

**Empirically Analyzing the Impact of U.S. Export Credit Programs  
on U.S. Agricultural Trade**

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## ACKNOWLEDGMENTS

The authors extend appreciation to Mr. Jeremy W. Mattson and Mr. Richard D. Taylor for their constructive comments and suggestions. Special thanks go to Ms. Beth Ambrosio, who helped to prepare the manuscript.

The research was conducted under the U.S. agricultural policy and trade research program funded by the U.S. Department of Homeland Security/U.S. Customs and Border Protection Service (Grant No. TC-03-003G, ND1301).

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## ABSTRACT

The use of officially supported export credit programs for agricultural products has been a widely debated issue at the World Trade Organization (WTO) negotiations in recent years. The European Union (EU) has agreed to reduce their direct export subsidies if the United States reduces its export credits. Specifically, the main issue of contention is whether to limit the length of repayment of the U.S. export credit programs to a period not exceeding 180 days. However, the impacts of such a reduction on the importing countries and the United States are not clear. In light of this debate, we analyze the impact of a reduction in the repayment period to 180 days on importing countries and examine the subsequent effects on U.S. exports supported through export credit programs. Our results indicate that importing countries do indeed benefit from export credit programs and are likely to increase their imports when they are in place. However, the benefits are reduced when the export credit repayment period is limited to 180 days. This implies that the more restrictive terms and conditions that the WTO is trying to impose over these programs, based on their implicitly subsidized components, may have an adverse impact on importing countries.

**Keywords:** export credit programs, agricultural trade, World Trade Organization

## HIGHLIGHTS

The use of officially supported export credits for financing and stimulating export sales of agricultural products has been a source of on-going negotiation at the World Trade Organization (WTO). In April 2004, without final agreements regarding the use of officially supported export credits for agricultural trade, the Dispute Settlement Body of the WTO ruled against the U.S. export credit program in favor of Brazil in the cotton case. The Appellate Body also upheld the finding by the WTO panel and concluded that the U.S. export credit guarantee programs provided under the U.S. Department of Agriculture's Commodity Credit Corporation (CCC), including the General Service Management (GSM)-102 and GSM-103 programs, and the Supplier Credit Guarantee Program (SCGP), constitute an export subsidy. It is unclear whether, in the future, the Dispute Settlement Body of the WTO will make similar rulings to discipline the use of officially supported export credits for other agricultural commodities as it did to the U.S. cotton exports. Negotiations within the WTO have called for the maximum repayment period of an export credit for most agricultural products to not exceed a period of 180 days. GSM-102 and GSM-103 currently have maximum repayment periods of 3 years and 7 years, respectively.

Supporters of export credit programs stress that an export credit could generate an "additionality" to importing countries through relaxation of budget constraints, which would consequently increase the volume of trade. At the same time, the world price may not necessarily be depressed. On the other hand, opponents argue that export credit programs constitute a direct subsidy element which may depress world price.

This paper develops an import demand model to determine the impact of the reduction in the maximum repayment period for agricultural products on importing countries and to examine the subsequent effects on U.S. exports supported through export credit programs, particularly the GSM-102 program. In light of the ongoing debate, the problem we address is economically significant since, if additionality exists, then the more restrictive credit terms and conditions that the WTO is trying to use to discipline officially supported export credits, based on their implicitly subsidized components, will have a greater adverse impact on the importing countries which face budget constraints in financing their necessary imports.

Our results indicate that there are significant benefits in terms of cost savings to the importing countries as a result of the U.S. GSM-102 program. Our results imply that GSM-102 export credits increase the quantity exported due to the shifting of the import demand curve to the right. This implies that as the importing countries' budget constraints are relaxed through cost savings, they are likely to increase their imports. This contradicts other studies which claim that export credit causes a movement along the import demand curve and a shift in the excess supply curve to the right in order to increase quantity exported while lowering the world price.

There is a reduction in cost savings to the importing countries when the length of repayment of export credit is 180 days. This implies that more restrictive terms and conditions governing officially supported export credits, which the WTO is trying to discipline based on their implicitly subsidized components, will have some adverse impact on the importing countries.

# Empirically Analyzing the Impact of U.S. Export Credit Programs on U.S. Agricultural Trade

Paul Rienstra-Munnicha, Kranti Mulik, and Won W. Koo\*

## INTRODUCTION

Ever since Article 10.2 of the Agreement on Agriculture was created at the Uruguay Round,<sup>1</sup> the use of officially supported export credits for financing and stimulating export sales of agricultural products has been a topic of on-going negotiation at the World Trade Organization (WTO). The implementation of the article has not yet been finalized, even after the conclusion of the sixth WTO Ministerial Conference in Hong Kong, China, in December 2005. Prior to the sixth Conference, on August 1, 2004, the WTO General Council reached a decision on the framework (referred to as the July Package) to continue with the ‘multilateral’ trade negotiations under the Doha Development Agenda (DDA). With respect to the export competition pillar, the main focus of the July Package is the future elimination of all forms of export subsidies and better disciplines on export credits, state trading enterprises, and food aid (WTO, 2004).

