**Area VI: Globalization and Supply Chains**

# Regional Market Integration and MERCOSUR:

# Implications for Wheat Trade

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## ABSTRACT

The present paper examines the extent to which the creation of MERCOSUR had an impact on wheat market integration between Argentina and Brazil, the two dominant countries of MERCOSUR. This research investigates wheat market integration before and after the creation of MERCOSUR in 1991. Cointegration analysis is used to test support for the law of one price. Wheat prices were found not to be cointegrated over the pre-MERCOSUR period. The results confirm that wheat prices for Argentina and Brazil were cointegrated from 1991 to 1999. The comovement of prices has increased as a result of MERCOSUR indicating greater price transmission elasticity and market integration.

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### Problem Statement

The globalization of world markets, expedited by international policy changes since the Uruguay Round, has created an increasingly competitive world economy. This movement to reduce trade barriers continues through the World Trade Organization (WTO). These efforts are viewed as a means to accelerate economic growth, increase incomes and improve living standards. Countries that desire to increase regional trade have moved to create regional trade agreements that free up trade and investment among neighboring countries.

The European Union (EU) is the first, and perhaps best, example of successful regional integration that has increased intra-EU trade and accelerated economic growth. Many other nations have formed similar regional agreements. The North American Free Trade Agreement (NAFTA) among Canada, Mexico and the United States has increased trade among the three countries. The Common Market of the Southern Cone Countries (MERCOSUR) of Argentina, Brazil, Uruguay, and Paraguay was similarly formed to stimulate trade among member countries; a regional market with a population of over 200 million people was created. Several more agreements have been signed including the Andean Pact, the Central American Common Market (CACM), the Caribbean Community and Common Market (CARICOM), and discussions are under way to form a Free Trade of the Americas (FTAA) that would include all of North and South America. All these agreements have the potential to create enormous opportunities for agribusinesses to seek new markets, both regionally and globally.

### Objectives

We examine the extent to which the creation of MERCOSUR affected the degree of wheat market integration between Argentina and Brazil, the two dominant countries of MERCOSUR. Studying wheat, an important producer and consumer good in both countries, allows for a comparison of an importer (Brazil) with a highly protected domestic market and an exporter (Argentina) that is seeking new wheat markets regionally and globally. The primary objective of this research is to investigate the degree of wheat market integration before and after the creation of MERCOSUR.

Agricultural economists commonly argue that in a free market, the Law of One Price (LOP) holds in the long run. Therefore, within a multinational common market (such as the EU, NAFTA, and MERCOSUR), the LOP should tend to hold, and should do so increasingly as trade barriers among the countries within the market are reduced. As this occurs, greater transmission of prices among the countries will also result. In this paper, we test these propositions.

### Procedures

We use cointegration analysis to test support for the law of one price (LOP). Does the LOP hold for wheat markets before and since the establishment of MERCOSUR in 1991? Cointegration analysis is used to empirically assess the degree of the comovement of paired prices for ten years before, and ten years after, the establishment of MERCOSUR. We used

monthly market prices of wheat in Brazil, Argentina, and the United States (representing the world price of wheat) from 1982 to1999. All wheat data for Argentina are from the *Secretaria de Agricultura, Ganaderia, Pesca y Alimentacion de la Republica Argentina*. Because Brazil does not export its wheat, the wheat prices for Brazil are those paid to farmers, not FOB. The source of the Brazilian wheat data is *Revista Agroanalysis*. All U.S. data are from the U.S.D.A.

The model follows the process suggested by Engle and Granger. First, we performed unit root tests to examine the stationary properties of the data. Second, the finding of nonstationarity leads to similar tests using first differences. All time series were found to be integrated of order one. We found our series to be cointegrated, such that a linear combination of our two nonstationary series is considered stationary. As a result, we were able to estimate the long-run relationship between the two data series.

