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The Determinants of Intra-Industry Trade in Insurance Services

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Abstract

In light of the growing significance of trade in financial services, and the emphasis placed on trade in financial services during the Uruguay round of trade negotiations, this article is the first study of the determinants of intra-industry trade (IIT) in insurance services. The article analyzes and measures the magnitude of IIT in insurance services for the United States. The empirical results of the determinants of IIT indicate that foreign direct investment in insurance services (FDI) is a significant contributor to the volume of trade in insurance services. These empirical findings confirm the new theoretical trade models that, unlike the traditional trade theory that considered trade and foreign direct investment in insurance services as substitutes, trade and FDI complement each other and hence multinational insurance companies are contributing to an increase in the volume of trade in insurance services. Furthermore, this study shows that trade intensity between the United States and its trading partners leads to product differentiation in insurance services and hence an increase in consumer welfare.

Introduction

Due to the importance of the financial services sector and the emphasis placed on trade in financial services during the Uruguay round of trade negotiations, trade in insurance services has grown rapidly in the last 20 years, and a number of researchers have analyzed and examined various issues related to international insurance services. The study by Sapir and Lutz (1981) investigates the sources of comparative advantage in insurance services for developed and developing countries, primarily using the Heckscher-Ohlin-Samuelson (H-O-S) model. A number of studies by Outreville (1990, 1991, 1996, 1999) have shed light on the significance and implications of growth in international insurance services. The comprehensive study by Skipper

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(1987) analyzes many facets of protectionism in the provision of international trade in insurance services and paves the way for further study in this important area. The recent study by the Organisation for Economic Cooperation and Development (OECD) (1999) identifies and analyzes the obstacles to the establishment of branches of foreign insurers which could affect the volume of trade in insurance services. The OECD (1999) highlights the fact that in many OECD member countries, specific obstacles and requirements are created in order to slow down the process of the establishment of branches or agencies by foreign insurers. Examples include deposits or financial guarantees, business records in the home country, and official certification of the supervisory authority in a home country. Other obstacles reported by the OECD (1999) include the existence of fiscal advantages, normally granted to policyholders but not granted for cross-border insurance contracts, and various legal provisions in contract law, taxation, and work permits. More important, a major obstacle for the OECD countries, which are not part of the European Union (EU), is the absence of Third Directives similar to those implemented by the EU for member countries.

Despite some obstacles in establishing branches of insurance companies, trade in insurance services has grown rapidly in the last ten years. The data from the *Survey of Current Business* and *Insurance Statistics Yearbook* show that the U.S. trade in insurance grew from $20 billion in 1992 to $30.5 billion in 1999, showing an average growth of 14 percent over this period. Similarly, trade in insurance services in Europe grew from $9.2 billion in 1990 to $27.5 billion in 1999. The gross premiums from foreign insurance companies in the United States increased from $60 billion to $130 billion over the period 1992 to 1999. Furthermore, the share of foreign insurance companies in the United States has increased from 10 to 14 percent over the period 1992 to 1999, indicating an increase in international competition and growth in trade in insurance services.

In light of the growing volumes of trade and international competition in insurance services, one of the important empirical questions to be addressed is whether exports and imports of insurance services are mainly inter-trade or intra-trade, and the main purpose of this study is to analyze and elaborate on this issue.

Intra-industry trade (IIT) is an empirical phenomenon that has been found in international trade over recent years. IIT occurs when a country simultaneously exports and imports goods or services produced by the same industry. It is different from inter-industry trade, in which a country specializes in the production of a good or service and exports it in exchange for a different good or service for which it has no comparative advantage. IIT can be well explained in the extended framework of the H-O-S theory. Some researchers such as Lipsey (1976) and Pomfret (1979) have argued the inconsistency between IIT and the H-O-S theory. However, others such as Balassa (1979), Grubel and Lloyd (1975), and Krugman (1981) have argued that IIT can be explained in the context of the H-O-S theory if one of the basic assumptions is relaxed. This assumption is the linear homogeneous production function of the first degree, i.e., constant returns to scale. Grubel (1981) has argued that the solution to the inconsistency between the real world and the basic H-O-S model is to drop the assumption of constant returns to scale. However, the recent study by Davis (1995), supported by Bernhofen (1999), is an attempt to reconcile observed IIT with the theory of comparative advantage. Davis (1995) has demonstrated that IIT could also be explained in the context of the H-O-S theory or Heckscher-Ohlin-Ricardian (H-O-R) theory of constant return to scale and perfect competition.

