Composition of Trade between Australia and Latin America: Gravity Model[*]

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Abstract

This paper aims to analyse the value of merchandise through a broad category of trade between Australia and nine selected Latin American countries by using a gravity model focusing on the period from 1998 to 2004. The traditional cross-sectional data is a useful tool to understand this bilateral trade focusing on exports and imports through primary products, manufactured products, and total merchandise trade. The general thrust of the analysis regarding trade composition implies that Australian trade with Latin America has been shaped by political and economic variables. The trade of primary products is explained by economic distance, openness, population, and political influence. Economic mass along with economic distance are significant explanatory variables in the trade of manufactured products. Political influence on bilateral trade has been significant in most Latin American countries – captured by a dummy for presidential changes – exceptions are: Argentina, Chile, and Uruguay.

Key words: trade, gravity model, Latin America, Australia, cross-sectional data.

JEL classification codes: F14, F15, F41.

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1. Introduction

In terms of market size, the largest Latin American markets – Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela – are as significant for Australian trade as the emerging Asian markets – China, Indonesia, Malaysia, South Korea, Taiwan, and Thailand (Blanco, 2000). Nowadays, Brazil and Mexico are the most important Australian trade partners in Latin America. They also have the oldest diplomatic relationships in the region with Australia (62 and 41 years, respectively). The Latin American region has experienced rapid economic and political change in recent years. The new Latin American business environment increases expectations for trade growth with Australia.

Currently, bilateral trade between Australia and Latin America is scant, representing 1.5% share of Australian total world trade in 2005 (IMF, 2006). Latin American countries seem to have difficulties establishing a stable trade relationship with Australia. However, Argentina, Brazil, Chile, and Mexico have long-term bilateral relationships. The study of the main factors affecting the commodity composition is important to understand the paths of this trade. We are aware of only few previous empirical studies of Australian trade with the Latin American countries. For example, Battersby and Ewing 2005 used a gravity model to predict international trade of Australia –covering 3 Latin American countries Argentina, Brazil and Mexico in the data of bilateral trade between 73 countries.

The possibilities of negotiating Free-Trade Agreements (FTA) between Australia and three Latin American countries – Brazil, Chile, and Mexico – have been considered (Truss, 2006b). Recently, Australia signed a number of bilateral agreements to facilitate further trade with these three countries. For example, air-service agreements were signed with Mexico in 2005 and with Brazil in 2006 (Truss, 2006a).

These agreements allow international airlines from both participant countries to operate passenger and all-cargo services. A Double-Taxation Agreement was signed between Australia and Mexico (2004) and another one is under negotiation with Chile (2007). Memorandums of Understanding (MOU) on mining were signed with Mexico in 2002 and with Chile in 2006 (MacFarlane, 2006). An MOU on education and training was signed with Mexico in 2003 and with Brazil in 2005. Mexico has had an MOU on energy and an Investment Protection and Promotion Agreement with Australia since 2005.

The objective of this paper is to analyse the performance of trade between Australia and Latin American countries and to identify the most relevant factors that have shaped the composition of trade for the period from 1998 to 2004. Empirical analysis has used the gravity model – cross-sectional data – for broad categories of total exports and total imports. Traditional economic variables such as population, per-capita income of the importing and exporting country, and bilateral exchange rate along with non-traditional variables such as openness and political changes are used in the analysis.

The term "Latin American countries" has been used to refer to different groups of countries. For example, The Australian Department of Foreign Affairs and Trade (DFAT) includes as Latin American countries all Central American and South American countries (DFAT, 2006). However, in this paper, Latin American countries refer to a group of the nine major Australian trade partners in the region: Argentina (ARG), Brazil (BRA), Chile (CHI), Colombia (COL), Ecuador (ECU), Mexico (MEX), Peru (PER), Uruguay (URU), and Venezuela (VEN). These countries are located in the continental part of South America, except for Mexico in North America. The commodity composition of trade by broad categories was

studied by using the Australian DFAT data sets. Major trade categories comprise total primary products and total manufactured products.

The remainder of this paper is organized as follows. The next section describes briefly the background of the trade between Latin American countries and Australia. The third section refers to the theory of the gravity models and the empirical model for the paper. The fourth section presents the results of the empirical analysis. The fifth section concludes.

2. Background

Australian trade with the nine Latin American countries selected has increased from US$12.5-million in 1950 to US$3,145.3-million in 2005 (IMF, 2006). Latin American countries account for less than 1.5% of Australian total exports. In the past, these regions were seen as competitors (agricultural producers and mining exporters) rather than trading partners. However, in recent years economic relations between Australia and some of the Latin American countries have increased. In 2005, more than 130 Australian companies were operating in Mexico, Argentina, and Chile with investments close to AU $7.4 billion (DFAT, 2006).

The two main Australian trade partners in Latin America are Brazil and Mexico, as shown on Table 1. However, Brazil ranks only as the 24th Australian export partner and Mexico as the 30th Australian import partner in 2005-2006.

In general, Australian imports from the region have been concentrated in elaborately transformed manufactures. Taking into account the broad composition of imports, there are two groups of countries importing from Australia. The first group, concentrated in imports of manufactured products, includes Argentina, Brazil, and

Mexico (See Table 2). The other group, with imports concentrated in primary products, includes Chile, Colombia, Ecuador, Peru, and Uruguay.

