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Agricultural Economics Report No. 377 **July 1997**

Additionality of Credit Guarantees for U.S. Wheat Exports

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ACKNOWLEDGMENTS

The authors extend appreciation to the following individuals who provided constructive comments: Cole Gustafson, Demcey Johnson, Martin Benirschka. Finally, thanks to Charlene Lucken, who provided editorial comments, and Carol Jensen, who helped prepare the manuscript.

Research presented in this report was conducted under a USDA/CSRS NRI research grant, "Export Credit in International Wheat Trade," #93-37400-9464.

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ABSTRACT

The value of credit guarantee programs has recently been called into question. Credit guarantees are important marketing tools in the world wheat market, both to develop new markets and to compete in existing markets. This study examines the additionality of export credit guarantees. Empirical demand models were developed and estimated using pooled data among importing countries. Models were estimated for each of the principal exporting countries providing export credit guarantees: the United States, Canada and France. Additionality of credit guarantees were also contrasted to the Export Enhancement Program.

Positive additionality was found for CCC guarantees, indicating that the GSM programs have resulted in additional exports that would not have occurred without the programs. Additionality was not constant across exporters. Additionality was estimated at 12.6 MMT for credit guarantees and 19 MMT for EEP. The U.S. results, when considering costs of the programs, indicate that the CCC subsidy (from guarantees), on a per dollar of subsidy basis, provides about four times more additionality than EEP. These results cast doubt on the price subsidy equivalence of guarantees.

The subsidy implied in Canadian credit has a significant and negative effect on U.S. wheat exports. The magnitude of the coefficient is larger than the magnitude of the CCC guarantee subsidy. In the Canadian demand model, the effect of the CCC subsidy is insignificant. The results suggest that Canada's guarantee program does more to displace U.S. sales than it does to help Canadian sales. Further, as a whole CCC guarantees offset Canadian guarantees and outperform COFACE guarantees.

Key Words: Additionality, Export Credit Guarantees, Price Subsidy, GSM-102, EEP, Canada, United States, France.

HIGHLIGHTS

Credit guarantees are important marketing tools in the world wheat market, both to develop new markets and to compete in existing markets. Governments of exporting countries typically assume the default risk of importing countries when offering export credit guarantees. This has the effect of reducing the importer's cost of financing and may result in increased trade. Defaults represent an expected cost of the guarantees to the creditor and have led to questions concerning the effectiveness of guarantee programs. Credit is also offered by competing countries which dissipates the effect of additionality. This study examines the additionality of export credit guarantees. Comparisons are made across competing countries' programs and across export programs (EEP vs GSM).

Import demand models were developed and estimated using a pooled data set across importing countries. Models were estimated for each of the principal exporting countries providing export credit guarantees: the United States, Canada and France. Important conclusions from these results are:

- Additionality to U.S. Credit: Positive additionality was found for CCC guarantees, indicating that the GSM programs have resulted in additional exports that would not have occurred without the programs. Additionality of CCC guarantees totaled approximately 12.6 MMT to the six importing countries over 13 years.

- Constancy Across Importers: Additionality is not constant across countries, suggesting varying benefits across importers.

- Comparing Additionality of Credit Guarantees to EEP: The equivalence of the CCC subsidy and EEP subsidy was tested. The U.S. results indicate that the CCC subsidy (from guarantees), on a per dollar of subsidy basis, provides about 4 times more additionality than EEP. These results cast doubt on the price subsidy equivalence of guarantees. This disparity may be due to the overlap of the programs. Regardless, the assumption that these subsidies are equivalent is questionable as credit guarantees provide more than a price equivalent interest savings.

- Intercountry Rivalry and Additionality of Competitor Country Guarantees: The CWB subsidy has a significant and negative effect on U.S. wheat exports. The magnitude of the coefficient is larger than the magnitude of the CCC guarantee subsidy. A test of their equivalence indicated they are not significantly different in absolute value. This is evidence that the effect of the CCC subsidy is offset by the CWB subsidy.

Additionality for CCC guarantees is evidence of the benefits of the program. Sales that are attributable to the subsidy value would not have occurred without guarantees. Additionality of CCC guarantees can offset program costs. CCC guarantees are cost-effective when compared with EEP. Likewise, CCC guarantees offset CWB guarantees and outperform COFACE guarantees.

Additionality of Credit Guarantees for U.S. Wheat Exports

Matthew A. Diersen, William W. Wilson, Bruce L. Dahl, and Vidyashankara Satyanarayana[*]

INTRODUCTION

Credit guarantees are important marketing tools in the world wheat market, both to develop new markets and to compete in existing markets. Governments of exporting countries typically assume the default risk of importing countries when offering export credit guarantees. This has the effect of reducing the importer's cost of financing and may increase trade. Defaults represent an expected cost of the guarantees to the creditor and have led to questions concerning the effectiveness of guarantee programs. Credit is also offered by competing countries which dissipates the effect of additionality and makes credit an essential component of exporter strategy in selected markets.

One justification of guarantee programs is that additional grain is sold when guarantees are provided. "Additionality refers to the percentage of a program's exports that occurred mainly because of the program," (Smith and Ballenger) and is measured as the change in imports associated with the value of guarantees to an importer. The effect of the guarantee is through an implicit subsidy in the credit market. Thus, estimating additionality requires that the subsidy value be quantified and included in the analysis.

The effectiveness of credit guarantee programs is an important issue confronting policymakers. Canada and France, both large exporting countries whose governments offer guarantees, compete in the same markets as the United States. The extent of additional sales due to these programs is of interest to policymakers. Senator Richard Lugar, in discussions on the farm bill, asked, "What evidence is there that the GSM-102 program [a United States credit guarantee program] has expanded total import demand?" The guarantors' benefits accrue as increased sales, market share, or a higher price received for the product. Programs used by the United States were under scrutiny in 1995, both domestically and abroad. The combined effects of credit guarantee programs and the Export Enhancement Program (EEP) on importer behavior are not well-understood but are clearly affected by similar programs in competitor countries.

Producers, exporters, and importers are also concerned with the effectiveness of guarantee programs, as they are the principal beneficiaries of increased sales. Guarantees either alleviate importers' credit constraints or lower the cost of financing wheat purchases. There are several important questions about credit guarantees besides measuring additionality. One is the effect of credit programs versus direct price subsidies on sales. Another is the effectiveness in terms of additionality of programs offered by the United States versus competitor countries.

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The objective of this study was to assess the additionality of export credit guarantees. The focus was on countries who have received guarantees for wheat from the United States and its competitors. Specific objectives are

1) Define additionality attributable to credit guarantees and develop a model to explain how guarantees translate into increased wheat imports;

2) Empirically estimate wheat import demand, while allowing for multiple creditors and programs, to measure additionality attributable to the various programs' subsidies;

3) Test the extent that EEP and credit guarantees yield the same additionality; and

4) Compare the relative effectiveness of U.S. and competitors' subsidies in terms of additionality.

ELEMENTS OF THE PROBLEM AND PREVIOUS STUDIES

Exporter Credit Guarantee Programs

The United States, France, Canada, Australia, and some smaller wheat exporting countries each have some form of an export credit program (Harris, Dahl et al. 1995a, World Perspectives, Inc.). A government guarantee relieves exporters' banks of the risk that an importer will default. Guarantees are widely used by many importing countries, due to a high cost of alternative financing. Importers do incur financing fees to cover administration costs of the programs, but guarantees still provide an implicit subsidy to the importing country. The most popular programs are government-sponsored guarantees of private loans, which are described in this section.[1]

U.S. Credit Guarantee Programs

Guarantee programs for the United States are administered by the Commodity Credit Corporation (CCC). GSM-102 and GSM-103 have been the most widely used programs (Harris, Dahl et al.). GSM-102 provides short-term coverage, six months to three years. GSM-103 provides longer term coverage, three to seven years.

The CCC establishes program coverage for individual importing countries on an annual basis. Importers and exporters arrange credit sales using their respective banks. Once the importer obtains a letter of credit, the importer's bank must guarantee payment. The parties file with the CCC who either approves or denies a guarantee of 98% of port value and a portion of

[1]A recent article in the *Economist* examines the political motivations and problems associated with export credit guarantees and other forms of export promotion.

the accrued interest.[2] The loan is made at cost above the London Interbank Offer Rate (LIBOR), a standard benchmark for international lending. Some importers, such as those in Ghana, Togo, and the Philippines who are unable to secure letters of credit, are denied CCC guarantees (Missiaen and Smith, Levin and Lin). Defaulting on payments led to a suspension of further guarantees for Brazil (McClain and Dusch).[3]

Other government-sponsored export programs are used to expand markets and compete with subsidies of other exporters. The United States uses the EEP, concessional aid such as Food for Peace Program, and credit guarantee programs (Table 1). A substantial portion of exports since fiscal year 1985/86 have involved one or more of these programs. The percentage of total sales under these programs is adjusted to reflect an estimated overlap of credit guarantee and EEP sales (U.S. Department of Agriculture 1995).

