according to the level of income. We consistently find evidence that high income Asian countries (Japan, South Korea and Singapore) are not affected to the same extent as the middle income countries, Indonesia, Malaysia, Philippines, Thailand. However there is disagreement as to whether the level effect is positive for this group as compared to negative for the middle income countries when using GMM (Panel A and B) or zero versus negative for the high and middle income countries respectively when using IV (Panel A and B).

Table 9

The Impact of China's Export on High and Middle-income Asian Countries' Exports to the Third Markets – IV approach

Dependent variable: $ln\ EXP_{ijt}$				
	IV		IV/GMM	
	1st stage	2nd stage	1st stage	2nd stage
A. High Income Exporters				
$ln\ ChEXP_{jt}$	-	-0.043 (0.043)	-	0.120*** (0.029)
$ln\ ChDistw_j \times year\ 1994$	-0.855*** (0.245)	-	-0.855*** (0.245)	-
$ln\ ChDistw_j \times year\ 1995$	-0.836*** (0.245)	-	-0.836*** (0.245)	-
$ln\ ChDistw_j \times year\ 1996$	-0.846*** (0.245)	-	-0.846*** (0.245)	-
$ln\ ChDistw_j \times year\ 1997$	-0.836*** (0.245)	-	-0.836*** (0.245)	-
$ln\ ChDistw_j \times year\ 1998$	-0.818*** (0.244)	-	-0.818*** (0.244)	-
$ln\ ChDistw_j \times year\ 1999$	-0.819*** (0.245)	-	-0.819*** (0.245)	-
$ln\ ChDistw_j \times year\ 2000$	-0.793*** (0.245)	-	-0.793*** (0.245)	-
$ln\ ChDistw_j \times year\ 2001$	-0.783*** (0.245)	-	-0.783*** (0.245)	-
$ln\ ChDistw_j \times year\ 2002$	-0.763*** (0.245)	-	-0.763*** (0.245)	-
$ln\ ChDistw_j \times year\ 2003$	-0.728*** (0.245)	-	-0.728*** (0.245)	-
$ln\ ChDistw_j \times year\ 2004$	-0.687*** (0.245)	-	-0.687*** (0.245)	-
$ln\ ChDistw_j \times year\ 2005$	-0.663*** (0.245)	-	-0.663*** (0.245)	-
$ln\ ChDistw_j \times year\ 2006$	-0.635*** (0.245)	-	-0.635*** (0.245)	-
$ln\ ChDistw_j \times year\ 2007$	-0.608** (0.245)	-	-0.608** (0.245)	-
$ln\ ChDistw_j \times year\ 2008$	-0.581** (0.245)	-	-0.581** (0.245)	-
No. of observations	7229	7229	7229	7229
R-squared	0.821	0.735	0.821	0.744
First stage F stat [p-value]:	94.220 [0.000]			
Endogeneity test [p-value]:	108.849 [0.000]			
Heteroskesdacity test [p-value]:	475.137 [0.000]			
Hansen J-Statistic [p-value]:	152.216 [0.000]			
B. Middle Income Exporters				
$ln\ ChEXP_{jt}$	-	-0.671*** (0.076)	-	-0.292*** (0.050)
$ln\ ChDistw_j \times year\ 1994$	-0.681*** (0.200)	-	-0.681*** (0.200)	-
$ln\ ChDistw_j \times year\ 1995$	-0.66*** (0.200)	-	-0.66*** (0.200)	-
$ln\ ChDistw_j \times year\ 1996$	-0.673*** (0.200)	-	-0.673*** (0.200)	-
$ln\ ChDistw_j \times year\ 1997$	-0.665*** (0.199)	-	-0.665*** (0.199)	-
$ln\ ChDistw_j \times year\ 1998$	-0.651*** (0.199)	-	-0.651*** (0.199)	-
$ln\ ChDistw_j \times year\ 1999$	-0.645*** (0.199)	-	-0.645*** (0.199)	-
$ln\ ChDistw_j \times year\ 2000$	-0.619*** (0.199)	-	-0.619*** (0.199)	-
$ln\ ChDistw_j \times year\ 2001$	-0.607*** (0.199)	-	-0.607*** (0.199)	-
$ln\ ChDistw_j \times year\ 2002$	-0.587*** (0.199)	-	-0.587*** (0.199)	-
$ln\ ChDistw_j \times year\ 2003$	-0.558*** (0.199)	-	-0.558*** (0.199)	-
$ln\ ChDistw_j \times year\ 2004$	-0.517*** (0.199)	-	-0.517*** (0.199)	-
$ln\ ChDistw_j \times year\ 2005$	-0.488** (0.199)	-	-0.488** (0.199)	-
$ln\ ChDistw_j \times year\ 2006$	-0.458** (0.199)	-	-0.458** (0.199)	-
$ln\ ChDistw_j \times year\ 2007$	-0.430** (0.199)	-	-0.430** (0.199)	-
$ln\ ChDistw_j \times year\ 2008$	-0.401** (0.199)	-	-0.401** (0.199)	-
No. of observations	9687	9687	9687	9687
R-squared	0.819	0.605	0.819	0.694
First stage F stat [p-value]:	65.740 [0.000]			
Endogeneity test [p-value]:	319.540 [0.000]			
Heteroskesdacity test [p-value]:	405.378 [0.000]			
Hansen J-Statistic [p-value]:	137.311 [0.000]			

