PANEL CAUSAL RELATIONSHIP BETWEEN FDI AND EXPORTS. EVIDENCE FROM A SECTOR LEVEL ANALYSIS OF VIETNAM

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Abstract
This paper investigates the causal relationship between FDI and exports for Vietnam over the period 1995-2006. We apply a panel co-integration framework that allows for heterogeneity across seven economic sectors. We first use the General Method of Moments method for a dynamic heterogeneous panel, and then subject sector-specific FDI and export data to Granger causality tests. It turns out that FDI “causes” exports in the long-run in five sectors: Heavy industries; Light industries; Food industries; Oil and gas; Agriculture, forestry and fisheries. In contrast, the absence of causal link enables us to investigate the FDI and GDP causation in the Services and Other sectors. We find out an evidence of bidirectional causality between the two variables. Finally, we explore the possibility of cross-sector spillovers by performing additional Granger causality tests. Our results put evidence on cross-sector causality running from FDI inflows into Services to exports of the five above sectors at 10% significance level. In parallel, FDI inflows into Other sectors cause exports in Light industries; Food industries; Oil and Gas; Agriculture, Forestry and Fisheries but not in Heavy industries.

Key words: Foreign Direct Investment, Exports, Growth, Causal relationship, Vietnam.
JEL Classification : F14, F21, F41, O19, O53.
1. Introduction

Foreign Direct Investment (FDI) has become increasingly important in the developing world, replacing from 1994 onwards official resource flows (Official Development Aid and loans from multilateral organizations) as the main source of external finance. In 2006, 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 (GDP), compared to just 10% in 1980 (UNCTAD, 2007). For many observers, this worldwide trend is globalization’s most visible dimensions (Addison and al., 2006). On the one hand, the strong international mobility of both goods, services and intangible assets, together with greater flexibility and divisibility of the production process, has made entrance of Transnational Corporations (TNCs) in manufacturing and services as the key vehicles of international integration. On the other hand, trade and FDI have given to the rapidly growing East Asian countries a specific dimension by contributing to the acceleration of industrial growth and structural change along their development process. Such a strategy has reinforced policy prescriptions of the international organizations in favor of trade liberalization and the opening of goods and factors markets to foreign competition.

There is a vast literature bringing strong support to the relationship between FDI and economic growth. As documented by Chowdhury and Mavrotas (2006), the FDI-growth nexus has been investigated through four main channels: (i) determinants of growth (how does FDI affect growth?), (ii) determinants of FDI, (iii) role of TNCs in host countries, and (iv) direction of causality between the two variables. At the macroeconomic level, a large number of empirical studies were devoted to the relationship between FDI and growth. However, their results have been far from conclusive, enabling the FDI-growth nexus to become one of the most controversial debate among researchers. Despite the exhaustive literature on the topic, the growth effects of FDI remain ambiguous, while the direction of causality from FDI to economic growth does not find empirical evidence. As reminded Addison and al. (2006), this unclear idea of how FDI contributes to development is attributable to methodological issues, ambivalence over spillover effects, uncertainty over FDI’s contribution to capital accumulation, threshold effects and ambiguity with respect to the direction of causation. Nonetheless, the methodological issues inherent to the causal relationship between FDI and growth are crucial from a policy perspective (Chowdhury and Mavrotas, 2006; Hansen and Rand, 2006). Under the assumption that FDI causes growth, such conclusion may justify the substantial efforts and incentives devoted by governments to attracting FDI. Conversely however, when it is GDP growth that causes FDI, trade liberalization may weakly increase the flows of inward FDI. This casts some doubts on the validity of policy guidelines which emphasize the importance of FDI attraction and trade openness on overall economic growth. Notwithstanding the absence of any robust conclusions, most developing countries continue however to pursue policies aimed at encouraging more FDI inflows.

According to Carkovic and Levine (2005), the problem is that macroeconomic studies often fail to adequately account for endogeneity of FDI inflows and country-specific effects. This suggests the need for more individual country studies since causality between FDI and growth is also country specific. In line with this argument, our paper retains Vietnam’s case study to investigate such issue. First, instead of contributing to numerous works on the FDI-growth nexus, we aim at examining the role of outward-orientation on growth by focusing exclusively on the

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1 All developing economies excluding China.
relationship between FDI and exports. Indeed, export-led growth strategy postulates that exportation is the main channel through which outward orientation can affect the output level and consequently the rate of GDP growth. But as suggested Dritsaki and al. (2004), “The best interpretation of the empirical relationship between openness and economic growth should contribute not only to the understanding of the role of FDI to economic growth but also should facilitate the interpretation of the relationship between trade and FDI” (p. 230). To the best of our knowledge, there is only one recent paper that has explored the causal link between FDI and exports for Vietnam (Pham, 2009), but at the aggregate level. Second, recent literature puts stress on the divergent export-growth dynamics at the sector level (Cao and Tran, 2005; Hausmann and al., 2007; Rieber and Tran, 2002; Rodrik, 2006). The available evidence implies that a country’s pattern of exports could be as important as openness to international trade in determining the strength of FDI inflows. In line with this argument, our study attempts to contribute to this issue by distinguishing sector-specific relationships between FDI and exports. Only Chakraborty and Nunnenkamp (2008) applied cointegration and causality analyses on the basis of industry-specific data: but it concerned FDI-growth nexus in India. Hence, we apply causality tests at the sector-level and focus our investigation in the period of rapidly increasing FDI inflows and exports, 1995-2006, as foreign trade and FDI have been considered as important sources of growth in Vietnam during that period. Importantly, by doing so, one might assess the trade prospects for Vietnam following the current financial crisis.

The rest of the paper is organized as follows: Section 2 provides an overview of FDI liberalization in Vietnam. Section 3 briefly reviews the methodological issues on the relationship between FDI and exports before presenting the general options of our econometric approach. Section 4 presents our empirical findings and Section 5 concludes our paper.

2. Economic reforms and FDI in Vietnam

Within a process of both transition and development, Vietnam has been embarked in major changes regarding production, investment, distribution, and trade in goods and services since the initiation of economic reforms in the mid-1980s. Also, negotiations along WTO accession required major changes in laws, regulations and administrative procedures. At the specific FDI concerns, the opening up of Vietnam to foreign investment began in 1987. Since then, the legal regimes governing FDI have been progressively liberalized with important modifications made in recent years.

The first Law on Foreign Investment in Vietnam was dated 29 December 1987 and marked the first step towards renovation (the so-called Doi Moi in Vietnamese) of the domestic economy. The law established for the first time a regime under which FDI could enter Vietnam. However, despite the substantial efforts devoted by the government to improving the investment climate, the inflows of FDI were under expectations and the actual implementation of projects had fallen short of the plans (Kokko and al., 2003). This disappointing result was greatly attributable to the US embargo on trade and investment that hit Vietnam until 1994. Consequently, one might question the reliability of FDI data before the early 1990s.