Table 1. World rank of Australian trade partners in Latin America, 2005-06

Ranking in LACs	AUS M	Rank	AUS X	Rank	Total Bilateral trade (X+M)	Rank
1	MEX	30th	BRA	24th	MEX	29th
2	BRA	34th	MEX	28th	BRA	30th
3	ARG	44th	ARG	44th	ARG	45th
4	CHI	50th	Chile	45th	CHI	48th
5	PER	59th	PER	57th	PER	64th
6	COL	67th	COL	87th	COL	83rd
7	URU	80th	VEN	90th	URU	93rd
8	ECU	91st	URU	100th	VEN	100th
9	VEN	132nd	ECU	132nd	ECU	117th

Data source DFAT, 2006.

Table 2. Composition of Bilateral trade 2004

	Australian Imports	Australian Exports
ARG	Manufactures (71%) motor vehicles, leather, fish, "Soft" fixed vegetable fats and oils, Electrical equipment for circuits	Primary products (80%) coal, crude vegetable materials, wool, civil engineering equipment, and passenger motor vehicles.
BRA	Manufactures (66%) motor vehicles, fruit juices, animal feed, pulp and paper mill machinery, and coffee.	Primary products (46%) coal, nickel, crude petroleum, vehicles, and medicaments
CHI	Primary products (73%) pulp and waste paper, fish, wood, explosives, pyrotechnic products, preserved fruit and preparations.	Primary products (54%) coal, Internal combustion piston engines, civil engineering equipment, coke, machinery.
MEX	Manufactures (93%) telecommunication equipment, motor vehicle parts, medicaments, and internal combustion piston engines.	Primary products (67%) coal, meat, leather, butter, and motor vehicle parts.
LACs	motor vehicles, manufactured base metals, and telecommunication equipment.	coal, dairy products, meat, and nickel.

Data source: DFAT, 2005.

Since the early 1990s Australian exports to Latin American countries have been concentrated on primary products, especially fuels. Latin America predominantly imports coal from Australia and its share over the total imports has been growing. In fact, in 2005 more than 50% of Latin American imports from Australia were coal (ARG 70%, MEX 62%, BRA 52%, and CHI 50%), see Figure 1. In 2005, coal exports to Latin America increased on average by 56% (MEX 94%, BRA 54 %, and ARG 95%).

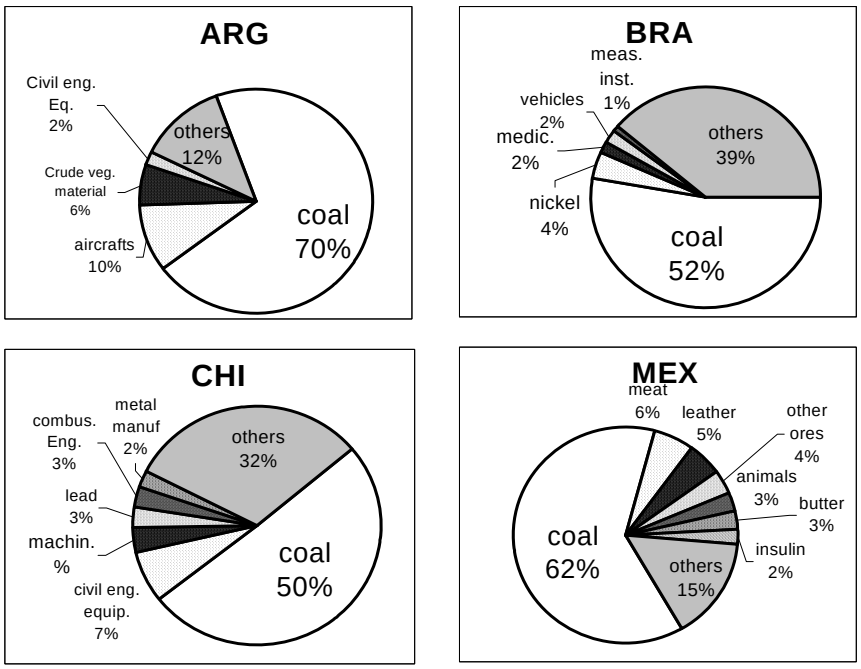

Figure 1. Import composition of main Australian partners in the region 2005.

Data source: DFAT, 2006.

Total Latin American imports from Australia were more volatile than total Australian imports from Latin America during the whole period studied. The highest growth rates of exports (55.4%) and imports (40.4%) appeared during the last decade. Figure 2 shows the evolution of the bilateral merchandise trade (Australian exports

and Australian imports) by major category – primary products, manufactures and total merchandise - for 1992 to 2004.