Notes: Significance level is denoted as ***1%, **5%, and *10% respectively. Figures in parentheses are robust standard errors (clustered by country-pairs).

The results reported thus far show that what specification to be used to analyse the effect of Chinese export expansion does matter. Although the coefficient for Chinese exports is positive and is significant for regressions (a) to (d), the magnitude varies significantly from one to another. Using the IV approach, we obtain more or less similar results of those literature adopting the same method. The negative coefficient for the variable of interest however suggests the existing of crowding out effect. These inconsistency evidence highlight the need to consider the most appropriate gravity specification to be used, particularly the one that is line with the established theoretical theories.

4.2 Theoretically Derived Gravity Model Regressions

Table 10 reports the results for the first differenced theoretically consistent gravity regressions where we include country *i*-time and country *j*-time dummies. In Panel A of Table 10, we use the exporter's human capital (Sec_i) and in Panel B the ratio of exporter's to China's human capital (Sec_i/Sec_c) to identify the effect of Chinese exports to country *j*.

In both regressions in Table 10 we find that Chinese exports interacted with human capital has a positive coefficient on the exports of other Asian countries. The effect of Chinese exports on other Asian country exports to the same destination is increasing in the human capital of the Asian country. This result matches the predictions of the Heckscher-Ohlin and Kimura et al. (2007) model of fragmentation. An annual increase of the 1% of Chinese exports corresponds to an increase of 0.05% in other Asian exporters' exports to third markets. Similar results are found when the ratio of human capital in country *i* to that of China's human capital is used.

Table 10
The Impact of China's Export on Asian Countries' Exports to the Third Markets - First-differencing DID Approach

Dependent variable: $ln\ EXP_{ijt}$	
A	
$\Delta ln\ ChEXP_{jt} \times Sec_i$	0.046** (0.022)
Country pair fixed effects	No
Exporter-time fixed effects	Yes
Importer-time fixed effects	Yes
No. of observations	15459
R-squared	0.227
Adj. R-squared	0.075
B	
$\Delta ln\ ChEXP_{jt} \times Sec_i/Sec_c$	0.047** (0.023)
Country pair fixed effects	No
Exporter-time fixed effects	Yes
Importer-time fixed effects	Yes
No. of observations	15459
R-squared	0.227
Adj. R-squared	0.075

Notes: Sec_i: Average years of secondary schooling, age 25+ (1990) in exporter country. Sec_c: Average years of secondary schooling, age 25+ (1990) in China. Significance level is denoted as ***1%, **5%, and *10% respectively. Figures in parentheses are robust standard errors (clustered by country-pairs).

Following evidence from Schott (2008) and Kimura et al. (2007), we have identified the effect of rising Chinese exports on other Asian countries using differences in their endowments of human capital. This raises a question of whether there are factors might also be statistically important. Rather than search across a wide range of variables we instead include an interaction term with GDP and then GDP per capita alongside the human capital variables on an assumption that other potential covariates are likely to be positively correlated with these two variables. In Panel A of Table 11 we report the results using the log of GDP and in Panel B the results for the log of GDP per capita.

In Table 11 Panel A, when we add the size of the economy interacted with Chinese exports we find that the interaction with endowments of human capital is significant whereas the interaction with GDP is insignificant. When we add the interaction with GDP per capita we find that neither this or the interaction with human capital is significant. This likely occurs because of the strong positive correlation between secondary schooling and GDP per capita.

