International Journal of Business and Development Studies Vol. 3, No. 1, (2011) pp. 5-28

Financial Crisis and Steel Trade Integration in Asia and Pacific: A Static and Dynamic Analysis

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Abstract

The objective of this paper is to explore the effect of financial crisis on trade flows of steel industries in the major Asian-Pacific steel producing countries. Using a static and dynamic panel data analysis, we test the hypothesis that the global financial crisis has a negative effect on Asia-Pacific bilateral steel trade flows. We also examine the role of regional trade integration in bilateral steel trade in Asia and Pacific. The underlying assumption is that such integration contributes to increase trade relations and possibly adjust the imposed costs of financial crisis on the sector. To this end, we use cross-sectional data on steel trade flows of the selected Asian-Pacific countries over a specific period (2002-2006). The study is based on an extended gravitational model, in order to incorporate the main gravity variables and qualitative factors as well. The implication of this study can be towards implementation of an integrating block of steel industry by collaborating different countries in Asia and Pacific. This creates a larger regional steel trade market, and leading possibly to reduce the global or regional crisis.

Key words: Financial Crisis, Trade Integration, Steel Industry, Asia-Pacific, Gravity Model, Panel data

JEL Classification: C23, F14, F15, G01

1. Introduction

Economists believe that trade is an important factor in creating financial crisis for two reason. First, trade imbalance has been accounted as one of the major factors that generate financial crises. As Krugman

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(1979) pointed out, an economy without having enough foreign reserves has more potential to a currency crisis. Second, financial crises can be transmitted between trading partners from an affected country. In explaining such contagion effects, economists have tried to identify the channels through which contagion was spread and many researchers have been devoted to trade, since it is the most obvious economic linkage between countries.

Eichengreen and Rose (1999) tested industrial economies in 1959-1993 to see whether bilateral trade linkages transmitted crises through a binary-probit model. Their findings showed that trade was an important factor, since the probability of a financial crisis occurring in a country increased significantly if the country had high bilateral trade linkages with countries in crises. Glick and Rose (1999) conducted a similar analysis with more countries between 1971 and 1997 and obtained a similar result. Forbes (2000) used company's stock market data to study the significant role of trade in financial crises transmission, while his result confirmed this. However, some works have provided different answers to the problem. For example, Goldfajn (1998) concluded that trade was not an important factor in the East Asian Crisis because the direct bilateral trade volumes between these economies were very small. In another work, Masson (1998) analyzed the Mexican crisis and the Asian crisis and obtained similar results.

On the other hand, trade could be affected by financial crises (including currency crises, banking crises or both) through not only the exchange rate, but also other channels. Reinhart (1999) showed that financial crises usually caused capital account reversal ("sudden stop") and caused an economic recession. Mendoza (2001) pointed out that in an economy with imperfect credit markets these sudden stops could be an equilibrium outcome. The economic recession reduces export capability through decreasing domestic demand and total output, while capital outflow forces the country to increase export.

The recent financial crisis quickly spread worldwide given the interconnectedness of the global economy in trade, finance and investments. The impact on and reaction from developed and developing countries have been different based on their global economic integration and policy responses. This is not the first time that world is the witness of crisis and may not be the last time. But global effort is to decrease its useless effects. Hence, whether exports increase or decrease after financial crises are still unclear without further analysis. The effect of crisis on steel trade is our main concern, which has been faced recently with dramatic fluctuations in the world market.

After overlooking briefly at the developments in production and trade of the world steel industry, we focus on investigating the effects of financial crisis and other determinants on the bilateral steel trade in Asia and Pacific through a generalized gravity model.

The remaining sections of this paper are as follows: Section 2 makes a brief overview on recent developments in production and trade of the world steel industry, while Section 3 specifies a generalized gravity model to cover the paper objectives. Section 4 analyzes the empirical results obtained by the various econometric methods of panel data, and Section 5 concludes.

2. Developments in Production and Trade of the World Steel Industry

The latest statistics showed that in 2008, global steel production was about 1329.7 million tones which grew annually 7% in comparison with 695 million tones in 1999. Crude steel production in September for the 66 countries reporting to the International Iron and Steel Institute (IISI) was 107.0 million tones, a drop of only 0.6% over September 2008. The total for the first nine months of 2009 was 866.0 million tones, 16.4% down on the previous year's January to September total. However, excluding China, the fall in the year to date production was 30.9% with the September total down by 17.6%. Global crude steel production for the full year may reach 1200 million tones, compared to 1326 million in 2008 (World Steel Production Report, 2009[1]).