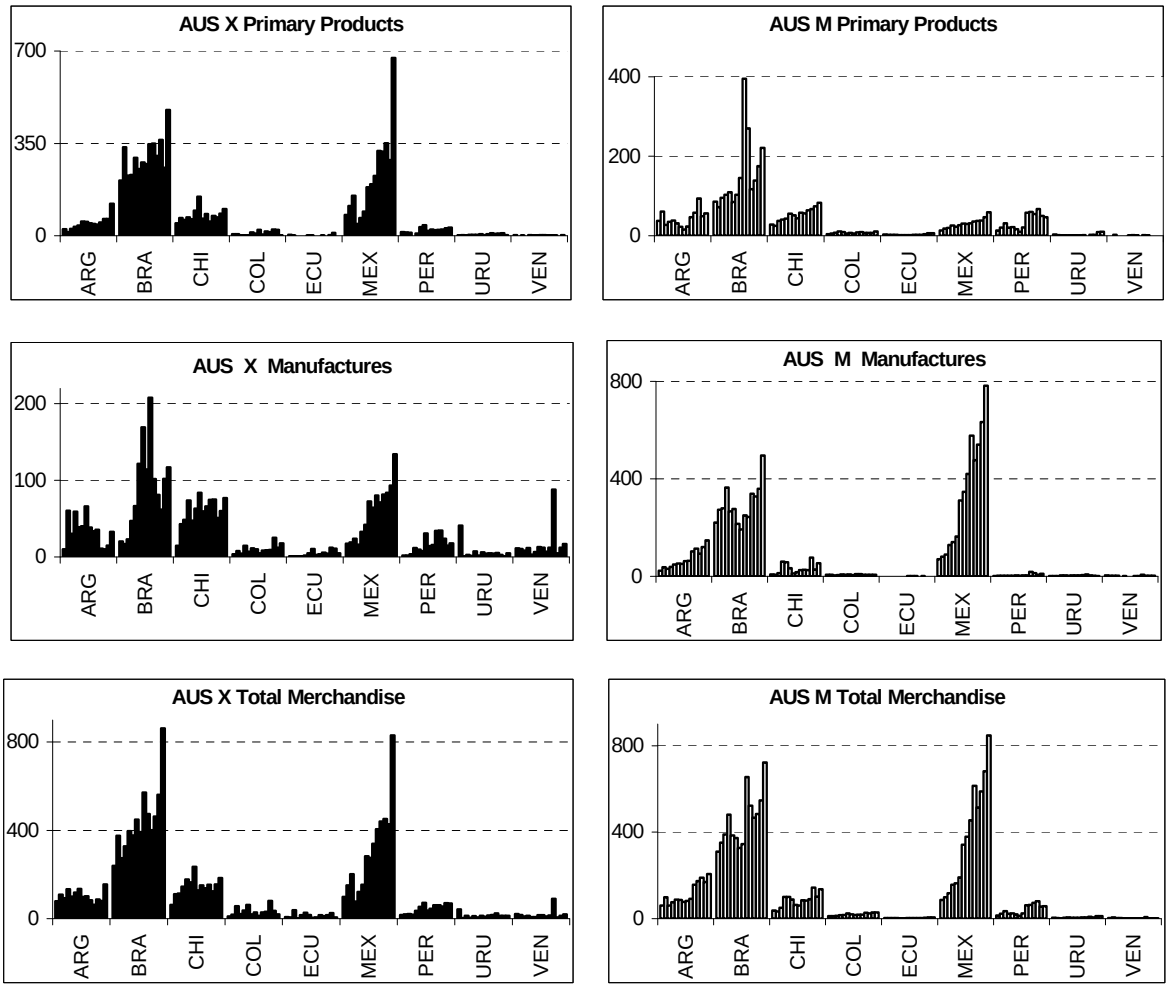

Figure 2. Bilateral trade by category (A$ million) 1992-2004

Data source: DFAT, 1990- 2006.

The Latin American countries selected in this study can be classified into three groups, bearing in mind the multilateral trade blocs in the region. One group is the Southern Cone Common Market, "*Mercado Común del Sur"* or (Mercosur), which includes Brazil, Argentina, and Uruguay. The Andean Community, "*Comunidad Andina de Naciones*" (CAN), includes Colombia, Ecuador, Peru, and Venezuela.

The last group compromises two independent Latin American countries – Chile and Mexico.

As noted in Table 3, the Latin American countries selected is a heterogeneous group with a broad range of real income (from US $ 4,881 in Ecuador to US $15,161 in Chile for 2004), and size – area and population. However, these countries have similar characteristics in terms of cultural background, location, and socio-economic history.

Table 3. Geographic and economic variables in 2004

Country	Geographical Distance to AUS (km)	Area (thousand) Km	Real Openness	Population (thousands)	RGDPTT US$*	Real Bilateral exc. Rate* 1 $ AUS =
ARG	11725	2,767	22.9	39,114.3	12315.44	2.15
BRA	14049	8,512	33.4	184,545.8	7839.19	2.15
CHI	11312	757	71.1	15,834.9	15160.99	448.13
COL	14416	1,139	42.4	42,313.0	6639.15	1933.09
ECU	13689	284	76.9	13,909.6	4880.68	0.74
MEX	13164	1,958	66.8	105,699.1	8882.84	8.30
PER	12845	1,285	35.9	28,829.0	4850.64	2.51
URU	11774	177	40.8	3,437.4	10717.97	21.11
VEN	15439	912	42.4	25,100.2	8363.00	1390.89
AUS		7,692	48.9	19,942.4	32182.83	

* At constant prices 2000.

Data source: Heston, Summers and Aten, 2006.

Although the current trade between Australia and Latin America is based on a small range of products, it is recognized that opportunities exist for expansion (Downer, 2000). Significant Australian export opportunities exist in sectors such as environment, telecommunications, mining, transportation, agribusiness and processed foods (Blanco, 2000; DFAT, 2007).

3. Gravity model

The theoretical framework to evaluate the bilateral trade relationship between the selected Latin American countries and Australia is based on a gravity model, which has been successfully used by many scholars for almost five decades (Balistreri and Hillberry, 2006; Battersby and Ewing, 2005; Kalbasi, 2001; Sanso, Cuairan, and Sanz, 1993; Geraci and Prewo, 1977; and Pulliainen 1963). There are two possibilities for measuring bilateral trade flows: at the point of exports or at the point of imports. Some scholars have been using the export side of trade such as Kristjánsdóttir, 2005. However, other scholars have used the import side. In this study, Australian imports from Latin America and Australian exports to Latin America are studied.

