TRADE ADJUSTMENTS TO EXCHANGE RATES

IN REGIONAL ECONOMIC INTEGRATION:

ARGENTINA AND BRAZIL

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A Dissertation

Submitted to

the Graduate Faculty of

Auburn University

in Partial Fulfillment of the

Requirements for the

Degree of

Doctor of Philosophy

Auburn, Alabama
December 16, 2005

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Fernando Daniel Sedano, son of Rodolfo Luis Sedano and Alicia Noemí (Leis) Sedano, was born August 22, 1972, in Buenos Aires, Argentina. He graduated from E.N.E.T. # 2, Ing. E. Mitre High School as mechanic technician in 1991. He attended Auburn University Montgomery, Alabama, and graduated summa cum laude with a Bachelor of Arts degree in International Studies in May 2000. He received a Master in Business Administration at Auburn University Montgomery in December, 2001. While working as a Research Specialist for Auburn University Montgomery, Fernando began the Doctor of Philosophy program at Auburn University in January 2003. In December 2004, he obtained a Master in Science in Economics at Auburn University. He married Juliana Piumatti, daughter of Roberto and Marilene (Moraes) Piumatti, on December 21, 2002.

DISSERTATION ABSTRACT

TRADE ADJUSTMENTS TO EXCHANGE RATES

IN REGIONAL ECONOMIC INTEGRATION:

ARGENTINA AND BRAZIL

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Doctor of Philosophy, December 16, 2005
(M.S., Auburn University, 2004)
(M.B.A., Auburn University Montgomery, 2001)
(B.A., Auburn University Montgomery, 2000)

186 Typed Pages

Directed by Dr. Henry Thompson and Dr. John Jackson

Currency devaluation is one of the most commonly used economic policies when a country faces a trade imbalance. By making exports more competitive in world markets and imports more expensive in terms of local currency, devaluations should induce trade balance improvements at the aggregate and bilateral levels. This dynamic behavior known as the J-curve has been tested in numerous empirical papers that have generated mixed results. This literature has not formally addressed the role played by regional economic integration among the countries under examination. Since almost all countries

are engaged in some sort of regional economic integration, this dissertation examines the trade effects of devaluations when countries are part of a regional integration agreement.

First, Chapter 1 discusses the challenges raised by regionalization and introduces the case study by describing the Southern Cone Common Market (Mercosur) and the exchange rate regimes implemented in Argentina and Brazil. Chapter 2 investigates the effects devaluations on countries' trade balances and examines potential trade diversion effects. Chapter 3 looks at gravity models of trade to test for potential trade diversion effects of currency devaluations. This chapter also investigates whether these trade adjustments are a consequence of changing demand structures as proposed by Linder (1961). Chapter 4 presents the overall conclusions and policy implication issues. Each chapter has its own literature review, theory, and empirical sub-sections.

All empirical work concentrates on Brazil and Argentina, the two major economies of Mercosur. Brazil devalued its currency in January 1999 and Argentina followed in January 2002. While both devaluations generated aggregate trade surpluses, unexpected adjustments emerged at the bilateral level. Although the empirical results are based on countries within a specific trading bloc, the economics behind them is subject to generalization.

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Dr. Keivan Deravi for his technical guidance and personal support. Dr. Henry Thompson and Dr. John Jackson, Co-Chairs, provided valuable assistance on theoretical and econometric issues, and Leonardo Paz laboriously retrieved hard copy data in Argentina and transmitted it to Alabama. Thanks are owed to Almerisio Lopes who helped editing this work. Dr. John Veres provided the resources and time flexibility that made this whole process possible. Thanks are due to the author's family, Rodolfo, Alicia, Diego, and Leandro Sedano for their unconditional support. The author's unborn daughter, Gabriela Sedano, furnished the motivation needed to complete this dissertation in a timely manner. The author is especially grateful to his beautiful wife, Juliana Piumatti Sedano, for her invaluable emotional support during a long journey. Without her love and patience, this undertaking could not have been accomplished.

Style manual or journal used: *Journal of Applied Economics*

Computer Software used: *Microsoft Word*

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CHAPTER 1: MERCOSUR: REGIONAL ECONOMIC INTEGRATION, EXCHANGE RATES, MACROECONOMICS, AND TRADE COMPOSITION

I. Introduction

Regional economic integration is rising. According to the World Trade Organization (WTO), close to 300 regional trading blocs will link countries around the world by the end of 2005. Of those 300 agreements, approximately two-thirds emerged after 1995. Many of these arrangements are among developed countries but others are formed by industrialized countries joining developing ones. This recent move toward regionalism raises a number of important issues for governments and policy makers around the world. At the center of those issues are the economic forces generated by interdependence among countries forming a regional agreement and how different policies should deal with those forces.

Currency devaluation is one of the most commonly used economic policies when a country faces trade balance of payments deficits. By making exports more competitive in world markets and imports more expensive in terms of local currency, devaluation will raise the trade balance at the aggregate and bilateral levels given sufficient elasticities. Since regionalization is becoming the norm rather than the exception, the present dissertation provides a framework for the analysis of devaluation when countries are part of a regional economic agreement. A survey describing regional economic integration and the macroeconomic behavior of the countries studied follows.

II. Steps towards Regional Economic Integration

The European Union (EU) is today the most deeply integrated of all trading blocs. Starting with the Treaty of Rome in 1957, European countries went through the different stages in the process of economic integration before launching the Euro in January 2000. The United States (US), Canada, and Mexico formed the North American Free Trade Agreement (NAFTA) in 1994, which allows for free trade in goods and services. In Asia, five countries established the Association of Southeast Asian Nations (ASEAN) in August 1967, which has grown to ten countries with the goal of creating the ASEAN Free Trade Area (AFTA) by 2005. According to the Inter-American Development Bank (IABD) (2002), some 15 integration agreements emerged recently in Africa and more than 30 agreements emerged since 1990 in Latin America.[1]

There are four steps towards complete economic integration: free trade areas, customs unions, common markets, and monetary unions.[2] Starting with the least ambitious of the agreements, a free trade area is composed of countries that agree to gradually eliminate tariffs. Free movement of goods and services is the ultimate goal of a free trade area. A customs union is a free trade area that sets a common external trade policy. Common external tariff rates and quotas are applied to all goods and services entering the area from non-member countries. A customs union with free movement of factors of production becomes a common market. A monetary union is the last step

[1] See Appendix III for a list of trade agreements.
[2] See Thompson (2001) for a discussion of each step toward economic integration.

towards complete economic integration. Countries forming a monetary union have a single currency and common fiscal and monetary policies. Each step in the process of regional economic integration has its pros and cons.

Among the positive aspects, regionalism reinforces the process of globalization by opening world markets, creating scale economies, and attracting foreign direct investment (FDI). It also helps small countries to have greater bargaining power when negotiating extra-regional agreements. According to IADB (2002), regionalism is also becoming a geopolitical tool by promoting peace, democracy, and cooperation in the development of regional infrastructure. On the negative side are the unforeseen economic forces that emerge in many regions and delay further integration. Among these forces are the uneven flows of FDI towards larger economies and the production and trade adjustments created by unilateral exchange rate movements (i.e., devaluations) in the absence of regulations such as currency bands or monetary unions.

The uneven flow of FDI (usually biased towards larger economies) is one of the main barriers to deeper integration. With the reduction of tariffs among countries in a regional trade agreement, many firms decide to locate production at one site to supply all countries within the bloc. As a consequence, member countries compete for multinational firms by offering incentives such as tax discounts. Once FDI within a regional economic agreement starts to concentrate in one country, other members raise their tariffs or implement quotas, hindering the efficiency gains of integration.

Uneven flows of FDI emerge also as a consequence of exchange rate adjustments. Devaluation in a member country continues to be the major barrier to deeper economic ties. Next section examines the general problems that materialize when unilateral devaluations occur in a regional bloc and presents some empirical evidence.

III. Devaluation in a Regional Trading Bloc: Common Problems

Large swings in bilateral real exchange rates usually create problems among countries in a regional integration agreement. According to IADB (2002), the most common problems of devaluation are the relocation of FDI, protectionist measures enacted by the country that is losing competitiveness, trade adjustments, and exchange rate crises that have the potential to develop into recessions.[3]

FDI relocation due to devaluation occurs more frequently among countries in a regional integration agreement.[4] According to IADB (2002), the factors that lead to relocation of FDI within a regional trading bloc depend on the type of FDI under consideration. When FDI is vertical or resource seeking, devaluation favors the depreciating country at the expense of all other potential hosts having similar factor endowments (regional trading partners). Specifically, lower production costs in the country devaluating its currency influence location criteria. In the presence of horizontal or market-seeking FDI within a regional trading block and in particular within a common market, firms are encouraged to produce in one single location (provided perhaps that scale economies are present) and from this location supply the entire market. Holding other factors constant, companies tend to choose the country with the lowest production costs. IADB (2002) finds that 1% depreciation in the real bilateral exchange rate

[3] See IADB (2002) for a detailed analysis of these issues.

[4] See Feenstra (1999), Pardo (2002), IADB (2002), and Eichengreen (1993). One of the most cited cases of FDI relocation is the move of the Hoover vacuum cleaning production facility from France to Scotland as a consequence of the 1992 European exchange rate mechanism crisis.

increases relative FDI inflows by 1.3% when both countries are members of a regional agreement. On the other hand, the impact of devaluations on FDI is found to be statistically insignificant for non-member countries. Appendix II presents evidence of companies moving from Argentina to Brazil following the devaluation of the Brazilian real in January 1999. Many large companies left Argentina and started production in Brazil, laying-off around 10,000 workers. More than a dozen car companies sent some 7,000 jobs (15% of the total industry) to the largest economy in Mercosur. According to this article, this corporate exodus was a consequence of the 35% depreciation of the real against the peso.

Tariffs, quotas, or non-tariff barriers (NTBs) could arise among regional trading partners when a member country devalues its currency. These protectionist measures are among the major reasons for the failure of deeper integration within trading blocs. For example, when the United Kingdom (UK) devalued the sterling in 1992 French officials proposed protectionist measures. According to Eichengreen (1993), the creation of a monetary union in Europe is a consequence of the tensions generated by the sterling devaluation and the rise of protectionist ideas. Eichengreen (1997) suggests that these protectionist reactions depend on the degree of integration within the trading block. Deeper economic integration among member countries leads to more serious protectionist actions by countries losing competitiveness. Eichengreen compares the 1992 sterling devaluation to the 1994 Mexican devaluation pointing out that while protectionist reactions emerged in Europe (a monetary union), only a few specific complaints were made by the US or Canada (free trade area).[5]

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[5] See introduction in Chapter 2 for a description of protectionist measures within Mercosur.

Regional trade agreements generally create trade diversion by substituting imports from more efficient non-member countries towards less efficient member countries. According to IADB (2002), regional trading blocs generate a demand for goods that are not internationally competitive and are known as regional goods. In general, devaluation depresses imports and therefore the demand for regional goods. Other member countries cannot redirect these regional products to markets outside the bloc due to their lack of competitiveness. IADB (2002) investigates whether exchange rate overvaluation leads to the same effect on exports to member and non-member countries. Results suggest that when 10% of a country's exchange rate overvaluation is due to a member country's devaluation, total exports decline by 14%. Further, when 10% of the overvaluation is due to non-member countries' devaluations, then exports decline by 3.5%. These results suggest that regional goods make up a significant portion of trade flows, especially when regional trading blocs are highly protected from the outside.

Devaluation also generates exchange rate crises for regional trading partners. IADB (2002) states the exit of the Italian lira from the European exchange rate mechanism in 1992 led the UK to abandon its peg, which in turn exerted enormous pressure on the French franc. Similarly, the depreciation of the Thai baht in 1997 caused depreciations and economic contractions in Singapore, Malaysia, Indonesia, and the Philippines, all members of ASEAN. The report also mentions contagions such as when Mexico devalued its currency in 1994, affecting the stability of the Argentine peso, or when the 1997 Asian crisis affected the Russian ruble which in turn affected the Brazilian real. The paper examines the effects of devaluations on the currencies of regional and non-regional trading partners. Findings suggest that a "10[%] overvaluation explained by exchange rate movements within the [regional integration agreement] increases the probability of a crisis by 4 percentage points" (p. 182). On the other hand, when a 10% exchange rate overvaluation comes from a non-member country, the probability of a crisis increase by 1.7%.

These findings suggest that when studying the effects of devaluation on bilateral trade balances with specific countries, the researcher should take into consideration the degree of economic integration between them. The effects of devaluation by a member country should be different from the effects generated by a similar devaluation in a non-member country. This dissertation investigates the effects of Argentina's devaluation on the country's bilateral trade balance with Brazil by taking into account the trade adjustments occurring with the US and EU (non-Mercosur members).[6] The following section presents a brief description of Mercosur, as well as the macroeconomic environment and composition of trade flows between Argentina and Brazil.

IV. Case Study: Mercosur, Argentina, And Brazil

The governments of Argentina, Brazil, Paraguay, and Uruguay signed the Treaty of Asunción and formed Mercosur on March 26, 1991. Mercosur's ultimate goal is to create a common market with free movement of goods, services, and factors of production. While most of Mercosur's intra-industry trade is tariff free, the steps toward a common market have been delayed on several occasions due to economic instability in the area. Each member maintains a list of a few sensitive products that are exempted from this zero rate and that are supposed to be gradually reduced by 2006. In January

[6] Brazil, the US, and EU are Argentina's major trading partners. Together, they explain almost 75% of the country's trade during the period under study.

2001, Argentina and Brazil agreed to implement temporary tariffs or quotas to protect industries harmed by exchange rate fluctuations. A common external tariff (CET) set in 1995 contains many exemptions and can be suspended under some scenarios. Mercosur average external tariff is about 13.5%.[7]

Since its implementation, Mercosur has been seeking extra-regional agreements. Chile became an associate member in 1996, but continues to maintain its own common external tariffs. Bolivia was also admitted to Mercosur as associate member in 1997. Mercosur and the European Union attempted to reach a free trade agreement but the high tariffs and subsidies for agricultural products in Europe have been a major barrier in the process. The same argument with regard to the US is delaying negotiations for a Free Trade Area of the Americas (FTAA).

Trade between Argentina and Brazil has increased significantly since the creation of Mercosur.[8] Currently, Argentina absorbs 85% of Brazilian exports to Mercosur while 90% of Brazilian imports (from Mercosur) come from Argentina. Similarly, Brazil accounts for 85% of Argentine exports to Mercosur whereas 91% of what Argentina imports from member countries come from Brazil. This close trading relationship between Argentina and Brazil increased over the last fifteen years despite major exchange rate and macroeconomic instability.

The Period of Fixed Exchange Regimes

Argentina and Brazil experienced significant structural reforms during the 1990s that included trade liberalization, privatization of public enterprises, and deregulation of

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[7] See subsection on trade regulations for details.
[8] Yeats (1998) offers a detailed description on Mercosur's trade patterns. The paper shows that Mercosur has created substantial trade diversion since the most rapidly growing products traded within the bloc are generally products in which members do not have a comparative advantage.

markets. Currency boards known as the convertibility plan in Argentina and the Real Plan in Brazil became the cornerstones of all reforms. Both plans attempted to create a stable and market-friendly environment to attract foreign investments and generate sustainable economic growth.

Argentina's convertibility plan was implemented in April 1991 with the goal of stopping hyperinflation that almost reached an annual rate 5,000% in 1989. In fact, the plan became the "Convertibility Law" with the peso and the US dollar ($) legally circulating at a one-to-one exchange rate. Peso holders could convert pesos into dollars without any restriction at this official rate. By law, the central bank was required to hold foreign reserves to fully cover its peso liabilities.[9] Reserves, consisting of gold and foreign currency or deposits and bonds payable in gold and foreign currency, had to be maintained at a level no less than 100% of the monetary base. Up to 30% of reserves could be held in bonds issued by the Argentine government. The autonomous creation of currency became legally impossible. Expansion was only possible when proper reserves existed to cover it, with a contraction occurring in the opposite case. Authorities could compensate for either of these situations by means of greater or lesser Central Bank holdings in public securities within the established 30% margin.

The 1994 Brazilian Economic Stabilization Program, known as the Real Plan, became the most successful of all plans that previously attempted to solve Brazil's problems with chronic inflation. On July 1st 1994, a new currency called the "real" (R$) was created. The real was backed by the country's international reserves at an exact ratio of one US dollar to each real emitted. Part of the country's international reserves was to

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[9] See (Hanke, 2002).

be held in a special account at the central bank for this purpose. Exchange rate parity was to be held at a one-to-one rate with the US dollar for an indeterminate length of time. However, to avoid exchange rate rigidity, the Minister of Finance had the right to set the criteria to be used by the National Monetary Council to back the real as well as to make any changes to the parity policy.

Both plans achieved price stability and economic growth during the first years of implementation. However, economic growth became vulnerable under external shocks. The so-called "Tequila Crisis" in Mexico was the main cause of Argentina's 1995 recession while the 1997 Asian crisis and 1998 Russian devaluation unveiled the weakness of the Real Plan. In Argentina, the requirement that all pesos in circulation had to be backed by the same amount of US dollars in reserves played a negative role. When all agents in the economy began changing pesos for dollars, the reduction of international reserves at the central bank meant a decrease in the monetary base. International reserves went from $17.8 billion in December 1994 to $12.4 billion in March 1995, and the monetary base went from 16 billion pesos to 10.8 billion pesos in the same time period. A $12 billion package from the World Bank saved Argentina's banking system and put the economy back in the growth trend, peaking at an annual rate of 9.2% by the 4th quarter of 1996. By the 4th quarter of 1998, Argentina entered a 4-year recession that lasted until the 4^{th} quarter of 2002.

Economic growth during the convertibility plan did not translate into a reduction in unemployment rates. In fact, the unemployment rate in Argentina doubled between 1991 and 2001 from less than 10% to almost 20%. In Brazil, the unemployment rate was more stable ranging from annual rates of 8% to 12%. The highest unemployment figures in Brazil appeared in 1998, the year marking the collapse of the Real Plan.[10]

During the 1992-1994 period, Argentina was receiving higher FDI than Brazil. It is only after the implementation of the Real Plan that FDI increased significantly in Brazil. An inflection point seems to appear in 1995, when Mercosur's CET was implemented. By 2001, Argentina received only 8% of the amount of FDI in Brazil.

The fixed exchange rate regimes generated aggregate trade deficits in both countries. Occasional trade surpluses emerged as economic contractions depressed import levels. In terms of bilateral trade, Argentina maintained a trade surplus with Brazil during the fixed exchange rate regimes.[11]

Brazil's Currency Devaluation

In January 1999, the collapse of the Real Plan in Brazil and the subsequent devaluation shocked Mercosur's economic stability. Brazil's trade deficits coupled with the capital outflows that emerged after the Asian and Russian crisis were the major determinants for devaluation. The steady decrease in foreign reserves at the central bank starting in 1997 accelerated in 1998 as foreign investors were covering their losses from Asia and Russia. By January 1999, foreign reserves have dropped to $35 billion, almost half of the January 1997 level. On January 13th 1999, the central bank announced that the real would be traded at a new and wider band of 1.20-1.32 reals to the dollar. Two days later the currency band was abandoned, thus making the real a free-floating currency.

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[10] The Brazilian Institute of Geography and Statistics (IBGE) changed the methodology used to calculate unemployment rates in 2001, therefore, figure 1.8 in Appendix I shows estimated rates for the period 1994-2001.

[11] See figure 1.10, 1.11, and 1.12 in Appendix I.

Following that decision, the real fell 64% against the US dollar between mid-January and the beginning of March 1999.[12]

The devaluation of the real created inflation fears that never materialized. Amman and Baer (2002) state that the economic contraction of 1998 and part of 1999 led to low levels of capacity utilization, adding that responsible fiscal and monetary policies also contributed to price stability. Specifically, as the real was losing value in the first weeks after devaluation, the central bank dramatically tightened its monetary policy, causing interest rates to reach 43% by March 1999. The paper also mentions the fiscal surplus imposed by the International Monetary Fund (IMF) as a counter-inflationary measure. By the end of 1999, the devaluation of Brazil's real stood at only 22% in real terms (Giambiagi and Averburg, 2000).

Brazil's economy grew for most of the post-devaluation period with the exception of the 4th quarter of 2001 and the 1st quarter of 2002. This contraction is usually attributed by the Argentine crisis and devaluation. The stable macroeconomic behavior and growth experienced by Brazil after the devaluation of the real kept the unemployment rate around 10% for most of the period. FDI increased significantly in 1999 and reached a maximum level of over 30 billion dollars in 2000. This unprecedented level of FDI started to decrease steadily before reaching less than 10 billion dollars in 2004. The aggregate trade balance went from deficit to a $2.6 billion surplus in 1999. By 2004, the surplus had reached an impressive $33 billion. Finally, the bilateral trade balance with Argentina stayed on the deficit side until 2003, where it became a surplus.

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[12] See Amman and Baer (2002) for details.

The End of Convertibility

The convertibility plan became under pressure once Brazil devalued the real. Even though the government was committed to the currency board, the fiscal deficits continued and the external debt reached unprecedented levels. This led to a loss of confidence from investors that generated large capital outflows and increased the costs of accessing funds in the international markets. International reserves declined leading to a monetary contraction that severely affected credit markets. Argentina's central bank lost around 40% of reserves in 2001 alone, reaching their lowest level since the inception of the convertibility plan. By then, three economic ministers have tried different policies with the result of further economic contraction.[13] The unemployment rate in Argentina reached an unprecedented 20% in October 2001. FDI decreased to its lowest level since the implementation of the convertibility plan.

The aggregate balance of trade became a surplus in 2000 and increased to $7 billion in 2001. This trade surplus was a consequence of a reduction in imports and not a result of higher exports. Argentine exports to Brazil declined almost 30% in 1999 but lower imports maintained a trade surplus for Argentina even after the devaluation of the real. The economic recession and trade restrictions imposed by Argentina were the major contributors toward reduction of Brazilian imports.

Three years after the economic recession started, decreasing international reserves raised doubts about the sustainability of the one-to-one rate between the peso and the US dollar. Once the IMF refused to send a 1.2 billion dollar package to sustain the currency board, the Argentine government imposed restrictions on bank withdrawals so as to stop

[13] See Quispe-Agnioli and Kay (2002) for details on the collapse of the convertibility plan.

the accelerating run on deposits. Violent protests led economic minister, Domingo Cavallo and president, Fernando de la Rúa to resign. Interim president Adolfo Rodríguez Saá announced that Argentina was halting payments on its $140 billion external debt, creating the largest sovereign default in history.[14] In January 2002, Argentina's Congress repealed the Convertibility Law and set a rate of 1.4 pesos per dollar. Fears of further devaluation exerted pressure on the exchange rate. By February 2002, the peso started to float freely against the dollar. In fact, a managed floating system emerged since the government had the right to intervene the foreign exchange market when it deemed necessary.

Argentina's recession accelerated after the devaluation of the peso in January 2002. GDP contracted by an annual rate of 11% and the unemployment rate reached 23% in May 2002. The annual inflation rate in 2002 reached 41% as the price of imports (mainly intermediate goods) passed through domestic prices. The peso reached its lowest level in July 2002 by reaching a rate of 4 pesos per dollar. FDI in Argentina continued to decrease and remained around $2 billion per year in 2002 and 2003, representing only 15% of FDI received by Brazil. By December 2002, international reserves at the central bank dropped to $10.5 billion, the lowest level in ten years.

Argentina's aggregate trade surplus reached a record high in 2002, pushed by a 55% decrease in imports. This decrease in imports could be attributed to banking restrictions applied in December 2001, import payment restrictions, and overall exchange rate uncertainty after devaluation.[15] Exports decreased by almost 5% in 2002 as compared to 2001. Argentine exports to Brazil decreased by 22% and imports contracted

[14] See Quispe-Agnioli and Kay (2002).
[15] See sub-section on trade restrictions.

at a 52% rate in 2002. This led to the highest bilateral trade surplus for Argentina with its major trading partner in at least ten years. By 2003, Argentina experienced an economic recovery that spurred imports, especially those coming from Brazil.

Argentina's Economic Recovery and Bilateral Trade Flows

Banking restrictions were lifted in December 2002 as the peso stabilized at a rate of 3 pesos per dollar. Restrictions on the transfer of funds from Argentine importers to foreign suppliers were relaxed. Argentina's economy started recovering by the first quarter of 2003, after shrinking for seventeen consecutive quarters. GDP growth averaged 9% in 2003 and 2004 bringing the economic activity close to the peak reached in 1998. This growth was achieved with inflation rates running at 3% and 6% respectively for 2003 and 2004. By the fourth quarter of 2004, the unemployment rate fell to less than 12% and FDI almost doubled between 2002 and 2004. International reserves increased by 100% due to aggregate trade surpluses and central bank intervention aimed to keep the peso at a stable rate of 3 pesos per dollar.[16]

By the second quarter of 2003, Argentina started to experience a trade deficit with Brazil. Imports from Brazil grew by 87% in 2003 and another 62% in 2004. Imports from Brazil reached record levels while imports from the US and EU grew at much lower rates, reaching only half of the 1998 level by the end of 2004.[17] After devaluation, Argentine exports to Brazil remained at levels below those of the currency board. The stable path of Argentine exports to Brazil and the unstable behavior of imports suggest a study of the composition of trade flows between both countries.

[16] At this exchange rate, exports surged and the government could collect taxes on exports to maintain its fiscal surplus.
[17] See figures 1.15, 1.16, and 1.17 in Appendix I.

Composition of Argentina's Imports and Exports

Table 1.3 in Appendix I presents Argentina's exports by type of good for the 1992-2004 period. On average, manufactures of agricultural origin represented 34% of total exports during this period, followed by manufactures of industrial origin with 29%, primary products with 23%, and fuels and energy with 14% share of total. Residues and waste from the food industry is Argentina's largest export followed by fats and oils, cereals, crude oil and carburant.

Argentine exports have increased steadily since 1992 without changing its composition.[18] Exports of manufactures of agricultural origin increased almost three-fold, manufactures of industrial origin went from $3 billion to $9 billion, exports of primary products increased by 100%, and fuels and energy increased almost six times during the 1992-2004 period. Table 1.5 in Appendix I breaks down the value of total exports by price and quantity.

Among imports, intermediate goods represent the largest category averaging a 35% of the total, followed by capital goods with 23%, spare parts and pieces for capital goods with 17%, and consumer goods with 16%. Vehicles and fuels amount to an average 4% of Argentina's total imports. Imports of intermediate goods have been rising especially after the peso devaluation. These imports represented 28% of the total in 1994, peaking at 48% in 2002, and declining to 38% of total imports in 2004. Consumer goods declined from $3.7 billion 2001 to a low $1 billion in 2002.

Brazilian exports to Argentina have been gaining market share relative to the US and EU. In the case of intermediate goods, Brazilian imports increased their share from

[18] See figures 18-25 in Appendix I.

38% in 1995 to 50% in 2004 at the expense of US and EU products.[19] Imports of Brazilian capital goods went from 13% market share to 45%, fuels from 10% to 34%, consumer goods from 31% to 52%, and vehicles went from 20% to an impressive 88% share for the 1995-2004 period.

Brazilian exports to Argentina have increased their share gradually since the inception of Mercosur CET in 1995, but growth accelerated after the peso devaluation. The share of Argentina's imports of intermediate goods from Brazil jumped from 40% to 50% between 2001 and 2004. During this time period, capital goods increased their share from 27% to 45%, the share of spare parts and pieces for capital goods rose from 33% to 40%, and the share of vehicles increased from 58 to 88%.

Argentina's Trade Regulations

On December 1st 2001, the government imposed emergency exchange controls in order to stop the drain of dollars from the financial system and maintain the convertibility system. Under the new measures that were to be put in effect for 90 days, the general public could only withdraw $250 in cash per week from any bank account. Transfer of funds abroad were limited to $1,000 for the general public while companies had to obtain official clearance before transferring any amount over $1,000 abroad.

Restrictions were imposed on external trade transactions to keep the peso from further depreciation. For instance, capital goods, high-tech goods, and telecommunications could be only paid six months or a year after the transaction. According to Argentina's Central Bank Communiqué "A 3473" of February 9th 2002, capital goods that represented f.o.b. value of $200,000 or less could be only paid after a

[19] See Tables 1.6 and 1.7 where imports from Brazil, EU, and US are 100% of total imports.

180-day term, accepting anticipated payments only up to 30% of the f.o.b. value. For merchandise worth more than f.o.b. $200,000, 20% could be paid ahead of time and the rest was to be financed at a minimum of 360-day period. These rules help explain the 68.5% contraction in imports of capital goods in 2002 as compared to 2001. Similarly, depending on the consumer good, payments would not be accepted prior to anywhere from 90 to 360 days, a fact that might also explain their 72% contraction from 2001 to 2002. With regard to payments coming from exports, Argentina's Central Bank Communiqué "A 3473" established a maximum of 15 days to exchange foreign currency into pesos.

Some goods were exempted from these restrictions. According to "resolution 61/02" of Argentina's Ministry of Economy, health care products, critical intermediate goods, and primary products could be paid ahead of time. The importer was supposed to prove the acquisition of those imports within 90 days following payment. Most of the restrictions on payments for trading goods were lifted in January 2003 when the central bank stopped restrictions on foreign currency-denominated payments for imports and lifted the limits on foreign companies' ability to send dividend payments abroad.

Customs Tariffs

The Argentine Harmonized System was implemented on January 1st 1992. This system complies with the WTO Customs Classification Code adopted in 1979. Ad-valorem duties are imposed on the cost of insurance and freight (c.i.f.) value of the imported merchandise. Tariffs range from zero to 30%, and the average applied tariff is about 13.5%. On January 1st, 1995, Argentina adopted the Mercosur CET which reduced the average tariff to zero on certain goods not produced locally and established a 2% to

10% tariff rate on raw materials, intermediate industrial materials, and primary products, a 12% tariff on capital goods, informatics, and telecommunications goods, a 15 to 20% tariff on consumer durable and nondurable goods, and 22.5% on non-finished goods. Commercial importers and individuals are authorized to import automobiles equivalent in value to a maximum of 10% of the value of domestic automobile production during the previous year. On March 2000, Argentina and Brazil agreed to raise the CET on automobiles to 35%.

Taxes on Exports

Due to the economic crisis and the fiscal problems at the time of devaluation, Argentina began imposing taxes on exports, a policy that had not been used in this country since the 1980s. Exports of crude petroleum oils and oils from bituminous minerals are subject to a 20% tax. Primary products pay a 10% export tax. Comparatively, manufactures of industrial origin as well as of gas end electricity pay a 5% export tax. On March 5th 2002, "Resolution # 35/2002" imposed a 20% tax on exports of some agricultural products. These exports taxes remain in place at the time of the writing of this dissertation.

APPENDIX I

Figure 1.1: Argentina's International Reserves

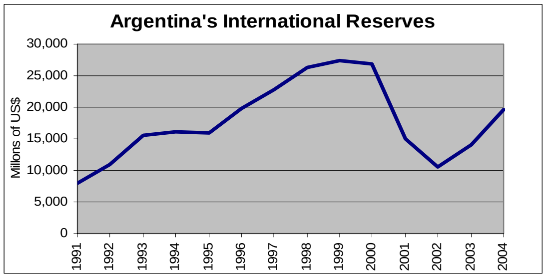

Figure 1.2: Brazil's International Reserves

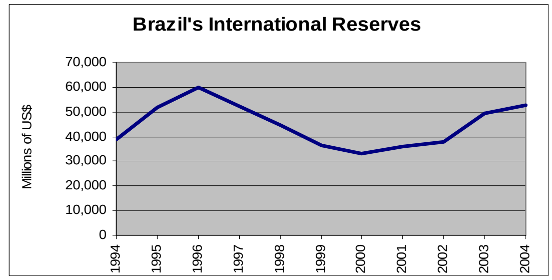

Figure 1.3: Argentina's Annual Inflation Rate

Figure 1.4: Brazil's Annual Inflation Rate

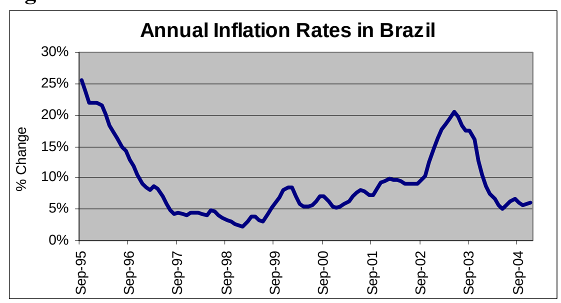

Figure 1.5: Argentina's GDP Annual Growth Rate

Figure 1.6: Brazil's GDP Annual Growth Rate

Figure 1.7: Unemployment Rate in Argentina

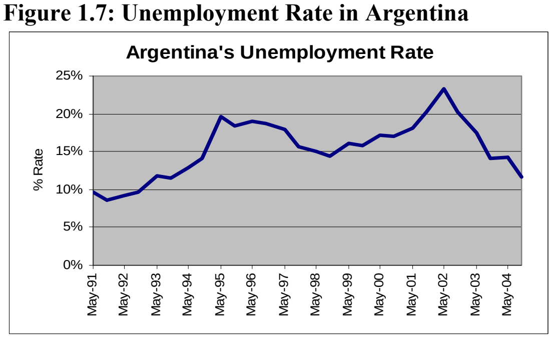

Figure 1.8: Unemployment Rate in Brazil

Figure 1.9: Foreign Direct Investment

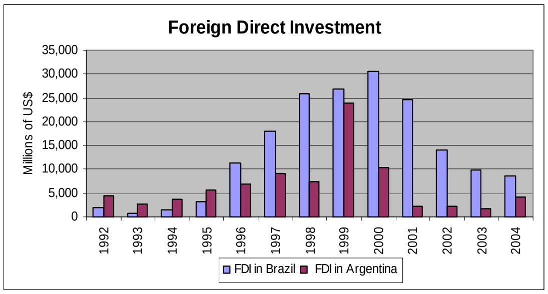

Figure 1.10: Argentina's Balance of Trade

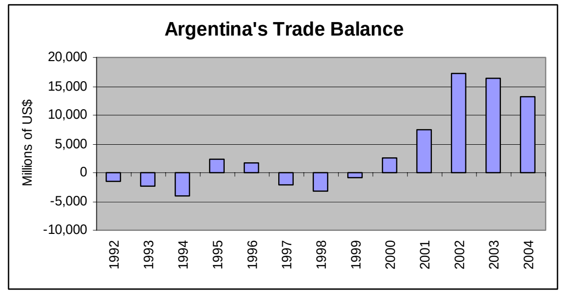

Figure 1.11: Brazil's Balance of Trade

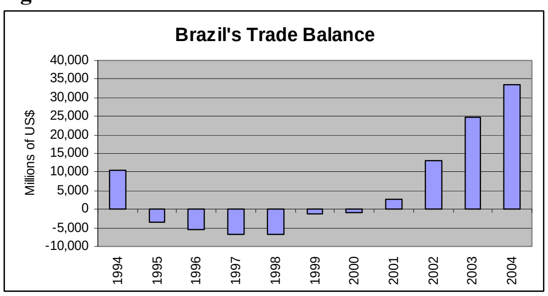

Figure 1.12: Argentina's Balance of Trade with Brazil

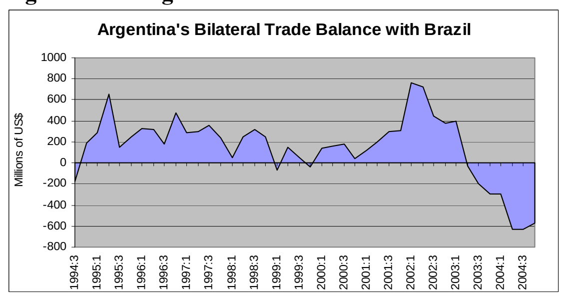

Figure 1.13: Exchange Rates

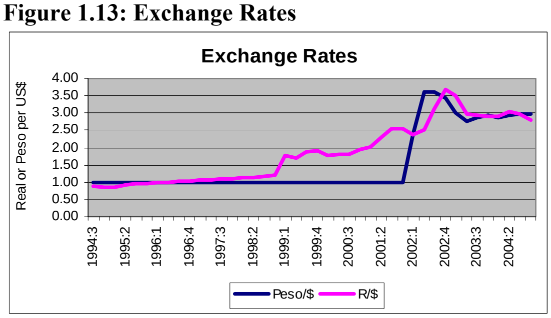

Figure 1.14: Argentina's External Debt

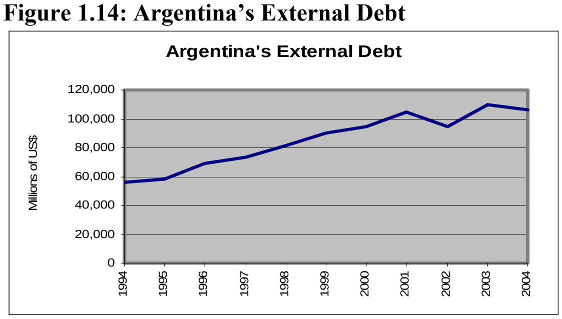

Figure 1.15: Argentina's Imports from Brazil

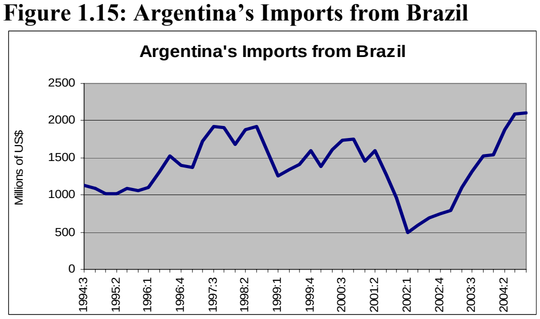

Figure 1.16: Argentina's Exports to Brazil

Figure 1.17: Argentina's Imports from EU and US

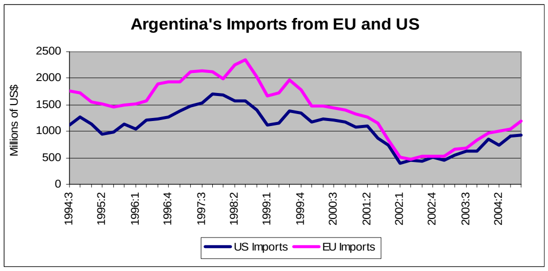

Figure 1.18: Argentina's Exports of Manufactures of Agricultural Origin

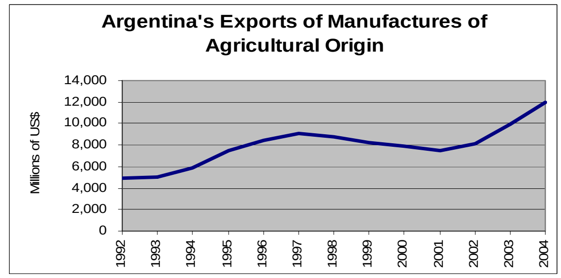

Figure 1.19: Argentina's Exports of Manufactures of Industrial Origin

Figure 1.20: Argentina's Exports of Primary Products

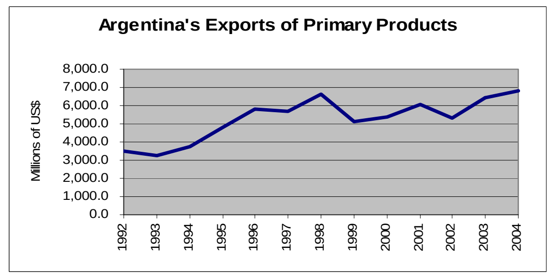

Figure 1.21: Argentina's Exports of Fuels and Energy

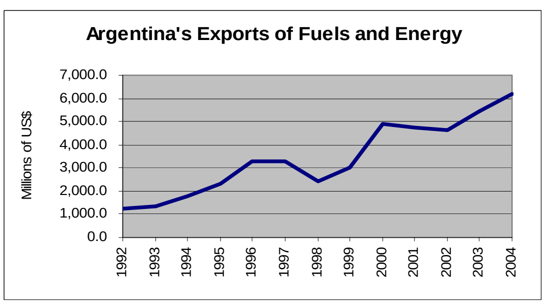

Figure 1.22: Argentina's Exports of Manufactures of Agricultural Origin (%Share)

