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**Institutions for Non-Simultaneous Exchange:
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Institutions for Non-Simultaneous Exchange: Microeconomic Evidence from Export Insurance

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Abstract

Information frictions make non-simultaneous exchange risky, particularly across borders. Therefore, many countries insure cross-border exchange. We investigate the effects on firm trade, jobs, value added and productivity, using uniquely detailed, comprehensive and longitudinal transaction-level Swedish data on insurance and granular data on exporters and foreign buyers. For identification, we employ matching and difference-in-difference and fuzzy regression discontinuity estimators and exploit a quasi-natural experiment. We find strikingly heterogeneous effects across firm size and response variables. The strongest positive effects are for small traders and new users. Overall, the evidence suggests a causal link from export insurance to firm performance.

Keywords: Information friction, Institutions, Export insurance, Credit constraints, Trade, Firm performance

JEL Codes: D22, F14, F36, G28, G32, H81, L25.

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1. INTRODUCTION

Non-simultaneous exchange is intimately associated with the issue of who is to bear the risk of default. Is it the seller by extending credit or the buyer by paying in advance? Information frictions are at the heart of this problem. Local self-governing communities can overcome such frictions through monitoring and punishment of opportunistic behaviour but such arrangements are less viable for long-distant impersonal exchange (Ostrom, 1990, Dixit, 2003, North, 1991). Therefore, throughout most of human history, traders have travelled to carry out the trade themselves, sent kin or used specialised middlemen and relied on a web of arrangements for contract enforcement, including force.¹ Still today, information frictions constitute substantial barriers for cross-border trade. The information frictions are similar in magnitude to transport costs (Allen, 2012).

In this paper, we investigate the role of institutions for non-simultaneous exchange by analysing the historically relatively novel and academically relatively neglected phenomenon of government-backed insurance for cross-border exchange. After World War I, several countries, including the pioneer of the United Kingdom (1919), independently established export credit agencies (Greene, 1965, Dietrich, 1935, Aldcroft, 1962). By acting as a “guarantor of last resort”, the institutions were to facilitate non-simultaneous commercial exchange across borders. The ultimate purpose was to promote exports and jobs. Today, export credit agencies exist in scores of countries. In 2017, governments backed-up about USD 1 trillion of new export insurance (Berne Union, 2018).² Despite the substantial amounts involved and the risks of such interventions distorting markets, research is scarce on the effects of this institution.³ Less than a dozen countries have been studied and primarily using macro-level

¹In late medieval times, a community responsibility system emerged in Europe and facilitated impersonal exchange between small and distant geographic entities, but eventually it demised and was replaced with national court systems, which facilitate trade *inside* national borders (Greif, 2006).

²Globally, in 2017, new public and private export insurance amounted to USD 2.3 tn, constituting an 111 percent increase from the value at the onset of the financial crisis. Governments backed approximately 45 percent of this amount, or USD 1 tn.

³Deardorff (2000) discusses conditions for interventions to address cross-border market imperfections. James (2011) provides a critical perspective of such interventions in the form of support from export credit

data.

A main challenge with identifying the effect of export insurance lies with the lack of reliable micro-level data. Empirical investigations using trade finance and export data aggregated to sector or country levels are often contaminated by omitted variables and selection issues. In particular, trade financing is based on criteria that are often linked to firms' financial and trade records.⁴

We tackle this empirical challenge by combining novel, uniquely rich, comprehensive transaction-level longitudinal data on export insurance in Sweden over almost two decades with detailed firm-destination-country panel data on trade as well as with data on exporter and foreign buyer characteristics. We present granular and robust empirical evidence on the effects of export insurance on firms and establish striking heterogeneity of these effects across key dimensions. Export insurance increases the probability that a firm enters a new destination market (the extensive firm-destination-country margin) and increases the value of existing exports to a destination (the intensive firm-destination-country margin). Smaller exporters and foreign buyers benefit considerably more than firms overall in terms of exports. We find effects on jobs, value added and labour productivity to be limited to new users of insurance and to small transactions.⁵ We also examine *how* insurance facilitates foreign trade, distinguishing between reduction in the default risk and in the liquidity constraint, with the reduced default risk being more important.

Our main identification strategy is to carefully match firm and export-destination-country dyads that receive so-called export credit guarantees (treated) with similar firm-destination-country dyads (controls) to account for the fundamental issue of self-selection into treatment. Then, we compare the changes – difference-in-differences (DD) – in the firm-destination and firm performance of treated and control firms while controlling for unobserved time-varying

agencies, in the midst of the debate of the continued existence of the US EXIM bank.

⁴Auboin and Engemann (2014) call for the use of transaction-level data when studying trade finance.