In response to this context, Vietnam strengthened its international integration by entering discussions about bilateral, regional and multilateral agreements. Parallel to this, the government pursued the economic reforms and improvements in the investment climate. Further efforts were devoted to restructuring the State Owned Enterprises (SOEs), the banking

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2 Between 1988 and 1990, only 214 projects for a capital amount of 1582 million USD were licensed; however, none were implemented before 1991.
and financial system, and tax administration. Several amendments were made to the first Law on Foreign Investment in order to accommodate foreign investors (Nguyen and Nguyen, 2007):

- In 1992, a number of articles were added and amended to grant foreign investors with more rights and incentives.
- In 1996, new forms of investment were allowed like Build-Operate-Transfer (BOT), Build-Transfer-Operate (BTO), or Build-Transfer (BT). By this date, a list of favored projects gives also priority to production of export goods.
- In 2000, the Law was modified again to acknowledge the right of foreign investors to merger and acquire companies and branches.

One should mention however, that by the latter amendment, the Vietnamese government recognized the importance of the private sector (both local and foreign) as the main engine for economic growth and job creation. Efforts were made to improve the regulatory environment of the sector and to eliminate existing discriminations against private owned enterprises. This was expressed by an Enterprise Law in 2000, and the formal acknowledgement of the importance of the private sector following the Fifth Plenum of the Ninth Party Congress in March 2002.

Afterwards, in preparation to WTO negotiations, a new Unified Enterprise Law was approved on 29 November 2005, followed by a Unified Law on Investment that came into force on 1 July 2006. These amendments cancel all previous laws and regulations that discriminated foreign firms in relation to domestic firms and aim to treat them equally according to the WTO principle of national treatment (which consist on giving others the same treatment as one’s own nationals). Most importantly, they insist upon the attraction of FDI as a key strategy to promote growth and development in the country.

Among the ten ASEAN member states, Vietnam experienced a dramatic increase in FDI inflows in the first half of the 1990s, attesting to the successful implementation of trade and investment reforms (Figure 1). Consistent with other countries in the East Asian region, FDI inflows decreased sharply during the financial crisis of 1997-98, but they rebounded quickly in 2001 and have grown uninterruptedly since then. As a result, Vietnam has overtaken Philippines and Indonesia to become the third largest recipient of FDI inflows in the ASEAN (Nguyen and Nguyen, 2007).

As predicted by the “Flying Geese Paradigm” which draws waves of industrialization experiences in the region in relation to the dynamics of comparative advantage, Vietnam is increasingly viewed as an alternative destination to countries such as China or Thailand. Due to its advantageous location in a rapid growing region, he has become an attractive location for efficiency-seeking FDI through its participation to the regional production network and division of labour. The surge in FDI inflows by 2007 attests to investor expectations in overall business climate with Vietnam’s accession to the WTO. What is striking, however, is that FDI inflows in Vietnam show a greater magnitude than in the other countries of East Asia: in 2006, inward FDI reached 11.5% of fixed capital formation and 54.8% GDP in Vietnam, compared to respectively 10.7% and 26.8% for the East Asian area as a whole. The similar measures were only 8.2% and 11.1% for China.

The Foreign Investment Law allows foreign investors to enter Vietnam in one of three forms: enterprises with 100% foreign ownership, Joint-Ventures (JVs) and Contractual Business

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3 Several other laws, including the Competition Law or the Bankruptcy Law, were approved by the National Assembly and contribute to clarify the status of private enterprises in Vietnam.
Cooperation (Table 1). In the early years of the Foreign Investment Law, JVs were the most common form of investment: due to little or no financial resource, most Vietnamese partners in JV enterprises contributed their part of the capital in the form of land and expertise. However, in a context of discriminations against private owned enterprises as aforementioned, SOEs were the only legal partners for foreign investors. Moreover, the various privileges (access to commercial land or to formal credit institutions, protection in import-substituting sectors), as well as the political contacts favoring SOEs, contributed significantly to their attractiveness as JV partners. Consequently, the number of investment projects, as well as the amount of licensed capital in the form of JV grew steadily, with a peak in 1995-96.

Wholly-owned affiliates were rather small in Vietnam and started to increase by 1992, once the Foreign Investment Law gave them the same status as JVs (Kokko and al., 2003). Some changes have occurred in recent years, along Vietnam’s continuous efforts in improving the investment environment. In 1991, wholly-owned affiliates accounted for about 20% of total invested capital and 10% of the number of projects; by 2000, these proportions had risen to 90% and 83% respectively. Moreover, they mainly originated from East-Asian countries in search of cost reduction and regional location complementation in manufacturing activities.

Table 2 depicts the distribution of FDI by top investors in Vietnam. In contrast to the early years of implementation of the Foreign Investment Law, East Asia is now the most important source of capital in the country. As predicted, Japan and the first-tier NICs are the top five of foreign investors (also trans-shipping through the British Virgin Islands) as they account for 67% of total investment. This predominance of regional investors greatly explains the sharp drop of FDI inflows in Vietnam following the onset of the East Asian crisis. Unsurprisingly, the main investor outside of East Asia is the United States after the embargo was lifted in 1994 and the coming into effect of the US-VN BTA in 2001. France and the European Union as a whole lag far behind the Asian investors with only about 10% of the number of projects and 15% of total investment.

The geographical distribution of FDI is highly concentrated in the Southeast region (with Hochiminh City and its surrounding provinces), followed by Hanoi and neighboring provinces (Figure 2). Such spatial distribution of FDI is quite consistent with empirical studies on the location determinants of FDI in Vietnam and reflects the effects of agglomeration. Common factors such as market potential, labour-related factors (availability, costs, quality of the workforce) or infrastructure reduce transaction costs and reinforce the role of Hanoi and Hochiminh City as the main hubs of the country (Nguyen and Nguyen, 2007). This uneven distribution of FDI across provinces is seen as a problem by the government and results in significant efforts devoted to attracting FDI in remote regions outside the metropolitan areas. Financial or tax incentives, as well as construction of industrial or export-processing zones in the poor rural areas are expected to balance the geographical distribution of FDI. Yet, the attempts to attract FDI outside the main urban areas have not proved successful.

FDI is not uniformly distributed across production sectors (Table 3). The majority of FDI in Vietnam goes into manufacturing industries both in terms of the number of projects and

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4 One explanation for the high failure rates observed for JVs in the early period by Kokko and al. (2003) are difficulties in cooperation between the foreign investors and their Vietnamese partners.

5 One can illustrate such motivation by the building of a petroleum refinery with Russia in Dung Quat, in the Central region of Quang Ngai (one of the poorest provinces of Vietnam).
implemented capital. However, they were concentrated in oil and gas exploitation or construction during the 1990s, moving rapidly to light and heavy industries in recent years. Chemicals, construction materials and electric equipment have become important while reliance on export-oriented development has channeled FDI inflows into light industries where Vietnam has comparative advantages (agro-processing, textiles and clothing). In the services and other sectors, transportation, telecommunication and finance have replaced service activities related to construction and real estate (hotel and tourism, office and apartment, infrastructure).

In the absence of petroleum refinery, half of oil and gas exploitation is devoted to export (Table 3) and thanks to favorable prices in recent years, the sector rose from 12.41% to 14.29% of total exports. Most importantly, Table 3 suggests that the economic sectors with growing shares in total production are also the ones with the same trend in total exports. Indeed, Heavy industries, Light and Food industries attest to the rapid diversification of industrial production and exportation along the development process.

