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Export Credit Guarantees and Export Performance:
Evidence from Austrian Firm-Level Data

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Abstract: This paper provides an economic assessment of export credit guarantee commitments by the Austrian export credit agency, using firm-level data on a cross-section of 178 Austrian exporting firms for the year 2008. In a first step, we estimate the relative importance of various determinants of export guarantee usage. Results suggest that the most crucial determinants are: firm size, whether or not the firm is part of a multinational enterprise, exposure to revenue risk, and R&D intensity. In a second step, we investigate the effects of export guarantees on export performance. Identification is achieved by using as instruments the exogenous determinants of export guarantee usage identified in the first step. We find that there are economically and statistically significant effects of export credit guarantee usage on firm-specific export performance ranging from some 80 to 100 percent compared with the control group of non-users.

I. Introduction

Public export credit guarantees are an important instrument in financing international trade. While their provision is nowadays highly restricted by international agreements and European economic law, they are still an important policy tool to mitigate the negative trade effects of financial constraints due to market failures such as asymmetric information. The use of export credit guarantees has surged recently as a result of the financial and economic crisis and its detrimental effects on international trade. New commitments by export credit agencies expanded between 30 and 50 percent up to mid-2009, increasing the share of covered world trade from 8 percent in 2008 towards 9 percent by mid-2009 (OECD, 2009; Asmundson et al., 2011).

The increased use of export credit guarantees raises the question of their effectiveness as a tool for promoting international competitiveness and exports. This question has become increasingly relevant in light of the current discussion about reducing global and euro area imbalances. In particular, successful models of export credit guarantees already in place might serve as role models, and provide one means (among others) for countries struggling to reduce their current account deficits.

While there is some evidence on the negative effects of financial constraints on international trade, the role of public export guarantees in supporting export activity is not well researched. Moser et al. (2008) use a dynamic macro-panel for German export flows, disaggregated by receiving country, to estimate the effect of the German programme, while Egger and Url (2006) analyze a static macro-panel, with Austrian export flows disaggregated by receiving country and kind of activity. Both studies find that political risk has a detrimental effect on international trade. Furthermore, export credit guarantees lead to a more than proportional increase in exports, i.e., guaranteed exports create follow-up deliveries without cover by an export credit agency.

To the best of our knowledge this paper is the first one to provide firm-level evidence on the trade effect of public export credit guarantees. In particular, we present evidence on i) the determinants of firms' use of export credit guarantees provided by the Austrian export credit agency (Oesterreichische Kontrollbank AG), and ii) the effects of Austrian export credit guarantees on firms' exports. We use a new data set of 178 Austrian firms from year 2008, which is particularly well suited to our subject. First, the data set enables us to exclude intra-firm trade, for which export guarantees have been shown to be more or less irrelevant (Chauffour and Farole, 2009). Thus we can focus on extra-firm trade, where information asymmetries are potentially important. Second, the sample is mainly made up of small and medium-sized enterprises, where the effects of financial constraints are expected to be most severe, and where export guarantees can be expected to play a strong role (Chauffour and Farole, 2009). Based on information about various firm characteristics, we provide – in a first stage – an assessment of the determinants of the firms' export guarantee usage. In a second

stage, we estimate the effect of export credit guarantees on (extra-firm) trade exports. To address endogeneity concerns due to reverse causality – for a given firm size, a high export level increases the likelihood of export guarantees usage – we estimate the trade effects by two-stage least squares, using as instruments the (exogenous) determinants of export guarantees identified in the first stage.

We find that large firms with a high risk exposure and high R&D intensity are more likely to make use of public export credit guarantees. On the other hand, being part of a multinational enterprise (MNE) reduces the incentive to use them, suggesting that international integration of firms is also a means of reducing information asymmetries. Moreover, we find a sizeable, economically and statistically significant effect of export credit guarantees on extra-firm exports, ranging from some 80 to 100 percent.

The remainder of the paper is organized as follows. Section II provides a survey of the recent literature on export guarantees, financial constraints, and international trade in light of the recent financial and economic crisis. Section III presents the data and some stylized facts on the use of export credit guarantees provided by the Austrian export credit agency (Oesterreichische Kontrollbank AG). Section IV motivates and sets up the empirical models regarding i) the determinants of export guarantee usage, and ii) the trade effects of export guarantees, and presents the estimation results. Section V summarizes the results and concludes.

II. Export Guarantees, Financial Constraints, and Exports: A Brief Survey of the Literature

1. Modes of Trade Finance

Cash payments are rare in international transactions. Various financial instruments have emerged as substitutes for the lack of face-to-face cash transactions between suppliers and customers in international trade. Trade finance usually assumes the form of open account finance, which covered between 38 and 45 percent of global merchandise trade in 2008 (Asmundson et al., 2011). In this case the exporter directly extends credit to the importer and thus bears the credit risk and the burden to provide liquidity to the counterparty.

