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FDI inflows and trade imbalances: evidence from developing Asia

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Abstract

The present paper examines the effects of FDI inflows on external imbalances in the developing and transition countries in Asia during the period 1991-2011. To this end, we extend the conventional trade balance model by reformulating the determinants of exports and imports. Our empirical findings suggest that current FDI inflows increase trade deficits, leading to negative consequences for the host country's macroeconomic stability. However, the coefficient estimated becomes negative when we lag the FDI variable, implying that FDI inflows worsen the trade balance first and then improve it. We also find that a real depreciation tends to worsen trade balances because the usual Marshall-Lerner constraint is magnified by the import content of exports. Lastly, higher domestic absorption and larger productive capacity in the manufacturing sector improve the trade balance. The latter result supports the export-investment *nexus*, one of the most distinctive features of Asia.

JEL: F14, F21, F41, 019, O53.

Keywords: FDI, export-led growth, trade imbalance, developing Asia.

1. Introduction

For most developing and transition countries, the relationships between trade and Foreign Direct Investment (FDI) are at the heart of globalization. On the one hand, overall growth dynamics in the developing regions have been stimulated by strong growth in their exports. On the other hand, the new international financial landscape has been characterized by an unprecedented growth in private financial flows to the detriment of official development assistance. Since 1993, FDI has become the most

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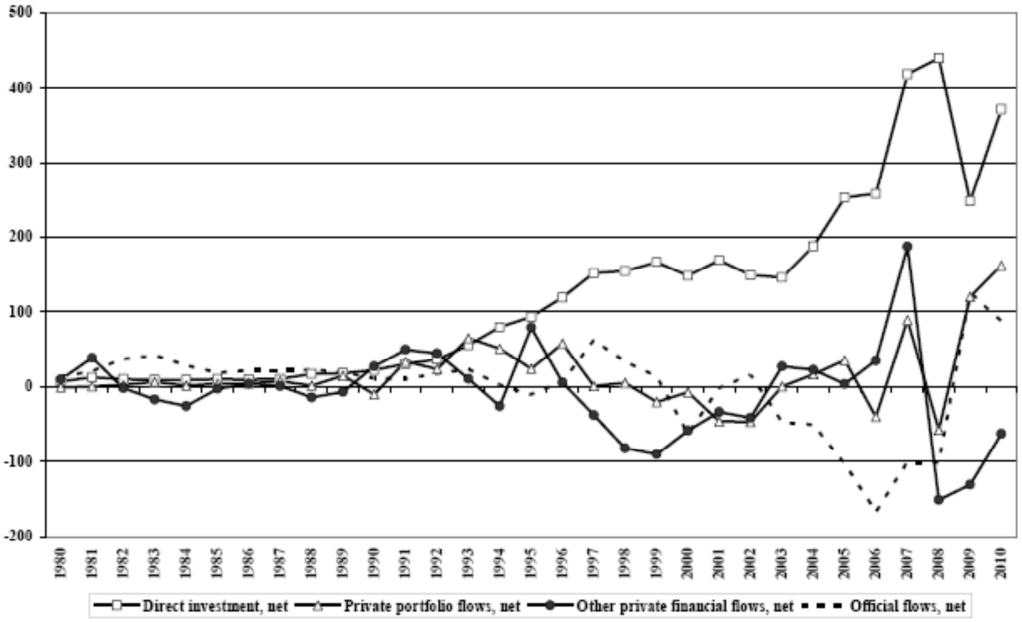
important external financing source in the developing world, followed by portfolio investment and private loans (see Figure 1). In 2010, the share of FDI inflows reached 51% of total capital flows to developing countries, while their inward stock of FDI amounted to about one third of their Gross Domestic Product[4] (GDP) compared to just 10% in 1980 (UNCTAD, 2011a).

Figure 1: Composition of net capital flows to developing countries, 1980-2010 (in billions US$)



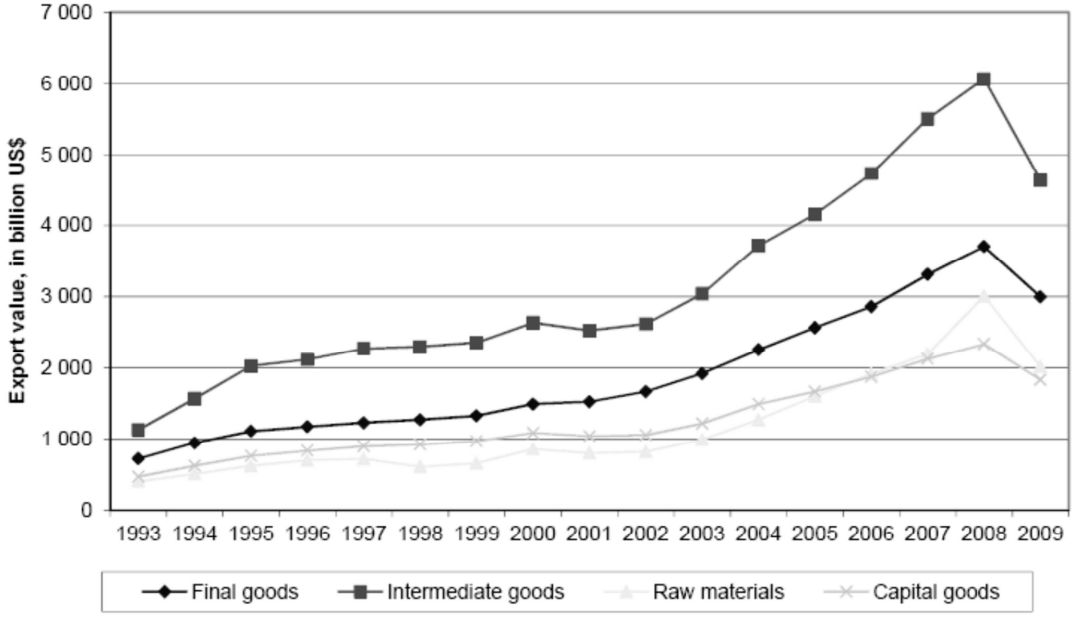
Source: UNCTAD (2011a)

Among the developing regions of the world, East Asia and Pacific (EAP) have clearly been the most successful in increasing exports (by volume) and in attracting FDI. The increased international mobility of both goods, services and intangible assets, together with the greater flexibility and divisibility of the production process, has made the entry of Multinational Corporations (MNCs) into manufacturing and services the key vehicle for Asia's successful integration into the global economy. Boosted largely by MNCs from the North (as well as by those from the South), the increasing fragmentation of production in the global economy has in turn led to increased exports of manufacturing parts, components and associated services (see Figure 2). The largest

[4] All developing economies excluding China.

wave of production-sharing schemes is to be found in developing countries, particularly in the dynamic Asian economies (UNCTAD, 2011b).