Table 1. United States' Wheat Exports by Selected Programs

Fiscal Year	Total Concessional Sales	Credit Guarantee Sales	Export Enhancement Sales	Total U.S. Wheat Sales	Program Sales as % of Total
	----------	----------	1000 MT	----------	----------
1980/81	2,541	3,261	0	42,246	14
1981/82	2,978	3,725	0	44,607	15
1982/83	3,463	8,597	0	36,701	33
1983/84	3,442	11,406	0	41,699	36
1984/85	4,466	8,221	0	28,524	44
1985/86	5,274	7,740	4,916	24,626	59
1986/87	4,334	8,125	12,214	28,204	67
1987/88	4,800	9,273	26,679	40,523	82
1988/89	3,964	8,897	17,906	37,774	68
1989/90	3,065	7,759	12,806	27,999	70
1990/91	3,067	8,339	15,150	26,792	79
1991/92	2,416	13,334	21,111	34,322	76
1992/93	5,828	8,538	21,832	36,039	84

Source: *Wheat Yearbook* (U.S. Department of Agriculture, 1995).

[2]Up to 1992, this was 4.5% interest. In 1993, this was lowered to 2.8%. In 1995, an adjustable rate was introduced. Interest covered is set annually at less than 55% of the most recent 12-month treasury bill auction (Dahl et al.).

[3]Dahl et al. and World Perspectives, Inc. provide further discussion of program details and developments.

Competitor Country Credit Guarantee Programs

The United States' rivals also guarantee credit in the same markets.[4] Canada offers a credit program administered by the CWB. The loan terms and interest rates are comparable to CCC guarantees: typically guarantees of up to three years at a cost above LIBOR. Coverage is 95 to 100% of principal and usually requires a 10% down payment by the importer. COFACE, the semi-private Company for International Trade Insurance, handles guarantees for France. It typically offers longer terms, up to seven years, at Paris Interbank Offer Rate (PIBOR) and premiums, depending on the term. Although guaranteeing loans is risky (the expected cost being defaults), governments can spread the risk over many loans, many years, and many importers. This may give an advantage to larger guarantors since they can compete with more favorable terms and absorb more default risk.

Motives for Offering Credit Guarantees

Alleged motives for offering credit guarantees include increasing sales by relaxing an importer's foreign exchange constraints (Smith and Ballenger), supporting specific sectors of an economy and correcting market failures (Raynauld), and competing with other guarantors (Baron). Additionality may be positive when market failures are corrected or when guarantees expand exporter-specific import demand. The importer's valuation of credit determines the response to a guarantee offering, the importer's valuation of any subsidy, and, ultimately, additionality. If either the demand for wheat or credit is inelastic, no additionality occurs, and credit sales simply displace cash sales. Additionality is also nil if the subsidy value of the guarantee is not transmitted to the importer (e.g., because it is captured by the importer's bank).

Some countries are credit constrained, but there are other reasons for demand for guarantees, as illustrated in a series of country reports by USDA's Economic Research Service. The availability of guarantees was viewed as an important demand determinant for Morocco and the former Soviet Union (Ackerman, Sheffield). South Korea and Tunisia were not credit constrained, but still wanted CCC guarantees. South Korean millers used it to extend credit to bakers (Raney and Morgan). Tunisia supposedly used CCC programs as a line of credit, as its main demand determinants are domestic production shortfalls (Lent and Dusch).

Cash flow problems, foreign exchange or income constraints, and financial constraints are some reasons importers demand guarantees (Grigsby and Jabara). Alleviating these constraints is achieved through the added dollar purchasing power from guaranteed loans, which can expand demand. Two impacts on lending activity occur with guarantees. "First, a U.S. government guarantee enables banks to provide financing in excess of country lending limits and to offer longer credit terms than they normally would provide for agricultural commodities. Second, banks usually charge a lower rate of interest because of the guarantee," (Grigsby and Jabara, p. 195).

[4]Dahl et al. provide a detailed description of competitor country programs, and Dahl, Wilson, and Gustafson analyzed the "value" of these options offered by these countries.

Additionality and Export Programs

Additionality as a Concept

Government credit guarantees can relax importers' credit constraints and/or make credit less expensive. Export credit frees foreign exchange in the short run, relaxes payment difficulties, and delays payment for consumption. If credit simply relieves exchange shortfalls or reduces short-run debt servicing difficulties, additionality might be limited. As Eaton describes, "For the special facilities [export credits and guarantees] to provide relief from balance-of-payments difficulties requires that some net reduction in the country's demand for foreign exchange be achieved, which works against the additionality criterion [of a net increase in sales]" (Eaton, p. 137).[5]

Baron defines additionality as sales that either would not have taken place without credit or sales where a competitor offered similar comparative financing. Baron critiqued earlier studies by the U.S. Treasury and ExIm Bank. In both cases, a subjective probability of additionality was assigned to sales by ExIm Bank. These probabilities were based on the riskiness of the credit recipient and level of competition. These methods are inadequate, and "a measure of the effect of an ExIm Bank credit on exports thus should be a function of the interest rate, the amount of the credit relative to the export value, the export value, the repayment schedule, and the competition faced by the product" (Baron, p. 214).

Additionality and Export Credit Guarantees

The U.S. GAO (1992) analyzed CCC guarantee programs and found that if the loans were liquidated, the loss would approach $6.5 billion. The study also points to the $4.51 billion in delinquent loans, mostly to Iraq and the Former Soviet Union (FSU). Iraq defaulted for political reasons, and states of the FSU received guarantees for political reasons. The CCC responded, stating that losses would be less if the program were evaluated only on the loans made for sound reasons (U.S. GAO 1992).

Importers receive an implicit subsidy from credit guarantee. The only direct transfer, or explicit subsidy, would occur if the importer defaults. Typically, the interest rate on the guaranteed loans is less than the interest rate for nonguaranteed loans. Thus, with guarantees, more credit is available to importing countries and at favorable terms. The total savings on interest payments constitute a subsidy to importers (Dahl et al.). The size of the subsidy depends upon the repayment terms of the loan, the banks involved, the size of the loan guaranteed, and the risk the importer exhibits. The subsidy value is distinguished from the value of the guarantee itself as described in Dahl et al., which estimated the actuarially sound premium that importers would have to pay for guarantees.

[5]Simply considering the repayment prospects ignores other facets of the effects of these programs. Additionality has been treated as a general topic by the ExIm Bank staff and others. ExIm Bank programs were first studied by Feinberg, who provides an overview of subsidy activity, creditworthiness, and risk. Protecting market shares is also a facet of additionality. This was the main point of Baron in an ExIm Bank study of additionality of export credit and guarantees.

Interest savings from credit guarantees, along with other subsidies, from EEP and PL-480, allow the United States to act as a price discriminating seller. Skully (1992) treated the interest subsidy as a price discount, or pure price subsidy. He computed a discriminatory price by discounting the difference between the interest rate on CCC guarantees and the market rate of interest for specific importers using $P_j = P\, e^{-(i-r)t}$, where P_j is the discriminatory price, P is the transaction price, i is the market rate of interest, r is the CCC guarantee rate of interest, and t is the term of the guarantee.

Hyberg et al. re-estimated the CCC guarantee subsidy using a method similar to that suggested by Seilor (1990).

Additionality and EEP

Ackerman and Smith define additionality as "the increase in total wheat exports attributable to the EEP" (Ackerman and Smith, p. 28). Anania et al. point out that "additionality required that EEP sales not displace commercial export," (p. 535). They use a partial equilibrium spatial model and find that EEP fails to meet this criterion. However, Bailey finds that the dollar value of EEP exports had an impact on U.S. wheat exports. Haley (1989) considers an equilibrium model with the subsidy included, then removed. In a given year, his results suggested increase in export volume of 10%-31%. Haley (1990) uses the same method to evaluate EEP for poultry, acknowledging a lack of data necessary for an econometric analysis.

Credit Guarantees and Import Demand: Previous Empirical Studies in Agriculture Trade

Credit programs have been modeled with limited attention to their value to importers. Quantities under GSM-102 were used by Fleming in a rice import demand study. Haley (1989) used the CCC guarantee subsidy in a flow model and conducted simulations. The subsidy rate was the proportion of claims to the volume of loans guaranteed over the four years before 1986-1987. Koo and Karemera included a dummy variable for credit sales and EEP when modeling wheat trade flows. The coefficient for credit sales was positive and significant, indicating that credit sales are a demand determinant. Using the dummy variable implies a shift in demand attributable to credit sales. EEP sales affect demand as well, but with a smaller shift. "The magnitude of the coefficient [EEP] is much smaller than those of the other programs" (p. 449).