Table 11
The Impact of China's Export on Asian Countries' Exports to the Third Markets - First-differencing DID Approach

Dependent variable: $ln\ EXP_{ijt}$	
A	
$\Delta ln\ ChEXP_{jt} \times Sec_i/Sec_c$	0.062*(0.035)
$\ln GDP_i \times \Delta ln\ ChEXP_{jt}$	-0.014 (0.026)
Country pair fixed effects	No
Exporter-time fixed effects	Yes
Importer-time fixed effects	Yes
No. of observations	15459
R-squared	0.227
Adj. R-squared	0.075
B	
$\Delta ln\ ChEXP_{jt} \times Sec_i/Sec_c$	0.017 (0.057)
$\ln CAP_i \times \Delta ln\ ChEXP_{jt}$	0.032 (0.044)
Country pair fixed effects	No
Exporter-time fixed effects	Yes
Importer-time fixed effects	Yes
No. of observations	15459
R-squared	0.227
Adj. R-squared	0.075

Notes: Sec_i: Average years of secondary schooling, age 25+ (1990) in exporter country. Sec_c: Average years of secondary schooling, age 25+ (1990) in China. Significance level is denoted as ***1%, **5%, and *10% respectively. Figures in parentheses are robust standard errors (clustered by country-pairs). The same results are obtained for $\Delta ln\ ChEXP_{jt} \times Sec_i$.

5. Conclusion

In this paper we use a theoretically consistent gravity model of Baldwin and Taglioni (2006) to investigate the impact brought by the China's export expansion on other Asian countries in third markets. Overall, our results do not show displacement effect by Chinese exports. On the contrary, complementary effects are found, although the results do suggest declining market shares. Larger complementary effect is faced by Asian exporters that with larger human capital stock. These findings are in marked contrast to the common predictions that China has posted a serious threat to other Asian countries export performance.

Appendix

List of Importing Countries

Importing countries			
High-income	Slovenia	Iraq	**Low-income**
Andorra	Spain	Jamaica	Tunisia
Antigua and Barbuda	Sweden	Jordan	Turkey
Aruba	Switzerland	Kazakhstan	Turkmenistan
Australia	Trinidad and Tobago	Kiribati	Ukraine
Austria	USA	Latvia	Uruguay
Bahamas	United Arab Emirates	Lebanon	Vanuatu
Bahrain	United Kingdom	Lesotho	Venezuela
Barbados		Libya	Bangladesh
Belgium	**Middle-income**	Lithuania	Benin
Bermuda	Albania	Malaysia	Burkina Faso
Brunei Darussalam	Algeria	Maldives	Burundi
Canada	Angola	Marshall Islands	Cambodia
China, Hong Kong SAR	Argentina	Mauritius	Central African Rep.
Croatia	Armenia	Mexico	Chad
Cyprus	Azerbaijan	Mongolia	Comoros
Czech Rep.	Belarus	Morocco	Dem. Rep. of the Congo
Denmark	Belize	Namibia	Eritrea
Equatorial Guinea	Bhutan	Nicaragua	Ethiopia
Estonia	Bolivia	Nigeria	Gambia
Faeroe Islands	(Plurinational State of)	Pakistan	Ghana
Finland	Bosnia Herzegovina	Palau	Guinea
France	Botswana	Panama	Guinea-Bissau
French Polynesia	Brazil	Papua New Guinea	Haiti
Germany	Bulgaria	Paraguay	Kenya
Greece	Cameroon	Peru	Kyrgyzstan
Greenland	Cape Verde	Philippines	Lao People's Dem. Rep.
Hungary	Chile	Poland	Liberia
Iceland	Colombia	Rep. of Moldova	Madagascar
Ireland	Congo	Romania	Malawi
Israel	Costa Rica	Russian Federation	Mali
Italy	Côte d'Ivoire	Saint Kitts and Nevis	Mauritania
Japan	Djibouti	Saint Lucia	Mozambique
Kuwait	Dominica	Saint Vincent and the	Nepal
Luxembourg	Dominican Rep.	Grenadines	Niger
Malta	Ecuador	Samoa	Rwanda
Netherlands	Egypt	Seychelles	Senegal
New Caledonia	El Salvador	Solomon Islands	Sierra Leone
New Zealand	FS Micronesia	South Africa	Tajikistan
Norway	Fiji	Sri Lanka	Togo
Oman	Gabon	Sudan	Uganda
Portugal	Georgia	Suriname	United Rep. of Tanzania
Qatar	Grenada	Swaziland	Uzbekistan
Rep. of Korea	Guatemala	Syria	Viet Nam
San Marino	Guyana	TFYR of Macedonia	Yemen
Saudi Arabia	Iran	Thailand	Zambia
Singapore	Honduras	Timor-Leste	Zimbabwe
Slovakia	India	Tonga	
	Indonesia		

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