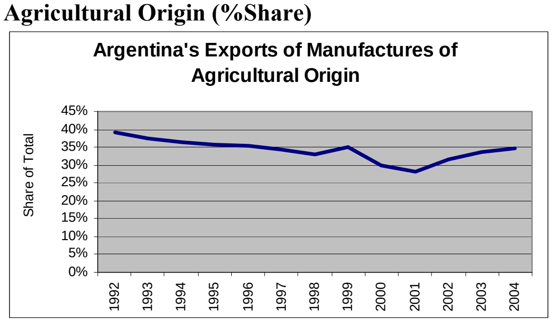

Figure 1.23: Argentina's Exports of Manufactures of Industrial Origin (%Share)

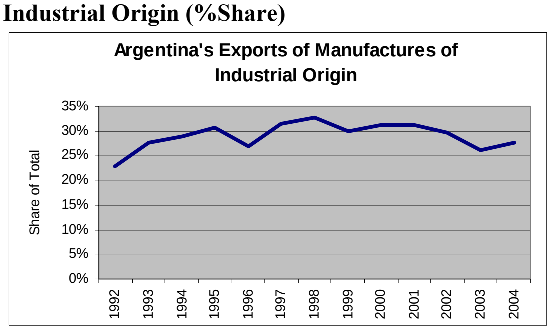

Figure 1.24: Argentina's Exports of Primary Products (%Share)

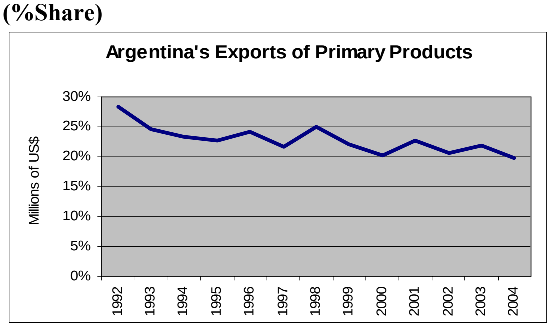

Figure 1.25: Argentina's Exports of Fuels and Energy (% Share)

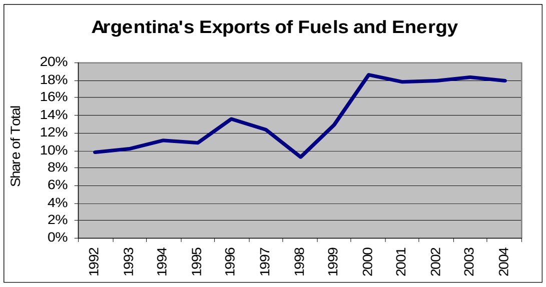

Figure 1.26: Argentina's Imports of Capital Goods from Brazil (% Share)

Figure 1.27: Argentina's Imports of Intermediate Goods from Brazil (% Share)

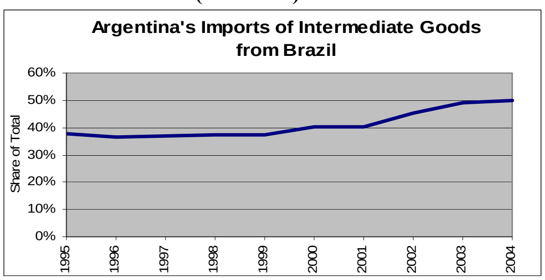

Figure 1.28: Argentina's Imports of Consumer Goods from Brazil (% Share)

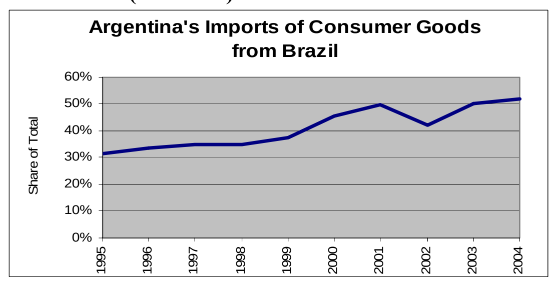

Figure 1.29: Argentina's Imports of Capital Goods by Country of Origin

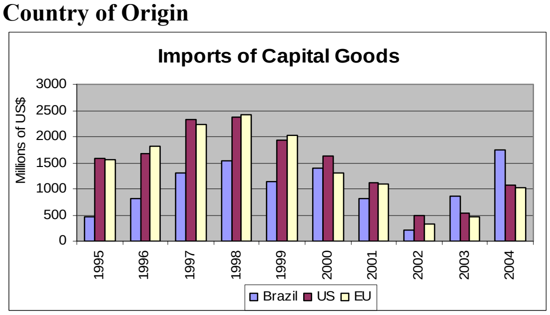

Figure 1.30: Argentina's Imports of Intermediate Goods by Country of Origin

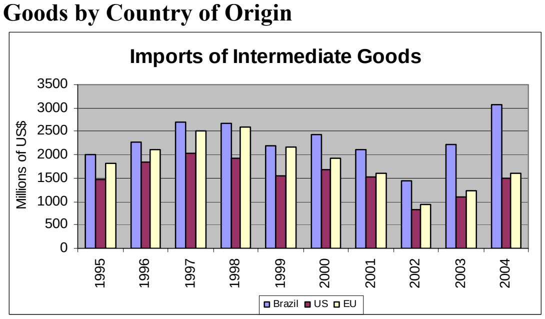

Figure 1.31: Argentina's Imports of Spare Parts and Pieces for Capital Goods by Country of Origin

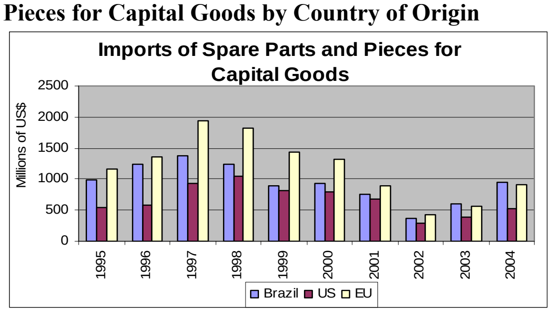

Figure 1.32: Argentina's Imports of Consumer Goods by Country of Origin

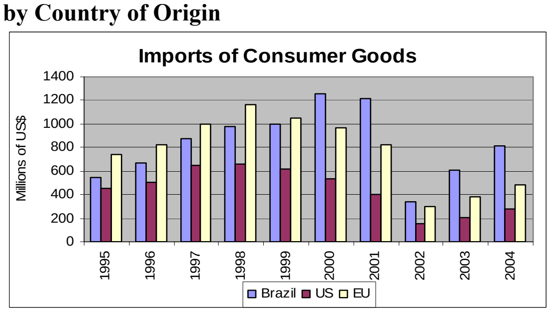

Figure 1.33: Argentina's Imports of Fuels by Country of Origin

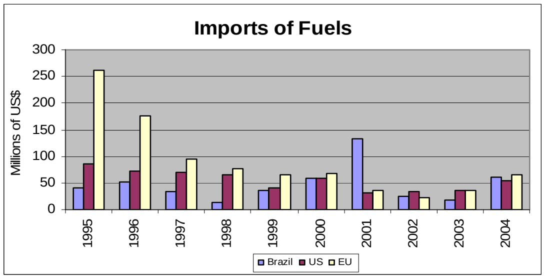

Figure 1.34: Argentina's Imports of Vehicles by Country of Origin

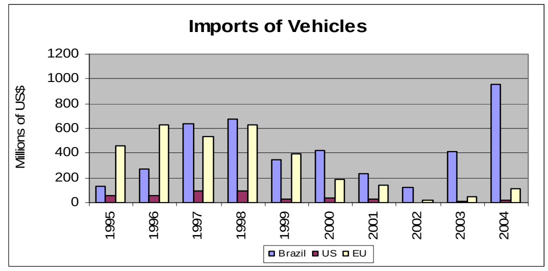

Table 1.1: Argentina's Aggregate Trade Balance (Millions of US$)

Period	Exports	Imports	BOT
1992	12,399	13,795	-1,396
1993	13,269	15,633	-2,364
1994	16,023	20,162	-4,139
1995	21,162	18,804	2,357
1996	24,043	22,283	1,760
1997	26,431	28,553	-2,123
1998	26,434	29,531	-3,097
1999	23,309	24,103	-795
2000	26,341	23,889	2,452
2001	26,543	19,158	7,385
2002	25,709	8,473	17,236
2003	29,566	13,118	16,448
2004	34,453	21,185	13,267

Table 1.2: Brazil's Aggregate Trade balance (millions of US$)

Period	Exports	Imports	BOT
1994	43,545	33,079	10,466
1995	46,506	49,972	-3,466
1996	47,747	53,346	-5,599
1997	52,994	59,747	-6,753
1998	51,140	57,763	-6,624
1999	48,011	49,295	-1,283
2000	55,086	55,839	-753
2001	58,223	55,572	2,650
2002	60,362	47,237	13,125
2003	73,084	48,291	24,793
2004	96,475	62,809	33,666

Table 1.3: Argentina's Exports by Type of Good

Categories	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Primary Products	**3,500.2**	**3,270.9**	**3,735.3**	**4,815.8**	**5,817.1**	**5,704.7**	**6,603.3**	**5,144.4**	**5,345.6**	**6,052.1**	**5,289.5**	**6,459.9**	**6,827.6**
Live Animals	8.7	13.2	51.0	97.8	44.6	35.2	19.3	17.9	15.9	17.5	8.2	8.8	11.3
Unprocessed Fish and Shell Fish	321.4	427.2	439.3	498.1	609.2	613.7	525.9	505.4	590.4	708.7	481.6	621.7	475.6
Honey	51.8	50.2	53.8	70.4	90.6	108.4	89.3	96.1	87.4	71.5	114.7	159.9	120.1
Unprocessed Vegetables, Legumes	168.2	185.5	259.2	268.4	270.5	352.1	460.6	270.2	210.2	233.5	184.9	187.4	198.7
Fresh Fruits	286.1	215.4	243.8	417.0	475.5	504.6	492.0	459.2	416.0	505.9	391.3	473.0	537.6
Cereals	1,547.7	1,453.6	1,332.7	1,862.6	2,560.1	3,006.7	3,042.1	2,063.1	2,419.1	2,447.8	2,134.6	2,306.7	2,703.7
Oil seeds and Fruits	790.1	696.5	951.8	884.6	963.7	338.7	1,052.1	869.7	1,016.8	1,401.1	1,294.6	1,992.5	1,829.8
Unprocessed tobacco	142.7	117.0	88.8	100.8	145.9	186.4	130.3	166.1	120.8	162.1	148.0	151.1	185.1
Raw Wool	41.2	49.1	74.6	86.2	64.7	61.3	39.7	38.7	43.2	30.4	35.4	35.2	41.8
Cotton fiber	76.6	25.7	176.3	432.8	497.0	332.3	224.3	177.9	53.3	73.1	12.1	2.3	10.8
Copper material and concentrates	0.0	0.0	0.0	0.0	0.0	68.5	438.6	412.6	307.0	346.7	437.2	467.3	642.4
Other Primary Products	65.7	37.5	64.0	97.1	95.3	96.8	89.1	67.5	65.5	53.8	46.9	53.8	70.7
Manufactures of Agricultural Origin	**4,863.7**	**4,970.5**	**5,857.7**	**7,528.6**	**8,493.5**	**9,104.6**	**8,762.0**	**8,193.2**	**7,863.5**	**7,460.1**	**8,167.9**	**9,990.9**	**11,932.0**
Meat	767.2	748.2	918.1	1,229.1	1,073.6	1,024.8	830.0	830.1	791.2	364.9	579.4	735.4	1,229.4
Processed Fish and Shellfish	236.6	279.3	285.8	416.2	394.9	416.5	385.8	296.5	242.7	237.7	236.2	253.8	322.3
Dairy Products	35.2	75.8	135.3	260.1	280.5	291.4	315.3	376.8	320.9	284.0	302.4	270.9	525.7
Other Products of Animal Origin	9.8	12.4	17.3	16.4	21.8	20.7	15.7	11.8	14.7	12.4	13.9	21.4	29.4
Dry or Frozen Fruits	23.7	21.9	32.0	27.8	33.4	31.3	31.6	34.4	35.2	31.0	42.3	54.6	63.6
Tea, Yerba Mate, Spices, etc.	46.9	62.3	61.0	67.3	64.6	79.2	84.4	65.0	64.7	67.0	60.8	53.4	61.0
Milled Products	51.4	59.3	87.8	90.2	166.0	203.5	165.1	131.4	158.3	145.1	115.9	86.1	92.9
Fats and Oils	1,109.1	1,078.6	1,533.6	2,097.1	1,890.5	2,225.0	2,733.7	2,332.1	1,678.1	1,636.6	2,095.4	2,831.5	3,168.0
Sugar and Confectionery items	65.4	43.3	58.7	122.0	144.5	133.7	135.9	106.1	137.9	120.6	159.2	131.2	146.6
Processed Legumes and Vegetables	260.4	166.4	160.1	321.2	400.1	391.5	319.0	340.7	308.4	325.7	291.1	365.9	447.6
Beverages, Alcoholic Liq. and Vinegar	64.0	64.2	79.8	165.2	153.1	197.4	231.3	205.9	215.2	209.8	173.6	216.1	273.1
Residues and waste from Food Industry	1,459.3	1,451.0	1,348.5	1,254.3	2,366.7	2,404.0	2,005.9	2,049.7	2,431.1	2,627.7	2,797.8	3,500.3	3,843.3
Tanning and Dyeing Extracts	40.3	44.2	43.2	39.6	41.5	49.8	46.2	39.0	39.8	39.7	34.9	33.8	35.6
Fats and Leather	475.1	617.8	762.8	937.0	889.3	980.1	812.4	779.8	835.7	819.5	700.6	727.3	840.9
Processed Wool	92.1	95.8	113.2	115.5	121.1	116.2	69.5	70.5	89.7	100.9	109.0	126.9	135.8

Table 1.3: Argentina's Exports by Type of Good (continued)

Other MAO	127.2	150.0	220.5	369.6	451.9	539.5	580.2	523.4	499.9	437.5	455.4	582.2	716.8
Manufactures of Industrial Origin	**2,823.4**	**3,678.9**	**4,646.8**	**6,504.1**	**6,465.7**	**8,334.6**	**8,624.3**	**6,965.6**	**8,230.0**	**8,305.6**	**7,634.5**	**7,703.2**	**9,522.0**
Chemicals and Related Products	533.4	558.8	727.5	972.5	980.0	1,176.1	1,370.0	1,373.1	1,386.6	1,432.1	1,349.1	1,558.9	2,017.5
Artificial Plastic Materials	148.0	133.0	180.6	340.7	339.9	349.2	380.0	369.3	518.6	628.7	642.7	695.9	937.8
Rubber and its manufactures	39.8	54.7	82.0	128.8	129.5	137.5	161.8	149.7	166.3	151.1	168.1	160.0	190.9
Leather goods	78.8	118.3	156.6	138.0	146.6	118.1	80.5	55.8	52.9	78.4	62.5	66.3	102.9
Paper, Cardboard, Printing and Publications	127.3	149.6	202.3	413.6	377.7	394.0	407.9	344.2	427.3	357.8	334.5	388.9	488.2
Textiles and Garments	121.5	164.9	210.1	383.8	304.5	334.7	320.5	278.3	304.7	263.9	227.6	210.4	271.5
Footwear and its Components	51.6	92.3	86.8	102.4	72.7	105.0	68.3	35.7	27.7	17.7	12.4	17.7	20.0
Stone, Gypsum and Ceramic Manufactures	71.2	78.8	70.9	109.8	106.7	120.2	113.7	96.1	96.7	91.3	94.7	102.0	123.6
Precious Stones and Metals and their Manuf.	4.2	52.0	251.6	23.1	4.9	3.7	29.6	113.0	102.3	103.9	118.0	115.8	145.5
Base metals and their manufactures	643.6	702.5	759.7	1,214.4	1190.3	1330.7	1234.5	1079.1	1412.1	1444.8	1601.9	1545.6	1670.5
Machines and Devices, Electric Material	518.4	754.8	866.5	983.0	961.5	1,230.4	1,109.6	1,054.8	1,102.4	1,125.1	942.2	861.0	1,052.1
Transport Material	404.8	719.4	918.2	1,307.8	1,641.9	2,786.4	3,102.5	1,751.9	1,957.0	1,982.2	1,615.1	1,432.2	2,068.1
Vehicles for air, maritime and river transportation	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	318.9	231.5	105.4	199.4	39.3
Other MIO	80.8	99.8	134.0	386.2	209.5	248.6	245.4	264.6	356.5	397.1	360.3	349.1	394.1
Fuels and Energy	**1,211.6**	**1,348.6**	**1,783.5**	**2,313.2**	**3,266.4**	**3,286.9**	**2,444.1**	**3,005.4**	**4,901.9**	**4,724.9**	**4,617.5**	**5,411.7**	**6,171.0**
Oil crude	348.8	527.4	1,125.6	1,591.9	2,320.0	2,191.4	1,462.7	1,589.6	2,808.8	2,363.3	2,235.3	2,298.6	2,314.6
Carburant	760.0	712.5	539.3	463.6	696.1	842.0	696.6	983.3	1,368.3	1,426.9	1,557.8	2,016.6	2,389.1
Lubricants from Fats and Oils	0.0	0.0	0.0	107.9	58.3	48.1	56.8	43.4	53.7	69.2	55.5	89.9	106.1
Oil gas and other hydrocarbures	44.3	65.9	71.8	75.7	109.6	128.9	162.1	278.9	451.8	609.8	628.1	872.1	1,131.1
Electric energy	1.9	1.1	0.9	7.8	13.0	11.3	2.5	27.9	148.2	159.4	67.2	36.7	93.3
Others	56.6	41.7	45.9	66.3	69.4	65.2	63.4	82.3	71.1	96.3	73.6	97.9	136.8
Total	**12,398.9**	**13,268.9**	**16,023.3**	**21,161.7**	**24,042.7**	**26,430.8**	**26,433.7**	**23,308.6**	**26,341.0**	**26,542.7**	**25,709.4**	**29,565.8**	**34,452.6**

Table 1.4: Argentina's Imports by Type of Good (FOB)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Capital Goods	2,900	3,889	5,696	4,509	5,348	7,387	8,154	6,515	5,728	3,981	1,248	2,426	5,209
Intermediate Goods	4,313	4,629	5,724	6,644	7,744	9,310	9,260	7,760	7,850	6,878	4,062	5,873	8,078
Fuels	468	422	598	781	841	897	785	676	970	791	457	518	919
Spare Parts and Pieces for Capital Goods	2,429	2,637	3,201	3,171	3,855	5,215	5,217	3,979	4,218	3,224	1,454	2,133	3,443
Consumer Goods	2,898	3,206	3,561	2,917	3,311	4,206	4,516	4,227	4,323	3,758	1,073	1,660	2,354
Vehicles	746	803	1,338	745	1,157	1,514	1,576	926	778	511	170	497	1,169
Others	41	48	45	39	27	26	24	21	22	15	10	12	13
Total	**13,795**	**15,633**	**20,162**	**18,804**	**22,283**	**28,553**	**29,531**	**24,103**	**23,889**	**19,158**	**8,473**	**13,118**	**21,185**

Table 1.5: Indices of Price and Quantities for Argentina's Exports and Imports

Period	Exports Value	Exports Price	Exports Quantity	Imports Value	Imports Price	Imports Quantity
1992	93.3	99.8	93.5	88.6	102.7	86.3
1993	100.0	100.0	100.0	100.0	100.0	100.0
1994	120.7	102.9	117.4	128.6	101.4	126.9
1995	159.8	108.8	146.9	119.9	106.9	112.2
1996	181.5	115.9	156.6	141.6	105.6	134.0
1997	201.5	111.9	180.1	181.4	103.2	175.8
1998	201.6	100.3	201.0	187.1	97.9	191.1
1999	177.7	89.1	199.5	152.0	92.4	164.6
2000	200.8	98.0	204.9	150.6	92.4	163.1
2001	202.3	94.7	213.7	121.1	89.9	134.7
2002	196.0	91.0	215.3	53.6	86.7	61.5
2003	224.0	99.7	224.7	84.2	87.0	94.7
2004	226.6	109.0	214.0	133.0	93.7	142.0

Table 1.6: Share of Brazilian Imports in Argentina

Period	Capital Goods	Intermediate Goods	Fuels	Spare Parts and Pieces for Capital Goods	Consumer Goods	Vehicles	Others
1995	13%	38%	10%	37%	31%	20%	9%
1996	19%	36%	17%	39%	33%	29%	24%
1997	22%	37%	17%	32%	35%	50%	23%
1998	24%	37%	9%	30%	35%	48%	24%
1999	22%	37%	26%	28%	37%	45%	23%
2000	32%	40%	32%	31%	46%	66%	22%
2001	27%	40%	66%	33%	50%	58%	17%
2002	21%	45%	31%	34%	42%	83%	33%
2003	46%	49%	19%	39%	50%	88%	56%
2004	45%	50%	34%	40%	52%	88%	41%

**Argentina's imports from Brazil, EU, and US represent 100% of imports.*

Table 1.7: Argentina's Imports by Type of Good and Country of Origin

Period	Capital Goods			Intermediate Goods			Fuels			Spare Parts and Pieces for Capital Goods			Consumer Goods			Vehicles		
	Brazil	US	EU	Brazil	US	EU	Brazil	US	EU	Brazil	US	EU	Brazil	US	EU	Brazil	US	EU
1995	465.4	1588.4	1568.4	2004.3	1478.4	1827.2	39.9	85.2	261.4	988.6	546.2	1156	542.8	448.5	743.8	132.4	56.8	457.7
1996	804.6	1674.8	1811.2	2269.3	1844	2111.8	51	71.4	175.5	1234	584.5	1349.4	665.4	501.7	819.2	273.9	58.1	628.8
1997	1305.3	2321.8	2240.7	2689.2	2033	2522.7	33.3	70.2	94.9	1370.4	931.2	1929.2	878	643.5	993.5	635.5	91.8	535.6
1998	1527	2374	2419.3	2660	1915.3	2581.6	13.9	64.4	77.5	1246.1	1052.6	1820.9	973.8	658.7	1162.7	671.5	89.3	624.4
1999	1132.4	1936.8	2024.8	2202.4	1560.3	2158.6	36.9	39.8	66.2	885.9	807.2	1430.5	997.1	618	1044.9	342.4	31.5	390.7
2000	1385.3	1621.9	1296.9	2425.1	1688.7	1929.3	58.6	58.7	68.7	926.9	801.7	1309.3	1256.7	536	965.5	421.8	36.8	184
2001	811.2	1116.5	1090.4	2120.3	1521.8	1614.1	134	32.2	35.9	758.7	677.9	893.9	1219.7	406.6	818.9	232.6	24.1	141.7
2002	214.9	484.8	331	1449.3	837.6	925.3	25.5	33.5	23.4	371.9	287.7	430.4	334.9	157.7	298.4	121.1	2.7	22.3
2003	855.8	532.7	466.2	2223.4	1095.5	1219	17	35.4	37	593.7	383.4	564	602.9	208.9	384.2	413.2	7.8	47.3
2004	1745.8	1077.7	1020.5	3075.6	1485.8	1603	61.7	53.2	65.8	942.7	523.5	912.8	817	276.5	481.1	959.8	14.7	114.1

APPENDIX II

International Business

ARGENTINA

ADIOS, ARGENTINA—HELLO, BRAZIL

Companies are stampeding out, posing a problem for de la Rúa

"Love thy neighbor" is not an easy commandment to live by for Argentina. Brazil's abrupt devaluation a year ago rendered Argentine products comparatively more expensive both at home and abroad. Worse, the cost of doing business became far cheaper in Brazil than in Argentina, spurring some two dozen companies to jump the border. The effect was to drag Argentina into a deep recession that it still hasn't shaken. Meanwhile, the Brazilian economy is set to rebound nicely in 2000. Thank you, Brasília.

This double whammy of a cheaper Brazilian currency and a local recession is presenting Argentina's new president, Fernando de la Rúa, with one of his first big policy challenges. The 35% slide of the Brazilian real against the Argentine peso is luring one manufacturer after another north to Brazil. If de la Rúa cannot stop it, the corporate exodus could cut short any nascent recovery, boost 14% unemployment to even higher levels, and spark social unrest in Argentina's poorest provinces. Also, corporate flight will deal another blow to Mercosur, the trade group anchored by Brazil and an increasingly disgruntled Argentina.

GOOD COMPANY. The latest to pull up stakes is Delphi Automotive Systems Corp. The world's largest auto-parts maker announced on Dec. 27 that it would shut down a wiring plant in Argentina's Córdoba province. Delphi is in good company: At least 15 auto-parts companies have moved north to Brazil, taking with them 7,000 jobs—or one-fifth of the industry's total workforce. Meanwhile, General Motors Corp., Ford Motor Co., and Italy's Fiat are all shifting some of their production to Brazil.

The stampede isn't limited to the auto industry. Compañía Industrial de Conservas Alimentícias (CICA), a unit of Anglo-Dutch giant Unilever, will close a plant in Mendoza province at midyear and step up exports from facilities in Brazil and Chile to supply Argentina. The company had considered the possibility of shuttering the Mendoza factory before Brazil's devaluation, but the real's slide "accelerated our decision," says Miguel Angel González Abella, CICA's head of institutional relations.

De la Rúa said just before New Year's that he will do everything in his power to stop the exodus. So far, the President has offered to ease the burden on business through cuts in payroll taxes and a reduction in import tariffs on key industrial goods. That could slow the rush of companies out of Argentina, but it will compromise de la Rúa's efforts to curb a gaping $6.5 billion budget deficit.

The fastest way out would be a devaluation, but there is virtually no support for such a move in Argentina. Scrapping the peso's 1-to-1 peg to the U.S. greenback would devastate scores of Argentine companies with dollar debts and end the country's nine-year streak of single-digit inflation. "This is a problem that has no quick solution," says Abel Viglione, an economist with the Latin American Economic Research Foundation (FIEL), a Buenos Aires think tank.

Argentina is learning the hard way that when times are tough, companies will focus on the big markets. Brazil's population of 165 million is nearly five times that of its neighbor. That's one reason why auto makers, even while scaling back in Argentina, are plowing more money into Brazil. Fiat plans to invest $1.5 billion over the next three years to boost sales of small trucks in the country—its largest market outside Italy. DaimlerChrysler is spending $500 million to modernize a truck plant. Although its economy barely grew in 1999, Brazil received $29 billion in foreign direct investment last year, compared with just $6 billion for Argentina.

OVERNIGHT. One long-term answer to Argentina's quandary is a Mercosur single currency. All of the bloc's members, which include Paraguay and Uruguay, have endorsed the concept. Yet it is clear that the merco, as the common coin could be called, can't emerge overnight. It took Europe more than a decade to lay the groundwork for the debut of the euro last year. "A single currency can be achieved, but it will probably take at least six years," says Michel Alaby, a São Paulo economist.

Corporate Exodus

Argentina's loss is Brazil's gain

DELPHI AUTOMOTIVE SYSTEMS	Closing down a wiring plant that employs about 400 workers and shifting production to Brazil.
CICA, A UNIT OF UNILEVER	Shuttering a tomato sauce plant, leaving 260 workers out of a job, and concentrating production in Brazil and Chile.
GOODYEAR TIRE & RUBBER	Retiring a tire factory, laying off about 900 workers. Will supply the market from its Brazilian operations.
TUPPERWARE	Closed a factory, laying off some 200 workers. Now exports to Argentina from its Brazilian factory.

DATA: BUSINESS WEEK

Until then, expect lots of disagreement within Mercosur. Two-way trade between Brazil and Argentina fell by over 25%, to an estimated $10.6 billion in 1999, the first annual decrease since the bloc was launched in 1991. Argentina has hiked tariffs and imposed quotas on Brazilian goods, from steel to household appliances. Brazil has retaliated with its own protectionist measures. Beggar thy neighbor, not love thy neighbor, are the words that Mercosur's two leading partners live by nowadays.

By Ian Katz in São Paulo

APPENDIX III

Table 1.8: List of Trade Agreements

Acronym	Trade Agreement	Countries
AFTA	ASEAN Free Trade Area	Brunei Darussalam Cambodia Indonesia Laos Malaysia Myanmar Philippines Singapore Thailand Vietnam
ASEAN	Association of South East Asian Nations	Brunei Darussalam Cambodia Indonesia Laos Malaysia Myanmar Philippines Singapore Thailand Vietnam
BAFTA	Baltic Free-Trade Area	Estonia Latvia Lithuania
BANGKOK	Bangkok Agreement	Bangladesh China India Republic of Korea Laos Sri Lanka
CAN	Andean Community	Bolivia Colombia Ecuador Peru Venezuela
CARICOM	Caribbean Community and Common Market	Antigua & Barbuda Bahamas Barbados Belize Dominica Grenada Guyana Haiti Jamaica Monserrat Trinidad & Tobago St. Kitts & Nevis St. Lucia St. Vincent & the Grenadines Surinam
CACM	Central American Common Market	Costa Rica El Salvador Guatemala Honduras Nicaragua
CEFTA	Central European Free Trade Agreement	Bulgaria Croatia Romania
CEMAC	Economic and Monetary Community of Central Africa	Cameroon Central African Republic Chad Congo Equatorial Guinea Gabon
CER	Closer Trade Relations Trade Agreement	Australia New Zealand
CIS	Commonwealth of Independent States	Azerbaijan Armenia Belarus Georgia Moldova Kazakhstan Russian Federation Ukraine Uzbekistan Tajikistan Kyrgyz Republic
COMESA	Common Market for Eastern and Southern Africa	Angola Burundi Comoros Democratic Republic of Congo Djibouti Egypt Eritrea Ethiopia Kenya Madagascar Malawi Mauritius Namibia Rwanda Seychelles Sudan Swaziland Uganda Zambia Zimbabwe
EAC	East African Cooperation	Kenya Tanzania Uganda
EAEC	Eurasian Economic Community	Belarus Kazakhstan Kyrgyz Republic Russian Federation Tajikistan
EC	European Communities	Austria Belgium Cyprus Czech Republic Denmark Estonia Finland France Germany Greece Hungary Ireland Italy Latvia Lithuania Luxembourg Malta Netherlands Poland Portugal Slovak Republic Slovenia Spain Sweden United Kingdom
ECO	Economic Cooperation Organization	Afghanistan Azerbaijan Iran Kazakhstan Kyrgyz Republic Pakistan Tajikistan Turkey Turkmenistan Uzbekistan

EEA	European Economic Area	EC Iceland Liechtenstein Norway
EFTA	European Free Trade Association	Iceland Liechtenstein Norway Switzerland
GCC	Gulf Cooperation Council	Bahrain Kuwait Oman Qatar Saudi Arabia United Arab Emirates
GSTP	General System of Trade Preferences among Developing Countries	Algeria Argentina Bangladesh Benin Bolivia Brazil Cameroon Chile Colombia Cuba Democratic People's Republic of Korea Ecuador Egypt Ghana Guinea Guyana India Indonesia Islamic Republic of Iran Iraq Libya Malaysia Mexico Morocco Mozambique Myanmar Nicaragua Nigeria Pakistan Peru Philippines Republic of Korea Romania Singapore Sri Lanka Sudan Thailand Trinidad and Tobago Tunisia United Republic of Tanzania Venezuela Vietnam Yugoslavia Zimbabwe
LAIA	Latin American Integration Association	Argentina Bolivia Brazil Chile Colombia Cuba Ecuador Mexico Paraguay Peru Uruguay Venezuela
MERCOSUR	Southern Common Market	Argentina Brazil Paraguay Uruguay
MSG	Melanesian Spearhead Group	Fiji Papua New Guinea Solomon Islands Vanuatu
NAFTA	North American Free Trade Agreement	Canada Mexico United States
OCT	Overseas Countries and Territories	Greenland New Caledonia French Polynesia French Southern and Antarctic Territories Wallis and Futuna Islands Mayotte Saint Pierre and Miquelon Aruba Netherlands Antilles Anguilla Cayman Islands Falkland Islands South Georgia and South Sandwich Islands Montserrat Pitcairn Saint Helena Ascension Island Tristan da Cunha Turks and Caicos Islands British Antarctic Territory British Indian Ocean Territory British Virgin Islands
PATCRA	Agreement on Trade and Commercial Relations between the Government of Australia and the Government of Papua New Guinea	Australia, Papua New Guinea
PTN	Protocol relating to Trade Negotiations among Developing Countries	Bangladesh Brazil Chile Egypt Israel Mexico Pakistan Paraguay Peru Philippines Republic of Korea Romania Tunisia Turkey Uruguay Yugoslavia
SADC	Southern African Development Community	Angola Botswana Lesotho Malawi Mauritius Mozambique Namibia South Africa Swaziland Tanzania Zambia Zimbabwe

SAPTA	South Asian Preferential Trade Arrangement	Bangladesh Bhutan India Maldives Nepal Pakistan Sri Lanka
SPARTECA	South Pacific Regional Trade and Economic Cooperation Agreement	Australia New Zealand Cook Islands Fiji Kiribati Marshall Islands Micronesia Nauru Niue Papua New Guinea Solomon Islands Tonga Tuvalu Vanuatu Western Samoa
TRIPARTITE	Tripartite Agreement	Egypt India Yugoslavia
WAEMU	West African Economic and Monetary Union	Benin Burkina Faso Côte d'Ivoire Guinea Bissau Mali Niger Senegal Togo

Source: WTO

CHAPTER 2: TRADE ADJUSTMENTS TO CURRENCY DEVALUATION AND TRADE DIVERSION

I. Introduction

In December 2001, with passage of the Law of Public Emergency and Reform of the Exchange Rate Regime, the "convertibility plan" was abolished and Argentina abandoned the one-to-one parity between the dollar and peso. By the end of January 2002, the peso started to float freely against all major currencies. Argentina's exchange rate regime reform and devaluation was intended to improve the country's balance of payments.

Economic theory suggests that devaluation should lead to a higher trade balance. According to Magee (1973), real devaluations lower the trade balance in the short run but raise it in the long run. This behavior is known as the J-curve since plotting the trade balance over time generates a curve with the shape of the letter J. Since Magee's seminal paper, a number of empirical studies have found mixed evidence on the J-curve. While papers finding J-curves use Magee's theoretical framework as a justification, studies finding no evidence of a J-curve do not highlight the reasons for the lack of empirical support.[20]

Argentina has been experiencing an aggregate (with the rest of the world) trade surplus since 1999, which indeed widened after the peso devaluation of 2002. However,

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[20] See literature review and Appendix I in Chapter 2.

two issues emerge in the analysis of Argentina's trade balance adjustments to devaluation. First, when studying a country that belongs to a common market (Mercosur), trade balance adjustments to exchange rate movements may differ between member and non-member countries primarily due to the regionalization forces detailed in Chapter 1. Second, as pointed out by Bahmani-Oskooee and Brooks (1999), aggregate trade data may not be an accurate gauge since a country's trade balance may improve against some trading partners (Argentina vis-à-vis Europe and the United States) and deteriorate against others (Argentina vis-à-vis Brazil). These two issues suggest that the analysis of bilateral trade flows might uncover trade patterns not apparent in aggregate data. Bilateral trade studies should lead to more precise policy implications.

After the peso devaluation of January 2002, Argentina's trade balance with Brazil deteriorated at a fast pace and became a deficit in the second quarter of 2003. In this case, Argentina's currency devaluation seems to have worked opposite to the theoretical prediction. On the other hand, Argentina's trade deficit with non-Mercosur trading partners US and EU became a surplus after devaluation.

Argentina's post-devaluation trade deficit with Brazil is primarily attributed to a surge in imports. This increase in Argentina's imports from Brazil has become one of the main economic topics in both countries. The effects of the peso devaluation on the trade balance with Brazil have been widely covered by the local media. Government officials have already implemented tariffs and non-tariff barriers (NTBs) to correct the current "asymmetries" in trade flows between the two countries. For example, in July 2004, Argentina's government imposed temporary import licenses on Brazilian home appliances. Also, a 21% tariff on imports of Brazilian television sets was imposed in July

2004. While the NTBs on home appliances are still in place, the 21% tariff imposed on imports of Brazilian televisions from the free trade zone of Manaus was eliminated. On March 2005, Brazilians rice producers complained to their government that Mercosur members are exporting rice to Brazil at dumping prices. A similar argument was made by Brazil's wine and flour producers. Those sectors plan to retaliate against Argentina's import tariffs.[21]

This chapter examines the statistical relationship between Argentina's currency devaluation and its bilateral trade balance with Brazil using quarterly data for the 1994:3-2004:4 period. An analysis of the short-run dynamics of trade balance adjustments is outlined. This analysis augments the conventional J-curve dynamics by including a measure of trade diversion in the balance of trade model. Real exchange rate devaluations lead to changes in a country's income and purchasing power relative to its trading partners. The peso devaluation in January 2002 could have lowered Argentina's income and accelerated the country's diversion of more expensive imports from the US and EU to cheaper substitutes from Brazil (a Mercosur member).[22] When analyzed in the context of regional economic integration, the dynamics of trade balance adjustments should investigate trade diversion effects from non-member to member countries.