Numerous empirical studies have successfully used the physical principle of gravity: *two opposite forces determine the volume of bilateral trade between countries* (De Benedictis and Vicarelli, 2005). Modeling of bilateral trade flows was initially independently started by Tinbergen (1962) and Pöyhönen (1963), based on the theory that trade between any two countries is determined by their national incomes and their geographical distance (Taplin, 1967). Linnemann (1966) modified the Tinbergen and Pöyhönen model by incorporating the population of the importing and exporting countries. Over time, the initial gravity equation has been transformed. The variables included in such models are not strictly prescribed. Sanso, Cuairan, and Sanz (1993) introduce the basic formula for the gravity equation as:

(1) $$M_{ij} = A Y_i^{\beta 1} \; Y_j^{\beta 2} L_i^{\beta 3} L_j^{\beta 4} D_{ij}^{\beta 5} \; eu^{ij}$$

where:

M_{ij} = value of sales from country i to country j

A = constant

Y = value of income

L = population

D_{ij} = distance between i and j

u_{ij} = normal random error.

Some authors, such as Anderson (1979), Bergstrand (1985), and Bergstrand (1989), used its basic formulation as a log-linear function. The theoretical framework of the gravity equation can be derived from various theoretical trade models (Deardorff, 1995). "Gravity equations establish a link between trade and its determinants conditional on the observed production and consumption patterns, which draw inference on trade flows from the underlying general equilibrium structure determining production and consumption allocations" (De Benedictis and Vicarelli, 2005, p.1).

The gravity models have also been used to analyze trade agreements and trade unions. Traditionally, the gravity model uses a multilateral setup. Nevertheless, some scholars have used a country-centered specification (Lissovolik and Lissovolik, 2006). Kucera and Sarna (2006) introduced a cross-country gravity model, evaluating 162 countries for the 1993 to 1999 period. Recent research on Latin American trade by using a gravity model has studied Mercosur-European Union trade (Martinez-Zarzoso and Nowak-Lehmann, 2002). Carrillo and Li (2002) studied the effect of the Andean Community and Mercosur on intra-regional and intra-industrial trade by applying the gravity model for the period from 1980 to 1997. In 2006, Agudelo, Benitez, and Davidson used a gravity model to study the evolution of trade in South America from 1980 to 2001. They focus on the Mercosur and the Andean Community. In Australia, different scholars have used the gravity model.

For example, Battersby and Ewing (2005) examined the influence of remoteness upon the level of Australia's aggregate level of trade by using a gravity trade model. Some recent studies have focused on the analysis of commodity composition of trade by using cross-section gravity models. The characteristic of a cross-section approach is to employ import or export data for many countries at a single point in time. Kalbasi (2001) used data for the years 1990 to 1998 to analyze the commodity composition of trade. Martínez, Fontoura and Proença (2002) focused on the trade of manufactured products among the 25 members of the European Union. Kristjánsdóttir (2005) applied a gravity model to examine Icelandic exports by using a panel data from 4 sectors to 16 countries over an 11-year period.

Selection of Variables

There are some broadly used variables in the gravity model. For instance, population and income are the most popular variables. The actual bilateral exchange rate variable represents the price of commodities trade. The explanatory variables used in this gravity model are the traditional macroeconomic variables (income and population) for each individual exporting and importing country and other trade variables specific for both countries (economic distance, economic mass, actual bilateral exchange rate, and lagged dependent variable – imports, exports, and total trade. These lagged variables are incorporated into the model to sketch features of the relation between past and present trade patterns. These are expected to capture aspects related to past promotion or restraint of this bilateral trade. Table 4 is a summary of explanatory variables.

Table 4. Summary of explanatory variables

Explanatory variables	***Proxy***	***Previous studies***
Income	Per capita GDP (importer and exporter countries)	Bergstrand, 1989; Sanso, Cuairan and Sanz, 1993; Kalbasi, 2001; Martinez, Fontoura and Proença, 2002; Guttmann and Richards, 2004.
Population	Total population (importer and exporter countries)	Sanso, Cuairan and Sanz, 1993; Kristjánsdóttir, 2005;
Exchange rate	Real Bilateral exchange rate (Latin American units of currency that can be purchased by one AU$)	Martinez, Fontoura and Proença, 2002
Openness	Total X+Total M /real GDP (importer and exporter countries)	Guttmann and Richards, 2004.
Economic mass		Battersby and Ewing, 2005
Economic distance	Geographic distance and Per capita GDP between both countries	Serlenga and Shin 2004; Kristjánsdóttir, 2005.
Dummy variables	Presidential changes	Cortes, Sanyal and Cullen, 2005.

Income

Income is one of the most traditional enhancement variables in bilateral trade. Some scholars have used income as the total GDP of a country (Geraci and Prewo, 1977 and Bergstrand 1985 and 1989), while others have used per-capita income (Bergstrand, 1989 and Sanso, Cuairan, and Sanz, 1993). The total GDP is influenced by the size, extension, and population of the country. Some scholars have included per-capita income as a proxy for the income share distribution and thus the capital and labor intensity of each country. Martínez, Fontoura and Proença, (2002) argued that the GDP must be the proper measure of the country's potential trade. This study

uses the Real Gross Domestic Income adjusted for changes in the terms of trade (RGDPTT) from the Penn World Table version 6.2 (Heston, Summers and Aten, 2006). The GDP of the exporting country measures productive capacity, while that of the importing country measures absorptive capacity. These two variables are expected to be positively related to trade (Kalbasi, 2001).