In April 2004, despite no final agreement regarding agricultural trade, the Dispute Settlement Body of the WTO ruled in a trade dispute in favor of Brazil. The Appellate Body upheld the finding by the WTO Panel that “the United States export credit guarantee programs at issue constitute per se export subsidies within the meaning of item (j) of the Illustrative List of Export Subsidies in Annex I of the SMC Agreement” (WTO, 2005).<sup>2</sup>

However, the introduction to Article 3 of the GATT 1994 legal text states that “[e]xcept as provided in the Agreement on Agriculture, within the measuring of the Article 1, the Sub-Articles 3.1 (a) and 3.1 (b) list the subsidies that are subjected to be prohibited” (WTO, 1994). This seems to indicate that agricultural products are exempt from item (j) of the Illustrative List of Export Subsidies in Annex I of the Subsidies and Countervailing Measures (SCM) Agreement. This agreement was reached by integrating the principle guidelines created to discipline the use of officially supported export credits on manufactured goods, which were originally agreed on by the member countries of the Organization for Economic Co-operation and Development (OECD, 1998).

It is unclear whether in the future the Dispute Settlement Body of the WTO will apply the SMC Agreement to discipline the use of officially supported export credits for other agricultural commodities, as it did for U.S. cotton exports. The EU has argued that they are willing to reduce their direct export subsidies if the United States and other countries would be willing to reduce

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<sup>1</sup> The Article states that, “The WTO member countries undertake the development of internationally agreed upon disciplines to govern the provision of export credits, export credit guarantees, or insurance programs and, after agreement on such disciplines, to provide export credits, export credit guarantees, or insurance programs only in conformity therewith” (WTO, 1995).

<sup>2</sup> Item (j) states that export credit facilities provided by governments or other institutions on their behalf should be at premium rates adequate to cover long-term operating costs and losses such as sunk costs (WTO, 1994).

their export credits, state trading enterprises, and food aid. Additionally, the July Package gives further instruction to the WTO Committee on Agriculture to discipline the use of officially supported export credits based on the “Harbinson Text,”<sup>3</sup> which emphasizes establishing consensual agreements on credit terms and conditions. This includes maximum repayment terms, minimum cash payments, interest rate payments, minimum interest rates, repayment of principal, premiums in respect of coverage of risks under export insurance, reinsurance and export credit guarantees, foreign exchange risk, and period of validity of export financing. For instance, to reflect the duration of agricultural products, the repayment of an export credit for most agricultural products has been negotiated for a maximum period not exceeding 180 days (WTO, 2003). If the agreement is finalized, the General Service Management (GSM) programs in the United States, such as GSM 102 and GSM 103, will need to reduce their maximum required repayment period to six months. The current repayment period is three years for the GSM 102 and seven years for the GSM 103.

As pointed out by Abraham (1990), export credits such as subsidized buyer credit and official development assistance provide favorable financing conditions to importers, which induce the importers to demand more of the exported good. However, it is not clear whether the increase in quantity demanded by importers is the result of a price discount offered through export credit programs, or the result of a relaxation in importing countries’ budget constraints through export credit programs. Supporters of export credit programs stress that an export credit could generate an “additionality” to importing countries through relaxation of budget constraints, which would consequently increase the volume of trade. At the same time, the world price may not necessarily be depressed, as in the case of a direct export subsidy (Baron, 1983; Smith and Ballenger, 1989; Diersen, 1995; OECD, 2001; and Young et al., 2001). On the other hand, opponents of export credit programs argue that these programs constitute a direct subsidy element which may depress world price and increase quantity demanded by importing countries (Fleisig and Hill, 1984; Fitzgerald and Monson, 1988; and Rodriguez, 1987). Thus, the reduction of repayment length to 180 days could have a significant impact on importing countries as well as on the U.S. GSM 102 program.

The objective of this paper is to determine the impact of the reduction in the maximum repayment period for agricultural products on importing countries and to examine the subsequent effects on U.S. exports supported through export credit programs, particularly the GSM 102 program. In light of the ongoing debate, the problem we address is economically significant since, if additionality exists, then the more restrictive credit terms and conditions that the WTO is trying to use to discipline officially supported export credits, based on their implicitly subsidized components, will have a greater adverse impact on the importing countries which face budget constraints in financing their necessary imports.

The paper is organized as follows. Section 1 provides a brief background on the ongoing negotiations in the WTO concerning disciplining the use of officially supported export credit programs. Section 2 provides the derivation of the theoretical model. Section 3 provides a brief description of the data and the empirical model. Section 4 presents the empirical results, while Section 5 provides concluding remarks.

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<sup>3</sup> The Harbinson Text is the revised draft of modalities that cover the three main pillars of the agricultural trade negotiations of the WTO: Market access, export competition, and domestic supports.

## BACKGROUND

The use of export credits in the trade of manufactured and agricultural goods has been apparent, especially during periods of economic and financial crises in importing countries. According to the International Monetary Fund (IMF), the estimated total use of export credit for developing countries and economies in transition by the Export Credit Agencies (ECAs) of developed countries reached U.S. \$550 billion by 1998 (Gianturco, 2001). Between 1995 and 1998, the total value of export credits for agricultural trade provided by the 15 OECD countries increased from \$5.5 to \$7.9 billion (OECD, 2001).

