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Arshad Alam, Vijay K. Vemuri, and Prabir K. Bagchi

CAUSAL LINKS BETWEEN SUPPLY CHAIN CAPABILITY AND FDI: A PANEL GRANGER CAUSAL ANALYSIS

ABSTRACT

Foreign Direct Investment (FDI) has grown significantly over the last few decades and it is seen as an engine for economic growth, especially for developing and transition economies, which account for more than 60% of global FDI flows. Location characteristics and supply-side factors are increasingly important in determining FDI flows. We borrow the concept of supply chain capability (SCC) of countries, developed by Alam and Bagchi (2011), to analyze the relationship between FDI and SCC for a panel of 64 countries for the period 1990 to 2013. We examine for causal rather than associative links between these factors using the Granger-causality methodology. Our results indicate that FDI Granger-causes SCC, but the causal relationship is not bidirectional. The paper contributes to the understanding of the link between FDI and SCC and has policy implications, especially for developing countries seeking to benefit from global investment flows.

Key Words: FDI, supply chain capability, panel data, Granger causality, Dumitrescu-Hurlin test

Arshad Alam
Prairie View A&M University, Prairie View, TX, USA

Vijay K. Vemuri
Quinnipiac University, Hamden, CT, USA

Prabir K. Bagchi
SRM University, Kancheepuram, India
The George Washington University, Washington, DC, USA

Correspondence: Arshad Alam
College of Business, Prairie View A&M University, Prairie View, TX 77446, USA
E-mail: aralam@pvamu.edu
Tel: 1-936-261-9244

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INTRODUCTION

Foreign Direct Investment (FDI) is a major vehicle for multinational enterprises (MNEs) for expanding their global presence and penetrating overseas markets. With the increasing globalization of the world economy and the lowering of tariffs toward investments, global FDI continues to grow. According to United Nations Conference on Trade and Development (UNCTAD) statistics, FDI inflows increased at a compound annual growth rate of nearly 12% between 1970 (US$13 billion) and 2013 (US$1.45 trillion). While historically the bulk of the global FDI flows have been between developed countries, developing countries now account for the greatest share of FDI inflows; 61% of all FDI flows in 2014 was to developing and transition economies (UNCTAD, 2014).

Along with globalization, there has been an attendant increase in international production and a reconfiguration of the ways in which MNEs make their FDI decisions as globalization offers a wider choice on how to serve international markets, and improve the efficiency of operations (UNCTAD, 1998). The focus of investment location decisions have in many instances shifted from serving one national market to serving a global market. MNEs are increasingly using integrated production systems (Verter and Dincer, 1992) which are reflected in the growth in international outsourcing.

The role of location in Dunning's (1998) ownership, location, and internalization (OLI) paradigm has assumed added significance. Differences in location-specific advantages can clearly affect an MNE's decision about where to invest. Countries differ in the quality of their government institutions, the strength of inter-firm relationships with supply chain partners in their economies, and the quality and capacity of their human capital to absorb knowledge and changes. They differ also in the extent of supporting industries present in their economies and the presence of what Porter refers to as "advanced factors" (communication, infrastructure, sophisticated skills, and research facilities). Additionally, the literature on the subject points out the interdependencies of many of these factors; the absence of one prevents the full realization of another.

While the literature on FDI has identified a host of factors as affecting FDI, the changing nature of FDI (increasing relevance of vertical FDI as opposed to horizontal FDI) and the fragmentation of international production systems suggest that supply-side factors are increasingly relevant in FDI decision making. We borrow the concept of SCC, a holistic variable developed by Alam and Bagchi (2011), to assess the attractiveness of a location. We come up with the SCC score of countries and then analyze the data for a

causal relationship between FDI and SCC. To the best of our knowledge, no researcher has used this terminology or a similar construct to measure the attractiveness of a location for FDI.

The paper is organized as follows. In the next section we enlarge on the concept of SCC and propose hypotheses. This is followed by a review of data structures in FDI research. We next discuss the model and methodology, followed by the results of our analysis and conclusions.

SUPPLY CHAIN CAPABILITY AND ITS INFLUENCE ON FDI

The globalization of markets and supply bases for many products, the focus on core competencies and the attendant growth in outsourcing and advances in information technology have made the internationalization of production and sales a reality. Consequently, supply chain management (SCM) has increased relevance for organizations involved in international production. The source of competitive advantage is now no longer restricted to activities internal to an organization but necessarily entails the environment in which the firm operates, such as the competency of its suppliers and the quality of its linkages with them.

