THE RELATIONSHIP BETWEEN EXPORTS, CREDIT RISK AND CREDIT GUARANTEES

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Abstract

This paper provides an understanding of how the export credit worthiness of an importing country affects export sales of agricultural and other manufactured products and how export credit guarantees or insurance can mitigate risks of non-payment. A theoretical model is developed. It shows how risk mitigation through export credit insurance could increase exports to high risk importing countries. The key result is that the export response curve is more inelastic in the presence of payment risk, and the effect of insurance is to make the export curve more elastic. Statistical evidence supports this fundamental premise.

Keywords: export credit insurance, export credit guarantees, international trade under uncertainty

Introduction

Promoting and selling manufactured as well as agricultural goods and services in foreign markets incurs a risk of insolvency or delayed payment by the foreign buyers because only a few of them are willing or able to pay full cash in advance. Posner (1997) classifies these risks into three types: commercial, political, and economical. Commercial risks include buyer insolvency, default on payment, repudiation of goods, or contract termination. Political risks arise from foreign exchange conversion, transfer payment difficulties, insurrection, cancellation of import or export permits, and/or changes in policies or government regimes that place new restrictions on, or delay the execution of, exporting contracts. Economic risks arise from the weaknesses of a country's economic condition.

A common approach to mitigating risks associated with export sales is to indemnify the risks through credit guarantees or insurance from either private financial institutions or government programs. In Canada, this can be accomplished by using various service packages offered by the Canadian Export Development Corporation. The insurability of an export is determined by a number of macroeconomic conditions relating to the importing country. These risks are represented through international credit scores. While credit scores are reasonably accurate in measuring intra-country risks and commonly used in deciding cross-country lending (Melvin, 2000), surprisingly, little is known about the relationship between actual credit scores and exports. The theory and practice of credit scoring for export risk suggests that exports would be higher for credit worthy importing countries. In addition to this gap in the academic literature, there does not seem to be a sound economic framework that ties the probability of default, as

measured ordinally by the credit scores, and other attitudes of the export decision, including coverage levels and risk aversion. Hence, this paper addresses both gaps in the literature by constructing a theoretical model and estimating an export response function for Canadian agricultural and other goods.

The problem we address is economically significant since goods will less likely be exported to countries with poor credit ratings due to high default rates. Export credit insurance can be used to mitigate such risks, but the gross benefits from risk reduction may be offset by premium and administrative, or loading, costs that increase with higher rates of default risks. Thus, subsidized credit insurance offered by governments could then lead to an incremental increase in exports over unsubsidized private insurance.

In the broader context of international trade theory, Abraham and Dewit (2000) and Leathers (2001) state that export promotion by governments is still controversial among academic economists, policy-makers, and business representatives. Fitzgerald and Monson (1988), and the OECD (1998) state that the earlier practices of export credit programs of industrialized countries had been in the form of export subsidies. Theoretically, Caves and Jones (1981), Houck (1986), Kreinin (1991), and others show that under the traditional assumptions of international trade theory, including certainty in prices and payment, export credit in the form of export subsidies may not be in the best interest of the exporting country because subsidies are transferred, in part, to the importing country and because of a misallocation of resources in both exporting and importing countries due to skewed market signals. In this context, a subsidy is considered to be an unfair and uneconomic trading practice. Furthermore, export

subsidies can deteriorate the terms of trade of countries that do not provide export subsidies.

On the other hand, risks and imperfect information are commonly present in foreign markets. If certainty and full information are relaxed from the traditional assumptions of international trade theory, the general conclusion discussed above may not be so clear-cut. Grinols (1985) concludes from an economic welfare perspective that the channels of welfare influence for an open country become more complicated when uncertainty and international trade in securities are considered. Moreover, when the assumption of uncertainty is relaxed, the theory of international trade does not rule out a role for government intervention (Brainard and Cooper, 1968). They show that wide variations in export receipts leading to fluctuations in national income are costly to primary producing countries in terms of social cohesion, efficient allocation of resources, and economic growth. Additionally, they point out that there are several ways in which the social costs of fluctuations may differ from private costs. This can lead to a diversified trade strategy for a private exporter that may not be optimal from a social point of view.

The purpose of this paper is to provide an understanding of how the export credit worthiness of an importing country affects export sales of agricultural and other manufactured products and how export credit guarantees or insurance can mitigate risks of non-payment. The paper makes a contribution to the specific literature on how export credit risks affect agricultural and other exports, and also contributes to the broader literature on international trade theory by showing that risk is indeed an economically significant factor in trade. The paper is positioned relative to an exporter who has agreed

to the terms of trade, including price, with an importer. Since price becomes a contractual obligation, we do not examine price discovery per se. Rather, we examine how, given a price, the probability of default affects exports. We argue that the economics driving export credit guarantees or export credit insurance rests on the premise that the supply curve of an exporting firm becomes more inelastic as the risk of non-payment increases. In other words, the exporting firm is more likely to export to countries with low risk of non-payment than one with higher risk, all other things being equal. It follows that the provision of export credit insurance or guarantees that are targeted towards risk reduction can increase exports by encouraging exports that would not otherwise be made to countries with high risk of non-payment.