Price transmission elasticity estimates ( $\beta_1$ ) were computed using methods of cointegration. Thompson and Bohl define:

$$p^d = \beta_0 + \beta_1 p^w + u_t \qquad \textbf{(1)}$$

$\beta_1$ as "the percentage change in the domestic price( $p^d$ ) in response to a one-percent change in the world price ( $p^w$ )." P.2 Normally, $\beta_1$ ranges from 0 to 1, where a high price transmission elasticity signifies a high degree of comovement between local and world prices of a given commodity. A value of 1 means that a one-percent change in the world price of a commodity is precisely reflected in a one-percent change in the local price of that commodity, so a high value for $\beta_1$ can be taken as a measure of well-integrated markets. Local prices of wheat were compared with the world price.

The data in Figure 1 show the production of wheat for Argentina and Brazil from 1964 to 1999. Figure 2 shows comparative exports of wheat from Brazil, Argentina and the U.S. for the same period. Since the US was clearly the leading exporter of wheat in this period, the U.S. price is used as the world price for the empirical cointegration tests.

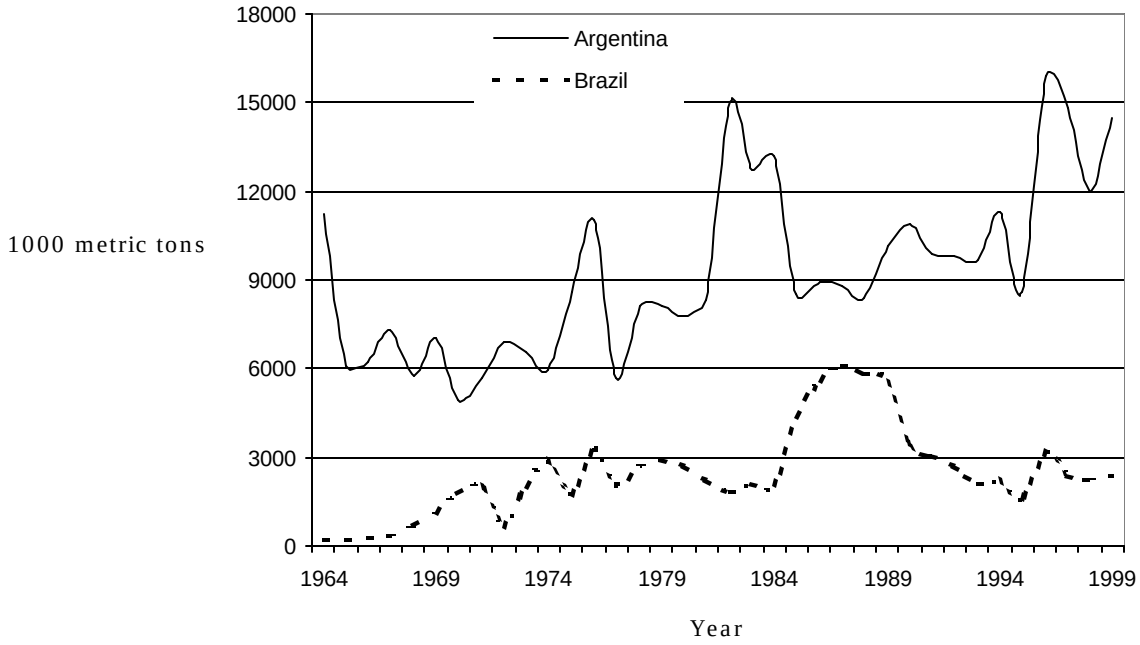


**Figure 1**: Wheat production, in metric tons, in Argentina and Brazil, 1964-1999.

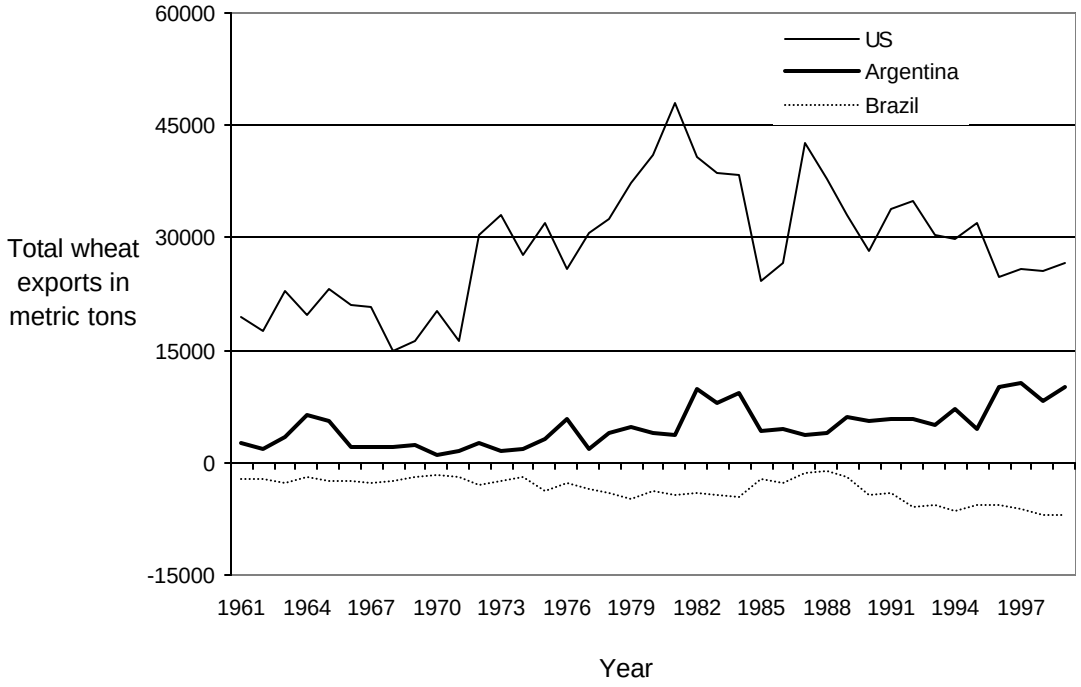


**Figure 2**: Total wheat exports in metric tons from Argentina, Brazil, and the United States, 1964-1999.

**Historical/Political Context**

Prior to the Treaty of Asuncion which established MERCOSUR in 1991, both Brazil and Argentina had a long history of protectionist policies for their domestic wheat, including government subsidies for the home-grown product and high tariffs on imported wheat.

Immigrants from the Portuguese Azores cultivated wheat in Brazil as early as 1749, but domestic Brazilian production of wheat has never reached a level adequate to supply the country's needs--primarily due to high aluminum toxicity in Brazilian soils. In the early 1950s, Brazilian governments determined that increased domestic wheat production should be a priority. Legislation was tailored to support that objective. As a result, credit