Figure 2: Trends in international trade, 1993-2009 (in billions US$)



Source: UNCTAD (2011b)

The rapidly growing Asian countries' successful experience with exports and FDI has reinforced the tendency of international organizations to prescribe policies in favor of trade liberalization and foreign capital attraction. This means that the overall pattern of export growth is dependent on participation in production fragmentation or the "global supply chains" that link developing countries to international markets (UNCTAD, 2011b). However, many observers argue that the dynamics of trade and financial integration have increased the vulnerability of national economies to the risks incurred by different cost, market and production connectivities. In contrast to the industrial economies in the Bretton Woods system, the developing and transition countries are much more open, with a greater trade component and more prevalent capital inflows. Open economies today react differently to relative price shocks, or demand and supply factors. In particular, the development of international production networks and related FDI flows has increased the import content of export production. While they enjoy the benefits of the processing trade regime, of policies designed to promote FDI and of special economic zones, most developing countries still face balance of payments problems in conjunction with their export-oriented growth (Soukiazis and Cerqueira, 2012). Financial crises in emerging market economies illustrate

the risks stemming from the volatility of private international capital flows, especially speculative short-term flows. However, few studies have investigated how export-led growth with massive capital inflows may result in current account imbalances.

In view of this, the present research paper aims to investigate whether trade imbalances are linked to FDI inflows. Participation in production fragmentation operated by MNCs has enabled developing countries to enter international markets. However, one consequence of this is that their current account balances are increasingly shaped by FDI and trade. FDI can disrupt macroeconomic stability through monetary counterparts and relative price movements; it can also directly affect the balance of payments through the investment balance, as a share of GDP produced in the host country is repatriated abroad in the form of profits and dividends. However, little attention has been paid to the indirect macroeconomic effects of FDI on the current account through the trade balance. The indirect effects might outweigh the direct negative effects of FDI on the current account and moderate them; but conversely, if it creates trade deficits, FDI might contribute to the further deterioration of the current account balance and thereby exacerbate the negative effects (Mencinger, 2008).

The purpose of our study is twofold. Firstly, it aims to examine the effects of FDI on the trade balance *via* exports and imports. An appropriate theoretical model of trade balance is formulated by extending the conventional model. Secondly, while the few existing studies that have investigated this issue relied on time-series data for individual countries, we conduct our investigation using panel data analysis techniques for the developing and transition countries in Asia, one of the most dynamic areas in these regards. By offering evidence of the short-run relationship between trade balance and FDI, our study will contribute to a better understanding of the factors underlying a country's balance of payments position.

The remainder of this paper will be organized as follows. Section 2 provides an overview of trade and FDI in the developing world. This provides a basis for formulating a theoretical model in Section 3. Section 4 presents the general options of our econometric approach before analyzing our empirical findings. Section 5 concludes and summarizes the results.

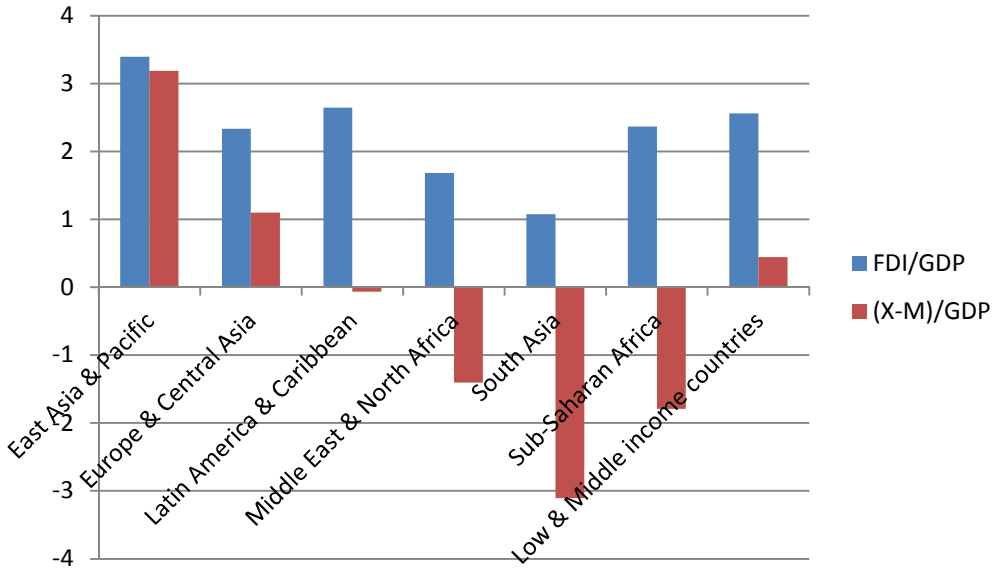
2. The relationship between trade and FDI in developing Asia

Regional integration in East and Southeast Asia has been intensifying since the 1990s. The plan to establish an ASEAN Economic Community by 2015 marks a further step towards the transformation of the ASEAN Free Trade Agreement (AFTA) into a single market (Fujita et al., 2012). Meanwhile, subsequent bilateral FTAs between ASEAN and China, South Korea and Japan (that is, ASEAN+3) were launched in 2005, 2007 and 2008 respectively, followed by agreements with India, Australia and New Zealand (the ASEAN+6 grouping). By deepening the connectivity and interpenetration

of economic activity, the idea is to develop production networks and supply chains that span the region in order to take the fullest advantage of economic complementarity. Accordingly, developing Asia has been the recipient of substantial net capital inflows since the early 1990s.