Population

Population is an important traditional explanatory variable because it represents the physical size of a country and therefore is a measure of the diversification of its economy. A large population in a country implies that it is a diversified economy, self-sufficient, and therefore with less trade. Nevertheless, if a country has a diversified economy, there is more opportunity for trade in a large variety of goods. Therefore, the effects of this variable cannot be assigned *a priori*.

Exchange rate

The real bilateral exchange rate is included in the empirical model as an explanatory variable. The actual bilateral exchange rate is defined in this paper as the number of the Latin American units of currency that can be purchased by one Australian dollar. The coefficient of the actual bilateral exchange rate is expected to be negative for Australian exports to Latin America and positive for Australian imports from Latin America.

Openness

Openness is an element that makes a difference in the formulation of traditional gravity equations. Guttmann and Richards (2004) suggested that the low openness ratio in Australia is explained by its distance from the rest of the world and by its large geographical size. Openness is the indicator of total exports plus total imports over GDP, Openness = (Total X + Total M)/ real GDP. Bilateral trade between Australia and Latin America could increase or decrease with the level of openness.

Economic mass

Economic mass is generally measured by the sum of each of the trading countries' total GDP. In Economic mass, the real income is used as a proxy variable for total attraction between both countries.

Economic Distance

This model has included economic distance as a proxy of transaction costs – including transportation costs. This variable takes into account the geographical distance between the two countries studied, including the economic per-capita income. This is used as a proxy for the distance, taking into account the relationship between Australia's and Latin America's real GDP per capita (AUS per capita GDP/ Latin America per capita GDP). Serlenga and Shin (2004) measured the differences in terms of relative factor endowments by a proxy of per-capita GDPs between two countries. It takes a minimum value of zero when there is equality in relative factor endowments. The most popular absolute geographical distance variable is the distance between capitals, as a proxy for the economic center of a country. If the real per capita income is similar in both countries the effect of this variable is the reduction of economic distance, but if the gap between the real per capita incomes increases, the effect is the increase in economic distance. While the gravity model has been estimated separately for different years, distance elasticity has been increasing over time (Leamer and Levinsohn, 1995; Disdier and Head, 2003; Carrere and Schiff, 2004). An increase in economic distance between countries is expected to increase costs – transportation and marketing – thus reducing trade. Some scholars have noted that the elasticity of bilateral trade with respect to distance falls with increased globalization (due to the decline in costs of communication and transportation). This variable is expected to be negative (Kristjánsdóttir, 2005).

Data

Disaggregation of the data by commodity composition presents some difficulties such as changes in the definition of export and import categories over time. Therefore, following the DFAT the disaggregation of bilateral trade in this research is based on the level of merchandise processing. Exports and imports by processing level include primary products, total manufactures, simply transformed manufactures (STM), elaborately transformed manufactures (ETM), and other goods. We focus our attention on trade flows for the period from 1998 to 2004.

Bilateral trade was obtained from the ABS and the DFAT, Australia. The Penn World Table 6.2, Heston, Summers and Aten, 2006, is the source of information for population, and the real variables – constant 2000 – for income, bilateral exchange rate, and openness. Information for build dummies for political changes was taken from sources such as historical texts and the Central Intelligence Agency (2007). One dummy variable per country is included for presidential elections; this variable is specific for each Latin American country and has been built to take the value of 1 (one) when there are presidential elections and the value of 0 (zero), elsewhere.

Methodology

The standard gravity model includes distance and income as independent variables. Most models also include population and different dummy variables. The selected general functional form for the gravity equation of this research was described by Sanso, Cuairan, and Sanz (1993) – equation (1). Additional variables might be added to improve the basic formulation of the selected gravity equation. The addition of variables gives us the possibility of adapting the gravity equation to the particular circumstances of this bilateral trade.

The value of exports imports/exports from Australia *i* of a product from or to a Latin American country *j* M_{ij} is:

(2) $$M_{ij} = A\ Y_i^{\beta 1}\ Y_j^{\beta 2}\ L_i^{\beta 3}\ L_j^{\beta 4}\ Op_i^{\beta 5}\ Op_j^{\beta 6}\ Exr_{ij}^{\beta 7}\ Ma_{ij}^{\beta 8} ED_{ij}^{\beta 9}\ DPr_j^{\beta 10}\ u^{ij}$$

Where A is a constant, Y is the real value of income, L is the population, Op is the real openness, Exr is the real bilateral exchange rate, Ma is the Economic Mass, ED is the economic distance, DPr is the dummy for changes of Latin American presidents, and $M_{ij(t-1)}$ is the lag of the dependent variable.

We transform (2) to a linear form (3) by logarithmic transformation. For estimation in panel data, this model would be re-written as the following log-linear equation:

(3) $$Ln\ (M_{ij}^{*}) = \beta_0 + \beta_1 .Ln(Y_i) + \beta_2 .Ln(Y_j) + \beta_3 .Ln(L_i) + \beta_4 .Ln(L_j) + \beta_5 .Ln(Op_i) + \beta_6 .Ln(Op_j) + \beta_7 .Ln(Exr_{ij}) + \beta_8 Ln.(Ma_{ij}) + \beta_9 .Ln(ED_{ij}) + \beta_{10} (DPr_j^{\beta 10}) + \varepsilon_{ij}.$$

These are annual data. All variables are real figures, base year 2000, and expressed in natural logarithm. The data set covers nine countries for the years 1998 to 2004 with six dependent variables and 11 explanatory variables. A total of n=378 (N=54 and T= 7) observations are available.

The inclusion of the selected variables was done on the basis of economic theory. The additional independent variables were included to the basic regression one by one on the basis of statistical criteria. Ordinary least squares (OLS) pooled regressions were performed on all the country-specific observations.