While firms can determine the supply chain orientation of their organizations, the efficacy of SCM is also determined by environmental factors. Members of the supply chain have no control over country-specific macro conditions, such as the quality of logistical services or the infrastructure of a country, which may constrain the efficiency of the SCM processes in place. To the extent that these factors are country or location-specific, a company's supply chain is a function of locational factors. Alam and Bagchi (2011) developed the concept of SCC of a country to capture these locational factors and used it to study its impact on FDI. As defined by them, a country's SCC is its capacity to efficiently meet the requirements of intermediates and other inputs of the focal organization. It is a composite index of different locational factors, namely, infrastructure, supply environment, and absorptive capacity, which have a bearing on a firm's supply chain efficiency. While other studies have used a variety of locational factors as explanatory variables of FDI, none of them have come up with a supply chain based holistic variable such as SCC to capture a location's attractiveness as a FDI destination. We use the construct of SCC developed by Alam and Bagchi (2011) for the purposes of this study. The constituent factors of SCC are discussed below.

Infrastructure

A good infrastructure facilitates transaction flows that are crucial to an efficient supply chain. The ease and speed of movement of goods is largely determined by the quality of a country's infrastructure – its transportation system, distribution and communication facilities, and other elements such as a reliable power supply. A good infrastructure is hence critical to an efficient supply chain. A composite index of overall infrastructure, which captures the state of the transportation system, communication network, status of utilities, etc., will *inter alia* determine the SCC of a country. Many empirical studies have found infrastructure as a significant determinant of FDI (Wheeler and Mody, 1992; Kumar, 1994; Loree and Guisinger, 1995; Lu and Yang, 2007)

Supply environment

A supply chain is as strong as the members of the chain, and the term *supply environment* refers broadly to the availability of competent local suppliers, the quality of their output, their customer orientation, their overall productivity, etc. The focus on core competencies resulting in an ever larger value of the end product being contributed by suppliers suggests that elements of competitiveness are now more than before dispersed along the entire supply network. Relationships and complementarities with suppliers can assist focal organizations (Kotabe, Martin, and Domoto, 2003) and be a source of competitive advantage (Dyer, 1996). Locations that suffer from poor supply environment would affect a firm's supply chain and adversely impact the efficiency of its operations. Conversely, organizations will benefit from locations with good supply environment. Supply environment therefore, constitutes the second element of SCC.

Absorptive capacity

Absorptive capacity has been defined differently by researchers. The most widely quoted definition is that of Cohen and Levinthal (1990), who define it as the firm's ability to identify, assimilate, and exploit outside knowledge. Mowery and Oxley (1995) suggest that it encompasses a broad array of skills reflecting the capacity to deal with the tacit elements of foreign technology and modify it. Kim (1998) meanwhile, suggests that it is the capacity to learn and solve problems. Absorptive capacity has been studied at different levels: firm level, inter-organization, and country level. From the perspective of a potential investor analyzing the overall production environment of a country, the appropriate unit of analysis

is the country level. A country's absorptive capacity broadly refers to the quality of human capital, *i.e.*, the set of knowledge and skills present in the workforce that bears on a country's ability to learn and apply newer technologies and processes.

A country's absorptive capacity determines the ability of the supplier network to assist in collaborative product and process development with the focal organization and meet its requirements for products, components, and services (ECLAC, 2005). Since a country's absorptive capacity aids or limits the ability of the supplier base to meet the requirements of the focal organization for knowledge transfer, it constitutes the third element of SCC.

Theoretical support to the notion of SCC comes from transaction cost economics, resource-based theory, and the network approach. While good infrastructure helps in lowering transaction costs, a good supply environment is likely to lead to higher transaction efficiency through competitive pricing and better product quality. The role of infrastructure and supply environment also finds support from the network approach as they are critical in the formation of a wide network of supporting suppliers which is a prerequisite for participation in international production networks. Additionally, from the resource-based theory perspective absorptive capacity helps in innovation and the development of skills and hence is a valuable asset.

DEVELOPMENT OF HYPOTHESES

Globalization and advances in technology, along with increased competition, have enhanced the importance of location in the OLI paradigm (Dunning, 1998). More than before, FDI decisions are being made keeping locational characteristics in mind since they can significantly impact productivity and competitiveness. The shift in FDI from being primarily market-seeking and asset-exploiting to efficiency and asset-seeking further heightens the importance of locational factors in decision making.

The production structure of a country's economy is adversely affected by the deficits in a country's fundamentals (Alfaro, Kalemli-Ozcan, and Volosovych, 2005). Weaknesses in technological and organizational capabilities affect the potential of some countries in attracting FDI (Afriye, 1992) and an enhancement of the "productive capacity" can lead to increased vertical FDI (Hanson, Mataloni, and Slaughter, 2001). A well-developed network of firms allows the focal organization to focus on its core competencies and enhances the competitiveness of the entire supply chain (Altenburg, 2007). The presence of supportive suppliers and service providers in a country along with good infrastructure

and absorptive capacity aids the competitiveness of the investing firms. An improvement in supply-side factors thus, enhances the attractiveness of a host country as an FDI destination (Lall, 1997).