For the case of each country, Russian crude steel production in September fell by 20% with the nine months total down 26.8% to 41.7 million tones. Kazakhstan's nine months total decreased by 19.6% to 2.8 million tones. The five major Asian countries - China, India, Japan, South Korea and Taiwan - showed very mixed results in steel production. Chinese production jumped by 28.7% in September,

[1] www.issb.co.uk

although the year to date total was only up by 7.5% to 420 million tones, 48.5% of global steel production. Japanese production, on the other hand, decreased by 18% in the month, bringing the cumulative total down 34% to 60.9 million tones. In South Korea production was down just 2.4% in September, and by 14.9% in the nine months to 35.1 million tones. India's steel production was flat in September, while the year to date total was up 1.6% to 41.7 million tones. Taiwanese production, however, decreased by 25% in September, and by 33% in the year to date to 10.6 million tones (ISSB Monthly World Steel Production Review)

In general, in 2008 the five major steel producing countries were China (500.5 m.t.), Japan (118.7 m.t.), United States (91.4 m.t.), Russia (68.5 m.t.), and India (55.2 m.t.), respectively (World Steel Association[1]). Also, Table 1 reports the country ranking on world steel production over the period 2002-2006.

[1] www.worldsteel .org

Table 1: The country ranking on the world steel production during 2002-2006

Country	2002	2003	2004	2005	2006
China	1	1	1	1	1
Japan	2	2	2	2	2
United State	3	3	3	3	3
Russia	4	4	4	4	4
South Korea	5	5	5	5	5
Germany	6	6	6	6	6
Ukraine	7	7	7	7	8
India	9	8	9	8	7
Brazil	8	9	8	9	10
Italy	10	10	10	10	9
France	11	11	11	12	13
Taiwan	12	12	13	13	12
Turkey	13	13	12	11	11
Spain	14	14	14	14	14
Canada	15	15	16	16	16
Mexico	16	16	15	15	15
United Kingdom	17	17	17	17	17
Belgium	18	18	18	18	18
South Africa	19	19	20	19	21
Poland	20	20	19	21	19
Iran	22	21	21	20	20
Australia	21	22	22	22	22
Czech Republic	23	23	23	27	24
Netherlands	25	24	24	24	25
Austria	24	25	25	23	23
Sweden	26	26	27	28	29
Romania	27	27	26	26	26
Argentina	30	28	29	30	28
Kazakhstan	28	29	28	35	35
Malaysia	29	30	35	25	30
Finland	34	31	30	33	33
Slovakia	32	32	34	34	32
Egypt	31	33	31	29	27
Saudi Arabia	35	34	36	36	36
Venezuela	33	35	32	32	34
Indonesia	38	36	37	37	37
Luxembourg	36	37	38	39	38
Thailand	37	38	33	31	31

Source: World Steel in Figures, International Iron and Steel Institute (IISI), www.worldsteel.org

In trade sector, China was the world's largest steel exporter in 2006, 2007 and 2008 but in the first six months of 2009 China dropped to 7th largest exporter with shipments down 68% on 2008. Combined shipments by the top ten steel exporters show quarterly totals of: - 2008 Q1 - 61.7 million tones: Q2 - 68.4 million tones: Q3 - 72.4 million tones: Q4 - 50.9 million tones: 2009 Q1 - 43.2 million tones: Q2 - 46.7 million tones. In addition, EU27 imports surged 23% in 2007 to 48.7 million tones but fell back 18% in 2008 to 39.7 million tones. US imports fell 27% to 29.5 million tones in 2007 and a further 4% in 2008 to 28.4 million tones. South Korea's 2008 imports rose 9% to 28.1 million tones bringing it very close to surpassing USA as 2nd largest importer. The first six months of 2009 has seen trade levels fall sharply with a few exceptions. Chinese imports have risen, as have exports to Egypt, India and Algeria (World Steel Association).

Table 2 represents the ranking of the top 20 steel exporting and importing countries during 2004-2008.

Table 2: The country ranking on the world steel trade during 2002-2006

Ranking of 20 Top Exporters						Ranking of 20 Top Exporters					
Country	2004	2005	2006	2007	2008	Country	2004	2005	2006	2007	2008
China	5	3	1	1	1	U S A	2	1	1	1	1
Japan	1	1	2	2	2	S. Korea	5	4	4	3	2
Ukraine	3	4	4	3	3	Germany	3	3	2	2	3
Germany	4	5	5	4	4	Italy	4	5	3	4	4
Russia	2	2	3	5	5	France	6	6	6	5	5
Belgium	7	7	6	6	6	China	1	2	5	7	6
S. Korea	8	8	8	7	7	Belgium	8	8	7	6	7
Turkey	10	11	14	10	8	U. A. E.	18	16	17	12	8
Italy	9	9	9	9	9	Turkey	13	12	13	9	9
France	6	6	7	8	10	Thailand	10	7	10	11	10
U S A	15	12	13	12	11	Spain	9	9	8	8	11
Netherlands	13	15	12	13	12	Taiwan	7	10	11	14	12
Taiwan	12	13	11	11	13	Netherlands	15	15	14	15	13
Spain	16	16	17	16	14	Canada	11	17	9	16	14
Brazil	11	10	10	14	15	Vietnam	17	19	19	17	15
U.K.	14	14	15	15	16	Indonesia	19	18	20	20	16
Canada	19	19	19	17	17	U. K.	12	14	12	13	17
India	18	18	16	19	18	Poland	20	20	18	18	18
Australia	17	17	18	18	19	Iran	14	13	16	10	19
Mexico	20	20	20	20	20	Mexico	16	16	15	19	20

Source: ISSB, Iron and Steel Statistics Bureau, www.issb.co.uk.