was granted to wheat growers at negative real interest rates and their purchase of fertilizers and agricultural machinery was subsidized. By the mid-1950s, government regulations required mills to purchase at least 25 percent of their wheat from the domestic market, even though international wheat prices were considerably cheaper.

Recognizing the high cost of wheat subsidies, the Brazilian government promised for nearly 20 years to phase them out, but it had not done so by 1984. Money spent on wheat subsidies was not available to support other social welfare programs. Geraldo Calegar estimates a total value of 6.7 billion dollars for the social costs of Brazil's wheat subsidy from 1966-1982. In August 1986, Brazil and Argentina signed the Second Protocol on Wheat in which Brazil agreed to buy from Argentina an average of 1,760,000 tons of wheat each year from 1987 to 1995, for a total purchase of at least 14,075,000 tons. Since the Argentine agreement assured nearly a decade of relative stability in the nation's wheat supply, the conditions were set for Brazil to phase out the subsidy to its own domestic wheat producers and mills, which ended in 1987.

Jorge Hazera (1986) identified Argentina as "the lowest cost supplier of wheat in world markets" despite a costly national grain marketing infrastructure and burdensome agricultural policies. He predicted that Argentina would not be able to continue its effectiveness in wheat exports without substantial reforms to its agricultural policies. These reforms were evident when, by 1999, observers noted that "the Argentine agricultural sector receives little direct government financial support. With the exception of tobacco, there are currently no major government policies, programs or subsidies to encourage production" (USDA Economic Research Service). Now, the Argentine government "is working vigorously in international organizations to attain further reductions in trade restrictions affecting agricultural products. Argentina clearly believes that the future of its agricultural sector is tied to growth from lower trade barriers around the world" (USDA Economic Research Service).