Prior to multilateral agreements among member countries of the OECD, which established benchmarks on credit terms and conditions offered through export credits, various ECAs could aggressively use export credits to underbid their competitors. This was done by offering lower interest rates, longer periods with more favorable conditions on loan credits, tied and/or untied aid,<sup>4</sup> and mixed credits<sup>5</sup> to importing countries. Consequently, the export credit races caused by underbidding practices became expensive to finance and resulted in the inefficient use of financial resources for those countries employing the strategy to increase their exports. In addition, the export credit races gave significant power to importing countries to bargain for more favorable import contracts with different exporting countries (Fleisig and Hill, 1984; Fitzgerald and Monson, 1988; and Rodriguez, 1987). Thus, to prevent future export credit races, the OECD member countries formed a negotiation forum, known as the Arrangement, to establish principle guidelines on the use of export credits for manufactured goods by setting benchmarks that included credit terms and conditions of export credits. The credit terms refer to interest rates, length of the repayment terms, down payments, and risk premium rates. The conditions of export credits refer to the financial interdependence of export credits with other programs such as large-scale projects,<sup>6</sup> tied and/or untied aid, and mixed credits.

By 1997, the key benchmarks for the credit terms and conditions of export credits from manufactured exports were consensually agreed upon by the OECD participants in the Arrangement. As previously mentioned, the principle guidelines of the Arrangement have been recognized and integrated into the multilateral trading system of the WTO, and are codified within Article 3 of the GATT-1994 Agreement on the SCM Agreement which prohibit many forms of export subsidization. Two specific disciplinary rulings with regard to the provisions of risk premium are item (j) and interest rates item (k) of the Illustrative List of Export Subsidies in Annex I.

Currently, there is no report indicating whether the OECD participants in the Arrangement have reached a consensus agreement on the guidelines for the use of export credits for agricultural products. On July 9, 2002, a progress report by the Chairman of the Arrangement was released

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<sup>4</sup> Tied aid is aid which is in effect tied to the procurement of goods and/or services from the donor country and a limited number of other countries. Untied aid is aid whose proceeds are fully and freely available for procurement of goods and/or services from all OECD countries and substantially from non-OECD countries (OECD, 1998).

<sup>5</sup> A mixed credit is a mixture of the direct loan credit and grant element (or the subsidy on the loan) as foreign aid to produce concessional financing packages having a grant element between official export credits and official development assistance (Fleisig and Hill, 1984).

<sup>6</sup> A large-scale project refers to a project involving mining operations, steel mills, industrial plants, and public utility plants, which requires a large-scale of financing with a long-term maturity.

which stated that the OECD participants had not reached a consensus agreement on the content of the report (OECD, 2002). The key benchmarks for credit terms and conditions that are on the negotiation table of the Arrangement are similar to the Harbinson Text discussed earlier. Thus, when and how Article 10.2 of the WTO will be finally implemented hinges on an on-going process within the WTO's Committee on Agriculture.

## THEORETICAL FRAMEWORK

From a theoretical perspective, one question that needs to be addressed is how the credit terms and conditions in export credit programs can be effectively assessed as subsidized elements, in terms of their effects on import demand and/or export supply of agricultural goods. Several studies developed different approaches to calculate the subsidy values of export credit programs. The present value approach was developed and applied in several studies, such as Baron (1983), Fleisig and Hill (1984), Barichello and Vercaemmen (1994), Raynauld (1992), Skully (1992), Hyberg et al. (1995), and Wilson and Yang (1996). These studies calculated subsidy values that are associated with officially supported export credits, such as those with subsidized interest rates and repayment periods longer than those that private markets would be willing to offer. They considered credit terms and conditions that provide more favorable financing and are given through officially supported export credit programs as cost savings to an importer. As mentioned earlier, the interpretation is unclear as to how import demand increases as a result of these programs. Demand may increase due to a price discount or because of the relaxation of importing countries' budget constraints. Figure 1 illustrates the two possible interpretations of cost savings benefits that an importing country may receive from an officially supported export credit program.

The view supporting a price discount argues that an officially supported export credit program constitutes a direct subsidy element which may depress world price and increase quantity demanded by importing countries, just as a direct export subsidy does (Fleisig and Hill, 1984; Fitzgerald and Monson, 1988; and Rodriguez, 1987). In Figure 1(a), the export volume increases from  $Q$  to  $Q'$  due to the drop in price from  $P$  to  $P'$ , which is caused by the shift in the excess supply from  $ES$  to  $ES'$ . If the export credit causes the excess supply to shift in this fashion, then the export credit is an alternative form of an export subsidy.<sup>7</sup>

By contrast, Baron (1983), Smith and Ballenger (1989), Diersen (1995), and the OECD (2001) pointed out that export credit programs could generate additionality through the relaxation of importing countries' budget constraints, which would increase the volume of trade. At the same time, the world price may not necessarily be depressed. Their view is presented in Figure 1(b). The key difference from Figure 1(a) is that the relaxation of the budget constraint causes the excess demand to shift outward from  $ED$  to  $ED'$ . As a result, the export volume increases from  $Q$  to  $Q'$  and the price increases from  $P$  to  $P'$ .

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<sup>7</sup>The OECD (2001) applied the present empirical approach to calculate the subsidy values of export credit programs for agricultural goods as a series of price discounts, in terms of their impact on the import demand side. They concluded that the subsidized elements of officially supported export credits used by the 15 member countries of the OECD are small.