3. Hypotheses and model specification

3.1. Theoretical and empirical background

The theoretical literature identifies a number of channels through which inward FDI may be beneficial to the host country. The most popular arguments giving prominence to the positive role of FDI on exports are that FDI is an important source of capital, which complements domestic private investment in developing productive capacity. It has the potential to generate employment and raise factor productivity via knowledge and skill transfers, adoption of new technology (de Mello, 1997). Furthermore, it enhances non-price export competitiveness in the host country as the goods produced by foreign firms result from a better technology, and can then be sold more easily abroad. The brands they propose are also more popular and satisfy the quality standards required by the international market. Lastly, the role of FDI derives from better management and marketing strategies that foreign firms can bring with them (Pacheco-Lopez, 2005). All these points contribute to upgrade the host country’s exports.

Notwithstanding these direct effects, FDI may be beneficial to the host country’s exports through the indirect and spillover effects derived from competitive interaction between foreign and domestic firms. Higher productivity, better quality of goods and services produced and supplied by foreign firms may spread to local producers, thereby improving their own productivity and competitiveness. However, this channel is highly ambiguous and depends on many factors, frequently with an undetermined effect. More specifically, the intensity of competition as well as the inter-linkages between domestic and foreign firms is subjected to the type of FDI. The possibility for positive spillovers from FDI are likely to arise when TNCs are located up or down the supply chain, so as local firms in downstream or upstream industries would benefit from inter-industry linkages (“vertical” spillovers). On the contrary, findings on “horizontal” spillovers (i.e. TNCs and local firms are located in the same industry) have been rather inconclusive (Gorg and Greenaway, 2004). Barrios and al. (2005) note that the spillover and indirect effects of FDI are more likely to dominate when domestic firms are export-oriented; however, they are downplayed when FDI is located in enclaves such as export-processing zones.

Overall, FDI may contribute to the long-term economic growth of the developing country through large productive capacity and positive spillover effects on the export-oriented sector.

Adams and al. (2006) argued that FDI has been a critical consideration in upgrading China’s export structure and supplying products that meet world market specifications.
In view of these arguments, the conventional approach seems to suggest that the direction of causality runs from FDI to exports.

Beside that, the determinants of FDI in developing countries have been well analyzed in the literature. The emphasis is on the quality of physical infrastructure, the level of skills and labor costs, the access to finance, the system of taxation, the macroeconomic policy, the regulatory and legal framework governing FDI and sound institutions. Others suggest however, that development orientation affects the growth effects deriving from FDI. In particular, the Import Substituting strategy of Industrialization (ISI) might be negative as it reduces competition in the domestic market and efforts to improve efficiency among the domestic firms (Balasubramanyam and al., 1996). In contrast, outward orientation and the rapid growth of exports may attract foreign firms in search of price competitiveness. One of the major incentives for foreign firms to invest in a country is the lower costs of production, allowing them to be more competitive on the world market, regardless of the size of the local one. In a regional context, country’s participation to preferential trade agreements may then attract foreign investors when they are motivated either by better utilization of location complementation that facilitates regional production network (“efficiency-seeking”) or by access to enlarged market (“market-seeking”).

Thus, all these arguments may suggest a two-way causation: exports stimulate FDI which, in turn, promotes exports. Basu and al. (2003) emphasized trade openness by addressing the question of the two-way link between FDI and growth: a more open trade regime is supposed to be conducive to stronger growth effects in the host country, thereby attracting more FDI. However, the authors explored the issue within a cross-country panel framework and with aggregate FDI data. In doing so, they submit the causal relationship between FDI and growth to a considerable degree of heterogeneity among host countries. This claims for host country-specific studies (Carkovic and Levine, 2005; Chowdhury and Mavrotas, 2006). Chakraborty and Nunnenkamp (2008) overcome these limitations by applying co-integration and causality analyses on the basis of disaggregated FDI data for India.

Relying on their study, this paper addresses the causal relationship between FDI and exports for Vietnam by applying the same methodology. As a latecomer, Vietnam has attracted booming FDI since mid-1990s and has registered growing exports within the same period. But we go a step further by accounting for sector-specific relationships.

### 3.2. Data and Methodology

Our analysis is based on panel quarterly data covering FDI inflows into Vietnam and exports of seven economic sectors: Heavy industries; Light industries; Food industries; Oil and gas; Agriculture, forestry and fisheries; Services; and Other sectors from 1995 to 2006. Two variables are identified as follows:

- \(EX_i\): Exports of sector \(i\)
- \(FDI_i\): Foreign Direct Investment flows in sector \(i\)

Because of unavailability of Vietnamese data, we must collect our panel data from many reliable sources: Foreign Investment Agency - Vietnam Ministry of Planning and Investment (FIA – MPI); Vietnam Ministry of Industry and Trade; Vietnam General Statistics Office (GSO) and International Monetary Fund (IMF). All data are collected in US dollars but are adjusted by Vietnam GDP deflator by sector in order to remove the influence of inflation. Our two variables are expressed in logarithms in order to include the proliferative effect of time series.

In this study, the method of Vector AutoRegressive (VAR) model is adopted to estimate the causal relationship between FDI and exports. To do this, we apply a panel co-integration
framework that allows for heterogeneity across sectors. The objective of our empirical work is twofold:
- Is there a long-run relationship between FDI inflows and exports in our sector panel?
- Given the existence of a co-integrated relationship, can the direction of causality between the two variables be identified?

Our investigation will be performed in four steps. First, we test the order of integration of the two variables or the presence of unit roots in our sector panel. Second, once the order of integration determined, we use heterogeneous panel co-integration techniques developed by Pedroni (1999) to test for the long run co-integrated relationship between the two variables. Third, the General Method of Moments (GMM) applied for a dynamic heterogeneous panel will be used to assess the short-run co-integration. The direction of causality between FDI inflows and exports is then inspected using heterogeneous panel causality tests. Finally, in order to increase the power of our tests, we will investigate the Granger causality between FDI and exports for each individual sector.

4. Empirical analysis

4.1. Tests of panel unit roots

Unit root tests are traditionally used to determine the order of integration or to verify the stationarity of the variables. The traditional Augmented Dickey-Fuller (ADF) technique has become well-known to test for unit root of time series. However, to test for the panel unit roots, a number of recent developments has appeared in the literature, including: Levin, Lin and Chu (LLC test) (2002); Im, Pesaran and Shin (IPS test) (1997); Maddala and Wu (1999); Choi (2001); and Hadri (2000). Among these different panel unit root tests, the two former are the most popular. Both of these tests are based on the ADF principle.

LLC test assumes homogeneity in the dynamics of the autoregressive (AR) coefficients for all panel members. Concretely, LLC test assumes that each individual unit in the panel shares the same AR(1) coefficient, but allows for individual effects, time effects and eventually a time trend. Lags of the dependent variable may be introduced to allow for serial correlation in the errors. The test may be viewed as a pooled Dickey-Fuller test, or an Augmented Dickey-Fuller (ADF) test when lags are included, with the null hypothesis that of non-stationarity (I(1) behavior). After transformation, the t-star statistic is distributed standard normal under the null hypothesis of non-stationarity.

In contrast, IPS test is more general than the above test because of allowing for heterogeneity in dynamic panel. Therefore, it is described as a “Heterogeneous Panel Unit Root Test”. It is particularly reasonable to allow for such heterogeneity in choosing the lag length in ADF tests when imposing uniform lag length is not appropriate. In addition, IPS test allows for individual effects, time trends, and common time effects. Based on the mean of the individual Dickey-Fuller t-statistics of each unit in the panel, IPS test assumes that all series are non-stationary under the null hypothesis. Lags of the dependent variable may be introduced to allow for serial correlation in the errors. The exact critical values of the t-bar statistic are given. IPS test thus relies on a technique which has higher power than the other tests, including LLC test.