Figure 3 shows average FDI inflows and external balances for the period 1991-2011 and compares the East Asia and Pacific region (EAP) to the other developing regions in the world. Unsurprisingly, FDI was the largest component of capital inflows in the region and was the largest also as a share of GDP relative to other emerging economies in the world. Taken as a whole, the low and middle-income countries attracted FDI amounting on average to 2.5% of GDP during the period considered, while their trade balances were in slight surplus (0.44% of GDP). The same ratios in the EAP area were 3.4% and 3.2% respectively. EAP, Europe and Central Asia are the only regions that simultaneously attracted FDI without encountering trade deficits. By splitting the two decades under consideration into two sub-periods (1991-2000, 2001-2011), our calculation suggests that two developing regions – Latin America and Caribbean and the Middle East and North Africa - improved their trade position over the two decades while continuing to attract FDI. This result is explained by the favorable boom in primary product prices, most of these countries being oil or mineral exporters. In contrast, the two remaining developing regions of South Asia and Sub-Saharan Africa attracted even greater amounts of FDI but this trend coincided with an increase in trade deficits during the second decade.

Figure 3: FDI inflows and external balance in developing regions, 1991-2011 (in % of GDP)



Source: Data from World Development Indicators (World Bank)

As current account balances are increasingly shaped by FDI and trade, this is an important issue for researchers. However, the consequences of FDI inflows for external balances and macroeconomic stability have been largely ignored in the existing studies (Menon, 2009). While most studies have exhaustively analyzed the determinants of FDI as well as its consequences, mainly for production, employment and productivity, one interesting implication of the literature concerns the indirect effects of FDI. A natural consequence of capital attraction is the burden of investment income and repayment over time, leading to negative effects on the current account. Besides these direct effects, the inflow of foreign capital might have indirect macroeconomic consequences for the current account *via* trade conducted through production networks. Firstly, exports depend much more on imported inputs in the FDI sector than they do in the domestic sector. Any increase in FDI might increase imports more than exports, creating trade deficits rather than trade surpluses (Pacheco-Lopez, 2005). Secondly, large FDI inflows might also become a threat to exchange rate stability, with adverse consequences for exports. Ultimately, trade imbalances may increase current account deficits in export-oriented countries instead of moderating them.

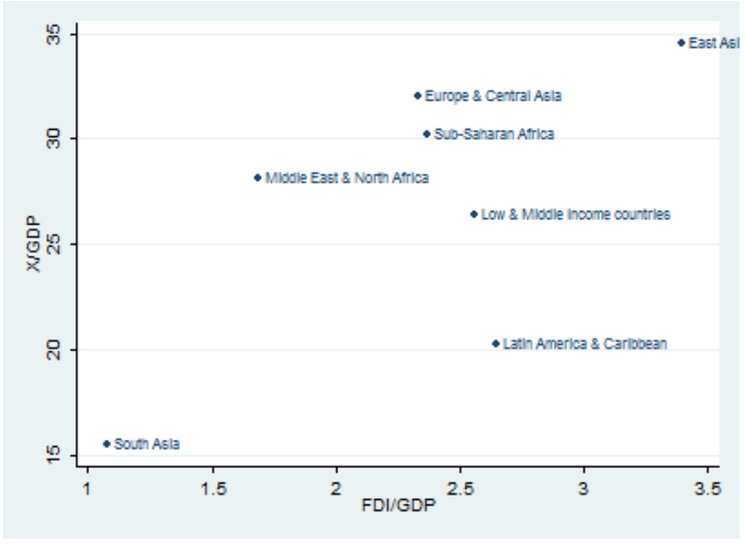
This leads us to make a distinction between the direct and indirect effects of FDI on the current account balance: *direct* effects determine the investment account balance, while *indirect* effects influence the current account balance by shaping the trade balance

(Mencinger, 2008). While the former are straightforward (FDI worsens the current account balance due to investment account deficits), the latter are less evident.

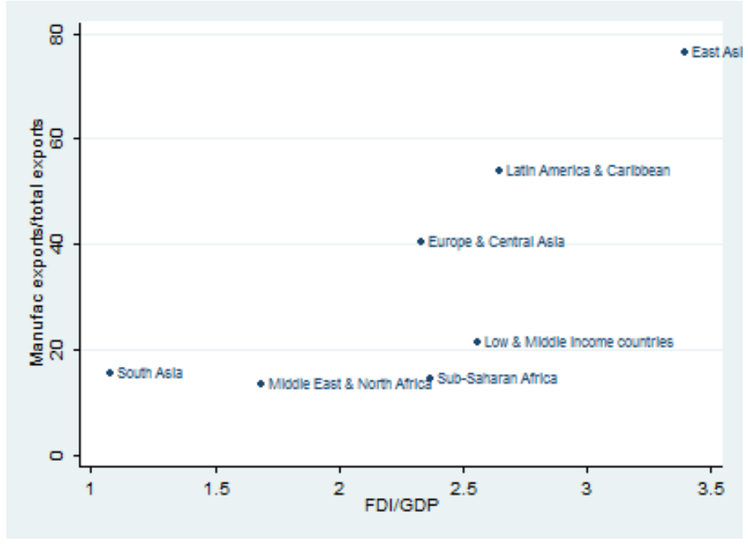
A second set of figures is used to examine the correlation between FDI and a number of macroeconomic variables (see Figure 4). All figures support the well-known export-investment *nexus* that explains East Asian success (Akyuz et al., 1998). In the specific case of the Asian latecomers, foreign investment is a key vehicle for this connection between exports and investment. The strongest effects of a potential FDI-export *nexus* are supposed to be in the manufacturing sector, where foreign-invested enterprises develop production networks and supply chains that increase trade. Consequently, there is a positive correlation between FDI and (manufactured) exports, between FDI and domestic investment and between the size of the manufacturing sector and the export-to-GDP ratio in EAP. In other words, the export-to-GDP as well as the investment-to-GDP ratios are highest in those transition and developing countries in Asia that also record the largest FDI inflows and manufacturing sectors.