Section II presents a review of the literature on the J-curve phenomenon. This review describes models and findings from previous research in the area starting with Magee's (1973) seminal paper. Section III provides an overview of relevant theoretical issues regarding the impact of currency devaluations on trade balances. Section IV

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[21] See Chapter 1 for a general discussion on tariffs, quotas, and NTB's within a regional economic integration agreement.
[22] Chapter 3 investigates the Linder hypothesis and trade diversion issues.

covers the empirical model and section V describes and prepares the data for model estimation. Section VI outlines results and section VII presents the conclusions and future research direction.

II. Literature Review

When the United States trade balance deteriorated from a surplus of $2.2 billion in 1970 to a deficit of $2.7 billion in 1971, the government devalued the dollar to correct such a deficit. The first year after the dollar devaluation (1972), the trade deficit reached $6.8 billion. Magee (1973) explains this phenomenon in terms of adjustment lags and analyzes the currency contract, pass-through, and quantity adjustments periods.[23] This paper analyzes in detail the short-term dynamics of devaluations on the trade balance when imports and exports are measured in home currency as well as in foreign currency. He argues that there may or may not be a J-curve in the short run and concludes that the long-run impact of devaluation on the trade balance is favorable. Since Magee's seminal paper, the J-curve theory has been tested in different countries. The most cited papers in the literature are presented below.[24]

Himarios (1985) uses annual data from 1956 to 1972 for Costa Rica, Ecuador, Finland, France, Iceland, Israel, the Philippines, Spain, Sri Lanka, and the United Kingdom. The study adds lagged values of exchange rates to a model investigating the trade dynamics of currency devaluations. Himarios suggests that the real exchange rate and not the nominal exchange rate is what affect trade flows. Domestic and foreign government expenditures as well as a variable accounting for the opportunity cost of

[23] See section III in this chapter for a detailed discussion of the currency contract, pass-through, and quantity adjustments periods.
[24] See Appendix I in this chapter for a table presenting the most frequently cited papers on J-curve.

money are part of the estimated model. Himarios (1985) finds that devaluation improves the trade balance in nine out of ten countries under study.

Bahmani-Oskooee (1985) analyzes the effect of devaluation in India, Greece, Korea, and Thailand using quarterly data for the 1973-1980 period. The paper is the first of a series of papers that test the presence of a J-curve by using an Almon lag structure on the exchange rate variable. A maximum of 12 lags are used to test for the J-curve phenomenon. With the exception of Thailand, the author finds the presence of a J-curve in Greece, Korea, and India, but with different time adjustments. The study also shows that devaluation in the long run deteriorates the trade balance for all countries except for Thailand. By using a dummy variable that represents a sudden change in the exchange rate for Korea, the author shows that sudden one-time shocks in the exchange rate affect the trade balance in a different way than small daily adjustments. The absorption and monetary approach are also tested with insignificant results in most cases.

Felmingham (1988) uses an unrestricted distributed lag model to test for the presence of a J-curve in Australia for the 1965:1-1985:2 period. The terms of trade, Australian GNP, and the US GNP (proxy for world income) are the model's explanatory variables whereas the import-export ratio is the dependent variable. Model estimations are based on two different periods: the fixed exchange rate period (1965-1973) and the managed or floating exchange rate period (1974-1983). Findings suggest evidence of a "delayed J-curve" since it takes more than eight quarters to improve the trade balance after a change in the terms of trade. Felmingham finds no evidence of a J-curve for the floating period. It is worth noting that changes in the terms of trade not always reflect changes in exchange rates; therefore, results may not properly reflect the impact of exchange rate adjustments on the trade balance.

Bahmani-Oskooee (1989) improves his 1985 paper by changing the way the real exchange variable is measured. The author adds a measure of foreign price level in the real exchange rate variable and defines the exchange rate as the number of units of domestic currency per unit of foreign currency. The paper shows that once these changes are in place, the real exchange variable should have negative coefficients followed by positive ones if a J-curve is present. The author finds an "inverse J-curve" when re-estimating the model in Bahmani-Oskooee (1985). Results suggest that devaluations first improve and then lower the trade balance. There are no changes in his long-run results that devaluation improved the trade balance only in Thailand.

Himarios (1989) examines the effectiveness of devaluation on trade balance adjustments by looking at two different samples (1953-73 and 1975-84) involving 27 countries and 60 devaluations. His evidence indicates that devaluations have been a successful tool in inducing trade balance adjustments. Specifically, he finds that nominal devaluations resulted in significant real devaluations that last for at least three years, and this significant real devaluation increased exports relative to imports.

Brissimis and Leventankis (1989) use an Almon lag structure to test the elasticities and monetary approaches to the balance of trade in Greece for the 1975-1984 period. The paper examines the impact of a non-sustained 10% devaluation of the Greek currency (drachma) on the country's trade balance. With the use of instrumental variables (IV), they find similar long-run results to Bahmani-Oskooee (1989). In the short run, they find evidence of a J-Curve in Greece with an initial deterioration that lasted one quarter. Contrary to Brissimis and Leventankis (1989), Karadeloglou (1990) finds evidence of an "inverse J-curve" for Greece during the 1974-1983 period. The results of this paper are based on a macroeconometric model of the Greek economy that includes consumption, private investment, imports, exports, inventory changes, prices, wages, and other macroeconomic variables.

Bahmani-Oskooee and Pourheydarian (1991) use an Almon lag structure on the real exchange rate variable. They test for the presence of a J-curve in Australia during the 1977–1988 period using quarterly data. They find evidence of a "delayed J-curve" for Australia and conclude that depreciation leads to trade balance improvements. The authors suggest that measuring the trade balance as an export-import ratio (X/M) does not affect the model's results.

Bahmani-Oskooee and Malixi (1992) use a similar model and test for the dynamics of the J-curve in 13 less developed countries (LDCs). Using quarterly data from 1973:1 to 1985:4, they find support for the J-curve in Brazil, Greece, Korea, and India. They also report, in line with Magee (1973), shapes such as the N-, M-, and I-curves, concluding that the short-run effects may not follow a standard pattern. Bahmani-Oskooee and Malixi find that in the long run devaluations have a positive impact on trade balance.

Bahmani-Oskooee and Alse (1994) improve Himarios (1989) by using stationary variables and measuring the trade balance as the import-export (M/X). The study discounts the results in Bahmani-Oskooee (1985) and Himarios (1989) arguing that these papers used non-stationary variables. Bahmani-Oskooee and Alse use Engle-Granger's cointegration technique on quarterly data from 1971 to 1990 for 19 developed and 22

LDCs. In the long run, devaluation improves the trade balance for Costa Rica, Brazil, and Turkey and has a negative effect in Ireland. No long-run effects are found in other countries. Using an error-correction model (ECM), the authors report the presence of a J-curve effect in Costa Rica, Ireland, the Netherlands, and Turkey.

Buluswar, Thompson, and Upadhyaya (1996) compare absorption, elasticity, and monetary models and conclude that the monetary model performs better in India. This paper uses quarterly data from 1960 to 1990 and imposes an Almon lag structure on the real exchange rate. They find no evidence of a J-curve and conclude that devaluations have had no significant long-run effects on the trade balance.

Upadhyaya and Dhakal (1997) test the effectiveness of devaluation on the trade balance of eight developing countries in Asia, Europe, Africa, and Latin America. They use a distributed lag model on the dependent variable and the real exchange rate. Their findings show that devaluation does not improve the trade balance in the long run. Specifically, only in Mexico does devaluation improve the trade balance in the long run, with the opposite applying to Cyprus, Greece, and Morocco. In Colombia, Guatemala, Singapore, and Thailand, devaluation is neutral in the long run.

Gupta–Kapoor and Ramakrishnan (1999) use an ECM for Japan during the 1975:1-1996:4 period. The trade balance is measured as the import-export ratio. The model is estimated with variables in nominal terms. Using Johansen's likelihood ratio cointegration test, the authors find evidence of a long-run relationship between the trade balance variable and the exchange rate. The authors find evidence of the J-curve phenomenon. Results remained unchanged even when real variables were used in the estimation.

Most of the recent papers examine the J-curve phenomenon with bilateral trade models. Rose and Yellen (1989) examine bilateral trade patterns for the US using quarterly data for the 1963-1988 period. They estimate a log-linear model with the trade balance measured as US net exports with the foreign country. Real GNP in the US and the foreign country along with the real exchange rate are the model's independent variables. The authors use stationary variables and test for cointegration among variables. Even though they find no evidence of cointegration among variables, they estimate a model in first differences with different lag structures on independent variables. They also correct for simultaneity bias and measurement errors by using IV. The paper fails to find a J-curve and concludes that the real exchange rate does not affect the trade balance with the exception to Germany and Italy in which lagged coefficients of the real exchange rate are statistically significant.

Marwah and Klein (1996) use an Almon distributed lag model for the US and Canada to show evidence of J-curves with France, Germany, the UK, and Japan on a bilateral basis. The authors use the export-import ratio as the dependent variable. The model is estimated using ordinary least square (OLS) and IV. A polynomial distributed lag is also used in the estimations. Marwah and Klein find that the timing and shape of J-curves are similar for both countries, but the initial deterioration of the trade balance is deeper in Canada. The paper covers the 1977:1-1992:1 period using quarterly data.

Bahmani-Oskooee and Brooks (1999) improve Rose and Yellen (1989) by using the US import-export ratio with its trading partners. They suggest that this ratio captures real and nominal movements in the trade balance. The paper also objects to the use of non-stationary data in Marwah and Klein (1996). Estimations are based on the

Autoregressive Distributed Lag (ARDL) model introduced by Peasaran and Shin (1995) and Peasaran, Shin, and Smith (2001). The paper examines the 1973:1-1996:2 period and finds no statistical evidence of a J-curve effect in the US. Model results show that a real depreciation has a positive effect on the bilateral trade balances between the US and its 6 major trading partners in the long run.

Wilson and Tat (2001) examine the relationship between the balance of trade and the real exchange rate between Singapore and the United States. Using quarterly data from 1970 to 1996 and an ARDL model, they find that the real exchange rate does not have a significant impact on the bilateral trade between both countries. They also find no evidence of a J-curve effect. Similarly, Wilson (2001) studies bilateral trade flows between Singapore, Malaysia, and Korea with both the US and Japan. In order to test for the presence of a J-curve, he uses a Vector Autoregressive (VAR) model and finds evidence of a J-curve only in the Korean case.

Baharumshah (2001) studies the effect of exchange rates on bilateral trade balances for Malaysia and Thailand with the US and Japan. With the use of an unrestricted VAR model, he finds that depreciation of Malaysia and Thailand currencies causes trade balances to improve with both the US and Japan. Further, he finds that the improvement in Malaysia-US trade balance place the same quarter that devaluation occurred. Results also suggest that the real effects of devaluation on the trade balance are distributed over a period of eight to nine quarters. The author finds evidence of stable long-run relationships between trade and exchange rates as well as between trade and incomes (domestic and foreign). The paper uses quarterly data from 1980:1 to 1996:4.

Bahmani-Oskooee and Kanitpong (2001) use an ARDL model to investigate the presence of a J-curve phenomenon for Thailand with Germany, the UK, the US, Japan, and Singapore. They use quarterly data from 1984 to 1997 to find a J-curve in the US and Japan.

Chen (2001) estimates two models by imposing an Almon lag structure on the real exchange rate. The first model estimates real exports as a function of foreign income, real imports, and real exchange rate. The second model estimates the trade balance as a function of foreign income and real exchange rates. Using quarterly data from 1981:1 to 1998:1, the paper studies bilateral trade flows for Taiwan with the US and Japan. Chen finds that real income affects real exports in both cases and that real exchange rates and real imports do not affect Taiwan's exports to the US, but they do affect Taiwan's exports to Japan. Chen also finds that real exchange rates have significant effects on the trade balance with US and Japan, but income does not.

Lal and Lowinger (2002) use quarterly data between 1980 and 1998 for seven East Asian countries. This paper examines the determinants of trade balances using Johansen's cointegration technique, error correction model, and impulse-response function. Among other findings, their investigation confirms the existence of a J-curve effect and results show that there are significant differences in the duration and extent of the J-curve effect across countries.

Bahmani-Oskooee and Goswami (2003) use an ARDL approach to cointegration and error correcting modeling to test for the presence of a J-curve in Japan with 9 major trading partners. The paper utilizes quarterly data from 1973 to 1998 and finds support for the J-curve only with Germany and Italy. They conclude that currency depreciation improves the trade balance in the long run.

Arora, Bahmani-Oskooee, and Goswami (2003) investigate the occurrence of a J-curve phenomenon in India's trade with Australia, France, Germany, Italy, Japan, the UK, and the US with an ARDL approach to cointegration and error correcting modeling. Defining the J-curve as a short-run deterioration followed by long-run improvements, they find a J-curve in India's trade with Australia, Germany, Italy, and Japan.

Hacker and Abdulnasser Hatemi-J (2003) test for the J-curve in five North European countries (Belgium, Denmark, the Netherlands, Norway, and Sweden) using generalized impulse-response functions. The results provide empirical support for the J-curve. Each country has an impulse-response function generated from a vector error-correction model suggesting that after depreciation there will be a dip in the export-import ratio within the first half-year. The long-run export-import ratio appears to be higher than the low point of this early dip in almost all cases.

Bahmani-Oskooee and Ratha (2004) expand Bahmani-Oskooee and Brooks (1999) by adding 12 US industrial trading partners. The study employs an ARDL model to investigate whether a J-curve is present. The results show that a J-curve is present only in the case of the Netherlands. Due to this lack of support for the theory, the authors redefined the J-curve phenomenon as a short-run deterioration of the trade balance with long-run improvements. Based on this version, results are supportive of a J-curve for Austria, Denmark, France, Germany, Ireland, Italy, Japan, New Zealand, Sweden, and Switzerland. In other words, a real devaluation of the dollar has a positive long-run impact on the trade balance. Finally, Bahmani-Oskooee and Ratha (2004b) broaden the scope of the previous paper by investigating the J-curve phenomenon between the US and 13 developing countries. With the use of quarterly data from 1975:1 to 2000:2, results from an ARDL model support the new definition of the J-curve in seven out of the thirteen countries studied.

Empirical findings are ambiguous. Note that none of the cited papers investigates whether the countries involved are part of a regional economic integration agreement. The focus of this chapter is to study the short-term dynamic of bilateral trade flows between two countries in of a common market that have intentionally devalued their currencies in order to induce trade balance improvements. At a time when talks about the Free Trade Area of the Americas (FTAA) seem to advance as slowly as the potential trade agreements between the European Union and Mercosur, examining trade patterns between the two major economies of Mercosur may uncover interesting policy implications.

III. Theories on Currency Devaluation and its Effect on the Trade Balance

Most of the models explaining a country's current account originated during the fixed exchange rates era (1950s and 1960s).[25] Consequently, the literature focuses on the effect of currency devaluation on the trade balance. Three main approaches emerged from the models of current account: the absorption, elasticity, and monetary approaches.

The Absorption and Monetary Approaches

The absorption approach focuses on home and foreign incomes, and states that an increase in home income relative to the income of trading partners should lower the trade balance. Domestic export revenue (X) is the value of domestic goods bought by

[25] See Krueger (1983).

foreigners and is a function of trading partners' real income (*Y**). As foreign income *Y** increases, some of that income would be spent on domestic goods and domestic exports will expand with the consequent improvement on the trade balance. Domestic imports (*M*) are the value of foreign goods bought by domestic residents and are a function of domestic real income (*Y*). A rise in domestic income is associated with higher imports since part of the additional income will be spent on foreign goods. Higher domestic real income leads to deterioration of the trade balance while higher foreign real income leads to trade balance improvements. A country's real GDP is commonly used as a measure of real income.

The monetary approach to the exchange rate states that devaluation decreases the real supply of money creating an excess demand that leads to hoarding, which in turn generates trade balance improvements. The monetary approach can be explained by analyzing the determinants of the price level in a small open economy. This scenario fits the case of the two countries in question. The price level on the economy is a weighted average of the prices of exportable goods and imported goods:

$$P = \alpha P_x + (1- \alpha)\, P_m \tag{2.1}$$

where P_x is the price of exportable goods, P_m is the price of imports, α is the share of exportable goods, and $(1- \alpha)$ is the share of imports in the economy.

It is assumed that this small open economy is a price taker, so to calculate domestic prices we convert world prices with the use of the nominal exchange rate *e*. Therefore, the domestic price of imports and domestic price of exports can be written as:

$$P_m = e\, P_m^* \tag{2.2}$$

$$P_x = e\, P_x^* \tag{2.3}$$

where P_m^* is the world price of imports and P_x^* is the foreign currency price of exports. Substituting (2.2) and (2.3) into (2.1), we obtain:

$$P = \alpha e P_x^* + (1-\alpha) e P_m^*$$

$$= e\,(\alpha P_x^* + (1-\alpha)\,P_m^*)$$

$$P = eP^* \qquad (2.4)$$

where $P^* = (\alpha P_x^* + (1-\alpha)\,P_m^*\,)$ is the world price of a basket of goods consumed domestically. As equation (2.4) implies, an increase in the nominal exchange rate e will raise the domestic price level P. As a consequence, the real value of money balances declines as shown by equation (2.5) where Ms is the money supply and L is real money demand or real money balances:

$$Ms/P = L\,(Y, i) \qquad (2.5)$$

A decrease in real money balances leads to hoarding while domestic spending or absorption decreases bringing about an improvement in the trade balance. The monetary approach predicts trade balance improvements in the short term. However, the payment surplus will generate additions to the money supply over time, taking the economy to the pre-devaluation equilibrium (Rivera-Batiz, 2002). In short, the monetary approach to devaluation states that currency devaluation improves the trade balance temporarily and in the long run leaves the real money supply and the balance of trade unchanged.

The Elasticities Approach and the J-curve

The elasticities approach focuses on the dynamics that generate the post-devaluation time-path of the trade balance. The response of trade flows to changes in exchange rates takes time because consumers are slow to change habits and, more importantly, because changes in production possibilities and supply require long-term investment decisions.[26] According to the elasticities approach, devaluation lowers the foreign currency price of exports and raises the domestic price of imports. As a consequence, quantities adjust and the trade balance improves due to import substitution, assuming that the Marshall-Lerner condition holds.[27] However, the increase in the price of imports may offset the decrease in quantity and lower the balance of trade. In this context, the outcome depends on price elasticities of demand for domestic exports and imports.

The theoretical justification of the J-curve phenomenon is as follows. The "contract period" hypothesis states that at the time of devaluation many contracts are already signed and many goods are in transit.[28] Krueger (1983) argues that the completion of these transactions dominate the short-run trade balance behavior. During the contract period, the trade balance should deteriorate due to fixed quantities and higher domestic prices for imports. Also, consumers and producers do not adjust instantaneously to changes in relative prices generated by real devaluations.

The "pass-through" period refers to slow quantity adjustments by producers and consumers to any price changes. Magee (1973) explains that quantities do not change during the pass-through period because of two reasons. First, supply might be perfectly inelastic for some time because exporters cannot suddenly adjust their output and sales abroad. Second, domestic demand of foreign goods might also be perfectly inelastic because it takes time for importers to substitute goods and change the flow of orders.

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[26] See Krugman (1989).
[27] According to the Marshall-Lerner condition, if the sum of imports and exports elasticities exceeds unity, a nominal devaluation has a positive effect on the trade balance.
[28] See Magee (1973) for a detailed analysis on the contract and pass through periods.

Finally, the "quantity adjustment" period calls for trade balance improvements in the long run when demand and supply for imports and exports become price elastic (Marshall-Lerner condition). Foreign importers have enough time to adjust their purchases to a lower foreign price of exports. Similarly, domestic importers adjust import quantities due to the increase in the domestic currency price of imports. Clearly, the quantity adjustment period calls for trade balance improvements due to an increase in the quantity of exports and decrease in the quantity of imports.

Based on the absorption, monetary, and elasticities approaches, the trade balance model and the expected sign for the different coefficients can be expressed as follows:

$$BOT_t = \alpha_0 + \alpha_1 \overset{(+)}{Y_t} + \alpha_2 \overset{(-)}{Y_t}^* + \alpha_3 \overset{(+)}{M_t} + \alpha_4 \overset{(-)}{M_t}^* + \alpha_5 \overset{(+)}{E_t} \quad (2.6)$$

where BOT_t is the trade balance at time t, Y_t and Y_t^* are home and foreign incomes measured by real GDP, M_t and M_t^* are home and foreign real money supply, and E_t is the real exchange rate at time t. The expected positive sign for E_t reflects the long-run expectations of improved trade balances after real exchange rate depreciations. It is assumed that the real exchange rate variable uses the nominal exchange rate as the amount of local currency per unit of foreign currency. Using this definition, an increase in E_t implies a depreciation of the local currency.

A J-curve in Argentina?

An important issue not often addressed in the literature is that the post-devaluation time-path of the trade balance depends on the currency used to measure imports and exports. This becomes important in the case of Argentina and Brazil because the trade balance is measured in US dollars. Magee argues that when the trade balance is measured in foreign currencies, it is not affected during the contract period, but it could be negatively affected during the pass-through period.

As a demonstration, consider the particular case of Argentina's bilateral trade balance with Brazil. The trade balance equation is presented in equation (2.7):

$$BOT = Px*X - Pm*M \tag{2.7}$$

where Px is the price of exports, X is the quantity of exports, Pm is the price of imports, and M is the quantity of imports. During the currency contract period, the quantities of exports (X) and the quantities of imports (M) are fixed. When the price of exports and imports are measured in US dollars (foreign currency), devaluation does not affect prices. Assume that an importer from Argentina signed a contract to buy 100 television sets from Brazil at a price of $1 each in November 2001. Clearly, the value of imports before the peso devaluation is $100. Assume that delivery and payments take place in March 2002 when the dollar was worth over 2 pesos. At this point, the Argentine importer has to pay the agreed $100 to the Brazilian exporter. In dollars, the value of imports continues to be $100. It is only when measuring the price of imports in local currency (pesos) that the value of imports increases during the contract period. A similar example could be used to demonstrate that the value of exports will not change during the contract period. Therefore, in line with Magee (1973), no initial deterioration of Argentina's trade balance with Brazil should be expected.

Now, consider the pass-through period, where the quantities are still fixed due to the short-term inelastic supply and demand for tradeables. During this period, the price of imports in dollars do not change and the price of exports measured in dollars decrease only if Argentine exporters are willing to allow devaluation to affect their prices. If

Argentine exporters do not pass through exchange rate changes onto the prices of their products, then the balance of trade will be again unaffected during this period. If they do charge Brazilian importers of Argentine goods a price reflecting the peso devaluation, the value of exports will decrease and the trade balance will deteriorate. As pointed out by Magee, a successful pass-through implies a deterioration of the trade balance during this short period.

Finally, during the quantity-adjustment period, we should expect an improvement in the trade balance. Specifically, the price of Argentine exports decreases and the quantity of exports increases. If the increase in quantities offsets the decrease in the price exports, then the value of exports increases. In equation (2.7), the dollar price of imports remains fixed and the quantity of imports decreases. Consequently, the value of imports decreases. Then, the overall result of the quantity-adjustment period depends on the elasticities of supply and demand for imports and exports or the Marshall-Lerner condition.[29] Specifically, higher elasticities lead to larger trade balance improvements in the presence of devaluation.

IV. The Model

Testing for the presence of a J-curve calls for examination of the contemporaneous and lagged effects of exchange rate movements on the trade balance. In general, a linear model could be used as follows:

$$y_t = \alpha + \sum_{i=0}^{p} \beta_i X_{t-i} + \delta Z_t + \varepsilon_{t,} \qquad (2.8)$$

[29] See Magee (1973) for details.

where Z_t is a covariate or a simple regressor without lagged coefficients, and X_{t-i} is a regressor with lagged coefficients. However, when the lag length (p) is long, multicollinearity becomes a problem. In the present case, although I do not find multicollinearity problems, a large number of lags (p) would use up degrees of freedom and the model would not generate consistent estimators.[30] Also, when dealing with trade data, one should impose constraints in the parameters β_i according to the notion that exchange rate effects on trade balance may peak after several quarters, then show diminishing effects, and finally disappear at a specific lag. Almon (1965) shows that a smooth pattern of lag weights could be approximated by a polynomial of low order.

The Almon PDL is considered a finite distributed lag model in which a change on an independent variable has an effect on the dependent variable that is distributed over several periods. The Almon PDL model is proven to be successful in capturing the lagged effects of exchange rate movements on the trade balance (see Bahmani-Oskooee (1985) and (1989), and Buluswar, Thompson, Upadhaya (1996)). Almon introduces the PDL model and its application by trying to predict quarterly capital expenditures in manufacturing industries for current and past appropriations for the period 1953-1961. With the use of an Almon PDL, one solves eventual multicollinearity problems and more importantly, the problem of inconsistent estimates due to low degrees of freedom.

$$\beta_i = \alpha_0^* + \sum_{j=0}^{d} \alpha_j^* i^j + \varepsilon_t, \; for\ j = 0, \ldots, d\ and\ i = 0, \ldots, p\ where\ d \leq p \qquad (2.9)$$

Equation (2.9) indicates that the coefficients β_is in (2.8) lay on a polynomial curve, which demonstrates that the effects of these lagged coefficients could first increase

[30] This is particularly important given that only 42 observations are available. See section V for data description.

and then decrease to finally disappear at some specific lag. The degree of the polynomial is generally not known, but can be determined empirically with the use of t-statistics. The degree of the polynomial (*j*) and number of lags (*i*) are determined based on Akaike Information Criteria (AIC), which is a measure that accounts for the trade-off between minimizing the sum of squares error (SSE) and limiting the number of regressors in a regression.

Model Adjustments

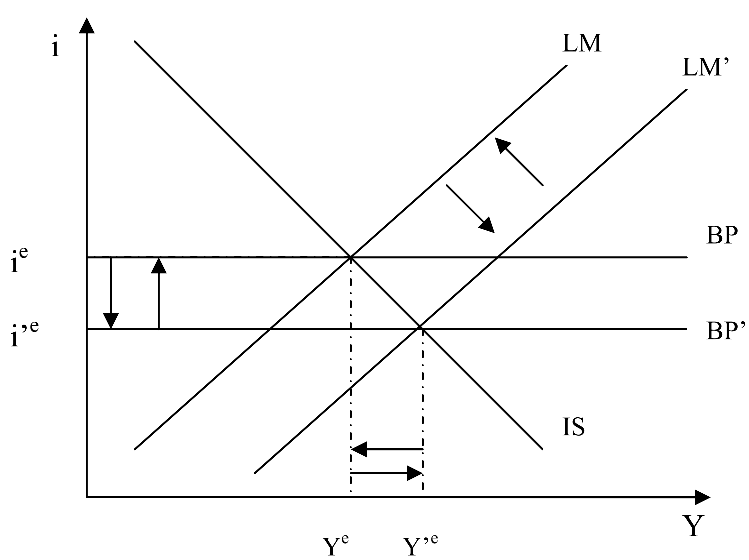
Equation (2.6) is adjusted before it is applied to the bilateral trade balance between Argentina and Brazil. First, the monetary variables (M and M^*) should be excluded when using real GDP because real income accounts for changes in income due to real money supply fluctuations (see for example, Bahmani-Oskooee and Artatrana (2004)). Second, M and M^* should be excluded because Brazil and Argentina had fixed exchange rates during most of the period under study, which, in turn, restrained all possibilities for implementing an autonomous monetary policy.

The first argument in favor of excluding monetary variables relates to the relationship between the monetary and the absorption approach. According to the monetary approach, a decrease in real money balances leads to hoarding while lower domestic spending improves the trade balance. Therefore, any changes in real money balances will affect the trade balance through absorption, phenomenon that is already captured by the relative income variable.

The Mundell-Fleming (ISLMBP) model is used here to help explain the second argument. According to the ISLMBP model, in a small open economy (SOE) that takes the world interest rate and has a fixed exchange rate regime coupled with perfect capital mobility, an increase in the money supply has no effect on income. This was the case of the convertibility plan established in Argentina and Brazil's Real Plan. Under these plans, the only manner to increase the money supply was through an increase in foreign reserves.

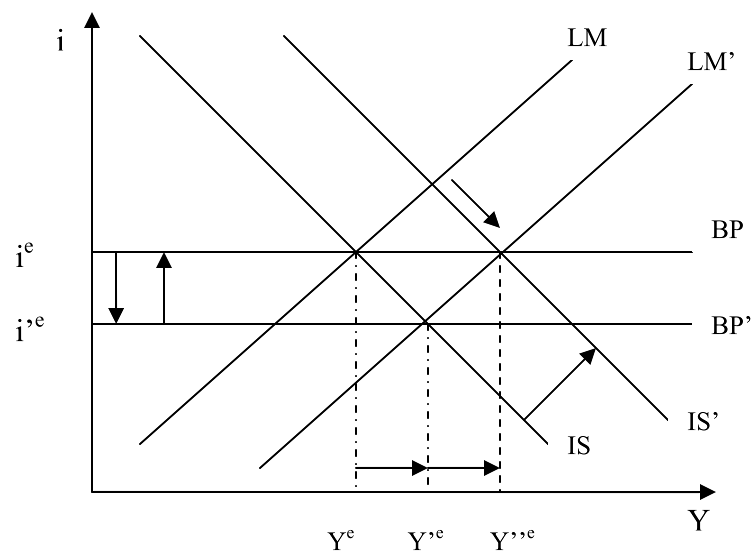
Figure 2.1 shows the ISLMBP model in a SOE with fixed exchange rates where *i* is the interest rate, *Y* is income, *IS* is the investment-savings curve (goods market equilibrium), *LM* and *LM'* are liquidity-money curves (money market equilibrium), and *BP* is the balance of payments. An increase in the money supply implies a rightward shift on the *LM* curve. This shift lowers home interest rates, which in turn leads to outflows of foreign funds (foreign bonds are a bargain). The government uses foreign reserves to maintain the exchange rate at the fixed level and this decrease in reserves shifts *LM* left to the original position, leaving income (*Y*) unchanged. In this model of fixed exchange rates, there is no effect of money supply on income and therefore no effect through the absorption approach on the trade balance.

Figure 2.1: ISLMBP with Fixed Exchange Rates



When a SOE with fixed exchange rates devalues its currency, domestic goods become more competitive and expenditures switch towards domestic goods. This has a positive and direct effect on aggregate expenditures shifting the *IS* curve rightward and increasing home interest rates that generate capital inflows. The central bank accommodates these capital inflows by accumulating foreign reserves. As a consequence, the *LM* curve shifts out increasing income. This is exactly the experience of Argentina and Brazil after both devaluations. These adjustments are similar to those of a SOE under flexible exchange rates and are displayed in Figure 2.2.

Figure 2.2: ISLMBP with Flexible Exchange Rates



In the ISLMBP model with flexible exchange rates, an increase in the money supply shifts LM rightward to LM'. This causes a decrease in interest rates that in turn leads to outflows of foreign funds. Capital outflows are offset by depreciation of home currency (decrease in demand for home currency) shifting the IS curve out due to increased consumption of domestic goods. This new equilibrium finds the level of interest rates unchanged and a higher income. An increase in money supply under a flexible exchange rate only affects income and changes in income affect the trade balance through the absorption approach.

Once the monetary variables are excluded, the model uses relative incomes to test for the absorption approach. In order to preserve degrees of freedom, the ratio of Y/Y^* (instead of Y and Y^* separately) is included in equation (2.6).[31] A priori, the sign on the estimated parameter of Y/Y^* is positive, indicating that income growth in Argentina relative to Brazil should increase the value of imports relative to exports.

Furthermore, two more variables accounting for the trade diversion phenomenon and Argentina's deep recession in 2002 are added to the model. In order to measure trade diversion, the ratio of imports from Brazil over imports from the Unites States and Europe (*Mb/Mo*) is used, where *Mb* is imports from Brazil and *Mo* is imports from outside Mercosur countries (the US and EU). It is expected, a priori, a positive relationship between (*Mb/Mo*) and *BOT* indicating trade diversion from non-member countries to Brazil.

The switch from a fixed to a free-floating exchange rate led to higher interest and inflation rates that helped deepen Argentina's recession. In order to account and correct for this structural break the model includes an interaction dummy (*DY*) that is defined as the change in relative incomes with respect to the same time period last year multiplied by a dummy that takes the value of 1 after the first quarter of 2002. The Almon PDL model used to test for the J-curve phenomenon in this chapter is as follows:

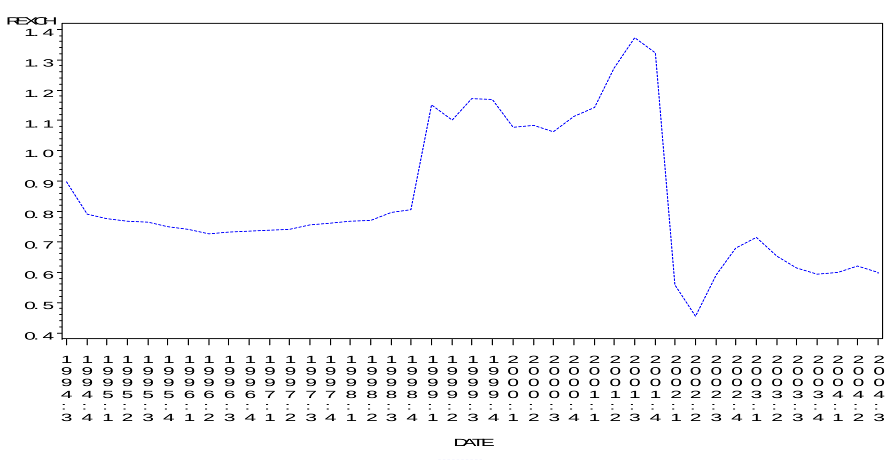
$$BOT_t = \alpha_0 + \alpha_1 Y_t/Y_t^* + \alpha_2 DY + \alpha_3 Mb/Mo + \sum_{i=1}^{n} b_i E_{t-i} + \varepsilon_t \qquad (2.10)$$

[31] Models using Y and Y^* separately give similar results than models using Y/Y^*.

V. Data Description and Stationarity Tests

Consistent with Bahmani-Oskooee and Alse (1994), Gupta-Kapoor and Ramakrishnan (1999), Bahmani-Oskooee and Brooks (1999), Baharumshah (2001), Lal and Lowinger (2002), trade balance is defined as the ratio of Argentine imports over exports. The value of imports and exports are measured in US dollars ($). Real GDP for both countries (Y, Y^*) are indices where 1994:3 is 100. The real exchange rate is calculated as $E = eP/P^*$, where E is the real exchange rate, e is the nominal exchange rate (measured as reals per pesos), P is Argentina's price level measured by the consumer price index (CPI), and P^* is the price level in Brazil (CPI).[32] The trade diversion proxy is measured as the ratio of imports from Brazil over imports from the US and Europe.[33] Figure 2.3 plots the real exchange rate for the time period under study, Figure 2.4 shows relative incomes, Figure 2.5 introduces the trade balance, and Figure 2.6 shows the trade diversion proxy. All figures plot the series in levels.

Figure 2.3: Real Exchange Rate (reals /pesos)



[32] An increase in the real exchange rate variable is evidence of an appreciation of the peso. This is a consequence of measuring the nominal exchange rate as reals per pesos.
[33] It is worth noting that Brazil, Europe, and the US account for almost 75% of Argentina's trade during the period under study.

Figure 2.4: Relative Real GDPs (*Y/Y)**

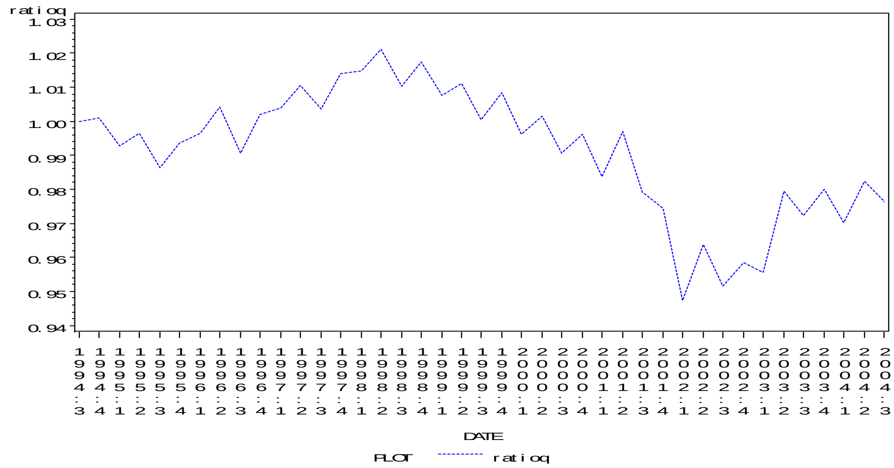


Figure 2.5: Bilateral Trade Balance measured as *M/X*

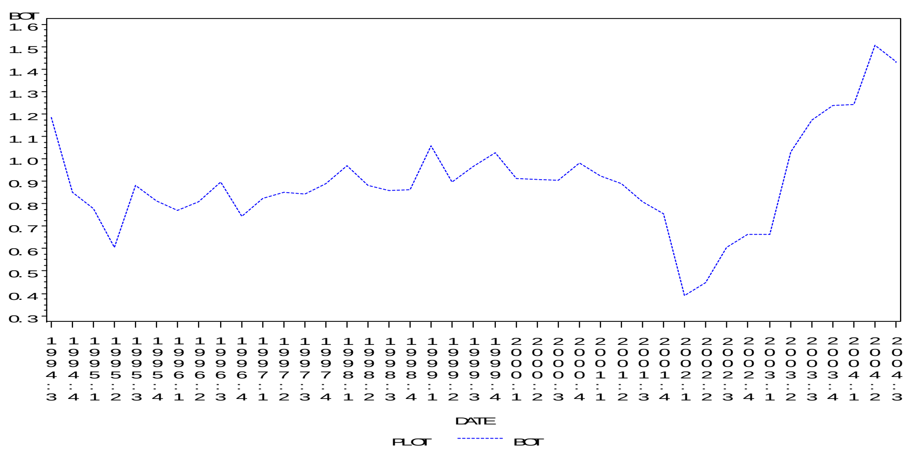
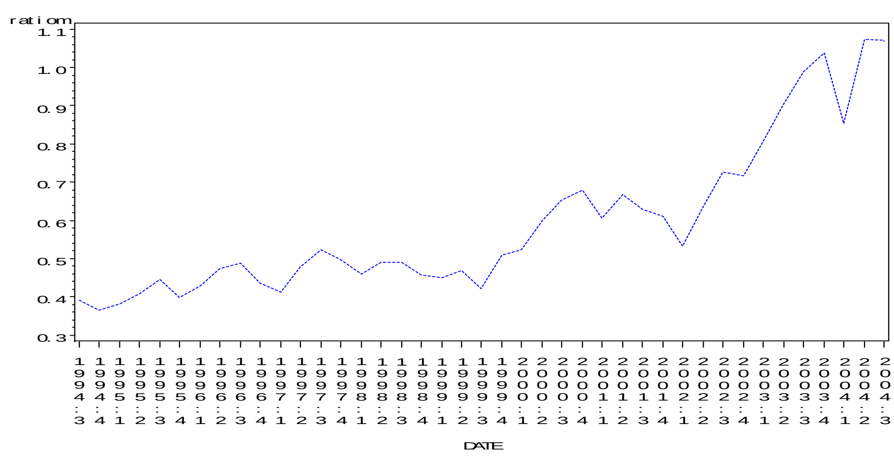


Figure 2.6: Ratio of Imports from Brazil over Non-Mercosur Partners (*Mb / Mo*)



A series is said to be stationary in the mean if its mean does not depend upon time. Similarly, a series is stationary in variance if the variance does not depend upon time or level. Differencing or detrending makes a series stationary in the mean and variance stabilizing transformations make the variance of a series to become constant. A logarithmic transformation is a variance stabilizing transformation that helps overcome the problem of nonstationarity in the variance. Also, when using a logarithmic transformation one can interpret the coefficients as elasticities. Therefore, all variables are transformed to a logarithmic scale before performing stationarity tests.