Statistical results of LLC and IPS tests for FDI and export data are reported in Table 4. In the LLC test for the levels of FDI inflows and exports, the small negative statistics values for

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7 If a time series is found to be nonstationary or integrated of order $d$, denoted by $I(d)$, it can be made stationary by differencing the series $d$ times. If $d = 0$, the resulting $I(0)$ process represents a stationary time series.
each variable do not exceed the critical values (in absolute terms). However, when we take the first difference of each variable, the large negative LLC statistics indicate rejection of the null of non-stationarity at the 1% level and 5% level for all models.

The IPS results indicate, in general, that the null of a unit root for the individual series is not rejected for all of the series tested at their levels. Given the short span of the individual series, we are more confident to accept the more powerful IPS panel test results, which undoubtedly do not reject the unit root null of unit roots for the panel with 336 observations. On the other hand, the null of unit root is strongly rejected at the least 1% level of significance for all series at their first difference. The results strongly support the conclusion that the series are stationary only after being differenced once. Hence, the IPS test indicates that the series are integrated of order one, i.e., I(1) at the 1% significance level. Therefore, we conclude that all variables are non-stationary and integrated of order one in level but integrated in order zero in their first difference at 1% level of difference.

Having established that FDI and exports series are integrated of the first order, the second step in testing the co-integration approach is applicable to determine the nature of the long-run relationship between the two variables of interest.

4.2. Tests for panel co-integration

The traditional co-integration analysis presented by Engle and Granger (1987) allows to identify the relationship between the variables by eliminating the risk of spurious regression. However, the Engle and Granger approach cannot identify the number of co-integration vectors and cannot adequately estimate the parameters if the number of variables is more than two. Hence, Johansen (1988) uses maximum likelihood method within a vector autoregressive (VAR) framework to test for the presence of co-integration relationship between the economic variables. The Johansen’s procedure is useful in conducting individual co-integration tests, but does not deal with panel co-integration test.

Therefore, most of recent empirical works use the two techniques of heterogeneous panel co-integration test developed by Pedroni (1999). Pedroni’s test allows different individual cross-section effects by allowing for heterogeneity in the intercepts and slopes of the co-integrating equation.

The Pedroni panel co-integration technique makes use of a residual-based ADF test. Pedroni test for the co-integrated relationship between FDI and exports in our panel is based on the estimated residuals from the following long-run model:

\[ FDI_{it} = \beta_{0i} + \beta_i EX_{it} + \varepsilon_{it} \]  

where \( i = 1, ..., N \) sectors and \( t = 1, ..., T \) period observations. The term \( \varepsilon_{it} = \rho \varepsilon_{it-1} + \xi_{it} \) is the deviations from the modeled long-run relationship. If the series are co-integrated, \( \varepsilon_{it} \) should be a stationary variable. The null hypothesis in Pedroni’s test procedure is whether \( \rho \) is unity. In addition, Pedroni technique permits to test the co-integrated relationship between FDI and exports in four different models: Model with heterogeneous intercepts and ignoring common time effect (M1); Model with heterogeneous intercepts and heterogeneous trend ignoring common time effect (M2); Model with heterogeneous intercepts allowing common time effect (M3); Model with heterogeneous intercepts and heterogeneous trend allowing common time effect (M4).
All of the Pedroni’s statistics under different model specifications are reported in Table 5.

<Insert Table 5>

Pedroni test’s results include seven different statistics for the test of the null hypothesis of no co-integration in heterogeneous panels. The first group of tests is termed “within dimension”. This group includes: The “panel v-stat” and the “panel rho-stat” are similar to the Phillips and Perron (1988) test; the panel pp-stat (panel non-parametric) and the “panel adf-stat” (panel parametric) are analogous to the single-equation ADF-test. The second group of tests calling “between dimensions” is comparable to the group mean panel tests of Im et al. (1997). The “between dimensions” tests include three tests: group rho-stat; group pp-stat; and group adf-stat.

A positive value for the “panel v-stat” and large negative values for all six deferent statistics under the different models allow the rejection of the null hypothesis of no co-integrated relationship between two variables at the 1% significance level. We can therefore point out the co-integrated relationship between FDI inflows and Exports in the long-run.

4.3. Test of panel causality

The previous section concluded the presence of a co-integrating relationship between FDI and exports, but did not indicate the direction of causality when the variables are co-integrated. The traditional causality test is the Granger causality. However, in the panel settings, Granger techniques will result in inconsistent parameter estimates. Therefore, in order to test for the causal linkage between FDI and exports in our dynamic panel, we will thus apply the General Method of Moments (GMM) developed by Arellano and Bond (1991). The GMM method can help reduce the estimation bias and control for problems often associated with cross-sectional estimators such as some unobserved problems concerning sector-specific and time-specific effects, and endogeneity in explanatory variables.

To investigate the panel causality, a time-stationary vector auto-regression (VAR) model is first constructed as follows:

$$FDI_i = \alpha_0 + \sum_{j=1}^{m} \alpha_j FDI_{i, t-j} + \sum_{j=1}^{m} \delta_j EX_{i, t-j} + f_{yi} + u_{it} \quad (2)$$

$$EX_i = \beta_0 + \sum_{j=1}^{m} \beta_j FDI_{i, t-j} + \sum_{j=1}^{m} \gamma_j EX_{i, t-j} + f_{xi} + v_{it} \quad (3)$$

where $FDI_i$ and $EX_i$ are the two co-integrated variables, $i = 1, \ldots, 7$ represents cross-sectional panel members, $u_{it}$ and $v_{it}$ are error terms. This model differs from the standard causality model in that it adds individual fixed effects $f_{xi}$ and $f_{yi}$ for each panel member $i$. In Equations 2 and 3, the lagged dependent variables are correlated with the error terms $u_{it}$ and $v_{it}$, including the fixed effects. Hence, Ordinary Least Squares (OLS) estimates of the above model will be biased. The remedy is to remove the fixed effects by differencing. However, differencing introduces a simultaneous problem because lagged endogenous variables will be correlated with the new differenced error term. In addition, heteroscedasticity is expected to be present because, in the panel data, heterogeneous errors might exist with different panel members. To deal with these problems, instrumental variable procedure is traditionally used in estimating the model, which produces consistent estimates of the parameters. In this case, GMM method proposed by Arellano and Bond (1991) has
been shown to produce more efficient and consistent estimators compared with other procedure. Therefore, to test for causality, the GMM estimation procedure of Arellano and Bond (1991) is applied to the balanced panel of the seven industrial sectors with 48 quarterly observations for each sector. The estimated equations are following:

\[
\Delta FDI_i = \sum_{j=1}^{m} \alpha_j \Delta FDI_{i-j} + \sum_{j=1}^{m} \delta_j \Delta EX_{i-j} + \Delta u_i \tag{4}
\]

\[
\Delta EX_i = \sum_{j=1}^{m} \beta_j \Delta FDI_{i-j} + \sum_{j=1}^{m} \gamma_j \Delta EX_{i-j} + \Delta v_i \tag{5}
\]

The results of the GMM are reported in Table 6 including values of estimated coefficients, Wald causality test, and the appropriate instruments used in estimation (Sargan test).