3. The Model

The first attempt to derive the gravity equation from economic theory was made by Anderson (1979). In his paper he assumes Cobb–Douglas (and CES) homothetic preferences identical across countries, perfect product specialization under the Armington assumption and perfect competition. Since the paper by Anderson, economists have shown that the gravity equation can be derived from three different trade models that assume product specialization: Ricardian models; Hecksher–Ohlin (H–O) models and increasing returns to scale (IRS) models (Evenett and Keller, 2002).

Due to many different factors and causes, an economy has some advantage in producing a given product and this originates specialization and trade. This product specialization can be obtained because countries have different factor endowments from H–O models or because firms enjoy increasing returns to scale in production from IRS models or because of technology differences in Ricardian models.

It is well known that H–O models predict only inter-industry trade in goods that are different. However, IRS models can account for intra-industry trade. In addition, trade flows between similar countries might be better interpreted in a monopolistic competition approach (Fillipini and Molini, 2003). Although a few studies have used the Ricardian approach in order to derive the gravity equation and test it at a sectoral or disaggregate level, recent papers have applied this equation to the intra-industry trade (Tayebi and Arbabian, 2007). The reason is that countries import and export similar products in order to expand their world market shares and so on.

Generally, studies on regional trading blocs find that trade volume is directly related to the economic and physical size (GDP and population) of the countries involved, as well as transaction costs which are usually proxied by distance. Tinbergen (1962) and Linnermann (1966) provide initial specifications for the gravity model and use it to look at the determinants of trade flows.

The most common empirical tool used to explore effects of trade integration, regional trade agreements (RTAs) and financial integration/crises on bilateral trade flows is a gravity model. A gravity model involves regressing trade on a series of explanatory variables, then using dummy variables to ascertain whether this relationship is affected by the existence of RTAs and global/regional financial crisis, for instance (Jugurnath et al., 2007). Moreover, Anderson (1979), Bergstrand (1989), Frankel and Wei (1995), Kreinin and Plummer (1998), Krueger (1999), Cernat (2001), Adams, et al. (2003), Filippini and Molini (2003) and Tang (2005) are just some of the studies which have used gravity models to estimate the 'trade creation' and 'trade diversion' effects of various RTAs, including NAFTA, MERCOSUR, and ASEAN. However, there is a lack of literature in order to find out the empirical results of recent financial crisis on trade relations. Due to discussion in previous sections, we use here a dummy variable in our gravity model specified below to examine the shock effect of the recent crisis on the world steel trade.

Although gravity models typically employ total trade (imports plus exports) as the dependent variable, we focus on exports of steel worldwide as they more closely proxy the effects of trade expansion in this industry. The model includes two steel product variables; $Product_i$ is for the exporting country and $Product_j$ is for the importing country. As output in each country increases, there would be both greater demand for steel products as well as increased production, therefore positive relationships between both of these variables and exports would be expected.

There are two population variables, POP_i for the exporting country and POP_j for the importer. It is expected that countries with larger populations will both import and export more. However, the larger is an exporter's population the larger will be the domestic demand for steel products, hence the smaller would be the potential export supply. Nevertheless, according to Bergstrand (1989), a larger population would allow for economies of scale, which may increase the price competitiveness of the export country's production, thereby leading to higher exports. Therefore, the sign on the coefficient of the population of the exporting country (POP_i) may be indeterminate, while the sign for the importing country (POP_i) is expected to be positive.

In common with much of the gravity literature, we try to capture steel exports (SX_{ij}) with a set of controls for all possible aids to bilateral trade relationship. Accordingly, we use two openness variables, $Open_i$

for the exporting country and $Open_j$ for the importer. Hence, greater openness should be expected to result in greater trade relationship in Asia in the long run. Specifically, the greater is the level of openness of partner countries, the greater is the joint steel trade of Asia with world, presumably because of both their mutual steel trade and their general openness to the global economy.

The physical distance between trading countries is a proxy for transport costs. It is expected that transport costs would be negatively correlated with trade. $Dist_{ij}$ is the geographical distance between the capital cities of the exporting country *i* and the importing country *j*.

As discussed earlier in this paper, recent financial crisis has affected the world trade sharply. The global economic crisis has pushed the world steel industry into recession, demand for steel has contracted sharply, steelmakers have introduced major production cuts, trade in steel has declined sharply, and steel prices and employment are also down substantially. However, steelmaking capacity continues to increase despite the market downturn. It is evident that slowdown was occurring already before the financial shock (in 2005 and 2006), while the financial shock reduced capital availability causing a contraction in fixed asset investment on the world steel industry (OECD Steel Committee, 2009).