Soon after the establishment of the EU in 1957, some visionary leaders pressed for greater economic cooperation among Latin American nations. The first steps toward regional integration took shape in the treaty that created the Latin American Free Trade Association (ALALC) established 1960. By 1980, the Latin American Integration Association (ALADI) replaced ALALC, creating an economic preference zone—not strictly speaking a free-trade zone, though the development of a common market was already the long-term objective. As early as May, 1980, Brazil and Argentina recognized the advantages of working together to build an environment that would attract investors, and in 1982 signed the Treaty to Avoid Double

Taxation, which was designed to avoid a double tax burden on investments in either country by investors who live in the other country (MERCOSUR). In 1988, Brazil and Argentina signed a Treaty for Integration, Cooperation, and Development that set the stage for barrier-free trade between them by 1994.

Political changes also helped prepare the way for regional cooperation. In 1985 Brazil changed from a military government to a government with free elections. Argentina's dramatic political shifts reached a level of stability in 1989, when free elections brought Carlos Saul Menem to power. In short, when they became members of MERCOSUR, both Argentina and Brazil were substantially more stable politically than at the beginning of the previous decade. Finally, on March 26, 1991, through the Treaty of Asuncion, Paraguay and Uruguay joined Argentina and Brazil to become the four member nations of the Southern Cone Common Market (MERCOSUR). In addition to the objectives of free transit of goods and services among member nations and the fixing of a common external tariff, one goal of MERCOSUR was the coordination of "macroeconomic and sectorial policies of member states relating to foreign trade, agriculture, [and] industry," among others (MERCOSUL, 2000, online).

**Results**

We hypothesized that, if MERCOSUR were successful in reducing trade barriers, Argentina and Brazil wheat prices would be found to be cointegrated from April 1991 to February 1999. Wheat prices were found not to be cointegrated over the 1982 to1991 pre-MERCOSUR period. However, the results confirm that wheat prices for Argentina and Brazil were cointegrated during the 1991 to 1999 period. Moreover, we found the comovement of prices to increase as a result of MERCOSUR. The post-MERCOSUR increase in the price transmission elasticity suggests greater market integration. The results clearly indicate that MERCOSUR contributed to increased integration of the wheat markets of Argentina and Brazil.

Wheat prices shown in Figure 3 are not closely related, implying the existence of considerable barriers to trade. For example, the U.S. is a large world producer of wheat. Argentina is only the fifth largest producer of wheat, so it doesn't play a dominant role in the international wheat market. Brazil is not self-sufficient in wheat. A large proportion of Brazilian wheat is imported from Argentina. As a result, it is reasonable to assume that Brazil's prices should be closely related to Argentina and the U.S.