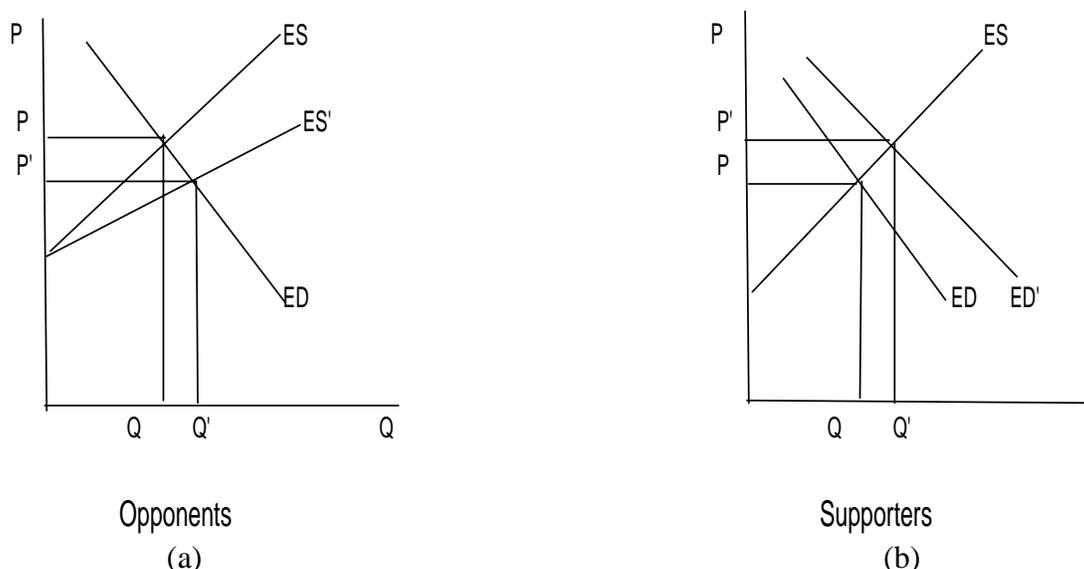


Figure 1. Illustration of the Two Conflicting Views of Export Credit Programs

Diersen (1995) applied the present value approach to calculate the subsidy values of export credit programs, and treated it empirically as an additionality. His theoretical approach is based on the two-period intertemporal consumption decision and relies on the assumption that officially supported export credits increase the loan supply, which in turn relaxes budget constraints of importing countries. Paarlberg (1999) and Rude and Gervais (2005) also apply the two-period intertemporal consumption decision framework. This approach seems to capture the interest term of officially supported export credits. An officially supported export credit can be offered in multiple combinations of various credit terms and conditions. Moreover, the general result of the two-period intertemporal consumption decision framework implies that the consumption in the first period will increase if there is the possibility to borrow from a future period, provided the consumer has a large discount rate.

Following Rienstra-Munnicha (2004), our study considers that if the benefits from an export credit program appear in terms of a cost savings to the importing country, the decision on how much to import is likely to be influenced by its budget constraints. Moreover, we presume that the cost savings may be viewed as additional income to the importing country. The benefits of an export credit program received by the importing country can be represented as a fixed discount rate on its import payment. According to Rienstra-Munnicha (2004), the fixed discount rate can be used to measure or capture the potential benefits arising from many of the policy parameters of an exporting country constituted within export credit programs, such as (i) down payments, (ii) annual subsidized or guaranteed interest with the export credits, (iii) annual discount rates (or market rates without export credits), and (iv) payments per year, length of repayment periods, grace periods, and a fee rate which is expressed as a percentage of value.

In terms of calculation, one can view the discount rate as the difference between two present value streams. The first present value stream ( $PV_1$ ) is calculated under a scenario in which there is no subsidy element being offered to the importing country, such as when the importer borrows in its home country. The second present value stream ( $PV_2$ ) is calculated under a scenario in

which there is a subsidy element being offered to the importing country through an export credit program. Thus, the fixed discount rate ( $d$ ) can be calculated as

$$d = \frac{PV_1 - PV_2}{PV_1} * 100 \quad (1)$$

By applying constrained utility maximization with the Cobb-Douglas utility function, Rienstra-Munnicha (2004) derived the import demand of the importing country with the absence and presence of benefits from an export credit program:

$$Q = \frac{2\alpha BI(1-d)^2 - P^2}{2B(1-d)P} \quad (2)$$

where  $Q$  is quantity demanded by the importing country,  $I$  is income,  $\alpha$  and  $B$  are parameters of the production function, and  $P$  is price. Note that the range of the subsidy element is assumed to take on the value of  $0 \leq d < 1$ . If  $d = 0$ , this implies that there is no discount on the import payments. If  $d = 1$ , then there is a full discount, such as for aid relief, which implies that consumption of good 1 is not an optimization choice for the consumer in the importing country. Thus, this study assumes that  $d < 1$ .

Rienstra-Munnicha (2004) showed that for any  $0 < d < 1$ , the cost saving in terms of relaxing budget constraints causes excess demand to shift outward. This situation arises because for any quantity demanded, the price differential between the two scenarios receiving and not receiving secondary benefits can be derived as

$$SF = P' = P/(1-d) \quad (3)$$

Equation 3 represents the degree to which the excess demand shifts to the right if the importing country were to receive benefits from an export credit program (see Figure 1(b)).