Yang and Wilson used a multinomial logit model to derive the marginal effects of changes in loan volume under CCC guarantees.[6] They find the elasticity of own credit was significant, but declined with the introduction of EEP in the late 1980s.

ESTIMATES OF CREDIT GUARANTEE SUBSIDY

Savings to importers from credit guarantees constitute an implicit subsidy, which is referred to the guarantee subsidy. Two factors affect the guarantee subsidy: the implicit interest subsidy and the loan volume guaranteed. The guarantee subsidy, in turn, affects the demand for

[6]In another study, Yang and Wilson found that allocations are also influenced by competitor credit sales.

wheat purchased under guarantees. An estimate of the guarantee subsidy is derived in this section.

Implicit Subsidy Calculation

This analysis is complicated by two important facts. First, credit constraints (maximum exposure, as percent of loan portfolio) imposed by private creditors are unobservable. Second, the private market for loans is thin and there is limited information about competitors' credit offerings. All that is observed is the loan volume under U.S. credit programs, L_{US}, and a proxy for the market interest rate, i_p.

The implicit interest subsidy and the loan volume guaranteed are important components of the guarantee subsidy. The volume of wheat sales under CCC guarantees, L_{US}, is published in *Notice to Exporters* (U.S. Department of Agriculture). CWB and COFACE sales quantity under guarantees are known, *albeit* ex-post. The implicit interest subsidy is the discounted interest savings provided by guarantees. The interest rate on CCC guaranteed loans is a small spread over LIBOR, reflecting the fees charged to process the loan and compensate for the 2% exposure of the exporter's bank. The discount rate represents the opportunity cost of funds for the guarantee recipient. This would be the market rate of interest that the importer would pay for private financing of similar terms. The market rate reflects a risk premium which varies by country and through time.

The implicit interest subsidy occurs over the length of the loan. A formula of the subsidy rate measures the savings importers receive when accepting a guaranteed loan relative to a nonguaranteed loan. The interest rate differential charged on the guaranteed loans is discounted to the current period. Using Raynauld's formula (1) (p. 42), the subsidy rate is

$$s = 100\left(1-\frac{r}{i}\right)\left[1-\frac{1-\frac{1}{(1+i)^T}}{iT}\right] \quad ,$$

where s is the subsidy rate, r is the interest rate on guaranteed loans, i is the discount rate, and T is the term of the guarantee.[7]

The subsidy rate for credit guarantees was derived for use in the empirical model described in the next section. That for the US, S_{US}, was computed using the interest rate charged on CCC guarantees at LIBOR + 25 basis points, where LIBOR was taken from International Monetary Fund (Table 2). In the last few years, S_{US} has varied across importers, between 25 and 100 basis points (Vanderbeek). A full term of three years is used along with annual payments and discounting.

[7]This is a discrete discounting method as most CCC guaranteed loans have annual or semiannual payment terms.

Table 2. CCC Guarantee Subsidy Parameters and Estimation

Guarantee Recipient	Year	Risk Premium	LIBOR + Premium	LIBOR + 25 Basis Points	CCC Subsidy Rate (S_{US})	CCC Subsidy
		---------- % ----------				-- $1000 --
Algeria	86	1.02	7.97	7.20	1.36	1,529
	87	1.67	9.28	7.86	2.45	4,311
	88	3.03	11.44	8.66	4.66	10,228
	89	2.21	11.52	9.56	3.28	4,307
	90	2.72	11.17	8.70	4.15	6,557
	91	3.25	9.54	6.54	5.17	8,072
	92	3.78	7.93	4.40	6.23	9,000
Brazil	82	0.71	14.40	13.94	0.74	2,483
	83	1.75	12.55	11.05	2.47	8,861
	84	2.68	14.50	12.07	3.90	17,283
	85	3.62	12.73	9.36	5.54	2,898
	86	5.44	12.39	7.20	8.58	2,984
	87	5.10	12.71	7.86	7.98	456
	88	4.80	13.21	8.66	7.43	1,255
	89	4.43	13.74	9.56	6.78	381
Egypt	82	3.06	16.75	13.94	4.37	7,208
	83	2.08	12.88	11.05	3.00	1,895
	84	0.33	12.15	12.07	0.13	44
	85	3.10	12.21	9.36	4.72	6,158
	86	6.10	13.05	7.20	9.58	6,451
	87	6.15	13.76	7.86	9.56	17,395
	88	5.46	13.87	8.66	8.43	24,801
	89	5.00	14.31	9.56	7.64	19,950
Mexico	86	5.96	12.91	7.20	9.37	125
	87	5.75	13.36	7.86	8.96	8,109
	88	4.67	13.08	8.66	7.23	5,525
	89	4.14	13.45	9.56	6.33	2,950
	90	3.13	11.58	8.70	4.81	1,591
	91	2.44	8.73	6.54	3.82	1,776
	92	1.80	5.95	4.40	2.82	2,782
Morocco	80	0.50	13.94	13.69	0.40	207
	81	0.93	17.06	16.38	1.05	804
	82	2.63	16.32	13.94	3.72	3,995
	83	2.43	13.23	11.05	3.56	6,151
	84	3.50	15.32	12.07	5.15	3,498
	85	4.65	13.76	9.36	7.13	7,093
	86	7.01	13.96	7.20	10.92	10,306

- Continued -

Table 2 (Continued)

Guarantee Recipient	Year	Risk Premium	LIBOR + Premium	LIBOR + 25 Basis Points	CCC Subsidy Rate (S_{US})	CCC Subsidy
		---------- % ----------				-- $1000 --
Morocco (contd.)	87	6.28	13.89	7.86	9.75	9,539
	88	5.33	13.74	8.66	8.23	9,273
	91	4.00	10.29	6.54	6.39	459
	92	3.69	7.84	4.40	6.08	9,656
Tunisia	82	1.34	15.03	13.94	1.74	370
	83	1.07	11.87	11.05	1.37	944
	84	0.46	12.28	12.07	0.35	112
	85	1.82	10.93	9.36	2.65	171
	86	4.35	11.30	7.20	6.88	2,619
	87	3.26	10.87	7.86	5.08	1,859
	90	2.38	10.83	8.70	3.60	745
	91	2.76	9.05	6.54	4.35	401
	92	3.00	7.15	4.40	4.91	807

The final variable is the importer-specific interest rate. There is little information on alternative costs of borrowing for guarantee recipients. Few comparable short-term loans are made to these countries and terms are usually not reported (Raynauld, Skully 1992, Seilor, Baron).[8] The closest proxies for private transactions are from Leipold et al. and can be derived from terms on bond issues, secondary market yields, and spreads on bank credit commitments. Terms on syndicated bank credits and yield spreads (at the launch) for bonds are given in Collyns et al. However, none of these observations are for short-term trade credits without guarantees. Some risk premiums reported in Raynauld are taken directly from country studies, but only six observations were applicable to this study. These premiums were combined and used to calculate the subsidy provided by GSM-102 to selected countries in Dahl et al.

For this paper, risk premiums (shown in the third column of Table 2) are from Skully (1994) from an estimation method described in Hyberg et al. Using these premiums has two advantages, they are computed using a method advocated by Seilor and they allow for a more comprehensive analysis than using those in Dahl et al. Importer specific discount rates are LIBOR plus this risk premium (shown in the fourth column of Table 2). The market interest (discount) rate is approximated, but falls within observed market rates for these and similar risky countries.

[8]Various sources were explored. Sources included Minnesota Trade Office, ExIm Bank, Federal Reserve Library in Minneapolis, Organization for Economic Cooperation and Development, Euromoney Publications, International Financing Review, and Institute for International Finance. Representatives for these organizations stated that spreads are largely unreported or nonexistent, and most suggested contacting New York banks. Economists at Global Trade Finance (Citibank) and Morgan Guarantee Trust Co. insist that this type of information does not exist.