⁵Research on the effects of export insurance across firm size groups is, to the best of our knowledge, absent, despite countries, their export credit agencies and intergovernmental organisations increasingly devoting attention to smaller firms' trade financing, including export insurance.

heterogeneity. Furthermore, we employ a fuzzy regression discontinuity design (FRDD) in a quasi-natural experimental setting where mid-sized firms were as if randomly approached by the Swedish Export Credit Agency. The granular and longitudinal nature of the data also permit the use of falsification tests, such as pseudo-treatment analysis.

There are two reasons why our novel, comprehensive and longitudinal transaction- and firm-destination level data outperform more aggregated data in identifying the effects of guarantees. First, at this level, we can study the detailed linkages among guarantees, firm destinations and firm performance while controlling for confounding factors at the levels of the firm, the industry and the countries involved. Second, export credit guarantees are provided at the transaction level – for a particular firm’s export of a certain product to a specific destination country’s particular buyer – and their direct effects can be expected to be captured more fully at that level. In contrast, estimation at the macro or industry level may attenuate the effects of guarantees.⁶

Studying the microeconomic effects of guarantees not only on firm-destination trade margins but also on jobs and value added is important for several reasons. First, because governments provide firms with guarantees to ultimately promote the public interest, which arguably includes employment and value added, these impacts should be evaluated. Second, the integration of value chains across countries make it pertinent to also analyse the effects of guarantees on other measures of firm performance than exports. Exports may increasingly cover content produced by foreign sub-contractors, decreasing the direct short-term impact of export credit guarantees on domestic jobs and value added. Third, guarantees might promote exports and yet merely redirect exports, why it is motivated to study effects on overall firm performance and across several dimensions. Guarantees could hypothetically simply induce firms to redirect trade from safer to riskier markets – guarantees are available

⁶To a lesser degree, this issue could occur even at the micro level, why firm-destination level data is preferred over firm level data. E.g., consider a firm that exports to many countries but receives guarantees only for a subset of those export transactions. In such a case, the effect on firm performance may be substantially diluted. For a parallel to the export promotion literature, see, e.g., [Munch and Schaur \(2018\)](#).

for the latter and they might offer higher expected profits – and this would divert rather than expand firm sales, leaving overall firm exports and jobs unaffected. Fourth, guarantees may reduce uncertainty about credit access and hence contribute to firm employment (e.g., [Quadrini and Qi, 2018](#)).⁷

In essence, we find the effects of guarantees to be economically substantial but strikingly heterogeneous, for example, across firm sizes, industries and response variables. For firms using export credit guarantees, guarantees subsequently increase the probability of exporting to a foreign market (18 percentage points, pp) and export values (213 pp) but not generally jobs or value added. However, for micro and small firms, the average treatment effects on the treated (*ATT*) in terms of export probability and export values are substantially larger. The effects are also larger for exports to smaller foreign buyers. For first-time users of guarantees for a specific market and for smaller transactions, there is also an impact on value added (7 pp) and jobs (14 pp), respectively, as well as on labour productivity (0.5 pp). Firms in service industries experience a stronger export impact than those in manufacturing industries. Finally, our robustness analyses indicate the importance of controlling for a wide range of characteristics in matching to avoid severely biasing the estimation results.

The substantial effects for smaller firms and less-experienced users of guarantees are in line with our conjecture that guarantees lower firms’ trade costs. Guarantees put firms on a new trajectory and sustain exports. Importantly, the substantial impacts on firm-destination exports are not only contemporaneous but also persist in subsequent years. We interpret this finding to mean that such firms benefit not only from the acquisition of a guarantee for a specific contract but also more generally in exports to that destination – a spillover effect. Additional analysis suggests that the main mechanism from guarantees to firm performance occurs via the reduction in the default risks facing exporters rather than via an improvement of firm liquidity in exports.

⁷The composition of firm exports also matters. A change in the total exports of a firm may affect employment and value added differently depending on any related changes in the firm’s export portfolio.

We contribute to the literature in a number of ways. First, we provide a conceptual framework on the existence and microeconomic effects of government-backed export credit guarantees, thereby deriving conjectures to take to the data. Second, we present what, to the best of our knowledge, is the first causal evidence on the effects of insurance on firm-destination trade margins. We do so by exploiting a comprehensive and finely detailed longitudinal dataset for the years 2000-2015 that also includes the foreign buyers. Third, we provide the first population-based evidence on the firm-level effects on firm employment, value added and labour productivity, while controlling for unobserved confounding factors, using a DD matching estimator with specific effects. Fourth, we are the first to use a quasi-natural experiment – specific direct marketing efforts by the Swedish Export Credit Agency – to more cleanly identify the effects of export insurance, employing a fuzzy regression discontinuity design. Fifth, and last but not least, we provide novel and detailed empirical evidence on the considerably heterogeneous impacts of insurance across important dimensions. In doing so, we contribute to the understanding of both the effects of export insurance on firms and markets as well as the underlying mechanisms.