Despite the consistency between the H-O-S theory of trade and IIT theory, the fundamental theory behind IIT was developed as part of the new trade theories proposed by Krugman (1981), who introduced monopolistic competition with product differentiation and economies of scale as the key contributors to the volume of IIT. Furthermore, studies by Helpman (1984) and Markusen and Venables (1998, 2000) developed trade theories in the presence of foreign direct investment in insurance services (FDI) in which IIT was positively related to FDI activities. While the empirical studies of IIT took into account the contribution of economies of scale and product differentiation in generating IIT, previous studies of IIT such as Hughes (1993), Lee and Lee (1993), Cooper et al. (1993), Greenaway et al. (1994), and Bernhofen (1999) did not take into account the significant role of FDI in generating IIT. Indeed, most of the previous empirical studies of IIT in the 1980s and 1990s suffered from misspecification due to the deletion of FDI as an important positive determinant of IIT. Furthermore, most of the previous studies of IIT did not take into account the significance of trade intensity as a major contributor to the volume of IIT among countries. In addition, shortage of data has prevented researchers from investigating the presence of IIT in insurance services. However, the new sets of disaggregated data on exports and imports of insurance services now make this investigation possible for the United States and also provide an opportunity to remedy the above deficiencies of the previous models of IIT.

Thus, the purpose of this study is to test, for the first time, the determinants of IIT in insurance services between the United States and its trading partners in 1995 and 1996, as well as the two-year pooled data. In doing so, it will take into account the role of FDI as well as market openness in generating IIT, ensuring that the IIT model does not suffer from misspecification. Furthermore, it will also improve the previous methodology used in the IIT literature by using two-stage least-squares (2SLS) and two-stage nonlinear logit (2SNL) models, as opposed to the use of either the OLS or the simple logit model, which created simultaneity and measurement errors in the previous studies of IIT in manufacturing.

The empirical results of this study support the modern trade theories that link the expansion of IIT to an increase in FDI activities. In other words, unlike the traditional trade theories that considered the role of FDI as a substitute for trade, this article demonstrates that multinational insurance companies contribute to an increase in the volume of trade in insurance services and increase in the volume of IIT. Furthermore, this study shows that trade intensity between the United States and its trading partners leads to product differentiation in insurance services ad hence an increase in consumer welfare.

The remaining part of this article is structured as follows: The next section describes the measurement of IIT in insurances; the following section builds the theoretical foundation for the seven hypotheses of the determinants of IIT in insurance services; the next section presents a model of IIT; the next section explains the data and methodology used in this article, followed by an empirical analysis; and the article concludes with a discussion of major findings.

IIT Classification in Insurance Services

Balassa (1966) introduced one of the first measures of a country's intra-industry specialization:

$$Sb = (1/n) \sum_{i=1}^{n} \left[\frac{|Xi - Mi|}{Xi + Mi} \right]$$

where Sb is the value of IIT, Xi and Mi refer to the exports and imports of commodity i (or industry i), respectively, and n is the sample size. However, the Balassa index suffers from two drawbacks. One is the equal weight it assigns to all industries, irrespective of their share in total trade flows. The other is the lack of correction for trade imbalance.

Grubel and Lloyd (1975) correct for the aggregate trade imbalances in Balassa's index and suggest the following measure of IIT:

$$IIT_{ij} = 1 - \frac{|X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} \tag{1}$$

where IIT_{ij} is the level of IIT with country j in industry i's goods; X_{ij} is the home country's exports of industry i's goods to country j; and M_{ij} is the home country's imports of industry i's goods to country j.

The index has a value of one when all trade is intra-industry, and a value of zero when no IIT exists within that particular industry (indicating high inter-industry specialization).

Since the introduction of Equation (1) as a measure of IIT, a number of researchers have analyzed the theories, measures, and policies related to IIT. Some researchers, such as Loertscher and Wolter (1980) and Glejser et al. (1982), have suggested alternative measures of IIT.[1] However, their indexes for IIT suffer from certain limitations. For instance, both the Loertscher and Wolter (1980) and Glejser et al. (1982) indexes present the problem of asymmetry, having a range of values from zero to infinity. But later literature, such as Tharakan (1983), Vona (1991), Ratnayake and Jayasuriya (1991), Clark (1998), and Bernhofen (1999), has reaffirmed the credibility of the Grubel-Lloyd IIT index (1975). In addition, as Bano (1991) points out, the analysis of various alternative measures of IIT indicates that the Grubel and Lloyd measures have an advantage over the other indexes with respect to (1) the concept of an "industry" at an appropriate level of aggregation, (2) the analysis of the bias arising from trade imbalances, and (3) the formulation and testing of hypotheses concerning the phenomenon of IIT. This article uses the Grubel-Lloyd (1975) unadjusted index (i.e., Equation [1]) to measure the magnitude of IIT in insurance services.

Unlike trade in merchandise goods, trade in insurance services is not divided into two-, three-, and four-digit levels of Standard International Trade Codes (SITC). In the current account balance of some of the major OECD countries, trade in insurance services is divided into merchandise and nonmerchandise insurance services. These two categories are in turn divided into primary insurance and reinsurance. In this study, trade in nonmerchandise primary insurance services will be used to measure the determinants of IIT in insurance services for the United States.

[1] See Aquino (1978), Loertscher and Wolter (1980), and Glejser et al. (1982) for details of the indexes.