MNEs invest abroad not just to internalize operations, as suggested by the internalization theory, but also to build capabilities and competencies as suggested by the resource-based theory. Locations with better SCC, an enabling factor that impacts the production environment of the country and enhances competitiveness, will be preferred over those that are deficient in SCC. A country's SCC is thus a determinant of FDI flows.

While the relationship between SCC and FDI using several control variables has been studied (Alam and Bagchi, 2011), the important question of time precedence relationships between FDI and SCC has not been researched. The time precedence relationship between FDI and SCC is an important question as it has clear policy implications. If SCC precedes FDI, a country can stimulate FDI inflows by concentrating on enhancing its SCC. It can improve its infrastructure and make investments in human capital which will strengthen absorptive capacity and supply environment. On the other hand, if FDI precedes SCC, the country should place more emphasis on attracting FDI inflows by cultivating relationships with firms and offering other incentives. If the simultaneity of time precedence relationships prevails, the country should emphasize both FDI enhancement and SCC improvements in a coordinated manner.

Based on the discussion above which lays the conceptual basis for the effect of SCC on FDI, we propose the following:

Hypothesis 1: SCC Granger-causes FDI Stock

SCC of a country is, however, not a static concept; it evolves over time based on improvements in infrastructure, absorptive capacity, and the supply environment. It is a determinant of FDI, but it is also augmented by FDI as newer technologies and processes help develop the domestic SCC (Alam and Bagchi, 2011). The conceptual basis of the positive externalities of FDI stems from (i) use of advanced technology by the investing firm, and (ii) the linkages created with local firms. In addition, FDI can lead to human capital formation and as such assist in the development of absorptive capacity.

There is extensive empirical literature on the positive spillover effects of FDI on the host country and its firms, though the findings do not always converge and are not always

conclusive (Lipsey and Sjöholm, 2004). Studies suggest that the extent of the positive spillover depends on the existing knowledge base and the absorptive capacity of the host country (Wang and Blomström, 1992; Perez, 1997; Kinoshita, 2001). Use of technology and improved management processes can flow to the domestic firm through labor mobility, *i.e.*, when trained MNE employees move to a domestic firm or when these trained workers start their own enterprises (Alfaro, Chanda, Kalemli-Ozcan, and Sayek, 2004). FDI can thus be a source of strengthening the SCC of the host country through transfer of technology, build-up of human capital, and improved productivity of domestic firms through improved processes, which are transferred to local firms through forward and backward linkages (UNCTAD, 2003). Based on the above discussion, we propose the following:

Hypothesis 2: FDI Stock Granger-causes SCC.

Support for both the hypotheses would establish a bi-directional relationship between SCC and FDI inflows.

DATA STRUCTURES AND CAUSALITY TESTS IN FDI RESEARCH

Early research on examining the determinants of FDI used simple data structures consisting of mainly cross-sectional and pooled data models. These studies examined covariance between FDI and other explanatory variables in an ordinary least squares setting. Chakrabarti (2001) provides an extensive survey of the research findings of this genre and his own analysis (using 1994 data) concludes that many of the relationships between FDI and other variables observed in the prior research are not very robust and many variables that are thought to be correlated with FDI do not hold significant relationship with FDI. Nigh (1985) utilizes pooled data to examine the relationship between FDI from the U.S. and political events in the host country. With the use of more complex data structures, the research questions have become more complex. Table 1 shows the main data structures used in explaining the levels of FDI inflows. It presents a representative sample of empirical studies with FDI as a dependent variable in a single equation estimation or as an endogenous variable in a multiple equation estimation. The research on FDI is extensive and we do not attempt to provide a comprehensive summary

of existing literature. Instead, we provide a typology of data structures giving a representative sample of each category. This typology provides a context for our own research and distinguishes our contribution from prior research.