## EMPIRICAL MODEL

Prior empirical works on the impact of export credit programs on U.S. exports include Koo and Karemera (1991) and Diersen (1995).<sup>8</sup> Previous empirical studies used import demand models to evaluate the impact of U.S. non-price export promotion programs on U.S. exports [Le et al. (1998); Halliburton and Henneberry (1995)].<sup>9</sup> Our empirical import demand model is based on a

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<sup>8</sup> Koo and Karemera (1991) used a similar approach to analyze the impact of export credit programs. Using a gravity model, they incorporate a dummy variable based on the periods in which export credit was offered under GSM-102 to capture the shift in the import demand. On the other hand, Diersen (1995) tested for additionality under the GSM-102 program using an intertemporal consumption model and “loans” as choice variables. Our study differs from Diersen (1995) in that we include the net present value of cost saving as the budget constraint. Empirically, we calculate the present value of cost savings based on semi-annual payment and use actual repayment period, while Diersen (1995) assumed a single payment and a fixed repayment period of 3 years.

<sup>9</sup> The estimated coefficient of the amount spent on non-price export promotion programs in these studies are interpreted as additionality, that is, additional imports due to the increased spending on these programs.

general consumer demand model with the inclusion of demand shifters, such as exchange rates and a variable representing the present value of cost savings (PVC) resulting from export credit, to test the concept of additionality.<sup>10</sup> Thus, a country's import demand for wheat is specified as follows:

$$M_i^j = f\left(\frac{P_j}{P_c}, GDP_i, DOM_i, EX_i^j, PVC_i\right) \quad (4)$$

Common demand theory applied to an import demand model states that imports of an importing country  $i$  from an exporter  $j$  ( $M_i^j$ ) are a function of the price of the exporting country ( $P_j$ ) and the price of its competitors ( $P_c$ ).<sup>11</sup> Exchange rates ( $EX_i^j$ ) represent the ratios of domestic currencies with respect to the U.S. dollar. Thus, as long as a product is substitutable, importing countries can choose alternate sources to satisfy their import demand (Anderson and Garcia, 1989). Similarly, income ( $GDP_i$ ) positively influences the quantity demanded. Export credit relaxes the budget constraints on importers, in the sense that they gain additional income due to cost savings and are likely to import more. Therefore, income is included in our model. Domestic production ( $DOM_i$ ) has a negative impact on demand in the importing countries provided wheat is a normal good. Finally, we incorporate a discount factor resulting from the present value of cost savings accrued from export credits ( $PVC_i$ ). In our empirical specification, we calculate the net present value of cost savings resulting from the GSM 102 export credit program as a demand shifter. We use this variable to test our theory of additionality as a result of export credits. Based on Equation (4), we specify our empirical model as follows:

$$\ln M_{i,t} = \beta_0 + \beta_1 \ln \frac{P_{US\ i,t}}{P_{ROW\ i,t}} + \beta_2 \ln EX_{i,t} + \beta_3 \ln GDP_{i,t} + \beta_4 \ln DOM_{i,t} + \beta_5 \ln PVC_{i,t} + e_{i,t} \quad (5)$$

where  $M$  is the value of imports of U.S. wheat in real U.S. dollars.<sup>12</sup> The subscript  $i$  denotes the seven importing countries ( $i$ = Egypt, Korea, Mexico, Algeria, Turkey, Jordan, and Indonesia), and the subscript  $t$  represents the time period ( $t$ =1994-2004), while  $\ln$  stands for the natural log

of the variables.  $\frac{P_{US\ i,t}}{P_{ROW\ i,t}}$  is the price ratio of U.S. wheat imports relative to the rest of the world

(ROW) wheat import price.  $EX$  is the relative exchange rate between the United States and importing countries.  $GDP$  is the real gross domestic product of the importing country, which represents the income expressed in U.S. dollars.  $DOM$  is the domestic production of the importing countries in metric tons, while  $PVC$  is the present value of cost savings to the

<sup>10</sup> Due to data limitation, we calculate 'd' factor as the present value of cost savings (PVC). The method is presented in the appendix.

<sup>11</sup> See Lord (1991) for details on application of common demand theory to trade models. Ideally, we should use the Canadian price of wheat and prices of other competitors' wheat, which compete directly in the international wheat market as a substitute for U.S. wheat, but due to lack of data, we use the ROW price. Moreover, as the U.S. price and the ROW price move closely together, we use a price ratio to avoid multicollinearity problems.

<sup>12</sup> Note that we deviate from the traditional estimation of import demand due to data limitation. For instance, export credits for wheat granted to an importing country is reported in dollar values, without specifying quantity and price.

importing country from export credits (see Appendix for details on calculation of the PVC). Finally,  $e_{i,t}$  is the error term, which is assumed to independent and normally distributed.

A similar model is additionally used to estimate the impact of credit programs when the length of repayment is reduced to 180 days; the only difference between the two models is the PVC variable, which was calculated using 180 days as the length of repayment period and a short-term interest rate (less than a year).

An increase in the U.S. price relative to the ROW would reduce the demand for U.S. wheat. Alternatively, an increase in the price of the ROW wheat relative to the United States will increase the demand for U.S. wheat. The variable price ratio is therefore expected to be negative. An increase in the value of the U.S. dollar relative to the importing countries' currencies would increase the price paid for U.S. wheat and thereby reduce the value of wheat imports from the United States. Similarly, a depreciation in the value of the U.S. dollar relative to currencies of the importing countries would make U.S. wheat cheaper and increase the demand for it. Thus, the variable exchange rate (EX) is expected to be negative. As income in the importing countries increases, they are likely to import more wheat from the United States; hence, the variable GDP is expected to be positive. As domestic production of wheat increases in the importing countries, they are likely to import less wheat from the United States and so the variable DOM is expected to be negative. Finally, the variable PVC for additionality is expected to be positive. As importing countries benefit from the increased present value of cost savings from the GSM 102 export credits granted by the United States, they are likely to import more U.S. wheat.