It is thus of interest to see whether the trade flows of the steel industry worldwide has been affected or not. It is also possible to explore whether implementation of steel trade integration in Asia could adjust the effect of the crisis shock in the Asian blocs. Hence, a dummy variable (*FC*) is used in the model to undertake this, while its value is one for the starting years of the crisis that are 2005 and 2006, and zero for the remaining of the considered period (2002-2004).

Equation (1) shows how this paper uses the above variables in the basic gravity model, which is specified as follows:

$$\begin{aligned} LogSX_{ijt} &= a_1 + a_2 Log\text{Produt}_{it} + a_3 Log\text{Product}_{jt} + a_4 LogPOP_{it} + a_4 LogPOP_{jt} \\ &+ a_5 LogOpen_{it} + a_6 LogOpen_{jt} + a_7 LogDist_{ij} + a_8 FC + U_{ijt} \end{aligned} \tag{1}$$

Where $LogSX_{ijt}$ denotes the log of steel exports from country *i* to country *j* in time *t*. A log specification was used as this has typically given the best results and *i* is the exporting country, while *j* is the importing country.

Any attempt for estimating equation (1), which assuming intercept (α_1) is homogeneous for trading-partner pairs, yields biased results, since countries are often different in structures. It is evident that the crucial source of the bias is as a result of failure to applying Ordinary Least Squares (OLS) methods to deal with the heterogeneity among bilateral trade relationships (Baltagi, 2005). We will implement this through F-test. Thus, one of the solutions to control for heterogeneity is the use of *Panel Data* procedure, which allows intercepts of the model to be specific to each trading pairs. Generally formed, the $LogSX_{ijt}$ model in *Panel Data* is as follows

$$LogSX_{ijt} = a_0 + a_t + a_{ij} + a_2 Log\text{Pr}odut_{it} + a_3 Log\text{Pr}oduct_{jt} + a_4 LogPOP_{it} + a_4 LogPOP_{jt} + a_5 LogOpen_{it} + a_6 LogOpen_{jt} + a_7 LogDist_{ij} + a_8 FC + U_{ijt} \quad (2)$$

In this model, intercept contains three parts; the first one is the same to all years and individuals including country pairs, α_0, the other becomes specific to year *t* and the same to all individuals, α_t, while the third refers to specific individuals, but the same to all years, α_{ij}. It is the so-called individual effect (a country pair fixed effect), which is allowed to be different across partner pairs, namely $\alpha_{ij} \neq \alpha_{ji}$. The estimation results obtained by OLS, therefore, show serious problems of biasness due to the restriction that country pair intercept terms equal zero. Ignoring α_t, we estimate Equation (2) by three methods: Random Effects (RE), Random –Effects Generalized Least Squares (RE-GLS), and Arellano-Bond Dynamic Panel Data (ABDPD). RE allows us to use dummies rather Fixed Effects, while fits panel data linear model using feasible generalized least squares. This allows estimation in the presence of AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels (Greene, 2003).

In general, dynamic panel-data models allow past realization of the dependent variable to affect its current level. ABDPD fits a dynamic model using the Arellano-Bond estimator. Arellano and Bond (1991) derive a generalized method-of-moments (GMM) estimator using lagged levels of the dependent variable and the predetermined variables and differences of the strictly exogenous variables. This method assumes that there is no second-order autocorrelation in the first-differenced idiosyncratic errors (Baltagi, 2005). ABDPD implies the test for autocorrelation and the Sargan test of over-identifying restrictions for the model.

4. Empirical Results

The empirical analysis in this paper makes use of a time-series/ cross-country dataset that provides comparable and consistent measurements of variables both across 20 Asian-Pacific countries and through the period 2002-2006. The data for bilateral steel trade (export flows) are collected from the various versions of the PC-TAS, CD-ROM. The data for other variables are obtained from the World Bank CD-ROM (2008) and Penn World Table (http://pwt.econ.upenn.edu/).

Table 3 reports estimation results for the bilateral steel export model. The results show that production of steel in both Asian-Pacific exporting and importing countries has a highly significant and expected effect on the steel trade flows, while it is more pronounced for the exporters. This result is true to the openness variable for which Asian-Pacific bilateral exports of steel are affected directly and significantly by development of trade sector in the countries. Hence, greater general openness has resulted in greater trade relationship in Asia and Pacific.

The empirical results indicate that an increase in population of the importing country results significantly in a rise in the steel trade flows in the region that is expected.Thus the larger is an importer's population the larger has been the foreign demand for steel exports. However, the coefficient of the exporter's population is significantly negative, which implies the larger population the larger the domestic demand for steel products, hence the smaller has been export supply in Asia and Pacific.