Table 1. Data structures in FDI studies

	Non-Causal Model: Independent Variables	**Causal Model: Other Endogenous Variables**
Cross-Sectional Data	Chakrabarti (2001): trade barriers, growth rate, openness, trade deficit, exchange rate, and taxes	
Pooled Data	Nigh (1995): Political events	
Time Series Data	De Mello, Jr. (1999): capital investment, output, and total factor productivity	Dasgupta (2009): Imports, exports, and FDI outflows Guru-Gharana (2012): GDP and exports
Panel Data	Qayoom, Ramachandran, and Sofi (2013): market size, total reserves, infrastructure, labor cost, and openness	Dritsaki and Dritsaki (2012): exports

With time series and panel data, an additional time dimension is available, and dynamics in the form of lagged variables are introduced into the analysis. Unlike cross-sectional and pooled data relationships between contemporaneous variables, variables dated in the past time periods are also available for estimation and testing. With time series and panel data, direction of causality can be estimated and tested. Causal modeling with time series, although focused on a particular country, is limited in its applicability as it lacks external validity – the ability to generalize to other countries. The use of panel data for understanding the determinants of FDI and its causal links with the determinants is becoming prevalent. Using panel data, Qayoom, Ramachandran, and Sofi (2013) find that market size, total reserves, infrastructure, and labor costs are the main determinants of FDI inflows to developing countries. They find that all the variables in their estimation are I(1) variables and are co-integrated. They utilize Fully Modified OLS estimation methods to establish determinants of FDI inflows. Dristaki and Dristaki (2012) take a different approach to testing for Granger causality and based on Granger's representation theorem, analyze a vector error correction model instead of a vector autoregression model. They build a heterogeneous panel data model for 12 EU countries and conclude that exports and FDI have bi-directional causal relationships.

Despite their wide appeal, panel data causality tests are relatively new. Only recently the asymptotic distribution of the sum of individual test statistics in heterogeneous panels has been derived (Dumitrescu and Hurlin, 2012). Software support for implementing these heterogeneous panel causality tests is not yet widely available. Erdil and Yetkiner (2009) is an early application of this testing procedure investigating causal relationships between health care expenditures and GDP. Chen, Clarke, and Roy (2014) is a more recent example of implementation of Dumitrescu and Hurlin (2012) methodology to test for causal links between infant mortality and per capita GDP. Nair-Reichert and Weinhold (2001) illustrates the difficulties in panel data causality testing prior to the development of asymptotic distribution of the aggregate test statistic. They develop an ad-hoc estimation procedure to study the relationship between FDI and economic growth for a panel of 24 developing countries.

In this study, we test for the causal relationships between SCC and FDI stock for a large and diversified group of countries. Our data covers both country dimension and time dimension covering annual data from 2001 to 2013. The FDI data is readily available from public data sources. We develop our own measure of SCC from several different variables.

MODEL AND METHODOLOGY

Our interest is in understanding the causal relationships between SCC and FDI. In the absence of controlled experiments, casual relationships are nearly impossible to establish. Granger (1969) proposed a concept of causality suitable for observational studies. His concept of causality (known as Granger-causality) is based on the ability of current and past realizations of a variable to improve predictions of another variable. A variable x Granger-causes another variable y, if addition of information in x (to all other available information) improves predictions of y. Granger-causality operationalizes the "cause must precede effect" requirement of the traditional causality. Granger-causality is developed in the context of time series data, that is, data for several time periods is analyzed for a unit of interest such as a country. In order to improve the power of causality tests, the Granger-causality concept is extended to panel data involving several countries and several time periods. The difficulty with using panel data in Granger-causality testing is in dealing with heterogeneity of cross-sectional units. That is, every country may have a different pattern of causality, leading to the problem of how to combine the heterogeneous

conclusions. Holtz-Eakin, Newey, and Rosen (1988), Nair-Reichert and Weinhold (2001), and Dumitrescu and Hurlin (2012) provide alternative frameworks to analyze the causal relationships. Dumitrescu and Hurlin's (2012) methodology is gaining wider acceptance (Chen, Clarke, and Roy, 2014; Erdil and Yetkiner, 2009) and we use it in our study. In this methodology, a heterogeneous panel data model with fixed coefficients is estimated and homogenous non-causality (HNC) is tested. The null hypothesis, HNC requires non-causality for any of the countries. The alternate hypothesis (heterogeneous non-causality – HENC) requires that at least one country exhibits causal relationship.

A vector auto regression model of order 2 for N (index i) countries and T (index t) time periods for FDI Stock, and SCC is written as:

$$LFDIstk_{it} = \alpha_{1i} + \sum_{p=1}^{2} \beta_{1i}^{(p)} LFDIstk_{it-p} + \sum_{p=1}^{2} \gamma_{1i}^{(p)} SCC_{it-p} + \varepsilon_{1it}.$$

$$SCC_{it} = \alpha_{2i} + \sum_{p=1}^{2} \beta_{2i}^{(p)} SCC_{it-p} + \sum_{p=1}^{2} \gamma_{2i}^{(p)} LFDIstk_{it} + \varepsilon_{2it}.$$

The regression coefficients have usual meaning, for example, $\beta_{2i}^{(2)}$ represents the coefficient for second lag of SCC in the SCC equation for country i. The usual OLS restrictions are imposed on the error terms.