However, the same is not true of the other developing regions. Firstly, FDI attraction did not lead to capital accumulation, as their investment rate stayed below 25% of GDP, lagging far behind the EAP region. In other words, FDI inflows did not necessarily enhance these countries' productive assets, which undermine the notion of a positive relationship between the share of FDI and the share of gross fixed capital in GDP. This is illustrated by South Asia, where we have the lowest inflows of foreign capital but the highest investment rate. Secondly, the picture is different again in Latin America, which is the second largest recipient of FDI in the developing world. On average, the ratio of exports to GDP in Latin America reached only 20% during the period 1991-2011, outperforming only South Asia in this aspect. To give a sense of perspective, the highest export-to-GDP ratio for EAP was 46.4% in 2006, while it peaked at only 23.4% for Latin America over the period considered. This implies that the export orientation of foreign-invested firms in the other developing regions is less clear-cut than expected.

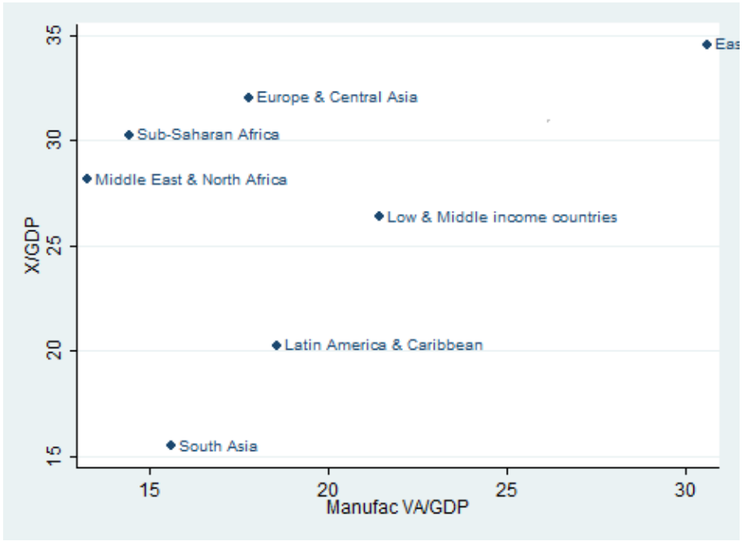
Figure 4: The relationship between exports and FDI in the developing countries by region



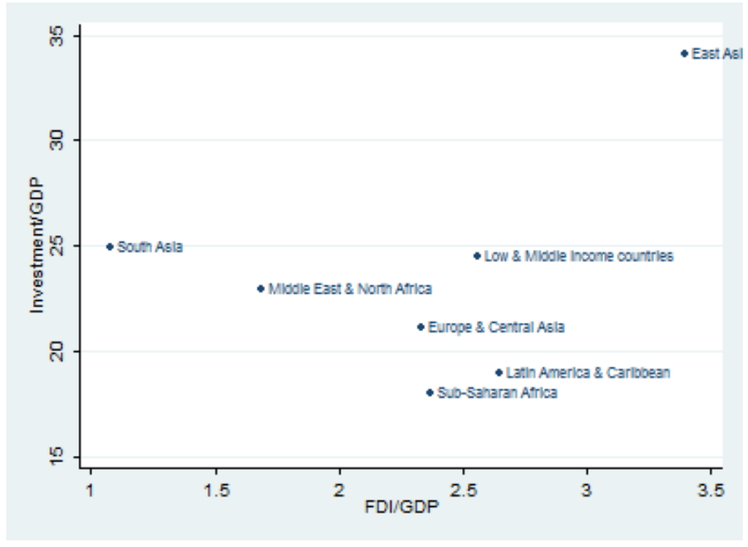
Correlation between FDI and exports



Correlation between FDI and manufactured exports



Correlation between manufactures and exports



Correlation between FDI and capital investment

Source: Data from WDI (World Bank)

Thus the evidence seems to show that the relationship between trade and FDI differs from region to region. Various country case studies have been carried out in EAP, using a range of different econometric approaches. Most of them focus on the role of real exchange rates[5] in affecting trade balance, while others use gravity models to explain bilateral trade balances[6]. So far the empirical results for the relationship between FDI and trade have produced positive results when it concerns exports: inward FDI expands the existing export channel if the host country is a source of low-cost production[7]. However, few if any studies have used cross-country data sets to explore the trade balance-FDI relationship *via* exports and imports simultaneously. Using panel data for the period 1990-2002, Udomkerdmongkol et al. (2006) assessed the impact of exchange rates on FDI in a sample of 16 emerging market countries. However, they did not examine the effects of FDI inflows on trade balances. Chaisrisawatsuk and Chaisrisawatsuk (2007) examined the differential impact of FDI on exports and imports using a gravity model approach, but their study mixed 29 OECD and 6 ASEAN countries. Ahmed et al. (2008) conducted the same study for Sub-Saharan African countries, but focused mainly on FDI, exports and economic growth instead of trade balances.

The factors underlying the relationship between trade balance and FDI need then to be examined in the developing and transition countries of Asia (called thereafter "developing Asia"), one of the most dynamic area in these regards. In this paper, use of panel data to explore common relationships across countries is particularly appropriate because it takes country-specific effects or unobserved heterogeneity into account.

3. The model

In the standard trade balance model, foreign demand for aggregate exports is a function of relative prices and foreign income:

$$X = f\left(\frac{EP^*}{P}, Y^*\right)$$

where X is the volume of a country's exports demanded by foreigners, Y* is the real foreign income, P is the domestic price of exports, P* is foreign competitor's prices on export markets (in foreign currency) and E is the nominal exchange rate (defined as the

[5] See Sugema for Indonesia (2005), Duasa (2007) for Malaysia. More generally, Bahmani-Oskooee and Ratha (2004) reviewed empirical papers related to the J-Curve phenomenon, in which currency devaluation is said to worsen the trade balance first and then improve it.

[6] See Khan and Hossain (2010) for Bangladesh, Ray (2012) for India.

[7] Wang and Wan (2008) investigated both the role of FDI and the exchange rate in the case of China. Dinh and Tran (2013) provided a critical survey of FDI in Vietnam.

price in terms of domestic currency of one unit of foreign currency). An increase in E signifies a depreciation of the domestic currency.