The remainder of this paper is organized as follows. Section 2 presents a theoretical model that explains the impact on exports arising from the risk of default and general export credit insurance and relates the findings of this model with related research findings. Section 3 empirically evaluates the key finding of the theoretical model using Canadian export data of agricultural goods and goods from all industries. To verify the results from the Canadian model, we also empirically examine additional export data from Canada, Australia, and United States. Section 4 concludes the paper.

A Theory on the Impact of Credit Guarantees and Insurance on Export Promotion

This section presents a theoretical model in which the exporting firm faces default risk on its exports but has the opportunity to indemnify itself against losses. The purpose of this model is to investigate how an optimal level of exports is impacted by the risk of default and the presence of a general insurance scheme that provides protection at a fair or subsidized cost. Suppose that the profit function of an exporting firm is,

(1) $$\Pi = QPF(\theta) + ZQP(1 - F(\theta)) - rQ - \delta w(\overline{F}(\theta), P, Z)Q.$$

Where 'Q' is the exporting quantity, 'P' is the negotiated contract price of the exporting good, 'F(θ)' is the cumulative probability distribution function of getting paid, and 'θ' is a credit score that explains non-payment on the export sales. For simplicity one might view F(θ) as the predicted value from a logistic international credit scoring model with a value F(θ) = 1 representing full payment of the amount 'QP', and F(θ) = 0 representing non-payment. The expected probability of being paid is denoted by $\overline{F} = \overline{F}(\theta)$, and in practice, this would represent a prior probability. Funatsu (1986), Dewit (1996), and Abraham and Dewit (2000) consider a similar problem structure. The variable 'Z' is the coverage level from an insurance policy or export guarantee such that '$1 \geq Z \geq 0$.' If the exporter receives less than 'Z%' of the contracted sales amount of (QP) then the exporter would receive an indemnifying amount of (ZQP – QP*) where P* is the actual average per unit price received by the exporter. The prior probability of such indemnifying payment is (1 - $\overline{F}$). The variable 'r' is a constant factor that reflects a constant marginal cost of exporting without accounting for risks of non-payment[1], and δ represents a loading factor that reflects the administrative cost of providing the insurance scheme. Note that a positive value for δ represents the loading cost to the exporter for purchasing private insurance, while a negative value for δ represents a subsidy as might be found with publicly provided insurance programs. Finally, 'w' is the insurance premium rate per unit of the exporting good. It is a function of the probability of payment ($\overline{F}$), prices (P), and a coverage level (Z) which the exporter desires to insure on his export sales, that is w = w($\overline{F}$, P, Z). By definition ∂w/∂P and ∂w/∂Z are positive, and ∂w/∂$\overline{F}$ is negative.

Equation (1) assumes that the risk of not getting paid, (1 – F(θ)), is directly attached to the export price. Thus, the price of getting paid (PF(θ)) is assumed to be a random variable with mean and variance defined as

(2) $$E[PF(\theta)] = P\overline{F},$$

(3) $$Var[PF(\theta)] = \sigma_\theta^2 = E\left[\{PF(\theta) - E[PF(\theta)]\}^2\right]$$

The expected value and variance of the profit function can then be written as equations (4) and (5) respectively.

(4) $$E[\Pi] = QP\overline{F} + ZQP - ZQP\overline{F} - rQ - \delta wQ,$$

(5) $$Var[\Pi] = \sigma_\Pi^2 = Q^2(1-Z)^2\sigma_\theta^2.$$

Assuming that the exporting firm maximizes the expected utility of profit, the problem can be written as

(6) $$Max_Q\left\{E[u(\Pi)] = E[\Pi] - \frac{\lambda}{2}\sigma_\Pi^2\right\},$$

$$\Rightarrow Max_Q\left\{E[u(\Pi)] = QP\overline{F} + ZQP(1-\overline{F}) - rQ - \delta wQ - \frac{\lambda}{2}Q^2(1-Z)^2\sigma_\theta^2\right\},$$

where λ is a constant factor that measures the risk attitude of the exporter. The higher the value of λ, the more risk averse the exporter will be. The first order condition of the maximization problem with respect to 'Q' is,