To demonstrate the calculation, the subsidy rate for Algeria in 1986 was derived as

$$S_{US} = 100\left(1 - \frac{0.0720}{0.0797}\right)\left[1 - \frac{1 - \frac{1}{(1+0.0797)^3}}{(0.0797)(3)}\right] = 1.36.$$

The subsidy rate is expressed as a percent of loan value. Thus, the implicit guarantee subsidy is 1.36% times the loan value (or 1.36% times the CCC guarantee dollar amount would be the total implicit subsidy value from Algeria's perspective, $1,529,000). The greater the S_{US} and/or the allocation amounts, the greater the value of the implicit guarantee subsidy. The remaining elements of the CCC subsidy estimates and parameters are shown in Table 2.[9, 10]

Subsidy Interpretation

The total implicit subsidy value of guarantees is derived as $V_{US} = S_{US} \bullet L_{US}$ where L_{US} and S_{US} are guaranteed loan volume and the subsidy rate respectively. V_{US} is an estimate of the discounted savings for an importer using CCC guarantees relative to a nonguaranteed loan. This is shown in the last column of Table 2.

In addition to this implicit interest rate subsidy, larger allocations by creditors might also imply a default subsidy; however, the credit limit for guarantees is determined under the assumption that a sovereign power could enforce a higher proportion of loans paid back. Other than transaction fees, guaranteed loans have an interest rate comparable to the cost of capital in less risky countries. Thus, an implicit subsidy is associated with guaranteed loans. This subsidy rate, S_{US}, is the interest savings between the private rate of interest, i_P, and the guarantee interest rate, i_{US}, for each dollar guaranteed.

Additionality of Guarantees

The interest subsidy and the volume of guaranteed loans combine to measure the value of guarantees to the importer, $V_{US} = S_{US} * L_{US}(I_{US}, E_{US})$.[11] Additionality of guarantees is defined as the partial derivative of the demand for wheat (D_{Credit}) with respect to the guarantee subsidy times the guarantee subsidy:

[9]Most observations are of GSM-102 guarantees, with some which are for GSM-103 and GSM-105. Because there were few non GSM-102 observations, all CCC guarantees were treated as though they were GSM-102 guarantees, i.e., given a three-year term.

[10]Using these premiums allowed for a more comprehensive analysis relative to those in Dahl et al. The major difference between Skully (1992) and Dahl et al. (1995a) is that Skully (1992) used a proxy for importer interest rates, while Dahl et al. (1995a) used actual observations for each country and year. The difference between Skully (1992) and the derivation in this study is that Skully (1992) used a continuous discounting formulation to estimate the interest subsidy, while here we used a periodic formulation to allow for payments over the time frame of the GSM guarantee. Importer interest rates used here are from Skully (1992).

[11]Johnson shows that the interest subsidy and credit expansion effect provide additionality in a two-exporter, nonlinear programming model.

$$\text{Additionality} = [\,\partial D_{US} / \partial V_{US}]\, V_{US}\ ,$$

Changes in V_{US} are measured as the combined effects of changes in loan volumes guaranteed and the interest subsidy. Defining additionality this way gives a direct measure of additionality, as opposed to the measure reported in the U.S. GAO (1995). This measure also isolates the subsidy effect net of other programs and price effects as called for by the U.S. GAO (1992) and Senator Richard Lugar.

EMPIRICAL MODEL AND PROCEDURES

Import Demand Specification

Additionality is difficult to measure due to the multiplicity of factors that govern import behavior.[12] We estimated import demands using ad hoc specifications which may be viewed as a first order approximation of a demand curve. Wheat import demand is viewed as being comprised of two components: the demand for cash sales and the demand for credit sales.

A pooled cross-sectional time-series model of imports from each of the United States, Canada, and France for five countries is used to evaluate the additionality of credit guarantees. Import demand is specified as

$$D_{ij} = f\,(P_{US}\ , P_{CA}\ , P_{FR}\ , V_{EEP}\ , V_{US}, V_{CA}\ , V_{FR},\ \text{PROD}_i, \text{GNPPC}_i) + \epsilon_{ij}$$

Here subscripts i and j refer to importing and exporting countries, respectively; D refers to wheat volume imported by country i from exporting country j; P is the export price from the United States (FOB net of subsidy), Canada (FOB net of subsidy), and France (FOB inclusive of export restitution); V_{EEPi} refers to the total value of the EEP subsidy. The credit guarantee subsidies for the United States, Canada, and France were CCC subsidy, CWB subsidy, and COFACE subsidy, respectively. The credit subsidies were obtained as a product of subsidy interest rate to the loan volume. For Canada and France the subsidy level and loan volume are not transparent and these are substituted by observed proxies. PROD and GNPPC are domestic wheat production and GNP per capita in the importing countries, respectively. ϵ_{ij} is the random error term.

Prices for the United States and Canada are FOB values net of subsidies, and EEP is treated separately. P_{FR} includes the export restitution. V_j is the implicit interest subsidy rate of the credit guarantee from exporting country j times the accepted loan volume guaranteed.

V_{US} was defined above, and variables for Canada and France were derived similarly. $V_{CA} = (S_{CA})(L_{CA})$ where S_{CA} is the subsidy rate for CWB guarantees and L_{CA} is the guarantee loan volume. Canada's interest rate and other terms of guaranteed loans are unobserved, so S_{CA} is assumed identical to S_{US}. Only the wheat quantity accepted under credit is observed (CWB), so the loan value, L_{CA}, is quantity times wheat price. The value of export subsidies from France was derived similarly. $V_{FR} = (S_{FR})(L_{FR})$ where S_{FR} is the subsidy rate for COFACE guarantees

[12] In particular, a price subsidy results in a substitution effect and an income effect that can only be captured with empirical demand equations derived explicitly from an underlying preference structure. Even so, assumptions regarding functional forms place restrictions on the behavioral patterns of interest.

and L_{FR} is the guarantee loan volume. S_{FR} is computed using a seven-year term. Only the quantity accepted under credit is observed, so the loan value is computed as wheat quantity times wheat price.

Coincidence of Guarantee and EEP Sales

Identifying additionality is complicated by the fact that GSM guarantees are often offered with EEP subsidies. For example, in fiscal year 1993, there was considerable overlap between these programs (Table 3).

Table 3. Overlap of U.S. Export Programs in 1993 for Wheat

Country	Program(s)	Quantity	Value of Sales
		---------- MT ----------	
Algeria	GSM-102	1,045,592	$131,350,090
	GSM-103	100,310	$ 13,190,585
	GSM-102, EEP	1,021,434	$128,293,347
	GSM-103, EEP	49,577	$ 6,794,228
Mexico	GSM-102	667,172	$ 98,717,620
	GSM-102, EEP	102,114	$ 13,211,090
Morocco	GSM-103	1,369,413	$158,915,675
	GSM-103, EEP	1,310,613	$149,613,186
Tunisia	GSM-103	151,416	$ 16,434,254
	GSM-103, EEP	151,416	$ 16,434,254

Source: *Notice to Exporters* (U.S. Department of Agriculture).

Until 1993, sales were reported separately with overlapping totals, eliminating any distinction between EEP and CCC guaranteed sales.[13] EEP allocations and bonuses are determined by the CCC. The cash price and EEP subsidy jointly affect the actual wheat price paid under CCC guaranteed loans. To measure the value of the EEP subsidy, V_{EEP} is defined as the sales quantity under EEP times the EEP bonus in $/MT.

Scope of Analysis

CCC allocations and acceptances have been sporadic across countries and time. Six countries receiving CCC guarantees were chosen for analysis: Algeria, Brazil, Egypt, Mexico, Morocco, and Tunisia. Taken together, these countries provide enough observations for an econometric analysis. Each country also has at least one competing guarantor (i.e., Canada or COFACE). The last year for which observations for all variables are available is 1992. Time

[13]If the sales could be separated, the EEP subsidy could be subtracted from P_{US} and EEP effects controlled.

series data for 20 years are used, which should give robust estimation with the pooled sample. However, credit has only been used extensively for about 10 years and is sporadic across countries and time. Thus, the analysis spans a period before and after credit guarantee programs were instituted.

Data Sources

Aggregate trade data are used from several sources. Quantities and all prices, including transportation costs, are from the International Wheat Council's *World Grain Statistics* and *World Wheat Statistics*. Canadian quantities were taken from its "Annual Report" (CWB). U.S. quantities were available from the U.S. Department of Agriculture, but these sources are inconsistent with IWC data, so the IWC data were used exclusively when possible.[14]

Credit data, specifically wheat quantities under guarantees, were taken from the "Annual Report" (CWB) for Canada. French shipments under COFACE guarantees were taken from IWC's *Grain Market Report* and *Secretariat Report* (IWC, 1988). Both quantity and loan volume for the United States are available from *Notice to Recipients* and *Notice to Exporters* (U.S. Department of Agriculture). The CCC guarantee data are reported annually (on a fiscal year basis, October to September). EEP data are from *Agricultural Export Assistance Update Quarterly Report* (U.S. Department of Agriculture). Per capita income was obtained from *World Tables 1994* by the World Bank.