Following Nelson and Plosser (1982), augmented Dickey-Fuller (ADF) tests are performed in each series in order to test for stationarity.[34]

$$\Delta y_t = \alpha_0 + \alpha_2 t + \gamma y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta y_{t-i+1} + \varepsilon_t \qquad (2.11)$$

where y_t is the variable of interest, t is a time trend, and Δ is the first difference operator. In equation (2.11) the null hypothesis for the ADF test is $\gamma = 0$. Failure to reject the null hypothesis indicates that the series is not stationary.[35]

Table 2.2 presents ADF results for the logarithmic series and for the differenced series. Based on the ADF tests none of the variables are stationary in logarithms. However, all series are difference stationary.[36] The lag length is determined using the AIC.[37]

[34] To test for the robustness of ADF results, Perron's (1989) procedure was performed to find out whether the series are trend or difference stationary. None of the variables was found to be trend stationary at the 5% level.
[35] Dickey and Fuller (1979) provide the t-statistics for the ADF test. For a sample size of 50 (the closest to our study), the t-statistics are 3.18, 3.50, and 4.15 at the 10%, 5%, and 1% confidence levels.
[36] For Y/Y*, stationarity is achieved by first differencing relative annual growth rates in real GDP (first difference of the change in the logarithm of relative incomes with respect to same period last year).
[37] AIC chooses ADF's with 1 lag or none due to low degrees of freedom.

Table 2.1: Augmented Dickey-Fuller Tests

Variable	Logarithmic Level	First Differences	Number of Lags
E	1.08	5.20***	0
Y/Y*	-0.53	3.51**	1
BOT	1.93	6.84***	0
(Mb/Mo)	2.31	5.69***	1

*Note: Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*

VI. Model Results

The Almon PDL model in first differences is as follows:

$$\Delta BOT_t = \alpha_0 + \alpha_1 \Delta Y_t/Y_t^* + \alpha_2 DY + \alpha_3 \Delta Mb/Mo + \sum_{i=1}^{n} b_i \Delta E_{t-i} + \varepsilon_t \qquad (2.12)$$

Equation (2.12) estimates the trade balance in first differences as a function of the ratio of Argentina's real GDP over Brazil's real GDP ($\Delta(Y/Y^*)$) in seasonal first differences, an interaction dummy (DY) between relative incomes ($\Delta(Y/Y^*)$) and Argentina's devaluation, the first difference of the ratio of Brazilian imports over US and EU imports ($\Delta(Mb/Mo)$), and the real exchange rate in first differences (ΔE) and its lags. The optimal lag length of the real exchange rate and the degree of the polynomial are determined using AIC. AIC determined the lag length and the degree of polynomial to be 5 and 3, respectively. Table 2.3 presents the model results and Figure 2.7 (in Appendix II) shows the model's residuals.

As is indicated in Table 2.3, changes in relative incomes do not affect the trade balance. The coefficient for DY is positive, which suggests that after the modification of the exchange rate regime GDP growth in Argentina relative to Brazil's income growth leads to higher imports relative to exports. Therefore, the absorption approach holds for the post-devaluation period.

Table 2.2: Almon PDL Results in First Differences

Variable	Coefficient	t-value
Constant	0.001	0.09
$\Delta(Y/Y^*)$	-4.344	1.53
DY	4.843	2.56**
$\Delta(Mb/Mo)$	0.407	2.49**
ΔE_t	0.449	4.38***
ΔE_{t-1}	-0.294	3.50**
ΔE_{t-2}	-0.367	4.47***
ΔE_{t-3}	-0.161	1.97*
ΔE_{t-4}	-0.065	0.81
ΔE_{t-5}	-0.470	5.03***

Adjusted R^2=0.79
Degrees of Freedom = 28
*Note: Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*

Results in Table 2.3 indicate the presence of an "inverse J-curve." An inverse J-curve calls for initial improvements followed by deterioration of the trade balance. The positive and significant coefficient of a contemporaneous change in the real exchange rate *E*, followed by the negative and significant coefficients for lags 1, 2, 3, and 5 are indicative of an "inverse J-curve." Bahmani-Oskooee (1989) finds inverse J-curves for Greece, India, Korea, and Thailand from 1973 to 1980. Karadeloglou (1990) also finds an inverse J-curve for Greece for the 1974-1983 period.

The temporary improvement on Argentina's bilateral trade balance with Brazil could be attributed to initial exchange rate uncertainty, the banking restrictions imposed on December 3rd 2001, and to the foreign exchange (capital controls) restrictions set by the Argentine government in 2002. Known as the "corralito" (little fence), the banking restrictions allowed deposits to be transferred within the financial system, but it prohibited deposits to be converted into cash or to be transferred outside the financial system beyond a certain limit. The freezing of bank accounts and the capital controls deterred import payments to foreign exporters. In December 2001 alone imports from Brazil decreased by almost 55%. Through the "A 3827" Communiqué (making reference to Resolution # 668/2002 of the Ministry of Economy) the Argentine Central Bank announced the end of banking restrictions in Argentina as of December 2nd 2002. Argentina's imports from Brazil started to pick up in 2003, once banking restrictions and extensive capital controls were lifted.[38]

The positive and significant coefficient for $\Delta Mb/Mo$ means that imports from Brazil can be also explained by the reduction in imports from the US and EU.[39] This suggests the presence of import diversion from non-Mercosur trading partners to Brazil. The later deterioration of the trade balance seems to emerge when the economy (and the exchange rate) started to stabilize and recover early in 2003. With a floating exchange rate managed by the government at 3 pesos per dollar, imports from the US and EU became too expensive.[40]

VII. Conclusions

This chapter studies the short-term dynamic adjustments in the bilateral trade balance between Argentina and Brazil after the peso devaluation in January 2002. An "inverse J-curve" emerges from estimates indicating that the peso devaluation was not effective in improving Argentina's trade balance with Brazil. Trade diversion contributes significantly to Argentina's unexpected trade deficit with Brazil. This supports the theoretical belief that the reduction in Argentina's purchasing power due to the peso

[38] See Levi Yeyati et al. for a discussion on the "corralito" and its effect on the Argentine stock market.
[39] See Appendix IV for theoretical simultaneity concerns.
[40] Chapter 3 deals with the issue of trade diversion by through a Linder effect.

devaluation has triggered a process of trade diversion from the more expensive non-member products to the more affordable Brazilian products.

Results suggest that trade adjustments to exchange rates are distributed over time. The estimates suggest exchange rates affect trade at a lag length of up to five quarters. Results also support the idea that regionalization should be taken into account when examining the impact of devaluation on bilateral trade balances. Devaluations affect bilateral trade flows in a manner that favors regional trading partners at the expense of non-member countries. Perhaps, economic forces linked to regionalization such as the uneven flow of FDI targeting Mercosur's largest economy and the migration of firms from Argentina to Brazil after devaluation of the real explain the "inverse J-curve." The substitution of imports from the US and EU for Brazilian imports may be an income effect as proposed by Linder. Chapter 3 examines these issues in detail.

The results presented here have policy implications. For countries within a regional trade agreement, a devaluation intended to raise the trade balance may have contrasting effects depending on timing. When analyzing the case of Argentina and Brazil, it becomes clear that the country that devalued first (Brazil) has somehow managed to improve its trade balance with its partner (Argentina) even after the latter devalued three years later. The results in this chapter could mean that the member country that devalues first gains a first-mover advantage in exporting.

APPENDIX I

J-Curve Literature Review

Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results	Type
Magee (1973)		*X/M*	Exchange rate, domestic real income, foreign real income	US	Monthly (1969–1973)	Develops the ideas of currency contract, pass-through, and quantity adjustments. There may or may not be a J-Curve in the short-run, but the long-run impact of devaluation on trade-balance is favorable.	Rest of the world
Junz and Rhomberg (1973)	Time series OLS	(i) Market shares in manufacturing exports (ii) Manufacturing exports	Price variable: relative price of exports	Austria, Belgium, Luxemburg, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, UK, US	Annual (1953–1969)	They find lags of up to five years in the effects of exchange rate changes on market shares of countries in world trade due to: lags in the recognition of the devaluation, in the decision to change real variables, in delivery time, in the replacement of inventories and materials, and in production.	Rest of the world
Himarios (1985)	Time series OLS	The first specification involves: [(X-M)/GNP]. The second equation involves trade balance measured in foreign currency (B_t)	Δg_i, Δg_R, ΔM_i, ΔM_R, ΔG_i, ΔG_R, and ΔER_i, where *gi* and *gr* are income growth rates, M_i and M_R are money supplies (M1), G_i and G_R are the ratio of government expenditures to output, and ER_i is the country's exchange rate. The second equation involves real exchange rates	Costa Rica, Ecuador, Finland, France, Iceland, Israel, Philippines, Spain, Lanka, UK	Annual (1956-1972)	Devaluation improves the trade balance in nine out of ten cases.	Rest of the world
Bahmani-Oskooee (1985, 1989a)	Time series Almon lag structure imposed on real exchange rate	Index of (X-M) Base year = 1975	*GNP* (Y_t), world income (YW_t), domestic high powered money (M_t), world high power money (MW_t), effective exchange rate deflated by wholesale prices. All variables are expressed in index forms with base year 1975	Greece, India, Korea, and Thailand	Quarterly (1973–1980)	Finds evidence of an inverse J-curve for Greece, India, and Korea. The long-run impact is favorable only in the case of Thailand.	Rest of the world

Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results	Type
Felmingham (1988)	Unrestricted distributed lag model	*M/X*	Terms of trade (*px/pm*), domestic income (y), and proxy for world income (y_f)	Australia	Quarterly (1965:1–1985:2)	No strong evidence of J-curve during the fixed exchange rate era (1965-1974). No resemblance of an Australian J-curve during the era of managed or free-floating exchange rates (1974-1983).	Rest of the world
Himarios (1989)	Time series OLS	Real trade balance	Domestic and foreign real income (*Y, Y**), domestic and foreign real government expenditures (*G, G**), domestic and foreign real money balances (*M, M**), interest rate (*i*), and a proxy for expectations (anticipated devaluation)	27 countries and 60 devaluation episodes	(1953-73 and 1975-84)	Indicates that devaluations have been a successful tool in inducing trade balance adjustments. Specifically, he finds that nominal devaluations resulted in significant real devaluations that last for at least three years, and this significant real devaluation increased exports relative to imports for the same time period.	Rest of the world
Brissimis and Leventankis (1989)	Time series Almon lag structure. IV method	Petroleum and non-petroleum exports and imports	Exchange rate, export and imports weighted effective exchange rate, balance on invisibles and capital flows in drachmas, etc.	Greece	Quarterly (1975-1984)	Evidence of a J-Curve for Greece. The initial deterioration lasts one quarter.	Rest of the world
Karadeloglou (1990)	Time Series. Simulations of the Macro-econometric (MYKL) of the Greek Economy	Consumption, private investment, imports, exports, inventory changes, prices, wages, etc.	Demographic variables, government expenditures, foreign demand, foreign export prices, monetary variables, exchange rate	Greece	1974-1983	Evidence of an inverse J-curve.	Rest of the world
Bahmani-Oskooee and Pourheydarian (1991)	Time series Almon lag structure on the real exchange rate	$(X\text{-}M)_t$ in real terms.	*GNP* (Y_t), world income (YW_t), domestic high powered money (M_t), world high-power money, real effective exchange rate *E*PW/P*, where *P* is domestic price level, *PW* is the world price level, and *E* is the effective exchange rate	Australia	Quarterly (1977–1988)	Depreciation leads to trade balance improvements. Evidence of a delayed J-curve for Australia. Measuring the trade balance as the ratio of X/M does not affect the results of the model.	Rest of the world

Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results	Type
Bahmani-Oskooee and Malixi (1992)	Time series Almon lag structure (X/M)t in real terms	$(X\text{-}M)_t$ in real terms.	*GNP* (Y_t), world income (YW_t), domestic high powered money (M_t), world high-power money, real effective exchange rate *E*PW/P*, where *P* is domestic price level, *PW* is the world price level, and *E* is the effective exchange rate	Brazil, Dominican Republic, Egypt, Greece, India, Korea, Mexico, Pakistan, Peru, Philippines, Portugal, Thailand, Turkey	Quarterly (1973 Q1 –1985 Q4)	They find support for the J-curve for Brazil, Greece, Korea, and India. They also report, in line with Magee (1973), shapes such as the N-, the M-, and the I-Curves, concluding that the short-run effects may not follow a standard pattern, though the long-run effects are favorable in most cases.	Rest of the world
Bahmani-Oskooee and Alse (1994)	Time series. Engle-Granger cointegration technique	*M/X*	Real effective exchange rate	19 developed and 22 less developed countries	Quarterly (1971-1990)	Finds J-curves for Costa Rica, Ireland, Netherlands, and Turkey. Concludes that levels used by Himarios and Bahmani-Oskooee (1985) were not stationary. Use ratio of imports to exports for trade balance.	Rest of the World
Buluswar, Thompson, and Upadhyaya (1996)	Time series Almon lag structure on the real exchange rate	*X - M*	*Y* is an index of industrial production in India, *Y** is a proxy for rest of the world income, *M* is India's M1, *M** is a proxy for rest of the world M1 (major trading partners), and *E* is the real exchange rate	India	Quarterly (1960-1990)	The paper compares absorption, elasticity, and monetary models and concludes that the monetary model performs better in India. They find no evidence of a J-curve and they conclude that devaluations have had no significant long-run effect on the BOT.	Rest of the World
Upadhyaya and Dhakal (1997)	Distributed lag model with lags on the dependent variable and the real exchange rate	*X - M*	Real exchange rate	Colombia, Cyprus, Greece, Guatemala, Mexico, Morocco, Singapore, Thailand	Annual (1967-1992) for Colombia, Cyprus, Guatemala, and Mexico, (1964-1992) for Greece and Morocco, (1962-1992) for Singapore, and (1962-1992) for Thailand	Their findings show that devaluation, in general, does not improve the trade balance in the long run. Specifically, only in Mexico does devaluation improve the trade balance in the long run, while in Cyprus, Greece, and Morocco it does not. In Colombia, Guatemala, Singapore, and Thailand, devaluation is neutral in the long run.	Rest of the World

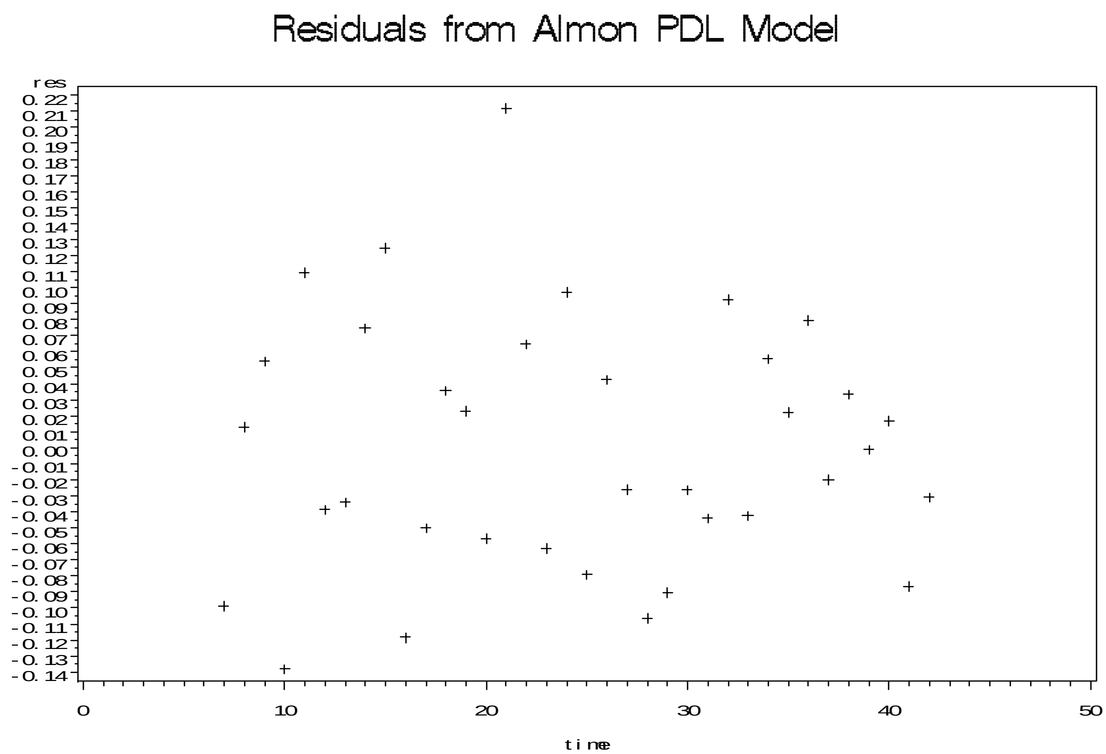
Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results	Type
Gupta–Kapoor and Ramakrishnan (1999)	Error Correction Model (ECM)	*Ln (M/X)*	*Y, Y** are nominal domestic and foreign incomes respectively, and the nominal effective exchange rate	Japan	Quarterly (1975 Q1–1996 Q4)	Finds evidence in favor of J-Curve.	Rest of the world
Akbostanci (2004)	Cointegration and error correction modeling. Impulse response function	*X-M*	*Y, Y** are nominal domestic and foreign incomes respectively, and the real exchange rate (*q*)	Turkey	Quarterly (1987:1-2000:4)	In the long run, a real depreciation of the Turkish lira improves the country's trade balance. In the long run, domestic a foreign income have no effects on the trade balance.	Rest of the world
Rose and Yellen (1989)	Time series: cointegration approach	*X-M* in domestic currency	Y_{USt}, Y_{Jt} is the US and country *j's* real GDP. REX_{jt} is the bilateral real exchange rate between $ and *j's* currency	US with Germany, Italy, Canada, France, Japan, UK	Quarterly (1963-1988)	Finds no indication of J-curve and no significant effect of the exchange rate on the trade balance.	Bilateral
Marwah and Klein (1996)	Almon distributed lag	*X/M*	The ratio of world trade to the country's GNP, and bilateral real exchange rate	US and Canada with France, Germany, Japan, and UK	Quarterly (1977:1 – 1992:1)	Evidence of J-curve effects for both the Us and Canada. The shapes of the J-curves are quite similar in both countries, but they seem to peak sooner and become more negative at the beginning of the adjustment process.	Bilateral
Sukar and Zoubi (1996)	Almon distributed lag. GLS estimates a reported	*X* in real terms	Foreign real income and real exchange rate	US with Canada and Japan	Quarterly (1975:3-1993:4)	Real income and real exchange rates are important determinants of bilateral trade flows.	Bilateral
Tongzon and Felmingham (1998)	Cointegration	*X/M*	Domestic and foreign real income (*Y, Y**), domestic and foreign real cash balances (*h, h**), and the real exchange rate (*q*)	US, Japan, Singapore, and Australia	Quarterly (1977:3-1994:3)	Real exchange rates have limited or no effect on bilateral trade balances in Australia, Japan, and US. Singapore's trade with US and Japan is the exception. Real cash balances and real income affect bilateral trade flows in the short-run.	Bilateral
Bahmani-Oskooee and Brooks (1999)	Time series ARDL approach: cointegration and error correction modeling	M/X	Y_{USt}, Y_{jt} is the US and country j's real GDP. REX_{jt} is the bilateral real exchange rate between $ and *j's* currency.	US with six major trading partners: Canada, France, Germany, Italy, Japan, UK	Quarterly (1973 Q1 –1996 Q2)	They improve Rose and Yellen by using M/X instead of X-M. They find no evidence of a J-curve. In the long-run, a $ depreciation leads to trade balance improvements.	Bilateral

Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results	Type
Wilson and Tat (2001)	Time series: ARDL approach	*X – M*	Real bilateral exchange rate (q), and real domestic and foreign income (Y, Y*) measured with the manufacturing production index and industrial production index respectively	Singapore with the US	Quarterly (1970-1996)	They find that the real exchange rate does not have a significant impact on bilateral trade between these two countries. They also find no evidence of a J-curve effect.	Bilateral
Wilson (2001)	VAR specification	*(X-M)/CPI*	Domestic income, foreign income and real bilateral exchange rate	Singapore, Malaysia, and Korea. Trading partners for these countries are the US and Japan	Quarterly (1970–1996)	Only in the case of Korea they find evidence of a J-curve.	Bilateral
Baharumshah (2001)	Time series. Unrestricted VAR model	*Ln(X/M)*	Domestic income, foreign income and the real effective (rather than bilateral) exchange rate	Malaysia and Thailand. Trading partners for these 2 countries are the US and Japan.	Quarterly (1980–1996)	No evidence of the J-curve.	Bilateral
Bahmani-Oskooee and Kanitpong (2001)	Time series ARDL approach: cointegration and error correction modeling	*Ln(X/M)*	Domestic income, foreign income and the real bilateral exchange rate. Improves Baharumshah (2001) by using the real bilateral exchange rate	Thailand with 5 partners: Germany, Japan, Singapore, UK, US	Quarterly (1984–1997)	Supports J-curve between Thailand and the US and Thailand with Japan.	Bilateral
Chen (2001)	Almon PDL structure imposed on the real exchange rate	i) *Ln(REX)* where *REX* is real exports ii) *Ln(RTB)* where *RTB* i real trade balance	i) Foreign income in logs (l*n RY**), l of real imports (*ln RIM*), and log of real exchange rate (*ln RER*). ii) log of foreign income (*ln RY**), and log of real exchange rate (*ln RER*)	Taiwan with the US and Japan	Quarterly (1981:1 -1998:1)	Real income affects real exports in both cases. Real exchange rates and real imports do not affect Taiwan's exports to the US, but they do affect Taiwan's exports to Japan. Real exchange rate has significant effects on trade balance with US and Japan, but income does not.	Bilateral
Lal and Lowinger (2002)	Time series Johansen's cointegration and error-correction modeling and impulse response function.	*Ln(M/X)*	Domestic income, world income and real effective exchange rate	Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand	Quarterly (1980–1998)	They confirm the J-curve and show that there are significant differences in the duration and extend of the J-curve effect across countries.	Bilateral

Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results	Type
Bahmani-Oskooee and Goswami (2003)	Time series. ARDL approach to cointegration and error correcting modeling	*Ln(X/M)*	Domestic income, trading partner's income and real bilateral exchange rate	Japan with Australia, Canada, France, Germany, Italy, Netherlands, Switzerland, UK, US	Quarterly (1973–1998)	Evidence supports the J-curve only with Germany and Italy. They conclude that the long-run effects of currency depreciation are to improve the trade balance.	Bilateral
Arora, Bahmani-Oskooee and Goswami (2003)	Time series. ARDL approach to cointegration and error correcting modeling	*Ln(X/M)*	Domestic income, trading partner's income and real bilateral exchange rate	India with: Australia, France, Germany, Italy, Japan, UK, US	Quarterly (1977–1998)	A new concept of the J-curve appears with Australia, Germany, Italy, and Japan.	Bilateral
Hacker and Abdulnasser Hatemi-J. (2003)	Time series Impulse response function	*Ln(X/M)*	Domestic income, trading partner's income and real bilateral exchange rate	Belgium, Denmark, Netherlands, Norway, Sweden	Quarterly and Monthly (1977–2000)	Supportive of the J-Curve.	Bilateral
Bahmani-Oskooee and Ratha (2004a)	Time series. ARDL approach to cointegration and error correcting modeling	*Ln(X/M)*	Domestic income, trading partner's income and real bilateral exchange rate	US with 18 trading partners: Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, UK	Quarterly (1975 Q1 – 2000 Q4)	Results support a new definition of the J-curve in 11 out of 18 cases.	Bilateral
Bahmani-Oskooee and Ratha (2004b)	Time series. ARDL approach to cointegration and error correcting modeling	*Ln(X/M)*	Domestic income, trading partner's income and real bilateral exchange rate	USA with 13 developing countries: Argentina, Chile, Ecuador, India, Indonesia, Israel, Korea, Malaysia, México, Nigeria, Pakistan, Singapore, South Africa	Quarterly (1975 Q1 – 2000 Q2)	Results support a new definition of the J-curve in 7 out of 13 cases.	Bilateral

APPENDIX II

Figure 2.7: Almon PDL Residual Plot



APPENDIX III

Investigation of Theoretical Simultaneity Issues:

Theoretical simultaneity concerns may arise because imports from Brazil (*Mb*) enter the model as the numerator of the dependent variable (*Mb/Xb*) as well as in the numerator of an independent variable (*Mb/Mo*). An instrumental variables regression is used to estimate imports from Brazil (*Mb*) as follows:

$$Mb = \alpha_0 + \alpha_1 Y_t + \alpha_2 e_t + \alpha_3 M_{t-1} + \alpha_4 P + \varepsilon_t \qquad (2.13)$$

In equation 2.13, *Y* refers to Argentina's real GDP, *e* is the nominal exchange rate (reals/pesos), *M* is Argentina's monetary base, and *P* is the price level in Argentina. Estimates for equation 2.13 follow:

$$\underset{}{Mb} = \underset{(0.80)}{1190.40} + \underset{(11.64)}{42.45\ Y} - \underset{(1.55)}{121.18\ e_t} + \underset{(3.82)}{0.02\ M_{t-1}} - \underset{(3.20)}{0.0001\ P}$$

The predicted values for Brazilian imports from this instrumental variables regression ($\hat{Mb}$) are used to create an instrument for the trade diversion proxy as ($\hat{Mb}$ / Mo). After taking a logarithmic transformation, the first difference of the series is stationary and used in the Almon PDL model (equation 2.12) which is re-estimated as follows:

$$\Delta BOT_t = \alpha_0 + \alpha_1 \Delta Y_t/Y_t^* + \alpha_2 DY + \alpha_3 \Delta \hat{Mb} / \mathrm{Mo} + \sum_{i=1}^{n} b_i \Delta E_{t-i} \qquad (2.14)$$

As shown in Table 2.4, results are similar to the originals presented in Table 2.3. The re-estimated trade diversion proxy shows a positive and significant coefficient, although it is smaller in magnitude. This suggests that results from the original Almon PDL model are subject to simultaneity problems. One can conclude that part of Argentina's bilateral trade deficit with Brazil is due to a decrease in imports from US and

Europe. In other words, import flows are being diverted from non-member countries to Brazil.

Table 2.3: Almon PDL Results with Instrument

Variable	Coefficient	t-value
Constant	0.009	0.56
$\Delta(Y/Y^*)$	-3.383	1.18
DY	4.807	2.46**
$\Delta(\hat{Mb} / \text{Mo})$	0.123	1.97*
ΔE_t	0.443	4.14***
ΔE_{t-1}	-0.288	3.28***
ΔE_{t-2}	-0.362	4.24***
ΔE_{t-3}	-0.160	1.88*
ΔE_{t-4}	-0.063	0.75
ΔE_{t-5}	-0.451	4.56***

Adjusted R^2*=0.77*
Degrees of Freedom = 28
*Note: Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*

CHAPTER 3: TRADE DIVERSION IN THE CONTEXT OF GRAVITY MODELS: A TEST OF THE LINDER HYPOTHESIS

I. Introduction

Starting with Ricardo's trade theory of comparative advantage, trade economists have developed frameworks to explain trade flows. The factor abundance theory (HOS theory) developed by Heckscher (1919), Ohlin (1933), and refined by Samuelson in the 1950s, is based on the principle of comparative advantage and suggests that trade is the result of differences in relative factor endowments between nations. Countries relatively well endowed with labor tend to export goods that use labor intensively. This factor proportion model suggests that trade patterns are mainly a supply-side phenomenon.

The HOS model was challenged by Leontief (1953) in a paper that studies trade patterns for the United States in 1947. Leontief found that US exports were on average labor intensive and that US imports were capital intensive in their factor contents. Since the US was believed to be a capital abundant country, this finding seemed to contradict factor proportion theory and became known as Leontief paradox. The evidence regarding the HOS model is mixed and a set of alternative theories has been developed.[41]

Linder (1961) proposes a demand-side approach that argues that HOS theory only applies to trade in primary products. Linder suggests that countries produce manufactures for their own consumption and that any excess supply is exported. He

[41] See Bharadwaj (1962), Bowen, Leamer, and Skeivaskas (1995), and Deardorff (1984).

argues that countries interested in buying this excess supply must have similar demand patterns. This principle of overlapping demands and production capacity explains why most world trade takes place between countries with similar endowments. The Linder hypothesis suggests that per capita income is the most important determinant of a country's demand structure and argues that similarity in per capita incomes increases the amount of trade between countries. It is worth noting that the Linder theory applies only to trade in manufactures and does not question the validity of the HOS theory for trade in resource based products.

During the 1980s and 1990s, trade theorists developed a new approach to explain world trade patterns. Krugman (1990) refers to a "new trade theory" that supplements other theories such as HOS or Linder. This new trade theory is based on increasing returns to scale, product differentiation, and imperfect competition. New trade theory played a major role in the development of a theoretical framework for the gravity model of trade, the most widely used model in the research examining the determinants of trade flows.[42]

Gravity models have successfully explained bilateral trade flows since the 1960s. Eichengreen and Irwin (1995) refer to the gravity model as the "workhorse" for empirical investigation due to its success explaining trade flows. The gravity model of trade proposes that trade depends upon economic size and geographic or economic distance between countries. The dependent variable becomes the sum of exports and imports, usually measured in US dollars. The gravity model was developed by Tinbergen (1962)

[42] See Section III for a discussion on the theoretical framework of the gravity model of trade.

and Linnemann (1966).[43] Tinbergen (1962) proposes that the amount of trade between two countries is directly related to their economic sizes (measured by GNPs or GDPs) and inversely related to their distance. Linnemann (1966) adds countries' populations as a measure of size. The GDP of the exporting country measures productive capacity, while that of the importing country measures absorptive capacity. The geographic distance between the two countries has been commonly used as a proxy for transportation costs. Per capita income has been also widely used because it accounts for both measures of country size GDP and populations. Besides testing for size and distance, the gravity model has been used to examine the presence of Linder effects.[44] Gravity models became a tool for testing the effects of regional economic integration, common language, monetary unions, exchange rate variability, and adjacency on trade flows as well as trade creation and trade diversion effects.

This chapter provides an analysis of the trade patterns between member and non-members countries by using a gravity type model. Section II presents a literature review that shows the development of gravity models since the 1960s. Theoretical underpinnings of the model are presented in section III. Section IV presents the Linder hypothesis and a review of the papers investigating its empirical success. A discussion of different econometric techniques is introduced in Section V. Section VI inspects the trade diversion effects of Argentina's devaluation and Section VII tests for the presence of Linder effects that could explain the diversion from non-Mercosur countries to Brazil. Section VIII presents the chapter's conclusions.

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[43] See literature review section.

[44] See Kennedy and McHugh (1983), Hoftyzer (1984), Hanink (1988 and 1990), Greytak and Tuchinda (1990), and McPherson, Redfearn, and Tieslaw (2000 and 2001).

II. Literature Review on Gravity Models

Tinbergen (1962) introduces the gravity equation to investigate standard patterns of trade that would prevail in the absence of trade restrictions. Any difference between actual and theoretical trade flows (actual vs. predicted values) is used as evidence of a preferential or discriminatory treatment of a country's exports in world markets. The main factors determining trade flows between two countries are GNPs and the geographic distance between them. The amount of exports a country is able to supply depends on its economic size, the size of the importing country, and on transportation costs. GNPs explain economic size and distance is a proxy for transportation costs.

In its simplest form, the gravity model introduced by Tinbergen is:

$$ln\ E_{ij} = \alpha_0 + \alpha_1\ ln\ Y_i + \alpha_2\ ln\ Y_j + \alpha_3\ ln\ D_{ij} + \varepsilon \qquad (3.1)$$

where E_{ij} is the value of exports from country i to country j, Y_i is country i's GNP, Y_j is country j's GNP, and D_{ij} is the distance between countries i and j. The model is cross-section with 18 countries in 1958. Dummy variables accounting for neighboring countries and regional integration are also part of the model. Results indicate that economic size and distance are the main factors explaining trade flows and that deviations from theoretical trade flows are considerable. A positive coefficient for the dummy representing the British Commonwealth preference implies higher trade among member countries.

Tinbergen repeats the previous exercise by using export data on 42 countries (70% of world trade) in 1959. He also estimates a model by adding a proxy for export commodity concentration. The correlation coefficient (R^2) for all regressions is 0.81. Significant deviations between actual and expected trade flows suggest the presence of discriminatory trade barriers. Tinbergen presents the reasons for those deviations and suggests that further research is needed. Among the reasons for positive deviations, the author cites preferential treatment of a country's exports, utilization of previously accumulated foreign exchange in the case of imports, or a net inflow of capital. Negative deviations are based on discriminatory treatment of exports, import restrictions, or net outflows of capital.

Linnemann (1966) explores the gravity model in detail by analyzing the factors that explain trade flows:

i) factors indicating total potential supply of country A (exporting country);

ii) factors affecting total potential demand of country B (importing country); and

iii) factors representing the "resistance" to trade flows from A to B.

Linnemann's trade flow equation follows:

$$X_{ij} = \delta_0 \frac{Y_i^{\delta_1} Y_j^{\delta_3} P_{ij}^{\delta_6}}{N_i^{\delta_2} N_j^{\delta_4} D_{ij}^{\delta_5}} \qquad (3.2)$$

where X_{ij} are trade flows from country i to country j, Y_i and Y_j are GNPs and have an expected positive effect, N_i and N_j are populations that are expected to have a negative coefficient, P_{ij} is a preferential trade factor (British, French, and Portuguese colonies), and D_{ij} is the distance between countries. GNPs and populations are factors affecting potential supply and demand, while P_{ij} and D_{ij} account for resistance to trade.

Linnemann investigates the link between his proposed equation and economic theory by using a model similar to Walras' model of general equilibrium prices.[45] Linnemann estimates world trade flows by applying (3.2) in a log-linear form to 80

[45] See Nicholson (1998) for a presentation of Walras' model. A more detailed presentation of Linnemann's model is introduced in the theoretical section of this chapter.

countries. The model is applied to different sets of data and is adjusted by adding a variable that measures the commodity composition of trade. Findings suggest a positive relationship between GNP and trade flows, a negative relationship between trade and population, a negative relationship between natural trade barriers (distance) and trade flows, and a substantial effect of preferential trade arrangements. By isolating and quantifying these effects, Linnemann (1966) improves Tinbergen (1962). Linnemann acknowledges the existence of "possible econometric shortcomings" and suggests further research in this area.

Aitken (1973) tries to separate the major forces that shaped trade flows in Europe during the 1951-1967 period. Aitken follows Tinbergen and Linneman by using a cross-section model with dummy variables examining the impact of the European Economic Community (EEC) and the European Free Trade Association (EFTA) on trade flows. Yearly regressions are performed for the pre- and post-integration periods to examine the forces that were in place before the formation of the EEC. Projection estimates are generated based on a base year equation to investigate trade creation and trade diversion effects.[46] Results are consistent with customs union theory. EEC has generated gross trade creation effects that are greater than those generated by EFTA ($9.2 billion and $1.3 billion respectively). Findings suggest that EEC had a net external trade creation effect on EFTA through 1964 that was offset by a growing net trade diversion effect from 1965

[46] Aitken (1973) defines gross trade creation (GTC) as the total increase in trade among members of a trading community due to integration, regardless of whether the additional trade replaces domestic production or whether it replaces non-members exports. Trade diversion (TD) is the substitution of imports from non-member countries (lower costs imports) for imports from member countries (higher cost imports). Finally, external trade creation (ETC) refers to integration-caused increases in trade between a trading community and countries outside the agreement. ETC minus TD yields the net effect of a trading bloc on the outside world.

to 1967. Aitken also suggests that 1958 is the last year for which it is safe to assume that European trade flows were not affected by the EEC.

Thoumi (1989) uses a gravity model to analyze intra-Latin American and Caribbean trade in 1971, 1975, and 1979. The paper uses GDP of the exporting country to account for productive capacity, the GDP of the importing country to capture its absorptive capacity, physical distance and country adjacency (border) as proxies for transportation costs, income per capita, bilateral exchange rates, and dummies capturing economic integration effects. The author applies the gravity equation to aggregate trade data as well as to three product categories: total goods traded except fuels, manufactures, and natural resource based products. Thoumi finds that exporters' GNP and distance are the most influential factors affecting trade patterns. Results also suggest that there is a tendency for richer countries to import more natural resource based products than manufactures from poor countries. In general, the author suggests that integration systems among countries that are not too distant, have similar sizes and development levels, and follow similar policies are more likely to succeed than other integration agreements.

Frankel, Stein, and Wei (1993) investigate the effects of trading blocs on trade flows. They estimate a gravity model using cross-sectional data including a large number of developing and industrial countries. The paper presents estimates every five years starting in 1965. The authors find that the EEC became a significant trade-creating force in the 1980s, peaking in 1985 and declining thereafter. Frankel, Stein, and Wei find that if two countries are members of the EEC, trade becomes 70% higher than it would have been otherwise (1990 estimates). They also find no trade creating effects for EFTA.