(7) $$P\overline{F} + ZP - ZP\overline{F} - r - \delta w - (1-Z)^2\lambda\sigma_\theta^2 Q^* = 0.$$

Solving equation (7) in terms of Q*, as the optimal exporting quantity[2], gives

(8) $$Q^* = \{P\overline{F} + ZP(1-\overline{F}) - r - \delta w\} \Big/ \{(1-Z)^2\lambda\sigma_\theta^2\}.$$

In contrast, the optimal exporting quantity in the absence of an insurance scheme (Z = 0), is

(9) $$Q_0 = (P\overline{F} - r) \Big/ \lambda\sigma_\theta^2 .$$

The relationship between the exporting quantity and the coverage level can be derived by taking the partial derivative of equation (8) with respect to Z to get,

(10) $$\frac{\partial Q^*}{\partial Z} = \left\{ \left(\frac{P(1-\overline{F}) - \delta \partial w / \partial Z}{(1-Z)^2 \lambda \sigma_\theta^2} \right) + \left(\frac{2[P\overline{F} + ZP(1-\overline{F}) - r - \delta w]}{(1-Z)^3 \lambda \sigma_\theta^2} \right) \right\}$$

$$= \left\{ \left(\frac{P(1-\overline{F}) - \delta \partial w / \partial Z}{(1-Z)^2 \lambda \sigma_\theta^2} \right) + \left(\frac{2Q^*}{(1-Z)} \right) \right\}.$$

If the exporting quantity (Q*) is positive, the second term on the right side of equation (10) is positive. Note that the partial derivative of 'w' with respect to Z is positive because as the coverage level increases it causes the insurance premium rate to increase. However, it is also reasonable to assume that $P(1 - \overline{F}) \geq \delta(\partial w/\partial Z)$; since in the alternative the exporter may not consider it worthwhile to pay for a particular level of coverage if the marginal cost of buying the coverage level is greater than its expected benefit. As a result, the right hand side of equation (10) is positive, and this implies that an exporter can increase exports in the presence of an insurance program.

Together with the change of coverage level, we can see the impact of a subsidized insurance premium by taking the partial derivative of equation (10) with respect to δ to obtain,

(11) $$\frac{\partial^2 Q^*}{\partial Z \partial \delta} = \left\{ \left[\frac{-\partial w / \partial Z}{(1-Z)^2 \lambda \sigma_\theta^2} \right] + \left[\frac{-2w}{(1-Z)^3 \lambda \sigma_\theta^2} \right] \right\}.$$

Clearly, it is negative. This implies that if a large portion of the premium is subsidized, exports will increase. This result is consistent with the findings of Funatsu (1986). However, the result also implies that an unsubsidized insurance premium with a positive

loading factor, $\delta > 1$, will decrease exports. In fact, there is a possibility that excessive loading costs can reduce or eliminate any economic benefit from increased coverage. Nonetheless, the result is also consistent with the conclusions of Abraham and Dewit (2000) in which even at unsubsidized levels, an insurer can reduce risk enough to provide some benefit to exporters. That is, as δ increases, $\partial Q^*/\partial Z$ approaches zero, diminishing the spread between Q^* and Q_0. In other words, a sufficiently high value of δ would encourage self-insurance at the export level of Q_0. As pointed out by Rude (2000), if trade distortion due to the subsidy of insurance credits is an issue, it is important to determine the implicit subsidy values as well as the face value of the export credit arrangement in order to assess whether such an arrangement has a distorting effect on trade flows.

Another view of the effect of the loading factor on the exporting quantity can be obtained by taking the partial derivative of equation (8) directly with respect to δ, holding all other factors constant:

$$\frac{\partial Q^*}{\partial \delta} = \frac{-w}{(1-Z)^2 \lambda \sigma_\theta^2} < 0. \tag{12}$$

As the loading factor (such as administrative costs) increases, it reduces the net benefit of the policy and therefore reduces optimal export quantities. However, if the loading factor is negative, due to (for example) government subsidies, equation (12) indicates that the exporter will likely increase the exporting quantity. This is the precise economic response to a publicly provided insurance program that leads critics to believe that subsidies lead to unfair trade practices (Fitzgerald and Monson (1988), Rude (2000), and Leathers (2001)).