Similarly, the demand for imports depends on relative prices and domestic income:

$$M = g\left(\frac{P}{EP^*}, Y\right)$$

where M is the volume of imports demanded by domestic residents, Y is the domestic income in constant prices and the relative price term defines the price of domestic substitutes for a country's imports compared to the price of imports in domestic currency.

For most observers, however, exchange rates and income variables are insufficient to explain the trade balance. The changes in international trade patterns suggest that FDI hosted by the developing and transition countries is likely to increase exports and imports over time; in particular, the strongest effects are supposed to be in the manufacturing sector. It is thus necessary to reformulate the trade balance model. Our theoretical model is specified in a partial equilibrium analysis and ignores the potential feedback of trade on FDI by focusing on one-way causation, *i.e.* FDI causes trade (Aizenman and Ilan, 2006).

Firstly, in addition to the traditional determinants, we assume that exports are a function of the country's export production capacity (Sugema, 2005). While the real exchange rate will illustrate the price effect, foreign income and export production capacity are respectively the demand-side and supply-side determinants of exports. The latter enables us to introduce FDI and the size of the manufacturing sector in order to capture the capacity to produce for export. Hence, FDI directly affects exports by building up the country's export capacity.

Secondly, the demand function for imports will depend on relative prices as usual. However, drawing partly on Esfahani (1991), who argues that export expansion relaxes the foreign currency constraint on imports that are required for production, it is further assumed that exports determine imports. Therefore imports in the host country will be determined by *domestic* and *foreign* demand factors, respectively domestic absorption and exports. When domestic absorption is greater than the domestic income, part of it will depend on imports.

Thirdly, the role of FDI in determining imports produces mixed effects. The initial *direct* effect of FDI on imports will be negative or positive, depending on the country's trade orientation. However, in the case of export-oriented FDI with vertical

integration, exports are heavily dependent on imported inputs, enabling inward FDI in the export sector to boost demand for imports as well. This suggests that FDI predominantly determines exports but impacts *positively* on imports through the strong links between exports and imports assumed above. Therefore FDI affects imports both *directly* and *indirectly* and these crossed relations are heavily influenced by the foreign firms' motives and the country's trade orientation.

Let us define "augmented" equations for exports and imports. Our trade balance model is derived from the following demand functions for imports and exports:

$$X = \left(\frac{EP^*}{P}\right)^{\alpha_1} (Y^*)^{\alpha_2} F^{\alpha_3} MA^{\alpha_4} \quad (1)$$

$$M = \left(\frac{P}{EP^*}\right)^{\beta_1} A^{\beta_2} F^{\beta_3} X^{\beta_4} \quad (2)$$

In addition to the variables already defined above, F and MA denote respectively FDI and the size of the manufacturing sector, while A denotes domestic absorption and replaces domestic income (Y) in determining imports. The parameters (α_1, α_2, α_4, β_1 and β_2) are assumed to be positive while the sign of the relationship linking trade and FDI (α_3, β_3 and β_4) remains uncertain. If α_3 and β_4 are positive, it means that exports and FDI are complements and the related imports will also be complements in conjunction with vertical integration. This *indirect* linkage between imports and FDI is different from another *direct* linkage measured by β_3: FDI inflows may increase domestic production if it is heavily dependent on foreign capital, leading to increased volumes of imported goods ($\beta_3>0$). Conversely, a negative sign will suggest that imports and FDI are substitutes: $\beta_3<0$ may signify that foreign investors are producing for the domestic market and thereby reducing the volume of goods imported into the country (import-substituting FDI). By the same token, FDI inflows may improve domestic efficiency, enabling the host country to substitute own production for goods produced abroad. As the empirical literature suggests that the case for complementarity between exports and FDI and between exports and imports is stronger (which is associated with vertical FDI and rather low trade costs), we expect α_3 and β_4 to be positive while the theory leaves the sign of β_3 unresolved.

We assume that trade is initially imbalanced and requires foreign capital inflows to finance the trade deficit. Its value (TB) is stated in domestic currency as follows:

$$TB = \frac{EP^*M}{PX} > 0 \quad (3)$$

Transforming equations (1)-(3) into logarithms and denoting R=EP*/P gives the following expressions:

$$x = \alpha_1 r + \alpha_2 y^* + \alpha_3 f + \alpha_4 ma \quad (4)$$

$$m = -\beta_1 r + \beta_2 a + \beta_3 f + \beta_4 x \quad (5)$$

$$tb = r + m - x \quad (6)$$

where lowercase letters denote natural logs. Substituting (4) and (5) into equation (6) yields:

$$tb = [1 - \beta_1 - \alpha_1(1 - \beta_4)]r + \beta_2 a + \\ +[\beta_3 - (1 - \beta_4)\alpha_3]f - (1 - \beta_4)(\alpha_2 y^* + \alpha_4 ma) \quad (7)$$

Equation (7) gives the reduced form of trade balance in the short run. The parameter that relates the real exchange rate (*r*) to the trade balance is expected to be negative if the term in brackets is negative: a real depreciation of the local currency will improve the trade balance through an increase in exports and a decrease in imports. It can be seen that, when β_4 is equal to zero (no production linkage between exports and imports), the well-known Marshall-Lerner condition is fulfilled, namely that the absolute value of the sum of the price elasticities of exports and imports must exceed one in order to improve the trade balance following a real depreciation. According to the conventional approach, the coefficient of domestic absorption (*a*) is expected to be positive. Foreign activity (y^*), in contrast, increases demand for domestic goods while the manufacturing sector (*ma*) build up the country's productive capacity to export. By increasing the country's export performance, coefficients on these two factors are expected to be negative if $0 \leq \beta_4 < 1$, assuming that $\alpha_2, \alpha_4 > 0$.

Lastly, FDI (*f*) affects the trade balance through three channels: exports (α_3), imports (β_3) and the import-content of exports ($\beta_4\ \alpha_3$). One interesting result of our theoretical model is the export-import connection that enables FDI to increase trade: (β_4 - 1)α_3 is the extent to which one unit of export-oriented FDI may impact on the trade balance. This has to be compared with the direct effect of FDI on imports (β_3). However, as this discussion is not clear cut, the net effect on trade balance is unpredictable. Table 1 summarizes the expected sign of the coefficients.