Alternatively, exporters may resort to cash-in-advance payment by the foreign customer, thereby shifting the risk of delivery to the importer who then faces the task of providing the liquidity for the transaction. According to estimates by the International Monetary Fund, cash-in-advance arrangements covered around one fifth of global merchandise trade in 2008 (Asmundson et al., 2011).

Finally, firms may use bank-intermediated trade finance rather than directly offering credit. A common instrument is the guarantee of a bank for payment after delivery of the goods (letter of credit). Alternatively, banks may provide liquidity before, during, and after the shipment of the product. A service widely used by exporters is supply chain financing or factoring, where the bank provides the working capital to the exporter and purchases the accounts receivable resulting from the trade at a discount. Banks also provide non-banking services, like export credit insurance, book-keeping, and handling trading and delivery documents. Bank-intermediated trade finance covered another 35 to 40 percent of global merchandise trade in 2008 (Asmundson et al., 2011).

2. Trade Finance During Periods of Economic Crises
During the fourth quarter of 2008 international trade contracted sharply. This gave rise to several public policy interventions to bolster trade finance. The rapid policy response, driven by concerns about the spread of the growing liquidity crunch in the money market towards the provision of inter-firm trade credit, led to a G20 agreement on a package at their April 2009 meeting in London (G20, 2009) to ensure sufficient additional capacity for trade finance to support $250 billion of trade over the 2009-2010 period.

Rapidly growing country and counterparty risks had previously been seen in financial crises in the late 1990s and early 2000s. At those times local banks in Thailand, Korea, Pakistan, Argentina, and other emerging countries faced opaque and intertwined liquidity and solvency problems that resulted in a substantial loss of credibility. International banks reportedly refused to confirm or underwrite letters of credit opened by local banks because of a general reduction in country credit ratings by rating agencies (Ferri et al., 1999) and a simultaneous loss of confidence in the respective local banking systems. At the same time trade volumes declined substantially (Auboin and Meier-Ewert, 2003).

Amiti and Weinstein (2009) argue that exports are more sensitive to financial frictions than domestic sales because a larger portion of export sales is on open account. Based on this evidence, Ahn et al. (2011) find that during 2008 US exports declined more steeply in sectors with greater financial dependence. Feenstra et al. (2011) and Manova et al. (2011) also find that the financial crisis had a sizeable negative impact on Chinese exports.

Cross border trade credit is more risky compared to conventional loans for physical investment or for buying working capital because there are additional macro-level risks, e.g., exchange rate fluctuations, political risks, and counterparty risks resulting from difficulties in gathering information about the trading partner and enforcing repayment in a foreign jurisdiction. This friction is even more pronounced during a financial crisis as the credibility of commitments by the foreign trading partners and banks is eroded by increased levels of asymmetric information. A recent World Bank study reports substantially higher costs, and

even a lack of trade finance, after the onset of the financial crisis in the second half of 2008, in particular for small and medium-sized exporters located in emerging markets (Chauffour and Farole, 2009).

3. The Role of Public Export Credit Guarantees

Public export credit guarantees are a policy instrument used to alleviate trade frictions arising from difficulties in financing export flows. Due to the possibility of hidden export subsidies, the provision of public export credit guarantees is highly restricted by international agreements (Knaepen, 1998) and EU law (EU Council Directive 98/29/EC). Exporters can get insurance against the consequences of non-payment of their receivables only if they face non-marketable risks, i.e., risks are restricted to higher-risk export markets, comprising essentially emerging and developing countries, and for open account terms with payment periods of more than two years.

Usually, guarantees by export credit agencies are fully backed by the government. Public guarantees are provided either directly, by public entities, or indirectly, by a private bank or an insurance company on behalf of the government. Export credit guarantees are most relevant for open account transactions as the risk of payment by the foreign importer lies fully with the exporting firm, but they also cover the risk for banks resulting from the issuance of letters of credit. Asmundson et al. (2011) estimate that in 2008 around 18 to 25 percent of outstanding open account transactions (around 8 percent of total world trade) were covered by export credit guarantees.. The protection against losses from non-payment is subject to insurance premiums that are supposed to cover the expected loss of the credit agency. Under the perfect market assumptions, higher risk will be reflected in a higher premium for export credit insurance. Yet under asymmetric information, the effect of increased premiums on the composition of the insurance pool is similar to the effect of higher interest rates on the composition of debtors in the credit portfolio of a bank: a higher interest rate crowds out good risks (Stiglitz and Weiss, 1981). Export credit insurers thus will start to refuse to underwrite those risks thought to be particularly prone to losses rather than increasing insurance premiums (Rothschild and Stiglitz, 1976).