STATISTICAL RESULTS AND HYPOTHESIS TESTS

Results for each of the exporting countries are presented in this section. The relative effectiveness of own and competitor guarantee subsidies are evaluated, and various hypothesis tests are conducted. EEP and GSM subsidies and cross-country pairs of credit subsidies are tested to determine their relative effectiveness. In each case, statistical estimates of the import demand model are presented first along with results from alternative specifications.

United States

Results for the basic model for the United States are shown in Table 4. An F-test was used to test the significance of the dummy variables for importing countries. The F value of 22.54, which when compared to the table F-value with 5 and 120 degrees of freedom at the 5% level of significance, implies rejection of the null hypothesis that all dummy variables are zero. Thus, dummy variables should be included in the model. Some price variables are significant and each has the correct sign. GNPPC is not significant, but PROD is highly significant reflecting its importance as a determinant of import demand.

[14]IWC reports U.S. prices by class and shipments aggregated. USDA quantities are by class and were used, when available, to compute the weighted average prices for all classes.

Table 4. Parameter Estimates and Significance Tests of the U.S. Model

Independent Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
GNPPC*	-0.012	0.091	-0.131	0.896
PROD*	-0.233	0.057	-4.083	0.000
P_{US}	-2.449	2.996	-0.818	0.415
V_{EEP}*	0.015	0.002	6.262	0.000
P_{CA}*	5.918	2.860	2.069	0.041
P_{FR}	0.083	1.681	0.049	0.961
V_{US}*	0.057	0.014	4.119	0.000
V_{CA}*	-0.072	0.032	-2.245	0.027
V_{FR}	0.036	0.044	0.815	0.417
Intercept	214.679	302.940	0.709	0.480
Brazil*	1210.717	205.963	5.878	0.000
Egypt*	1345.195	228.875	5.877	0.000
Mexico	298.589	212.873	1.403	0.163
Morocco	209.424	210.909	0.993	0.323
Tunisia*	-424.408	177.309	-2.394	0.018

Dependent Variable: D_{US}.
*Significant at the 10% level of significance.

V_{EEP} is significant. The insignificance of P_{US} and P_{FR} may be attributable to the strong influence of EEP. V_{US} has a positive, significant effect, and V_{CA} is significant with a negative sign, indicating that CWB subsidies adversely affect demand for U.S. wheat. V_{FR} is insignificant, suggesting that the effect of French COFACE subsidies on U.S. exports cannot be assessed definitively.

Model Choice

Pooling, across countries and over time, assumes constant variance among various groups and over time which may not always be true. Different models were specified, such as, fixed effects and random effects. Also, different estimators were used to correct for violations of distributional assumptions. The model outcomes were tested for heteroscedasticity,[15] correlated

[15]To test for a difference across countries, the error term matrix is tested for equal diagonal elements, on the assumption that off-diagonal elements are zero. The Lagrange multiplier statistic, 22.53, is higher than the critical value, leading to rejection of the hypothesis that all diagonal elements are equal. Two-step Generalized Least Squares (GLS) was used to compute the parameter estimates, allowing for Heteroscedastic error for importing countries. Testing the two-step GLS model with a likelihood ratio statistic again rejects the null hypothesis of homoscedastic errors. The covariance ranges from 19,410 for Tunisia to 729,600 for Egypt. Allowing for these differences improves the estimates. The effect of the correction on the parameter estimate is shown in Table 5. The V_{US} estimate increases slightly to 0.0575, as does the standard error of the estimate. V_{EEP} declines, and that of V_{CA} increases.

errors between countries,[16] and autocorrelation.[17] A fixed effects model provided the most reasonable estimates (the results presented in Table 5 show that the differences in estimates among different models are only marginal) and hence is discussed further and utilized for computation of additionality from EEP and Credit Guarantee Programs.

Table 5. Results of U.S. Relaxed Error Structure Models

	Selected Parameter Estimates and Standard Errors		
Model	V_{EEP}	V_{US}	V_{CA}
OLS with dummy intercept terms	0.0153 (.0023)	0.0574 (.0131)	-0.0731 (.0300)
GroupWise Heteroscedastic	0.0129 (.0025)	0.0575 (.0139)	-0.1043 (.0335)
GroupWise Heteroscedastic and cross-sectionally correlated	0.0126 (.0024)	0.0594 (.0134)	-0.1125 (.0323)
and Within-group autocorrelated	0.0132 (.0025)	0.0532 (.0139)	-0.0815 (.0358)
and Within- and between-group autocorrelated	0.0123 (.0025)	0.0486 (.0141)	-0.0857 (.0350)

Additionality Estimates of U.S. Guarantee Programs

These results indicate additionality for credit guarantees in these importing countries. Specifically, the coefficient V_{US} indicates that a $1000 change in the subsidy value (a subsidy unit) resulted in an estimated 57 MT (0.057*1000 MT) change in imports (1000 MT is the unit of quantity imported), on average, during the sample period.

[16]Assuming that off-diagonal elements equal zero implies no correlation among countries. To test for zero off-diagonal elements, a Lagrange multiplier statistic is used. The statistic is greater than the limiting Chi-square value, thus rejecting the null hypothesis. Again, this assumption can be relaxed and the model rerun using two-step GLS with an estimated covariance matrix. The test statistic still rejects homoscedastic errors and no correlation assumptions. The error disturbance correlation matrix shows a positive correlation between Morocco and Tunisia of 0.57. Egypt and Brazil have a correlation of 0.31 and Egypt and Morocco of 0.49. The rest of the correlations are below 0.30. Allowing for these correlations improves the estimates. The V_{US} is now 0.0594, and V_{CA} is -0.1125. Both increased in magnitude compared with the OLS and groupwise heteroscedastic models.

[17]No specific test is available to diagnose groupwise autocorrelation. Individual correlations are tested for significance against the chi-square distribution. These tests show insignificant correlations for all of the importing countries excluding Egypt, with a correlation of 0.61. The groupwise coefficient is 0.26, with uncertain significance. Models with groupwise and specific autocorrelation were estimated. The V_{EEP} and V_{US} parameter estimates are lower than the OLS estimates for both autocorrelation models. V_{CA} estimates are higher than OLS estimates.

The effect of the subsidy was quantified over time. For the 50 observed guaranteed loans to the six importing countries, the average CCC subsidy was $5,127,000. Loan guarantees averaged $105 million with an average subsidy rate of just over 5% of loan volume. Thus, on average, the subsidy accounted for 292,000 MT of additionality. This is about 23% of the average (1,261,000 MT) of total wheat exports to the sample of importing countries, and 33% of the average (877,000 MT) of guaranteed quantity.

The subsidy reflects interest savings with CCC guarantees (i.e., the interest rate differential) and changes in the loan volume under guarantees and the terms of the guarantees--all of which are under some control of the CCC. The credit guarantee accounts for a significant portion of fluctuation in U.S. exports. Significance of this parameter is evidence of additionality for the importing countries. Further, it remains significant and similar in value regardless of the error term assumption.

The estimated parameter for the CCC subsidy can be used to measure additionality across importing countries. The product of the subsidy, at a given time for a given importer, and the V_{US} coefficient yields a measure of additionality. This was derived for each importing country on an annual basis (Table 6). For example, in 1986, Algeria had 87,000 MT of additional imports attributable to the CCC subsidy, which is 0.057 (the subsidy coefficient) times the $1,529,000 subsidy. The additionality is the highest for Egypt, with 4.8 MMT of additionality over eight years. The lowest total is for Tunisia, which was the smallest importer in this study. A total of 14.6 MMT of additionality is accounted for across these importing countries.

Table 6. Estimate of CCC Guarantee Program Additionality by Year and Importer

	Additionality by Importing Country (1000 MT)					
Year	Algeria	Brazil	Egypt	Mexico	Morocco	Tunisia
80					12	
81					46	
82		142	411		228	21
83		505	108		351	54
84		985	2		199	6
85		165	351		404	10
86	87	170	368	7	587	149
87	246	26	992	462	544	106
88	583	72	1,414	315	529	
89	246	22	1,137	168		
90	374			91		42
91	460			101	26	23
92	513			159	550	46
Total	2,509	2,087	4,783	1,303	3,476	457

Comparison of Additionality to Other Studies

In previous studies, additionality has either been assumed unknown or measured with ambiguous results. Baron critiqued use of a subjective probability that a competitor offered credit and never measured additionality. Koo and Karemera, using a dummy variable for credit sales, found guarantees shift the demand for wheat. Results from this report support this conclusion and provide refined estimates of additionality.