Table (3): Empirical results on Asia-Pacific steel exports flows including effect of financial crisis

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
$LogProduct_i$	1.04544 Z = 13.38 P>|z| = 0.000	.9754867 Z = 23.02 P>|z| = 0.000	.8288831 Z = 1.82 P>|z| = 0. 069
$LogProduct_j$	.3798218 Z= 4.98 P>|z| = 0.000	.4091749 Z= 10.52 P>|z|=0.000	-.265993 Z= -0.68 P>|z| = 0. 496
$LogOpen_i$	.9166162 Z= 4.31 P>|z| = 0.000	.4971533 Z= 4.31 P>|z| = 0.000	-.3007896 Z= -0.24 P>|z| = 0. 814
$LogOpen_j$	1.310779 Z= 6.23 P>|z| = 0.000	1.05495 Z= 9.40 P>|z|=.000	1.756105 Z= 1.46 P>|z|=0. 143
$LogPOP_i$	-.1432889 Z= -1.35 P>|z|=0.176	-.2404189 Z= -4.73 P>|z|=.000	-11.58191 Z= -2.58 P>|z|=0. 010
$LogPOP_j$	.3715195 Z= 3.52 P>|z|=0.000	.2429725 Z= 4.89 P>|z|==.000	4.998242 Z=1.15 P>|z|==. 249
$LogDist_{ij}$	-1.242663 Z= -7.01 P>|z|=0.000	-1.236479 Z= -14.59 P>|z|:=.000	
FC	.2563064 Z: 3.73 P>|z|:0.000	.2714265 Z: 2.28 P>|z|:0. 022	-.2842909 Z: -1.71 P>|z|:0. 087
Diagnostic Tests	Wald chi2(5)=151.88[a] Prob>chi2=0.000 H-chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald: chi2(5)=151.88[a] Prob>chi2=0.000	S: chi2(5) = 15.59[d] Prob > chi2 =0.0081 AB: z = -6.36[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the 'goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average auto-covariance in residuals of order 1 is 0.

Geographical distance between two partners is one of the most effective determinants of bilateral steel trade, which has been found by this study. This shows the significant role of transportation cost denoted by the geographical distance between capital cities in trading steel products in Asia and Pacific.

As explained previously, *FC* is a dummy variable which defines the commencement of financial crisis since late 2005 and 2006. According to the estimation results obtained by several panel methods, the effect of current crisis is indeterminate. Specifically, estimation results earned by Random Effects (RE) and Random–Effects Generalized Least Squares (RE-GLS) address a significant but unexpected effect of the crisis on steel trade flows in Asia and Pacific, whereas the ABDPD procedure represents a significant and negative coefficient of the crisis at 10 percent significance level. In a dynamic viewpoint, the effect of financial crisis could become more apparent if more data are used in the estimation process.To examine the effects of regional trade agreements (RTAs) within the framework of the gravity steel trade flows, dummy variables are then added to explain regional steel trade integration in West Asia (Turkey, Iran (I.R), Saudi Arabia, Azerbaijan, India, Russia FED, Kazakhstan, Pakistan, and Qatar) and East Asia-Pacific (China, Japan, Malaysia, Indonesia, Taiwan, Korea REP, Philippines, Singapore, Thailand, and Australia). Two dummy variables are denoted by DUM_{EAP} (it takes one if the pair partners are the members of the East Asia and Pacific bloc, otherwise zero) and DUM_{WA} (it takes one if the pair partners are the members of the West Asia bloc, otherwise zero).When others have used this technique a consensus has emerged that RTAs are generally trade creating. For example, Aitken (1973), Bergstrand (1985), and Thursby and Thursby (1987) show that the European trading blocs have increased trade relations since the 1960s and 1970s. Later, work by Frankel and Wei (1995) and Frankel (1997) found evidence of 'trade creation' in Asian and in North American trading blocs. While a paper by Rose (2000) also found that RTAs were trade creating.

Hence, the results reported in Tables 4 and 5 indicate a significant and expected effect of implementing an East-Asia and Pacific integrating steel bloc, which has resulted in trade creation of the steel industry, whereas a regional trade Agreement in West Asia steel leads to trade diversion on the steel industry.

Table (4): Empirical results on Asia-Pacific steel exports flows including effects of financial crisis and regional trade integration in East Asia and Pacific

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
$LogProduct_i$	.9584013 Z: 12.63 P>|z|:0.000	.866252 Z: 20.84 P>|z|:0.000	.8288831 Z: 1.82 P>|z|:0. 069
$LogProduct_j$	.2991984 Z= 4.04 P>|z|=.000	.2971139 Z= 7.73 P>|z|=0.000	-.265993 Z= -0.68 P>|z|=. 496
$LogOpen_i$	.6899214 Z= 3.35 P>|z|=0.001	.2084841 Z= 1.85 P>|z|=0. 0.065	-.3007896 Z= -0.24 P>|z|=. 814
$LogOpen_j$	1.083714 Z= 5.31 P>|z|=.000	.7469638 Z=6.76 P>|z|:=.000	1.756105 Z: 1.46 P>|z|:0. 143
$LogPOP_i$	-.1139785 Z=-1.14 P>|z|=0. 253	-.1980919 Z= -4.09 P>|z|:0.000	-11.58191 Z: -2.58 P>|z|:0. 010
$LogPOP_j$	.395102 Z=3.98 P>|z|:0.000	.2753177 Z:=5.82 P>|z|:0.000	4.998242 Z: 1.15 P>|z|:0. 249
$LogDist_{ij}$	-1.001307 Z=5.78 P>|z|:0.000	-.9799172 Z: -11.65 P>|z|:0.000	-
FC	.3211356 Z: 4.65 P>|z|:0.000	.3506667 Z: 3.10 P>|z|:0. 002	-.2842909 Z: -1.71 P>|z|:0. 088
DUM_{EAP}	1.317545 Z: 5.00 P>|z|:0.000	1.354459 Z: 10.64 P>|z|:0.000	
Diagnostic Tests	Wald chi2(5)=151.88[a] Prob>chi2=0.000 H-chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald: chi2(5)=151.88[a] Prob>chi2=0.000	S: chi2(5) = 15.57[d] Prob >chi2 = 0.0082 AB : z = -6.36[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the 'goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average auto-covariance in residuals of order 1 is 0.