## DATA SOURCES

Export credit programs are an important component of U.S. agricultural exports. Table 1 presents the funding for U.S export credit programs for the 1998-2005 period. The total approved export credit value under the GSM-102 program was \$2,169 million in 2005. Of the total approved funding for all agricultural commodities, the amount approved for wheat was approximately \$424.8 million, or 15.10 percent of the total. Given the relatively large share of approved export credit for wheat, we limit our analysis to the impact of the GSM-102 program on U.S. wheat exports.

We consider seven importing countries which received GSM 102 export credits for wheat from the United States for the 1998-2005 period: Egypt, Korea, Mexico, Algeria, Turkey, Jordon, and Indonesia. Most of these countries are not granted export credit for wheat imports under the GSM 103 and SCGP programs, and so we limit our focus to the GSM 102 export credit program. Data on the quantity and value of wheat imported by these countries from the United States and the world were obtained from the United Nations' Comtrade database. Quantity and value of wheat imports by the importing countries from the ROW were calculated as the difference between total wheat imports from the world and from the United States. Import price of U.S. wheat was calculated by dividing the value of wheat imports from the United States by quantity. Import price of wheat imported from the world (world price) was calculated in a similar manner. Data on the GDP of the importing countries, consumer price index, and interest rates of the

importing countries, and the exchange rate between the United States and the importing countries were obtained from the International Financial Statistics (IFS) of the International Monetary Fund. Domestic production of wheat in the importing countries was obtained from the Food and Agricultural Organization (FAO) of the United Nations. Finally, data on the amount of export credit under the GSM-102 program and the specified repayment periods (which were later converted into cost savings-see Appendix 1 for details) given by the United States to the importing countries were collected from various fiscal year-end issues of the Foreign Agricultural Trade of the United States (FATUS). All data used in this study are annual data for the time period 1994-2004. All prices, import value of wheat, GDP, and cost savings were converted into real values by dividing them by the corresponding CPI of the importing countries.

Table 1. Funding for U.S. Export Credit Programs

FY	GSM-102		GSM-103		SCGP	
	Allocations	Approval	Allocations	Approval	Allocations	Approval
-----million \$-----						
1998	5793.00	3962.52	310.00	56.00	293.00	18.18
1999	5121.00	2955.10	377.00	44.20	361.00	46.02
2000	4550.00	2927.79	188.00	32.60	466.00	116.37
2001	4653.00	2958.63	193.00	42.30	720.00	225.98
2002	4581.00	2935.99	165.00	0.00	1127.00	452.14
2003	4528.00	2545.19	125.00	7.60	1372.00	669.97
2004	4484.00	2926.17	99.00	0.00	1542.00	790.38
2005	4546.50	2169.81	0.00	0.00	1370.00	454.71

## ESTIMATION METHOD

Due to the limited time span of data available for the GSM-102 export credits, we pool time-series and cross-section data to increase the sample size of our data set. Several econometric problems were addressed before estimation. First, we evaluated the stationarity properties of the variables using an Im, Pesaran, and Shin panel unit root test. Results of the test are reported in Table 2.<sup>13</sup>

The price ratio and domestic production variables were found to be stationary both in the presence of a constant and of a constant and trend, at the 1 percent level. On the other hand, exchange rate, income, and cost savings were found to be stationary in the presence of a constant but non-stationary under the presence of a constant and a time trend, at the 5 percent level (with the exception of exchange rate, which was significant at the 1 percent level). Based on our

<sup>13</sup> For additional literature on testing stationary properties of variables in panel data see Breitung and Meyer, 1994; Im, Pesaran, and Shin, 2003; Pedroni, 2004; and Baltagi, 2005. Results of the panel unit root test for model II are similar and not reported here to conserve space. These are available from the authors on request.

results, we can conclude that there is lack of sufficient evidence of non-stationarity in the variables tested.

Table 2. Results of Panel Unit Root Tests <sup>1</sup>

Variable	Constant	Constant and Trend
Value of wheat imports from the United States	-2.789(0.003)*** <sup>2</sup>	-3.015(0.001)***
Ratio of import prices between the United States and the Rest of the World (ROW)	-10.047(0.000)***	-8.414(0.000)***
Exchange rate between importers and the United States	-2.302 (0.011)***	1929(0.973)
GDP of the importing countries	-1.995(0.023)**	1.525(0.936)
Domestic production of wheat in the importing countries	-30.132(0.000)***	-23.222(0.000)***
Cost savings of the importing countries	-1.636(0.051)**	-0.088(0.465)

<sup>1</sup> Reported values include the test statistic and the probability of the null hypothesis that the variable has unit root (in parentheses).

<sup>2</sup>\*\*\*, \*\* and \* indicate significance at the 1, 5, and 10 percent level, respectively.