To test for causality between FDI flows into Vietnam and exports, we use results of Wald Causality test. The Wald test indicates that causality runs from FDI to Exports as the rejects the null of no causality at the 1% significance levels. On the other hand, the evidence is that causality is also running from Exports to FDI in the EX equation as well. The Wald test rejects the null of no causality at the same significance level. Therefore, we may conclude that there is bidirectional causality between foreign direct investment and exports in term of Vietnamese economic sector.

Besides, in order to make sure that our choice of instruments was ideal, we test for the over-identifying restrictions using Sargan test\(^8\), which is common test of the validity of instrumental variables used in estimation. The hypothesis being tested is that the instrumental variables are uncorrelated with residuals, and therefore may be used in estimation. The statistic is asymptotically distributed chi-squared if the null hypothesis is true. The results show that, when using all lagged values of the variables as instruments for \(t = 3\) and earlier, the Sargan test does not reject the validity of this set of instruments in both equations. This implies the validity of the instruments used in estimation.

### 4.4. Granger causality test for each sector

To explore the possibility that the direction and magnitude of causality links between the two variables might vary between individual sectors, we apply the Granger causality test for each of seven sectors in our panel. The results of Granger test is reported in Table 7. And indeed, the results reported in Table 7 reveal that the nature of the causal links between FDI and exports are strongly different across sectors.

We begin with discussions on causality results for the short-run. The null hypothesis that the exogenous variables do not “Granger cause” the endogenous variable is rejected since the \(F\) statistics on the explanatory variables exceed its critical value at the 10% level or better. We can thus conclude that there is bidirectional Granger causality between FDI and exports in three sectors: Light industries; Food industries, and Agriculture, forestry and fisheries and that it exists a unidirectional Granger causality running from FDI to exports in two sectors: Heavy industries and Oil and gas sector. In contrast, we do not find any causal relationship, neither unidirectional nor bidirectional, in Services and Other sectors.

\(^8\) Null hypothesis of Sargan test is that the overidentifying restrictions are valid
For the long-run, the t-statistics values show that there is a unidirectional causality from FDI to exports in the five sectors where the short-run causality either bidirectional or unidirectional has already existed. This important result suggests that FDI is oriented to export or encourages Vietnamese exports in five sectors: Light industries; Food industries, and Agriculture, forestry and fisheries; Heavy industries; and Oil and gas. On the contrary, the absence of causality between FDI and exports in the long-run in Services and Other sectors is pointed out. However, the latter attracted the bulk of FDI inflows in the second half of the 1990s (see Table 3). This results in another question: “What has motivated FDI inflows into the two sectors where the causal relationship between FDI and exports is not found?”. In this case, entry of foreign investors may be explained by their strategy for seeking potential markets in developing countries like Vietnam. So, in order to increase the power of our consideration, we will test for causal linkage between FDI and GDP in the Service and Other sectors.

### 4.5. Causal relationship between FDI and GDP in the Services and Other sectors

To test for the causal relationship between FDI and GDP variables, we apply the same panel co-integration framework than in the previous section. Our panel will include FDI and GDP quarterly data of Services and Other sectors in US dollar at constant price. All the preliminary results are reported in Appendix. LLC and IPS tests in Table A1 conclude that FDI and GDP variables in our new panel are non-stationary and integrated of order one in level but integrated of order zero in first difference at 1% level of significance. Since the variables under consideration are non-stationary variables, the co-integration approach is applicable to determine the nature of the long-run relationship. Pedroni test on the long-run relationship between the two variables is performed in Table A2 and concludes on a co-integrated relationship between FDI and GDP. Therefore, the direction of causality between the two variables in our heterogeneous panel is then inspected by using GMM method in Table A3. Taking the same comments for GMM estimates, we can suggest that there is a positive two-way correlation between FDI inflows and growth in our new panel. The final step here is to identify the direction of causation by testing the Granger causality between FDI and GDP for each sector. Following the same explanations than in the previous section, we find out an evidence of short-run and long-run bidirectional Granger causality between FDI and GDP in Services and in other sectors (Table 8).

One interesting implication is the causality running from GDP to FDI. Indeed, high growth rates have permitted to improve income and living standards of Vietnamese people and contributed to widen the potential of domestic market. Together with the international economic integration, domestic consumption has expanded, facilitating the business and production activities of enterprises, including the foreign-invested ones. For example, foreign investors may profit from a high domestic demand for sensitive service fields like banking, finance, transportation, telecommunications, tourism, education and training…etc. Furthermore, foreign investors may also profit from the infrastructure projects with appropriate methods including BOT and BT projects. Besides, a high economic growth has made Vietnam be well-evaluated by the international community as a safe investment location. The legal system of policies on foreign investment has been more and more completed to ensure a complete, transparent, spacious legal framework for investment and business.

Rather than presuming that FDI is one of the determinants of economic growth, we find out that FDI has been promoted by GDP in the Services and Other sectors. Consequently, one might consider an indirect relationship between FDI inflows into these sectors and export growth of the sectors studied in the previous section. Notably, the export-oriented sectors may

---

<Insert Table 8>
develop following FDI attraction in these sectors, but also by FDI inflows into the non-exporter sectors. Hence, in order to investigate such indirect relationship, we will explore the possibility of spillovers across sectors by performing additional Granger causality tests.

### 4.6. FDI and cross-sector spillovers

Cross-sector spillovers tests are based on the following two cross-sector pairs of aggregated data series: on one side, FDI in Services and Other sectors, and on the other side, exports of the five sectors, Heavy industries, Light industries, Food industries, Oil and gas, and Agriculture, forestry and fisheries. The results of cross-sector causality tests are reported in Table 9.

We begin with discussions on causal relationship between FDI inflows into Services and exports of the five economic sectors. We find out an evidence of cross-sector causality running from FDI to exports at 10% significance level or better in the short-run and also in the long-run. This suggests that exports in a specific sector have not only been promoted by FDI inflows into this sector but also by FDI inflows into Services through cross-sector spillovers. At the same time, statistic results show that there is cross-sector causality running from FDI in Other sectors and exports of four other sectors (except Heavy industries) in the short-run and/or the long-run. This indicates that FDI inflows into Other sectors, like the Services, have potential linkages and spillovers on exports of Light industries, Food industries, Oil and gas, and Agriculture, forestry and fisheries in Vietnam.

### 5. Conclusion

More than ever, countries at all levels of development seek to leverage FDI for development and, in consequence, adopt measures aimed at improving their investment climate. In 2006, according to UNCTAD’s annual survey of changes in national laws and regulations relevant to the entry and operations of TNCs, a total of 184 policy changes were identified, 80% of which were in the direction of making the host country environment more favorable (UNCTAD, 2007). Despite the exhaustive literature on the topic, results on growth effects of FDI still remain controversial. Although some studies found a positive association, others resulted in reverse conclusions. The effects of FDI vary significantly by the sector in which the FDI is made, the form it takes, the country of origin as well as the conditions in the host country (institutional and legal framework, macroeconomic background, policy regime, growth pattern). Notwithstanding the absence of any robust conclusions on the direction of causality between FDI and growth, most developing countries continue however to pursue policies aimed at encouraging more FDI inflows.