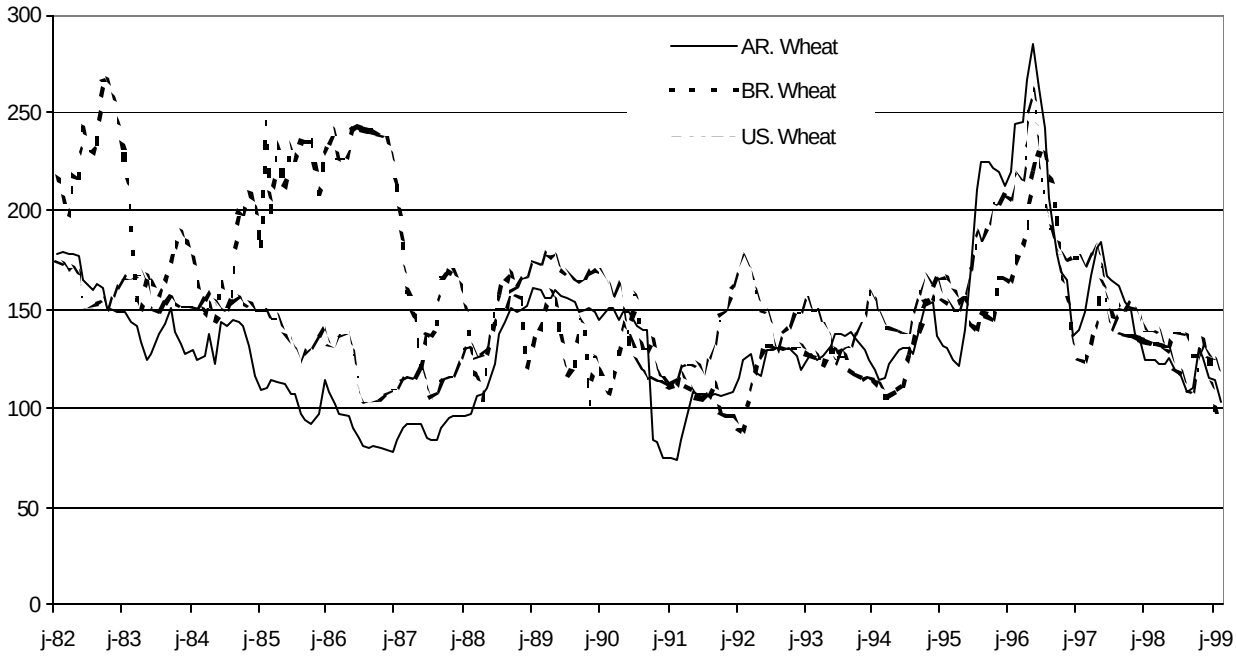


**Figure 3**: Wheat prices in $US/Metric ton, in Argentina (AR), Brazil (BR), United States (US) 1982-1999.

The Engle and Granger procedure was applied to the data for the three countries Argentina, Brazil and U.S. Appendix A presents the results. Unit Root Tests showed stationarity at the 10% level for Argentina and the U.S. for the entire sample period. All other time series showed nonstationarity. Results of testing for stationarity on first differences are reported in Appendix B, and Appendix C presents results of the residual-based cointegration analysis for wheat.

The estimates of $b_1$, the measure of price transmission elasticity are reported in Table 1. Since US prices are taken to represent, but may in fact vary slightly from, world market prices, the point elasticity estimates lie outside the 0-1 range. Therefore, it is important to regard $b_1$ as a point estimate with standard error 0.2. For wheat, Argentina and the United States are major exporters. Therefore, to be competitive in the world market, their prices need to be cointegrated to a high degree, and transmission elasticity estimates confirm this. Values for $b_1$ for Brazilian wheat generally show a markedly lower degree of cointegration using this measure—not surprising since Brazil is a net importer of wheat.

It was hypothesized that Argentina and Brazil wheat prices would be found to be cointegrated from 1991:04-1999:02, since barriers to trade were to fall during this period. The results confirm that, for 1991 to 1999, wheat prices for Argentina and Brazil were cointegrated, for both $t_1$ and $t_2$, whether either Argentina or Brazil is the independent variable. The level of cointegration varies from one percent to five percent. For 1982-1991, these prices were found not to be cointegrated.

| Variable | Sample period | Wheat |
|---|---|---|
| ARGENTINA-BRAZIL | 1982:02-1999:02 | 0,08 |
| | 1982:02-1991:03 | -0,06 |
| | 1991:06-1999:02 | 1,17 |
| ARGENTINA-US | 1982:02-1999:02 | 1,26 |
| | 1982:02-1991:03 | 1,21 |
| | 1991:06-1999:02 | 1,25 |
| BRAZIL-ARGENTINA | 1982:02-1999:02 | 0,11 |
| | 1982:02-1991:03 | -0,14 |
| | 1991:06-1999:02 | 0,54 |
| BRAZIL-US | 1982:02-1999:02 | 0,11 |
| | 1982:02-1991:03 | -0,25 |
| | 1991:06-1999:02 | 0,65 |
| US-ARGENTINA | 1982:02-1999:02 | 0,63 |
| | 1982:02-1991:03 | 0,65 |
| | 1991:06-1999:02 | 0,63 |
| US-BRAZIL | 1982:02-1999:02 | 0,04 |
| | 1982:02-1991:03 | -0,06 |
| | 1991:06-1999:02 | 0,70 |

**Table 1**: Results of the Price Transmission Elasticities ( $b_1$ ) for Wheat, pre and post

MERCOSUR, with all Countries as Dependent and Independent Variables.