Additionality as measured in this study is about 30% on average for these guarantee recipients. This is not as high as the U.S. GAO level of 77%, which adjusted the USDA estimate for EEP payout. The U.S. GAO called for multiple of ranges of additionality (U.S. GAO 1995). However, the composition of guarantee recipients would undoubtedly affect the estimate. For example, the FSU was more likely to be credit constrained than Tunisia: Tunisia likely benefitted from a price subsidy and FSU from a greater access to credit.

Additionality Due to EEP

Additionality of export sales attributable to EEP was analyzed in a similar manner. The EEP subsidy parameter estimate is significant and similar in value regardless of the error structure. The V_{EEP} coefficient indicates that every $1000 change in total EEP subsidies (bonus times quantity) results in an estimated 15 MT (0.015 * 1000 MT) change in imports. The subsidy accounts for some fluctuation in U.S. exports. The average value of the V_{EEP} for these countries was $32.2 per MT on EEP sales of 905,000 MT. The average impact of EEP subsidies is the V_{EEP} coefficient estimate times the average total subsidy (0.015 * 32,188) or 492,000 MT, which is roughly 54% of EEP sales.

Comparison of EEP and GSM Additionality

EEP and GSM programs accounted for substantial additionality in the years offered. The annual U.S. additionality totals for both programs are shown in Table 7 and were computed as the total program's subsidy by year times the subsidy's estimated coefficient. The totals reflect the different coefficients for V_{US} and V_{EEP}, as the CCC subsidy coefficient is higher, but is outweighed by the higher average EEP subsidy. The decline in the additionality for CCC guarantees in later years is mainly due to reduced allocations in more recent years to these importers.

Hypothesis Tests

The estimation results presented above show that both credit guarantees and EEP have added substantially to the wheat exports from the United States. The results also suggest that Canada's guarantee program has adversely affected U.S. exports. To provide further evidence on the relative effectiveness of the programs, several hypotheses were formulated using the parameter estimates, and statistical tests were conducted. In particular, hypotheses tests on the equivalence of parameter estimates on U.S. and Canadian guarantee programs, parameter estimates on U.S. EEP and credit guarantee program, and additionality across importing countries are tested. Also, the significance of interaction between credit guarantee and EEP is tested.

Table 7. United States Additionality by Year and Program

Year	Program Additionality (in 1000 MT) EEP	GSM-102, 103, 105	Total
80		12	12
81		46	46
82		802	802
83		1,018	1,018
84		1,192	1,192
85	1,093	930	2,023
86	2,528	1,368	3,896
87	4,244	2,376	6,620
88	1,556	2,913	4,469
89	531	1,573	2,104
90	2,066	507	2,573
91	3,915	610	4,525
92	3,111	1,268	4,379
Total	19,044	14,615	33,659

U.S. and Canadian Equivalence

One function of the CCC guarantee programs is to compete with other guarantors' programs. Additionality of CCC and CWB credit subsidies was tested for equivalence. If the estimated subsidy coefficients have the same magnitude and opposite signs, then guarantee subsidies have equal, but opposite, effects on demand for U.S. wheat. The null hypothesis is

$$H_o: \hat{\beta}_{V_{US}} + \hat{\beta}_{V_{CA}} = 0 \quad ,$$

If this hypothesis is true, then a dollar of CWB subsidy has the equal and opposite effect of a dollar of CCC subsidy, implying that they would cancel each other out in terms of changing U.S. exports. A t-test is used, and the t-statistic is -0.472 which is less than the table t-value for 0.05 probability and 120 d.f. of 1.98, thus failing to reject the null hypothesis. Thus, CWB subsidies have an equal and opposite impact of CCC subsidies on U.S. wheat exports.

CCC Guarantees and EEP Subsidies

Credit guarantees have been assumed to be equivalent to price subsidies or discounts in earlier studies by Skully (1992) and Haley (1989). This is a strong and frequently used assumption and is tested with these results. The null hypothesis is that a dollar of credit subsidy is equivalent to a dollar of price subsidy:

$$H_o: \hat{\beta}_{V_{EEP}} - \hat{\beta}_{V_{US}} = 0 \quad .$$

The t-test statistic is -2.867 which is greater than the table t-value of 1.98. Thus, the null hypothesis is rejected.

These results indicate that the effect of the credit guarantee subsidy is not equivalent to the effect of a direct price subsidy on U.S. exports. The guarantee subsidy accrues as interest savings across the loan volume guaranteed and is indirect. EEP subsidies, on the other hand, are bonuses given to exporters on a per bushel basis; this is transferred to importers via a lower selling price and is therefore a direct subsidy. Importers, based on the test result, do not respond to these subsidies in the same manner. A dollar of CCC guarantee subsidy has a greater impact in terms of additional exports, than does a dollar in EEP subsidy.

GSM and EEP Interaction

Use of credit guarantees and EEP are correlated across importers and through time, as importing countries are often targeted with both programs. In our sample, V_{US} and V_{EEP} are correlated.[18] While neither correlation is extremely high, they do suggest possible interaction between the subsidies.

To test for the significance of this relation, an interaction term between the subsidies is added to the basic model. Adding this variable did not add significant explanatory power. The F-statistic from a restricted and unrestricted model comparison is 1.983, which is less than the table value of 4.54. Using the interaction term, which was significant with a negative sign, did not affect the estimate of additionality.

Test of Constant Additionality Across Importers

A test of the equivalence of the CCC subsidy effects across importers was conducted. Since not all countries are credit constrained or face the same cost of financing, there is *a-priori* justification to expect different responses to credit by different importers.

To test this hypothesis, interaction terms of CCC subsidy by importer, i.e., (d_i) (V_{US}), were added to the model. Parameter estimates are shown in Table 8. Results suggest additionality may be higher for Tunisia, Brazil, Egypt, and Morocco, than indicated by the earlier estimate.

Testing the joint significance of the slope dummy variables yields an F-statistic of 2.397 which, when compared to the table F-value with 5 and 112 degrees of freedom at the 5% level of significance, 2.295, rejects the null hypothesis. This shows some evidence that the response to credit varies by importer.

[18]These values were r = .38 and r = .45, for the full sample and for the 50 guarantee observations, respectively.

Table 8. CCC Guarantee Subsidy Slope Shifting Parameter Estimates

Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
Algeria (V_{US})	-0.033	0.043	-0.779	0.437
Brazil (s2)*	0.157	0.048	3.262	0.002
Egypt (s3)*	0.081	0.044	1.856	0.066
Mexico (s4)	0.049	0.068	0.722	0.472
Morocco (s5)*	0.091	0.050	1.806	0.074
Tunisia (s6)	0.181	0.179	1.022	0.309

* Significant at the 10% level of significance.

Empirical Results From Competitor Countries' Programs

Canada

Testing for the inclusion of intercept dummy variables in the Canadian model yielded an F Statistic of 33.191 which is greater than the table F-value of 2.29. Thus, we reject the null hypothesis that all dummy variables are zero. Table 9 shows the results of the OLS model with dummy variables. The model explains 76% of the variation and is heavily dependent upon the CWB credit subsidy. PROD is significant with a negative sign. GNPPC is significant with a positive sign, indicating that as incomes rise, more Canadian wheat is demanded. V_{CA} is the only statistically significant guarantee subsidy variable. Prices have *a-priori* expected signs, but are insignificant. V_{EEP} is not significant, suggesting that EEP has not adversely affected exports from Canada in these markets.

An interesting aspect of the Canadian results is the nonsignificance of a number of parameter estimates. The only variables that have a significance effect are GNPPC, PROD, and V_{CA}. This means that somehow the Canadians have been successful in mitigating the effects of competing guarantors.

Additionality Estimates

Using the V_{CA} parameter estimate, additionality is measured for the observed CWB subsidies. The higher V_{CA} parameter estimate and lower loan volume, on average, relative to the United States, give about the same level of additionality for Canada and the United States (Table 10). Algeria and Brazil account for most of Canada's additionality.

Table 9. Parameter Estimates and Significance Tests of the Canadian Model

Independent Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
GNPPC*	0.137	0.033	4.120	0.000
PROD*	-0.089	0.021	-4.241	0.000
P_{US}	0.257	1.103	0.233	0.816
V_{EEP}	-0.001	0.001	0.780	0.436
P_{CA}	-0.177	1.053	-0.168	0.867
P_{FR}	0.751	0.619	1.213	0.227
V_{US}	-0.004	0.005	-0.789	0.432
V_{CA}*	0.046	0.012	3.838	0.000
V_{FR}	-0.004	0.016	-0.226	0.822
Algeria* (int)	200.732	111.586	1.799	0.075
Brazil*	506.858	75.865	6.681	0.000
Egypt	-29.865	84.304	-0.354	0.724
Mexico*	-182.302	78.410	-2.325	0.022
Morocco*	-137.992	77.687	-1.776	0.078
Tunisia*	-359.468	65.310	-5.504	0.000

Dependent Variable: D_{CA}.
* Significant at the 10% level of significance.