Bayoumi and Eichengreen (1995) examine the effects of preferential trade agreements in Europe since the 1950s. The paper's goal is to find whether regionalism creates trade diversion by using the EEC and EFTA as case studies. The paper estimates the gravity equation in differences rather than in levels to correct for the heterogeneity across countries.[47] The authors argue that the problem of omitting third-country effects is solved by including the real exchange rate between European countries and the US. The dependent variable of the gravity equation is bilateral trade between 21 developed countries. Real incomes, populations, distance, and the real exchange rate between European countries and the US are the model's independent variables. The sample data is divided into three overlapping periods: formation of the EEC and EFTA (1956-73), the entry of the United Kingdom, Ireland, and Denmark in the EEC (1965-80), and EEC expansion to include Greece, Portugal, and Spain (1975-92). Five dummy variables measure trade within the EEC, trade within EFTA, trade between EEC and EFTA, trade between EEC and other industrial countries, and trade between EFTA and other industrial countries. Results resemble those of Aitken (1973) and suggest that the formation of EEC and EFTA had a significant effect on European trade flows that cannot be attributed to economic factors or even unobservable characteristics. Bayoumi and Eichengreen find that EFTA was trade-creating, while EEC generated trade creation and trade diversion.

Eichengreen and Irwin (1995) add a historical perspective to the gravity model and examine the effect of regional trade agreements on trade. They suggest that the standard gravity model neglects the effect of historic ties on trade patterns and therefore suffers from an omitted variable problem. The paper presents evidence that demonstrate

[47] See section on econometric issues.

that the coefficients on traditional variables (incomes, populations, and distance) are distorted when a lagged dependent variable is added to the equation. The authors make this point by analyzing the evolution of trade between 1949 and 1965. They find a significant effect on lagged trade variables. While the paper suggests interpreting these lagged coefficients with caution, the results are robust to instrumental variables replacing lagged trade values. Specifically, Eichengreen and Irwin find that in the absence of lagged trade variables, the trade-creating effects of the European Payments Union (EPU) as well as the importance of the Dillon Round in the early 1960s are exaggerated.[48] They conclude that one should always include lagged variables in the gravity equation.

Frankel and Wei (1997) estimate an augmented gravity model using data for 63 countries for four years between 1970 and 1992. The dependent variable is the value of exports from country *i* to country *j* rather than the value of exports plus imports. Besides the standard explanatory variables included in gravity models, the authors use distance between trading partners and dummies for contiguous borders, common language, and regional groupings. Results from this augmented gravity model show that affinity variables such as common language or adjacency are significant and that intraregional trade biases exist. Frankel and Wei show that Western European countries are estimated to have traded 17% more than when these estimates are obtained with a standard gravity model. Similarly, Western Hemisphere and ASEAN countries are estimated to have traded 40% and 145% more than what a model without dummies would have estimated.

[48] Following the establishment of the European Economic Community in 1957, large-scale negotiations were held between September 1960 and May 1961 under Article XXIV:6 of the General Agreement. These negotiations were supplemented by a round of tariff negotiations, proposed by Douglas Dillon, Under Secretary of State of the United States. The Dillon Round yielded modest results: only 4,400 tariff concessions were exchanged, and agriculture and certain sensitive products were not covered.

Among other findings, results also suggest that increased trade in ASEAN and EEC did not occur at the expense of third countries. Finally, Frankel and Wei examine the extent to which currency blocs and currency stability follow regional trading blocs and trade flows between countries. Their findings suggest evidence of a currency bloc in Europe that follows the mark and a dollar bloc in the Pacific. The authors also find evidence suggesting that exchange rate volatility hinders trade.

Frankel, Stein, and Wei (1997) estimate a gravity model that resembles the one in Frankel and Wei (1997) but adds per capita income levels as an explanatory variable. Western European countries traded 36% more that what the standard gravity model would have predicted between 1970 and 1992. The authors also examined the extent to which intraregional trade was higher due to higher openness than average and they study trends in intraregional trade over time. Results show that trade increased over time as a consequence of trade-creating and trade-diverting effects. The coefficient for the per capita income variable is positive, suggesting that richer countries trade more. Frankel, Stein, and Wei add transportation costs and imperfect competition to their model. They claim that regional preferential agreements are welfare-improving, but conclude that the extent of preferences among regional partners has probably exceeded optimal levels.

Frankel (1997) provides a comprehensive investigation of the gravity model. The dependent variable is the logarithm of the total value of merchandise traded (exports plus imports) between two countries. Frankel estimates the gravity model with 65 countries every five years from 1965 to 1985 and then in 1987, 1990, 1992, and 1994. The model's independent variables are GNPs, per capita incomes, distance, and dummies accounting for adjacency between a pair of countries, common language, and preferential trade agreements. Results show that trade increases with a country's GNP but less than proportionally. According to Frankel, this suggests that smaller countries tend to be more open to trade than larger ones. The coefficients on per capita income are highly significant and indicate that richer countries trade more than poor ones. The coefficients on the distance variable are sensitive to the inclusion of the common border dummy. When the common border dummy appears in the equation, the coefficient for distance ranges from -0.5 to -0.7. In other words, increasing the distance by 1% reduces trade by 0.6%. Results also suggest that two countries sharing a common border trade 82% more than two similar countries not sharing borders.

Results in Frankel (1997) also show that two countries sharing linguistic or colonial links trade 55% more than they would otherwise. When examining the effects of trading blocs, Frankel finds that members of the ASEAN and the Australian-New Zealand Closer Economic Relationship (CER) have increased trade by almost fivefold. The Andean Pact and Mercosur have increased trade by more than two times. He also claims that the EEC has increased intra-trade by 65% after 1985. Frankel also shows that there are no factor endowment effects and finds significant historical-political effects and bilateral FDI effects on trade.

During the 1990s a number of researchers started to raise some questions about the econometric properties of the gravity model of trade. They argue that the standard cross-sectional ordinary least square (OLS) method in gravity regressions generates biased results because it cannot properly account for heterogeneity in trade flows between countries.[49] Specifically, it is claimed that gravity models of trade overestimate the effects regional integration as well as the effects of time invariant variables such as distance, common language, or adjacency. Misspecification issues and omitted variable problems are cited as reasons for the biased results.

Mátyás (1997) shows that all gravity models of international trade are misspecified from an econometric point of view. The paper starts by presenting the standard gravity model with the addition of country and time effects. These country and time effects are treated as unknown fixed parameters. The author states that cross-sectional studies restrict the model by assuming no time effects and time series models restrict local specific effects. Mátyás claims that the gravity models used up to that time did not take into account the time, local, and target country (importing country) effects. The study shows that imposing these restrictions leads to incorrect inferences due to the misinterpretation of the coefficients on dummies accounting for trading blocs, common border, or common language. He suggests that models explaining trade should take into account these fixed effects. Mátyás, Kónya, and Harris (1997) study the volume of exports in the APEC countries for the 1982-94 period. They present results for the restricted model and for the fixed effects model showing that most country-specific parameters (fixed effects model) are statistically significant.

Dell'Ariccia (1999) analyzes the effects of exchange rate volatility on bilateral trade flows in Western Europe. The argument is that exchange rate volatility could have negative effects on trade and investment. The paper argues that the European Monetary

[49] See Mátyás (1997), Bayoumi and Eichengreen (1997), Cheng (1999), Pakko and Wall (2001), Glick and Rose (2001), Wall (1999, 2000, 2002, and 2003), Egger (2002), Millimet and Osang (2004), and Cheng and Wall (2005).

System (EMS) and later the European Monetary Union (EMU) had the objective to control exchange rate movements and misalignments in Europe. The author uses a panel data approach with different measures and techniques that focus on solving potential simultaneous causality problems. Results from a Hausman test suggest that the OLS regression generates biased results indicating the existence of simultaneity bias. This bias is due to the existence of unobserved country-pair specific effects and is addressed with the use of instrumental variables and a fixed effects model. A fixed effects model is preferred over a random effects model and results are similar to OLS estimates. The sample data covers the 1975-1994 period for the fifteen countries forming the EU and Switzerland. Results suggest that exchange rate volatility decreases international trade and these results are robust for different specifications. The coefficients on the standard gravity variables are in line with expectations.

Mátyás, Kónya, and Harris (2000) follow Mátyás, Kónya, and Harris (1997) in analyzing trade patterns among the 12 original APEC members between 1978 and 1997. The dependent variable is exports from country *i* to country *j* and the explanatory variables are GDPs, populations, foreign currency reserves, real exchange rates, and distance. Local, target, and time specific effects are also added. The authors follow the econometric analysis presented in Mátyás (1997) and then estimate four different models. Model A is a fully restricted model that assumes no local or target country effects, and no time effects. Model B includes local effects, Model C adds target effects to the previous one, and Model D is a fully unrestricted model. They conclude, based on F-tests, that Model D is the preferred specification claiming that this specification is superior in terms of statistics and economics. The paper identifies countries with strong propensity to import and export. APEC members trying to increase exports should look at Singapore and New Zealand as potential markets. The authors claim that policy implications could be wrong in the absence of specific effects. Results also suggest that foreign GDP effects were underestimated in previous studies, that the effect of population on trade could be positive, and that the effect of real exchange rates is significant.

Rose (2000) uses a gravity model to estimate the separate effects on trade of exchange rate volatility and common currencies. A large cross-country panel data set includes the EU countries as well as other 92 countries that have some sort of common currency arrangement. The augmented gravity model explains bilateral trade as a function of GDP, income per capita, distance, and a series of dummies accounting for common language, regional trade agreement, colonies, common nations, a common currency dummy, and a variable explaining exchange rate volatility.[50] Rose finds that two countries with a common currency trade three times as much as countries not sharing a common currency. This common currency effect is larger than the effect of reducing exchange rate volatility to zero but keeping separate currencies. The author performs a sensitivity analysis that suggests robust results.

Soloaga and Winters (2001) investigate the effect of regional preferential trade agreements (PTAs) on trade. The paper applies a gravity model to 1980-1996 annual non-fuel imports data for 58 countries representing 70% of world trade. The authors modify the usual gravity equation by adding dummy variables that identify separate effects of PTAs on intra-bloc trade, members' total imports, and their total exports. They also test the significance of changes in the estimated coefficients before and after the

[50] Exchange rate volatility is measured as the standard deviation of the first difference of the monthly natural logarithm of the bilateral nominal exchange rate.

formation of trading blocs. Results show no indication that increasing regionalism during the 1990s raised intra-bloc trade significantly. The paper presents evidence of trade diversion taking place in the EU and EFTA. Soloaga and Winters also suggest that trade liberalization efforts in Latin America had a positive impact on bloc members' imports.

Pakko and Wall (2001) proposes a gravity equation that uses trading pair-specific fixed effects to control time invariant or fixed geographic, cultural, and historical factors instead of controlling these factors through the use of specific dummy variables. They argue that Rose (2000) has an estimation bias problem that leads to unprecedented findings. The authors claim that the fixed effects model avoids the estimation bias that may arise due to misspecification or omitted variables. Misspecification could arise with the creation of the variable distance that is supposed to reflect relative costs of trading. Omitted variable problems arise because it becomes impossible to include enough variables to account for all the important fixed factors (time invariant factors). Further, Pakko and Wall suggest that the fixed effects model not only controls variables such as language, common nation, colony, and distance, but also accounts for factors that are usually not included in gravity models. The paper shows that by using the data from Rose (2000) the fixed effects model results in much weaker evidence. Rose (2000) found that countries sharing a common currency trade three times more as they would with different currencies. Pakko and Wall find that having a common currency has no significant effect on trade flows between trading partners and conclude that one should be cautious in drawing conclusions when models are not robust.

Martinez-Zarzoso and Nowak-Leman (2002) use an adjusted gravity equation to study the role of economic and geographical distance on Mercosur plus Chile exports to

15 EU countries. The authors use a panel data approach for annual exports disaggregated by sectors for the 1988-1996 period. Using a log-linear model, they estimate a gravity equation with sector specific exports for different countries at different time periods as the dependent variable. The independent variables are the differences in per capita income between countries (economic distance), distance between countries scaled by infrastructure, and the bilateral real exchange rate. The economic distance variable accounts for Linder and HOS effects. When trading partners have contrasting per capita income, higher economic distance might deter trade (Linder effect). When higher economic distance leads to higher trade, then HOS effects are present. The infrastructure variable is an index capturing information on roads, paved roads, railroads, and telephones. The geographical distance is scaled by using this infrastructure index. The authors utilize a fixed effects model allowing for country-pair specific effects and time specific effects. This paper finds that products that are highly sensitive to economic distance and not sensitive to geographical distance are the best candidates for future trade with EU. The authors find evidence of Linder effects in some industries and of HOS effects in other industries. Specifically, the Linder hypothesis applies to telecommunications, iron and steel, metals, industrial machinery, and animal feed. Sectors with a dominant HOS effect are furniture, footwear, beverages, meat and fish (products in which Mercosur has a comparative advantage).

Martinez-Zarzoso and Nowak-Leman (2003) follow the previous paper by applying a gravity model to investigate Mercosur-EU trade patterns and trade potential. A sample of 20 countries consisting of the four members of Mercosur, plus Chile, and the 15 countries forming the EU is used. The fixed effects model is preferred over the random effects model. Exporter and importer incomes have a positive effect on trade flows. Results also show that exporter's population has a negative effect on exports and importer's population has a positive effect. Findings also suggest that for Mercosur-EU trade flows, only exporter infrastructure has a positive effect on trade. Preferential trade agreements also increase trade flows. Potential trade estimates show that Mercosur was exporting below its potential levels in 1996, but results are varied for previous years.

Cheng and Wall (2005) study the various fixed effects specifications and evaluate them in terms of their econometric appropriateness. First, they show that standard pooled-cross-section methods used in gravity models have an estimation bias problem due to omitted or misspecified variables. The paper shows that a two-way fixed effects model solves this by using country-pair and period dummies that explain bilateral trade patterns. This two-way fixed effects model replaces Mátyás' (1997) three-way model due to its bilateral nature. Country-specific dummies capture factors such as distance, common border, common language, history, culture, and others that are constant over time. Cheng and Wall show that alternative fixed effects models such as Mátyás (1997), Glick and Rose (2001), and Bayoumi and Eichengreen (1997) are special cases of their proposed two-way model. They claim that the restrictions applied to obtain these alternative models are not supported statistically. Finally, the paper investigates the effect of integration on trade patterns by adding dummies accounting for preferential agreements and controlling country-pair heterogeneity using the two-way fixed effect model proposed. Results indicate that unless heterogeneity is accounted for properly, gravity models of bilateral trade can overestimate the effects of integration on trade flows.

III. Theoretical Framework of Gravity Models

The first theoretical foundation of the gravity model was developed by Linnemann (1966). Chapter 3 of Linnemann's book attempts to reconcile the trade flow equation in (3.2) with economic theory. The author suggests that trade flows between individual countries could be derived from a Walrasian type general model. Linnemann starts with a 3-country model that accounts for transportation costs and production. The demand equations for the product of country 1 are a system composed of domestic demand and the demand for the product in countries 2 and 3.

$$X^D{}_{11} = D_{11}(Y_1, N_1, p_1, p_2, p_3, t_{21}, t_{31}), \tag{3.3}$$

$$X^D{}_{12} = D_{12}(Y_2, N_2, p_1, p_2, p_3, t_{12}, t_{32}), \tag{3.4}$$

$$X^D{}_{13} = D_{13}(Y_3, N_3, p_1, p_2, p_3, t_{13}, t_{23}), \tag{3.5}$$

where, $X^D{}_{ij}$ is the demand for the product of country i in country j, Y_i is national product or income in country i, N_i is the population in country i capturing the notion of optimum size in a production unit, p_i is the price of a product unit of country i in country i, and t_{ij} are transport costs between countries i and j for a product unit of country i. Equation (3.3) shows domestic demand for the product of country 1 while (3.4) and (3.5) represent foreign demand. The supply equation shows that total supply depends on production capacity K_i and on price p_i.

$$X^S{}_1 = S_1(K_1, p_1) \tag{3.6}$$

Linnemann's model is a short-run model in which production capacity and income are given. He assumes a constant capital-output ratio in the short-run (income and production capacity are given) and rewrites equation (3.6) as follows:

$$X^S{}_1 = S'_1(Y_1, p_1) \tag{3.7}$$

Equality of supply and demand is given as:

$$X^{S}_{1} = X^{D}_{11} + X^{D}_{12} + X^{D}_{13} \tag{3.8}$$

Equation (3.8) is an equilibrium equation reached through the interaction of supply and demand. It is neither a supply nor a demand function and therefore it does not contribute to explain trade flows X_{ij} as proposed in equation (3.2). Consequently, X^{S}_{i} and p_i are excluded so that we have X_{ij} as a function of other X_{ij}, t_{ij}, Y_i, and N_i. In order to eliminate the X_{ij} as an explanatory variable, Linnemann reduces this 3-country model to a bilateral one, in which X_{ij} is a function of t_{ij}, Y_i, and N_i. Before defining this bilateral trade model, Linnemann defines the foreign supply for product *i* as follows:

$$X^{SF}_{i} = X^{S}_{i} - X^{D}_{ii} \tag{3.9}$$

where X^{D}_{ii} is the domestic demand for product *i*, X^{S}_{i} is domestic supply, and X^{SF}_{i} is foreign supply. For small countries that have no power to affect neither world prices nor third countries' trade resistances (t_{ij}), it is sensible to eliminate them from the model. Therefore, Linnemann's bilateral model of trade flows is as follows:

$$X^{D}_{12} = D'_{12}\,(Y_2, N_2, p_1, t_{12}) \tag{3.10}$$

$$X^{SF}_{12} = S^{F}_{12}\,(Y_1, N_1, p_1) \tag{3.11}$$

$$X^{SF}_{12} = X^{D}_{12} \tag{3.12}$$

This bilateral equilibrium model of X_{12} depends on economic sizes (Y_i and N_i) and trade resistances (t_{ij}) between the two countries under consideration as in the standard gravity model presented in equation (3.2).

Anderson (1979) uses a linear expenditure system with homothetic and uniform preferences for a country's goods and with products that are differentiated by place of origin. Using a pure Cobb-Douglas expenditure system model, Anderson presents the simplest possible gravity equation assuming that each country specializes in the production of one good with no tariffs or transportation costs. The fraction of income spent on the product produced by country i is denoted by b_i and is the same across countries due to identical Cobb-Douglas preferences. Income in country j is denoted by Y_j and assuming prices are equal to unity, imports of good i by country j M_{ij} equals:

$$M_{ij} = b_i Y_j \tag{3.13}$$

Income should equal sales $Y_i = b_i (\sum Y_j)$ and substituting into (3.13), Anderson finds the "simplest form of gravity model":

$$M_{ij} = Y_i Y_j / \sum Y_j \tag{3.14}$$

Anderson also uses a trade share expenditure system to derive a gravity-type equation by appending to the previous Cobb-Douglas expenditure system a traded-non-traded goods split. He presents a weakly separable utility function as $u = u(g(\text{traded goods}), \text{nontraded goods})$ where individual demand for traded goods are determined by homothetic preferences and are maximized subject to a budget constraint. Since preferences are identical across countries, expenditure shares are the same everywhere. For any country j, θ_i is the expenditure on country i tradeable good divided by total expenditure on tradeables in country j. Let φ_j be the share of expenditures on all traded goods in country j's total expenditure, $\varphi_j = F(Y_j, N_j)$. Anderson defines the demand of imports of country i's good on country j as follows:

$$M_{ij} = \theta_i \, \varphi_j \, Y_j \tag{3.15}$$

The share of national expenditures on tradeables is a function of income and population and the share of total tradeable goods expenditures accounted by each good is a function of transport costs. The balance of trade equation for country i implies that

$Y_i\ \varphi_i = (\sum Y_j\ \varphi_j)\theta_i$. Solving for θ_i and substituting this equation into (3.15), Anderson finds a deterministic form of gravity equation without the distance term and with a scale term added:

$$M_{ij} = \frac{\varphi_i Y_i \varphi_j Y_j}{\sum_j \sum_i M_{ij}} \tag{3.16}$$

Krugman's (1979) seminal paper develops a model that explains trade flows as a function of economies of scale instead of factor endowments or technology. He assumes that scale economies are internal to firms with a market structure that follows a Chamberlinian monopolistic competitive market where firms have some monopoly power but entry drives monopoly profits to zero.[51] It is assumed a one factor (labor) economy that is able to produce many goods. All consumers share the following utility function U:

$$U = \sum_{i=1}^{n} v(c_i), \qquad v' > 0, \qquad v'' < 0 \tag{3.17}$$

where c_i is the consumption of good i. All goods share the same cost function and the amount of labor needed for production is a linear function of output:

$$l_i = \alpha + \beta x_i, \qquad \alpha, \beta > 0 \tag{3.18}$$

where α are fixed costs, l_i is the labor used to produce good i, and x_i is the quantity produced of good i. Through conventional consumer's utility maximization subject to a budget constraint, Krugman derives the demand function faced by a firm. Then,

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[51] Chamberlin (1933, 1962) introduces the tangency solution in his theory of monopolistic competition in which entry and exit of firms lead to a zero profit situation. At the tangency solution, an individual's demand curve is tangent to a falling portion of the average cost curve in which scale economies prevail.

following a profit maximizing behavior and Chamberlin's tangency solution, he finds the firm's supply curve and pricing scheme.

Krugman examines the effects of population growth, trade, and factor mobility with conventional comparative statics. Population growth and trade increase the production of each good as well as the number of goods. It is also shown that the volume of trade is maximized when economies of scale between two countries equal in size, a result that is in line with the Linder hypothesis. Further, in the presence of increasing returns and trade impediments, factor mobility seems to create a process of agglomeration in which all workers will concentrate in one country or the other. The author suggests that the more populous the region, the more variety of goods and the higher real wages which would induce immigration. Krugman proposes that trade may be a channel to extend markets and therefore to allow the utilization of scale economies. The paper shows that trade need not be a result of international differences in technology or factor endowments. Krugman argues that trade is a way of extending a domestic market allowing for scale economies. He concludes that economies of scale are "underemphasized" in formal trade theory.

Krugman (1980) extends the previous paper by examining the effects of transportation costs and the effects of larger domestic markets on wages as well as the effects of home market size on trade. The author follows the same approach as in Krugman (1979) with scale economies where firms can differentiate their products at no cost and equilibrium is reached by Chamberlinian monopolistic competition. Krugman shows that transportation costs have no effects on pricing policies and also no effects on output and the number of firms. He also finds that countries with larger domestic markets tend to have higher wage rates. Finally, Krugman argues that countries with larger domestic markets on specific goods will tend to export those goods. He also suggests that findings are in line with Linder (1961).

Krugman (1981) develops a model that formalizes previous work such as Balassa (1967), Grubel (1970), and Kravis (1971). The paper attempts to explain the fact that much of the world trade is between countries with similar factor endowments, trade between similar countries is mainly intra-industry, and that the growth on intra-industry trade has not caused serious income distribution problems. Krugman proposes that the usual forces of comparative advantage operate on "groups of products" giving rise to inter-industry specialization and trade. On the other hand, scale economies lead each country to produce only a subset of goods within a group, leading to intra-industry trade. Krugman argues that similar countries have an incentive to trade, that this trade will be mainly on goods that use similar productive factors, and that this intra-industry trade will not generate income distribution problems that usually arise with inter-industry trade.

Helpman and Krugman (1985) present the theoretical framework supporting that bilateral trade flows depend on the product of GDPs.[52] In a nutshell, demand for variety drives consumer expenditures and monopolistic competitive firms produce differentiated products. The authors argued that under the usual assumptions, the Heckscher-Ohlin theory does not have the property that bilateral trade depends on the product of GDPs. Empirical gravity models find a significant effect for the product of incomes, suggesting that a model of trade with differentiated products is preferred.

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[52] See Helpman and Krugman (1985), section 1.5.

Bergstrand (1985) uses a general equilibrium model of trade where consumers across countries maximize the same utility function with constant elasticity of substitution (CES) subject to an income constraint:

$$U_j = \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq j}}^{N} X_{kj}^{\frac{\sigma_j - 1}{\sigma_j}} \right)^{\frac{\sigma_j}{\sigma_j - 1}} \right]^{\frac{\mu_j - 1}{\mu_j}} + X_{jj}^{\frac{\mu_j - 1}{\mu_j}} \right\}^{\frac{\mu_j}{\mu_j - 1}} , \quad j = 1, \ldots, N \tag{3.19}$$

where X_{kj} is aggregate demand in country j for k's goods, X_{jj} are domestically produced goods, μ_j is the CES between domestic and importable goods, and σ_j is the CES among importable goods. Expenditures in country j are constrained by income as follows:

$$Y_j = \sum_{k=1}^{N} \bar{P}_{kj} X_{kj} , \; j = 1, \ldots, N \tag{3.20}$$

where $\bar{P}_{kj} = P_{kj}T_{kj}C_{kj}/E_{kj}$ and P_{kj} is the k-currency price of k's product sold in the j^{th} market, T_{kj} is one plus j's tariff rate on k's product, C_{kj} are transport costs to ship k's product to j, and E_{kj} is the spot value of j's currency in terms of k's currency. Maximizing utility in equation (3.19) subject to (3.20) generates $N(N + 1)$ first order conditions that lead to $N(N - 1)$ bilateral aggregate import demands and N domestic demand equations.

In terms of supply, Bergstrand uses equation (3.21) in which firms in each country i maximize the profit function:

$$\prod_i = \sum_{k=1}^{N} P_{ik}X_{ik} - W_iR_i \; , \qquad i = 1, \ldots , N \tag{3.21}$$

where R_i is the amount of the single, fixed (internationally immobile) resource to produce different goods and W_i is the price of this resource (i.e., wage in the case of labor). R is allocated in each country according to a constant elasticity of transformation (CET) function as follows:

$$R_i = \left\{ \left[\left(\sum_{\substack{k=1 \\ k \neq i}}^{N} X_{ik}^{\frac{1+\gamma_i}{\gamma_i}} \right)^{\frac{\gamma_i}{1+\gamma_i}} \right]^{\frac{1+\eta_i}{\eta_i}} + X_{ii}^{\frac{1+\eta_i}{\eta_i}} \right\}^{\frac{\eta_i}{1+\eta_i}}, \qquad j = 1, \ldots, N \tag{3.22}$$

where η_i is i's CET between production at home and foreign markets and γ_i is i's CET for production among exports markets. Substituting (3.22) into (3.21) and maximizing this equation, Bergstrand finds $N(N-1)$ bilateral exports supply equations and N domestic supply equations.[53]

Bergstrand derives a general equilibrium model of trade by equating supply and demand equations. To find a general equilibrium consistent with the gravity specification, he assumes countries are small open economies taking prices and foreign incomes as given. He also assumes identical utility and production functions across countries. Assuming also perfect substitutability of goods across nations, perfect commodity arbitrage, zero tariffs, and zero transport costs, the general equilibrium equation is simplified to the general form of the gravity equation:

$$PX_{ij} = (1/2)Y_i^{1/2}Y_j^{1/2} \tag{3.23}$$

In the last section of his paper, Bergstrand estimates a generalized gravity model for 1965, 1966, 1975, and 1976.[54] He finds that price and exchange rates have significant statistical effects on trade flows. Bergstrand suggests that if trade flows are differentiated by origin, the typical gravity equation omits prices and exchange rates. He also finds that

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[53] See equations 8 and 9 in Bergstrand (1985).
[54] See Appendix III for a list of the variables used by Bergstrand.

exporter's income increases trade flows, which implies that the elasticity of substitution among importables σ_j is greater than 1. The negative coefficient on country *i*'s GDP deflator supports this conclusion and suggests that the elasticity of substitution between domestic and imported goods is less than 1. Finally, the negative coefficient for *i*'s export unit value index implies that "the elasticity of transformation among export markets exceeds that between production for domestic and foreign markets" (Bergstrand, p. 480). Overall, these elasticities imply that in terms of production and spending, countries are more flexible when it comes to substitute among export and import markets than when they substitute between a domestic and a foreign market.

Bergstrand (1989) extends the previous paper by incorporating factor endowments differences (H-O theory) and non-homothetic preferences (the Linder hypothesis) to the model. Consumers maximize a Cobb-Douglas-CES-Stone-Geary utility function subject to an income constraint. National income, income per capita, and prices explain bilateral trade flows. According to Bergstrand, the utility function of consumer *l* in country *j* (U_{jl}) is:

$$U_{jl} = \left[\left(\sum_{n=1}^{N} \sum_{h=1}^{H_{An}} X_{Ahnjl}^{\theta^A} \right)^{1/\theta^A} \right]^{\delta} \text{x} \left[\left(\sum_{n=1}^{N} \sum_{h=1}^{H_{Bn}} X_{Bhnjl}^{\theta^B} \right)^{1/\theta^B} - \bar{X}_B \right]^{1-\delta}$$

$$-\infty < \theta^A, \theta^B < 1;\ 0 < \delta < 1 \qquad (3.24)$$

where X_{Ahnjl} (X_{Bhnjl}) is the amount of manufactured (non-manufactured) goods produced by industry *A's (B's)* firm *h* in country *n* demanded by consumer-worker *l* in country *j*, and $\bar{X}_B$ is the minimum consumption of good *B* (necessity). Expenditures are constrained by consumer's nominal income (Y_{jl}):

$$Y_{jl} = \sum_{a=A,B} \sum_{n=1}^{N} \sum_{h=1}^{H_{an}} (P_{anj}T_{anj}/E_{nj})X_{ahnjl} \qquad (3.25)$$

where T_{anj} is one plus the tariff rate on industry a ($a = A, B$) exports from country n to j, E_{nj} is exchange rate between n and j, and P_{anj} is the free on board (f.o.b.) price of firm h's output of industry a exported from country n to j. Maximizing (3.24) subject to (3.25) leads to a set of bilateral import demand functions that are aggregated since consumers in country j are identical. Bergstrand derives country j's demand curve for the output of A produced by firm g in country i as:

$$P_{Aij} = \delta^{1/\sigma^A} X_{Agij}^{-1/\sigma^A} (Y_j)^{1/\sigma^A} (1 - y_j^{-1})^{1/\sigma^A} T_{Aij}^{-1} E_{ij} \text{ x} \left[\sum_{n} \sum_{h}^{A} \left(P_{Ahjn} T_{Anj} / E_{nj} \right)^{1-\sigma^A} \right]^{-1/\sigma^A},$$

$$i = 1, \dots, N \qquad (3.26)$$

where, $\sigma^A = 1/(1 - \theta^A)$, Y_j is j's nominal GDP and y_j is j's GDP per capita. Bergstrand assumes that similar demand exists for industry B's output.

On the supply side, each firm in each of the two industries produces a differentiated product in a Chamberlinian monopolistic competition market using labor (L) and capital (K). Bergstrand's profit function assumes a linear technology function shared by all firms, a fixed supply of labor and capital in each country, and assumes that each firm's output is distributed among domestic and foreign markets according to a CET function:

$$\pi_{agi} = \sum P_{ain} X_{agin} - (W_i \alpha_{La} + R_i \alpha_{Ka}) - W_i \beta_{La} \left[\sum_{n} \left(C_{ain} X_{agin} \right)^{\phi^a} \right]^{1/\phi^a}$$

$$- R_i \beta_{Ka} \left[\sum_{n} \left(C_{ain} X_{agin} \right)^{\phi^a} \right]^{1/\phi^a}, \text{ g} = 1, \dots, H_{ai}; \ a = A, B; \ i = 1, \dots, N \qquad (3.27)$$

Maximizing the profit function, Bergstrand finds equations for the marginal costs of exporting industries *A* and *B*.[55] After making the appropriate substitutions, solving for reduced form equations, and summing up all firms in industry A or B in country *i*, the author presents a generalized gravity equation that explains trade flows as a function of GDP, per capita income, distance, tariffs, price levels, and the exchange rate.

Bergstrand applies the derived gravity equation to the same data of his previous paper to test the H-O model. Results show that between 40% and 80% of the variation across countries in one digit SITC trade flows are explained by the model. Coefficients on exporter and importer's income are positive as expected, and coefficients for exporter's per capita income suggest that chemicals, raw materials, manufactures, machinery and transport equipment, and food products are usually capital intensive in production whereas beverages, tobacco,and miscellaneous manufactures are labor intensive. Bergstrand further notes that the coefficient on importer's per capita income suggests that manufactures tend to be luxuries and raw materials necessities. Finally, he suggests further research for the effects of prices on trade flows.

Bergstrand (1990) extends previous theoretical work by examining how average levels and inequality of GDP, GDP per capita, tariff rates, and capital-labor ratios affect the share of intra-industry trade. The paper provides a theoretical framework for such a model and then presents an empirical analysis for 14 developed countries. These theoretical foundations are similar to Bergstrand (1989) with minor differences. By maximizing constrained utility functions, a bilateral import demand function is as follows:

[55] See Bergstrand (1989) for details on marginal costs functions and on the final derived gravity equation.

$$X_{hij} = \delta Y_j(1-y_j^{-1})\ (P_{hij}D_{ij}T_{ij}/E_{ij})^{-\sigma}(P_j)^{-1} \qquad (3.28)$$

where X_{hij} is the aggregate demand in country j for output of country i's firm h, Y_j is j's national income, y_j is j's income per capita, P_{hij} is the f.o.b. i-currency price of firm h's output of X sold in j, D_{ij} is the transport cost to ship X from i to j, T_{ij} is one plus the tariff rate on imports of X from i to j, E_{ij} is the exchange rate, P_j is an import price index for good X in country j, and σ is the elasticity of substitution in consumption.

On the supply side, a Chamberlinian monopolistic competition characterized by profit maximization and zero economic profits yields the following mark-up pricing function:

$$P_{hij} = [(1-\sigma^{-1})^{-1}(X_{hij}/X_{hi})^{1/\gamma}](W_i\beta_{LX} + R_i\beta_{KX}) \qquad (3.29)$$

where W_i and R_i are the wage and rental rate in country i, X_{hij} is the output of firm h in country i that is exported to j, X_{hi} is total output of firm h, γ is the elasticity of transformation of output among domestic and foreign markets, and $(W_i\beta_{LX} + R_i\beta_{KX})$ are marginal costs. Firm's output is determined by:

$$X_{hi} = (\sigma-1)[(W_i\alpha_{LX} + R_i\alpha_{KX})/(W_i\beta_{LX} + R_i\beta_{KX})] \qquad (3.30)$$

where, $(W_i\alpha_{LX} + R_i\alpha_{KX})$ are fixed costs. Then, substituting firm's output in (3.30) and demand for imports (3.28) in the mark-up price equation (3.29) and then solving for the equilibrium price and quantity, one can determine the value of bilateral trade flows of firm h from country i to j. Multiplying the value of the flow of firm h by the number of firms, Bergstrand finds the gravity equation.[56]

Using a Grubel-Lloyd index that measures the share of intra-industry trade between i and j, Bergstrand presents eight propositions based on comparative statics.

[56] See Bergstrand (1990) to find the derived gravity equation.

These propositions are empirically tested for each of the two-digit SITC category 7 for each possible bilateral trade flow among 14 major developed countries in 1976. Empirical results are all in line with the theoretical framework. In general, Bergstrand's model reveals that more similar per capita income between two countries leads to higher intra-industry trade. In terms of supply, the author proposes that the more inequality among capital-labor ratios, the lower intra-industry trade (Heckscher-Ohlin-Samuelson). Regarding demand, the greater the inequality between per capita incomes, the lower the share of intra-industry trade due to differences in tastes (Linder).

Harrigan (1994) proposes an econometric approach to test the monopolistic competitive model of intra-industry trade summarized in Helpman and Krugman (1985) using 1983 disaggregated data from OECD countries. He suggests using gross trade volumes to examine the contribution of scale economies to trade because using a Grubel-Lloyd index of intra-industry trade is subject to aggregation bias. Harrigan distinguishes between a model of monopolistic competition and what he called the "Armington-HOV" model explaining that aggregate intra-industry trade with taste for variety and technological differences make it possible for foreign varieties to be produced at home. He indicates that if the monopolistic competitive model explains gross trade flows, industries with high gross trade flows should be described as having large scale economies. If that is not the case, then the Armington-HOV model is right and high gross trade is determined by substitution between domestic and foreign production.

Harrigan uses two different equations and four distinct proxies for scale economies to test whether trade is explained better by any of the previous models. The level of aggregation is at the 3-digit ISIC, which consists of 26 industry categories.

Results strongly support both models in the sense that the elasticity of imports with respect to a country's output is one. Harrigan further finds some evidence that higher volumes of gross trade are associated with scale economies but this is sensitive to the choice of proxy variables. He concludes that scale economies and product differentiation by location of production are important causes of trade patterns.

Deardorff (1995) demonstrates that the gravity equation can be also derived from the HOS theory. Deardorff uses two scenarios: one in which he assumes frictionless trade with no barriers to trade and homothetic products and another in which he introduces impediments to trade and product differentiation. In the first case, consumers are indifferent when choosing among goods from different countries, including their own country. With homothetic preferences, Deardorff derives what he calls a "simple frictionless gravity equation" where trade depends on incomes and a factor of proportionality.[57] He shows that this result holds even assuming arbitrary preferences. In the case of impeded trade, Deardorff derives equations for bilateral trade using Cobb-Douglas and CES preferences. In the first case, Deardorff derives a simple frictionless gravity equation for trade measured as c.i.f. and then presents the standard gravity equation (adds transport costs) with trade valued as f.o.b. Results based on CES show similar findings but trade is lower for distant countries. His findings show that gravity models could be easily derived from standard HOS trade theory and consequently it is not appropriate to conclude that the empirical success of gravity models suggest failure of the factor proportions or any other theory.

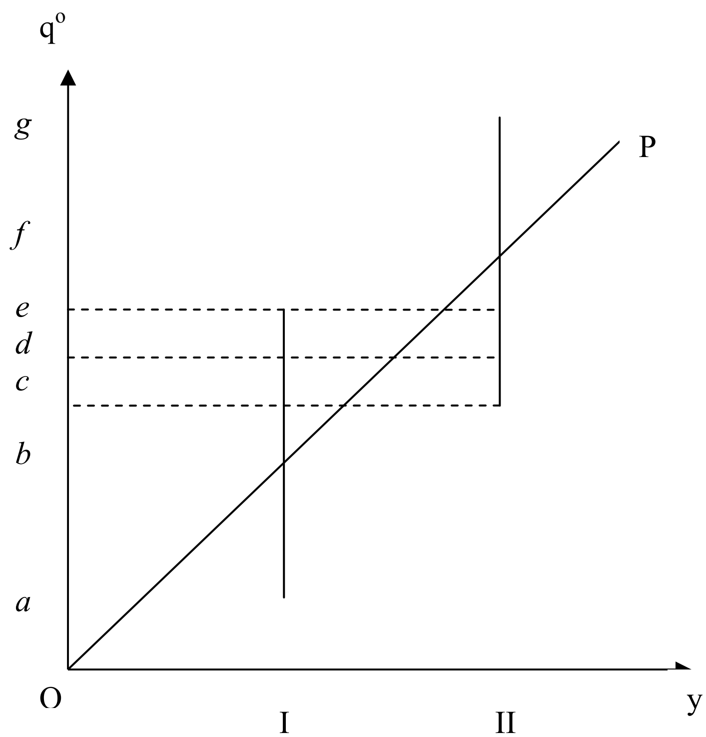
[57] See Frankel (1998), page 13.