The relationship between the optimal exporting quantity and the attitude of the exporter can be obtained by taking the partial derivative of equation (8) with respect to λ,

$$(13) \qquad \frac{\partial Q^*}{\partial \lambda} = \frac{-\{P\overline{F} - ZP(1-\overline{F}) - r - \delta w\}}{(1-z)^2 \lambda^2 \sigma_\theta^2}$$
$$= \frac{-Q^*}{\lambda} < 0.$$

This implies that as the risk aversion of the exporter increases optimal exports decrease, even in the presence of an export insurance policy. Since $\partial^2 Q^*/\partial\lambda\partial Z < 0$, the negative impact of risk aversion can be offset with increased coverage levels or, because $\partial^2 Q^*/\partial\lambda\partial\delta > 0$, increased subsidization. However, if risk aversion is a result of informational asymmetries between the exporter and the importer, or ambiguity about the political economy of the importing country, it may be possible for a government to reduce risk aversion by increasing the flow of credible information to the exporter. This could cause a decrease in λ and consequently would increase Q*.

In a finding consistent with Funatsu (1986), as the variance (σ_θ^2) increases, optimal exports decrease because

$$(14) \qquad \frac{\partial Q^*}{\partial \sigma_\theta} = \frac{-2\{P\overline{F} - ZP(1-\overline{F}) - r - \delta w\}}{(1-z)^2 \lambda \sigma_\theta^3}$$
$$= \frac{-2Q^*}{\sigma_\theta} < 0.$$

This result is consistent with the theoretical conclusions of Ruffin (1974), Anderson and Riley (1976), and Eaton (1979). Increased levels of coverage or subsidization can offset the variance effect because it lowers the probability of loss. The probability of loss is an explicit argument in the definition of variance found in equation (3).

The relationship between the optimal exporting quantity and the prior probability of getting paid can be obtained by taking the partial derivative of equation (8) with respect to $\overline{F}$,

$$(15) \qquad \frac{\partial Q^*}{\partial \overline{F}} = \left\{ \left[\frac{P(1-Z) - \delta \partial w / \partial \overline{F}}{(1-Z)^2 \lambda \sigma_\theta^2} \right] - \left[\frac{2\left[P\overline{F} + ZP(1-\overline{F}) - r - \delta w \right]}{(1-Z)^2 \lambda \sigma_\theta^3} \right] \frac{\partial \sigma_\theta}{\partial \overline{F}} \right\}$$

$$= \left\{ \left[\frac{P(1-Z) - \delta \partial w / \partial \overline{F}}{(1-Z)^2 \lambda \sigma_\theta^2} \right] - \frac{2Q^*}{\sigma_\theta} \frac{\partial \sigma_\theta}{\partial \overline{F}} \right\} > 0.$$

The second term on the right hand side is positive under the reasonable assumption that $\partial\sigma_\theta/\partial \overline{F}$ is non-positive. That is, as the prior probability of getting paid increases it is most likely that the variance about the prior probability of getting paid will either decrease or at least not change. Equation (15) implies that as the prior probability, or certainty, of getting paid increases exports will rise. The converse is economically significance, since it suggests that uncertainty unto itself is sufficient to negatively impact export quantity. For example, if an exporter must choose between a developed economy with good credit worthiness versus a lesser developed economy with poor credit worthiness, the tendency would be to export to the safer market. This suggests a role for credit insurance in export markets. In fact, even in the absence of credit insurance it is simple to show from equation (9) that $\partial Q_0/\partial \overline{F} > 0$.

In the presence of credit insurance, it is clear that the difference of the partial derivatives of equations (8) and (9) with respect to $\overline{F}$ is positive:

$$(16) \qquad \left(\frac{\partial Q^*}{\partial \overline{F}} - \frac{\partial Q_0}{\partial \overline{F}}\right) = \left\{ \frac{PZ(1-Z) - \delta \partial w / \partial \overline{F}}{(1-Z)^2 \lambda \sigma_\theta^2} \right\} - \left\{ \frac{2(Q^* - Q_0)}{\sigma_\theta} \right\} \frac{\partial \sigma_\theta}{\partial \overline{F}} > 0.$$

This implies that as the prior probability of getting paid increases, the exporter increases its level of exports more under the presence of export insurance scheme rather than in the absence of an export insurance scheme.

Empirical Evidence of the Relationship Between Exports and Credit Worthiness

The theoretical model developed in the previous section rested on the premise that there is indeed a positive relationship between credit worthiness as measured by the credit score of an importing country and the exports to that country. We take as the null hypothesis that no such relationship exists, but if this hypothesis is rejected then we can accept the assertion that follows from it. For example, if there is no relationship between exports and credit risk, then the conditions for a credit insurance market are not satisfied. In the absence of a credit insurance market, issues surrounding credit subsidies and the economic consequences of subsidies are moot.

From the theoretical model, we assert that a positive relationship between credit worthiness and exports does exist. Especially, equation (15) shows that, as the prior probability of getting paid increases, the amount of exports will rise. In addition, the model suggests that because of credit risks the amount of exports to countries with high-risk of defaulting will be lowered. As a result, such credit insurance would encourage exporters to increase their exports to countries with high-risk of defaulting.