Table (5): Empirical results on Asia-Pacific steel exports flows including effects of financial crisis and regional trade integration in West Asia

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
$LogProduct_i$	1.026634 Z: 13.21 P>|z|:0.000	.9318569 Z: 21.99 P>|z|:0.000	.8288831 Z: 1.82 P>|z|:0. 069
$LogProduct_j$	.362291 Z: 4.78 P>|z|:0.000	.3637762 Z: 9.31 P>|z|:0.000	-.265993 Z: -0.68 P>|z|:0. 496
$LogOpen_i$	.7879789 Z: 3.60 P>|z|:0.000	.2453649 Z: 2.02 P>|z|:0. 043	-.3007896 Z: -0.24 P>|z|:0. 814
$LogOpen_j$	1.183343 Z: 5.46 P>|z|:0.000	.8074656 Z: 6.82 P>|z|:0.000	1.756105 Z: 1.46 P>|z|:0. 143
$LogPOP_i$	-.1609149 Z: -1.54 P>|z|:0. 124	-.2655839 Z: -5.29 P>|z|:0.000	-11.58191 Z: -2.58 P>|z|:0. 010
$LogPOP_j$	.352845 Z: 3.38 P>|z|:0.001	.214727 Z: 4.37 P>|z|:0.000	4.998242 Z: 1.15 P>|z|:0. 249
$LogDist_{ij}$	-1.432726 Z: -7.22 P>|z|:0.000	-1.495566 Z: -15.83 P>|z|:0.000	
FC	.2880524 Z: 4.10 P>|z|:0.000	.3294272 Z: 2.80 P>|z|:0. 005	-.2842909 Z: -1.71 P>|z|:0. 088
DUM_{WA}	-.7792541 Z: -1.99 P>|z|:0.046	-1.122989 Z: -5.85 P>|z|:0.000	
Diagnostic Tests	Wald chi2(5)=151.88[a] Prob>chi2=0.000 H-chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald: chi2(5)=151.88[a] Prob>chi2=0.000	S: chi2(5) = 15.57[d] Prob > chi2 =0.0082 AB: z = -6.36[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the 'goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average autocovariance in residuals of order 1 is 0.

Finally, to justify the issue of crisis effect, evidence addressed by the OECD Steel Committee expressed a production slowdown already before the financial shock (in 2005 and 2006). Accordingly, the empirical results reported by Tables 6-9 show a significant and expected cross effect of the steel product (in both trading partners) times *FC* ($LogProduct_{i/j}$*FC) on bilateral steel trade in Asia and Pacific, modifying the bias created in the model.

Table (6): Empirical results on Asia-Pacific steel exports flows including effects of financial crisis and regional trade integration in West Asia as well as cross effect of *FC*LogProduct$_i$*

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
$LogProduct_i$	1.024036 Z= 12.57 P>|z|=0.000	.9242877 Z= 18.25 P>|z|=0.000	.8976576 Z= 1.70 P>|z|=0. 089
$LogProduct_j$	.3630278 Z= 4.83 P>|z|=0.000	.3636899 Z= 9.31 P>|z|=0.000	-.2667594 Z= -0.69 P>|z|=0. 492
$LogOpen_i$	.7781296 Z= 3.57 P>|z|=0.000	.2440073 Z= 2.01 P>|z|=0.000	-.3766804 Z= -0.30 P>|z|=0. 764
$LogOpen_j$	1.175268 Z= 5.46 P>|z|=0.000	.8075598 Z= 6.83 P>|z|=0. 044	1.827069 Z= 1.54 P>|z|=0. 123
$LogPOP_i$	-.1623567 Z= -1.57 P>|z|=0. 117	-.2655016 Z= -5.29 P>|z|=0.000	-12.44374 Z= -2.24 P>|z|=0. 025
$LogPOP_j$	.3498499 Z= 3.39 P>|z|=0.001	.2147692 Z= 4.37 P>|z|=0.000	5.119448 Z= 1.19 P>|z|=0. 235
$LogDist_{ij}$	-1.435749 Z= -7.32 P>|z|=0.000	-1.495072 Z= -15.83 P>|z|=0.000	
FC	.2649216 Z= 0.75 P>|z|=0.454	.1491811 Z= 0.22 P>|z=0. 824	-.0379392 Z= -0.05 P>|z|=0. 958
DUM_{WA}	-.7875804 Z=-4.04 P>|z|=0.042	-1.123948 Z= -5.86 P>|z|=0.000	
$FC*LogProduct_i$	.0022698 Z= 0.07 P>|z|=0.943	.0164136 Z= 0.27 P>|z|=0. 785	-.0216288 Z= -0.35 P>|z|=0. 728
Diagnostic Tests	Wald chi2(5)=151.88[a] Prob>chi2=0.000 H-chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald: chi2(5)=151.88[a] Prob>chi2=0.000	S: chi2(5) = 15.93[d] Prob >chi2 = 0.0071 AB: z = -6.32[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the 'goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average auto-covariance in residuals of order 1 is 0.