IV. The Linder Hypothesis

Linder (1961) proposes a supplement to HOS theory by letting trade be determined by demand rather than supply. He argues that the more similar the demand structures between two countries, the more intensive their bilateral trade in manufactures. Linder develops this principle due to an apparent lack of empirical success of the factors proportion theory explaining patterns of trade. Linder emphasizes that factor proportions works well when primary products are being traded, but fails to explain trade in manufactures. Linder's basic proposition is that the production of non-primary exportable products is determined by internal demand. He claims that goods will not be produced at a comparative advantage unless there is a domestic market for those products. Therefore, countries produce manufactures for their own consumption and exports are surpluses or excess supply. He concludes that countries interested in these surpluses should have similar demand patterns to the exporting country. Determining which factors affect a country's demand structure should predict which countries will trade more intensively.

Linder suggests that the average level of income is the single and most important determinant of a country's demand structure. Considering consumer goods, Linder argues that higher average income leads to replacement of less sophisticated consumer goods toward better quality goods. He suggests that higher income induces qualitative changes in demand besides the usual increase in quantities. In terms of capital goods, Linder argues that because per capita income is determined (among other factors) by the capital stock, higher income countries demand more sophisticated capital equipment than lower income ones. Therefore, he suggests that differences in per capita income are an obstacle to trade. When income differences are of a certain magnitude, goods produced at comparative advantage in one country are not demanded in the other and vice versa.

Figure 3.1: Trade in Manufactures for 2 Countries



Linder hypothetical reasoning is summarized in Figure 3.1. The horizontal axis measures per capita income and the vertical axis measures the quality of each product demanded in ordinal numbers. The positive relationship between per capita income and product quality is represented by line *OP*. Consumer and capital goods of different qualities are demanded in a specific country because a limited degree of quality could result from a single product and also due to unequal income distribution. A given specific per capita income may cover a range of qualitative degrees around the average degree on *OP*. Therefore, for country I in Figure 3.1, the products demanded have a degree of quality that ranges from *a* to *e*, with *b* as the average quality. Similarly for country II, the quality range is *c*-*g* with *f* as the average. Both countries share the qualitative range *c-e*. These overlapping demands relate to products that have a quality within this range *c-e* and these products are the candidates for trade. Country I will not demand products whose quality is higher than *e*, and country II will not demand products with a quality below *c*.

Linder mentions that factors such as distance, languages, and cultural and political affinity act as "trade-braking functions" that could dissolve the effect of similar per capita incomes on actual trade.[58] He tests his theory using 32 countries and trade data for 1958. Linder uses a graphical approach by plotting the average marginal propensity to import of all countries with respect to a specific country. These diagrams seem to indicate that Linder hypothesis is correct, but he suggests further empirical research.

One of the first attempts to test the Linder hypothesis is Hirsch and Lev (1973). This paper follows Linneman (1966) and estimates a gravity model to explain commodity flows in five industries for Denmark, the Netherlands, Israel, and Switzerland. The five industries comprise processed food, textiles, clothing and footwear, processed chemicals, machinery, electrical machinery, appliances, and professional equipment. The independent variables are GNP, distance, a dummy for preferential trade, and a variable indicating per capita income differential. This income differential variable is specified as a ratio, with the numerator being the smallest per capita income of the two countries. Other specifications are tested with no significant changes in results. Hirsch and Lev find results that are consistent with the Linder hypothesis. Most coefficients for the income differential variable are negative and significant, implying that the greater the difference in per capita income, the lower the volume of trade between two countries.

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[58] See Linder (1961), page 108.

Thursby and Thursby (1987) use bilateral trade flows between 17 countries to examine the Linder hypothesis and the effects of exchange rate variability using a gravity model and running separate regressions for different countries. The period under study is 1974-1982. Following standard demand and supply analysis, the authors estimate a gravity model that shows overwhelming support for the Linder hypothesis and the theoretical proposition that exchange rate risk affects bilateral trade flows. The coefficient on the Linder variable is negative and significant with the exception of 2 countries. Similarly, most of the countries with proper specified equations show a statistically significant negative coefficient for the exchange rate risk variable. They also conclude that using nominal or real exchange rates does not make a difference in terms of results.

Other papers such as Hoftyzer (1975) or Greytak and McHugh (1977) empirically test the Linder hypothesis and suggest adding a distance variable. They show that distance plays a significant role explaining trade flows of manufactures. They conclude that Linder's empirical test for his hypothesis overestimates the effects of income differential on trade flows. Similarly, Qureshi, French, and Sailors (1980) claim that the main problem concerning empirical verifications of the Linder hypothesis is the inability to statistically account for the separate influence of distance and the Linder effect on the intensity of trade. In order to solve the distance problem, they propose an alternative empirical method that tests the theory in terms of changes in propensities to trade against changes in income differences between two points in time. This model fails to find evidence of a Linder effect. Kennedy and McHugh (1980) follow Greytak and McHugh (1980) and find no evidence of a Linder effect when distance is accounted for.

Hanink (1988) adds to Linder's model of bilateral trade flows by incorporating the hierarchical flow of goods that is common in regional trade. This hierarchical trade is determined by population size and the largest country has the widest variety of goods and the smallest country has the smallest variety. Hanink calls this model the "extended Linder model" and he performs empirical tests to examine its validity explaining actual trade flows. Results indicate that trade flows are positively related to market homogeneity (the Linder hypothesis), negatively related to distance, and positively related to variety across goods. The dependent variable is trade intensity measured as per capita imports of country *i* from country *j*. The explanatory variables are the absolute difference in per capita GNP, the distance between economic centers, and the variability across goods measured by absolute difference in populations. Hanink concludes that his extended model should be further tested to examine its validity in "the increasingly complex international economy" (Hanink, p. 333).

Chow, Kellman, and Shachmurove (1999) investigate whether the Linder hypothesis explains trade flows between four Newly Industrialized Countries (NICs) in East Asian and their major OECD trading partners. The authors examine the behavior of exports from these four NICs to OECD markets during the 1965-1990 period. They emphasize the fact that per capita income differentials between these NICs and those of OECD have been constantly decreasing during the period under study. Linder's theory is tested by using disaggregated data on manufactured exports. With the use of an improved measure of trade intensity (trade complementary index) as the dependent variable, the authors use OLS for twelve country-partner pairs (4 NICs and 3 OECD countries). Results support the Linder hypothesis and suggest that tastes significantly affect trade flows in those countries.

McPherson, Redfearn, and Tieslau (2000) examine the Linder hypothesis using a random effects Tobit approach. Findings support the Linder hypothesis for all but one of the 19 OECD countries under consideration. Results provide strong evidence that countries with similar income levels trade more. The paper uses a panel data approach to capture both time-invariant and time-variant effects. They also compare the results of the Tobit random effects model to a simple random effects model and conclude that a simple model leads to misleading results. The data includes 161 potential trading partners of each of the OECD countries covering the 1990-1995 period. The dependent variable is the dollar value of exports from OECD country *j* to potential trading partner *i* at time *t*. The explanatory variables are real GDP of trading partner *i*, real exchange rates, and the absolute differences in per capita income between trading partners (the Linder effect). Besides finding support for the Linder hypothesis, the paper finds that the relative size of a trading partner's economy has a positive effect on trade. In terms of exchange rates, all but three of the OECD countries show the expected positive and significant effect on exports.[59]

McPherson, Redfearn, and Tieslau (2001) examine the Linder hypothesis in six East African developing countries. In five out of six countries, the Linder hypothesis holds. The paper uses a fixed effect panel data model that captures the time-invariant country-specific effects. It is one of the first attempts to test the Linder hypothesis in developing countries. Results show that Ethiopia, Kenya, Rwanda, Sudan, and Uganda

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[59] See McPherson, Redfearn, and Tieslaw (2001) for a description of the exchange rate variable.

trade more intensively with countries that have similar per capita incomes. As in their previous paper, the authors enforce the idea that a censored Tobit model should be used when studying bilateral trade flows between one country and a large number of partners. The authors argue that using imports as a dependent variable is appropriate to test for Linder effects since most imports in developing countries tend to be manufactures. Country specific effects are for the most part statistically significant at the 95% confidence level. The authors conclude that the factor proportions theory is inadequate when investigating trade flows in developing countries and suggest the appropriateness of the Linder hypothesis in such a context. Other papers such as Martinez-Zarzoso and Nowak-Leman (2002 and 2003) have found a Linder effect for trade patterns between Mercosur and EU.[60]

V. Econometric Issues

The gravity model of trade has been specified in many different forms. The standard gravity model with country income, population, and distance as explanatory variables was augmented by adding income per capita, real exchange rates, and dummy variables that account for common borders, common language, preferential trade agreements, and so on. Starting with Mátyás (1997), recent literature has focused on estimating gravity models of trade using different fixed effects models. This section presents the different specifications of the gravity model going from the standard model to the various fixed effects models.

The standard gravity model introduced by Tinbergen (1962) in log linear form is presented in (3.1) of this chapter. Adding population as suggested by Linnemann (1966)

[60] This paper's findings are discussed in Section II.

and using as dependent variables the product of income and population gives (3.31) as in Frankel (1997):

$$log\ T_{ij} = \alpha_0 + \alpha_1 log\ (GDP_i * GDP_j) + \alpha_2 log\ (pop_i * pop_j) + \alpha_3\ log\ Dist_{ij} + \varepsilon \quad (3.31)$$

where T_{ij} is trade between country i and country j (exports plus imports), GDP_i and GDP_j are real gross domestic products, pop_i and pop_j are populations, and $Dist_{ij}$ is the geographic distance between the two countries. Modifications of (3.31) use income per capita as another explanatory variable. The product of GDPs is expected to be positively related to trade since large countries should trade more than small ones. The coefficient for distance should be negative given that proximity reduces transportation and information costs. Populations are expected to be negatively related to trade since larger countries tend to be relatively less open to trade as a percentage of GDP.

Adding dummy variables to the standard gravity specification leads to the first version of the augmented gravity model of trade:

$$log\ T_{ij} = \alpha_0 + \beta_1\ log\ (GDP_i * GDP_j) + \beta_2\ log\ (pop_i * pop_j) + \beta_3\ log\ Dist_{ij} + \beta_4\ Adj + \beta_5\ Lang + \sum \beta_i\ PTA + \varepsilon \quad (3.32)$$

where *Adj* is a dummy that stands for adjacency or common border, *Lang* accounts for common language effects, and *PTAs* are dummies capturing the effects of preferential trade agreements. Equation (3.32) has been used repeatedly in the literature (see Frankel (1997), Frankel, Stein, and Wei (1997), Bayoumi and Eichengreen (1995), Chow, Kellman, and Shachmurove (1999), Del'Ariccia (1999), and Pakko and Wall (2001)). However, other papers such as Hirsch and Lev (1973), Bergstrand (1985), Thoumi (1989), Bergstrand (1989), Mátyás, Kónya, and Harris (1997), Soloaga and Winters (1999), Mátyás, Kónya, and Harris (2000), Martinez-Zarzoso and Nowak-Lehmann

(2002), and Cheng and Wall (2005) have specified the gravity equation by separating GDPs and populations. This is appropriate when trying to explain a country's imports or exports since it captures a country's productive and absorptive capacities separately.

$$\log X_{ij} = \alpha_0 + \beta_1 \log GDP_i + \beta_2 \log GDP_j + \beta_3 \log pop_i + \beta_4 \log pop_j + \beta_5 \log Dist_{ij} + \beta_6\ Adj + \beta_7 Lang + \sum \beta_i PTA + \varepsilon \quad (3.33)$$

where X_{ij} is the value of exports of country *i* to *j*.

Most of the literature has used some sort of the standard or augmented gravity models presented above. Mátyás (1997) examines the econometric properties of the equation. He suggests that all gravity type models used to measure the effect of trading blocs on trade patterns are misspecified and lead to incorrect interpretation and improper economic inference since they do not account for the local country, target country, and time effects. According to Mátyás, the correct econometric specification is as follows:

$$\log E_{ijt} = \alpha_i + \gamma_j + \lambda_t + \beta_1 \log GDP_{it} + \beta_2 \log GDP_{jt} + \beta_3 \log Dist_{ij} + \ldots + \varepsilon_{ijt} \quad (3.34)$$

where E_{ijt} is exports from country *i* to *j* at time *t*, α_i is the local country effect, γ_j is the target country effect, and λ_t is the time (business cycle) effect. According to Mátyás, α_i, γ_j, and λ_t are fixed unknown parameters.

Mátyás claims that all other forms of gravity equations are restrictions of (3.34). For *N* countries, Mátyás presents this panel data approach in vector form as follows:

$$\mathbf{y} = D_N \alpha + D_J \gamma + D_T \lambda + Z \beta + \varepsilon \quad (3.35)$$

where, **y** is a vector of observations on the dependent variable, Z is the matrix of observations of the explanatory variables in (3.34), and D_N, D_J, and D_T are dummy variable matrices.[61] Mátyás claims that when dummies accounting for common language or common borders are added to the model, equation (3.35) becomes:

$$\mathbf{y} = D\theta + Z\beta + \varepsilon \qquad (3.36)$$

where θ is the parameter vector of the previously mentioned dummies. The author claims that it is easy to show using simple matrix algebra that the column vectors on D can be expressed as a linear combination of the column vectors of the matrices D_N, D_J, and D_T. If the parameters α, γ, and λ in (3.35) are significant, then θ should be significant in (3.36) due to misspecification of the model. Therefore, he concludes that any inference based on θ is misleading.

The panel data fixed effects model proposed by Mátyás (1997) dominates the recent empirical literature. Dell'Ariccia (1999), Mátyás, Kónya, and Harris (2000), Pakko and Wall (2001), Martinez-Zarzoso and Nowak-Lehmann (2002), and Cheng and Wall (2005) use the fixed effects model in the gravity equation. Different fixed effects models claim to solve the problem of country-pair heterogeneity not addressed when using the classical OLS gravity approach.

Cheng and Wall (2005) claim that the model introduced by Mátyás (1997) is a three-way fixed effects that becomes a two-way fixed effects model when dealing with country pairs. Specifically, Cheng and Wall propose the following equation:

$$log\ E_{ijt} = \alpha_0 + \gamma_{ij} + \lambda_t + \boldsymbol{\beta' Z_{ijt}} + \varepsilon_{ijt} \qquad (3.37)$$

where, $\boldsymbol{Z_{ijt}}$ is a row vector of gravity variables (GDP, population, per capita income, differences in per capita income, real exchange rate, etc), α_0 accounts for that portion of the intercept that is common to all years and all country pairs, γ_{ij} is the part of the

[61] See Mátyás (1997) for details on dummy matrices.

intercept that is specific to each country pair and common to all years, and λ_t is specific to year *t* and common to all country pairs. The dependent variable is defined as in (3.34). In this equation, country pair effects are allowed to differ depending on the direction of trade flows ($\gamma_{ij} \neq \gamma_{ji}$). Cheng and Wall (2005) compares different fixed effects specifications and a pooled cross-section model to the general fixed effects in (3.37).

Cheng and Wall (2005) show that the standard pooled-cross-section model suffers from estimation bias due to omitted or misspecified variables.[62] This issue is solved by using fixed effects to capture those factors that remain constant over time such as distance, common border, common language, historical links, or cultural affinities. The authors also showed that alternative fixed effects are special cases of their general equation presented in (3.37) that introduce restrictions with no statistical validity.

Fixed Effects and a Time Series Cross Section Model

According to Greene (2003), in the presence of relatively small cross-sectional units and relatively large time periods, it is reasonable to specify a common conditional mean function across groups (countries) with heterogeneity taking the form of different variances rather than different intercepts. A gravity model estimating trade for a small number of countries over a long period of time requires a special type of panel data that takes into account the time series properties of the data set.

Greene (2003) refers to this model as a time-series-cross-section (TSCS) that is specified as:

$$y_{it} = \boldsymbol{\beta' X_{it}} + \varepsilon_{it} \qquad (3.38)$$

[62] See literature review section for more on Cheng and Wall (2005).

where it is assumed that $\beta_1 = \beta_2 = ... = \beta_n$. The model allows for $E[\varepsilon_{it}^2] = \sigma_{ii}$ (groupwise heteroscedasticity), $Cov[\varepsilon_{it}, \varepsilon_{jt}] = \sigma_{ij}$ (cross group correlation), and $\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + u_{it}$ (within group autocorrelation).[63] A groupwise heteroscedastic model assumes variances differ across countries, a cross group correlation model allows for correlation among units (countries), and within group autocorrelation models permits different ρs for each country.

TSCS models can be estimated by using the econometric software Limdep, which allows for different estimations producing up to nine sets of results that depend upon specification. In terms of the disturbance covariance, the TSCS command allows for a model specification with no correlation or heteroscedasticity (S0), a model with groupwise heteroscedasticity (S1), and a model with cross group correlation and groupwise heteroscedasticity (S2). Regarding autocorrelation, a model with no autocorrelation (R0), a model with autocorrelation and same ρ for all groups (R1), and one with autocorrelation allowing for different ρs (R2) can be specified. All nine combinations of these models can be estimated. Model selection for models not accounting for autocorrelation (R0 with S0, S1, and S2) can be based on likelihood ratio tests. Since the autocorrelation models are not estimated by maximum likelihood, performing likelihood ratio tests between two models specified as R1 or R2 is not appropriate.

VI. Trade Diversion

The J-curve analysis presented in Chapter 2 suggests that trade could have been diverted from non-Mercosur members (EU and US) to Brazil. Results imply that

[63] See Greene (2003) for a discussion on models and estimators Chapter 13.

Argentina's trade deficit with Brazil since 2003 could be partially attributed to a surge in imports from Brazil that replaced American and European products.[64] These trade adjustments emerged after Argentina's devaluation as suggested by an inverse J-curve. Trade diversion is trade that emerges between two or more countries within a regional trade agreement that replaces trade that otherwise would have taken place with more efficient non-members.[65] Arguably, devaluations intended to converge exchange rates of countries in a regional trading bloc may also divert trade from non-member to member countries.

Figure 3.2: Shares of Argentina's Imports

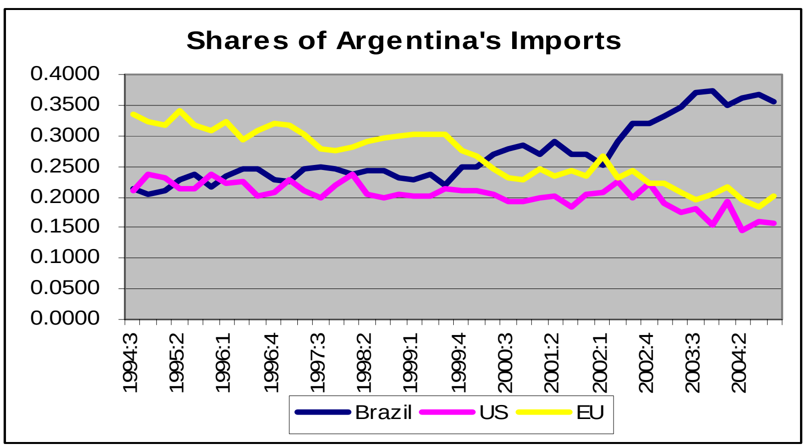

Figure 3.2 shows market shares of Brazilian, American, and European exports to Argentina. Note that Argentina's imports from Europe were almost 35% of total imports in 1994 and stayed above 30% until the end of 1999. The European import share reached their lowest share at 20% for the period following the peso devaluation. Similarly, American imports maintained a share of 23% for the period preceding Argentina's devaluation and then declined to 15% in 2004. On the other hand, Brazilian exports to Argentina maintained an average 23% share during the 1994-1999 period. Brazil's

64 See model results in Chapter 2. The trade diversion variable was significant at the 5% level.
65 See Frankel (1997) for examples of papers measuring trade diversion and trade creation.

devaluation seems to have started a process of import diversion in Argentina favoring Brazilian goods. The share of Brazilian imports in Argentina grew to over 25% between 1999 and 2002. This growth trend accelerated after Argentina's devaluation leading to a share that exceeded 35%.

In this section, a gravity model examines trade diversion using a TSCS approach and a fixed effects (FE) model.[66] The TSCS approach captures heterogeneity among country-pairs with different specifications of the covariance matrix either with a common constant term as proposed by Greene (2003) or with country-specific time invariant effects (different intercepts for each country pair). The FE model captures the country-specific time invariant effects with the use of country-pair dummies and corrects for heteroscedasticity and autocorrelation (common ρ). The goal is to estimate the impact of the peso devaluation on Argentina's imports. If imports have been diverted from non-members to Brazil after devaluation, Argentina's trade deficit with Brazil and the inverse J-curve found in Chapter 2 are a reasonable outcome of this policy.

The data comprises three cross section units (three country-pairs) and 42 time series observations for each country-pair (126 total observations). Imports of country *i* from country *j* are the model's dependent variable as in Frankel and Wei (1997). Equation (3.39) presents the gravity model testing for trade diversion effects. When heterogeneity is captured with different covariance specifications and a common intercept, the dummies *Europe* and *Brazil* are excluded from the equation.

$$\log M_{ijt} = \alpha_0 + \alpha_1 Europe + \alpha_2 Brazil + \beta_1 \log Y_{it} + \beta_2 \log Y_{jt} + \beta_3 \log P_{it} + \beta_4 \log P_{jt} + \beta_5 \log REX_{ijt} + \beta_6 DR + \beta_7 DB + \beta_8 DNM + \varepsilon_{ijt} \qquad (3.39)$$

[66] See Section V in this chapter for details on the econometrics of these models.

where M_{ijt} is Argentina's imports from country *j* at time *t* in US dollars, *Europe* and *Brazil* are dummies capturing country-pair fixed effects, Y_{it} is Argentina's GDP at time *t* (index), Y_{jt} is trading partner's GDP at time *t* (index), P_{it} is Argentina's population at time *t*, and P_{jt} is trading partner's population at time *t*.[67] REX_{ijt} is the bilateral real exchange rate between pairs of countries. Imports, incomes, populations, and real exchange rates are transformed to natural logarithms. *DR* is a dummy variable accounting for the effects of the temporary restrictions on payments for imports, the initial exchange rate uncertainty, and the banking restrictions implemented by the Argentine government in 2002. Finally, *DB* and *DNM* are multiplicative dummy variables that separate the effects of Argentina's devaluation between member-country Brazil (*DB*) and non-members US and EU (*DNM*). These dummies test for structural or regime changes in Argentina. The sign of the coefficients for these dummies should reveal if trade has been diverted from the US and EU toward Brazil after the peso devaluation. Trade diversion is implied in the case that β_7 is positive and β_8 is either negative or insignificant and also in the case that β_7 is positive or insignificant and β_8 is negative. Even if β_7 and β_8 have the same sign, comparing the magnitude of the coefficients could reveal trade diversion effects as in Frankel (1997).[68] When TSCS estimates are robust across all nine possible combinations of Ss and Rs, the S2-R2 model with cross group correlation, groupwise heteroscedasticity, and different ρs for each country-pair is selected since it is the least restrictive of models. Table 3.1 presents the results from (3.39). Coefficients for all variables except dummies are read as elasticities.

[67] Annual population estimates from the International Database of the US Census Bureau were interpolated to obtain quarterly estimates.
[68] Frankel (1997) calls trade diversion the fact that after the 1995 Mexican devaluation, Mexican imports from US declined less than non-NAFTA imports from EU and Japan.

Table 3.1: Trade Diversion

Variable	TSCS with Common Intercept	TSCS with Country-Pair Effects	FE Model
Intercept	-12.761 (0.591)	24.822 (1.042)	15.701 (0.545)
Europe		-1.195*** (5.495)	-1.405*** (3.827)
Brazil		2.411*** (7.894)	2.770*** (5.044)
Argentina's GDP	2.785*** (9.464)	2.974*** (11.065)	2.836*** (13.053)
Trading Partner's GDP	-1.860*** (6.031)	-0.597 (1.496)	-0.438 (0.734)
Argentina's Population	0.675 (0.517)	-6.970*** (5.894)	-7.257*** (4.613)
Trading Partner's Population	0.205*** (3.400)	4.766*** (7.115)	5.487*** (4.713)
Real Exchange Rate	0.051 (0.473)	0.106 (1.517)	0.045 (0.412)
Restrictions	-0.367*** (2.680)	-0.300*** (2.851)	-0.392*** (3.109)
Dev. Effect for Brazil	0.227* (1.797)	0.200** (2.008)	0.178 (1.563)
Dev. Effect for Non-members	-0.312** (2.462)	-0.193** (2.117)	-0.241* (1.887)
Rho			0.167* (1.867)

*Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*

The first column in Table 3.1 presents the results of a TSCS S2-R2 model capturing heterogeneity across country-pairs with different covariance specifications and common intercept. The second column shows estimates from a TSCS S2-R2 model capturing time invariant effects for each country-pair with the use of different intercepts. The last column in Table 3.1 presents the results of a fixed effects model that does not allow for different autocorrelation coefficients as in the TSCS S2-R2 model.

Results indicate the presence of trade diversion. The model with common intercept shows that the peso devaluation in Argentina increased Brazilian imports while decreasing imports from non-Mercosur members US and EU. Specifically, a devalued and floating peso increased imports from Brazil by 25% ($e^{0.227}$-1 = 0.254) and reduced imports from non-members by 27% ($e^{-0.312}$-1 = -0.268). Estimates from the TSCS S2-R2 with country pair specific effects show also a positive impact of Argentina's devaluation in the country's demand for Brazilian products and a negative impact for goods imported from the US and EU. The effects are smaller in magnitude since this model captures time invariant effects that are country specific. After devaluation, imports from Brazil increased 22% and imports from non-member countries decreased by 17%. TSCS estimations are robust with regard to the different specifications of the covariance matrix. The FE model also generates results consistent with the hypothesis of trade diversion. This model estimates that Brazilian imports remained at pre-devaluation levels but it shows a 21% decrease in imports from non-member countries.

Time invariant country-specific effects are important. The coefficient for *Europe* is negative, suggesting that factors such as distance, lack of common border, or not being part of Mercosur depressed Argentina's imports from Europe for the time period under study. The coefficient for *Brazil* shows that Mercosur membership, common borders, and short geographic distances increase Brazilian exports to Argentina.

Argentina's GDP is positively related to the country's imports showing the economy's absorptive capacity. This positive coefficient for Argentina's GDP is robust and does not change significantly in magnitude across all models in Table 3.1. An increase in Argentina's GDP of 1% leads to a 2.8% increase in imports. Trading partners' GDP has no significant effect in Argentine imports (only the model specified with a common intercept shows a negative sign, significant at the 10% level). Both models capturing time invariant effects show that a larger population in Argentina leads to a reduction in the country's imports. As the country experiences population growth, it becomes more self-sufficient with a wider variety of goods being produced and less need for imports. Similarly, the larger the population of trading partners, the greater Argentina's imports, which supports the idea that larger populations lead to more diversified economies and greater possibilities for exports. This is in line with Krugman's Chamberlinian competitive model with scale economies. Once devaluation effects are captured by dummies, the real exchange rate has no significant effect on imports. The initial exchange rate uncertainty and the restrictions on payments for imports and capital mobility imposed by the Argentine government in 2002 reduced the amount of the country's imports. This negative effect is robust across all models in Table 3.1. Appendix II shows models' residuals and Q-statistics suggesting non-white noise errors.

The model in (3.39) treated Argentina's real GDP as exogenous when in fact there are good reasons to believe that this variable is affected by the level of imports. Since Argentina's imports are the model's dependent variable, the significant effect of Argentina's income on imports could be spurious and therefore biased due to simultaneity problems. Even though results from Ramsey's Reset test show no specification bias, the gravity model is estimated by using an instrumental variables (IV) approach to replace Argentina's real GDP in equation (3.39).[69] Results from this IV estimation are presented in Table 3.2.

[69] The instrument is the predicted values of a regression that estimates Argentina's real GDP as a function of a lagged dependent variable, Brazil's real GDP, an economic activity estimator calculated by INDEC, time, and a dummy for 2002 capturing the deep contraction in Argentina's GDP during that year.

Table 3.2: Trade Diversion with IV

Variable	TSCS with Common Intercept	TSCS with Country-Pair Effects	FE Model
Intercept	-42.735** (2.221)	2.784 (0.130)	-23.324 (0.933)
Europe		-1.166*** (4.812)	-1.568*** (4.621)
Brazil		2.367*** (6.804)	2.943*** (5.750)
Argentina's GDP	3.233*** (12.700)	3.248*** (13.214)	3.201*** (15.555)
Trading Partner's GDP	-1.866*** (5.705)	-0.578 (1.419)	-0.894* (1.717)
Argentina's Population	2.374** (2.054)	-5.680*** (4.987)	-5.473*** (3.935)
Trading Partner's Population	0.119* (1.670)	4.674*** (6.190)	5.920*** (5.475)
Real Exchange Rate	0.045 (0.445)	0.105 (1.421)	-0.003 (0.032)
Restrictions	-0.373*** (3.285)	-0.308*** (3.347)	-0.441*** (4.087)
Dev. Effect for Brazil	0.047 (0.441)	0.071 (0.824)	0.007 (0.066)
Dev. Effect for Non-members	-0.432*** (3.885)	-0.324*** (3.846)	-0.398*** (3.579)
Rho			0.289*** (3.334)

*Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*

Using an instrument instead of Argentina's GDP as an explanatory variable does not affect results significantly. Estimates in Table 3.2 show the occurrence of trade diversion favoring Brazilian products, since imports from non-Mercosur countries declined significantly and imports from Brazil stayed at pre-devaluation levels. The decline in non-member imports after the devaluation of the peso ranges from 28% for the TSCS model with country-pair fixed effects to 35% for the TSCS model with common intercept. The instrument for Argentina's GDP is positively related to imports, showing again Argentina's economy absorptive capacity. Trading partners' GDP now appears to be inversely related to imports in two out of three models. Population and restrictions effects do not change from those in Table 3.1. The real exchange rate continues to have no effect on Argentina's imports.

A visual inspection of the models' residuals and Q-statistics suggest autocorrelation or misspecification problems.[70] An Omitted variable problem could arise since the previous models do not capture potential habit formation effects that are common in demand equations.[71] Therefore, a dynamic model using a lagged dependent variable is estimated as in Eichengreen and Irwin (1995) and Harris and Mátyás (1998). It is shown in Appendix II that the TSCS model capturing time invariant effects specific to country-pairs and the FE model generate white noise residuals. This suggests that equation (3.39) should be estimated with a lagged dependent variable. Inferences are based on estimates appearing in the second and third column of Table 3.3.

Lagged imports exert a positive and highly significant effect on current import flows. Both models capturing time invariant fixed effects generate estimates that are similar. Argentina's GDP has a positive effect on imports at the 1% level, thus suggesting that a 1% increase in economic activity leads to 2.3% to 2.4% growth in imports from its major trading partners. Economic growth in Brazil, the US, and EU does not lead to higher Argentinean imports. The dummy variable *Brazil* remains positive, the coefficient on Argentina's population continues to be negative, and the coefficient on trading partners' population stays positive. Again, the initial instability

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[70] See Appendix II.

[71] Pollak (1970) defines a habit such that (i) past consumption influences current preferences and hence, current demand and (ii) a higher level of past consumption of a good implies, ceteris paribus, a higher level of present consumption of that good.

brought by devaluation coupled with the capital restrictions of 2002 have depressed Argentine imports. The real exchange rate still has no effect on imports.

Table 3.3: Trade Diversion with IV and Lagged Imports

Variable	TSCS with Common Intercept	TSCS with Country-Pair Effects	FE Model
Intercept	-2.029 (0.154)	22.934 (1.198)	2.014 (0.097)
Europe		-0.637*** (2.813)	-0.958*** (3.486)
Brazil		1.344*** (3.972)	1.820*** (4.341)
Argentina's GDP	2.124*** (10.129)	2.344*** (10.828)	2.446*** (11.860)
Trading Partner's GDP	-1.035*** (4.279)	-0.218 (0.590)	-0.486 (1.119)
Argentina's Population	-0.036 (0.046)	-4.558*** (4.794)	-4.439*** (4.004)
Trading Partner's Population	0.056 (1.286)	2.615*** (3.599)	3.636*** (4.102)
Real Exchange Rate	-0.032 (0.474)	0.056 (0.899)	-0.022 (0.284)
Restrictions	-0.165** (1.978)	-0.146* (1.817)	-0.235** (2.559)
Dev. Effect for Brazil	0.156** (2.118)	0.175** (2.368)	0.102 (1.282)
Dev. Effect for Non-members	-0.120 (1.537)	-0.090 (1.190)	-0.181* (1.923)
Lagged Imports	0.519*** (9.909)	0.399*** (7.168)	0.370*** (6.991)
Rho			0.118 (1.311)

*Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*

Estimates in Table 3.3 also show the presence of trade diversion. While the TSCS model capturing time invariant effects shows that imports from Brazil increased and non-Mercosur imports remained at pre-devaluation levels, the FE model shows that imports from non-members declined and those from Brazil remained at levels that prevailed during the fixed exchange rate regime. Since TSCS estimates are not robust, inferences are based on the FE model. According to FE estimates, devaluation in Argentina depressed the country's imports from the US and EU by 17%. Trade diversion impacts of devaluation are still implied since the 17% decline in non-members imports is compared to a lack of decline on Brazilian imports. As in Frankel (1997), one can conclude that after the devaluation of the peso Brazilian goods gained market share in Argentina relative to the US and EU.

Based on the results from the different estimated models, trade diversion favoring imports from Brazil emerged as a consequence of the peso devaluation. However, further examination is required since dummy variables suggest the presence of structural changes but do not uncover the specific economic factors behind these changes. The next section presents a TSCS model that examines the determinants of Argentine imports and tests for the presence of a Linder effect.

VII. The Linder Hypothesis and the Peso Devaluation

Since devaluation reduces a country's purchasing in international markets, trade adjustments could be demand driven. These theoretical demand-side adjustments and the composition of Argentine imports (mainly manufactures) suggest an investigation of Linder effects.[72] The Linder hypothesis suggests that trade in manufactures depends on demand structures which are mainly determined by per capita incomes.[73] The greater the difference between two countries' per capita incomes, the lower the amount of trade in manufactures between them. This theory has been tested empirically using gravity models of trade. The difference in per capita incomes between countries becomes the variable of interest. The hypothesis is that Argentina's devaluation depressed the

[72] See Chapter 1 for a description on the composition of imports.
[73] See section on Linder hypothesis for details.

country's per capita income generating changes in its demand structure. A negative coefficient for the Linder variable indicates the presence of a Linder effect.

The Linder variable is created by first converting per capita incomes to US dollars and then taking the difference between countries. For example, Argentina's real GDP in pesos is divided by the country's population and then converted to US dollars by using the nominal exchange rate. Equation (3.40) shows the gravity model testing for Linder effects:

$$\log M_{ijt} = \alpha_0 + \alpha_1 Europe + \alpha_2 Brazil + \beta_1 \log Y_{it} + \beta_2 \log Y_{jt} + \beta_3 \log P_{it} + \beta_4 \log P_{jt} + \beta_5 \log REX_{ijt} + \beta_6 DR + \beta_7 D + \beta_8 \log LINDER + \varepsilon_{ijt} \qquad (3.40)$$

where most of the variables are defined as in (3.39), *D* is a dummy that accounts for structural changes after devaluation, and *LINDER* is the difference in per capita income between countries. Equation (3.40) is estimated following the approach of Section VI.

All models in Table 3.4 show the presence of a Linder effect. The TSCS model with common intercept indicates that a 1% increase in the difference between Argentina's per capita income and that of its major trading partners reduce imports by 0.30%. When dummies are used to capture the country-specific time invariant effects, a 1% increase in the difference between per capita incomes leads to a reduction of 0.13% in imports. As in Section VI, membership in a regional integration agreement, and time invariant factors such as shorter distances, common borders, or cultural affinities increase trade. This is implied by a positive coefficient on the dummy *Brazil*, and a negative coefficient for *Europe*.

Economic growth in Argentina leads to higher imports as previously shown with other models. Trading partners' GDP and the real exchange rate do not impact significantly the level of Argentinean imports. The initial devaluation effects and the restrictions in capital mobility depressed imports. The negative coefficient on the dummy capturing any structural break after 2003 indicates that the newly devalued and floating peso has reduced Argentine imports.[74] Results also indicate that population growth in Argentina lower imports while population growth abroad leads to higher imports. None of these models generate white noise residuals.

Table 3.4: Linder Effects

Variable	TSCS with Common Intercept	TSCS with Country-Pair Effects	FE Model
Intercept	58.957*** (2.666)	0.279 (0.011)	5.956 (0.187)
Europe		-1.569*** (6.747)	-1.941*** (4.770)
Brazil		2.724*** (7.859)	3.398*** (5.362)
Argentina's GDP	2.216*** (8.768)	2.768*** (10.691)	2.641*** (11.080)
Trading Partner's GDP	0.665 (1.580)	-0.831* (1.880)	-0.366 (0.558)
Argentina's Population	-4.057*** (2.992)	-6.417*** (5.297)	-8.354*** (4.717)
Trading Partner's Population	0.428*** (5.521)	5.706*** (7.891)	7.065*** (5.428)
Real Exchange Rate	0.010 (0.092)	0.020 (0.173)	0.050 (0.331)
Restrictions	-0.536*** (4.122)	-0.501*** (3.564)	-0.431** (2.512)
Devaluation	-0.323*** (3.078)	-0.265** (2.206)	-0.112 (0.729)
Linder	-0.296*** (7.565)	-0.127** (2.213)	-0.128* (1.867)
Rho			0.365 (4.325)

*Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*
Numbers in parenthesis are t-statistics.

[74] Only the FE model shows no significant structural break once restrictions were lifted and exchange rate instability diminished.

Equation (3.40) is estimated using an IV approach that corrects for potential endogeneity in Argentina's GDP. For the most part, results are similar to those in Table 3.4 and are consistent with the Linder hypothesis. Only the TSCS S2-R2 model shows no significant Linder effects. However, this may arise due to over parameterization of the model. The fact that six out of the nine combinations of Ss and Rs show a significant Linder effect suggests over parameterization.[75] Table 3.5 summarizes the results. Again, none of these models generate white noise residuals.