In this section, we attempt to provide evidence that supports the main assertions. We expect that the export value per capita of an importing country is an increasing function of the credit score that is tagged to that importing country. We use export values per capita of importing countries, rather than total export values, to normalize the data

across importing countries. Additionally, we use intra-country credit ratings as calculated by the Euromoney magazine[3].

Relying simply on the relationship between exports and credit scores may at first glance seem to omit several relevant explanatory variables. However, according to Haque et al (1997), Euromoney magazine derives the credit scores based on three main indicators: analytical, credit, and market indicators. It assesses 40% weight to analytical indicators. These indicators include political risk, economic risk, and economic indicators. The economic indicators include debt service/exports, external debt/GNP, and balance of payments/GNP. It assesses 20% weight to credit indicators that include historical payment records and any previous rescheduling of debts. The remaining 40% weight is assessed to market indicators that include an access to bond markets, a sell-down on short-term paper, and an access to discounts available from forfeiting houses. Therefore, a country that has a credit score close to 100 percent is considered to be creditworthy.

To include additional explanatory variables raises the possibility of multicollinearity. For example, if the GNP per capita of the importing countries were to be included as an additional explanatory variable, the result would be collinear because the GNP of an importing country is included as a component of the credit score tagged to that country[4].

For our analysis, we obtained intra-country credit ratings from the Euromoney magazine issued in 1998. Thus, we take the credit scores of the importing countries as given and focus on examining the relationship between the international credit scores and export values per capita of the importing countries.

Data on export values per capita were obtained from three different sources. Data for 1998 Canadian export values for all industries and for agricultural and related service industries were obtained from Statistic Canada's 'Trade Data Online'[5]. This data set is comprised of over 175 different countries matched to their credit scores. To confirm the generality of the result, we also obtained trade data for Canada, United States, and Australia from the International Trade Statistics Yearbook published by the World Bank. We use this data on general exports, F.O.B., in US dollars, to identify a group of 22 importing countries that all three countries exported to. Lastly, data of 1998 population and GNP per capita in US dollars of the importing countries were obtained from 'the 2000 World Development Indicators'.

Since not all of these countries imported Canadian goods in a consistent pattern and without knowing the real causes of missing data, countries that did not import Canadian goods or had no record of its GNP per capita in 1998 were excluded from the analysis. Table 1 provides a summary of the two types of Canadian exports. There are a total of 156 and 118 countries importing 'goods from all industries' and 'agricultural and related service industries' respectively from Canada.

Table 2 summarizes Canadian, American, and Australian export values for 22 common importing countries. The difference between the two data sets is evident by comparing the figure for Canada. In Table 2, the mean GNP per capita of importing countries is $14,247 whereas the counter part from the data set for Canadian exports from all industries is $5,735. Clearly, the data set of Canadian exports from all industries is larger and includes more of the less developed countries. Consequently, the mean credit

score for this data set at 37.91 is much lower than 68.09 found for the 22 more prosperous countries in Table 2.

Table 3 illustrates the relationship between the key variables used in our analysis[6]. It consists of the export values per capita of the importing countries from Canada, United States, and Australia as well as the GNP per capita of those importing countries. Column 2 provides the rank of credit worthiness of the importing countries with '1' being the most credit worthy and '22' the least. The third column provides credit scores from Euromoney out of 100. It ranges from a high of 97.06 for Germany to a low of 27.20 for Indonesia.

To support our assertion that exports are an increasing function of the credit worthiness of importing countries, we estimate across the importing countries the following regression:

(17) $$Y = a + bX + e.$$

In equation (17), Y is the log of export value per capita of a designated importing country, X is the log of the credit score tagged to that importing country, and 'e' is an error term. To incorporate the difference of income effects on the export values among importing countries, we segregated the data into four income categories by adding three dummy variables into equation (17) as:

(18) $$Y = a^{*} + bX + cD_1 + dD_2 + eD_3 + e.$$

In equation (18), D_1 represents the dummy variable for a low-income country by taking on the value of '1' if the 1998 GNP per capita of that importing country is less than $765 US and zero otherwise[6]. D_2 represents the dummy variable for a low-middle income country in which GNP per capita is greater than $765 but less than $3035 US, and D_3

represents the dummy variable for an upper-middle income country with GNP per capita greater than $3035 but less than $9385 US. In this model, the intercept term (a*) represents a high-income country in which its GNP per capita is greater than $9385 US.

Table 4 presents the results of the regressions of equations (17) and (18) with respect to Canadian 'agricultural goods' and 'goods from all industries' using the statistic Canada data. From Table 4, the results clearly reject the null hypothesis, H_0: b = 0, at the 5% level of significance for both types of Canadian exports. However, when the dummy variables were included, H_0 is rejected only for the Canadian goods from all industries.