The remainder of the paper is organised as follows. In Section 2., we summarise previous literature. In Section 3., we conceptually discuss export insurance. In Section 4., we account for and describe our data. In Section 5., we elaborate on our identification strategy. In Section 6., we present, discuss and test our econometric results. In Section 7., we conclude. (Additional statistics and econometric results are provided in the Online Appendix.)

2. PREVIOUS LITERATURE

The literature on the institution of export insurance to which we contribute is small despite the growing interest in the role of trade finance in exports and the prevalence of export credit guarantees. In contrast, there is a substantial body of research on the role of social networks in overcoming information frictions in trade, see, e.g., [Rauch \(2001\)](#), [Rauch and Casella \(2003\)](#) and [Chaney \(2014\)](#).

Previous related research suggests that exporters face binding liquidity constraints with respect to the funding of both the fixed and variable costs of exporting (Manova, 2013). As a consequence, exporters may be unable to extend credit to foreign buyers, reducing their competitiveness abroad. To overcome such liquidity constraints and to extend foreign credit, firms may access additional financing from financial institutions (Amiti and Weinstein, 2011, Javorcik and Demir, 2014, Paravisini *et al.*, 2014). Firms may also apply for export credit guarantees to facilitate such external financing or to embolden themselves to extend credit, in spite of the risk of foreign buyer default.

Theoretically, Funatsu (1986) introduce export credit guarantees in a framework with profit-maximising exporters. Since the exporters do not know whether a foreign customer will pay its dues, they restrict output. The model indicates that the positive effect on exports of government-backed export credit insurance hinges either on a more-than-favourable premium rate or the presence of a fairly larger number of risk-averse firms. More recently, Heiland and Yalcin (2015) construct a theoretical model showing what kinds of financial market frictions can be mitigated by state export credit guarantees.⁸

Empirically, almost all previous studies on government-backed export credit guarantees and/or export credits are at the aggregate (country/industry) level (Abraham and Dewit, 2000, Egger and Url, 2006, Mah, 2006, Moser *et al.*, 2008, Korinek *et al.*, 2010, Sieber and Url, 2010, Felbermayr and Yalcin, 2013, Janda *et al.*, 2013b, Auboin and Engemann, 2014, Felbermayr *et al.*, 2015, van der Veer, 2015, Freund, 2016, Polat and Yesilyaprak, 2017, Agarwal and Wang, 2018). Researchers have mainly studied the instruments of export credit agencies (ECAs) of individual countries, primarily Austria and Germany, but there are also individual studies with Australian, Belgian, Czech, Japanese, Turkish and US data.⁹ Overall, the studies find a positive association between export credit guarantees and exports. Typically,

⁸Ellingsen and Vlachos (2009) theoretically analyse intervention in trade financing during liquidity crises.

⁹There are also a few multi-country studies of various aspects of export financing, e.g., those by Baltensperger and Herger (2009) and Janda *et al.* (2013a) on guarantees of OECD countries and of four eastern European countries providing export financing, respectively.

this relation is found to be elastic. The association is stronger for industries that are more dependent on external financing. Some studies find a stronger association for trade with countries with low financial development and/or higher risk.¹⁰

Most recently, a few firm-level studies have emerged ([Felbermayr *et al.*, 2012](#), [Badinger and Url, 2013](#), [Heiland and Yalcin, 2015](#)). [Badinger and Url \(2013\)](#) provided the first firm-level evidence. They analysed cross-section survey data for firms, some of which acquired guarantees, in Austria for the year 2008 (the response rate was 21 percent). The authors estimate the trade effects for 71 of the firms. They find that export credit guarantees are positively associated with firm exports. Regarding usage, they study 178 firms and find that the usage is more common for exporting to countries with higher credit risk but less common for multinational firms. [Heiland and Yalcin \(2015\)](#) construct a sample panel dataset of 521 firms in Germany in the 2000-2010 period, merging German guarantee data with information from a survey on, for example, firms' expected trade (anywhere) and with commercial data. They employ within-firm estimation and find that the probability that a firm will expect above-normal exports is positively correlated with guarantees. The link is stronger for smaller firms, including an interaction with employment. Finally, [Felbermayr *et al.* \(2012\)](#) merge similar German guarantee data with commercially available sample data for predominantly larger German exporters and employ a quasiexperimental estimator. In the absence of time-varying export information, they focus on the link from guarantees to firm-level sales and employment. For the 290 firms using guarantees, they find that guarantees increase firm-level sales and employment. The effects were larger during the onset of the financial crisis.

¹⁰Most studies are on export insurance, while a few include or focus on credits ([Growth Analysis, 2015a](#)).

3. CONCEPTUAL FRAMEWORK

3.1. *Information Problems in Foreign Trade*

In non-simultaneous exchange, heterogeneous agents face uncertainty over whether the other agent will deliver. Without perfect information, both agents are exposed to the risk that the other will default – the default problem – and to the opportunity cost of having scarce resources committed to a deal that restricts the agent’s alternative use of these resources – the liquidity problem. The time value of money further adds to the liquidity problem under delayed delivery.