Although the Engle and Granger method is limited, there are data in this study that support the hypothesis of increased cointegration between Brazil and Argentina. These data are found in the value of $\beta_1$, the price transmission elasticity. The value of $\beta_1$ ranges from 0 to 1, plus or minus .2 as a factor for error. Looking at the price transmission elasticities, we can infer closer relationships between the countries of the Southern Cone. Data in Appendix D, show that in 17 out of 30 cases the price transmission elasticity increased from before 1991 to after 1991, and therefore that a closer relationship developed among the markets studied. More specifically, where the Engle and Granger method shows wheat markets are cointegrated, there is almost a 1 to 1 relationship among the world price and prices in Brazil and Argentina. That is, a 1 percent change in prices in Argentina will change prices in Brazil or the US by 1 percentage point.

**Conclusions and Implications**

If MERCOSUR were successful in reducing trade barriers, we expected that Argentina and Brazil wheat prices would be found to be cointegrated from April 1991 to February 1999. On the one hand, wheat prices were found not to be cointegrated over the 1982 to1991 pre-MERCOSUR period. On the other hand, the results confirm that wheat prices for Argentina and Brazil were cointegrated during the post-MERCOSUR period (1991-1999). We found the comovement of prices to increase as a result of MERCOSUR. The post-MERCOSUR increase in the price transmission elasticity suggests greater market integration. The results show that MERCOSUR contributed to increased integration of the wheat markets of Argentina and Brazil.

Since MERCOSUR was created, wheat trade has increased from 1.7 million tons in 1989/90 to over 6.4 million metric tons in 1996/97 among the MERCOSUR countries. The increased integration of markets affects agribusinesses of Argentina, Brazil, and the United States in many ways. Agribusinesses within MERCOSUR have found new trading opportunities that did not exist before the agreement. U.S. firms have also been affected because they may have gained new markets and lost other markets such as wheat because of the regional trade agreement.

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## Appendix A

### Results of the Unit Root Tests (in their levels) on Wheat prices.

| Time Series | Sample Period | $t_1$ | n | $t_2$ | n |
|---|---|---|---|---|---|
| | 82:02-99:02 | -2,85 *** | 1 | -3,01 | 1 |
| ARWHEAT | 82:02-91:03 | -1,91 | 1 | -1,88 | 1 |
| | 91:04-99:02 | -2,22 | 1 | -2,10 | 1 |
| | 82:02-99:02 | -2,32 | 7 | -2,50 | 7 |
| BRWHEAT | 82:02-91:03 | -2,09 | 2 | -2,94 | 2 |
| | 91:04-99:02 | -2,12 | 6 | -1,42 | 6 |
| | 82:02-99:02 | -2,81 *** | 1 | -2,83 | 1 |
| USWHEAT | 82:02-91:03 | -1,95 | 4 | -1,95 | 1 |
| | 91:04-99:02 | -2,13 | 1 | -1,99 | 1 |

Under Time-Series (TS), The last three letters refers to the commodity; In this case WHEAT.

t1 tests the Ho of the regression + a constant to be I (1) against $H_1$ to be I (0).

t2 tests the Ho of the regression + a constant and trend to be I (1) against $H_1$ to be I (0).

n denotes the lag length which is chosen according to the largest lag with a statistically significant coefficient at the 5% level.

*** denotes significance at the 10% critical value. Meaning that the series could be I (0).

Critical values can be found in the E-views output. The 1% critical value is from MacKinnon (1991).