THE EMPIRICAL HYPOTHESES FOR IIT IN INSURANCE SERVICES

The IIT theory can be explained in the context of the H-O-S trade theory, and researchers such as Davis (1995) and Bernhofen (1999) have clearly demonstrated the consistency of the H-O-S theory and IIT. The theory behind IIT is developed by the extension of the H-O-S model, which assumes perfect competition and constant returns to scale. However, the new trade theories developed by other researchers incorporated other economic factors into the H-O-S trade theory that became the theoretical foundation of the determinants of IIT. Linder (1961) proposed "demand similarity," which contributes to similar products being exported and imported to the countries with similar per capita income as an important factor in determining trade in similar products among countries. Krugman (1981) introduced monopolistic competition, which demonstrates that "economies of scale" and "product differentiation" are two important determinants of trade in general as well as IIT among certain countries. Leamer (1988) and Harrigan (1994, 1996) highlighted the significance of market openness in increasing the volume of trade and hence IIT. However, this factor was not used in the empirical studies of IIT. In recent times, studies by Helpman (1984), Markusen (1994), and Markusen and Venables (1998, 2000) incorporated FDI as another important component of modern trade theory and demonstrated, on a theoretical basis, the contribution of FDI in generating IIT. Therefore, the underlying theory behind IIT evolved over the last few decades by focusing on demand similarities, economies of scale, product differentiation, market openness, and FDI.

However, most of the previous empirical studies of IIT neither tested the role of FDI as a determinant of IIT nor took into account the effects of market openness. Given the significance of FDI as a major contributor of capital flows and activities of multinational corporations (MNCs) in different parts of the world and the absence of FDI as a determinant of IIT in the empirical studies of IIT, this may have led to misspecification of the models of IIT since the mid-1980s. In this study, the above factors contributing to the theoretical foundation of IIT will be used in measuring the determinants of IIT in insurance services. In doing so, this article incorporates both country characteristics and industry characteristics into the model of IIT in insurance services.

Based on the studies of modern trade theories and the previous empirical studies of IIT, one can consider the following seven factors as possible explanatory variables needed to measure IIT in insurance services: (1) difference in per capita income, (2) market concentration in goods and services, (3) trade imbalance in goods and services, (4) differences in financial market size, (5) foreign direct investment in insurance services, (6) service flows between U.S. MNCs and their foreign affiliates, and (7) market openness.

Hypothesis 1: *An inverse relationship exists between the difference in per capita income and IIT.*

Proof of Hypothesis 1: Linder (1961) and Balassa and Bauwens (1987) propose that the difference in per capita income (DPI) represents a difference in the demand structure. These studies find that the share of IIT is negatively correlated with DPI between two trading partner countries. Similarities in demand structure will promote exports of relatively differentiated domestic products and imports of relatively differentiated foreign products. This allows economies of scale to be exploited to give more scope for differentiation of products to satisfy demand, hence leading to a higher share of

IIT in total trade. In the case of insurance, similar demand structures (represented by income levels) will create similar needs for insurance services, hence facilitating the development of trade in either local or in a trading partner country's differentiated insurance services.

Similar to Balassa and Bauwens (1987), this study does not use the absolute value of the difference between two countries' per capita incomes. As Balassa and Bauwens (1987) point out, the absolute value of the difference will be subject to a change of unit in measurement and may easily suffer a size bias. Accordingly, one can use the following formula to determine the relative difference in per capita incomes between the United States and its trading partners:

$$DPI = 1 + \frac{wLnw + (1 - w)Ln(1 - w)}{Ln2} \tag{2}$$

U.S. per capita income where w = U.S. per capita income/(U.S. per capita income + trading partners per capita income).

One can easily verify that as w approaches 1/2, DPI approaches 0. But as w takes the value closer to either 1 or 0, DPI will take the value closer to unit. This measurement has the characteristics of symmetry, i.e., DPI will take the same patterns of change along with the change of w around 1/2 to 0 or to 1. In addition, this index will provide not absolute but relative indicators of DPI, which means that results will not be subject to the unit of measurement and will not be affected by the magnitude of per capita income.

Hypothesis 2: *A positive relationship exists between the market concentration in goods and services and IIT.*

Proof of Hypothesis 2: Market concentration (or trade intensity, i.e., how much of a country's total trade is conducted with a particular country in goods and services [TIN]) is one of the country factors that contribute to the existence of product differentiation and an increase in the level of IIT with a country's partner countries. The Grubel and Lloyd (1975) index of total trade in all products with a country rises as trade volume increases. Similarly, the theory of IIT developed by Krugman (1981), Venables (1985), and Krugman (1991) indicates the existence of product differentiation as the volume of trade between countries increases. They propose that as trade volume increases, there will be greater opportunities for more differentiated products to be traded.

Consequently, given that the nature of insurance services is to protect against loss when trade in goods and services is entered into, as the volume of goods and services trade with a country increases, additional trade in insurance services between two countries is facilitated. Therefore, differentiated insurance products are developed to enter into trade, and the trade has the potential to be in both directions.

In this study, based on Grubel and Lloyd (1975) and Lee and Lee (1993), the following ratio is used to measure trade intensity in insurance services:

$$TIN = \frac{Xj + Mj}{Xt + Mt} \tag{3}$$

where *Xj* is the total exports of goods and services from the United States to country *j; Mj* is the total imports of goods and services of the United States from country *j; Xt* is the total exports of goods and services from the United States; and *Mt* is the total imports of goods and services of the United States.