Typically, in foreign trade, agents agree that one of the agents will extend credit to the other in the form of trade credit (in-kind) via an open account or cash-in-advance for the exporter and importer, respectively. In the latter case, the importer either uses her liquid funds for payment or borrows funds from a financial intermediary using her balance sheet as collateral. The default problem means that there is a moral hazard that agents will deviate from the agreed deal for opportunistic reasons, beyond the risk of involuntary default because of payment issues or even bankruptcy.¹¹ The liquidity issue in non-simultaneous exchange is exacerbated in foreign trade because of by geographical distance and border procedures, which make foreign trade time consuming (Djankov *et al.*, 2010).

To address the default problem, agents can spend resources to gather information about one another and the foreign market, incurring fixed costs. Alternatively, they can involve a financial intermediary that specialises in such services. Likewise, agents can tie up working capital to maintain liquidity during the non-simultaneous exchange or alternatively borrow from a financial intermediary for the duration of the exchange. Irrespective of the source of financing, the agents incur financing costs and these are monotonically increasing in the size of the deal and potentially also in its duration.

¹¹In addition, the incomplete nature of contracts in combination with more cumbersome contract enforcement internationally exacerbates this risk (Ellingsen and Vlachos, 2009).

If agents incur fixed costs, gathering information about specific foreign agents and markets, and variable costs, financing the exchange, then not every agent is able to retrieve the information and afford financing, at least not for every potential other agent. Generally, costs of trade may be bearable by only the most productive agents. Therefore, not all agents engage in foreign trade, and those that do may trade primarily with neighbouring markets or markets where they already have established a foothold (Melitz, 2003, Chaney, 2014, Morales *et al.*, 2018). Some firms, such as small-sized or young firms, may be disadvantaged, even if highly productive, either due to the potentially non-existent/small scale of their current trade, which can result in high or even prohibitive average costs in foreign trade, or because of their inability to access external financing (Berman and Héricourt, 2010, Minetti and Zhu, 2011, Forlani, 2014, Muûls, 2015).¹²

The most productive agents, which can bear the information and financing costs, can either extend trade credit to signal the superiority of their offer (Lee and Stowe, 1993, Giannetti *et al.*, 2011) or use financial intermediaries to do so. Firms with more liquid funds can more easily extend trade credit themselves than other firms can. However, even using financial intermediaries to extend trade credit likely requires a strong balance sheet or particular collateral. These requirements may disfavour less-productive firms and firms in industries with less collateral (USITC, 2010, OECD, 2013, Manova, 2013). Smaller firms may be particularly disadvantaged, as they are generally liquidity constrained and face difficulties accessing external financing (see, e.g., Ang, 1991, Carpenter and Petersen, 2002, Beck and Demircuc-Kunt, 2006, Riding *et al.*, 2012). Less-productive, less-collateralised and smaller-sized agents may require trade credit to engage in trade, thereby restricting their trade to “safe” counterparties, de facto limiting firm growth and employment (Eck *et al.*, 2015, Quadrini and Qi, 2018). The least productive firms abstain from trade altogether.

That foreign trade is marred by political risk, such as exchange rate fluctuations, currency

¹²Consider two firms, A and B, that have identical productivity, but the former already exports extensively, while the latter has just begun. Then, firm B may find the fixed costs of entering into trade prohibitive.

transfer restrictions or even war, adds to the costs of information gathering and financing. Therefore, there may be trade deals with positive expected value that, due to high levels of risk, neither the most productive firms nor specialised financial intermediaries are willing to take on, at least not without very high or even prohibitively high costs. Asymmetries in information between the exporter and the financial intermediary about the importer may make the intermediary non-competitive in underwriting the risk (Smith, 1987, Brennan *et al.*, 1988). As a result, there may be adverse selection into using the underwriter, in turn limiting the latter’s underwriting to “safer” deals with short maturity or whole customer portfolios rather than limited or even individual transactions. The financial development and regulation of the countries involved can also affect the availability and costliness of trade finance. Overall, uncertainties over export revenues can restrict foreign trade (see, e.g., Anderson and Marcouiller, 2002, Berman *et al.*, 2012, Danziger, 2018).

3.2. *Export Credit Guarantees*

To address the default and liquidity problems that may depress foreign trade below the level associated with optimal resource allocation and therefore welfare, governments may intervene (Dixit, 2003). The government can act as the “guarantor of last resort” through government-backed export credit guarantees for a fee. These non-marketable guarantees reduce the default risks involved and thereby also the liquidity problem.¹³ Thus, more exporters can trade and can more easily secure trade credit financing (Funatsu, 1986, Zammit *et al.*, 2009, Felbermayr *et al.*, 2015, Heiland and Yalcin, 2015).