Table 1: Expected sign of the coefficients

	Real exchange rate	Domestic absorption	World GDP	FDI	Manufacturing sector	Exports
Exports (4)	$\alpha_1>0$	/	$\alpha_2>0$	$\alpha_3>0$	$\alpha_4>0$	
Imports (5)	$-\beta_1<0$	$\beta_2>0$		β_3 uncertain		$\beta_4>0$
Trade deficit (7)	$1-\beta_1-\alpha_1(1-\beta_4)<0$ under Marshall-Lerner condition	$\beta_2>0$	$(\beta_4-1)\alpha_2<0$ if $0\leq\beta_4<1$	$\beta_3+(\beta_4-1)\alpha_3$ uncertain	$(\beta_4-1)\alpha_4<0$ if $0\leq\beta_4<1$	

4. Empirical investigation

4.1 Data and research methodology

The evolution of the external balance and its relationship with FDI will be reflected in the aggregate demands for exports and imports. An assessment of the individual effects of FDI would help to understand how exports and imports are affected separately. To date however, the empirical results on the relationship between exports, imports and FDI have produced mixed results. On the other hand, estimating the trade balance model in a reduced form would allow us to explore the overall effect of FDI rather than isolating its differential impact on exports and imports. The reduced form approach permits one to avoid any assumption required on export, import behaviors. This is a less precise insight than might be gained from a structural form approach, but with the advantages of weaker assumptions and simpler interpretability of the associated parameters (Rose, 1990). With the above discussion in mind, we decided therefore to estimate both models of exports and imports separately, and the reduced form equation of trade balance.

Equations (4), (5) and (7) constitute the basis for our cross-sectional time-series analysis of the relationship between exports, imports, trade balance and FDI. Their log-linear models are then empirically tested using static panel data analysis techniques:

$$lnX_{it} = a_1 lnRER_{it} + a_2 lnY^*_{it} + a_3 lnF_{it} + a_4 lnMA_{it} + \gamma_i + \epsilon_{it}$$

$$lnM_{it} = b_1 lnRER_{it} + b_2 lnA_{it} + b_3 lnF_{it} + b_4 lnX_{it} + \delta_i + \theta_{it}$$

$$lnTB_{it} = c_1 lnRER_{it} + c_2 lnF_{it} + c_3 lnY^*_{it} + c_4 lnMA_{it} + c_5 lnA_{it} + \varepsilon_i + \mu_{it}$$

where X and M are respectively exports and imports in percentage of GDP, TB is the trade balance defined by the ratio of imports to exports in current prices. This ratio is independent of the unit of measurement and makes it possible to conduct unbiased comparisons between countries across periods[8]. It is preferable to the ratio of exports to imports (also called the coverage ratio) because of asymmetry in trade positions: here, we have a narrow range for trade surpluses (from 0 to 1) but a potentially infinite range for trade deficits. Our three dependent variables are explained by a vector of time-varying regressors.

The real exchange rate (RER) is constructed by using World GDP (P*) and domestic GDP (P) deflators. The official nominal exchange rate (E) refers to local currency units relative to the U.S. dollar and is calculated as an annual average based on monthly averages. World GDP (Y^*) and domestic absorption (A) are stated in constant prices. F is net inflows of FDI as a percentage of GDP and a transformed variable is used in order to avoid the problems with the log of null and negative values[9] (Fontagné and Pajot, 1999). The size of the manufacturing sector (MA) is measured by manufacturing value added as a share of GDP. Finally, to take into account individual heterogeneity, the terms γ_i , δ_i , ε_i encompass an unobservable country-specific component and ϵ_{it}, θ_{it}, μ_{it} are the error terms or overall disturbances.

[8] The trade balance defined as the difference between exports and imports divided by GDP is sensitive to units of measurement and is affected by domestic price indices. It is also biased by country size (Bahmani-Oskooee and Brooks, 1999). In contrast, the ratio of imports to exports could be interpreted as the nominal or real trade balance.

[9] As all observations are greater than -3 (the minimum is -2.75), we divided the FDI/GDP values by 3 so that they will never be lower than –1 and thus the transformed variable is always larger than 0:

$$FDI < 0 => Ln\left(1 + \frac{FDI/GDP}{3}\right) < 0$$

$$FDI = 0 => Ln\left(1 + \frac{FDI/GDP}{3}\right) = 0$$

$$FDI > 0 => Ln\left(1 + \frac{FDI/GDP}{3}\right) > 0$$

Our empirical investigation is conducted with balanced panel data for 15 developing and transition countries of Asia between 1991 and 2011 on bases of data availability: Bangladesh, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Maldives, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, and Vietnam. All data are extracted from the World Bank's World Development Indicators (WDI) database and supplemented by the World Economic Outlook database of the IMF.

Before running the panel data estimations, it is necessary to detect the existence of multicollinearity, *i.e.* whether one predictor variable is correlated with the others. If our variables are highly correlated, the standard errors will be high, confidence intervals for coefficients will be wide and t-statistics tend to be very small. The simple correlation coefficients between the explanatory variables were examined. Their values are lower than 0.80, meaning that there is no multicollinearity in the model. This result is confirmed when the Variance Inflation Factor (VIF) is computed, which shows how much the variance of the estimated coefficients is being inflated by multicollinearity. As all VIFs are lower than 10 (see Table 2), this means that there is no correlation between any of the explanatory variables.

Table 2: Tests of multicollinearity

Variables	VIF			1/VIF		
	LnX	**LnM**	**LnTB**	**LnX**	**LnM**	**LnTB**
LnRER	1.01	2.43	4.94	0.991910	0.411148	0.202489
LnF	1.03	1.30	1.10	0.975119	0.769925	0.909789
LnY*	1.01		1.09	0.991963		0.921484
LnMA	1.01		2.81	0.990189		0.355271
LnA		2.63	6.83		0.380932	0.146328
LnX		1.43			0.697583	
Mean VIF	1.01	1.95	3.35			

The estimation procedures take place in two stages. First, some tests are performed in order to choose the appropriate estimation techniques.