Bilateral trade between Australia and each of the nine Latin American countries under study was analysed by using six dependent variables:

1) Total Australian exports of primary products
2) Total Australian imports of primary products
3) Total Australian exports of total manufactures
4) Total Australian imports of total manufactures
5) Total Australian exports to the Latin American country
6) Total Australian imports from the Latin American country.

4. Results of the empirical analysis

Table 5 reports on cross-section analysis for broad categories of trade. Reported results included only well behaved equations, poor regression results have been excluded from the paper. Empirical evidence was found indicating that the traditional gravity models together with additional bilateral explanatory variables are able to explain bilateral trade between Australia and the Latin American countries.

Economic distance is a significant explanatory variable in all the countries studied, except in Ecuador, Uruguay and Venezuela. In Argentina, Brazil, Chile, Mexico, and Peru distance is an explanatory variable of the Australian exports to these countries. Comparing the coefficients between these countries (Table 4), the highest coefficients of distance elasticity are in Peru (-277.9), followed by Colombia (-68.9) and Brazil (-42.3). The distance coefficients in Mexico are low (-0.4 and -2.6) compared to the other countries. In Argentina, Colombia, Peru and Mexico (40.0%) of the regressions have economic distance as a significant coefficient; Brazil has 4 out of 5 regressions (80.0%). Figure 3 shows the economic distance of the countries studied. Apparently, economic distance has been one of the big restrictions on this bilateral trade. The highest coefficients are related to the highest economic distances (Figure 3).

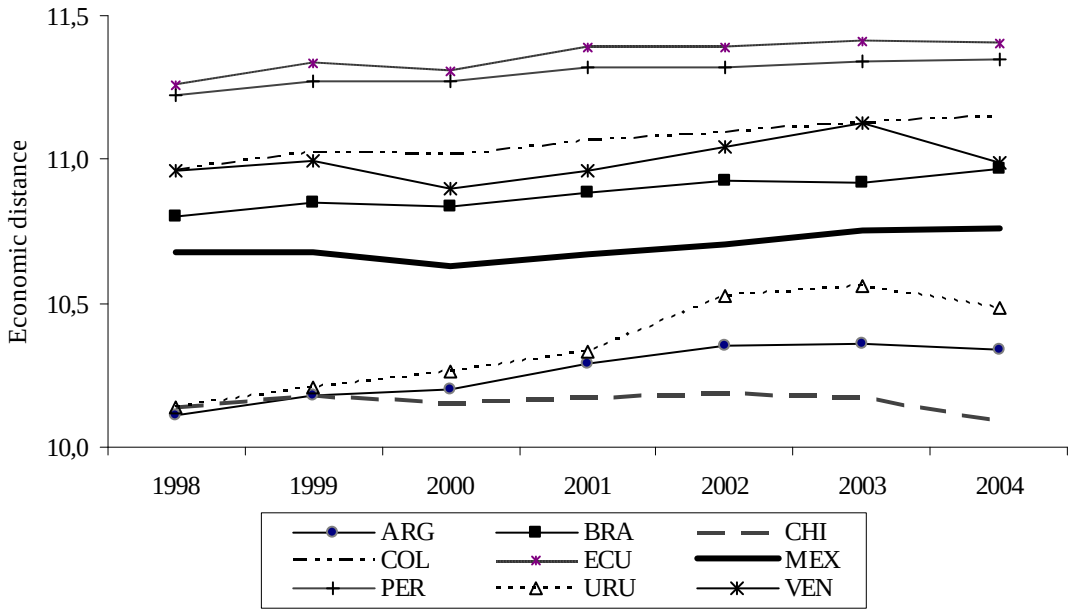

Figure 3. Economic distance: Australia and Latin American countries

Data source: Author's calculations (based on Heston, Summers and Aten, 2006; and Geobytes, 2007).

Table 5a. Results for Broad Categories of Trade

		Primary Products		Manufactured Products		Total Trade	
		Exports	Imports	Exports	Imports	Exports	Imports
ARGENTINA	Trend						
	Constant						
	Population Aus	-74.060 ***	-772.829 ***		142.252 ***		-1.681 ***
	Population LACs	64.185 ***	730.400 ***		-136.492 ***		
	Income Aus		21.713 ***				4.090 ***
	Income LACs						
	Openness Aus						
	Openness LACs			4.667 ***			
	Bilat. Exch. rate			-0.661 ***			
	Mass	2.347 ***				1.283 ***	
	Distance			-0.799 ***		-5.433 ***	
	Dep. Variable $_{t-1}$						
	Dum. President						
	R^2	*0.72*	*0.67*	*0.93*	*0.80*	*078*	*0.95*
	DW	*1.87*	*2.10*	*1.86*	*2.13*	*2.10*	*2.06*
BRAZIL	Trend						
	Constant	-71.869 ***					
	Population Aus	164.614 ***	21.862 ***		-2.183 ***		
	Population LACs	-138.376 ***					
	Income Aus		8.093 ***		4.609 ***		
	Income LACs						
	Openness Aus					8.604 ***	
	Openness LACs						
	Bilat. Exch. rate		3.389 ***			-0.779 ***	1.469 ***
	Mass						3.435 ***
	Distance	-5.076 ***	-42.325 ***			-1.291 ***	-16.604 ***
	Dep. Variable $_{t-1}$				-0.894 ***		
	Dum. President		-1.519 ***			0.240 ***	-0.662 ***
	R^2	*0.83*	*0.68*		*0.93*	*0.91*	*0.98*
	DW or D'h	*1.70*	*1.61*		*1.76*	*1.67*	*2.05*
CHILE	Trend						
	Constant					522.845 ***	
	Population Aus				-7.115 ***		
	Population LACs	3.983 ***				-34.194 ***	
	Income Aus		0.220 ***	2.785 ***	10.812 ***		
	Income LACs					6.021 ***	
	Openness Aus						
	Openness LACs				4.048 ***		
	Bilat. Exch. Rate	-1.306 ***		-2.315 ***			
	Mass						
	Distance	-4.710 ***					
	Dep. Variable $_{t-1}$		0.456 ***		-1.484 ***		
	Dum. President						
	R^2	*0.33*	*0.43*	*0.63*	*0.81*	*0.82*	
	DW or D'h	*2.01*	*1.64*	*1.98*	*1.76*	*2.30*	