Public export credit agencies may overcome this quantity restriction by providing export credit guarantees, thereby promoting trade that might otherwise not occur due to lack of financing. An OECD (2009) survey among the 31 participants in the arrangement on officially guaranteed export credits shows that new commitments expanded between 30 and 50 percent during the financial crisis. As a consequence, the share of world trade covered by public export credit guarantees increased from 8 percent in 2008 to 9 percent in 2009.[1]

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[1] OECD (2009) and Asmundson et al. (2011) provide a detailed list of expansionary steps by export credit agencies during the financial crisis.

Theories of trade credit motivate their existence as a mechanism for easing access to finance for credit-constrained buyers. For example, sellers may have informational advantages over banks in assessing the risk of default by the buyer (Smith, 1987; Brennan et al., 1988). The seller may also have better access to the collateral and better ability to convert it into money (Petersen and Rajan, 1997) or sellers may use receivables as collateral for bank credit and thus simultaneously improve access to finance for both the seller and the buyer (Burkart and Ellingsen, 2004). For a sample of Belgian firms, Deloof and Overfelt (2011) suggest that trade credit was a tool for channelling funds from firms with close banking ties to other firms during the pre-World War I period. Love et al. (2007) provide evidence that bank credit was substituted by trade credit during the 1997 Asian financial market crisis.

Besides purely financial reasoning, the provision of trade credit allows firms to add features to their products' characteristics, which may help to secure long-term trading relations with customers by providing financial services; moreover, it also facilitates price discrimination between customers (Giannetti et al., 2011). Trade credit may also be used to reduce the seller's inventory holding costs by providing the buyer with a subsidy (Daripa and Nilsen, 2011). Finally, trade credit provides a credible signal of high quality products and services because the buyer has the opportunity to delay payment until a successful verification or a resale is accomplished (Lee and Stowe, 1993). Based on a sample of 56 large buyers, Klapper et al. (2011) find evidence in favor of the warranty motive.

4. Trade Effects of Export Credit Guarantees
Regarding their effects on international trade, export credit guarantees can be informally thought of as a reduction in both fixed and variable trade costs, which would imply an increase both at the extensive and the intensive margins of international trade in standard new trade theory models with heterogeneous firms (Melitz, 2003).

Recent work (Manova, 2008) explicitly introduces credit constraints into the Melitz (2003) type heterogeneous firms model, thereby creating an interaction between firm heterogeneity and financial constraints. This interaction reinforces the selection of only the most productive firms into export activities. For technological reasons, exporters in this model have to finance different shares of their export costs externally, and firms vary with respect to the amount of tangible capital they can put forward as collateral. This differentiation depends upon the kind of activity. Furthermore, better developed domestic financial markets mitigate restrictions on external finance as they make the enforcement of financial contracts easier. The model predicts that the productivity cut-off varies over countries according to the development of the domestic financial sector and across industries according to their need for external finance and their ability to pledge tangible capital as collateral.

In a two-stage estimation Manova (2008) finds that credit constraints reduce firm-level exports of US firms, limit export product variety, and increase product churning for countries with less developed financial markets. Bellone et al. (2010) link financial factors to firms' export behavior in a set of French manufacturers. In addition to differences in productivity, heterogeneity in financial constraints helps to explain the selection of firms into exporters and non-exporters.

Summing up, there are strong theoretical reasons, along with some empirical evidence, to assume that public export credit guarantees help to overcome market failures related to asymmetric information by providing insurance where no private markets exist. They thereby mitigate financial constraints, facilitate the provision of trade credit by exporters to their customers, and reduce uncertainty and trade costs, such that one would expect an effective system of public export credit guarantees to promote international trade both at the extensive and intensive margin. In the next section, we will take up this hypothesis, using a sample of 178 Austrian firms, and test for the effects of export credit guarantees on export performance.

III. Data and Descriptive Statistics

Before turning to the econometric analysis of the determinants and effects of export credit guarantees, we provide a short description of the dataset. The data are from a survey among Austrian firms conducted in June 2009 and refer to activities in the last completed business year of the respective firm at that date. The questionnaire asks (among other things) for general management ratios, employment figures, measures of human capital, research and development activities, measures of export activity, and information on the use of export guarantees.

The firms' identities for a part of the sample were provided by the Oesterreichische Kontrollbank (OeKB), the Austrian export credit agency. This part of the sample is made up of the OeKB's recent users of export credit guarantees. To this sample of users we added a control group of firms not using export credit guarantees, which were matched by firm size (based upon the number of employees) and kind of activity (NACE1) to the sample of users. The questionnaire was sent out by the Austrian Institute of Economic Research on behalf of the Ministry of Finance to 832 firms. A reminder specifically targeted to firms active within classifications that showed low response rates during the first four weeks of the survey helped to achieve a balanced sample.

A total of 252 firms responded to the questionnaire, of which 221 firms indicated export activities. About half of the exporting firms (104) acknowledged at least a one-time use of export credit guarantees in the past. Due to incomplete answers we can use only 178 observations in the econometric analysis of the determinants of export guarantees. In the analysis of the trade effects of export guarantees, which is more data-demanding and uses a

larger set of variables, the sample is further reduced to 71 firms. In this section, we refer to the two samples of 178 and 71 firms as the full and reduced sample, respectively. Table 1 provides a list of the key variables and summary statistics.