Table (7): Empirical results on Asia-Pacific steel exports flows including effects of financial crisis and regional trade integration in West Asia as well as cross effect of *FC*LogProduct$_j$*

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
LogProduct$_i$	1.025717 Z= 13.28 P>|z|=0.000	.9319731 Z= 22.00 P>|z|=0.000	.8390328 Z= 1.83 P>|z|=0. 068
LogProduct$_j$	.4127653 Z= 5.19 P>|z|=0.000	.3741377 Z= 7.88 P>|z|=0.000	-.4413189 Z= -0.96 P>|z|=0. 338
LogOpen$_i$	.7799918 Z= 3.58 P>|z|=0.000	.2459332 Z= 2.03 P>|z|=0.000	-.3970759 Z= -0.31 P>|z|=0. 758
LogOpen$_j$	1.213104 Z= 5.61 P>|z|=0.000	.8101986 Z= 6.84 P>|z|=0. 043	1.817156 Z= 1.53 P>|z|=0. 127
LogPOP$_i$	-.1626144 Z= -1.56 P>|z|=0.118	-.265595 Z= -5.29 P>|z|=0.000	-12.10251 Z= -2.64 P>|z|=0. 008
LogPOP$_j$	.3403876 Z= 3.28 P>|z|=0.001	.2147019 Z= 4.37 P>|z|=0.000	7.390633 Z= 1.36 P>|z|=0. 174
LogDist$_{ij}$	-1.43376 Z= -7.27 P>|z|=0.000	-1.494742 Z= -15.82 P>|z|=0.000	
FC	.9354637 Z= 2.82 P>|z|=0.005	.569439 Z= 0.89 P>|z|=0. 371	-.8539743 Z= -1.21 P>|z|=0. 226
DUM$_{WA}$	-.7593205 Z= -1.96 P>|z|=0.050	-1.120717 Z= -5.84 P>|z|=0.000	
FC*LogProduct$_j$	-.059828 Z= -2.00 P>|z|=0.046	-.0220908 Z= -0.38 P>|z|=0. 702	.0510257 Z= 0.84 P>|z|=0. 402
Diagnostic Tests	Wald chi2(5)=151.88[a] Prob>chi2=0.000 H-chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald chi2(5)=151.88[a] Prob>chi2= 0.000	S: chi2(5) = 15.11[d] Prob > chi2= 0.0099 AB: z = -6.30[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the 'goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average auto-covariance in residuals of order 1 is 0.

Table (8): Empirical results on Asia-Pacific steel exports flows including effects of financial crisis and regional trade integration in East-Asia and Pacific as well as cross effect of *FC*LogProduct$_j$*

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
$LogProduct_i$	.9583209 Z= 12.67 P>|z|=0.000	.8663354 Z= 20.84 P>|z|=0.000	.8390328 Z= 1.83 P>|z|=.068
$LogProduct_j$	.345241 Z= 4.44 P>|z|=0.000	.3094339 Z= 6.67 P>|z|=0.000	-.4413189 Z= -0.96 P>|z|=0. 338
$LogOpen_i$	.6843124 Z= 3.33 P>|z|=0.001	.208687 Z= 1.85 P>|z|=0.000	-.3970759 Z= -0.31 P>|z|=0. 758
$LogOpen_j$	1.111207 Z= 5.45 P>|z|=0.000	.749772 Z= 6.77 P>|z|=0. 064	1.817156 Z= 1.53 P>|z|=0. 127
$LogPOP_i$	-.1158599 Z= -1.17 P>|z|=0. 244	-.1981855 Z= -4.09 P>|z|=0.000	-12.10251 Z= -2.64 P>|z|=0. 008
$LogPOP_j$	.3843144 Z= 3.88 P>|z|=0.000	.2752046 Z= 5.82 P>|z|=0.000	7.390633 Z= 1.36 P>|z|=0. 174
$LogDist_{ij}$	-1.008836 Z= -5.84 P>|z|=0.000	-.9796767 Z= -11.65 P>|z|=0.000	
FC	.9294675 Z= 2.81 P>|z|=0.005	.6374976 Z= 1.04 P>|z|=0. 300	-.8539743 Z= -1.21 P>|z|=0. 226
DUM_{EAP}	1.301681 Z= 4.96 P>|z|=0.000	1.353838 Z= 10.64 P>|z|=0.000	
$FC*LogProduct_j$	-.0562226 Z= -1.88 P>|z|=0. 061	-.0263905 Z= -0.47 P>|z|=0. 635	.0510257 Z= 0.84 P>|z|=0. 402
Diagnostic Tests	Wald chi2(5)=151.88[a] Prob>chi2= 0.000 H-chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald: chi2(5)=151.88[a] Prob>chi2:0.000	S: chi2(5) =15.11[d] Prob > chi2 = 0.0099 AB: z = -6.30[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the ‘goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average auto-covariance in residuals of order 1 is 0.