Table 10. Estimate of Canadian Additionality by Year and Importer

	Additionality by Importing Country (1000 MT)			
Year	Algeria	Brazil	Egypt	Mexico
82		93		4
83		260	161	72
84		363	5	
85		455	183	
86	12	422	126	90
87	125	237		92
88	146			
89	171	117		
90	223	125		
91	147	340		
92	273	151		
Total	1,097	2,563	475	258

France

Results for France differ from those of the United States and Canada. In the U.S. model, neither P_{FR} nor V_{FR} was significant. In the French model, the dummy intercept variables are significant and improve the results. The F-statistic for inclusion of these effects is 35.91 which is greater than the table F-value of 2.29. Thus, we reject the null hypothesis that all dummy variables are zero.

Parameter estimates for France are shown in Table 11. V_{EEP}, P_{FR}, and P_{CA} are all significant with *a-priori* signs. The V_{EEP} coefficient is smaller than in the U.S. model; thus, EEP improves U.S. exports more than it harms French exports. Income, GNPPC, and domestic production, PROD, were also significant. The signs on the three credit subsidy variables were not as expected. Apart from their statistical insignificance, a possible explanation for the signs was given by Johnson. The extension of guarantees by the United States and Canada may have freed foreign exchange for other import purchases, including French wheat (for blending). The loan volume guaranteed, on average, for COFACE was about half the CCC guarantee volume. COFACE terms are also for seven years. In the short run, importers may benefit from CCC and CWB subsidies; and all exporters, not just U.S. and Canadian exporters, see increased sales.

Table 11. Parameter Estimates and Significance Tests of the French Model

Independent Variable	Parameter Estimate	Standard Error	t for H_0: Parameter=0	Prob > |t|
GNPPC*	0.088	0.050	1.758	0.081
PROD*	-0.082	0.032	-2.614	0.010
P_{US}	-1.995	1.656	-1.205	0.231
V_{EEP}*	-0.003	0.001	-1.857	0.066
P_{CA}*	5.218	1.581	3.301	0.001
P_{FR}*	-2.128	0.929	-2.290	0.024
V_{US}	0.006	0.008	0.763	0.447
V_{CA}	0.029	0.018	1.629	0.102
V_{FR}	-0.002	0.024	0.070	0.944
Algeria*	281.356	167.468	1.680	0.096
Brazil*	-478.768	113.858	-4.205	0.000
Egypt*	885.116	126.524	6.996	0.000
Mexico*	-488.349	117.678	-4.150	0.000
Morocco	110.509	116.592	0.948	0.345
Tunisia*	-325.033	98.018	-3.316	0.001

Dependent Variable: D_{FR}.
* Significant at 10% level.

SUMMARY AND IMPLICATIONS

One of the important problems confronting U.S. export programs is estimating the volume of trade that can be attributed to expenditures on the program. This is particularly apparent in the case of export credit guarantees which has a number of important characteristics. First, any subsidy element associated with the program is implicit as opposed to direct. Second, most major competitors use similar programs, thereby dissipating the potential effects of U.S. credit programs. Finally, these indirect subsidy programs ultimately have to compete as a strategic variable with the direct price subsidies. The purpose of this study was to analyze the effectiveness of export credit programs relative to other programs and to provide estimates of additionality.

Summary of Empirical Findings

Empirical models of demand were developed and estimated using a pooled data set of importing countries. Models were estimated for each of the principal exporting countries providing export credit guarantees: the United States, Canada, and France. Important conclusions from these results are:

1. Additionality to U.S. Credit: Positive additionality was found for CCC guarantees, indicating that the GSM programs have resulted in additional exports that would not have occurred without the programs. Additionality of CCC guarantees totaled approximately 12.6 MMT to the six importing countries over 13 years.

2. Constancy Across Importers: Additionality is not constant across importing countries, suggesting varying benefits across importers

3. Comparing Additionality of Credit Guarantees to EEP CCC guarantees have been viewed as providing a default subsidy (Haley 1989) and a pure price subsidy (Skully 1992). While there is a price subsidy equivalent, this is not the same as the direct price subsidy as provided by EEP. The equivalence of the CCC subsidy and EEP subsidy was tested. The U.S. results indicate that the CCC subsidy (from guarantees), on a per dollar of subsidy basis, provides about 4 times more additionality than EEP. These results cast doubt on the price subsidy equivalence of guarantees. This disparity may be due to overlap of the programs. Regardless, the assumption that these subsidies are equivalent is questionable as credit guarantees provide more than the imputed value of interest savings.

4. Intercountry Rivalry and Additionality of Competitor Country Guarantees: The CWB subsidy has a significant and negative effect on U.S. wheat exports. The magnitude of the coefficient is larger than the magnitude of the CCC guarantee subsidy. A test of their equivalence indicated they are not significantly different in absolute value. This is evidence that the CCC and CWB subsidies have equal but opposite effects.

   In the Canadian demand model, the effect of the CCC subsidy is insignificant. The coefficient of the CWB subsidy in the Canadian model is less than either the

CCC subsidy or the CWB subsidy in the U.S. model. Thus, Canada's guarantee program does more to displace U.S. sales than it does to help Canadian sales.[19]

Policy Issues and Implications

Additionality for CCC guarantees is evidence of the benefits of the program which must be offset by the program costs. These results show that CCC guarantees are cost effective when compared with EEP. Likewise, CCC guarantees offset CWB guarantees and outperform COFACE guarantees.

Guarantee programs have been criticized for their high cost (U.S. GAO 1992). Program performance evaluation must consider program costs, an issue not considered in this study. When countries do not pay back loans, these costs are absorbed by taxpayers. Any additionality from guarantee programs must be weighed against costs of default to assess net benefits to the United States. Several countries have failed to pay back CCC guaranteed loans. These countries, shown in the first column of Table 12, have paid claims outstanding which total about $1.7 billion. These loans are unlikely to be recovered and represent the realized cost of providing CCC guarantees. The list includes paid claims outstanding for all commodities, not wheat sales alone. Of the total, Iraq is the largest debtor, with about $1.6 billion in outstanding loans owed to the CCC.

Table 12. CCC Guarantee Recipients With Paid Claims Outstanding or Rescheduled Loans

Countries With Paid Claims Outstanding*	Countries With Rescheduled Loans*	
Argentina	Algeria**	Mexico**
Dominican Republic	Brazil**	Morocco**
Iraq	Dominican Republic	Panama
Surinam	Egypt**	Peru
Tanzania	El Salvador	Philippines
Yugoslavia	Former Soviet Union	Poland***
	Honduras	Sudan
	Jamaica	Zaire
	Jordan	

* May include nonwheat loan guarantees.
** Countries with measurable additionality in this study.
*** Debt forgiven in 1991.

Source: Nunn.

[19]Interpretation of this is marked by possible effects of EEP, which may lower the price for U.S. exports, and by the less accurate data for Canadian prices.

A more common occurrence, should an importing country fall into arrears, is to reschedule the loan. Here, any unpaid interest owed to CCC is added to the principal and considered for repayment later. CCC recipients with rescheduled loans are listed in the last two columns of Table 12. The rescheduled loans total about $5 billion, but do not represent a loss from the CCC's perspective, as importers must remain current on the rescheduled loans to continue receiving CCC guarantees.

Additionality, in the long run, must offset default costs for the program to be cost effective. Estimates from this study suggested that among these countries in the case of wheat, the additional sales attributable to export credit amounted to about 12.6 MMT. The unit price for guaranteed sales averaged $122 per MT (loan volume divided by quantity of wheat), which translates to $1.5 billion in sales revenue. Profits of these sales, or perhaps the savings on other programs (U.S. GAO 1995), could be counted as offsetting the paid claims of CCC guarantees for all commodities, which totaled $1.7 billion. Since the analysis in this study only measures additionality for six guarantee recipients, and for wheat only, it would understate the total additionality of CCC guarantees. While five of these countries have rescheduled loans, they have yet to present a cost to the CCC, and all have additionality.

Additional sales resulting from the total EEP subsidy are not as favorable as from CCC guarantee subsidies when comparing the costs of the programs. Approximately 19 MMT of additional sales to these countries is attributable to EEP. The additional revenue needs to be balanced against the $1.3 billion in EEP bonuses paid out on EEP sales to these six recipients alone. Total EEP bonuses for wheat up to 1992/1992 were about $3.7 billion. This is similar to the results of Hyberg et al. who found that without political defaults, the costs of CCC guarantee programs are less than for EEP.