The demand for U.S. wheat by importing countries may influence the import price of wheat. Thus, the value of U.S. imports and price are jointly determined, causing the price ratio to be correlated with the error term. The presence of an endogenous variable indicates that instrumental variable (IV) techniques must be used for estimation. In order to justify the use of IV techniques, the variable must satisfy the endogeneity test. To test the exogeneity of the price ratio variable, we use the Davidson and MacKinnon (1993) test.<sup>14</sup> The null hypothesis of the test states that an OLS fixed effect model would result in consistent estimates. Rejection of the null hypothesis indicates the need to use instrumental variable techniques. We fail to reject the null hypothesis for both models, indicating that endogeneity is not a potential problem and the results from OLS fixed effects estimation should be consistent.

Finally, due to the nature of our panel data set, we test for evidence of serial correlation using the Wooldridge test.<sup>15</sup> The null hypothesis of this test states that there is no serial correlation, while

<sup>14</sup> This test is similar to the Durbin-Wu-Hausman test, but Davidson and MacKinnon (1993) show that it is superior to the Hausman test in that we are always able to compute a test statistic. Computation of a test statistic under the Hausman test is possible only when the difference between estimated covariance matrices results in a positive definite matrix. Thus, it is difficult to compute a reasonable test statistic using standard matrix inversion techniques. See Davidson and MacKinnon (1993) for details.

<sup>15</sup> Under this test, the null hypothesis states that the residuals from the regression performed on first differenced variables should have an autocorrelation value of about -0.5. That is, when we regress lagged residuals on current residuals, the coefficient on the lagged residuals should be -0.5. Drukker (2003) shows that this test performs well when the sample size is sufficient. See Wooldridge (2002) and Drukker (2003) for more details.

the significance of the F-statistics indicates that there is presence of serial correlation. In both the models, we fail to reject the null hypothesis, indicating that serial correlation is not a problem.

One of the major problems with panel data is heterogeneity across panels. If the unobserved heterogeneity effects of the individual panels are correlated with the variables, a fixed-effect model is estimated. However, if the unobserved effects are uncorrelated with the variables, there will be efficiency gains if we model the individual panel effects as randomly distributed components of the error using a random-effect estimator (Baltagi, 1995).<sup>16</sup> We perform a Hausman specification test to compare the estimates from the consistent fixed effects model to the estimates from the efficient random effects estimator. The null hypothesis is that the individual effects are uncorrelated with the model. If the null hypothesis is rejected, a random effects model produces biased estimators and a fixed effects model is preferred. For both the models, the Hausman test rejected the null hypothesis in favor of the fixed effects model. However, when we used the Breusch and Pagan Lagrangian multiplier test for random effects, we rejected the null hypothesis in favor of the random effects model.<sup>17</sup> Due to the inconsistencies of the Hausman test, we decided to use the random effects model.<sup>18</sup>

## EMPIRICAL RESULTS

The results of the estimated demand equations are reported in Table 3. All of the variables have the expected signs in both models. Domestic production is negative and significant in both models at the 1 percent level, indicating that as domestic production of wheat in the importing countries increases, they are likely to import less wheat from the United States. Exchange rate is negative and significant at the 1 percent level in both models, indicating that an appreciation of the U.S. dollar relative to the importing countries' currency decreases the amount of wheat imported from the United States. GDP is also significant at the 5 percent level in both models, indicating that an increase in importing countries' income increases the demand for U.S. wheat. More importantly, cost savings from export credit is positive and significant at the 5 percent level in both models, supporting our theory of additionality. In model I, where the length of repayment is more than 180 days, an increase in the present value of cost savings results in about a 3 percent increase in the value of U.S. imports. The effects are smaller compared to Diersen (1995), who finds that benefits from export credit programs result in an 8 percent increase in the

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<sup>16</sup> The standard random-effects estimator is the weighted average of the fixed-effect and between-effect estimator. See Baltagi (1995) for details.

<sup>17</sup> We also test for random effects using the Breusch and Pagan Lagrange multiplier (LM) test. The null hypothesis is that the variances across groups are zero. If the null hypothesis is not rejected, pooled OLS regression is appropriate. We reject the null hypothesis in favor of the random effects model in both models.

<sup>18</sup> One of the stronger assumptions of the Hausman test is that one of the estimators is efficient, that is, it has minimum asymptotic variance. If this is violated, results are inconsistent. In our analysis, when we specified the random effects model as efficient (tested fixed vs. random), we rejected the null hypothesis in favor of the fixed effects model in both models I and II. However, when we specified the fixed effects model as efficient (tested random versus fixed), we obtained a negative Chi-Square value in both the models. A negative Chi-Square value may be interpreted as allowing us to accept the random effects model in favor of the fixed effects model. However, the results of the Hausman test are sensitive to specification of the regression model and need to be interpreted with caution. Please see Greene (2002) for more details.

quantity imported from the United States.<sup>19</sup> In model II, where the length of repayment is reduced to 180 days as proposed under the new WTO guidelines, cost savings result in a 2.5 percent increase in the value of U.S. imports. Although the reduction in import value is less than 1 percent following reduction in terms of repayment, this is significant when we consider the total value of U.S. wheat imports by the importing countries.