There are a number of reasons why a government institution can insure foreign transactions that financial intermediaries hardly underwrite and do so at competitive fees. If the government provides the guarantees, it takes on the fixed costs of information collection, including the acquisition of specialised knowledge about political risks and channels for assessing com-

¹³Export credit guarantees differ from classic insurance in regards to the following: First, in the case of a credit guarantee, the guarantor takes over the claim in the event of the buyer’s default, whereas an insurer does not. Second, a credit guarantee cannot cover more than the value of the export contract. In the case of classic insurance, the insured amount can potentially exceed the value of the loss.

mercial risks in foreign trade; diversifies risks beyond the scope of many firms; and utilises its taxation authority and endowments as collateral to ensure contract fulfilment (within the coverage ratio), even for highly risky or large transactions. The government may also easily reinsure export credit risks. It may also employ its public and diplomatic channels to pursue claims against defaulting parties. Government-backed trade finance via guarantees may be especially important during macroeconomic crises, as trade finance is more important in foreign than in domestic trade, and trade finance tends to dry up during such crises ([Ahn et al., 2011](#)). Finally, in practice, the government would seem to be advantaged vis-a-vis banks in providing competitively priced guarantees, since only the latter have been subject to new regulations in recent years, e.g., increased capital requirements, in the aftermath of the financial crisis.

An export insuring institution, which addresses the information problem in non-simultaneous exchange across borders to lower the fixed and variable trade costs, can promote firm exports at both the extensive and intensive margins in a [Melitz \(2003\)](#)-type trade model. Lowering the fixed costs causes new firms to start exporting, expanding their sales. Likewise, lowering the variable costs spurs firm exports both by new export entry and expansion of existing exporters. Assuming heterogeneous export costs across countries, we would expect similar export effects across firm-destination margins (Conjecture 1). If the new exporters are at the right-tail of the productivity distribution of the non-exporters ([Lileeva and Trefler, 2010](#)), and assuming that the expanding existing exporters also are above par in their distribution, this will generate between-firm productivity growth through competition for scarce resources and subsequent exit of the least productive firms ([Melitz, 2003](#)). Hence, exports, sales and productivity will rise, improving welfare. If we abstract from [Melitz \(2003\)](#), to also allow for dynamic gains from trade, export insurance could lead to within-firm productivity growth (Conjecture 2), further improving welfare. Producing for the foreign market may lead to more investment in innovation ([Schmookler, 1954](#), [Lileeva and Trefler, 2010](#), [Aghion et al., 2018](#)), learning-by-exporting effects (e.g., [Loecker, 2013](#)), or provide a foothold from where

to more easily enter into adjacent foreign markets, lowering firm-country entry costs (e.g., Chaney, 2014, Morales *et al.*, 2018).

Related to our discussion and conjecture 1, we expect that smaller and less-collateralised firms may be particularly advantaged in exports by institutional support. In addition, we would expect stronger export effects in times of macroeconomic shock.

Finally, we have two corollaries. The first corollary (Corollary 1) of conjecture 1 is that guarantees increase firm exports, not simply divert them to high-risk markets. Therefore, our empirical investigation should also analyse the effects of guarantees on total firm performance, such as employment and value added.¹⁴

The discussion also highlights that a guarantee addresses two main problems: default risk and the liquidity problem. Since the first problem is more transaction specific, in a sense, than the second, this difference could help us to empirically investigate how guarantees affect firm exports.¹⁵ Hence, our second corollary (Corollary 2a) holds that we would expect the guarantees to have a stronger impact on firm exports to the given destination for which the guarantee is provided if the guarantee addresses primarily default risk. Conversely (Corollary 2b), we would expect guarantees to have as large an impact on exports to another destination if the guarantee primarily addresses the liquidity problem.

4. DATA AND A PORTRAIT OF THE FIRMS INVOLVED

We begin this section with a primer on the source of our data on export credit guarantees – the Swedish Export Credit Agency. Next, we introduce our exhaustive transaction-level panel data on guarantees and present descriptive statistics on their usage. We then proceed by describing how we constructed the full panel dataset, adding granular and comprehensive

¹⁴The promotion of jobs has been, and remains, a commonly forwarded argument for government-backed export credit guarantees; see, e.g., for the US, www.exim.gov/what-we-do, and, for Sweden, the account by Sjögren (2010).

¹⁵Acquiring a guarantee for a specific transaction addresses the risk of buyer’s default in that transaction but not in other transactions of the firm, while a guarantee facilitates access to external funding, which generally eases liquidity constraints of the firm.

data on firms and foreign trade. We end the section by providing a portrait of the firms using the guarantees and their foreign buyers.