Table 3.5: Linder Effects with IV

Variable	TSCS with Common Intercept	TSCS with Country-Pair Effects	FE Model
Intercept	21.748 (0.996)	-19.853 (0.852)	-31.133 (1.127)
Europe		-1.560*** (6.414)	-2.111*** (5.524)
Brazil		2.836*** (7.708)	3.661*** (6.062)
Argentina's GDP	2.732*** (11.037)	3.178*** (12.470)	3.093*** (13.213)
Trading Partner's GDP	0.047 (0.107)	-0.897** (2.039)	-0.770 (1.344)
Argentina's Population	-1.875 (1.394)	-5.466*** (4.690)	-6.837*** (4.318)
Trading Partner's Population	0.377*** (3.645)	5.778*** (7.573)	7.591*** (6.155)
Real Exchange Rate	0.037 (0.302)	0.046 (0.407)	0.028 (0.207)
Restrictions	-0.487*** (3.929)	-0.425*** (3.232)	-0.437*** (3.009)
Devaluation	-0.383*** (3.702)	-0.314*** (2.841)	-0.247* (1.866)
Linder	-0.223*** (5.074)	-0.070 (1.217)	-0.101* (1.629)
Rho			0.467*** (5.830)

*Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively. Numbers in parenthesis are t-statistics.*

[75] See Appendix I for Limdep's output with all nine models.

The absorptive capacity of Argentina's economy, the country-specific time invariant effects, population impacts, the effect of capital mobility restrictions with the exchange rate uncertainty of 2002, and the structural break caused by the new exchange rate regime closely resemble estimates in Table 3.4. Results indicate that increasing the difference in per capita income between countries by 1% reduces imports by 0.22% in the TSCS model with a common intercept, and by 0.10% in the FE model. The lack of white noise residuals suggests potential omitted variable problems. In order to account for any habit formation effect, a lagged dependent variable is added to this IV model.

Table 3.6: Linder Effects with IV and Lagged Imports

Variable	TSCS with Common Intercept	TSCS with Country-Pair Effects	FE Model
Intercept	37.807** (2.291)	3.157 (0.150)	-3.117 (0.139)
Europe		-0.904*** (3.857)	-1.221*** (4.178)
Brazil		1.537*** (4.318)	1.987*** (4.366)
Argentina's GDP	1.955*** (9.597)	2.223*** (10.083)	2.325*** (10.654)
Trading Partner's GDP	0.116 (0.324)	-0.551 (1.342)	-0.460 (0.991)
Argentina's Population	-2.638** (2.559)	-3.976*** (3.999)	-4.781*** (3.985)
Trading Partner's Population	0.170*** (2.957)	3.235*** (4.320)	4.265*** (4.514)
Real Exchange Rate	-0.024 (0.356)	-0.021 (0.225)	-0.066 (0.647)
Restrictions	-0.173** (2.120)	-0.195* (1.841)	-0.267** (2.250)
Devaluation	-0.060 (0.851)	-0.074 (0.811)	-0.099 (0.948)
Linder	-0.140*** (4.479)	-0.070 (1.518)	-0.108** (2.383)
Lagged Imports	0.517*** (10.093)	0.459*** (8.271)	0.426*** (7.885)
Rho			0.158* (1.766)

*Significance at the 10%, 5%, and 1% level are denoted by *, **, and *** respectively.*
Numbers in parenthesis are t-statistics.

Results in Table 3.6 show that regardless of model specification, factors such as longer distances, absence of preferential agreements, or lack of common borders reduce the amount of trade between Argentina and EU. As expected, the magnitude of the coefficients is smaller when lagged imports are used as an explanatory variable. On the other hand, Mercosur and time invariant factors such as Brazil's common borders and relatively short distance with Argentina exert a positive impact on trade.

The instrument replacing Argentina's GDP is positive at the 1% level for different model specifications showing again the country's absorptive power. Models capturing time invariant effects suggest that a 1% growth in Argentina's economic activity leads to an increase of 2.2% in the country's imports from Brazil, the US, and EU. Trading partner's GDP has no influence on Argentine imports. Argentina's population has a negative effect on imports and trading partner's population is positively related to the level of Brazilian, European, and American exports to Argentina.

Real exchange rates seem to have no impact on Argentine imports. Restrictions on import payments and capital mobility as well as the exchange rate uncertainty brought by devaluation worked as expected by reducing the level of the country's imports. The coefficient for the dummy variable capturing any structural break for the pre- and post-devaluation period is insignificant. This is evidence in favor of the Linder hypothesis since any structural change in the demand for imports is explained by the differences in incomes per capita rather than a dummy variable. Lagged imports are positive and significant at the 1% level suggesting that habit formation effects are important when modeling demand for imports in Argentina.

Results suggest evidence of a Linder effect even after capturing country-pair time invariant effects and any structural break generated by devaluation or capital restrictions. Estimates support Linder's proposition that the greater the difference between two countries' per capita incomes the lower the amount of trade between them. The coefficient for *LINDER* is negative at the 1% level when the TSCS model is estimated with a common intercept. This suggests that a 1% increase in the difference between Argentina's per capita income and that of its major trading partners leads to 0.14% decrease in imports. These estimates are robust to different covariance specifications. Over parameterization may exist since the TSCS S2-R2 model capturing time invariant effects shows no significant Linder effects while all other eight combinations of Ss and Rs show a negative coefficient for *LINDER*.[76] Estimates from the FE model in the third column of Table 3.6 support Linder's theory. At the 5% significance level, results indicate that a 1% increase in the difference between Argentina's per capita income and that of its major trading partners leads to a 0.11% decrease in the country's imports.

There are (at least) four ways to model (parameterize) the pair-wise cross-country differential trade effects: (1) dummy variables (fixed effects), (2) different variances (random effects), (3) different autoregressive processes (different ρs), and (4) cross trading partner income differences (Linder effects). The above TSCS with common intercept approach and the FE results suggest that using up to any three of these parameterizations in a given specification produces very reasonable results. However, the TSCS model capturing country-specific effects indicate that when all four parameterizations are used the Linder effect is only marginally significant, if at all. To

[76] See Appendix I in this chapter.

reinforce this notion, if Greene's philosophy that problems such as the current one should be modeled with a common mean (Greene, p. 320) so that the fixed effects dummies can be dropped, then the TSCS model with common intercept in Table 3.6 confirms that the Linder effect is statistically significant in all specifications.

In summary, modeling heterogeneity across countries with different covariance specifications and a common intercept shows significant Linder effects; in the FE model, which allows for groupwise heteroscedasticity and corrects for autocorrelation with a common ρ for all trading country-pairs, the Linder effect is significant; and the TSCS estimates capturing countries' fixed effects shows in eight out of the nine possible specifications a significant Linder effect. Only in the TSCS S2-R2 model capturing time invariant effects and therefore incorporating all four parameterizations of the pair-wise cross-country differential trade effects, was the Linder pair-wise cross-country differential trade effects effect found to be statistically insignificant at traditional levels. Thus, it is reasonable to conclude that the Linder effect is in fact a statistically significant determinant of Argentinean imports, and any apparent insignificance is due to an over parameterization of pair-wise cross-country differential trade effects. Results suggest that the Linder hypothesis explains part of the trade diversion favoring Brazilian products. In sum, Argentina's devaluation depressed the country's per capita income generating changes in its demand structure, which seems now more closely related to its Mercosur partner Brazil.

VIII. Conclusions

This chapter provides evidence of trade diversion effects after devaluation. Argentina's imports have been diverted favoring Brazilian goods to the detriment of imports from non-Mercosur trading partners, and this diversion can be explained by Linder effects. Empirical results suggest that trade diversion may occur as a consequence of exchange rate adjustments and not necessarily as the direct result of the formation of a trading bloc. A currency devaluation that sets a country's exchange rate more in line with regional trading partners can create trade diversion. Estimates support the idea that devaluation depressed Argentina's per capita income to levels closer to Brazil's and more distant from the US and EU. In sum, findings suggest that Argentina's trade deficit with Brazil is a consequence of an import diversion process after a devaluation that generated drastic changes in relative per capita incomes.

First, a gravity model separates the effects of Argentina's devaluation on imports from Brazil and from non-Mercosur US and EU with dummy variables. Estimates from different specified models indicate trade diversion in favor of Brazilian products. Some estimates suggest a significant increase in Argentina's imports from Brazil coupled with a decrease in non-member imports. Other estimates show a decline in non-member imports with no effects on Brazilian goods. In this case, trade diversion favoring Brazil is implied since lower imports from the US and EU have increased Brazil's market share. Results are robust to the use of an instrumental variable approach and when adding a lagged dependent variable. Examination of model residuals suggests a dynamic IV model is more appropriate.

Finally, a gravity model focuses on the Linder hypothesis as a possible explanation of this trade diversion. Two main reasons make the case under study appropriate for a test of the Linder hypothesis. First, Argentina's imports are composed mainly of manufactures as shown in Chapter 1. Second, the peso devaluation has depressed Argentina's per capita income to levels that are much closer to Brazil's. In other words, the peso devaluation lowered Argentina's buying power in international markets, making the country's demand structure more similar to that of Brazil. This section presents a gravity model of trade that tests the presence of a Linder effect that could explain the trade adjustments under examination.

A Linder effect is evident suggesting that devaluation depressed Argentina's per capita income affecting its import demand structure. Results suggest that every 1% increase in the difference between Argentina's per capita income and those of its major trading partners leads to 0.11% decrease in imports. The trade diversion effects of devaluation are a consequence of a change in Argentina's import demand structure. This becomes a reasonable explanation for the inverse J-curve found in Chapter 2 and for Argentina's post-devaluation trade deficit with Brazil.

APPENDIX I

Output for TSCS Model with Country-Pair Fixed Effects in Table 3.5

Constant: intercept; *DEU*: EU's fixed effects; *DB*: Brazil's fixed effects; *IV*: instrument for Argentina's GDP; *LRGDPTP*: trading partners' GDP; *LPA*: Argentina's population; *LPTP*: trading partners' populations; *LREXCH*: real exchange rates; *DR*: dummy for restrictions and initial exchange rate instability; *D*: dummy testing for structural break; *LLINDER*: Linder effects.

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Homoskedastic Regression          (S0) |
| Nonautocorrelated disturbances    (R0) |
| Pooled OLS residual variance (SS/nT) .0139|
| Test statistics for homoscedasticity:  |
| Deg.Fr. = 2 C*(.95) = 5.99 C*(.99) = 9.21 |
| Lagrange multiplier statistic   = .4062 |
| Log-likelihood function = 88.038328    |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-51.48850340	-2.007	.0447
DEU	-2.214822839	-7.482	.0000
DB	3.522114733	7.859	.0000
IV	3.436856862	17.074	.0000
LRGDPTP	-1.487776687	-2.798	.0051
LPA	-5.581821569	-4.074	.0000
LPTP	7.640157113	8.202	.0000
LREXCH	-.9338096301E-01	-.790	.4294
DR	-.5436679333	-4.046	.0001
D	-.3305538788	-2.819	.0048
LLINDER	-.1647341573	-3.235	.0012

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Groupwise Het. Regression         (S1) |
| Nonautocorrelated disturbances    (R0) |
| Test statistics for homoscedasticity:  |
| Deg.Fr. = 2 C*(.95) = 5.99 C*(.99) = 9.21|
| Wald statistic = .7921                 |
| Likelihood ratio statistic = .6698     |
| Test statistics against the correlation |
| Lagrange multiplier statistic = 18.9285 |
| Log-likelihood function = 88.373244    |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-54.66486465	-2.072	.0383
DEU	-2.203326600	-7.481	.0000
DB	3.496215899	7.913	.0000
IV	3.420367714	17.127	.0000
LRGDPTP	-1.589000719	-2.918	.0035
LPA	-5.313355075	-3.861	.0001
LPTP	7.589312657	8.235	.0000
LREXCH	-.9136991987E-01	-.756	.4497
DR	-.5379784140	-3.967	.0001
D	-.3365355759	-2.834	.0046
LLINDER	-.1600420348	-3.059	.0022

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Groupwise Het. and Correlated     (S2) |
| Nonautocorrelated disturbances    (R0) |
| Test statistics against the correlation |
| Deg.Fr.= 3 C*(.95) = 7.81 C*(.99) = 11.34|
| Test statistics against the correlation |
| Likelihood ratio statistic = 32.3206   |
| Log-likelihood function = 104.533556   |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-65.22837805	-2.815	.0049
DEU	-2.047727145	-9.245	.0000
DB	3.153428153	10.204	.0000
IV	3.531696643	14.800	.0000
LRGDPTP	-1.895733396	-3.917	.0001
LPA	-3.945576954	-3.396	.0007
LPTP	6.962724639	10.510	.0000
LREXCH	-.1621153580	-1.453	.1462
DR	-.6135926526	-4.434	.0000
D	-.3905205474	-3.395	.0007
LLINDER	-.1744948964	-3.287	.0010

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Homoskedastic Regression          (S0) |
| Common autocorrelation            (R1) |
| Autocorrelation coeff.      r = .30048 |
| Pooled OLS residual variance (SS/nT).0121|
| Corrected residual var.= (s2/(1-r2) .0133|
| Test statistics for homoscedasticity:  |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21 |
| Lagrange multiplier statistic = .2224  |
| Log-likelihood function = 96.824261    |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-29.30068623	-1.111	.2665
DEU	-2.049038471	-5.665	.0000
DB	3.534286741	6.200	.0000
IV	3.106245792	14.079	.0000
LRGDPTP	-.8516051351	-1.564	.1178
LPA	-6.664164690	-4.479	.0000
LPTP	7.361089326	6.311	.0000
LREXCH	.3816237421E-01	.301	.7632
DR	-.4257695960	-3.071	.0021
D	-.2380300682	-1.897	.0578
LLINDER	-.1046321027	-1.788	.0738

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                2 Step GLS  |
| Groupwise Het. Regression         (S1)|
| Common autocorrelation            (R1)|
| Autocorrelation coeff. r = .30048      |
| Test statistics for homoscedasticity:  |
| Deg.Fr. = 2 C*(.95) = 5.99 C*(.99) =9.21|
| Wald statistic  = .3073                |
| Likelihood ratio statistic =  .2781    |
| Test statistics against the correlation |
| Lagrange multiplier statistic = 18.9790 |
| Log-likelihood function =     96.963303 |
+----------------------------------------+
+---------+-------------+--------+--------+
|Variable | Coefficient  |b/St.Er.|P[|Z|>z] |
+---------+-------------+--------+--------+
Constant -30.45959809      -1.161   .2455
DEU      -2.073470579      -5.821   .0000
DB        3.580267343       6.370   .0000
IV        3.112024229      14.134   .0000
LRGDPTP  -.8472722888      -1.568   .1168
LPA      -6.697070184      -4.567   .0000
LPTP      7.446380250       6.484   .0000
LREXCH    .3097006680E-01    .245   .8063
DR       -.4320181646      -3.117   .0018
D        -.2404074324      -1.909   .0562
LLINDER  -.1022020250      -1.764   .0778
```

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS  |
| Groupwise Het. and Correlated      (S2)  |
| Common autocorrelation             (R1)  |
| Autocorrelation coeff.        r = .30048  |
| Test statistics against the correlation  |
| Deg.Fr. = 3 C*(.95) = 7.81 C*(.99) = 11.34|
| Test statistics against the correlation  |
| Likelihood ratio statistic = 25.5855     |
| Log-likelihood function = 109.756048     |
+----------------------------------------+
+---------+-------------+--------+--------+
|Variable | Coefficient  |b/St.Er.|P[|Z|>z] |
+---------+-------------+--------+--------+
Constant -22.16508109       -.902   .3669
DEU      -1.785021674      -7.093   .0000
DB        3.121988981       8.316   .0000
IV        3.195241630      11.519   .0000
LRGDPTP  -.7236082904      -1.492   .1357
LPA      -6.158654349      -4.618   .0000
LPTP      6.491619773       8.317   .0000
LREXCH    .2506924037E-01    .213   .8315
DR       -.4461429597      -3.090   .0020
D        -.2320266335      -1.806   .0709
LLINDER  -.1111659187      -2.102   .0356
```

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                2 Step GLS  |
| Homoskedastic Regression          (S0) |
| Group specific autocorrelation    (R2) |
| Autocorrelation coefficients:          |
|  .635  .080  .186                      |
| Pooled OLS residual variance (SS/nT).0105|
| Test statistics for homoscedasticity:  |
| Deg.Fr. = 2 C*(.95) = 5.99 C*(.99) = 9.21|
| Lagrange multiplier statistic = .2523  |
| Log-likelihood function = 105.381853   |
+----------------------------------------+
+---------+-------------+--------+--------+
|Variable | Coefficient  |b/St.Er.|P[|Z|>z]|
+---------+-------------+--------+--------+
Constant -22.58413029       -.898   .3694
DEU      -1.698841609      -5.065   .0000
DB        3.095530181       5.940   .0000
IV        3.142792803      15.453   .0000
LRGDPTP  -.9900509139      -2.041   .0412
LPA      -5.850580030      -4.641   .0000
LPTP      6.282933591       5.829   .0000
LREXCH    .1224329178        .963   .3355
DR       -.3426319367       2.584   .0098
D        -.2334961153      -2.012   .0442
LLINDER  -.4738260781E-01   -.738   .4606
```

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                2 Step GLS  |
| Groupwise Het. Regression         (S1) |
| Group specific autocorrelation    (R2) |
| Autocorrelation coefficients:          |
|  .635  .080  .186                      |
| Test statistics for homoscedasticity:  |
| Deg.Fr. = 2 C*(.95) = 5.99 C*(.99) = 9.21|
| Wald statistic = .3903                 |
| Likelihood ratio statistic =      .3218 |
| Test statistics against the correlation |
| Lagrange multiplier statistic  = 18.6963 |
| Log-likelihood function = 105.542770    |
+----------------------------------------+
+---------+-------------+--------+--------+
|Variable | Coefficient  |b/St.Er.|P[|Z|>z] |
+---------+-------------+--------+--------+
Constant -20.86407858       -.852   .3940
DEU      -1.711805614      -5.094   .0000
DB        3.107752920       5.923   .0000
IV        3.141020155      15.330   .0000
LRGDPTP  -.9253603152      -1.957   .0503
LPA      -6.009467756      -4.766   .0000
LPTP      6.325636412       5.840   .0000
LREXCH    .1243844649       1.000   .3173
DR       -.3413836872      -2.609   .0091
D        -.2287966047      -1.999   .0456
LLINDER  -.5549234217E-01   -.887   .3751
```

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =               2 Step GLS   |
| Groupwise Het. and Correlated      (S2)|
| Group specific autocorrelation     (R2)|
| Autocorrelation coefficients:          |
|  .635  .080  .186                      |
| Test statistics against the correlation|
| Deg.Fr.= 3 C*(.95) = 7.81 C*(.99)= 11.34
| Test statistics against the correlation|
| Likelihood ratio statistic = 25.0810   |
| Log-likelihood function = 118.083280   |
+----------------------------------------+
+---------+-------------+--------+--------+
|Variable |Coefficient  |b/St.Er.|P[|Z|>z]|
+---------+-------------+--------+--------+
Constant -19.85336430       -.852   .3941
DEU      -1.560062126      -6.414   .0000
DB        2.836483244       7.708   .0000
IV        3.177866078      12.470   .0000
LRGDPTP  -.8973043201      -2.039   .0415
LPA      -5.465667793      -4.690   .0000
LPTP      5.778095087       7.573   .0000
LREXCH    .4624001189E-01    .407   .6839
DR       -.4249076912      -3.232   .0012
D        -.3136158694      -2.841   .0045
LLINDER  -.7002352755E-01  -1.217   .2236
```

Output for TSCS Model with Country-Pair Fixed Effects in Table 3.6

Constant: intercept; *DEU*: EU's fixed effects; *DB*: Brazil's fixed effects; *IV*: instrument for Argentina's GDP; *LRGDPTP*: trading partners' GDP; *LPA*: Argentina's population; *LPTP*: trading partners' populations; *LREXCH*: real exchange rates; *DR*: dummy for restrictions and initial exchange rate instability; *D*: dummy testing for structural break; *LLINDER*: Linder effects; *LLM*: lagged imports.

```
+-----------------------------------------+
| Groupwise Regression Models             |
| Estimator =                2 Step GLS   |
| Homoskedastic Regression            (S0) |
| Nonautocorrelated disturbances      (R0) |
| Pooled OLS residual variance (SS/nT).0085|
| Test statistics for homoscedasticity:    |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21 |
| Lagrange multiplier statistic  = 3.8898  |
| Log-likelihood function = 118.587125     |
+-----------------------------------------+
+---------+-------------+--------+--------+
|Variable | Coefficient  |b/St.Er.|P[|Z|>z]|
+---------+-------------+--------+--------+
Constant -4.328539165       -.209   .8346
DEU      -1.186839605      -4.587   .0000
DB        1.880526469       4.747   .0000
IV        2.299379938      11.328   .0000
LRGDPTP  -.5670874650      -1.324   .1854
LPA      -4.491064980      -4.169   .0000
LPTP      4.093817757       4.929   .0000
LREXCH   -.7888716608E-01   -.854   .3929
DR       -.2599494720      -2.369   .0179
D        -.8929186880E-01   -.934   .3501
LLINDER  -.1146430845      -2.853   .0043
LLM       .4491282638       8.862   .0000
```

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =               2 Step GLS   |
| Groupwise Het. Regression          (S1)|
| Nonautocorrelated disturbances     (R0)|
| Test statistics for homoscedasticity:  |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21|
| Wald statistic = 11.1897               |
| Likelihood ratio statistic = 5.7117    |
| Test statistics against the correlation |
| Lagrange multiplier statistic = 10.0028 |
| Log-likelihood function = 121.442980   |
+----------------------------------------+
+---------+-----------+--------+---------+
|Variable | Coefficient|b/St.Er.|P[|Z|>z] |
+---------+-----------+--------+---------+
Constant -13.43228469       -.628   .5303
DEU      -1.199427084      -4.921   .0000
DB        1.864988943       5.043   .0000
IV        2.223133585      11.505   .0000
LRGDPTP  -.7492502318      -1.718   .0857
LPA      -3.894243767      -3.722   .0002
LPTP      4.079513688       5.255   .0000
LREXCH   -.1182971194      -1.244   .2135
DR       -.2827611220      -2.592   .0095
D        -.1181493207      -1.212   .2254
LLINDER  -.1093501724      -2.682   .0073
LLM       .4701993929       9.549   .0000
```

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Groupwise Het. and Correlated     (S2) |
| Nonautocorrelated disturbances    (R0) |
| Test statistics against the correlation|
| Deg.Fr.= 3 C*(.95) = 7.81 C*(.99) = 11.34|
| Test statistics against the correlation|
| Likelihood ratio statistic = 11.0771   |
| Log-likelihood function = 126.981512   |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-6.485590308	-.310	.7568
DEU	-1.039327388	-4.798	.0000
DB	1.640163100	5.107	.0000
IV	2.158760077	9.728	.0000
LRGDPTP	-.6818866959	-1.676	.0938
LPA	-3.743287432	-3.777	.0002
LPTP	3.568682539	5.213	.0000
LREXCH	-.8206692881E-01	-.907	.3643
DR	-.2309253188	-2.108	.0351
D	-.6742807191E-01	-.688	.4916
LLINDER	-.9512367887E-01	-2.436	.0149
LLM	.4971602796	9.137	.0000

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Homoskedastic Regression          (S0) |
| Common autocorrelation            (R1) |
| Autocorrelation coeff. r = .11594      |
| Pooled OLS residual variance (SS/nT).0084|
| Corrected residual var.= (s2/(1-r2).0085 |
| Test statistics for homoscedasticity:  |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21 |
| Lagrange multiplier statistic = 4.0128 |
| Log-likelihood function = 119.295641   |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-3.513507828	-.165	.8690
DEU	-1.211780853	-4.370	.0000
DB	1.966239592	4.561	.0000
IV	2.321325946	11.190	.0000
LRGDPTP	-.4773424870	-1.081	.2798
LPA	-4.712384387	-4.150	.0000
LPTP	4.228882511	4.720	.0000
LREXCH	-.6717585366E-01	-.691	.4893
DR	-.2685893260	-2.384	.0171
D	-.1009231434	-1.019	.3084
LLINDER	-.1095868300	-2.544	.0110
LLM	.4259261602	8.273	.0000

```
+---------------------------------------+
| Groupwise Regression Models           |
| Estimator =                2 Step GLS |
| Groupwise Het. Regression         (S1)|
| Common autocorrelation            (R1)|
| Autocorrelation coeff. r = .11594     |
| Test statistics for homoscedasticity: |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21|
| Wald statistic = 10.3369              |
| Likelihood ratio statistic = 5.5414   |
| Test statistics against the correlation |
| Lagrange multiplier statistic = 8.4777 |
| Log-likelihood function = 122.066340  |
+---------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-9.385832925	-.432	.6654
DEU	-1.213516720	-4.675	.0000
DB	1.958273975	4.872	.0000
IV	2.241131371	11.324	.0000
LRGDPTP	-.5659917893	-1.275	.2024
LPA	-4.316529526	-3.978	.0001
LPTP	4.202782322	5.036	.0000
LREXCH	-.9944158334E-01	-1.007	.3139
DR	-.2815969539	-2.522	.0117
D	-.1166766043	-1.159	.2463
LLINDER	-.1003391581	-2.346	.0190
LLM	.4514300650	9.021	.0000

```
+----------------------------------------+
| Groupwise Regression Models            |
| Estimator =                 2 Step GLS |
| Groupwise Het. and Correlated     (S2) |
| Common autocorrelation            (R1) |
| Autocorrelation coeff. r = .11594      |
| Test statistics against the correlation|
| Deg.Fr.= 3 C*(.95) = 7.81 C*(.99) = 11.34|
| Test statistics against the correlation|
| Likelihood ratio statistic = 9.2445    |
| Log-likelihood function = 126.688598   |
+----------------------------------------+
```

Variable	Coefficient	b/St.Er.	P[|Z|>z]
Constant	-.7858523221	-.037	.9708
DEU	-1.054469711	-4.566	.0000
DB	1.748903148	4.993	.0000
IV	2.206686846	9.755	.0000
LRGDPTP	-.4598841120	-1.100	.2711
LPA	-4.300398013	-4.136	.0000
LPTP	3.714137359	5.040	.0000
LREXCH	-.5262695206E-01	-.554	.5799
DR	-.2244885564	-1.980	.0477
D	-.5779015481E-01	-.563	.5732
LLINDER	-.8592608030E-01	-2.115	.0344
LLM	.4697544127	8.504	.0000

```
+----------------------------------------------+
| Groupwise Regression Models                  |
| Estimator =                   2 Step GLS     |
| Homoskedastic Regression             (S0)    |
| Group specific autocorrelation       (R2)    |
| Autocorrelation coefficients:                |
|  .337 -.181  .191                            |
| Pooled OLS residual variance (SS/nT).0078|
| Test statistics for homoscedasticity:        |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21 |
| Lagrange multiplier statistic = 2.6841       |
| Log-likelihood function =  124.156140        |
+----------------------------------------------+
+---------+------------+--------+---------+
|Variable | Coefficient |b/St.Er.|P[|Z|>z] |
+---------+------------+--------+---------+
Constant  2.453876151        .119   .9054
DEU      -1.073684103      -3.859   .0001
DB        1.796759495       4.164   .0000
IV        2.346478696      11.748   .0000
LRGDPTP  -.5092769136      -1.203   .2292
LPA      -4.600952542      -4.234   .0000
LPTP      3.817546954       4.244   .0000
LREXCH   -.1227996339E-01  -.126   .8998
DR       -.2110490463      -1.973   .0486
D        -.8062070258E-01  -.878   .3798
LLINDER  -.8876857445E-01 -1.901   .0573
LLM       .4148341393       8.162   .0000
```

```
+----------------------------------------------+
| Groupwise Regression Models                  |
| Estimator =                   2 Step GLS     |
| Groupwise Het. Regression            (S1)|
| Group specific autocorrelation       (R2)|
| Autocorrelation coefficients:                |
|  .337 -.181  .191                            |
| Test statistics for homoscedasticity:        |
| Deg.Fr.= 2 C*(.95) = 5.99 C*(.99) = 9.21|
| Wald statistic = 6.6433                      |
| Likelihood ratio statistic = 3.8838          |
| Test statistics against the correlation      |
| Lagrange multiplier statistic = 9.8574       |
| Log-likelihood function = 126.098059         |
+----------------------------------------------+
+---------+------------+--------+---------+
|Variable |Coefficient |b/St.Er.|P[|Z|>z] |
+---------+------------+--------+---------+
Constant -3.419443371      -.159   .8739
DEU      -1.048838745     -3.961   .0001
DB        1.732512011      4.249   .0000
IV        2.279375245     11.780   .0000
LRGDPTP  -.6528403904     -1.497   .1344
LPA      -4.077125930     -3.879   .0001
LPTP      3.689520309      4.338   .0000
LREXCH   -.4618038487E-01  -.458   .6467
DR       -.2306228000     -2.147   .0318
D        -.1000224029     -1.068   .2854
LLINDER  -.8177022979E-01 -1.689   .0911
LLM       .4371750965      8.716   .0000
```