< Table 1 here >

Firms were asked to supply information on total exports, total sales (*SALES*), the share of exports in their sales, and the share of intra-firm exports to own foreign subsidiaries. This information allows us to calculate, for the reduced sample of 71 firms, the value of extra-firm exports (*EXP*), defined as exports excluding deliveries to own subsidiaries. The upper panel of Table 1 gives summary statistics for the full sample of 178 firms. Their average sales amount to €101 million, but this measure is clearly upward biased, as can be seen by the comparatively low median value of €28.8 million. Hence, most of the firms in our sample belong to the group of small and medium-sized enterprises according to the Eurostat classification. Around half of the firms used export credit guarantees (D^G) in the recent past and some 30 percent belong to a multinational enterprise (D^{MNE}). Average spending on R&D as a share of sales (*RD*) amounted to 5 percent in our sample. This value exaggerates innovative activity because the median in the sample is at 2 percent. The lower panel in Table 1 presents the same summary statistics for the reduced sample of those firms, which also provided information on intra-firm trade (and all required explanatory variables). Compared with the full sample, firms in this sub-sample are bigger, use export guarantees more often, and belong to a MNE less often.

We also measure firm-specific revenue risk from providing international trade credit by aggregating country specific credit rankings, from the *Institutional Investor* for the year 2008, into regional risk measures[2]. Our survey provides information on the share of exports to three regions: i) industrialized countries (EU27, NAFTA, USA, CAN, and NZL), ii) Southeastern Europe and Commonwealth of Independent States (CIS), and iii) the rest of world. From the perspective of an Austrian firm, regions outside the European Union exhibit a higher risk with regard to actually getting payment for outstanding receivables. We construct firm-specific risk measures in two steps. We start from country-specific credit ratings and compute weighted averages for the three regions using Austria's export shares to these countries.[3] The corresponding measures for the three regions are -0.63 (EU27, etc.), -0.141 (Southeastern Europe and CIS), and -0.067 (rest of the world). In a second step, we use firm-specific information from our survey about the distribution of the firm's exports across those three regions and aggregate the regional credit ratings from the first step into a trade-share-

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[2] The country credit ratings provided by the Institutional Investor range from 0 to 100 and are decreasing in country risk. The ratings reflect global and national economic conditions, the public policy stance and general political risks. To obtain a more intuitive definition of our risk measure, we multiply the indices by -1/100, so that they are defined over a range from -1 to 0 and increasing in risk.

[3] As an alternative to calculate the aggregate risk measures for the three country groups, we used GDP shares of the destination countries as weights and obtained very similar results.

weighted, firm-specific risk measure. The full and the reduced sample in the upper and lower panel of Table 1 are highly similar with respect to the riskiness of exports.

< Table 2 here >

A rough look at the data shows that firms with high export volumes are above average users of export credit guarantees. In the survey their exports accounted for 62 percent of the total export volume declared. On the other hand, Austrian subsidiaries of a multinational enterprise (MNE) tend to use export guarantees less often; only a quarter of MNE-subsidiaries in the sample use Austrian export credit guarantees. This is also reflected in the unconditional correlations in Table 2. A comparison with respect to R&D expenditures reveals that export guarantees users range neither low nor high among the firms in our sample. As expected, there is a positive correlation between size and export volume. Finally, we observe a sizeable positive correlation between the dummy variable for users of export credit guarantees and the (log of) extra-firm exports.

IV. Empirical Model and Estimation Results

1. Determinants of Export Credit Guarantee Usage
In a first step, we assess the importance of alternative determinants of the likelihood for export credit guarantee usage. As a micro-economic motivation consider the following probit model

$$\mathrm{P}(D_i^G = 1 | \mathbf{X}_i) = \mathfrak{F}(\mathbf{X}_i \boldsymbol{\lambda}), \tag{1}$$

where i is the (cross-sectional) firm index, D_i^G is a dummy variable, taking a value of 1 if the firm has used an export credit guarantee[4], $\mathbf{X}_i$ is the regressor matrix, and $\mathfrak{F}$ is the cumulative density function (cdf) of the standard normal distribution. Underlying the specification in (1) is the latent variable model

$$G_i = \mathbf{X}_i \boldsymbol{\lambda} + \upsilon_i, \tag{2}$$

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[4] Since there are hardly firms in our sample that used export guarantees a 'long time ago' but not over recent years, we have a rather clear-cut distinction between 'users' and 'non-users' such that we do not take into account the time period when the export guarantee was used. To be more precise, 45 of the 71 firms (used in the regression of export performance on export guarantees below) are 'users', and the distribution of firms with respect to the last year of use is as follows: 1999:1, 2000:1, 2003:2, 2004:1, 2005:1, 2006:2, 2007:3, 2008:13, 2009: 21.