In this framework, Granger non-causality is tested by performing joint Wald test on all lags of a variable. For instance, to test non-causality of supply chain capabilities on FDI for country *i*, a Wald test is performed on the joint hypothesis that $\gamma_{1i}^{(p)}$ for all *p*. Dumitrescu and Hurlin (2012) average individual Wald statistic W_i as $W_{NT} = \sum_{i=1}^{N} \frac{W_i}{N}$. They show that under sequential convergence, the statistic $Z_{NT} = \sqrt{\frac{N}{2P}}(W_{NT} - p)$ converges in distribution to standard normal distribution. Using these W-bar and Z-bar statistics, we test HENC hypothesis.

Before we estimate the above VAR model, we tested for panel unit roots for FDI and SCC. If one or more of the variables have a panel unit roots, the model relationships can be spurious and causality testing cannot be trusted without further investigating cointegrating relationships (Granger and Newbold, 1974). If one of the series has a panel

unit root, cointegration relationship is not a possibility and that variable needs to be differenced in order to establish relationships between stationary variables.

Data sources and variables

Our data consists of annual FDI and SCC data for 64 countries for the years 1990 to 2013. Although, a priori, we have not eliminated any countries, data availability, especially for SCC, reduced the number of countries to 64. Data sources for the variables used in the study are described below and are summarized in Table 2.

Table 2. Variables and data sources

Concept:/Variable	Data Source
FDI Stock	UNCTAD Statistics
SCC	Score constructed using principal component analysis of measures of infrastructure, supply environment, and absorptive capacity.
Infrastructure	The Global Competitiveness Report (GCR) of the World Economic Forum (WEF): Overall Infrastructure Quality Score
Supply Environment	GCR (WEF): Constructed using principal component analysis of measures of intensity of local competition, buyers' sophistication, local supplier quality, local supplier quantity, and production process sophistication
Absorptive Capacity	GCR (WEF): Firm Technology Absorption Score
Per Capita Gross National Income	World Bank

FDI: The FDI inflow and stock data are available from the UNCTAD database. Annual FDI inflows can be very volatile; it is even negative for a nontrivial number of observations. Consequently, we used FDI stock to represent FDI. This enables us to achieve some level of heteroskedasticity stabilization by using log transformation. We could not have achieved this with annual FDI inflows as log of negative values is undefined.

Infrastructure: Data for infrastructure quality score, which indicates the overall physical environment in which the firms operate, was obtained from the Global Competitiveness Report (GCR) of the World Economic Forum (WEF).

Supply Environment: GCR of the WEF carries data on factors such as intensity of local competition, buyers' sophistication, local supplier quality, local supplier quantity, and production process sophistication. These factors reflect the availability and quality of local suppliers and the extent and quality of domestic competition in the supplier's market.

Principal Component analysis (PCA) was employed on the above variables to come up with a score of supply environment.

Absorptive Capacity: Firm Technology Absorption score from the GCR of the WEF is used as a proxy for a country's absorptive capacity.

SCC: The SCC score was constructed from its constituent factors by using PCA on the measures of infrastructure, supply environment, and absorptive capacity. Eigen value criterion was used to select a single principal component.

ANALYSIS AND RESULTS

Panel unit root tests

Tests of panel unit roots are sensitive to assumptions about heterogeneity of units in the panel, lags and aggregation of individual unit results into an overall result. Many studies use several procedures for deciding on panel unit tests. Based on the results of several panel unit root tests (see Table 3), the inference is unambiguous that SCC and FDI in levels do not have a unit root. This result establishes that we can estimate our VAR model in levels.

Table 3. Panel unit root test results*

	SCC		LFDIstk	
	Statistic	**p-value**	**Statistic**	**p-value**
Null: Unit Root Process with Common Root				
Levin, Lin, and Chu t*	-10.99	0.0	-7.56	0.0
Null: Unit Root Process with individual Roots				
Im, Pesaran, and Shin W-test	-6.046	0.0	-2.20	0.014
ADF – Fisher Chi-Square	328.19	0.0	188.85	0.0004
PP-Fisher Chi-Square	348.72	0.0	377.12	0.0

* Individual intercepts, automatic lag length selection is based on Hannan-Quin criteria using Bartlett Kernel

Granger causality test results

Table 4 shows panel Granger non-causality test results using Dumitrescu and Hurlin panel causality tests for the entire sample of 64 cross-sectional units. Prior research investigating the determinants of FDI has found that the effect of many determinants on FDI is not uniform across all countries and systematic differences exist. Specifically, the effect on FDI depended systematically on the stage of economic development of the host country. Therefore, we examined if there are systematic differences in the causal relationships among the countries based on the stage of economic development *i.e.* if the relationships were different for developed and developing countries. Using the World Bank's 2013 per capital gross national nominal income US$12,746 as the cutoff, we group 36 countries into high-income countries and 28 countries as low-income countries. The Appendix A1 shows the list of the countries and their classification. The choice of two income groups, instead of three, *i.e.*, high, middle, and low-income, was based on practicality. Three groups did not provide an adequate sample for each income group. Table 5 shows Granger causality test results separately for developing and developed countries.