Hypothesis 3: *IIT is negatively related to the trade imbalance in goods and services.*

Proof of Hypothesis 3: This hypothesis states that the share of IIT in insurance services should be negatively related to the size of the trade imbalance (TIM) in goods and services.[2] Aquino (1978) and Lee and Lee (1993) include trade imbalance as one of the explanatory variables so that this variable can control for any possible downward bias in estimating the determinants of IIT. However, other studies of IIT do not use trade imbalance as one of the variables. One explanation for the absence of this variable in other IIT studies is that the previous studies of IIT suffer from econometric inaccuracy because they mainly used ordinary least-squares (OLS) in estimating the determinants of IIT, without proper statistical diagnosis, and hence the researchers did not consider the significance of downward bias in the IIT models.

The imbalance of trade in total goods and services is applied here in determining IIT in insurance services. This article hypothesizes that the absolute share of IIT (receipts plus losses) will become smaller as the size of the trade imbalance increases.

This study, similar to the study by Lee and Lee (1993), uses the following formula to measure trade imbalance:

$$TIM = \frac{|Xj - Mj|}{Xj + Mj} \tag{4}$$

where *Xj* and *Mj* are the same as defined above.

Hypothesis 4: *IIT is negatively related to the difference of financial market size.*

Proof of Hypothesis 4: Dixit and Norman (1980), Helpman (1981), and Balassa and Bauwens (1987) hypothesize that the share of IIT in total trade will be negatively correlated with the difference in country size, as similar country size indicates economies of scale and hence a similar ability to provide differentiated products. However, empirical studies of country size were not always statistically significant, so some researchers argued that market size is a better indicator of economies of scale. In the case of insurance, this study uses the difference in financial market size (DMM) or insurance market size (DPG) as an indication of economies of scale. Countries of a similar market size will have similar insurance products, thus stimulating IIT in insurance services. This hypothesis states that the difference in insurance market size will be negatively related to IIT. Similar to per capita income, one can use Equation (2) to measure the difference in the insurance market size between the United States and its trading partners.

A number of proxies have been used to represent financial development in an attempt to measure the size of the market in insurance services. Outreville (1996) used the ratio

[2] Note that, as long as overall exports and imports do not exactly match each other, IIT can never be 100 percent. So the measure of IIT is biased downward, if the country's total trade is imbalanced.

of quasi-money (M2/M1) to the broad definition of money (M2) to measure financial development. Outreville (1990) and Liu and Woo (1994) used the ratio of M2/M1 as a proxy for this purpose. Other proxies proposed by Outreville (1999) are M2/GDP, M1/GDP, and (M2-M1)/GDP. As an attempt to find the best proxy for the size of the market with respect to IIT, this study tests all the above-mentioned proxies.

Hypothesis 5: *A positive relationship exists between FDI and IIT.*

Proof of Hypothesis 5: The new trade theories developed since the Leontief paradox in the 1950s focused on monopolistic competition, technological changes, and economies of scale as an extension of the traditional H-O-S model of trade theory.

As MNCs became more crucial for the production of goods and services, Helpman (1984) and Helpman and Krugman (1985) developed a trade theory of IIT in the presence of FDI. Their trade theory was designed to reflect the volume of trade, the share of IIT, and the share of intra-firm trade by MNCs. However, the trade theory of Helpman and Krugman in the presence of FDI was never tested. In the 1990s, Markusen (1994) and Markusen and Venables (1998, 2000) extended the trade theories of IIT in the presence of FDI developed by Helpman and Krugman in the 1980s and argued that FDI positively contributes to the volume of IIT, and hence any IIT model that attempts to test the presence of IIT should take into account the positive contribution of FDI. Markusen and Venables (1998, 2000) argued that while the cost of trade in the form of trade barriers might be high, MNCs will overcome the cost of trade by establishing themselves in the host countries and then generating trade with the source country.

Despite the growing importance of FDI in the last 20 years or so, not many empirical studies of IIT have taken into account the positive contribution of FDI in generating IIT in goods or services. The exception is the two studies in the 1980s by Caves (1981) and Balassa and Bauwens (1987), who considered the role of FDI as a negative factor to the level of IIT. Note that the study by Balassa and Bauwens (1987) was done without any reference to the important studies of Helpman (1984) and Helpman and Krugman (1985).

Caves (1981) used an inadequate proxy to measure the role of FDI in the presence of IIT, so Caves argued that his empirical result should be treated with caution. The study by Balassa and Bauwens (1987) found a mixed result, as empirical studies for the European countries showed a positive relationship between FDI and IIT, while the results of other regions found a negative relationship between FDI and IIT. Despite the hypothesis of a negative relationship between FDI and IIT, Balassa and Bauwens expressed their reservations as to whether one really should expect a negative relationship between FDI and IIT. One should also consider the fact that these two studies used data from the 1970s, when FDI was not as significant as it has become since the mid-1980s, so the negative relationship may have captured those factors that are articulated in the next hypothesis of this study, where business activities among MNCs may reduce the volume of IIT. Furthermore, Caves (1981) and Balassa and Bauwens (1987) used simple econometric techniques in estimating their IIT models. Lack of more sophisticated econometric techniques also created doubts as to whether the negative relationship between FDI and IIT was statistically meaningful. Therefore, this study hypothesizes that FDI positively contributes to the expansion of IIT in insurance services.