Table 5b. Results for Broad Categories of Trade

		Primary Products		Manufactured Products		Total Trade	
		Exports	Imports	Exports	Imports	Exports	Imports
COLOMBIA	Trend						
	Constant				-1855.531 ***		
	Population Aus		-296.241 ***				
	Population LACs		327.763 ***		148.249 ***	-9.146 ***	-0.858 ***
	Income Aus						
	Income LACs						
	Openness Aus					54.603 ***	7.045 ***
	Openness LACs						
	Bilat. Exch. Rate						
	Mass						
	Distance		-68.950 ***		-56.394 ***		
	Dep. Variable $_{t-1}$					-2.975 ***	
	Dum. President		-1.139 ***			0.227 **	0.354 ***
	R^2		*0.43*		*0.28*	*0.83*	*0.72*
	DW or D'h		*1.82*		*2.13*	*1.74*	*1.75*
MEXICO	Trend						
	Constant						
	Population Aus	-17.082 ***					
	Population LACs	16.681 ***	-0.754 ***				
	Income Aus		1.713 ***		3.273 ***		0.444 ***
	Income LACs			0.953 ***			
	Openness Aus						2.934 ***
	Openness LACs						
	Bilat. Exch. Rate						
	Mass						
	Distance			-0.391 ***	-2.553 ***		
	Dep. Variable $_{t-1}$						0.311 ***
	Dum. President	-0.085 **	-0.069 ***				
	Dum. Pres. t-1			-0.237 ***	0.124 ***		
	R^2	*0.75*	*0.83*	*0.83*	*0.91*		*0.88*
	DW or D"h	*2.24*	*1.60*	*2.01*	*2.29*		*2.00*
PERU	Trend						
	Constant						
	Population Aus	- ***		-8.798 ***	-277.679 ***		-38.322 ***
	Population LACs	346.485 ***			272.441 ***	0.966 *	34.113 ***
	Income Aus						
	Income LACs						
	Openness Aus						0.847 ***
	Openness LACs	144.477 ***		139.693 ***		5.840 ***	
	Bilat. Exch. rate			-60.962 ***			6.010 ***
	Mass						
	Distance	- ***				-2.171 **	
	Dep. Variable $_{t-1}$						
	Dum. President	-0.978 *		-3.391 ***	-4.133 ***	-0.248 ***	
	R^2	*0.92*		*0.89*	*0.44*	*0.42*	*0.83*
	DW Statistic	*2.10*		*1.67*	*2.05*	*1.99*	*2.27*

Table 5c. Results for Broad Categories of Trade

		Primary Products		Manufactured Products		Total Trade	
		Exports	Imports	Exports	Imports	Exports	Imports
ECUADOR	Trend						
	Constant						
	Population Aus						
	Population LACs	-95.642 ***	-43.026 ***				
	Income Aus						
	Income LACs						
	Openness Aus						
	Openness LACs						
	Bilat. Exch. rate						
	Mass	30.327 ***	13.684 ***				
	Distance						
	Dep. Variable $_{t-1}$						
	Dum. President		-0.301 ***				
	R^2	*0.68*	*0.95*				
	DW	*1.93*	*1.78*				
URUGUAY	Trend						
	Constant	-33384.81 ***					
	Population Aus	-4625.145 ***					
	Population LACs	7391.503 ***					
	Income Aus						
	Income LACs						
	Openness Aus						
	Openness LACs						
	Bilat. Exch. rate	-14.327 ***					
	Mass						
	Distance						
	Dep. Variable $_{t-1}$						
	Dum. President						
	R^2	*0.95*					
	DW	*2.05*					
VENEZUELA	Trend						
	Constant						
	Population Aus		-1.930 ***				
	Population LACs						
	Income Aus						
	Income LACs						
	Openness Aus						
	Openness LACs		8.642 ***				
	Bilat. Exch. rate						
	Mass						
	Distance						
	Dep. Variable $_{t-1}$						
	Dum. President		0.678 ***				
	R^2		*0.55*				
	DW Statistic		*2.19*				

Australian openness is significant for Australia's major trading partners: Brazil, Chile, Colombia, Mexico, and Peru. Australian openness has high coefficients, especially in the total Australian exports to Colombia and Brazil and also in the total Australian imports from Chile and Colombia. However, this variable does not show a significant coefficient with any broad category of trade. In contrast, Latin American openness shows significant coefficients in Australian manufactured products exported to Argentina and Peru. Latin American openness is also a significant explanatory variable in the Australian exports of primary products to Peru.