Table 4. Dumitrescu-Hurlin panel causality tests (all countries)

	Lags Included: 1		
	w-Stat	**Z-bar Stat**	**p-value**
SCC Does not homogeneously cause LFDIstk	1.456	0.592	0.553
LFDIstk Does not homogeneously cause SCC	4.518	11.241	0.0
	Lags Included: 2		
	w-Stat	**Z-bar Stat**	**p-value**
SCC Does not homogeneously cause LFDIstk	3.036	0.056	0.955
LFDIstk Does not homogeneously cause SCC	5.368	3.641	0.0

Table 5. Dumitrescu-Hurlin panel causality test by development stage

Developed Countries – 36 Cross-Sectional Units			
	Lags Included: 1		
	w-Stat	**Z-bar Stat**	**p-value**
SCC Does not homogeneously cause LFDIstk	0.943	-0.089	0.371
LFDIstk Does not homogeneously cause SCC	5.393	10.716	0.0
	Lags Included: 2		
	w-Stat	**Z-bar Stat**	**p-value**
SCC Does not homogeneously cause LFDIstk	2.487	-0.592	0.554
LFDIstk Does not homogeneously cause SCC	4.502	1.734	0.083
Developing Countries –28 Cross-Sectional Units			
	Lags Included: 1		
	w-Stat	**Z-bar Stat**	**p-value**
SCC Does not homogeneously cause LFDIstk	2.116	1.909	0.056
LFDIstk Does not homogeneously cause SCC	3.392	4.845	0.0
	Lags Included: 2		
	w-Stat	**Z-bar Stat**	**p-value**
SCC Does not homogeneously cause LFDIstk	3.743	0.756	0.459
LFDIstk Does not homogeneously cause SCC	6.481	3.544	0.0004

The results clearly establish that FDI Granger-causes SCC, but the causal relationship does not hold in the reverse direction. The result is fairly conclusive in that it holds for all countries combined, as well as separately for developed and developing countries. Only a slight anomaly is the p-value of 0.083 (slightly higher than traditional α value of 0.05) in the case for developed countries when two lags are included. Hypothesis 2 is thus supported. Evidence is lacking for Hypothesis 1, which proposed that SCC Granger-causes FDI. This is surprising given that there is a conceptual basis for FDI flowing to countries with strong SCC. SCC of a country is indicative of the overall production environment of the country; countries with higher SCC enhance the competitiveness of the investing firm and ceteris paribus make them a more attractive FDI destination. A possible explanation is that our study does not include GDP as it is limited to pair-wise analysis of causality. Nearly all previous regression-based FDI studies have found GDP as a determinant of FDI (Root and Ahmed, 1978; Wheeler and Modi, 1992; Kravis and Lipsey, 1982). Market size is the most widely accepted significant determinant of FDI and GDP has been found to be significant across different sets of countries, time periods, and model specifications. Absence of GDP in our estimation equation is the most plausible

explanation for bi-directionality not being established and literature does suggest that results of causality analysis can vary with the period studied, the econometric method employed, and the inclusion of other related variables or interaction terms in the model (Won and Hsiao, 2008).

Furthermore, production and logistic efficiencies of the host country are most likely to affect vertical and export-platform FDI while horizontal FDI is primarily motivated by the size of the host country's economy. In other words, SCC is likely to have a much greater impact on vertical and export-platform FDI than horizontal FDI (Alam and Bagchi, 2011). It is possible that the use of overall FDI figures in the study confounds the overall finding and results in Hypothesis 1 not being substantiated (since international FDI data is not identified as horizontal or vertical and export-platform FDI, separate analyses based on the type of FDI is not possible).

Finally, SCC being an enabler of production efficiencies, it is logical to infer that after a certain threshold level, further improvements in SCC would have diminishing marginal utility on production efficiencies and it will cease to have a measurable effect on FDI (Alam and Bagchi, 2011). This might be another factor why Hypothesis 1 is not supported.

CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The result that FDI Granger-causes SCC has clear policy implications, especially, for countries trying to meet the challenge of globalization. While the literature on the spillover effects of FDI is not entirely conclusive, our results will add weight to the body of literature suggesting positive externalities. In effect, this suggests that countries deficient in their SCC may reap benefits by providing incentives to MNEs to invest in their countries through tax regimes and other instruments. Improvement in SCC is an improvement in the productive capacity of the country and it enhances the competitiveness of the country in the global economy.

Our findings have strong policy implications, especially for developing countries. For the economic integration of a developing country into a global economy, it may not be enough to merely enhance a country's infrastructure, supply environment, and absorptive capacity. The efforts to attract FDI through tax incentives, revamping of legal and economic institutions, a stable political environment, exchange rate stability, friction-less convertibility of local currencies, and sound macroeconomic policies are possibly as

important as investments in the constituent factors of SCC. Put differently, FDI does not necessarily flow into a country simply because of its strong SCC. Our educated conjecture is that other factors, such as political climate, economic policies, and investment opportunities, may significantly affect FDI, and that SCC will evolve to sustain the increased economic activity FDI creates. To reinterpret, without time sequencing, SCC may be a necessary but not a sufficient condition for attracting FDI. The inward flow of FDI, however, does enhance the SCC of countries and thus is likely to make them even more attractive as FDI destinations.

Future researchers may benefit by considering other variables, such as GDP, and try going beyond pair-wise analysis of causality to consider multivariate causality. Also, countries may be grouped together based on cultural similarity and geographical proximity and then analyzed separately. Our study lays the basis for further research in the field.

REFERENCES

Afriye, K. 1992. Enhancing FDI and value-added production in developing economies: Governments, MNEs, and development agencies. *The International Trade Journal* 7 (1): 85-109.

Alam, A. and P. Bagchi. 2011. Supply chain capability as a determinant of FDI. *Multinational Business Review* 19 (3): 229-249.

Alfaro, L., A. Chanda, S. Kalemli Ozcan, and S. Sayek. 2004. FDI and economic growth: The role of local financial markets. *Journal of International Economics* 64: 89-112.

Alfaro, L., S. Kalemli-Ozcan, and V. Volosovych. 2005. Why doesn't capital flow from rich to poor countries? An empirical investigation. *NBER Working Paper 11901.*

Altenburg, T. 2007. Donor approaches to supporting pro-poor value chains. The Donor Committee for Enterprise Development, German Development Institute, Bonn, Germany.

Chakrabarti, A. 2001. The determinants of foreign direct investment: Sensitivity analyses of cross-country regressions. *kyklos* 54: 89–114.

Chen, W., J. A. Clarke, and N. Roy. 2014. Health and wealth short panel Granger causality tests for developing countries. *The Journal of International Trade & Economic Development* 23 (4): 755-784.

Cohen, W. M. and D. A. Levinthal. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, Special Issue: Technology, Organizations, and Innovation* 35 (1):128-152.

Dasgupta, N. 2009. Examining the long run effects of export, import and FDI inflows on the FDI outflows from India: A causality analysis. *Journal of International Business and Economy* 10 (1): 65-88.

De Mello, Jr., L. R. 1999. Foreign direct investment-led growth: Evidence from time series and panel data. *Oxford Economic Papers* 51: 133-151.

Dritsaki, C. and M. Dritsaki. 2012. Exports and FDI: A Granger causality analysis in a heterogeneous panel. *Oxford Bulletin* 32 (4): 3128-3129.

Dumitrescu, E. and C. Hurlin. 2012. Testing for Granger causality in heterogeneous panels. *Economic Modeling* 29: 1450-1460.

Dunning, J. H. 1998. Location and the multinational enterprise: A neglected factor? *Journal of International Business Studies* 29 (1): 45-66.

Dyer, J. H. 1996. Specialized supplier networks as a source of competitive advantage: evidence from the automotive industry. *Strategic Management Journal* 17 (4): 271–291

ECLAC. 2005. *Foreign investment in Latin America and the Caribbean*. Available at www.eclac.org. Accessed 10 April 2007.

Erdil, E. and H. Yetkiner. 2009. The Granger-causality between health care expenditure and output: A panel data approach. *Applied Economics* 41: 511–518.

Granger, C. W. J. 1969. Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* 37 (3): 424-438.

Granger, C. W. J. and P. Newbold. 1974. Spurious regressions in econometrics. *Journal of Econometrics* 2: 111-120.

Guru-Gharana, K. K. 2012. Econometric investigation of relationships among export, FDI and growth in India: An application of Toda-Yamamoto-Dolado-Lutkephol Granger causality test. *Journal of Developing Areas* 46 (2): 231-247.

Hanson, G. H., R. J. Mataloni Jr., and M. J. Slaughter. 2001. Expansion strategies of U.S. Multinational Firms. *NBER Working Paper* 8433.