Hypothesis 6: *IIT is negatively related to the total service flows between U.S. MNCs and their foreign affiliates.*

Proof of Hypothesis 6: While the presence of MNCs could increase the volume of IIT in insurance services via more intra-corporation trade as well as more product differentiation, it is also possible, as Caves (1981) argued, that due to a close relationship between the parent companies and their affiliates overseas, some of the services to affiliates are provided by the parent companies, hence reducing demand for these services to be provided by the local companies.

Assume that the provision of services (EAI) between parent companies and their foreign affiliates will be a substitute for some of the insurance services, which would otherwise be purchased from the host countries. In other words, the inter-industry activities of the U.S. parent companies and their overseas locally incorporated foreign affiliates will have a negative effect on the volume of IIT between the United States and its trading partner countries in insurance services. For example, if the U.S. MNCs pay for some kind of insurance premiums on behalf of the worldwide overseas affiliates, such as the employees' automobile insurance and machinery insurance, the affiliates do not have to buy insurance coverage from U.S. insurance companies or from local insurance companies, and vice versa. It is therefore obvious that the intra-industry activities of insurance services will be reduced. So one can hypothesize that EAI will be negatively related to IIT.

Hypothesis 7: *A negative relationship exists between the difference of market openness and IIT.*

Proof of Hypothesis 7: In the past, IIT studies did not take into account the significance of market openness as an important factor in contributing to IIT. However, a number of studies have highlighted the importance of market openness in increasing the volume of trade and allowing for economies of scale and product differentiation. Studies by Leamer (1988) and Harrigan (1994, 1996) highlighted the significance of market openness in generating more trade and hence an increase in the volume of IIT. In the past, all the main studies of IIT such as Caves (1981), Balassa and Bauwens (1987), Hughes (1993), Lee and Lee (1993), Cooper et al. (1993), Greenaway et al. (1994), and Bernhofen (1999) have ignored market openness as one of the contributors to the volume of IIT.

Despite trade barriers and the restricting influence of national regulations on IIT in insurance services, a new era of free trade in services, following the successful conclusion of the Uruguay trade negotiations, saw growth in the importance of insurance service liberalization and deregulation. The more open an economy is, the more opportunities there are for insurance companies to internationalize their products, leading to a higher degree of IIT. In the absence of a better proxy to capture the nature of market openness in insurance industry in the United States, which is subject to different state regulations and laws, express the measurement of market openness (DGL) as globalization, which is abstracted from the *World Competitiveness Yearbook*. On a scale of 0 to 10, the measure gives higher value to the countries where globalization is not threatening the economy. The United States is ranked as one of the highest. One can expect that the difference in market openness between the United States and its trading partner countries will have negative effects on IIT in insurance services.

THE MODEL FOR IIT IN INSURANCE SERVICES

The structural model of IIT in insurance services should be similar to that of trade in goods. Based on the previous discussions, the proposed model for IIT in insurance services in the United States is as follows:

$$IIT = f(DPI, TIN, TIM, DMM, FDI, EAI, DGL)$$

Thus, express the model for IIT in insurance services in the United States as:

$$IIT = \beta_0 + \beta_1 DPI + \beta_2 TIN + \beta_3 TIM + \beta_4 DMM + \beta_5 FDI + \beta_6 EAI + \beta_7 DGL, \quad (5)$$

where *IIT* is IIT in insurance services as measured by Equation (1); *DPI* is the difference in per capita income between the United States and its trading partners; *TIN* is the trade intensity in insurance services between the United States and its trading partners; *TIM* is the trade imbalance in insurance services between the United States and its trading partners; *DMM* is the difference in financial market size between the United States and its trading partners; *FDI* is foreign direct investment abroad in insurance services of the United States with its trading partners; *EAI* is business flows in services between the U.S. MNCs and their foreign affiliates; and *DGL* is the difference in market openness between the United States and its trading partners.

With the following expected signs:

$$\beta_1 < 0, \beta_2 > 0, \beta_3 < 0, \beta_4 < 0, \beta_5 > 0, \beta_6 < 0, \beta_7 < 0.$$

All variables are expressed in either nominal U.S. dollars (e.g., FDI in insurance) or percentage (for the measurements of differences and TIN and TIM).

DATA AND METHODOLOGY

The IIT model uses cross-sectional as well as the two-year pooled international insurance trade data for 1995 and 1996 for the following 26 countries: Canada, Belgium, Luxembourg, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, Mexico, Venezuela, Israel, Australia, China, Hong Kong, India, Indonesia, Japan, South Korea, Singapore, Taiwan, Thailand, and South Africa. These are the only economies for which IIT data in insurance are available.