The purpose of our paper was to examine this causal relationship in Vietnam. More precisely, negotiations along WTO accession required the Vietnamese government to dismantle entry barriers to foreign investment in the hope that it will promote exports. This policy option has led us to explore the causality relationships between FDI and exports. At the macroeconomic level, there is no study performing causality tests between FDI and exports in Vietnam, except in Pham (2009). Our novel contribution here was to extend this work by subjecting sector-specific data to these tests within a panel co-integration framework that allows sector-specific heterogeneity.

Our study indicates a strong causal link running from FDI to exports in five industrial sectors in the lon-run: Heavy industries; Light industries; Food industries; Oil and gas; Agriculture, forestry and fisheries. This result suggests that the Vietnamese government has succeeded in the export-oriented development strategy by allowing foreign investment to stimulate exports.
in the referred sectors. In return, fast growth of exports in the latter has attracted FDI inflows into Vietnam beside other factors such as abundant labour, socio-political stability, good macroeconomic fundamentals, etc.

In a second step, our research also points out a bi-directional causality between FDI and GDP in the sectors where the causal link between FDI and exports was not found: Services and Other sectors. Then, we performed Granger causality tests to explore cross-sector spillovers. Our results indicate that FDI in the sectors where the causation between FDI and exports was not found can however explain positive indirect effects on exports of the other sectors. In other words, Vietnam’s rapid economic growth has motivated FDI inflows into the non-export sectors which, in turn, have stimulated indirectly exports from the export-oriented sectors.

Although such results attest to the successful outward-oriented development strategy pursued by the Vietnamese government in the last ten years, they may imply conversely greater vulnerability to the current financial crisis, thereby constraining heavily Vietnam’s balance of payments.

References


Tables and Figures

Figure 1: FDI in Vietnam, 1990-2007

Source: Vietnamese Ministry of Planning and Investment (MPI)

Figure 2: FDI distribution by region updated to 31 December 2007

Source: FIA - MPI
**Table 1:** FDI distribution by type of investment, from 1988 to 2007 (in millions USD)

<table>
<thead>
<tr>
<th>Forms of Investment</th>
<th>Number of projects</th>
<th>Investment capital</th>
<th>Registered capital</th>
<th>Executed capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% foreign capital</td>
<td>6743</td>
<td>52 437</td>
<td>21 476</td>
<td>11 324</td>
</tr>
<tr>
<td>Joint-Venture</td>
<td>1640</td>
<td>24 575</td>
<td>9 292</td>
<td>11 145</td>
</tr>
<tr>
<td>BCC</td>
<td>226</td>
<td>4 579</td>
<td>4 128</td>
<td>5 661</td>
</tr>
<tr>
<td>BOT, BT, BTO</td>
<td>8</td>
<td>1 711</td>
<td>456</td>
<td>727</td>
</tr>
<tr>
<td>Joint Stock Company</td>
<td>66</td>
<td>1 658</td>
<td>451</td>
<td>363</td>
</tr>
<tr>
<td>Mother-Subsidiary company</td>
<td>1</td>
<td>98</td>
<td>83</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8684</strong></td>
<td><strong>85 058</strong></td>
<td><strong>35 877</strong></td>
<td><strong>29 234</strong></td>
</tr>
</tbody>
</table>

*Source: Foreign Investment Agency (FIA), Vietnamese Ministry of Planning and Investment (MPI)*

BCC: Business Cooperative Contracts

BOT: Build-Operate-Transfer; BT: Build-Transfer; BTO: Build-Transfer-Operate

**Table 2:** Top ten FDI Countries updated to 31 December 2007 (in millions USD)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Number of projects</th>
<th>Capital investment</th>
<th>Registered capital</th>
<th>Executed capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>South Korea</td>
<td>1857</td>
<td>14 398</td>
<td>5 168</td>
<td>2 738</td>
</tr>
<tr>
<td>2</td>
<td>Singapore</td>
<td>549</td>
<td>11 059</td>
<td>3 894</td>
<td>3 858</td>
</tr>
<tr>
<td>3</td>
<td>Taiwan</td>
<td>1801</td>
<td>10 763</td>
<td>4 599</td>
<td>3 079</td>
</tr>
<tr>
<td>4</td>
<td>Japan</td>
<td>934</td>
<td>9 180</td>
<td>3 963</td>
<td>4 987</td>
</tr>
<tr>
<td>5</td>
<td>BritishVirginIslands</td>
<td>342</td>
<td>7 795</td>
<td>2 612</td>
<td>1 376</td>
</tr>
<tr>
<td>6</td>
<td>Hong Kong</td>
<td>457</td>
<td>5 933</td>
<td>2 167</td>
<td>2 161</td>
</tr>
<tr>
<td>7</td>
<td>Malaysia</td>
<td>245</td>
<td>2 823</td>
<td>1 797</td>
<td>1 083</td>
</tr>
<tr>
<td>8</td>
<td>The USA</td>
<td>376</td>
<td>2 789</td>
<td>1 450</td>
<td>746</td>
</tr>
<tr>
<td>9</td>
<td>Netherlands</td>
<td>86</td>
<td>2 599</td>
<td>1 482</td>
<td>2 031</td>
</tr>
<tr>
<td>10</td>
<td>France</td>
<td>196</td>
<td>2 376</td>
<td>1 441</td>
<td>1 085</td>
</tr>
</tbody>
</table>

*Source: FIA - MPI*
Table 3: FDI, exports and production in Vietnam by production sector

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Structure of FDI (%)</th>
<th>Exports in % of production</th>
<th>Share in total production (%)</th>
<th>Share in total exports (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1995-2000 (on average)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy industries</td>
<td>19.63</td>
<td>20.93</td>
<td>13.75</td>
<td>19.80</td>
</tr>
<tr>
<td>Light industries</td>
<td>9.57</td>
<td>17.02</td>
<td>19.04</td>
<td>22.40</td>
</tr>
<tr>
<td>Food industries</td>
<td>5.13</td>
<td>3.01</td>
<td>14.69</td>
<td>3.12</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>14.64</td>
<td>29.34</td>
<td>5.93</td>
<td>12.41</td>
</tr>
<tr>
<td>Agriculture, forestry and fisheries</td>
<td>7.04</td>
<td>12.80</td>
<td>21.44</td>
<td>19.77</td>
</tr>
<tr>
<td>Services (a)</td>
<td>5.87</td>
<td>11.12</td>
<td>22.83</td>
<td>17.95</td>
</tr>
<tr>
<td>Other sectors (b)</td>
<td>38.13</td>
<td>3.66</td>
<td>21.59</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>2001-2006 (on average)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy industries</td>
<td>38.57</td>
<td>22.23</td>
<td>19.17</td>
<td>23.87</td>
</tr>
<tr>
<td>Light industries</td>
<td>23.37</td>
<td>18.84</td>
<td>26.38</td>
<td>27.87</td>
</tr>
<tr>
<td>Food industries</td>
<td>4.74</td>
<td>6.66</td>
<td>16.08</td>
<td>6.00</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>0.58</td>
<td>50.61</td>
<td>5.24</td>
<td>14.29</td>
</tr>
<tr>
<td>Agriculture, forestry and fisheries</td>
<td>7.85</td>
<td>13.88</td>
<td>14.76</td>
<td>11.41</td>
</tr>
<tr>
<td>Services</td>
<td>5.90</td>
<td>10.96</td>
<td>17.21</td>
<td>10.68</td>
</tr>
<tr>
<td>Other sectors</td>
<td>18.98</td>
<td>5.92</td>
<td>17.61</td>
<td>5.88</td>
</tr>
</tbody>
</table>