```
+----------------------------------------------+
| Groupwise Regression Models                  |
| Estimator =                   2 Step GLS     |
| Groupwise Het. and Correlated        (S2)    |
| Group specific autocorrelation       (R2)    |
| Autocorrelation coefficients:                |
|  .337 -.181  .191                            |
| Test statistics against the correlation      |
| Deg.Fr.= 3 C*(.95) = 7.81 C*(.99) = 11.34|
| Test statistics against the correlation      |
| Likelihood ratio statistic = 10.4309         |
| Log-likelihood function =  131.313516        |
+----------------------------------------------+
+---------+------------+--------+---------+
|Variable | Coefficient |b/St.Er.|P[|Z|>z] |
+---------+------------+--------+---------+
Constant  3.157003063        .150   .8809
DEU      -.9038215936      -3.857   .0001
DB        1.536627635       4.318   .0000
IV        2.223201630      10.083   .0000
LRGDPTP  -.5512611447      -1.342   .1796
LPA      -3.975726923      -3.999   .0001
LPTP      3.235175268       4.320   .0000
LREXCH   -.2136747710E-01  -.225   .8219
DR       -.1954216562      -1.841   .0656
D        -.7415923703E-01  -.811   .4173
LLINDER  -.7037746598E-01 -1.518   .1290
LLM       .4589651116       8.271   .0000
```

APPENDIX II

Figure 3.3: Residuals from TSCS Model with Common Intercept in Table 3.1

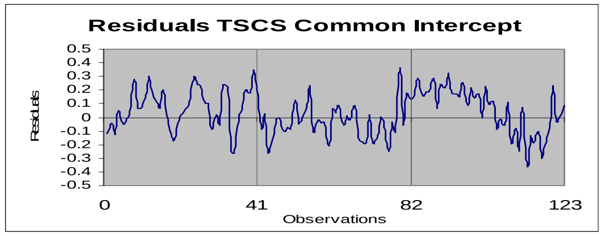

Table 3.7: Q-statistics TSCS Common Intercept Table 3.1

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	72.50	6	<.0001
12	82.68	12	<.0001
18	89.07	18	<.0001
24	151.20	24	<.0001

Figure 3.4: Residuals from TSCS Model with Fixed Effects in Table 3.1

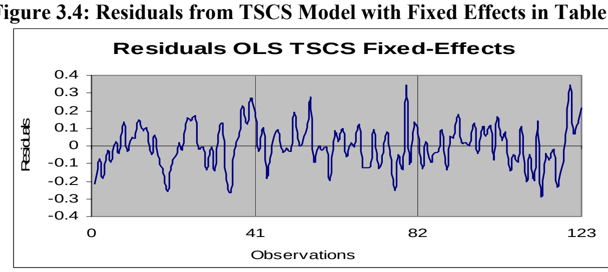

Table 3.8: Q-statistics TSCS Fixed Effects Table 3.1

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	21.52	6	0.0015
12	44.88	12	<.0001
18	52.36	18	<.0001
24	66.49	24	<.0001

Figure 3.5: Residuals from FE Model in Table 3.1

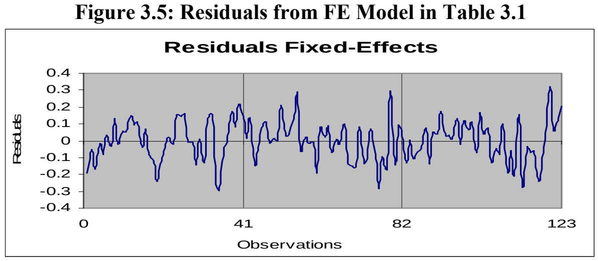

Table 3.9: Q-statistics FE Model in Table 3.1

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	17.34	6	0.0081
12	35.16	12	0.0004
18	40.40	18	0.0018
24	56.76	24	0.0002

Figure 3.6: Residuals from TSCS IV Model with Common Intercept Table 3.2

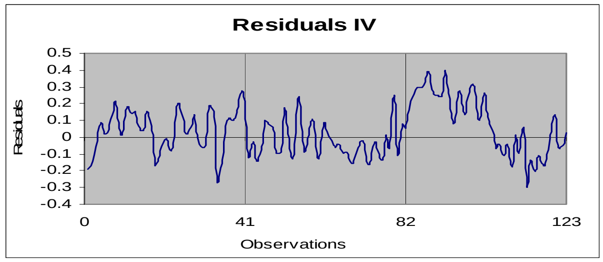

Table 3.10: Q-statistics TSCS IV Model with Common Intercept in Table 3.2

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	142.38	6	<.0001
12	167.54	12	<.0001
18	189.79	18	<.0001
24	284.61	24	<.0001

Figure 3.7: Residuals from TSCS IV Model with FE in Table 3.2

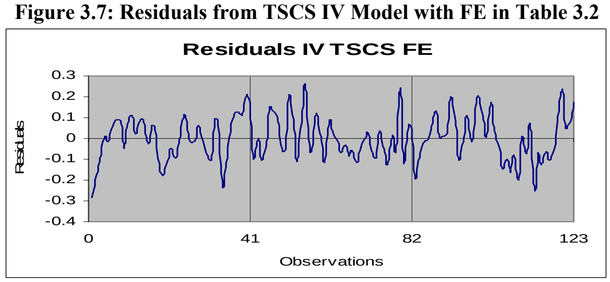

Table 3.11: Q-statistics TSCS IV Model with FE in Table 3.2

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	22.08	6	0.0012
12	26.11	12	0.0103
18	33.84	18	0.0132
24	36.20	24	0.0520

Figure 3.8: Residuals from FE Model in Table 3.2

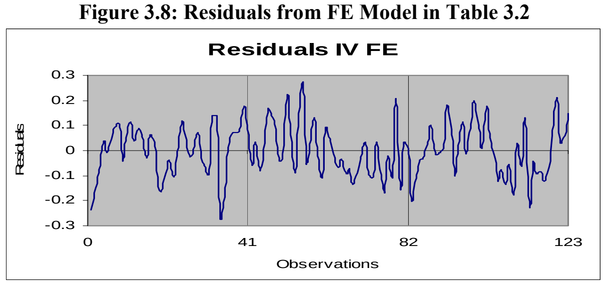

Table 3.12: Q-statistics FE Model in Table 3.2

Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	18.20	6	0.0058
12	23.54	12	0.0235
18	30.33	18	0.0343
24	35.19	24	0.0656

Figure 3.9: Residuals from TSCS IV Model with Common Intercept and Lagged Imports in Table 3.3

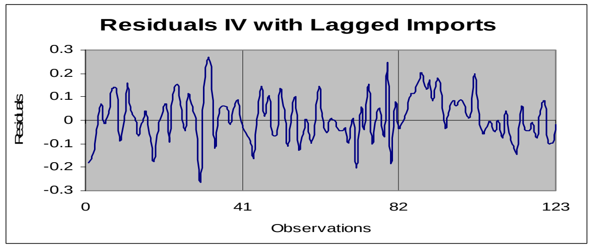

Table 3.13: Q-statistics TSCS IV Model with Common Intercept and Lagged Imports in Table 3.3

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	13.16	6	0.0406
12	20.41	12	0.0597
18	25.66	18	0.1077
24	40.83	24	0.0174

Figure 3.10: Residuals from TSCS IV Model with FE and Lagged Imports Table 3.3

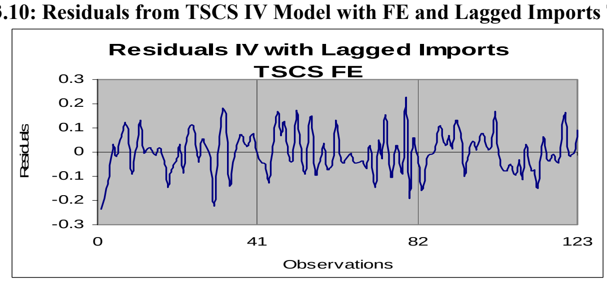

Table 3.14: Q-statistics TSCS IV Model FE and Lagged Imports Table 3.3

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	4.21	6	0.6480
12	7.71	12	0.8073
18	8.37	18	0.9727
24	10.24	24	0.9935

Figure 3.11: Residuals from IV Model with FE and Lagged Imports Table 3.3

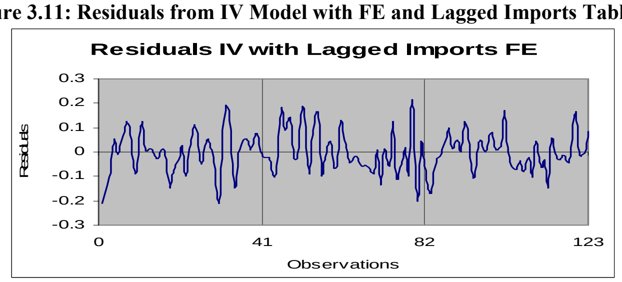

Table 3.15: Q-statistics IV Model FE and Lagged Imports Table 3.3

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	5.16	6	0.5229
12	7.95	12	0.7888
18	8.86	18	0.9630
24	10.48	24	0.9923

Figure 3.12: Residuals from Linder TSCS Model with Common Intercept Table 3.4

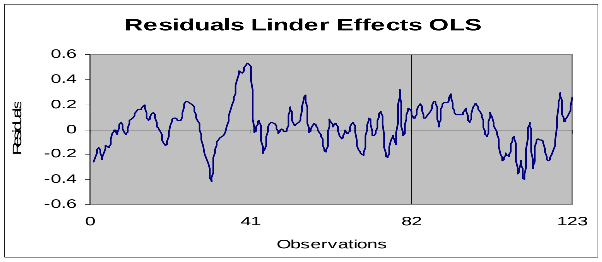

Table 3.16: Q-statistics Linder TSCS Model with Common Intercept Table 3.4

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	102.29	6	<.0001
12	114.21	12	<.0001
18	121.63	18	<.0001
24	168.47	24	<.0001

Figure 3.13: Residuals from Linder TSCS Model with FE Table 3.4

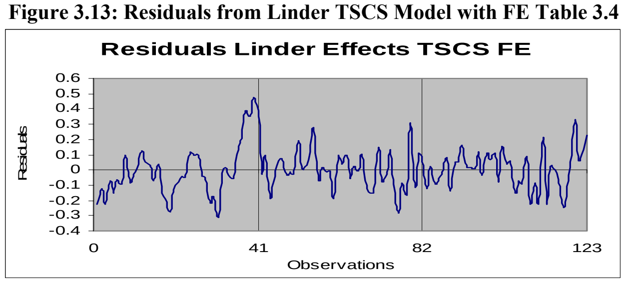

Table 3.17: Q-statistics Linder TSCS Model with FE Table 3.4

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	38.83	6	<.0001
12	54.38	12	<.0001
18	62.07	18	<.0001
24	79.28	24	<.0001

Figure 3.14: Residuals from Linder Model with FE Table 3.4

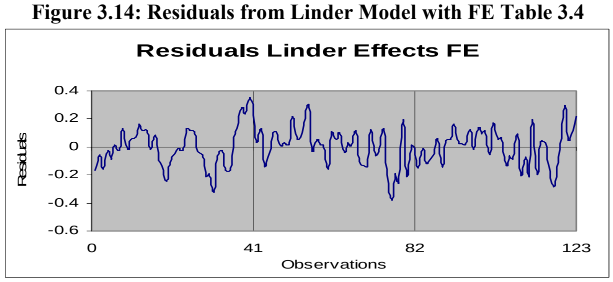

Table 3.18: Q-statistics Linder Model with FE Table 3.4

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	35.02	6	<.0001
12	45.59	12	<.0001
18	50.07	18	<.0001
24	83.58	24	<.0001

Figure 3.15: Residuals Linder TSCS IV Model with Common Intercept Table 3.5

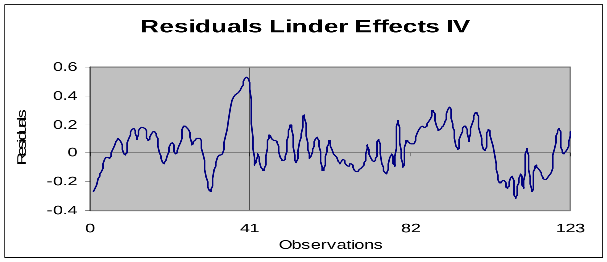

Table 3.19: Q-statistics Linder TSCS IV Model with Common Intercept Table 3.5

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	126.74	6	<.0001
12	127.76	12	<.0001
18	142.93	18	<.0001
24	191.35	24	<.0001

Figure 3.16: Residuals Linder TSCS IV Model with FE Table 3.5

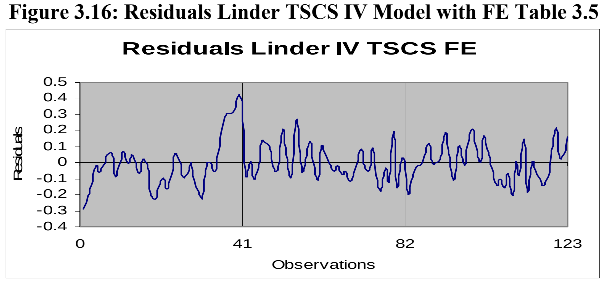

Table 3.20: Q-statistics Linder TSCS IV Model with FE Table 3.5

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	53.84	6	<.0001
12	55.28	12	<.0001
18	58.45	18	<.0001
24	64.42	24	<.0001

Figure 3.17: Residuals Linder IV Model with FE Table 3.5

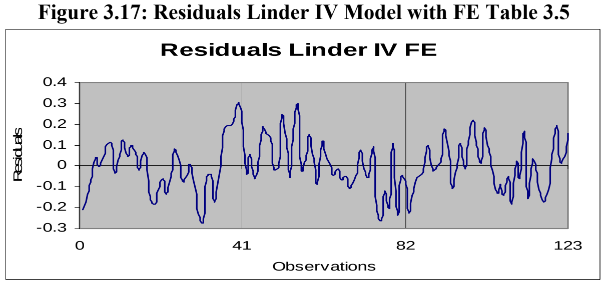

Table 3.21: Q-statistics Linder IV Model with FE Table 3.5

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	51.06	6	<.0001
12	53.73	12	<.0001
18	65.15	18	<.0001
24	91.39	24	<.0001

Figure 3.18: Residuals Linder TSCS IV Model with Common Intercept and Lagged Imports Table 3.6

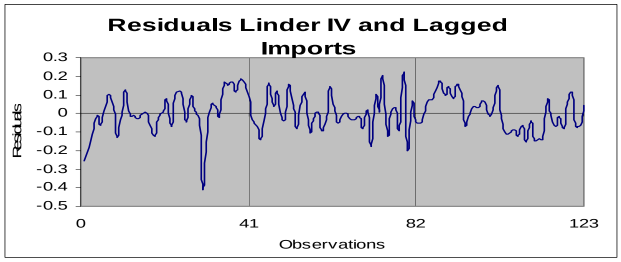

Table 3.22: Q-statistics Linder TSCS IV Model with Common Intercept and Lagged Imports Table 3.6

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	17.53	6	0.0075
12	22.45	12	0.0328
18	30.65	18	0.0316
24	52.57	24	0.0007

Figure 3.19: Residuals Linder TSCS IV Model with FE and Lagged Imports in Table 3.6

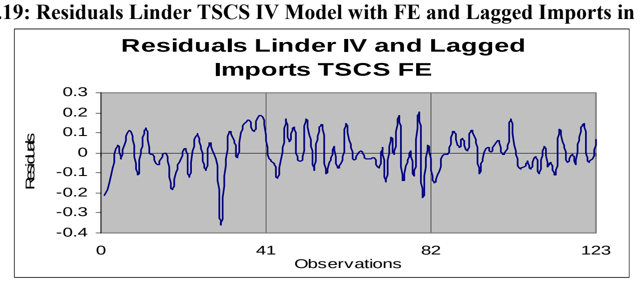

Table 3.23: Q-statistics Linder TSCS IV Model with FE and Lagged Imports in Table 3.6

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	8.71	6	0.1903
12	14.47	12	0.2715
18	20.39	18	0.3112
24	28.49	24	0.2399

Figure 3.20: Residuals Linder IV Model with FE and Lagged Imports Table 3.6

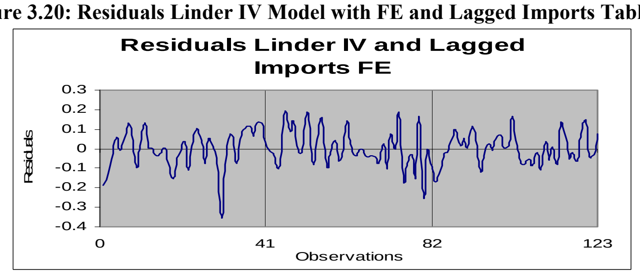

Table 3.24: Q-statistics Linder IV Model with FE and Lagged Imports Table 3.6

To Lag	Chi-Square	Degrees of Freedom	Prob. > Chi-Square
6	7.23	6	0.2998
12	11.44	12	0.4915
18	16.43	18	0.5625
24	23.00	24	0.5200

APPENDIX III

Literature Review for Gravity Models

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Theoretical and Empirical	Linder (1961)	Graphical approach by plotting countries' average propensity to import from other countries			32 countries	1958	Proposes an alternative to the HOS theory by claiming that trade is determined by demand rather than supply. He argues that the more similar the demand structure between two countries, the more intensive their bilateral trade in manufactures. Linder suggests that the average level of income is the single and most important determinant of a country's demand structure. Therefore, he suggests that differences in per capita income are an obstacle to trade.
Empirical	Tinbergen (1962)	OLS Cross-Section	E_{ij}: value of exports from country *i* to country *j*	Y_i: country's *i* GNP; Y_j: country's *j* GNP; D_{ij} is the distance between countries *i* and *j;* and dummies for Adjacency and Regional Integration	18 countries, 42 countries	1958 and 1959	Economic size and distance are the main factors explaining trade flows. The only dummy variable that is positive and significantly different from zero is the one representing the Commonwealth preference. Significant deviations between actual and expected trade flows suggest the presence of discriminatory trade barriers. The reasons for these deviations are preferential treatment of a country's exports, utilization of previously accumulated foreign exchange in the case of imports, or a net inflow of capital. Negative deviations are based on discriminatory treatment of exports, import restrictions, or net outflows of capital.
Theoretical and Empirical	Linnemann (1966)	OLS Cross-Section	*Xij*: the trade flows from country *i* to country *j* in logs.	Y_i and Y_j are GNPs; N_i and N_j are populations; P_{ij} is a preferential trade factor; and D_{ij} is the distance between countries	80	1958-1960	Findings suggest a positive relationship between GNP and trade flows, a negative relationship between trade and population, a negative relationship between natural trade barriers (distance) and trade flows, a substantial effect of preferential trade arrangements, and a trade regulating effect of trading partners' commodity composition of exports and imports. The paper derives the gravity equation from a Walrasian type general model.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical	Aitken (1973)	OLS Cross-Section: yearly regressions	*Xij*: log of the dollar value of exports from country *i* to country *j*	Y_i and Y_j are GNPs; N_i and N_j are populations; P_{ij} is a preferential trade factor (EEC and EFTA); D_{ij} is the distance between countries; *Aij* is a dummy for adjacency	Belgium-Luxembourg, France, Germany, Italy, Netherlands, Austria, Denmark, Norway, Portugal, Sweden, Switzerland, UK	1951-1967	EEC generated gross trade creation effects that are greater than those generated by EFTA. Findings suggest that EEC had a net external trade creation effect on EFTA through 1964 that was offset by a growing net trade diversion effect from 1965 to 1967. Results imply that 1958 is the last year for which it is safe to assume that European trade flows were not affected by the EEC.
Empirical. Tests the Linder Hypothesis	Hirsch and Lev (1973).	OLS Cross-Section	*Xijk:* log of exports of commodity k from country *i* to country *j*	GNPs, distance, a dummy for preferential trade, and a variable indicating per capita income differential	Denmark, Netherlands, Israel, and Switzerland	1966	Hirsch and Lev find results that are consistent with Linder's hypothesis. Most coefficients for the income differential variable are negative and significant, implying that the greater the difference in per capita income, the lower the volume of trade between two countries.
Theoretical	Anderson (1979)						Uses expenditures systems with identical homothetic Cobb-Douglas preferences across countries and with products that are differentiated by place of origin. Using a pure Cobb-Douglas expenditure system model, Anderson presents the simplest possible gravity equation assuming that each country specializes in the production of one good, and no tariffs or transportation costs exist. The paper explains the multiplicative form of the equation; permits an interpretation of the distance in the equation; implies that the usual estimator of the gravity equation may be biased.
Theoretical	Krugman (1979)						Explains trade flows as a function of economies of scale instead of factor endowments or technology. He assumes that scale economies are internal to firms with a market structure that follows a Chamberlinian monopolistic competitive market where firms have some monopoly power but entry drives monopoly profits to zero. The paper shows that trade need not be a result of international differences in technology or factor endowments. Krugman argues that trade is a way of extending a domestic market allowing for scale economies.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Theoretical	Krugman (1980)						Shows that transportation costs have no effects on firms' pricing policies and also no effects on output and number of firms. He also finds that countries with larger domestic markets tend to have higher wage rates. Finally, Krugman argues that countries with higher domestic markets on specific goods will tend to export those goods. Overall, findings lead to implications for the pattern of trade that are in line with Linder (1961).
Theoretical	Krugman (1981)						This paper proposes that the usual forces of comparative advantage operate on "groups of products" giving rise to inter-industry specialization and trade. On the other hand, scale economies lead each country to produce only a subset of goods within a group, originating intra-industry trade. Krugman argues that the gains from larger markets when countries are similar have outweighed any income distribution problem. He concludes that similar countries have an incentive to trade, that this trade will be mainly on goods that use similar production factors, and that this intra-industry trade will not generate income distribution problems that usually arise with inter-industry trade.
Theoretical	Helpman and Krugman (1985)						Demand for variety drives consumer expenditures and monopolistic competitive firms produce differentiated products. The authors argued that the Heckscher-Ohlin theory does not have the property that bilateral trade depends on the product of GDPs. Since all empirical gravity models estimated a significant effect for the product of incomes, this approach suggests that a model of trade with differentiated products is preferred.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Theoretical and Empirical using exchange rates as explanatory variable	Bergstrand (1985)	OLS Cross-Section	*PXij:* dollar value of exports from country *i* to country *j* in logs	Nominal GDPs, Distance, Adjacency dummy, Preferential trade agreement dummy, Exchange Rate, GDP deflators	Canada, US, Japan, Belgium-Luxembourg, Denmark, France, West Germany, Italy, Netherlands, UK, Austria, Norway, Spain, Sweden, Switzerland	1965, 1966, 1975, and 1976	Uses a general equilibrium model of trade where consumers maximize a utility function with constant elasticity of substitution (CES) that is subject to an income constraint. Producers maximize profits based on a constant elasticity of transformation (CET) production function. Bergstrand finds that price and exchange rates have significant statistical effects on trade flows. Bergstrand suggests that if trade flows are differentiated by origin, the typical gravity equation omits prices and exchange rates. He also finds that the elasticity of substitution among importables is greater than 1, the elasticity of substitution between domestic and imported goods is less than 1, and that "the elasticity of transformation among exports markets exceeds that between production for domestic and foreign markets."
Empirical. Tests the Linder Hypothesis. Uses exchange rates as explanatory variable	Thursby and Thursby (1987)	OLS: Cross sections. Regression for each country against al others	*PQij:* dollar value of exports from country *i* to country *j* in logs	Import price of *i*'s exports to *j*, index of import prices of exports from other countries, CPIs, GNPs, export price of *i*'s exports to *j*, index of net export prices of *i*'s exports to other countries, variable reflecting tastes in *j* for *i*'s export good (Linder), spot price of *i*'s currency in terms of *j*, tariffs, transport costs, and a factor reflecting hedging by importers	Canada, US, Japan, Belgium, Denmark, France, Finland, Germany, Greece, Italy, Netherlands, UK, Austria, Norway, Sweden, Switzerland, South Africa	1974-1982	The gravity model shows overwhelming support for Linder's hypothesis and the theoretical belief that exchange rate risk affects bilateral trade flows. The coefficient on the Linder variable is negative and significant with the exception of 2 countries. Similarly, most of the countries with proper specified equations show a statistically significant negative coefficient for the exchange rate risk variable.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical. Tests the Linder Hypothesis	Hanink (1988)	Spatial effects model	Trade intensity measured as per capita imports of country *i* from country *j*.	Absolute difference in per capita GNPs, the distance between economic centers, and the variability across goods that is measured by absolute difference in populations	Australia, Argentina, Canada, US, Japan, Belgium-Lux., Denmark, France, Finland, West Germany, Greece, Italy, Israel, Ireland, Mexico, Netherlands, New Zealand, Portugal, Singapore, South Korea, UK, Austria, Norway, Sweden, Switzerland, South Africa, and Spain	1984	Incorporating the hierarchical flow of goods that is common in regional trade. This hierarchical trade is determined by population size. Trade flows are positively related to market homogeneity (Linder hypothesis), negatively related to distance, and positively related to variety across goods.
Theoretical and Empirical. Uses exchange rate as explanatory variable	Bergstrand (1989)	OLS Cross-Section: yearly regressions	*PXaij:* the value of exports in industry *a* from country *i* to *j*	National income, income per capita, distance, adjacency, preferential trade agreement dummies (EFTA and EEC), appreciation of importer's currency, wholesale price indices for each country, and prices	Canada, US, Japan, Belgium-Luxembourg, Denmark, France, Germany, Italy, Netherlands, UK, Austria, Norway, Portugal, Spain, Sweden, Switzerland	1965, 1966, 1975, 1976	Extends Bergstrand (1985) by incorporating factor endowments differences (H-O theory) and non-homothetic preferences (Linder hypothesis) to the model. Consumers maximize a Cobb-Douglas-CES-Stone-Geary utility function subject to an income constraint. Demand curves based on this utility function use national income, income per capita, and prices to explain bilateral trade flows. Results show that between 40 to 80% of the variation across countries in one digit SITC trade flows are explained by the model. Coefficients on exporter and importer's income are positive as expected, and coefficients for exporter's per capita income suggest that chemicals, raw materials, manufactures, machinery and transport equipment, and food products are usually capital intensive in production whereas beverages and tobacco with miscellaneous manufactures are labor intensive. Bergstrand further notes that the coefficient on importer's per capita income suggests that manufactures tend to be luxuries and raw materials necessities.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical using exchange rates as explanatory variable.	Thoumi (1989)	OLS Cross-Section: yearly regressions	*PXij:* dollar value of exports from country *i* to country *j* in logs	GDP of the exporting country; the GDP of the importing country; physical distance and country adjacency; income per capita, bilateral exchange rates, and dummies capturing economic integration effects	Mexico, all Central American countries except Belize; all South American countries except Suriname; Jamaica, Haiti, the Dominic Republic, Barbados, Trinidad & Tobago	1971, 1975, and 1979	Exporters' GNP and distance are the most influential factors affecting trade patterns. Results also suggest that there is a tendency for richer countries to import more natural resource-based products than manufactures from poor countries. In general, the author suggests that integration systems among countries that are not too distant have similar sizes and development levels, and follow similar policies are more likely to succeed than other integration agreements.
Theoretical and Empirical. Tests for Linder hypothesis	Bergstrand (1990)	OLS Cross-Section	Grubel-Lloyd intra-industry trade index	GDPs, GDPs per capita, tariffs rates, dummy for adjacency, inequality of GDPs, inequality of GDPs per capita, and capital-labor ratios	14 developed countries	1976	Extends previous theoretical work by examining how average levels and inequality of GDPs, GDPs per capita, tariffs rates, and capital-labor ratios affect the share of intra-industry trade. The paper provides a theoretical framework for such a model and then presents an empirical analysis for 14 developed countries. These theoretical foundations are similar to Bergstrand (1989) with minor differences. Bergstrand's model reveals that the more similar per capita income within two countries, the more intra-industry trade. Specifically, in terms of supply, the author proposes that the more inequality among countries' capital-labor ratios, the lower intra-industry trade (Heckscher-Ohlin-Samuelson). Regarding demand, the greater the inequality between per capita incomes, the lower the share of intra-industry trade due to differences in tastes (Linder).
Empirical	Frankel, Stein, and Wei (1993)	OLS Cross-Section: yearly regressions	The value of exports plus imports in log form	GNPs, GNPs per capita, distance, dummy for adjacency, preferential trade agreement dummies (East Asia, European Community, and NAFTA)	63 countries	1965-1990 every 5 years	EEC became a significant trade-creating force in the 1980s, peaking in 1985 and declining thereafter. If two countries are members of the EEC, trade becomes 70% higher than it would have been otherwise (based on 1990 estimates). No trade creating effects for EFTA were found.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Theoretical and Empirical	Harrigan (1994)	OLS Cross-Section	Log of the value of imports divided by adjusted GNP	Log of exporting country output; 4-firm concentration ratio, Herfindahl index, minimum efficient plant scale, and price cost margin variables	Australia, Belgium, Canada, France, Germany, Italy, Netherlands, Austria, Finland, Norway, Sweden, Switzerland, UK	1983	He proposes an econometric approach to test the monopolistic competitive model of intra-industry trade summarized in Helpman and Krugman (1985). The author indicates that if the monopolistic competitive model explains gross trade flows, then industries with high gross trade flows should be described as having large scale economies. If that is not the case, then the Armington-HOV model is right and high gross trade is determined by substitution between domestic and foreign production. Results strongly support both models in the sense that the elasticity of imports with respect to a country's output is one. Harrigan further finds some evidence that higher volumes of gross trade are associated with scale economies but this is sensitive to the choice of proxy variables. He concludes that scale economies and product differentiation by location of production are important causes of trade patterns.
Empirical using exchange rates as explanatory variable	Bayoumi and Eichengreen (1995)	Gravity equation in differences rather than in levels	Bilateral trade flows between countries in US dollars	Real incomes, populations, distance, and the real exchange rate between European countries with the US. Five dummy variables measure trade within the EEC, trade within EFTA, trade between EEC and EFTA, trade between EEC and other industrial countries, and trade between EFTA and other industrial countries	Australia, Canada, US, Japan, Belgium-Luxembourg, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Netherlands, UK, Austria, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland	1956-1992 divided in 3 periods	The formation of EEC and EFTA had a significant effect on European trade flows that cannot be attributed to economic factors or even unobservable characteristics. Bayoumi and Eichengreen find that EFTA was trade creating, while EEC generated trade creation and trade diversion.
Empirical adding lagged variables and exchange rates	Eichengreen and Irwin (1995)	OLS in logs, OLS scaled, Tobit	Bilateral trade between countries *i* and *j*	The product of the 2 countries national income, the product of the 2 countries per capita income, distance, lagged trade (dependent), and dummy for adjacency	38 countries	1928, 1938, 1949, 1954, 1964	They find a significant effect on lagged trade variables. Results are robust to instrumental variables replacing lagged trade values. Specifically, they find that in the absence of lagged trade variables, the trade-creating effects of the European Payments Union (EPU) as well as the importance of the Dillon Round in early 1960s are exaggerated. They conclude that one should always include lagged variables in the gravity equation.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Theoretical	Deardorff (1995)						Deardorff uses two scenarios: one in which he assumes frictionless trade with no barriers to trade and homothetic products and another in which he introduces impediments to trade and product differentiation. With homothetic preferences, Deardorff derives what he called a "simple frictionless gravity equation" where trade depends on incomes and a factor of proportionality. He shows that this result holds even when assuming arbitrary preferences. In the case of impeded trade, Deardorff derives equations for bilateral trade using Cobb-Douglas and CES preferences. His findings show that gravity models could be easily derived from standard HOS trade theory and consequently, it is not appropriate to conclude that the empirical success of gravity models suggest failure of the factor proportions or any other theory.
Empirical using exchange rates as explanatory variable	Frankel and Wei (1997)	OLS Cross-Section: yearly regressions	Value of exports from country *i* to country *j*	Real incomes, populations, distance between trading partners, and dummies for contiguous borders, common language, and regional groupings	60 countries	Four yearly regressions between 1970-1992	Affinity variables such as common language or adjacency are significant and intraregional trade biases exist. European countries are estimated to have traded 17% more than when these estimates are obtained with a standard gravity model. Similarly, Western Hemisphere and ASEAN countries are estimated to have traded 40% and 145% more than what a model without dummies would have estimated. Results also suggest that increased trade in ASEAN and EEC did not occur at the expense of third countries. The paper presents evidence of a currency bloc in Europe that follows the mark and a dollar bloc in the Pacific. The authors also find evidence suggesting that exchange rate volatility hinders trade.
Empirical using exchange rates as explanatory variable	Frankel, Stein, and Wei (1997)	OLS Cross-Section: yearly regressions	Value of exports from country *i* to country *j*	Real incomes, populations, per capita incomes, distance between trading partners, and dummies for contiguous borders, common language, and regional groupings	60 countries	Four yearly regressions between 1970-1992	Western European countries traded 36% more that what the standard gravity model would have predicted between 1970 and 1992. Results show that trade increased over time and suggest that this growth is a consequence of trade creating as well as trade diverting effects. The coefficient for the per capita income variable is positive, suggesting that richer countries trade more. Findings also suggest that regional preferential agreements are welfare improving, but the authors conclude that the extent of preferences among regional partners has probably exceeded optimal levels.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical using exchange rates as explanatory variable	Frankel (1997)	OLS Cross-Section: yearly regressions	Total value of merchandise traded (exports plus imports) between two countries	GNPs, per capita incomes, distance and dummies accounting for adjacency between a pair of countries, common language, and preferential trade agreements	65 countries	Every five years from 1965 to 1985 and then in 1987, 1990, 1992, and 1994	Trade increases with a country's GNP but less than proportionally. This suggests that smaller countries tend to be more open to trade than larger ones. The coefficients on per capita income are highly significant and indicate that richer countries trade more than poor ones. The coefficients on the distance variable are sensitive to the inclusion of the common border dummy. When the common border dummy appears in the equation, increasing the distance by 1% reduces trade by 0.6%. Results also suggest that two countries sharing a common border trade 82% more than two similar countries not sharing borders.
Empirical. Addresses econometric issues	Mátyás (1997)	Standard gravity model with country and time effects as unknown fixed parameters	*EXPij:* exports from country *i* to country *j*	Countries GDPs, populations, foreign currency reserves, and real exchange rates. Local, target, and time specific effects are also added	Australia, Canada, India, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand, US	1982-1994	Mátyás claims that the gravity models used up to that time did not take into account the time, local, and target country (importing country) effects. The study shows that imposing these restrictions leads to incorrect inferences due to the misinterpretation of the coefficients on dummies accounting for trading blocs, common border, or common language. He suggests that models explaining trade should take into account these fixed effects.
Empirical. Tests the Linder Hypothesis	Chow, Kellman, and Shachmurove (1999)	OLS	Trade intensity (trade complementary index)	Log of per capita income ratio, a relative price variable that takes the log of the ratios of exchange rates and wholesale price indices	Taiwan, Korea, Hong Kong, Singapore with US, EC, and Japan	1965-1990	Linder theory is tested by using disaggregated data on manufactured exports. Results support the Linder hypothesis and suggest that tastes significantly affect trade flows in these countries.
Empirical using exchange rates as explanatory variable. Addresses econometric issues	Dell'Ariccia (1999)	Panel data	Log of exports plus imports between countries *i* and *j*	GDPs, populations, distance, exchange rate volatility, a variable accounting for "third country" volatility, dummies for common border, common language, and EU	Belgium-Luxembourg, Finland, France, Greece, Germany, Ireland, Italy, Netherlands, Austria, Denmark, Spain, Portugal, Sweden, Switzerland, UK	1975-1994	Results from a Hausman test show that OLS regression generates biased results suggesting the existence of simultaneity bias. Specifically, this bias is due to the existence of unobserved country-pair specific effects. This simultaneity bias is addressed with the use of instrumental variables and a fixed effects model. A fixed effects model is preferred over a random effects model and results are similar to OLS estimates. Results suggest that exchange rate volatility decreases international trade and these results are robust for different specifications. The coefficients on the standard gravity variables are also as expected.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical using exchange rates as explanatory variable. Addresses econometric issues	Mátyás, Kónya, and Harris (2000)	Panel Data: Fixed Effects. Four models are estimated	Exports from country *i* to country *j*	Countries GDPs, populations, foreign currency reserves, real exchange rates, and distance. Local, target, and time specific effects are also added	Australia, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand, US, and the European Economic Area	1978-1997	APEC members trying to increase exports should look at Singapore and New Zealand as potential markets. They claim that policy implications could be wrong in the absence of specific effects. Results also suggest that foreign GDP effects were underestimated in previous studies, that the effect of population on trade could be positive, and that the effect of real exchange rates is significant.
Empirical. Tests the Linder Hypothesis. Uses exchange rates as explanatory variable	McPherson, Redfearn, Tieslau (2000)	Panel Data: Fixed Effects, Tobit Approach	Dollar value of exports from OECD country *j* to potential trading partner *i*	GDP of trading partner *i*, real exchange rates, and the absolute differences in per capita income between trading partners	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, UK, US, and 161 potential trading partners	1990-1995 at annual intervals	Supports the Linder hypothesis for all but one of the 19 OECD countries under consideration. The relative size of a trading partner's economy has a positive effect on trade. In terms of exchange rates, all but three of the OECD countries show the expected positive and significant effect on exports.
Empirical using exchange rates as explanatory variable	Rose (2000)	Cross-country panel data, yearly regressions	Bilateral trade	GDPs, incomes per capita, distances, and a series of dummies accounting for common language, regional trade agreement, colonies, common nations, a common currency dummy, and a variable explaining exchange rate volatility	EU countries as well as other 92 countries	1970, 1975, 1980, 1985, 1990	Rose finds that two countries with a common currency trade three times as much as countries not sharing a common currency. This common currency effect is larger than the effect of reducing exchange rate volatility to zero but keeping separate currencies. The author performs a sensitivity analysis that suggests robust results.
Empirical. Addresses econometric issues	Soloaga and Winters (2001)	17 separate yearly regressions and then, pooled data estimation	Value of imports of country *i* from country *j*	GDPs, populations, distance, weighted distance, land area, dummies for common border, island, cultural affinities, and preferential trade agreement	58 countries representing 70% of world trade	1980-1996 annual non-fuel imports	Results show no indication that increasing regionalism during the 1990s raised intra-bloc trade significantly. The paper presents evidence of trade diversion taking place in the EU and EFTA. Soloaga and Winters also suggest that trade liberalization efforts in Latin America had a positive impact on bloc members' imports.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical using exchange rates as explanatory variable. Addresses econometric issues	Pakko and Wall (2001)	Panel Data: Fixed Effects	*Xij*: log of total real trade of country *i* with country *j*	GDPs, per capita GDPs, dummies for preferential agreement, common currency, and a vector of time dummies	EU countries as well as other 92 countries	1970, 1975, 1980, 1985, 1990	The authors claim that the fixed effects model avoids the estimation bias that may arise due to misspecification or omitted variables. Misspecification could arise with the creation of the variable distance that is supposed to reflect relative costs of trading. Omitted variables problems arise because it becomes impossible to include enough variables to account for all the important fixed factors (time invariant factors). Further, Pakko and Wall suggest that the fixed effects model not only controls for variables such as language, common nation, colony, and distance, but also, it accounts for any other factors that are usually not included in gravity models. The paper shows that using the same data of Rose (2000), the fixed effects model results in much weaker evidence.
Empirical. Tests the Linder Hypothesis. Uses exchange rates as explanatory variable	McPherson, Redfearn, Tieslau (2001)	Panel Data: Fixed Effects, Tobit Approach	Value of imports from trading partners	GDP of trading partner *i*, real exchange rates, and the absolute differences in per capita income between trading partners	Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda and their trading partners	1984-1992 Annual	In five out of six countries, the Linder hypothesis holds. In particular, results show that Ethiopia, Kenya, Rwanda, Sudan, and Uganda trade more intensively with countries that have per capita incomes similar to them. The authors conclude that factor proportions theory is inadequate when investigating trade flows in developing countries and they suggest the appropriateness of Linder hypothesis in such a context.
Empirical	Evenett and Keller (2002)	OLS Cross-Section	Grubel-Lloyd intra-industry trade index	GDPs per capita, GDPs, Capital per Worker, # of industries traded	58 countries accounting for 67% of world imports and 79% of world GDP	1985	Specialization and trade have a positive relationship with the share of intraindustry trade on total trade. Evenett and Keller suggest that a model with IRS and product differentiation explains the North-North trade. They also find that trade volumes increase when there are larger differences in factor endowments suggesting that factor abundance is important explaining North-South trade.

Type	Author (Year)	Method	Dependent Variable	Independent Variables	Countries	Time Period (frequency)	Results
Empirical using exchange rates as explanatory variable	Martinez-Zarzoso and Nowak-Leman (2002)	Panel Data: fixed effects	Sector specific exports for different countries at different time periods	Differences in per capita income between countries (economic distance), distance between countries scaled by infrastructure, and the bilateral real exchange rate	Mercosur plus Chile exports to 15 EU countries	1988-1996	Products that are highly sensitive to economic distance and not sensitive to geographical distance are the best candidates for future trade with EU. Results suggest that the Linder hypothesis applies to telecommunications, iron and steel, metals, industrial machinery, and animal feed. Sectors with a dominant HOS effect are furniture, footwear, beverages, meat and fish (products in which Mercosur has a comparative advantage). Results also indicate that some industries have a high and significant geographical distance effect.
Empirical using exchange rates as explanatory variable	Martinez-Zarzoso and Nowak-Leman (2003)	Panel Data: fixed effects	Value of exports from country *i* to country *j*	GDPs, difference in GDPs per capita, populations, distance, infrastructure, real exchange rate, EU dummy, Mercosur dummy	Mercosur plus Chile exports to 15 EU countries	1988-1996	Exporter and importer incomes have a positive effect on trade flows. Results also show that exporter's population has a negative effect on exports and importer's population has a positive effect. The findings also suggest that for Mercosur-EU trade flows, only exporter infrastructure has a positive effect on trade. Preferential trade agreements are also shown as variables increasing trade flows. Potential trade estimates show that Mercosur was exporting below its potential levels in 1996 (each country member), but in previous years, results are varied.
Empirical using exchange rates as explanatory variable. Addresses econometric issues	Cheng and Wall (2005)	Panel data: fixed effects	*Xij*: exports from country *i* to country *j* in logs	GDPs, populations, distance, country pair dummies	Argentina, Australia, Austria, Belgium-Lux., Brazil, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK, Uruguay, US	1982, 1987, 1992, 1997.	The authors show that standard pooled-cross-section methods used in gravity models have an estimation bias problem due to omitted or misspecified variables. The paper shows that a two-way fixed effects model solve this econometric issues by using country-pair and period dummies that explain bilateral trade patterns. Country-specific dummies capture factors such as distance, common border, common language, history, culture, and others that are constant over time. Cheng and Wall show that alternative fixed effects models such as Mátyás (1997), Glick and Rose (2001), and Bayoumi and Eichengreen (1997) are special cases of their proposed two-way model. They claim that the restrictions applied to obtain these alternative models are not supported statistically. Results indicate that unless heterogeneity is accounted for properly, gravity models of bilateral trade can overestimate the effects of integration on trade flows.

CHAPTER 4: CONCLUDING REMARKS AND POLICY IMPLICATION ISSUES

I. Concluding Remarks

This dissertation examines the trade adjustments to exchange rate policies in a world of increasing regional economic integration. It provides a framework for the analysis of currency devaluations and their effect on bilateral trade balances within the context of a regional trading bloc. The empirical investigation is based on Argentina and Brazil, two countries that have devalued their currencies to correct trade imbalances. Argentina experienced a deterioration of its trade balance with Brazil after the peso devaluation leading to a lively political discussion between the two governments that blocked further advancements to a more meaningful Mercosur economic integration.

Chapter 1 introduces the problems and challenges faced by countries entering regional trading blocs. It highlights the effects of devaluation in a country party to a regional trade agreement. The most common problems of devaluation in this context are the relocation of foreign direct investment (FDI), protectionist measures enacted by the country that is losing competitiveness, trade adjustments, and exchange rate crises that have the potential to develop into recessions. There is evidence of these issues in Mercosur. Starting with Brazil's devaluation in January 1999, a large number of firms relocated from Argentina to Brazil. This led the Argentine government to adopt protectionist measures such as tariffs and quotas. Chapter 1 also describes the composition of trade in Argentina as well as the macroeconomic performance of both countries for the period under study.

Chapter 2 studies dynamic adjustments of trade balances to devaluations or the J-curve phenomenon. The proposed model augments conventional J-curve models by adding a trade diversion variable that captures the effects of regional economic integration. Results from an Almon polynomial distributed lag (PDL) model provide evidence of an "inverse J-curve" and a significant trade diversion effect. Argentina's trade balance with Brazil initially improved and then became a deficit as the exchange rate stabilized and capital restrictions were relaxed or lifted. Potential simultaneity concerns between the variable capturing trade diversion effects and the trade balance variable are addressed by estimating the Almon PDL model with an instrumental variables (IV) approach. Results are robust to model specification.

Chapter 3 investigates the reasons for the inverse J-curve and the potential trade diversion effects found in Chapter 2. A gravity model of trade examines trade diversion effects of devaluations and the Linder hypothesis. Estimates from different specifications of the time-series cross-section model described in Greene (2003) and from a fixed effects model provide evidence of trade diversion. Findings imply that trade was diverted from the US and EU to Brazil as a consequence of devaluation rather than a direct consequence of regionalization. Models testing the Linder hypothesis show that a change in Argentina's demand structure might explain diversion effects. As devaluation depressed Argentina's per capita income, the country's demand structure has become more similar to Brazil's, diverging from the US and EU demand structures. In other words, changes in demand structures suggested by Linder explain the increased demand for Brazilian manufactures in Argentina at the expense of non-Mercosur countries.

The inverse J-curve in Chapter 2 should not be surprising considering the effects of regionalization and changing demand structures. First, if these two countries were not Mercosur members, the relocation of production capabilities from Argentina to Brazil after the devaluation of the real would have been of a lesser magnitude. Increased production capabilities through an FDI surge in Brazil expanded the country's potential for exports. By the time Argentina devalued its currency, imports from the US and EU became too expensive and were substituted for goods produced in Brazil, the only Mercosur country with capacity to supply foreign markets with manufactures.

In summary, this dissertation contributes to the existing literature by examining trade adjustments to exchange rates in the context of regional economic integration. The analysis of the dynamic effects of currency devaluation on trade balances also tests for trade diversion effects. A gravity model investigates whether trade diversion effects emerged as a consequence of devaluation rather than being a direct consequence of a preferential trade agreement. By testing the Linder hypothesis for the first time in Mercosur countries, this dissertation contributes to the literature examining the presence of Linder effects in developing countries. An up-to-date literature review on gravity models is also provided.

II. Policy Implications

The empirical results in this dissertation support the notion that currency links play a major role in explaining trade flows. The fact that Mercosur has not become a fully working common market is due for the most part to the divergent or contradicting exchange rate policies implemented by member countries. Consequently, countries entering regional trade agreements should set either a common currency or exchange rate convergence criteria for better results. This is in line with Frankel (1997) who says that "European leaders believe that currency links are not just a desirable supplement to a successful common market, but are actually a necessary component of it" (p. 135). Also, IADB (2002) argues that trade agreements seem to fail in the presence of "exchange rate disagreements."

Results indicate that in the absence of specific rules regulating exchange rates among countries in a regional trading bloc, devaluation by a country member may induce adjustments that are irreversible when other members do not follow in a timely fashion. Argentina's devaluation came too late to redirect FDI flows from Brazil to Argentina. This is similar to a first mover advantage where the country that devalues first derives most of the benefits in terms production and export capabilities. Once countries in a regional trading bloc start experiencing uneven benefits, the whole issue of regionalization becomes questionable, at least over an intermediate time period. Evidently, monetary agreements are essential for successful regional economic integration between countries.

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