Population is a significant variable in most regressions (23 out of 34 or 68%). In Argentina, Brazil, and Mexico, the coefficients of Australian population are higher than the Latin American population coefficients. The Peruvian population is significant in all the regressions (in Australian imports, the coefficient of Australian population is higher than the coefficient of Peruvian population). The Latin American countries with lowest population – Ecuador, Uruguay, and Venezuela – show population as a significant variable of trade of primary products with Australia.

Per-capita income of the importing country is a proxy of the consumer budget constraint, and per-capita income of the exporting country gives us characteristics of the production. In fact, per-capita income represents the supply and demand potentials of the exporting and importing countries, respectively. Per-capita income is also a measure of endogenous growth. Income RGDPTT was a significant explanatory variable in 12 out of 34 regressions (35%). It is likely that the main reason for this behavior is that there are other explanatory variables included in the regression that use income as a proxy. For example, that could be the case with openness and economic mass. In any regression, there are significant coefficients for income and

economic mass as explanatory variables at the same time. However, it is important to note that in some regressions mass performed better than per-capita income. This is the case with Argentina, Brazil, Ecuador, and Uruguay.

The majority of regressions of Australian bilateral trade by broad categories of commodity composition perform well for the major Australian trade partners – Argentina, Brazil, Chile, Colombia, Mexico, and Peru. However, the regressions with Ecuador, Uruguay, and Venezuela do not perform well. The Australian trade in primary products from all the countries seems to be explained by gravity variables, except in the case of Australian exports to Colombia. This trade seems to be different to the Australian exports to other countries in the region may be because there is no coal exported to Colombia. The regressions of Australian trade (exports and imports) of manufactured products to Colombia, Ecuador, Uruguay and Venezuela have a poor performance. It seems that the main reason for the behavior of these regressions is the low and irregular value of some of these bilateral trade relationships.

The main Australian trade partners in Latin America, Brazil and Mexico, will be studied separately.

Brazil

In Brazil, economic distance is a significant explanatory variable of trade of primary products and total trade. This variable is more sensitive for Australian imports than for Australian exports to Brazil. For example, the highest coefficient of distance is shown in the Australian imports of primary products from Brazil (-42.3), compared to total Australian exports to Brazil (-1.3) (See Table 4.a). If economic distance were to be reduced, the Australian trade with Brazil could be expected to increase. Population has been a significant variable to explain Australian imports from Brazil,

for both imports of primary products and manufactured products. The coefficients of the Australian population are higher than the coefficients of the Brazilian population. It seems that the high coefficients can be explained because these variables have only gradual changes.

Mexico

In Mexico, the Mexican population is a significant variable in 2 out of 5 regressions. As expected, the Mexican population is negative related to Australian imports from Mexico. Population and real per-capita income are explanatory variables of the Australian trade with Mexico.

Mexico is the only country where the dummy of political presidential changes is shown to be a significant contemporary variable in the trade of primary products and it becomes a lagged variable (election campaigns) in the trade of manufactured products. The coefficient of this dummy is higher in manufactured products than in primary products. This could be because Mexico has been importing from Australia some commodities that have political influence on voters. For example, in 2004 Mexican imports of primary products included dairy products (4.4%) and meat (9.8%). It seems that during the election campaigns, voters are influenced by the restrictions on importing basic food. For manufactured products, it is possible that expectations of the new president affect trade with Australia, perhaps taking into account the expectations in multilateral agreements – NAFTA and APEC.

There is a significant positive relationship between the Australian openness and total Australian imports from Mexico. However, this variable does not show a significant coefficient in the trade of primary products or manufactured products. In the Australian exports of manufactured products to Mexico, distance is significant.

5. Conclusions

The commodity composition of bilateral trade between Australia and Latin America has been shaped by economic and political variables. It seems that economic variables have governed the choice of products in the Australia-Latin America trade under review. Political influence on bilateral trade – measured as a dummy in the presidential elections – is significant in Brazil, Mexico, and the Andean Community countries (Colombia, Ecuador, Peru, and Venezuela).

Economic distance is a significant and negative explanatory variable for the trade of primary products to Latin America, except in Mexico (where economic distance is significant in the trade of manufactured products). The bilateral exchange rate is significant in Australian exports of primary products to three countries – Brazil, Chile and Uruguay. In this study, the cross-section analysis using the gravity model was successfully estimated to study 99.6% of the primary products trade, 87.3% of total manufactured products and 79.2% of the total bilateral trade value. Trade functions that could not be identified included: Australian exports of manufactured products to Brazil, Colombia, Ecuador, Uruguay and Venezuela and Australian imports of manufactured products from Ecuador, Uruguay, and Venezuela.

Results of this research show some similar patterns of bilateral trade by countries from the same trading blocs in the region. For example, Mercosur countries have a significant actual bilateral exchange rate in Australian exports of manufactured products. They seem to take into account the price of the manufactured products. In the Andean community – Colombia, Ecuador, Peru, and Venezuela, economic distance, Australian openness, and the dummy to capture political influence are significant variables. It seems that the main restriction on bilateral trade with these

countries is economic distance, and the main driving factor for Australian imports from this group of countries has been Australian openness.

Some Latin American countries – Brazil, Chile, and Mexico – have been showing increasing interest in developing further ties with Australia. For future development of bilateral trade, it may help to focus marketing efforts on both sides. Economic distance indicates that if distance between Australia and Latin America were reduced, the expected change in trade would be positive, especially in exports to Argentina, Brazil, Chile, Mexico, and Peru; and also in Australian imports from Colombia, Ecuador, Mexico, and Uruguay. Logistics are important in this trade, which could be increased by improved connections such as direct air travel and improved maritime transportation between Australia and Latin America.

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