Holtz-Eakin, D., W. Newey, and H. S. Rosen. 1988. Estimating vector autoregressions with panel data. *Econometrica* 56: 1371-1396.

Kim, L. 1998. Crisis construction and organizational learning: Capability building in catching-up at Hyundai Motor. *Organization Science* 9 (4): 506-521.

Kinoshita, Y. 2001. R&D and Technology spillovers through FDI: Innovation and absorptive capacity. *CEPR Discussion Paper* 2775.

Kotabe, M., X. Martin, and H. Domoto. 2003. Gaining from vertical partnerships: Knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. *Strategic Management Journal* 24 (4): 293-316.

Kravis, I. B. and R. E. Lipsey. 1982. The location of overseas production and production for export by U.S. multinational firms. *Journal of International Economics* 12: 201- 223.

Kumar, N. 1994. Determinants of export orientation of foreign production by US multinationals: An inter-country analysis. *Journal of International Business* 25 (1): 141-156.

Lall, S. 1997. *Attracting foreign investments: new trends, sources and policies.* London: Commonwealth Secretariat, Economic Affairs Division.

Lipsey, R. E. and F. Sjöholm. 2004. Host country impacts of inward FDI: Why such different answers? *Working Paper* 192. Available at http://swopec.hhs.se/eijswp/papers/ eijswp0192.pdf. Accessed 18 June 2015.

Loree, D. and S. E. Guisinger. 1995. Policy and non-policy determinants of U.S. equity foreign direct investment. *Journal of International Business Studies* 26: 281-300.

Lu, C. and C. Yang. 2007. An evaluation of the investment environment in international logistics zones: A Taiwanese manufacturer's perspective. *International Journal of Production Economics* 107: 279–300.

Mowery, D. C. and J. E. Oxley. 1995. Inward technology transfer and competitiveness: The role of national innovation systems. *Cambridge Journal of Economics* 19: 67-93.

Nair-Reichert, U. and D. Weinhold. 2001. Causality tests for cross-country panels: A look at FDI and economic growth in less developed countries. *Oxford Bulletin of Economics and Statistics* 63: 153-171.

Nigh, D. 1985. The effect of political events on United States direct foreign investment: A pooled time-series cross-sectional analysis. *Journal of International Business Studies* 16: 1–17.

Perez, T. 1997. Multinational enterprises and technological spillovers: An evolutionary model. *Journal of Evolutionary Economics* 7: 169-192.

Qayoom, A., M. Ramachandran, and I. Sofi. 2013. Determinants of FDI inflows to developing countries: A panel data analysis. *Journal of International Business and Economy* 14 (2): 29-47.

Root, F. R. and A. A. Ahmed. 1978. The influence of policy instruments on manufacturing direct foreign investment in developing countries. *Journal of International Business Studies* 9 (3): 81-94.

UNCTAD. 1998. *World investment report 1998*. New York: United Nations.

UNCTAD. 2003. The development dimension of FDI: Policy and rule-making perspectives. *Proceedings of the Expert Meeting held in Geneva from 6 to 8 November 2002*. New York: United Nations.

UNCTAD. 2014. *World investment report 2014*. New York: United Nations.

Verter, V. and M. Dincer. 1992. Designing global manufacturing strategies. *European Journal of Operational Research* 60 (3): 1-18.

Wang, J. and M. Blomström. 1992. Foreign investment and technology transfer: A simple model. *European Economic Review* 36: 137-155

Wheeler, D. and A. Mody. 1992. International investment location decisions. *Journal of International Economics* 33: 57-76.

Won, Y. and F. S. T. Hsiao. 2008. Panel causality analysis on FDI: Exports-economic growth nexus in first and second generation ANIEs. The Jour*nal of the Korean Economy* 9 (2): 237-267.

APPENDIX

Table A1. Countries included in the study

Developing Countries	Developed Countries
Bangladesh	Argentina
Brazil	Australia
Bulgaria	Austria
China	Belgium
Colombia	Canada
Costa Rica	Chile
Ecuador	Czech Rep.
El Salvador	Denmark
Guatemala	Estonia
Honduras	Finland
India	France
Jamaica	Germany
Jordan	Greece
Malaysia	Hungary
Mauritius	Iceland
Mexico	Ireland
Nicaragua	Israel
Nigeria	Italy
Panama	Japan
Paraguay	Korea
Peru	Latvia
Philippines	Lithuania
Romania	Netherlands
South Africa	New Zealand
Sri Lanka	Norway
Thailand	Poland
Turkey	Portugal
Ukraine	Singapore
	Slovenia
	Spain
	Sweden
	Switzerland
	Taiwan
	United Kingdom
	United States
	Uruguay