Table (9): Empirical results on Asia-Pacific steel exports flows including effects of financial crisis and regional trade integration in East-Asia and Pacific as well as cross effect of *FC*LogProduct$_i$*

Variables	Random-Effects (RE)	RE-GLS	Arellano-Bond Dynamic Panel-Data (ABDPD)
$LogProduct_i$	.9515993 Z= 11.97 P>|z|=0.000	.8565489 Z= 17.31 P>|z|=0.000	.8976576 Z= 1.70 P>|z|=0.089
$LogProduct_j$	.2994299 Z= 4.09 P>|z|=0.000	.2969852 Z= 7.73 P>|z|=0.000	-.2667594 Z= -0.69 P>|z|=0.492
$LogOpen_i$	.6769459 Z= 3.31 P>|z|=0.001	.2068474 Z= 1.83 P>|z|=0. 067	-.3766804 Z= -0.30 P>|z|=0. 764
$LogOpen_j$	1.07569 Z= 5.32 P>|z|=0.000	.7471681 Z= 6.76 P>|z|=0.000	1.827069 Z= 1.54 P>|z|=0. 123
$LogPOP_i$	-.1143617 Z= -1.16 P>|z|=0.246	-.1979336 Z= -4.08 P>|z|=0.000	-12.44374 Z= -2.24 P>|z|=0.025
$LogPOP_j$	.3925437 Z= 4.00 P>|z|=0.000	.2754221 Z= 5.82 P>|z|=0.000	5.119448 Z= 1.19 P>|z|=0.235
$LogDist_{ij}$	-1.000429 Z= -5.84 P>|z|=0.000	-.9788471 Z= -11.63 P>|z|=0.000	
FC	.2476567 Z= 0.70 P>|z|=0.484	.1200321 Z= 0.19 P>|z|=0. 853	-.0379392 Z= -0.05 P>|z|=0. 958
DUM_{EAP}	1.323102 Z= 5.08 P>|z|=0.000	1.355279 Z= 10.65 P>|z|=0.000	
$FC*LogProduct_i$	.0068864 Z= 0.22 P>|z|=0. 828	.0210006 Z= 0.36 P>|z|=0. 718	-.0216288 Z= -0.35 P>|z|=0. 728
Diagnostic Tests	Wald: chi2(5)=151.88[a] Prob>chi2=0.000 H: chi2(4)= 33.80[b] Prob>chi2= 0.000 LM chi2(1)= 3662.92[c] Prob>chi2= 0.000	Wald: chi2(5)=151.88[a] Prob>chi2=0.000	Se: chi2(5) = 15.93[d] Prob > chi2 = 0.0071 AB: z = -6.32[e] Pr > z = 0.0000

[a] The Wald Statistic which is used for the 'goodness of fit' of the RE and RE-GLS models.
[b] The Hausman test which is used for testing a consistent selection of RE or FE.
[c] Brusch-Pagan LM Statistic, which tests the consistent results of OLS or RE.
[d] Sargan test of over-identifying restrictions.
[e] Arellano-Bond test that average auto-covariance in residuals of order 1 is 0.

5. Conclusion

The study was based on an extended gravitational model, in order to examine the effects of recent financial crisis, regional trade integration and other main determinants on Asia-Pacific steel trade flows during 2002-2006. The results revealed the fact that based on a dynamic specification the recent financial crisis, proxied by a dummy variable, affected negatively the bilateral steel trade between Asian-Pacific trading partners. However, the result was indeterminate based on the static analyses. The results also confirmed the significant and expected role of regional trade integration in promoting steel trade relations in East Asia and Pacific even though that was unexpected for the regional trade integration in West Asia. Besides, other major gravity variables such as production, population and level of openness have had significantly expected effects on the bilateral steel trade flows in the region.

The implication of this study can be towards implementation of a regional integrating block of by steel industry by collaborating different countries in Asia and Pacific. This creates a larger regional steel trade market, and leading possibly to reduce the global or regional crisis.

Overall, the concerning point of this study has relied on the inadequate data on steel trade in particular. This did not allow us to go through investigating deeply the shocked effect of the 2008-2009 financial crisis on the Asia-Pacific steel trade. This remains for the future works.

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