The exports and imports of insurance services of the United States and its trading partner countries, the trade flows in services between the U.S. MNCs and their foreign affiliates in which the United States has trade in insurance services, and foreign direct investment in insurance services are from the *Survey of Current Business.* The data for total trade in goods and services between the United States and its trading partner countries are from *IMF Direction of Trade Statistics Yearbook.* The data for insurance premiums are from *Swiss Reinsurance, Sigma*. Each country's population, national income, gross domestic product (GDP), and monetary base (M1 and M2, except for the United Kingdom and Sweden) data are from *International Financial Statistics.* The monetary base data of the United Kingdom and Sweden are from the Bank of England and Sveriges Riksbank, respectively. The data for market openness are from *The World Competitiveness Yearbook for 1999*. Taiwan's data are from the *Statistical Yearbook of Republic of China* and *Taiwan Statistical Data Book.*

Estimate the proposed model by the following econometric means: OLS, nonlinear logit, two-stage least-squares (2SLS), and two-stage nonlinear logit (2SNL). First estimate the model using OLS for each of the two years and for the 1995–1996 pooled data set. Conduct various diagnostic tests for heteroskedasticity, model misspecification, and nonnormality of the error terms. Apply the Chow test to the pooled sample to see whether there is a structural change between the 1995 and 1996 samples.

The proposed model has the form of a linear probability model with constraints on the end values of the dependent variable, namely the constraint that the value of IIT must be between the values of zero and one. Estimates of IIT using OLS would not satisfy this constraint and hence, an alternative estimation method is required and the nonlinear logit model is chosen for this purpose.

For the nonlinear logit model, use the following logit probability function as a functional form: namely,

$$IIT_{it} = 1/(1 + \exp(-\beta' X_{it})) + e_{it}, \tag{6}$$

where X_{it} is the vector of explanatory variables and e_{it} is the disturbance term. Equation (6) is a nonlinear model and can be estimated using nonlinear least-squares.

While the nonlinear logit model restricts the estimated values of IIT to be between the values of zero and one, the regression model estimates would be biased and inconsistent due to simultaneity bias. This problem is due to the fact that the explanatory variables FDI and IAI are also functions of IIT and hence are endogenous variables. Nevertheless, using the 2SLS estimation method can mitigate this problem. The method involves two stages. In the first stage, the reduced-form equations of both FDI and IAI are estimated, and in the second stage, the values of both FDI and IAI are replaced by their respective fitted values obtained in the first stage, and Equation (6) is estimated using nonlinear least-squares. For the estimation of the reduced-form equations for FDI and IDI, the additional explanatory variables used include FDI(−1), IAI(−1), and IIT(1). For comparison, the linear model of Equation (5) is also estimated using 2SLS.

EMPIRICAL RESULTS

Table 1 reports the regression results and diagnostic tests, and Table A1 in the Appendix reports the correlation matrix of all the variables. As can be seen from Table 1, the OLS estimates for the linear model and the nonlinear least-squares estimates for the nonlinear logit model are rather similar in terms of the signs and the significance of the explanatory variables. At the 5 percent level, only one variable (TIM) is significant for the OLS results, while only two variables (TIM and DPI) are significant for the nonlinear logit results. Moreover, the coefficient of the variable *TIM* has the wrong sign for both sets of results.

The 2SLS results have substantial improvements in both the linear model and the nonlinear logit model.

Several diagnostic tests were carried out. The results of the Chow test for structural change between the 1995 and 1996 data sets suggest that no significant difference exists between the two data sets and that one can combine the two data sets. A few tests for heteroskedasticity were also carried out, but this study reports only the Breusch-Pagan test results since both the likelihood ratio and the White tests for heteroskedasticity yielded similar results. All test results indicate that the 2SLS estimates have

TABLE 1
Regression Results and Diagnostic Tests of U.S. IIT in Insurance Services