Table 3. Results of the Random Effects (RE) Models

Variable	Description	Model I: More than 180 days	Model II: 180 days
LPRAT	Ratio of import prices between the United States and the Rest of the world (ROW)	-0.28 (0.30)	-0.27 (0.30)
LEXRATE	Exchange rate between importers and the United States	-0.86 (0.19)***	-0.85 (0.19)***
LGDP	GDP of the importing countries	0.47 (0.20)**	0.45 (0.20)**
LDOMPRD	Domestic production of wheat in the importing countries	-0.31 (0.86)***	-0.31 (0.08)***
LPVC	Cost savings of the importing countries	0.03 (0.031)**	0.025 (0.01)**
Davidson-MacKinnon test of exogeneity		F(1,57)=2.42 p=0.12	F(1,57)=2.24 p=0.13
Wooldridge test for serial correlation		F(1,6)=2.17 p=0.191	F(1,6)=2.07 p=0.199
Durbin-Wu-Hausman test: fixed effects model vs. random effects model		$\chi^2(5) = 39.34$ p=0.00***	$\chi^2(5) = 29.99$ p=0.00***
Breusch and Pagan Lagrangian Multiplier test for random effects		$\chi^2(1) = 23.06$ p=0.00***	$\chi^2(1) = 22.86$ p=0.00***

\*\*\* and \*\* indicate significance at the 1 and 5 percent levels, respectively. Numbers in parentheses are the standard errors.

<sup>19</sup> The difference in results is due to the fact that our technique of calculating cost savings is different from Diersen (1995), as explained earlier.

## SUMMARY AND CONCLUDING REMARKS

This paper examined the ongoing debate on the use of officially supported export credit programs and their impact on U.S. exports. The guidelines agreed upon by the OECD for the use of officially supported export credit programs were integrated into the WTO Rulings to discipline the use of officially supported export credit programs on manufactured goods. However, the integration guidelines do not apply in the case of export credits for agricultural goods, which have been the subject of negotiations after the conclusion of the Uruguay Round and the WTO's Agreement on Agriculture under Article 10.2.

We use an import demand model to examine whether an export credit such as the U.S. GSM-102 program constitutes additionality in terms of cost savings to importing countries. Our results indicate that there are significant benefits in terms of cost savings to the importing countries as a result of the U.S. GSM-102 program. Our results imply that GSM-102 export credits increase the quantity exported, due to the shifting of the import demand curve to the right. This implies that as the importing countries' budget constraints are relaxed through cost savings, they are likely to increase their imports. This contradicts other studies which claim that export credit causes a movement along the import demand curve and a shift in the excess supply curve to the right in order to increase quantity exported while lowering the world price (Fleisig and Hill, 1984; Fitzgerald and Monson, 1988; and Rodriguez, 1987).

However, there is a reduction in cost savings to the importing countries when the length of repayment of export credit is 180 days. This implies that more restrictive terms and conditions governing officially supported export credits, which the WTO is trying to discipline based on their implicitly subsidized components, will have some adverse impact on the importing countries.

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## Appendix: Calculation of Present Value of Cost Savings

We demonstrate the method used to calculate the present value of cost savings (PVCS) using an example in which export credit is given by the United States to Egypt. In this example, PVCS is calculated when the term of repayment is greater than 180 days. A similar approach is used to calculate PVCS when the period of repayment is 180 days, except we use a short-term interest rate.

Step 1: Finding semi-annual payment ( $PMT_{US}$ ) if borrowing in the United States:

$$EC_{US} = PMT_{US} \left[ \frac{1 - \left( \frac{1}{(1 + r_{US})^n} \right)}{r_{US}} \right]$$

$$PMT_{US} = EC_{US} \left[ \frac{r_{US}}{1 - \left( \frac{1}{(1 + r_{US})^n} \right)} \right]$$

where  $EC_{US}$  is the export credit given by the United States to Egypt,  $i_{US}$  is the interest rate in the United States,  $n$  is the term of repayment (semi-annual payment for two periods or 12 months)

and  $r_{US} = \frac{i_{US}}{n * 100}$ ,  $n = 2$

Step 2: Finding the future value ( $FV_{US}$ ) of the credit under U.S. borrowing:

$$FV_{US} = PMT_{US} \left[ \frac{(1 + r_{US})^n - 1}{r_{US}} \right]$$

Step 3: Finding the semi-annual payment ( $PMT_{EC}$ ) if borrowing in Egypt:

$$EC_{EG} = EC_{US} * \text{Exchangerate}$$

$$PMT_{EG} = EC_{EG} \left[ \frac{1 - \left( \frac{1}{(1 + r_{EG})^n} \right)}{r_{EG}} \right]$$

where  $EC_{EG}$  is the export credit received by Egypt from the US,  $i_{EG}$  is the interest rate in Egypt, and  $r_{EG} = \frac{i_{EG}}{n * 100}$ ,  $n = 2$

Step 4: Finding the future value ( $FV_{EG}$ ) of the credit under Egypt borrowing:

$$FV_{EG} = PMT_{EG} \left[ \frac{(1 + r_{EG})^n - 1}{r_{EG}} \right]$$

Step 5: Converting  $FV_{EG}$  into U.S. dollars:

$$FV_{EG}^* = \frac{FV_{EG}}{\text{Exchange rate}}$$

Step 6: Calculating the future value of cost savings ( $FVCS$ ) from steps 1 and 4:

$$FCSV = FV_{US} - FV_{EG}^*$$

Step 7: Calculating the present value of cost savings ( $PVCS$ ):

$$PVCS = FVCS \left( \frac{1}{(1 + r_{EG})^n} \right)$$

Note: When we calculate the present value of cost savings for 180 days, the term of repayment is one ( $n=1$ ). All other formulas remain the same.