4.1. *The Swedish Export Credit Agency*

In Sweden, export credit guarantees are provided by the Swedish Export Credit Agency, *Exportkreditnämnden (EKN)*. The EKN is an independent governmental agency under the Foreign Ministry. It was established in 1933 as a temporary solution to the financial crisis and the subsequent collapse of foreign trade and increased unemployment, and it was made permanent in 1963. Currently, the agency has 140 employees and is wholly Swedish-based, with a head office in Stockholm and three regional offices. In recent years, the agency has annually provided new guarantees worth approximately five billion USD (SEK 40 billion), but it has the authority to provide substantially larger amounts and benefits from unlimited credit from the Swedish National Debt Office (EKN, 2017). In 2017, the agency had some 400 customers and covered between 1,500 and 2,000 business transactions to over 130 foreign countries. In 2017, the value of all guarantees outstanding was USD 21,256 million (SEK 181,485 million).¹⁶

The Export Credit Guarantee Ordinance states that agency may issue export credit guarantees to promote Swedish exports, internationalisation and competitiveness “*if the operation that is to be guaranteed is of Swedish public interest, or otherwise beneficial for the financial development in Sweden.*”. The agency is also instructed to increase knowledge about its services among small and medium-sized enterprises (SMEs) as well as to reduce the export thresholds for SMEs. The agency guarantees are to complement privately available – so-called marketable – guarantees. In other words, the agency is to be the guarantor of last resort.¹⁷ Moreover, the agency should break even in the long run. Therefore, the fees paid by

¹⁶As in many EU countries (Janda *et al.*, 2013a), but unlike in, e.g., the US, the Swedish export financing system is divided in two, with the EKN providing guarantees to firms and the Swedish Export Credit Corporation providing export credit for medium- to long-term and large export contracts by large and mid-sized firms.

¹⁷In Sweden, there are some private insurers. However, they cover mainly all turnover or customer

its customers – the so-called premiums – should finance the business of the agency, covering both expected losses and overhead costs. If and when it fails to cover losses, which only has occurred once, it can access the necessary funding from the Swedish National Debt Office (NAO, 2014).

Applying for a guarantee is free of charge, open to any firm, streamlined and may be done online, while using the guarantee is associated with a fee (the premium). When applying for a guarantee, the applying and buying firm and the related export transaction are screened. The purpose is to assess whether the parties to the deal are able to fulfill their contractual obligations and to assess the risk of losses so that the guarantee would be needed. Denial is rare but does take place.¹⁸ If offered a guarantee, the firm may opt to use it or not. Most of the firms that receive an offer accept it, resulting in the agency issuing the guarantee. As mentioned above, using a guarantee is associated with a fee (the premium). The per annum premium is transaction specific and expressed as a percentage of the guaranteed export value. It is based partly on the agency's calculation of the probability of default and partly on the risk duration, as well as the insured amount – the higher the default probability, the longer the risk duration and the larger the insured amount, the higher the premium is. The default risk, in turn, is based on the country credit risk, endogenously and annually set cooperatively by OECD ECAs and on the commercial risk of the buyer.¹⁹

There is an upper limit on the share of the export transaction that the firm may insure at the EKN, the so-called coverage ratio.²⁰ The remaining share of the transaction – the deductible – is retained by the firm for its own account.

The EKN is not allowed to issue short-term guarantees (< 24 months) for exports to countries

portfolios, ensuring that risks are spread out and, thereby, lower premiums and overhead costs.

¹⁸However, according to discussions with the agency, denial is very rare because the agency generally attempts to facilitate firm efforts to acquire a guarantee, if the firm so wishes.

¹⁹The agency itself performs the commercial risk classification of the buyer, classifying the buyers on an A-F scale, with an A corresponding to a government buyer and an F corresponding to newly established or weak firms or a highly uncertain project, see Table A1.

²⁰The coverage ratio is the ratio of the value of the transaction subject to the guarantee divided by the potential loss on claim stipulated by the firm. The potential loss on claim, in turn, is the sum of the foreign contract value and foreign market costs related to the contract for the firm.

considered to be very safe in terms of credit risk (a 0 rating on a 0–7 scale), such as the high-income OECD countries and countries in the European Union (EU). Nevertheless, the EKN may issue guarantees for very safe countries for credit periods longer than 24 months.

4.2. Data

Data on Export Credit Guarantees

We have accessed novel and exhaustive panel data from the EKN on offered and issued guarantees that insure export transactions against buyers' default, so-called loss on claim guarantees (LOCs: henceforth, we express the term as export credit guarantees or guarantees).²¹ Our very detailed data enable us to explore seller-contract-destination-buyer variation over almost two decades.

The data include all four types of losses on claim guarantees offered by the EKN:²²

Guarantees for exporter, short. This guarantee covers the risk of the buyer not paying according to the agreement for credit periods up to 12 months.²³

-Guarantees for exporter, long. This guarantee is identical to that described above, except that it is issued for credit periods over 12 months.

-Guarantees for lender, long. This guarantee is issued to a bank that finances the export agreement. It covers the risk of non-payment by the foreign borrower (i.e., the foreign buyer of exports). This guarantee is issued only for credit periods longer than 12 months.