where the unobserved variable G_i represents the net benefit from the use of export credit guarantees. Obviously, if the net benefit of an export credit guarantee is positive ($G_i > 0$), firm i will make use of it, and the variable D_i^G takes a value of 1. Otherwise, for $G_i \leq 0$, the variable D_i^G takes a value of 0. Assuming that the error term υ is standard normally distributed, this yields the probit specification given in equation (1) (see Wooldridge, 2010, pp. 565). As an approximation of equation (1), we will also consider the linear probability model

$$D_i^G = \mathbf{X}_i \boldsymbol{\lambda} + u_i .$$ (3)

In light of the micro-economic motivation outlined above, we hypothesize that the regressor matrix **X** includes the following set of variables:

First, since use of export credit guarantees is associated with fixed costs in terms of effort, administrative procedures, and costs of obtaining information, it is plausible to assume that these costs are less relevant for larger firms. Hence, a key variable used in the regression is firm size, which we measure in terms of (the natural log) of annual sales (*SALES*).

Second, given that guarantees are used to reduce risk, in particular non-marketable risk, we argue that being part of a multinational enterprise (MNE) reduces the need for (and thus the likelihood of) using export credit guarantees due to intra-firm information flows and improved access to information on foreign markets and trading partners. Hence, we include a dummy variable, taking a value of 1, if the respective firm is part of an MNE and zero otherwise (D^{MNE}).

Third, we expect firm-specific risk exposure (*RISK*) related to export destinations to be an important determinant of the likelihood of using export credit guarantees. Ideally, one could use a measure of non-marketable risks; in light of data-availability, we have to resort to the firm-specific risk measure developed in section III. We expect that this measure also, to some extent, captures the fact that the use of export credit guarantees is legally restricted by OECD agreements and EU law for most exports into the lowest-risk region of industrialized countries (EU-27, etc.).

Finally, to account for differences among firms' need for external finance and their ability to pledge tangible capital as collateral across different sectors (Manova, 2008), we include five industry dummies at the NACE 1-digit level.

In our view, these variables of our dataset have the strongest theoretical motivation for being included in model (1). To make the best use of the data, however, we also explore the

relevance of a range of further variables, namely: human capital in terms of the share of employees with a certain level of education (five categories, ranging from primary schooling to university degree), R&D expenditures as a share of sales, a dummy variable reflecting whether the firm has foreign equity holdings, the share of intermediates in sales, and the shares of intermediates sourced domestically or abroad.

Table 3 reports the estimation results, based on a sample of 178 exporting firms, for which data on the variables used in equation (1) is available. We start from a linear probability model as given by equation (3), using firm size (*SALES*) as a single explanatory variable. Then we include, as additional regressors, the dummy for being part of an MNE (D^{MNE}) and the firm-specific exposure on export markets (*RISK*). As can be seen from the results in columns (1) to (3), each of the variables is significant at conventional levels and adds a non-negligible amount to the explanatory power of the model in column (3), which amounts to 0.219 in terms of the R^2.

< Table 3 here >

All the variables show the expected sign: Larger firms are more likely to make use of export credit guarantees; doubling firm size increases the probability of export credit guarantee usage by some 10 percentage points. Being part of an MNE reduces the likelihood of export credit guarantee usage by 30 percentage points. Finally, higher risk is associated with a higher likelihood of making use of export credit guarantees. To give an economic interpretation to the coefficient of *RISK*, note that the maximum (minimum) of the variable *RISK* in our sample is -0.07 (-0.63), the mean is -0.46, and the standard deviation is 0.18. Hence, an increase in *RISK* by one standard deviation increases the likelihood of export credit guarantee usage by 12.4 percentage points.

As outlined above, we explored a wide range of other variables as possible determinants. However, of these sets of variables only the research and development ratio (*RD*) turned out to have a significant effect; results are reported in column (4) and point to a positive effect on the likelihood of using a guarantee amounting to 0.87 percentage points for a 1 percentage point increase in the R&D ratio. Given that size and risk is controlled for in the regression, the mechanism through which R&D affects export credit guarantee use is not entirely clear; one possible interpretation would be that technologically more advanced firms have a higher success ratio in attracting export credit guarantees.

The final column (5a) reports the probit estimates of the preferred specification in column (4). As evident from column (5b), which shows the average partial effects implied by the estimates in column (5a), results are very close to those of the linear probability model, both in terms of statistical and economic significance. This also holds true for the specifications in

columns (1) to (3), which, for the sake of brevity, show the results of the linear probability model only.