Individually, the estimated coefficients of the dummy variables representing the upper-middle and high-income countries are not significantly different from zero at the 10% level for both types of Canadian exports. However, the estimated coefficients of the dummy variable representing the low-middle income countries is significantly different from zero at the 5% level for Canadian goods from all industries, and only significantly different from zero at the 10% level for Canadian agricultural goods. Clearly, the estimated coefficients of the dummy variables representing the low-income countries are significantly different from zero at the 5% level for both types of Canadian exports. A Chow test, using equation (17) as a restricted model, indicates that collectively the dummy variables are significantly different from zero at the 5% level.

The results lead to several important conclusions. First, the relationship between credit worthiness and the two types of Canadian export values is unambiguously positive. Second, the magnitude of relationship between credit worthiness and export values is different for the two types of Canadian exports. From Table 4, based on the regression of equation (17), a 1% increase in the credit score of an importing country suggests an

increase of 1.43% in the value of Canadian agricultural goods exporting to that country, but 2.18% for the value of Canadian goods from all industries.

Third, when the importing countries are categorized into different income classes, it is evident that the export relationship is characterized by two different export response functions. Given, the insignificance of the dummy variables representing the upper- and high-income countries, the results suggest that these two classes are all treated the same in terms of the relationship between the credit score and exports. In contrast, the significant and negative values associated with the estimated coefficients of the dummy variables representing the low-income and low-middle income countries suggest that there exists an additional and negative bias toward them.

Fourth, not only do the results suggest a direct relationship between credit worthiness and exports, but also it follows automatically that repayment risk is an important determinant of exports. From a policy perspective, credit insurance or credit guarantees, at a fair or subsidized price, can help exporters mitigate risks of exporting to low-income countries. As such, risks are reduced, credit worthiness improved, and an increase in exports will be realized. This improvement will be highest for low-income and less developed countries. As concluded from the theoretical model, factors such as high guarantees, reduced loadings or subsidies, and lower possibilities of default, are all factors that would increase the credit worthiness of an importing country, and hence lead to improved exports.

A Cross-Country Comparison

In this section we use the data set from the International Trade Statistics Yearbook to see whether the results found for the larger Canadian data set are general.

Equations (17) and (18) were estimated for the inter-country comparisons between Canada, United States, and Australia using the data reported in Table 3, and the results are presented in Table 5. The results of the regression (17) clearly reject the null hypothesis, H_0: b = 0, at the 5% level of significance for all Canadian, American, and Australian export values. However, when the dummy variables were included, H_0 cannot be rejected for all Canadian, American, and Australian export values. The joint test of all estimated coefficients being zero against the alternative of at least one estimated coefficient not being zero is rejected at the 5% level of significance for all Canadian, American, and Australian export values.

Individually, the estimated coefficients of the dummy variables representing the high-, upper-, low-middle-, and lower-income countries are not significantly different from zero at the 10% level for the Australian export values. However, only the estimated coefficients of the dummy variables representing the high-, upper-, and low-middle-income countries are not significantly different from zero at the 10% level for both the Canadian and American export values. The estimated coefficients of the dummy variables representing the lower-income countries are significantly different from zero at the 10% and 5% levels for Canadian and American export values, respectively.

To determine whether the dummy variables in the Canadian and Australian models contributed any explanatory power to equation (18), we again employed a Chow F-test using equation (17) as the restricted regression. The Chow test cannot be rejected at the 10% levels of significance for Australia but can be rejected at the 10% level of significance for Canada[7].

The results from the cross-country comparison are somewhat, but not totally, consistent with the larger Canadian-based model. One strong conclusion is that all countries display a significant relationship between the credit score and exports. Regarding the 22 common importing countries, neither Canada or Australia differentiate export response based on the income levels of the importing countries, but the evidence does suggest that United States does distinguish low-income countries from other income classes. The reason for the discrepancies between the larger Canadian-based model results and cross-country comparison is (as implied by endnote 7) probably due to the fact that the larger data set as described in Table 1 includes a larger number of low income countries, with a lower income base, than the 22 common countries represented by Tables 2 and 3.

VI. Concluding Comments

This paper examined how export credit risks impact export sales, and how export credit guarantees or insurance mitigate the risks of non-payment on export sales, including agricultural products as well as products from all industries. We presented a theoretical model that showed how risk mitigation through export credit insurance could increase export supply. The theoretical model suggests that exports will increase with a decrease in the probability of default, an increase in the coverage or guarantee, a decreased or subsidized premium rate, lower risk aversion, and lower variance of amounts getting paid. Subsidies will increase exports, but pressures under the Arrangement[8] and WTO legislation may cause the removal of all export subsidies, even for agricultural products. To induce exports, the results suggest that reducing

informational asymmetries or risk perceptions may be a non-pecuniary approach to encouraging export sales.