	Linear Model						Nonlinear Logit Model					
	OLS			2SLS			Nonlinear Least-Squares			2SNL		
	1995	1996	1995-6	1995	1996	1995-6	1995	1996	1995-6	1995	1996	1995-6
Constant	0.26	0.38	0.32	3.42	10.17	4.15	2.86	−0.95	−0.96	14.08	45.43	17.50
	(1.12)	(1.56)	(2.38)**	(4.17)***	(7.19)***	(6.56)***	(0.76)	(−1.20)	(−1.56)	(3.09)***	(8.07)***	(6.00)***
DPI	−0.22	−0.41	−0.35	−2.11	−6.61	−3.15	−1.62	−2.82	−1.91	−9.68	−31.22	−15.15
	(−0.88)	(−1.48)	(−1.58)	(−4.15)***	(−7.34)***	(−7.27)***	(−1.61)	(−1.67)	(−2.20)**	(−3.53)***	(−8.51)***	(−6.67)***
TIN	1.70	−1.08	1.43	55.20	122.38	71.15	9.31	5.80	6.54	253.12	579.87	343.71
	(1.19)	(0.78)	(1.46)	(3.94)***	(7.01)***	(6.40)***	(1.25)	(0.97)	(1.58)	(3.41)***	(8.34)***	(6.19)***
TIM	0.89	0.62	0.76	−1.40	−13.50	−4.37	4.94	2.92	3.39	−6.16	−63.31	−20.71
	(2.26)**	(1.56)	(3.46)***	(−1.96)*	(−6.62)***	(−5.21)***	(2.11)**	(2.31)**	(3.36)***	(−1.77)*	(−7.92)***	(−5.37)***
IAI	2.18×10^{-4}	5.09×10^{-5}	1.26×10^{-3}	−0.02	−0.07	−0.03	5.19×10^{-4}	9.53×10^{-5}	6.29×10^{-4}	−0.10	−0.31	−0.16
	(0.90)	(0.20)	(1.17)	(−3.80)***	(−6.95)***	(−6.22)***	(0.39)	(0.12)	(1.30)	(−3.33)***	(−8.25)***	(−6.14)***
FDI	-2.21×10^{-6}	2.81×10^{-6}	3.97×10^{-7}	6.38×10^{-4}	1.95×10^{-3}	9.82×10^{-4}	-7.86×10^{-5}	1.74×10^{-5}	-1.25×10^{-6}	2.92×10^{-3}	9.25×10^{-3}	4.74×10^{-3}
	(−0.22)	(0.28)	(0.10)	(3.68)***	(6.96)***	(6.25)***	(−1.00)	(0.63)	(−0.07)	(3.22)***	(8.26)***	(6.15)***
DMM	0.17	0.26	0.32	−22.86	−74.42	−34.69	6.71	5.22	3.16	−104.72	−348.15	−165.14
	(0.07)	(0.01)	(0.23)	(−3.58)***	(−6.88)***	(−5.99)***	(0.59)	(0.62)	(0.51)	(−3.12)***	(−7.94)***	(−6.01)***

DGL	−2.64	−0.20	−1.23	−43.58	−3.05	−3.46	−171.31	9.75	−2.06	−226.40	−17.53	−20.10
	(−0.77)	(−0.05)	(−0.47)	(−1.83)*	(−1.63)	(−1.95)*	(−1.16)	(0.58)	(−0.20)	(−1.66)	(−2.21)**	(−2.68)**
Adj R^2	0.17	0.03	0.24	0.58	0.75	0.64	0.22	0.08	0.26	0.56	0.75	0.65
LLF	1.1	1.58	1.76	9.51	18.28	20.63	1.85	1.96	2.16	9.01	18.4	21.32
NOB	25	25	50	25	25	50	25	25	50	25	25	50
Chow-test	–	–	0.28	–	–	1.02	–	–	–	–	–	–
BP	12.04*	12.94*	13.21*	6.67	4.12	6.38	16.80**	31.98***	8.59	11.03	5.6	2.95

Note: Student *t*-values are given in parentheses. The asterisks ***, **, and * denote 1, 5, and 10 percent level of significance for two-tail tests. The variables are: IIT = intra-industry trade in insurance services measured by Equation (1); DPI = difference in per capita income between the United States and its trading partners; TIN = trade intensity in insurance services between the United States and its trading partners; TIM = trade imbalance in insurance services between the United States and its trading partners; DMM = difference in financial market size between the United States and its trading partners; FDI = foreign direct investment abroad in insurance services of the United States in its trading partners; IAI = business flows in services between U.S. MNCs and their foreign affiliates; DGL = difference in market openness between the United States and its trading partners.

no heteroskedasticity for both the linear model and the nonlinear logit model. Hence, heteroskedasticity is not a problem.

The negative significance of DPI confirms Hypothesis 1, which states that dissimilarities in demand structure or resource endowments (which are represented by per capita income) will reduce the possibility of exports of relatively differentiated domestic insurance products and imports of relatively differentiated foreign insurance products. Similar levels of income will create similar needs for insurance, hence facilitating the development and trade of differentiated insurance services. This implies that developed (high-income) countries mainly trade with developed (high-income) countries and developing (low-income) countries.

The positive significance of TIN verifies the validity of including it as one determinant in analyzing IIT in insurance services. This finding supports the theoretical model of Krugman (1981) that trade intensity is one of the factors that contributes to product differentiation. The market concentration (TIN) of total goods and services trade relates positively to IIT, because as the trade volume with a country increases, there will be more chances for more differentiated products to be traded in insurance services. Insurance is used to protect potential losses in trade, so the variety of insurance products will expand as trade volume of total goods and services increases.

The negative significance of TIM confirms that the share of IIT will become smaller as the size of the trade imbalance increases. In other words, trade imbalance will negatively influence the degree of IIT in insurance services. This is consistent with the Grubel-Lloyd theory of IIT (1975) and the possible TIM, which was further articulated by Aquino (1978).

The negative significance of the DMM, measured as (M2-M1)/M2, indicates their suitability to be incorporated in the independent variables to explain IIT.[3] The dissimilarity of the financial market size, which is proxied by the difference in the ratio of M2-M1 to M2, represents economies of scale and the different ability of a particular country to provide differentiated insurance products. The more different the ability of the United States and its trading partner countries to provide differentiated insurance products is, the less likely that the degree of IIT in insurance services will be high.