Since individual effects are included in the regressions, it has to be decided whether they are to be treated as fixed or random. In the Fixed Effects (FE) model, γ_i, δ_i, ε_i are assumed to be a parameter specific to each country *i* but constant over time[10].

[10] Time-specific effects were also introduced but they were not statistically significant, allowing us to exclude them.

When using FE models, we assume that something *within* the individual country may impact or bias the independent variable or the dependent variables and that we therefore need to control for this. Otherwise, if for example γ_i is treated as a random variable independent of the error term ϵ_{it}, we have $\gamma_i=\gamma+\pi_i$ where γ is a constant while π_i is the country-specific *alea* which is time-invariant. A central assumption of the Random Effects (RE) model is that the individual random effects (*i.e.* differences across countries) are uncorrelated with the explanatory variables. We employ both estimation techniques where all the explanatory variables are assumed to be independent of π_i and ϵ_{it} for all *t* and *i*, and perform the Hausman test to choose between FE and RE model. The low value of Hausman's Chi-squared statistic reveals that the RE model produces more consistent parameter estimates.

To check for the existence of unobservable individual heterogeneity, we use the Breusch and Pagan Lagrange Multiplier (LM) test for RE. The later confirms the existence of panel effects, allowing us to reject the pooled Ordinary Least Squares (OLS) method which is unable to take country-specific factors into account. In other words, there are differences across countries that have some influence on our dependent variables.

FE and RE estimations assume that the error terms are independent and identically distributed. However, given the nature of panel data, the variance-covariance matrix of the error terms has to be specified. Therefore, we check for groupwise and cross-sectional heteroskedasticity, and contemporaneous and serial correlation. Firstly, the Breusch and Pagan test and the modified Wald test detected the existence of heteroskedasticity both *within* and *between* (that is, in every) observation. Secondly, we use Pesaran, Friedman and Free's tests of cross-sectional dependence. The results also indicate the presence of contemporaneous correlation in the residuals; that is, cross (or between) dependence in exports, imports and trade balances across countries. Finally, testing for serial correlation in the residuals leads us to perform the Wooldridge test, and we find the presence of first-order autocorrelation in the panel data. As the null hypothesis is rejected in all tests, this means that the errors do not have the same variance and are correlated across countries and across time (the last period's value affects the current value).

In the presence of heteroskedasticity across countries, cross-sectional dependence and serial correlation, the OLS method produces inefficient coefficient estimates and biased corresponding errors estimates. In the second stage, the panel is corrected for these features and the three equations are estimated using an appropriate method. We chose the Generalized Least Squares (GLS) procedure, which produces more consistent and unbiased estimates for the coefficients and the standard errors when the variances of the observations are unequal and there is a certain degree of correlation between the observations. Moreover, serial correlation is remedied by using the GLS procedure with

Auto-Regressive disturbance estimation. A first-order autocorrelation which is either common or panel-specific to each country (denoted respectively AR(1) and PSAR(1)) is then taken into account. When corrected for the three categories of non-spherical disturbances, the corrected regressions improve the statistical properties of the estimated coefficients (as shown by stronger statistical values or lower *p*-values).

4.2 Estimation results

The panel data estimation results are reported in Table 3: columns (1) and (2) present the estimated coefficients of the explanatory variables in the individual export and import equations, while column (3) reports the estimation results for trade balance. In the latter, the reduced form parameters give the full or aggregate effects of a change in the independent variables. To check the possibility of time-lagged effects and endogeneity issues, the final columns (4)-(6) are the same estimation models with FDI data lagged by one period (FDI_{t-1}).

Table 3: Estimation results

Variables	Corrected Model with FDI_t			Corrected Model with FDI_{t-1}		
	LnX	**LnM**	**LnTB**	**LnX**	**LnM**	**LnTB**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
LnRER	.01041	.0735***	.0431***	.00067	.0707***	.0420***
	(.00990)	(.00510)	(.00497)	(.00827)	(.00522)	(.00497)
LnFDI	.0495***	.0522***	.0196***	.0338***	.0137	-.0124*
	(.00988)	(.00970)	(.00690)	(.01037)	(.01028)	(.00729)
LnY*	1.0410***		-.0781	1.0086***		-.0947*
	(.10032)		(.05220)	(.09591)		(.05222)
LnMA	.2389***		-.1088***	.2330***		-.1037***
	(.03878)		(.02005)	(.03721)		(.01942)
LnA		-.0624***	-.0188***		-.0587***	-.0152**
		(.00569)	(.00637)		(.00586)	(.00678)
LnX		.6741***			.6935***	
		(.01208)			(.01379)	
Constant	-29.6435***	3.0401***	3.3534**	-28.5989***	2.8824***	3.7705**
	(3.12165)	(.16589)	(1.57149)	(2.98234)	(.17584)	(1.56158)
Nb. of obs.	315	315	315	315	315	315
Nb. of groups	15	15	15	15	15	15
Wald test	$\chi^2(4)=178.69$	$\chi^2(4)=4598.14$	$\chi^2(5)=196.39$	$\chi^2(4)=195.42$	$\chi^2(4)=3573.35$	$\chi^2(5)=206.91$

*Notes: *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Standard deviations are in parentheses.*

For the period under analysis, we find that the coefficient estimated for the real exchange rate variable is not in line with predictions. While positive but statistically insignificant in the individual export equation, it appears that imports are positively related to the real exchange rate. The former result suggests that exports are irresponsive to real depreciation. One possible explanation for the inverted sign in the

import equation is that it depends on the type of goods imported. A major part of foreign goods is demanded for production (intermediate inputs and capital goods) and may affect therefore the relationship between the real exchange rate and imports. Most importantly, we find that a real depreciation worsens the country's trade balance position. The effectiveness of exchange rate depreciation in improving the trade balance has long been an issue for economists (Rose, 1990; Bahmani-Oskooee and Ratha, 2004). In the traditional approach, this negative impact would be explained by low elasticities of imports and exports with respect to the relative price term. However, McKinnon (1990) has shown already that in open economies with a greater trade component and prevalence of capital inflows, exchange rate changes may have unpredictable effects on trade balances. In our model, the Marshall-Lerner constraint is magnified by the import content of exports ($\beta_4\alpha_1$): the real depreciation stimulates the demand for imports of production goods, thereby worsening the initial trade imbalance. This supports the view that improvement in trade balance through the real exchange rate would mainly come from import compression or substitution if export response is insignificant (Sugema, 2005).