- Guarantees for letter of credit, short or long. This guarantee is issued to a Swedish or a

²¹LOCs are typical products of export credit agencies, see, e.g., the survey of [Growth Analysis \(2015b\)](#). With respect to the EKN, LOCs account for approximately 80% of the number of offered guarantees. The remaining 20% of the offered guarantees concern (a) bills of exchange; (b) claims against exporters; (c) investment credits; and (d) working capital. While (a) is not directly tied to the export event, (b) is, but it concerns exporters' rather than buyers' default. The latter two guarantees (c and d) are not directly tied to an export contract. For an overview, see Table 1 in the Online Appendix.

²²In addition to these types, we include corresponding guarantees that exist in our dataset but are no longer offered, see Table 2 in the Online Appendix. However, we exclude a specific combination guarantee that combines guarantees for losses on production and on claims, as they do not solely cover buyer default. The combination guarantee accounts for only 4% of the number of the guarantees.

²³The agency's definition of a short-term guarantee is up to 12 months, which differs from the EU definition of up to 24 months.

foreign bank that confirms the letter of credit bought by the foreign buyer from its issuing bank. It covers the risk of the issuing bank not paying the confirming bank, despite submission of the requested documents from the exporter via the confirming bank to the issuing bank. The guarantee exists in both short-term (up to 12 months) and long-term (longer than 12 months) versions.²⁴

The first two types of guarantees listed above typically cover up to 95 percent of the claimed loss of exporters, while the guarantee for losses on claims for a lender covers up to 85 percent. Thus, the firm risks between 5 and 15 percent of an unpaid amount, respectively.²⁵ The last guarantee type – a letter of credit – has a cover ratio of only up to 50 percent and requires that the confirming bank cover at least 25 percent, resulting in a minimum 25 percent coverage by the other bank involved.²⁶

Table 1 shows the distribution of transactions across the four types of guarantees and across the offer and guarantee stages. The short-term guarantees (up to 12 months) represent approximately 73 percent of the issued guarantees. However, over time, there is a trend toward an increased share of long-term guarantees.

The short-term guarantee for exporters is the most common guarantee type, representing nearly half of the guarantees. The long-term version of this type of guarantee accounts for approximately one-quarter of the guarantees, while the share of guarantees for lenders represents only a small part of the total. The guarantee for a letter of credit, short term, accounts for a non-negligible share of the guarantees, while the long-term version is very infrequent. The most remarkable difference between the offer and the guarantee stage is for the short-term letters of credit guarantee, which are more prevalent among issued than offered guarantees. Overall, 59 percent of the guarantees offered to firms are actually issued.

²⁴A letter of credit – or documentary credit, as it is also called – is a commitment by the buyer’s bank to pay the exporter when the exporter has fulfilled the terms specified in the letter of credit. For an introduction to letters of credit, see, e.g., [Niepmann and Schmidt-Eisenlohr \(2017\)](#).

²⁵Notice that the amount of claimed loss can be larger than the value of an export contract when there are local costs associated with the purchase of products or services in the importing country.

²⁶In the event that the buyer defaults but the EKN manages to reclaim the full amount, the excess is divided evenly between the agency and the guarantee holder.

TABLE 1
Distribution of loss on claim guarantees, 2000-2016.

	Offer stage		Guarantee stage	
	N	Percent	N	Percent
Guarantee for exporter, short	12,057	48.8	7,075	46.3
Guarantee for exporter, long	7,853	30.5	3,768	24.6
Guarantee for lender, long	1,138	4.4	404	2.6
Guarantee for letter of credit, short	4,186	16.3	4,038	26.4
Guarantee for letter of credit, long	20	0.1	11	0.1
Total Obs.	25,749	100	15,296	100

The picture that emerges from these data is that a limited number of firms account for a large number of guarantees and/or highly valued export contracts (see Table 3 in the Online Appendix). At least half of the firms have only one guarantee per year, while the average number of guarantees per firm and year is six. The average value of an export contract is USD 3.8 million, and the median is USD 259,100. The number of unique firms receiving guarantees in the years that we cover is 957.²⁷

Turning to the regional allocation of guarantees, most guarantees are for exports to the Middle East and Latin America, and these two regions also attract the largest amounts in terms of guarantee value, see Table 4 in the Online Appendix. In total, guarantees are issued to 168 destination countries.²⁸

In Figure 1, we display the trends in the number of guarantees (panel A) and firms (panel B) for guarantees in the years 2000-2016. Overall, the number of guarantees increased substantially, while the number of firms using them rose more moderately. The upward trends had begun in the years before the financial crisis, but following the crisis, the increase was more rapid. In the aftermath of the crisis, firms temporarily decreased and then increased

²⁷Of these firms, 84.6% (810 firms) are registered in Sweden.