2. Export Credit Guarantees and Export Performance

Having provided an assessment of the determinants of export credit guarantee use, we go on to estimate the effect of export credit guarantees on export performance, using the following baseline specification:

$$\ln EXP_i = \gamma_0 + \gamma_1 \ln SALES_i + \gamma_2 D_i^G + \eta_j + \varepsilon_i. \tag{4}$$

The dependent variable (*EXP*) is given by (the natural log of) firm *i*'s extra-firm exports, i.e., total exports, excluding intra-firm trade in the form of exports to their own subsidiaries. As outlined above, export credit guarantees play essentially no role in the intra-firm trade (Chauffour and Farole, 2009). For the present sample of firms used in the estimation of equation (4), the average share of exports to own subsidiaries amounts to some 20 percent.

The parsimonious specification in (4) includes firm size (*SALES*) as the only control variable. In this respect it is worth emphasizing that equation (4) is a cross-sectional model, and that the dependent variable is defined as (extra-firm) exports of firm *i* (located in Austria) to the world.[5] Hence, firm-invariant variables specific to the country of origin (Austria) and the 'country' of destination (the world) are captured by the constant. Moreover, firm-invariant but industry-specific variables are controlled for by the industry fixed effects (η_j), which are included in all regressions.

Note that even for a given firm size, the likelihood of making use of export credit guarantees may depend on the level of exports. In order to address these endogeneity concerns, we re-estimate equation (1) by two-stage least squares (2SLS), using as instruments the (exogenous) determinants of export credit guarantee usage identified in section IV.1. Table 4 reports the estimates of model (4) and extended versions thereof, using a sample of 71 exporting firms, for which data on the regressors, instruments as well as exports to non-subsidiaries (required to calculate extra-firm trade) are available. The least squares results in column (1) point to a significant and sizeable effect of guarantees on export performance, amounting to some 100 percent. Column (1b) reports the 2SLS estimates of equation (1), using D^{MNE}, *RISK*, and *RD* as instruments. Hence, our identifying assumption is that i) being part of an MNE has no effect on export performance (to other firms), ii) risk exposure has no effect on exports, once export credit guarantee usage has been controlled for, and iii) the R&D intensity has no systematic effect on export performance.

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[5] Our data set comprises no bilateral trade data. For a subset of countries, export shares to the three regions mentioned above are available. Some results of region-specific regressions will be discussed below.

<Table 4 here >

The 2SLS estimates indicate an even larger effect of export credit guarantees of 126 percent. Instrument quality is satisfactory with an F-statistic of excluding the instruments from the first stage regression amounting to 12.1.[6] Overall there is no strong evidence for endogeneity of export credit guarantees with a *p*-value of 0.798 for the Hausman test. Also note that neither the test for over-identifying restrictions (OID), nor the Eichenbaum, Hansen, and Singleton (1988) orthogonality tests for each single variable (EHS) reject the null of valid instruments.

In light of the fact that there is no strong evidence of endogeneity and given that – in all specifications – the 2SLS estimates turned out to be larger than the LS estimates, we focus on the least squares estimates in the following for conservativeness and interpret the estimated effects as a lower bound. To explore the sensitivity of the results we include as additional regressors the variables D^{MNE}, *RISK*, and *RD* respectively, to see whether there is evidence of a significant effect of these variables in the second stage regression. Results are reported in columns (2) to (4). Neither of the variables turns out to be significant, and the effect of export credit guarantees is virtually unaffected in the regressions.

The fact that research and development does not affect exports is somewhat surprising. Although our instrument diagnostics indicate no misspecification, we re-estimated the specification in column (1b) excluding *RD* as an instrument from the 2SLS regression. This additional robustness check reduces the instrument quality and standard errors increase, but the effect of export guarantees (D^G) on export performance remains significant at the 10 percent level with an even higher coefficient of 1.405.

Finally, restricting our attention to the least squares estimates allows us to slightly increase our sample to 81 observations by including the firms on which data for (some of) the instrumental variables are unavailable. The estimates of the preferred specification for this extended sample, which are reported in column (5), are consistent with our previous findings.

Another interesting result (not reported in the table) emerges from the estimation of our preferred specification in column (5) for exports to each of the three regions (industrialized; Southeastern Europe; rest of world) separately. However, results are not directly comparable with those in Table 4 since we have to use total exports rather than extra-firm exports (which are not available by region).[7] Re-estimating model (4) with a sample of 99 firms for each

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[6] Stock and Yogo (2005) provide critical values, depending on the number of endogenous variables and the number of instruments, to test the null hypothesis that instrument quality is below one of four pre-specified quality levels, defined in terms of the maximum tolerable size distortion of a conventional Wald test or the maximum tolerable bias relative to OLS. In the present context, the Stock and Yogo test implies that we can reject the null of the instrument quality being below the highest level.