## Appendix B

## Results of the Unit Root Tests (First Differences) on Wheat prices.

| Time Series | Sample Period | $t_1$ | n | $t_2$ | n |
|---|---|---|---|---|---|
| ARWHEAT | 82:02-99:02 | -7,83 | 1 | -7,81 | 1 |
| | 82:02-91:03 | -6,16 | 1 | -6,13 | 1 |
| | 91:04-99:02 | -5,40 | 1 | -5,49 | 1 |
| BRWHEAT | 82:02-99:02 | -6,11 | 7 | -6,12 | 7 |
| | 82:02-91:03 | -5,55 | 2 | -5,52 | 2 |
| | 91:04-99:02 | -4,02 | 6 | -4,32 | 6 |
| USWHEAT | 82:02-99:02 | -8,94 | 1 | -8,92 | 1 |
| | 82:02-91:03 | -3,88 | 4 | -6,38 | 1 |
| | 91:04-99:02 | -5,99 | 1 | -6,10 | 1 |

Under Time-Series (TS), The last three letters refers to the commodity; In this case WHEAT.
t1 tests the Ho of the regression + a constant to be I (2) against $H_1$ to be I (1).
t2 tests the Ho of the regression + a constant and trend to be I (2) against $H_1$ to be I (1).
n denotes the lag length which is chosen according to the largest lag with a statistically significant coefficient at the 5% level.
All series are insignificant at the 10, 5, and 1% level of significance.
Critical values can be found in MacKinnon (1991).

## Appendix C

## Results for the Residual-Based Cointegration Analysis for Wheat prices.

| Variable | Sample period | $t_1$(ADF) | | n | $t_2$(ADF) | | n |
|---|---|---|---|---|---|---|---|
| | 1982:02-1999:02 | -2,80 | *** | 1 | -3,04 | | 1 |
| ARWHEAT-BRWHEAT | 1982:02-1991:03 | -2,25 | | 2 | -2,23 | | 2 |
| | 1991:06-1999:02 | -3,91 | * | 1 | -3,89 | ** | 1 |
| | 1982:02-1999:02 | -3,05 | ** | 8 | -4,15 | * | 8 |
| ARWHEAT-USWHEAT | 1982:02-1991:03 | -4,14 | * | 1 | -3,81 | ** | 8 |
| | 1991:06-1999:02 | -2,56 | | 6 | -6,35 | * | 4 |
| | 1982:02-1999:02 | -2,27 | | 7 | -2,50 | | 7 |
| BRWHEAT-ARWHEAT | 1982:02-1991:03 | -2,16 | | 2 | -3,11 | | 2 |
| | 1991:06-1999:02 | -4,04 | * | 1 | -5,28 | * | 9 |
| | 1982:02-1999:02 | -2,32 | | 7 | -2,50 | | 7 |
| BRWHEAT-USWHEAT | 1982:02-1991:03 | -2,07 | | 2 | -3,05 | | 2 |
| | 1991:06-1999:02 | -3,39 | ** | 6 | -3,92 | ** | 6 |
| | 1982:02-1999:02 | -6,40 | * | 4 | -6,65 | * | 4 |
| USWHEAT-ARWHEAT | 1982:02-1991:03 | -4,06 | * | 1 | -4,08 | * | 1 |
| | 1991:06-1999:02 | -1,27 | | 9 | -5,79 | * | 4 |
| | 1982:02-1999:02 | -2,84 | *** | 1 | -2,88 | | 1 |
| USWHEAT-BRWHEAT | 1982:02-1991:03 | -1,88 | | 4 | -2,02 | | 4 |
| | 1991:06-1999:02 | -3,63 | * | 1 | 3,78 | ** | 1 |

$t_1$ tests the Ho of a regression + a constant to be I (1) against $H_1$ to be I (0).

$t_2$ tests the Ho of a regression + a constant and trend to be I (1) against $H_1$ to be I (0).

* denotes rejection of Ho at the 1% critical value. Meaning that the residuals are I (0), so the series are cointegrated.

** denotes rejection of Ho at the 5% critical value. Meaning that the residuals are I (0), so the series are cointegrated.

*** denotes rejection of Ho at the 10% critical value. Meaning that the residuals are I (0), so the series are cointegrated.

n is equal to the number of Lags that each regression was run with.

Critical values can be found in Davidson and Mackinnon (1993, Table 20.2).