TABLE 3
Pair-wise Granger causality between exports and CDIA, 1946-2006

Null hypothesis	OBS.	F Statistic	Probability
CDIA does not Granger Cause X	49	2.32	0.04
X does not Granger Cause CDIA	49	3.55	0.00

In the computation one should pick a lag length that corresponds to reasonable beliefs about the longest time over which one of the variables could help predict the other. For this study, a 12 year lag was chosen. The test was run using time series data for total exports and the total CDIA stock over the 1946-2006 period. The analysis tests for the joint hypothesis that all coefficients on the lagged variables are null, implying no causality.

The results show that we cannot reject both hypotheses that "CDIA does not Granger cause X" and "X does not Granger cause CDIA" (Table 3). Therefore it appears that Granger causality runs from CDIA to exports and from exports to CDIA. Quite simply, this means that if one considers the relation between Canadian exports and CDIA, past values of exports help explain CDIA and past values of CDIA help predict exports.

Gravity model

Having established that there is a two-way link between trade and direct investment abroad, the question remains as to whether these two elements are complements or substitutes. In order to answer this question for Canada, a gravity model is used to characterize the relationship between Canadian trade flows and Canadian direct investments abroad (CDIA). Gravity models are commonly used to explain bilateral merchandise trade flows between different regions or countries using economic size and distance as explanatory variables. Other variables are usually added to the model to account for the impact of various factors on the formation and the intensity of international trade patterns.

To this end, the value of Canadian exports and imports with 44 different countries[5], from 1996 to 2006, are incorporated into the model.

In the basic gravity model, bilateral trade flows are explained by the economic size of countries as approximated by their GDP. A country with a bigger GDP produces more and spends more, and consequently will have a higher supply of exports and a higher demand for imports. Therefore, a strong positive relationship between trade flows and countries' economic size is expected. Similarly, the farther the distance between two countries, the smaller is their likely bilateral trade. Distance serves as a proxy for time and transportation costs, which cause trade to be more expensive and more complicated. In this case, distances weighted with data on the principal cities are used in each country, thus allowing for the population's distribution in each country's territory.

As the main focus under study is the relationship between trade and Canadian outward FDI stock, CDIA is included as an explanatory variable. A negative relationship would imply that CDIA and trade are substitutes, and a positive one signals a complementary relation. Complementarity would indicate that when Canadian companies invest more in a specific country, Canadian trade flows with that country tend to be larger.

Other determinants of trade flows are incorporated into the model to capture their potential effects on

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5   Argentina, Australia, Barbados, Belgium, Bolivia, Brazil, Chile, China, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, France, Germany, Hong Kong SAR, Hungary, India, Indonesia, Ireland, Italy, Japan, South Korea, Luxembourg, Malaysia (1997-2006), Mexico, Netherlands, New Zealand, Norway, Panama, Peru, Philippines, Poland, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan Province of China, Turkey, United Kingdom, United States, Venezuela and Zimbabwe.