[7] Moreover, the firms in the sample for which data on exports by region are available and the sub-sample for which data on extra-firm exports are available intersect only partly. Finally, some of the exporting firms do not

region separately, we find that the effect of export credit guarantees is insignificant for exports to the group of industrialized countries (EU27, etc.) with a coefficient of -0.042 and a p-value of 0.883 but becomes significant at the 5 percent level for the second region (Southeastern Europe and CIS) with a coefficient of 0.639. It is highest for the third region (rest of world), with a coefficient of 0.826 (statistically significant at the 1 percent level). This reflects the fact discussed above that the use of export credit guarantees is highly restricted for exports to EU but also to other OECD countries through international agreements and EU law. Moreover, it suggests that the effect of export credit guarantees is larger for exports to countries associated with higher credit risk.

Overall, our results suggest a statistically and economically sizeable effect of export credit guarantees on export performance, ranging from 97 to 126 percent. In light of our cross-sectional specification, these estimates should be regarded as long-run equilibrium effects of export credit guarantees. Moreover, if we account for the fact that exports to firms other than own subsidiaries (used in the regression) amount to 80 percent of total exports, the implied effect of export credit guarantees on total exports ranges from 78 to 101 percent.

V. Conclusions

This paper considers the effects of export credit guarantee usage on trade for a new dataset comprising a cross-section of 178 Austrian firms for the year 2008. From a theoretical perspective, export guarantees are expected to foster trade by reducing uncertainty and helping firms to overcome financial constraints.

Against this background, the dataset used in the present paper is particularly well-suited to assess the effects of export guarantees, since i) it is mainly composed of small and medium-sized enterprises, where the effects of financial constraints are expected to be most severe, and ii) it allows us to focus on extra-firm trade, where information asymmetries are potentially important.

In addition, based on information about various firm characteristics, we provide – in a first stage – an assessment of the determinants of the firms' export guarantee usage. This is an interesting question in itself and also allows us to address endogeneity concerns due to reverse causality when estimating the trade effects of export guarantees.

We find that large, stand-alone domestic firms (which are not part of an MNE) with a high R&D intensity and a high risk exposure are most likely to make use of public export credit guarantees. Moreover, we find a sizeable, economically and statistically significant effect of

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export to every region. Hence, we use ln(1+*EXP*) as dependent variable in the export regressions by region, which results in a sample size of 99 firms.

export credit guarantees on extra-firm exports, ranging from about 100 to 130 percent. Related to total exports, i.e., including intra-firm trade, this amounts to an effect between 80 and 100 percent. Our result is in line with findings based on macro-panels, showing a more than proportional effect of export credit guarantees on export volumes.

While the point estimates should not be overemphasized, the results clearly show that export credit guarantees, already covering some 9 percent of world trade, have a non-negligible effect on the integration of the world economy. Moreover, our results indicate that export guarantees are a particularly effective instrument for preventing large slumps in international trade during times of increased uncertainty and mutual distrust. Finally, the results suggest that the Austrian system works well in bolstering export performance. A full assessment of the export credit guarantee system, however, would have to include the programme costs arising from the state-backed guarantee that substitutes for the solvency capital private insurance companies would have to assign for each underwriting. The OECD agreement eliminates incentives to offer indirect subsidies through premiums below the expected value of losses. Consequently, the Austrian export credit guarantee system is balanced in the long run. Nevertheless, market distortions may well result from the non-profit strategy of export credit agencies and the cost advantage of state guarantees over the provision of solvency capital by private investors. On the other hand, the export-promoting effect of guarantees certainly has positive repercussions for output, employment, and general tax revenues. While a full assessment of all these effects is beyond the scope of this paper, a more comprehensive assessment of the costs and benefits of public export credit guarantees is an interesting avenue for future research.

From a policy perspective, further country-specific studies on the functioning of export guarantee systems would be of interest to identify possible differences in their effectiveness. The most effective and efficient systems might then serve as role models for countries struggling with persistent current account deficits or as models for systems that can be activated or extended during periods of severe economic downturn in order to prevent a sharp drop in international trade.

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Table 1. *Summary Statistics of the Key Variables*

Variable	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis
			Full sample (178 firms)				
D^G	0.49	0.00	1.00	0.00	0.50	0.02	1.00
ln *SALES*	10.31	10.27	14.45	6.42	1.57	0.09	2.87
SALES	101331	28794	1888733	615	230564	5.12	34.44
D^{MNE}	0.29	0.00	1.00	0.00	0.45	0.94	1.89
RISK	-0.46	-0.53	-0.63	-0.07	0.18	0.96	2.56
RD	0.05	0.02	0.73	0.00	0.09	4.28	26.09
			Reduced sample (71 firms)				
Exports (total)	117716	36612	1888733	480	263418	4.86	30.75
EXP	70483	24846	720086	475	120698	3.25	15.33
ln *EXP*	10.02	10.12	13.49	6.16	1.67	-0.19	2.57
D^G	0.63	1.00	1.00	0.00	0.49	-0.56	1.31
SALES	170866	55801	1888733	1300	335068	3.55	16.38
ln *SALES*	10.95	10.93	14.45	7.17	1.48	0.14	2.94
D^{MNE}	-0.24	-0.00	1.00	0.00	0.43	1.22	2.49
RISK	-0.47	-0.53	-0.63	-0.10	0.16	0.89	2.54
RD	0.05	0.02	0.51	0.00	0.09	3.55	16.50