REFERENCES

Ackerman, Karen Z. 1993. *Morocco: Determinants of Wheat Import Demand*. Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES 9315.

Ackerman, Karen Z., and Mark E. Smith. 1989. "A Review and Analysis of the EEP for Wheat." *Wheat Situation and Outlook*. Economic Research Service, U.S. Department of Agriculture. Washington, DC. WS-287. (Nov): 25-30.

Anania, Giovanni, Mary Bohman, and Colin A. Carter. 1992. "United States Export Subsidies in Wheat: Strategic Trade Policy or Expensive Beggar-Thy-Neighbor Tactic?" *American Journal of Agricultural Economics* 74(Aug): 534-545.

Bailey, Kenneth W. 1989. *Why Did U.S. Wheat Exports Expand?* Economic Research Service, U.S. Department of Agriculture. Washington, DC. Agriculture Information Bulletin Number 564. May.

Baron, David P. 1983. *The Export-Import Bank: An Economic Analysis*. Academic Press, Inc. New York.

Canadian Wheat Board. *The Canadian Wheat Board Annual Report*. Winnipeg, Manitoba. Various issues.

Collyns, Charles, John Clark, Robert Feldman, Ahsan Mansur, Paul Mylonas, Karen Parker, Susan Prowse, Robert Rennhack, Phillippe Szymczack, and Louis W. Pauley. 1992. *Private Market Financing for Development Countries*. International Monetary Fund. Washington, DC. December.

Dahl, Bruce L., D. Demcey Johnson, William W. Wilson, and Cole R. Gustafson. 1995. *Credit Guarantee Programs in International Grain Markets: Background and Issues.* Department of Agricultural Economics, North Dakota State University, Fargo. Agricultural Economics Report No. 326. March.

Dahl, Bruce L., William W. Wilson, and Cole R. Gustafson. 1995. *Valuing Option Provisions for Export Credit Guarantees*. Department of Agricultural Economics, North Dakota State University, Fargo. Agricultural Economics Report No. 330. June.

Eaton, Jonathan. 1986. "Credit Policy and International Competition." pp. 115-145. In *Strategic Trade Policy and the New International Economics*, edited by Paul R. Krugman, The MIT Press, Cambridge, MA.

Economist. "Governments and Exports: Thoroughly Modern Mercantilists," in *The Economist*, February 1, 1997: 23-25.

Feinberg, Richard E. 1982. *Subsidizing Success*. Cambridge University Press, Cambridge, MA.

Fleming, Ann. 1990. "The Role of Export Credit Programs for Rice." *USDA Rice Situation*. RS-59.

Grigsby, S. Elaine, and Cathy L. Jabara. 1985. "Agricultural Export Programs and U.S. Agricultural Policy." pp. 185-201. In *Agricultural-Food Policy Review*, Commodity Program Perspectives, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Agricultural Economics Report No. 530. July.

Haley, Stephen L. 1989. *Evaluation of Export Enhancement, Dollar Depreciation, and Loan Rate Reduction for Wheat*. Agriculture and Trade Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES 89-6. April.

Haley, Stephen L. 1990. *Measuring the Effectiveness of the Export Enhancement Program for Poultry*. Agriculture and Trade Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES-9016. March.

Harris, Meghan. 1990. *Export Credit Guarantee Programs of Major Exporting Countries*. Unpublished monograph. Foreign Agricultural Service, United States Department of Agriculture. Washington, DC.

Hyberg, Bengt, Mark Smith, David Skully, and Cecil Davison. 1995. "Export Credit Guarantees: The Commodity Credit Corporation and U.S. Agricultural Export Policy." *Food Policy* 20(1):27-39.

International Monetary Fund. 1995. *International Financial Statistics*. Washington, DC. CD-ROM. March.

International Wheat Council. *Grain Market Report*. London. Various issues.

International Wheat Council. 1992, 1993, 1994. *World Grain Statistics*. London. Various issues.

International Wheat Council. *World Wheat Statistics*. London. Various issues.

International Wheat Council. 1988. *Wheat Support Policies and Export Practices in Five Major Exporting Countries*. London. Secretariat Paper No. 16. May.

Johnson, D. Demcey. 1995. *Export Credit Guarantees: A Welfare and Strategic Analysis*. Department of Agricultural Economics, North Dakota State University, Fargo. Agricultural Economics Miscellaneous Report No. 174. February.

Koo, Won W., and David Karemera. 1991. "Determinants of World Wheat Trade Flows and Policy Analysis." *Canadian Journal of Agricultural Economics* 39:439-455.

Levin, Carol E., and Chin-Zen Lin. 1993. *Philippines: Determinants of Wheat Import Demand*. Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture.

Leipold, Allessandro, Mohamed A. El-Erian, Ajai Chopra, John Clark, Paul Mylonas, and Louis W. Pauly. 1991. *Private Market Financing for Developing Countries.* International Monetary Fund. Washington, DC. December.

Lent, Rebecca, and Erin Dusch. 1994. *Tunisia: Determinants of Wheat Import Demand*. Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES 9409.

Lugar, Richard G. 1994. "Draft questions for comprehensive senate agriculture committee hearings on the 1995 farm bill." U.S. Senate, Washington, DC. December 9.

McClain, Emily A., and Erin Dusch. 194. *Brazil: Determinants of Wheat Import Demand.* Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES 9415.

Missiaen, Margaret, and Mark Smith. 1993. *Ghana and Togo: Determinants of Wheat Import Demand*. Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES 9316.

Nunn, Sally. 1995. Personal communication. Assistant treasurer. Commodity Credit Corporation, U.S. Department of Agriculture. Washington, DC. August.

Raney, Terri. 1986. *The Impact of External Debt Variables on the Demand for Imports by Lesser Developed Countries*. Unpublished Ph.D. dissertation. Oklahoma State University, Stillwater.

Raynauld, Andre. 1992. *Financing Exports to Developing Countries.* OECD, Paris.

Seilor, Robin. 1990. *Budgeting for ExIm Bank: A Case Study of Credit Reform.* Congress of the United States, Congressional Budget Office. Washington, DC. January.

Sheffield, Sharon S. 1993. *Russian Federation: Determinants of Wheat Import Demand.* Agriculture and Trade Analysis Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Staff Report No. AGES 9331.

Skully, David W. 1992. "Price Discrimination and State Trading: The Case of U.S. Wheat." *European Review of Agricultural Economics* 19:313-329.

Skully, David W. 1994. Personal Communication. Agricultural Economist. Economic Research Service, U.S. Department of Agriculture, Washington, DC.

Smith, Mark E. and Nicole Ballenger. 1989. "Agricultural Export Programs and Food Aid." pp. 169-186. In *Agricultural-Food Policy Review: U.S. Agricultural Policies in a Changing World*, Agriculture and Trade Division, Economic Research Service, U.S. Department of Agriculture. Washington, DC. Agricultural Economics Report No. 620.

U.S. Department of Agriculture, Economic Research Service. 1995. *Wheat Yearbook*. Commercial Agriculture Division, Department of Agriculture. Washington, DC. WHS-1995. February.

U.S. Department of Agriculture, Foreign Agricultural Service. *Notice to Exporters*. Department of Agriculture. Washington, DC. Various issues.

U.S. Department of Agriculture, Foreign Agricultural Service. *Notice to Recipients*. Department of Agriculture. Washington, DC. Various issues.

U.S. Department of Agriculture, Foreign Agricultural Service. *Agricultural Export Assistance Update Quarterly Report*. Department of Agriculture. Washington, DC. Various issues.

U.S. GAO. 1992. *Loan Guarantees: Export Credit Guarantee Programs' Costs are High*. Government Accounting Office. Washington, DC. GAO/GDD-93-45. Dec. 22.

U.S. GAO. 1995. *Former Soviet Union: Creditworthiness of Successor States and U.S. Export Credit Guarantees*. Government Accounting Office. Washington, DC. GAO/GGD-95-60. Feb. 24.

Vanderbeek, Jerry. 1994. "United States Export Credit Programs for Russian Importers." Presentation at Northern Crops Institute, Fargo, ND. April 14.

World Bank. 1994. *World Tables 1994*. International Economics Department of the World Bank. Washington, DC.

World Perspectives Inc. 1995. *The GSM Export Credit Guarantee Programs: A Review with Recommendations for Reform*. World Perspectives Inc. Washington, DC. July, pp. 54.

Yang, S., and W. Wilson. 1996. "Credit Allocation Decisions of Wheat Exporting Countries," *Canadian Journal of Agricultural Economics*, March, 44:53-65.

Yang, S., and W. Wilson. 1996. "Effect of Wheat Export Policies on Market Shares," *Review of Agricultural Economics* (18), pp. 585-98. September.