Finally, using export values per capita of the importing countries, data for Canadian agricultural goods and goods from all industries and for Canada, Australia and the U.S. and international credit scores we showed, empirically, that there is indeed a relationship between exports and credit worthiness. The theoretical model, and the empirical results provide a strong justification for the use of export credit insurance and guarantees to increase optimal export quantities. The results suggest that governments can 'encourage' exports to less developed countries by subsidizing insurance premiums to exporters, and/or providing other low cost intelligence services. The results suggest that the exporter's supply curve is more inelastic in the presence of uncertainty, than it would be in the case of certainty. Moreover, the results suggest that the supply curve will become more elastic, offering a larger quantity for a given price, in the presence of export credit guarantees or insurance. Since the exporter's supply curve facing low-income countries such as less developed countries is the most inelastic, it appears that programs targeting them can improve social welfare for both the importer and exporter.

Endnotes:

1. We have assumed for simplicity that at the negotiated price (P) the exporting firm faces a constant average or marginal cost, in the neighbourhood of that negotiated price. This assumption is also made by Abraham and Dewit (2000). Regarding to the second order condition, see note 2. However, suppose, as in Dewitt (1996), that the marginal cost is increasing and described by 'rQ^2' rather than 'rQ' then upon substitution into the maximisation problem, '$\partial Q^* / \partial r < 0$' and '$\partial^2 Q^* / \partial r^2 > 0$'. This suggests that an increase in 'r' will lead to a greater expected profit if the new price is able to be renegotiated to equal its marginal cost at a new solution, since the percentage increase in price will exceed the percentage increase in quantity.

2. The second order condition of the maximization problem is,
$-(1-Z)^2 \lambda \sigma_\theta^2 < 0,$
which is held true without assuming the marginal cost is an increasing function of the export quantity (Q).

3. Another source of country risk ratings is the *Institutional Investor* in which has compiled a country risk rating since 1979.

4. We have run two types of regressions to determine the relationship between the credit score and the GNP per capita of importing countries and to determine the existence of multicollinearity. The results showed that there is a significant positive relationship between the credit score and the GNP per capita of the importing countries. Also, the results showed symptoms of multicollinearity when the GNP per capita was included together with the credit score as explanatory variables of the export values per capita of the importing countries. The inclusion of GNP per capita helps improving the values of R^2 but makes the estimated coefficients smaller and not significantly different from zero.

5. www.strategis.ic.gc.ca/

6. The categorization of these importing countries is followed from the report of the IMF in which the Development Assistance Committee of the OEDC categorized developing countries in deciding financial aids.

7. Similar procedure of the cross-country analysis was also performed for the available data in which the three countries export to. There were 35, 37, and 38 countries that Australia, Canada, and United States export to, respectively. The significant results indicate that the estimated coefficients of the dummy variable representing the low-income countries are significantly different from zero at 5% level for both Canadian and American export values and is significantly different from zero at the 10% level for Australian export values. This also indicates that these three exporting countries have a negative bias against the low-income countries.

8. It is also known as the "Gentleman's Agreement" in which twenty-two participants that represent member countries of the Organization for Economic Cooperation and

Development (OECD) negotiate a set of rules regarding to the use of export credit subsidies. OECD (1998) describes more detail about the Arrangement.

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Table 1: A Summary of Canadian Agricultural and All Goods Exporting to Various Importing Countries

	Agricultural Goods	All Goods
Number of Observations	118	156
Mean of Credit Score (CS)	43.68	37.91
Highest of CS	98.90	98.90
Lowest of CS	4.94	4.94
Standard Deviation of CS	28.47	27.56
Mean of Export Values* (EV)	1.77	17.88
Standard Deviation of EV	3.13	60.16
Mean of GNP*	6999.7	5735.00
Standard Deviation of GNP	10054.0	9233.8

*The unit is measured as per capita of the importing countries.

Table 2: A Summary of Cross Exporting Country Comparison the Relationship Between Credit Scores and Export Values Per Capita of Common Importing Countries

	Canada	U.S.A.	Australia
Number of Observations	22	22	22
Mean of Credit Score (CS)	68.09	68.09	68.09
Highest of CS	97.06	97.06	97.06
Lowest of CS	27.20	27.20	27.20
Standard Deviation of CS	26.34	26.34	26.34
Mean of Export Values* (EV)	31.70	460.38	47.07
Standard Deviation of EV	39.45	518.53	75.53
Mean of GNP*	14247.00	14247.00	14247.00
Standard Deviation of GNP	12324.00	12324.00	12324.00

*The unit is measured as per capita of the importing countries.