Source: Authors’ calculation from data of IMF, UNSD and General Statistics Office (Vietnam)

(a) Insurance, Finance, Public administration, Education
(b) Construction, Hotels and restaurants, Transports and communications, Real estate services

Table 4: Panel unit root tests

Panel A: LLC unit root test

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>First difference</th>
<th>FDI</th>
<th>EX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>FDI</td>
<td>EX</td>
</tr>
<tr>
<td></td>
<td>FDI</td>
<td>EX</td>
<td>FDI</td>
<td>EX</td>
</tr>
<tr>
<td>(1)</td>
<td>-1.93</td>
<td>-3.31</td>
<td>-10.56**</td>
<td>(6.85)</td>
</tr>
<tr>
<td>(2)</td>
<td>-1.01</td>
<td>-2.30</td>
<td>-10.50**</td>
<td>(4.15)</td>
</tr>
<tr>
<td>(3)</td>
<td>-2.58</td>
<td>-3.23</td>
<td>-10.46***</td>
<td>(-10.32)</td>
</tr>
</tbody>
</table>

Value in parentheses is critical value. (1): Model with heterogeneous intercepts and heterogeneous trend. (2): Model with heterogeneous intercepts. (3): Model without heterogeneous intercepts. (***): Rejection of the null hypothesis at the 5% significance level. (**:): Rejection of the null hypothesis at the 1% significance level.

Panel B: IPS unit root test

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>First difference</th>
<th>FDI</th>
<th>EX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>FDI</td>
<td>EX</td>
</tr>
<tr>
<td></td>
<td>FDI</td>
<td>EX</td>
<td>FDI</td>
<td>EX</td>
</tr>
<tr>
<td>With common time effect</td>
<td></td>
<td></td>
<td>FDI</td>
<td>EX</td>
</tr>
<tr>
<td>(1)a</td>
<td>-1.80</td>
<td>-2.44</td>
<td>-4.88***</td>
<td>-5.30***</td>
</tr>
<tr>
<td>(2)b</td>
<td>1.54</td>
<td>-0.63</td>
<td>-4.60***</td>
<td>-5.17***</td>
</tr>
<tr>
<td>Without common time effect</td>
<td></td>
<td></td>
<td>FDI</td>
<td>EX</td>
</tr>
<tr>
<td>(1)a</td>
<td>-2.23</td>
<td>-2.31</td>
<td>-3.75***</td>
<td>-6.62***</td>
</tr>
<tr>
<td>(2)b</td>
<td>-2.27</td>
<td>-1.51</td>
<td>-3.78***</td>
<td>-6.50***</td>
</tr>
</tbody>
</table>

a: The critical value at 1%, 5% and 10% is -2.99, -2.67 and -2.56 respectively.
b: The critical value at 1%, 5% and 10% is -2.95, -2.46 and -2.95 respectively.
### Table 5: Pedroni panel co-integration tests

<table>
<thead>
<tr>
<th>Test statistics</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>panel v-stat</td>
<td>10.68</td>
<td>6.17</td>
<td>4.88</td>
<td>1.45</td>
</tr>
<tr>
<td>panel rho-stat</td>
<td>-20.74</td>
<td>-17.23</td>
<td>-20.46</td>
<td>-16.43</td>
</tr>
<tr>
<td>panel pp-stat</td>
<td>-25.49</td>
<td>-26.64</td>
<td>-21.43</td>
<td>-24.21</td>
</tr>
<tr>
<td>panel adf-stat</td>
<td>-16.69</td>
<td>-19.75</td>
<td>-12.45</td>
<td>-13.40</td>
</tr>
<tr>
<td>group pp-stat</td>
<td>-35.81</td>
<td>-30.30</td>
<td>-24.65</td>
<td>-25.50</td>
</tr>
</tbody>
</table>

### Table 6: GMM estimation and causality results

<table>
<thead>
<tr>
<th>Estimated coefficients</th>
<th>Dependent variable</th>
<th>FDI (2 lags)</th>
<th>EX (2 lags)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI_{t-1}</td>
<td>0.64</td>
<td>-0.74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.02)</td>
<td></td>
</tr>
<tr>
<td>FDI_{t-2}</td>
<td>-2.46</td>
<td>-0.07</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>EX_{t-1}</td>
<td>-0.14</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.03)</td>
<td></td>
</tr>
<tr>
<td>EX_{t-2}</td>
<td>-0.45</td>
<td>-1.61</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.01)</td>
<td></td>
</tr>
</tbody>
</table>

**Sargan test**
- Dependent variable: FDI, EX
- \( \chi^2 \) = 329.11, 293.32
- p-value = (0.17), (0.57)

**Wald causality test**
- Null Hypothesis: FDI does not cause EX, EX does not cause FDI
- \( \chi^2 \) = 22.99, 10.95
- p-value = (0.00)***, (0.05)**

*Values in parentheses are the p-values. *** (**) : Significant at 1% level (5% level)*
**Table 7:** Granger causality tests for each sector

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Dep.var</th>
<th>ΔlnFDI</th>
<th>ΔlnEX</th>
<th>ΔlnFDI</th>
<th>ΔlnEX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy industries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.32 (0.06)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.60 (0.24)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>0.04 [0.15]</td>
<td>-0.20 [0.02]***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light industries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.09 (0.07)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.01 (0.09)*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>0.02 [0.46]</td>
<td>-0.50 [0.00]***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food industries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.57 (0.04)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.07 (0.07)*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>0.12 [0.18]</td>
<td>-0.06 [0.01]***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and Gas</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.02 (0.06)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.14 (0.17)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>0.08 [0.37]</td>
<td>-0.05 (0.02)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture, Forestry and Fisheries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.13 (0.05)**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.01 (0.02)**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>0.02 [0.15]</td>
<td>-0.02 [0.01]***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.04 (0.85)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.67 (0.35)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>0.07 [0.15]</td>
<td>0.02 [0.21]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other sectors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>0.17 (0.68)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnEX</td>
<td>0.27 (0.61)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>-0.01 [0.91]</td>
<td>0.06 [0.00]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dep.var: Dependent variable. Ind.var: Independent variable. Values in brackets are t-statistics. Values in parentheses are p-values associated with Wald test statistics. * (**, ****) denotes statistical significance at the 10%, 5% and 1% levels respectively.