In nearly all estimations, the coefficient for FDI confirms our earlier argument: it is statistically significant and positive, implying that current FDI inflows increase simultaneously exports, imports and the resulting trade balance. Since trade and FDI are found to be complements (with α_3, β_3 and $\beta_4>0$), the negative consequences of FDI inflows on macroeconomic stability and external balance cannot be ignored. As discussed earlier, FDI affects the trade balance through three channels: exports (α_3), imports (β_3) and the import content of exports ($\beta_4\alpha_3$). FDI can boost trade deficits even though it simultaneously contributes to an expansion of export earnings. This is confirmed here by a statistically significant and positive coefficient estimated for exports in the import equation: by stimulating exports, FDI inflows also stimulate the demand for imports. The only way to improve trade balances with FDI inflows is by simultaneously increasing the export outcomes of export-oriented FDI (higher α_3) and reducing the imports required by foreign-invested firms (lower $\beta_3+ \beta_4 \alpha_3$).

Our findings also suggest that the overall trade balance is determined by both demand and supply-side factors. While insignificant in the trade balance model, the coefficient attached to the World income is statistically significant with the expected sign in the export equation. Higher World activity will increase exports through a demand effect equal to 1.04. In the same manner, the coefficient estimated for the manufacturing sector variable is highly significant in both models. It suggests that a 1% increase in productive capacity in the manufacturing sector will improve export performance by 0.24% and the trade balance by 0.11%.

On the other hand, the coefficient estimated for the domestic demand variable is highly significant but negative: it means that an increase in domestic absorption lowers imports and improves the country's trade balance, which is contradictory with

traditional theoretical expectations. Usually, the domestic absorption variable impacts directly on the imports demanded by domestic residents. But in the specific case of developing Asia, the investment-export *nexus* can suggest an indirect effect which explains a negative sign of the coefficient. A rise in absorption capacity through domestic investment enabled the country to expand exports, but also to substitute own production for goods produced abroad. Another explanation for the inverted sign in the individual import equation is that the absorption effects also depend on the type of goods demanded. A vast literature on the Asian economies has assessed causes of the 'East Asian Miracle' and discussed extensively the lessons from it. Notably, some measures of industrial and trade policies were relevant to encourage diversification of exports and the expansion of domestic productive capacities in new manufactures (Stiglitz and Yusuf, 2001; Weiss, 2005). Any increase in domestic absorption led by export-oriented investment will also help to improve the country's trade balance, which will therefore unexpectedly have a negative sign.

Columns (4)-(6) in Table 3 report regression estimates when FDI inflows are lagged by one year. The previous results are largely confirmed, but with some major differences. Most importantly, the coefficient estimated for the FDI variable becomes statistically insignificant in the import equation, while the associated sign turns out to be negative in the trade balance model. In other words, FDI inflows in the previous period improve trade balance position in the current period, suggesting that trade balance responds with lag to FDI inflows. In the analytical model, previous FDI does not explain current imports (β_3), allowing export-oriented FDI to fully impact positively on the trade balance ((β_4 - 1)α_3). Finally, our coefficient estimated for the World income variable becomes statistically significant at the ten percent level with the expected sign.

5. Conclusion

The involvement of developing countries in international trade has increased sharply in the last two decades, while capital inflows in the form of FDI have expanded rapidly. More than ever, countries at all levels of development are seeking to leverage FDI for development and are consequently adopting measures aimed at improving their investment climate. Against this background, our paper has investigated the role of outward-oriented development in increasing a host country's vulnerability to macroeconomic turbulence. The balance of payments and relative price problems commonly faced by developing countries with large capital inflows arise out of their integration into global and regional economies. Firstly, they now account for a much higher proportion of international trade than the industrial countries under Bretton Woods. Secondly, there is growing evidence that export-oriented FDI in most developing countries is dependent on imported inputs for export production. The point here is that the negative consequences of FDI inflows for external balances have been largely ignored in the existing studies.

Considering these facts, our paper has analyzed the indirect effects of FDI on the short-run evolution of external balances. In order to discover what explains a country's overall balance of trade position, the theoretical models of exports and imports were extended in the light of the changes currently taking place in international trade patterns. We empirically examined the effects of FDI on the trade balance through exports and imports using panel data analysis techniques for the developing and transition countries in Asia between 1991 and 2011.

This paper contributes to the literature on the impact of FDI inflows on the trade balance position of host countries in several ways.

There is a widely shared view that export performance is related to inward FDI and that this is one of the reasons why developing countries seek to attract FDI. However, our empirical results show that FDI stimulated the growth of exports from host countries but, at the same time, triggered strong import dynamics. Under the hypothesis of complementarity between FDI and trade, FDI attraction implies negative consequences, which are reflected in deteriorating macroeconomic stability and external balances. The only way to improve trade balance positions is to increase the export outcomes of export-oriented FDI and to reduce the imports necessitated by foreign-invested firms' production. However, our empirical investigation shows that trade balance responds with lag to FDI inflows. It appears that FDI inflows worsen the trade balance first and then improve it.

For the period under analysis, we find that a real depreciation of the local currency led to a deterioration in the trade balance position because the usual Marshall-Lerner condition is magnified by the import content of exports. The real depreciation stimulates the demand for imports of production goods, thereby worsening the initial trade imbalance.

Our findings also suggest that the volume effect on the overall trade balance is determined by both demand-side and supply-side factors. Increased productive capacity in the manufacturing sector raises a country's export performance and improves the trade balance position. The World income variable affects exports positively and becomes statistically significant when FDI inflows are lagged by one year. Counter-intuitively, the coefficient estimated for the domestic absorption variable is negative, meaning that higher domestic absorption improves the trade balance. This unexpected sign indicates an *induced* effect of export-led growth: any increase in the domestic absorption led by export-oriented investment will also help to improve the country's trade balance. The latter result supports the export-investment *nexus*, one of the most distinctive features of East Asian economies.

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