Table 3: Representative Values of Canadian, American and Australian Export Values Per Capita of Common Importing Countries

Common Importing Countries	Rank	Score	CAN98	USA98	AUS98	GNP98
Germany	1	97.06	21.81	324.61	10.51	26570
Netherlands	2	96.92	79.31	1210.58	36.98	24780
Switzerland	3	96.43	87.63	1020.80	93.61	39980
France (includes Monaco and Andorra)	4	95.87	19.18	307.09	9.88	24210
United Kingdom (U.K.)	5	95.01	49.72	661.56	50.27	21410
Belgium	6	94.25	107.32	1423.19	74.56	25380
Sweden	7	93.39	27.83	431.48	11.74	25580
Spain	8	92.01	9.60	138.80	8.72	14100
Italy (includes Vatican City State)	9	91.10	17.85	156.92	18.75	20090
Japan	10	88.02	44.10	457.91	86.42	32350
Hong Kong	11	75.75	140.97	1932.42	332.55	23660
Korea, South (Dem. Rep.)	12	64.47	51.59	713.75	165.48	8600
Saudi Arabia	13	63.68	10.22	507.50	28.54	6910
China (including Mongolia)	14	47.97	1.165	11.51	1.92	750
South Africa	15	42.03	5.27	89.91	16.31	3310
Malaysia	16	41.89	12.87	403.65	51.79	3670
Thailand	17	41.15	3.16	85.51	13.15	2160
Philippines	18	40.35	1.67	89.61	9.18	1050
India	19	39.01	0.24	3.62	1.38	440
Turkey	20	38.50	2.39	55.36	5.52	3160
Brazil	21	35.94	1.77	91.38	1.58	4630
Indonesia (includes East Timor)	22	27.20	1.69	11.25	6.64	640

Table 4: A Summary of Regression Results For Canadian Agricultural goods and goods from all industries

Dependent Variable	**Estimated Coefficients of Explanatory Variables**					
Log of Export Value Per Capita	**Constant**	**Credit Score**	**Low Income**	**Low-Mid Income**	**Up-Mid Income**	**R^2**
Agricultural goods (18)	-1.809 (1.766)	0.551 (0.387)	-2.217^{S*} (0.743)	-1.152^{S} (0.641)	-0.529 (0.601)	0.3064
Agricultural goods (17)	-5.973^{S*} (0.871)	1.428^{S*} (0.241)				0.2327
Goods from All Industries (18)	-1.251 (0.999)	1.093^{S*} (0.218)	-2.891^{S*} (0.463)	-1.468^{S*} (0.407)	-0.549 (0.380)	0.6820
Goods from All Industries (17)	-6.426^{S*} (0.535)	2.180^{S*} (0.155)				0.5621

Note that the numbers in the parentheses are the standard errors of the corresponding estimated coefficients.
S is referred to being significant different from zero at 10% level of significance.
S* is referred to being significant different from zero at 5% level of significance.
Note that individual test of being zero was performed for each estimated coefficient based on the two rails t-test.

Table 5: A Summary of Cross Exporting Country Comparison of the Relationship Between Credit Scores and Export Values Per Capita of Common Importing Countries

Dependent Variable	***Estimated Coefficients of Explanatory Variables***					
Export Value Per Capita of	**Constant**	**Credit Score**	**Low Income**	**Low-Mid Income**	**Up-Mid Income**	**R^2**
Canadian Exports (18)	-3.765 (5.930)	1.650 (1.309)	-2.438^{S} (1.348)	-1.519 (1.301)	-0.579 (1.023)	0.7469
Canadian Exports (17)	-10.934^{S*} (2.197)	3.230^{S*} (0.528)				0.6516
American Exports (18)	-1.422 (5.337)	1.702 (1.179)	-2.676^{S*} (1.214)	-0.416 (1.171)	0.1953 (0.921)	0.7781
American Exports (17)	-6.234^{S*} (2.472)	2.780^{S*} (0.594)				0.5224
Australian Exports (18)	-2.262 (7.908)	1.281 (1.746)	-1.409 (1.798)	-0.090 (1.735)	0.241 (1.364)	0.3775
Australian Exports (17)	-4.366 (2.711)	1.757^{S*} (0.6517)				0.2665

Note that the numbers in the parentheses are the standard errors of the corresponding estimated coefficients.
S is referred to being significant different from zero at 10% level of significance.
S* is referred to being significant different from zero at 5% level of significance.
Note that individual test of being zero was performed for each estimated coefficient based on the two rails t-test.