The positive significance of FDI shows that an MNC's activity abroad can have a profound influence on IIT in insurance services. This is consistent with the theoretical trade models of Helpman and Krugman (1985) and Markusen and Venables (1998, 2000) who argued that FDI and trade will complement each other in the presence of IIT. This result is quite significant, and it indicates that multinational insurance companies stimulate trade and product differentiation.

The negative significance of total service trade flows (EAI) between U.S. MNCs and their foreign affiliates can reduce the need for IIT, since EAI removes the chance for intra-trade between the source and host countries in insurance services. In other words, inter-industry trade in services (between U.S. MNCs and their foreign affiliates in this

[3] In addition to using the ratio (M2-M1)/M2 as a proxy for financial development, this study also used the ratio M2/M1 and premium/GDP, and the empirical results were also statistically significant. However, the empirical results of the financial market size proxied by M1/GDP and (M2-M1)/GDP were not statistically significant.

case) complements IIT (between U.S. MNCs and the foreign insurance companies in the United States or between foreign affiliates and local insurance companies in the host countries).

Finally, the negative significance of the DGL supports Hypothesis 7, which states that a more open economy will encourage the internationalization of insurance products and hence a greater volume of IIT. This result is consistent with the theoretical models of Leamer (1988) and Harrigan (1994, 1996) which show that market openness will contribute to the expansion of trade and hence IIT. Those countries that want to engage in international economic activities will be best served by following the trend toward globalization and deregulating their insurance industries.

CONCLUSION

The purpose of this article is to measure, for the first time, the extent of IIT for insurance services. This article takes into account the evolution of traditional trade theories that led to the emergence of new trade theories with an emphasis on monopolistic competition, product differentiation, economies of scale, and FDI as the factors contributing to an increase in the volume of IIT.

The following seven hypotheses capture factors identified as the key determinants of IIT in insurance services: (1) difference in per capita income, (2) market concentration in goods and services, (3) trade imbalance in goods and services, (4) differences in financial market size, (5) foreign direct investment in insurance services, (6) service flows between U.S. MNCs and their foreign affiliates, and (7) market openness.

The empirical results support all the above hypotheses, including the positive role of FDI in generating IIT. This result indicates that the IIT model of insurance services has captured the key factors that are important in increasing the volume of IIT in insurance services accurately. The positive role of FDI in contributing to an increase in the volume of IIT supports the new trade theories that emphasize the role of MNCs in complementing the increase in the volume of trade rather than being seen as a substitute for trade. Furthermore, trade intensity between the United States and its trading partners contributes to the existence of product differentiation in insurance services and hence an increase in consumer welfare.

Finally, the difference in the openness of the domestic market between the United States and its trading partner countries can negatively influence the degree of IIT. This is because the greater number of opportunities provided by a more open economy can facilitate the internationalization of the insurance companies' products, hence leading to a higher degree of IIT.

APPENDIX 1

TABLE A1
Correlation Matrix

	1995							
	IIT	DPI	TIN	TIM	IAI	FDI	DMM	DGL
IIT	1.00							
DPI	−0.34	1.00						
TIN	0.33	−0.12	1.00					
TIM	0.24	0.30	−0.17	1.00				
IAI	0.36	−0.38	0.45	−0.26	1.00			
FDI	0.26	−0.41	0.25	−0.25	0.78	1.00		
DMM	−0.10	−0.07	−0.06	−0.27	−0.20	−0.19	1.00	
DGL	−0.25	0.63	−0.05	0.28	−0.11	−0.27	−0.30	1.00
	1996							
	IIT	DPI	TIN	TIM	IAI	FDI	DMM	DGL
IIT	1.00							
DPI	−0.41	1.00						
TIN	0.22	−0.12	1.00					
TIM	0.11	0.36	−0.19	1.00				
IAI	0.28	−0.36	0.40	−0.32	1.00			
FDI	0.27	−0.34	0.25	−0.28	0.83	1.00		
DMM	−0.09	−0.13	−0.10	−0.31	−0.23	−0.24	1.00	
DGL	−0.25	0.68	−0.05	0.33	−0.13	−0.26	−0.38	1.00
	1995 + 1996							
	IIT	DPI	TIN	TIM	IAI	FDI	DMM	DGL
IIT	1.00							
DPI	−0.38	1.00						
TIN	0.28	−0.12	1.00					
TIM	0.17	0.33	−0.18	1.00				
IAI	0.32	−0.37	0.43	−0.29	1.00			
FDI	0.26	−0.37	0.25	−0.27	0.80	1.00		
DMM	−0.10	−0.10	−0.08	−0.29	−0.22	−0.22	1.00	
DGL	−0.25	0.65	−0.05	0.31	−0.12	−0.26	−0.34	1.00

Note: IIT is IIT in insurance services as measured by Equation (1); *DPI* is the difference in per capita income between the United States and its trading partners; *TIN* is the trade intensity in insurance services between the United States and its trading partners; *TIM* is the trade imbalance in insurance services between the United States and its trading partners; *DMM* is the difference in financial market size between the United States and its trading partners; *FDI* is foreign direct investment abroad in insurance services of the United States with its trading partners; *EAI* is business flows in services between the U.S. MNCs and their foreign affiliates; and *DGL* is the difference in market openness between the United States and its trading partners.

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