Notes: Source is a survey by the Austrian Institute of Economic Research (WIFO) among Austrian firms. Variable definitions: D^G is a dummy variable, taking a value of 1 if the respective firm has used an export credit guarantee in the recent past. Firms' sales are given in millions of Euros. D^{MNE} is a dummy variable, taking a value of 1 if the respective firm is part of a multinational enterprise. *RISK* is a firm-specific index of revenue risk in exports, which is defined over a range from -1 to 0 and increasing in risk (see the definition above). *RD* is the ratio of expenditures for research as development to sales. *EXP* are extra-firm exports, defined as a firm's total exports excluding deliveries to own subsidiaries.

Table 2. *Correlation Matrix*

	Exports	*EXP*	ln*EXP*	D^G	*SALES*	ln*SALES*	D^{MNE}	*RISK*
EXP	0.57							
ln *EXP*	0.47	0.72						
D^G	0.04	0.27	0.52					
SALES	0.87	0.56	0.45	0.03				
ln *SALES*	0.63	0.63	0.74	0.36	0.73			
D^{MNE}	0.42	0.34	0.17	-0.19	0.50	0.41		
RISK	-0.07	0.06	-0.02	0.13	-0.13	-0.12	-0.01	
RD	-0.01	0.02	0.05	0.21	0.03	-0.03	-0.12	-0.11

Notes: See Table 1. Reduced sample of 71 exporting firms.

Table 3. *Determinants of Export Credit Guarantee Usage*

	(1) LS	(2) LS	(3) LS	(4) LS	(5a) Probit	(5b) APE
Constant	-0.410* (0.246)	-0.695*** (0.256)	-0.472* (0.262)	-0.576** (0.264)	-2.477** (1.153)	-0.782
ln *SALES*	0.085*** (0.024)	0.121*** (0.026)	0.128*** (0.024)	0.134*** (0.024)	0.421*** (0.083)	0.133
D^{MNE}		-0.286*** (0.089)	-0.293*** (0.087)	-0.296*** (0.084)	-0.941*** (0.261)	-0.297
RISK			0.716*** (0.212)	0.778*** (0.215)	2.408*** (0.616)	0.760
RD				0.869** (0.344)	2.929** (1.239)	0.924
R^2	0.107	0.160	0.219	0.243	0.195[a]	0.238[b]
SEE	0.482	0.469	0.453	0.448	0.448	0.448

Notes:
Dependent variable is export credit guarantees usage (D^G).
*, **, *** indicate significance at the 10, 5, 1 percent level.
All models are based on a cross-section of 178 exporting firms for the year 2008 and include 5 industry dummies (at the NACE1 digit level).
Heteroskedasticity-robust standard errors in parentheses.
Column (5b) reports the average partial effects (APE) of the probit estimates in column (5a).
[a] Pseudo R^2,
[b] Squared correlation between actual and predicted values.

Table 4. *Export Credit Guarantee Usage and Export Performance*

	(1a) LS	(1b) 2SLS	(2) LS	(3) LS	(4) LS	(5) LS
constant	1.511 (0.979)	1.640* (0.947)	1.229 (1.407)	1.513 (1.027)	1.542 (0.990)	1.007 (0.851)
ln *SALES*	0.721*** (0.101)	0.702*** (0.099)	0.753*** (0.153)	0.722*** (0.103)	0.718*** (0.102)	0.762*** (0.090)
D^{G}	1.080*** (0.304)	1.261** (0.580)	1.013** (0.409)	1.079*** (0.334)	1.097*** (0.309)	0.971*** (0.265)
D^{MNE}			-0.206 (0.508)			
RISK				-0.008 (0.974)		
RD					-0.331 (0.650)	
R^{2}	0.655	0.653$^{a)}$	0.657	0.655	0.656	0.679
SEE	1.033	1.036	1.038	1.041	1.041	1.013
obs	71	71	71	71	71	81

Notes:
Dependent variable is extra-firm exports (ln *EXP*).
*, **, *** indicate significance at the 10, 5, 1 percent level.
Heteroskedasticity-robust standard errors in parentheses.
All models are based on a cross-section of 71 exporting firms for the year 2008 and include 5 industry dummies (at the NACE1 digit level).
$^{a)}$ Squared correlation between actual and predicted values.
Instrument diagnostics for column (1b): F-stat. on excluding instruments from first stage regression: 12.098. Hausman test (*p*-value): 0.798. OID test (*p*-value): 0.586. EHS-orthogonality test (Eichenbaum et al., 1998) of D^{MNE}, *RISK*, and *RD* respectively (p-values): 0.611, 0.906, 0.630.