**Table 8:** Granger causality tests for FDI and GDP in the Services and Other sectors

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Dep.var</th>
<th>ΔlnFDI</th>
<th>ΔlnGDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>4.75 (0.03)**</td>
<td></td>
</tr>
<tr>
<td>ΔlnGDP</td>
<td>14.31 (0.00)***</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>-0.03 [0.06]*</td>
<td>-0.02 [0.09]*</td>
<td></td>
</tr>
<tr>
<td>Other sectors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔlnFDI</td>
<td>-</td>
<td>5.72 (0.02)**</td>
<td></td>
</tr>
<tr>
<td>ΔlnGDP</td>
<td>13.08 (0.00)***</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ECT</td>
<td>-0.06 [0.03]***</td>
<td>-0.01 [0.06]***</td>
<td></td>
</tr>
</tbody>
</table>

Dep.var: Dependent variable. Ind.var: Independent variable. Values in brackets are t-statistics. Values in parentheses are p-values associated with Wald test statistics. * (**, ****) denotes statistical significance at the 10%, 5% and 1% levels respectively.
### Table 9: Results of cross-sector causality tests

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Long-run</th>
<th>Short-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_0$: FDI in Services does not cause Heavy industries Exports</td>
<td>-0.02 [0.09]*</td>
<td>3.37 (0.07)**</td>
</tr>
<tr>
<td>$H_0$: FDI in Services does not cause Light industries Exports</td>
<td>-0.32 [0.00]***</td>
<td>5.35 (0.02)**</td>
</tr>
<tr>
<td>$H_0$: FDI in Services does not cause Food industries Exports</td>
<td>-0.04 [0.08]*</td>
<td>4.49 (0.03)**</td>
</tr>
<tr>
<td>$H_0$: FDI in Services does not cause Oil and Gas Exports</td>
<td>-0.74 [0.08]*</td>
<td>6.77 (0.00)***</td>
</tr>
<tr>
<td>$H_0$: FDI in Services does not cause Agriculture, Forestry and Fisheries Exports</td>
<td>-0.02 [0.02]**</td>
<td>9.50 (0.00)***</td>
</tr>
<tr>
<td>$H_0$: FDI in Other sectors does not cause Heavy industries Exports</td>
<td>0.05 [0.86]</td>
<td>0.76 (0.21)</td>
</tr>
<tr>
<td>$H_0$: FDI in Other sectors does not cause Light industries Exports</td>
<td>-0.03 [0.00]***</td>
<td>9.43 (0.00)***</td>
</tr>
<tr>
<td>$H_0$: FDI in Other sectors does not cause Food industries Exports</td>
<td>0.31 [0.15]</td>
<td>6.16 (0.01)**</td>
</tr>
<tr>
<td>$H_0$: FDI in Other sectors does not cause Oil and Gas Exports</td>
<td>-1.11 [0.03]**</td>
<td>1.87 (0.17)</td>
</tr>
<tr>
<td>$H_0$: FDI in Other sectors does not cause Agriculture, Forestry and Fisheries Exports</td>
<td>-0.60 [0.04]**</td>
<td>2.71 (0.09)*</td>
</tr>
</tbody>
</table>

Values in brackets are t-statistics. Values in parentheses are p-values associated with Wald test statistics. * (**, ***) denotes statistical significance at the 10%, 5% and 1% levels respectively.
## Appendix

### Table A1: Unit root tests for FDI and GDP in the Services and Other sectors

#### Panel A: LLC unit root tests

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables</th>
<th>Level</th>
<th>First difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FDI</td>
<td>GDP</td>
<td>FDI</td>
</tr>
<tr>
<td>(1)</td>
<td>-0.41 (-2.14)</td>
<td>-0.73 (-3.53)</td>
<td>-5.67* (-1.30)</td>
</tr>
<tr>
<td>(2)</td>
<td>-0.56 (-2.39)</td>
<td>0.20 (-0.83)</td>
<td>-5.51** (-1.98)</td>
</tr>
<tr>
<td>(3)</td>
<td>-1.90 (-1.93)</td>
<td>2.72 (-2.77)</td>
<td>-5.42*** (-5.33)</td>
</tr>
</tbody>
</table>

Value in parentheses is critical value. (1): Model with heterogeneous intercepts and heterogeneous trend. (2): Model with heterogeneous intercepts. (3): Model without heterogeneous intercepts. *** (**, *): Rejection of the null hypothesis at the 1%, 5% and 10% significance level respectively.

#### Panel B: IPS unit root tests

<table>
<thead>
<tr>
<th>Models</th>
<th>Variables</th>
<th>Level</th>
<th>First difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FDI</td>
<td>GDP</td>
<td>FDI</td>
</tr>
<tr>
<td>With common time effect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)a</td>
<td>-1.43</td>
<td>-2.35</td>
<td>-3.78***</td>
</tr>
<tr>
<td>(2)b</td>
<td>-1.61</td>
<td>-0.56</td>
<td>-3.71***</td>
</tr>
<tr>
<td>Without common time effect</td>
<td>FDI</td>
<td>GDP</td>
<td>FDI</td>
</tr>
<tr>
<td>(1)a</td>
<td>-1.38</td>
<td>-1.91</td>
<td>-5.52***</td>
</tr>
<tr>
<td>(2)b</td>
<td>-1.44</td>
<td>-2.43</td>
<td>-5.08***</td>
</tr>
</tbody>
</table>

a: The critical value at 1%, 5% and 10% is -3.02, -2.76 and -2.63 respectively. b: The critical value at 1%, 5% and 10% is -2.42, -2.15 and -2.02 respectively.

### Table A2: Pedroni panel co-integration test for FDI and GDP

<table>
<thead>
<tr>
<th>Test statistics</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>panel v-stat</td>
<td>3.21</td>
<td>1.44</td>
<td>3.70</td>
<td>1.58</td>
</tr>
<tr>
<td>panel rho-stat</td>
<td>-8.98</td>
<td>-7.33</td>
<td>-10.61</td>
<td>-8.43</td>
</tr>
<tr>
<td>panel pp-stat</td>
<td>-8.40</td>
<td>-9.53</td>
<td>-8.33</td>
<td>-8.95</td>
</tr>
<tr>
<td>panel adf-stat</td>
<td>-6.45</td>
<td>-7.30</td>
<td>-6.20</td>
<td>-8.65</td>
</tr>
<tr>
<td>group rho-stat</td>
<td>-7.65</td>
<td>-5.84</td>
<td>-9.18</td>
<td>-6.81</td>
</tr>
<tr>
<td>group pp-stat</td>
<td>-10.02</td>
<td>-10.29</td>
<td>-9.37</td>
<td>-9.26</td>
</tr>
<tr>
<td>group adf-stat</td>
<td>-4.84</td>
<td>-7.63</td>
<td>-6.61</td>
<td>-8.94</td>
</tr>
</tbody>
</table>

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**Table A3:** GMM estimation and causality results

<table>
<thead>
<tr>
<th>Estimated coefficients</th>
<th>Dependent variable</th>
<th>FDI (2 lags)</th>
<th>GDP (2 lags)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI (_{t-1})</td>
<td></td>
<td>-0.13</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>FDI (_{t-2})</td>
<td></td>
<td>0.48</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.02)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>GDP (_{t-1})</td>
<td></td>
<td>-0.26</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.09)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>GDP (_{t-2})</td>
<td></td>
<td>0.17</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.06)</td>
<td>(0.08)</td>
</tr>
</tbody>
</table>

**Sargan test**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>FDI</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\chi^2)</td>
<td>82.94</td>
<td>63.94</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.51)</td>
<td>(0.95)</td>
</tr>
</tbody>
</table>

**Wald causality test**

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>FDI does not cause GDP</th>
<th>GDP does not cause FDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\chi^2)</td>
<td>34.93</td>
<td>30.96</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.00)***</td>
<td>(0.00)***</td>
</tr>
</tbody>
</table>

Values in parentheses are the p-values. ***: Significant at 1% level