²⁸According to discussions with industry members, the share of bilateral exports covered by guarantees of the EKN varies substantially, with the agency, in effect, being almost the sole provider of guarantees for exports to some risky countries.

their usage, as measured by the number of guarantees. However, the the number of firms using the agency’s guarantees gravitated toward the lower pre-crisis level in the post-crisis period. A similar pattern is found with respect to export firms seeking repayment. Overall, these patterns indicate an increase in the number of guarantees per firm.

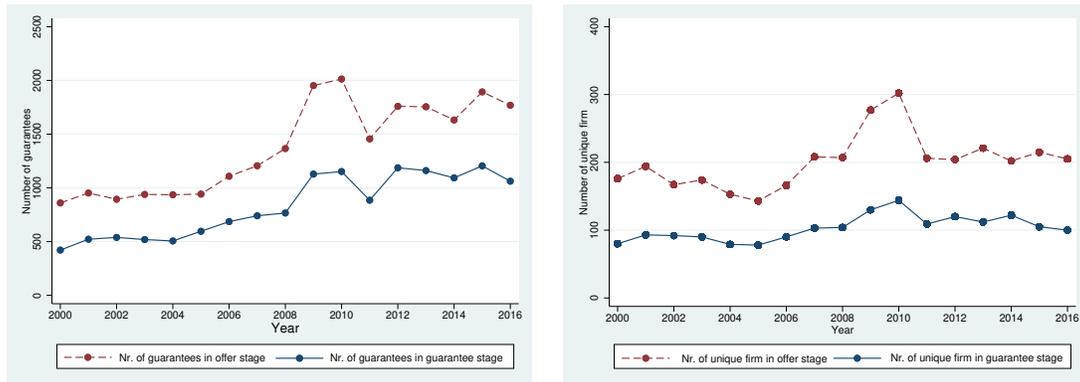


FIGURE 1

Number of guarantees and firms per year.

Notes: Left: Number of guarantees per year. Right: Number of unique firms per year.

Note that the financial crisis had a bipolar effect on the risk profile of the guarantee destinations, see Figure 1 in the Online Appendix.²⁹ The most striking difference is the increase in guarantees to countries with a risk classification of 0. We also observe a shift toward higher-risk countries in categories 6 and 7.³⁰

Constructing the Dataset for Econometric Analysis

To identify the causal effects of guarantees, we need to carefully consider the selection into the use of guarantees and control for confounding factors in the estimation of the effects on firm performance. Therefore, we must complement the previously mentioned EKN data with exhaustive information on firm performance and characteristics, such as foreign trade, value added, workforce size and composition, and affiliations. We have access to such information

²⁹Although the crisis had already begun in mid-2008, there is no large difference in distribution of country risk between 2007 and 2008. Following the crisis, in 2009 and 2010, a large share of guarantees were issued to countries with risk categories 0 and 6.

³⁰Whether this finding is an indication of firms increasingly exporting to riskier countries or of firms’ export destinations being re-classified is unclear.

in the detailed registers from Statistics Sweden. Because of the presence of unique identifiers of all residents, establishments, firms and enterprise groups in Sweden, we can easily merge the EKN data with those registers from Statistics Sweden.³¹

In addition to the information from the EKN, the resulting dataset includes information on, among other variables, firms' turnover, sales, value added, investments and employment; workers' education; firms' year of establishment; firms' affiliations to enterprise groups and multinational status; and firms' detailed foreign trade.³² Additionally, we include macro-level data, for example, on production, access to foreign markets, financial development and trade flows. (We summarize our variables, definitions and sources in Table A1.)

Our dataset contains information on virtually all workers, establishments, firms and enterprise groups in Sweden.³³ Most of the information is provided on an annual basis. Henceforth, the period of study is 2000-2015, since we lack business statistics for year 2016.

In Table 2, we summarize statistics on the agency dataset and its merger with the register data from Statistics Sweden.

In columns 1 and 2 of Table 2, we display the original EKN dataset in terms of transactions and export guarantee values in million USD for the 2000-2015 period. In total, we have 14,189 transactions, which together cover USD 44.9 billion in exports.

We then merge the EKN and Statistics Sweden datasets, see columns 3 to 6 of Table 2. In

³¹All entities involved in our data have been de-identified by Statistics Sweden to preserve their confidentiality, replacing the identification numbers with new ones. Moreover, data were accessed only in a safe environment provided by Statistics Sweden.

³²Data on trade in goods are comprehensive for trade with countries outside the EU but truncated for trade with other countries. Approximately 96% of intra-EU trade is captured. For intra-EU trade, a firm's annual exports/imports with the rest of the union has to amount to SEK X mn to be recorded, with X being 9 and 4.5 for imports/exports, respectively, in the years 2015 onward; 4.5, from 2009-2014; 2.2 and 4.5 for imports/exports, respectively, in the years 2005-2008; and 1.5 in the years 1998-2004. Data on trade in services come from a stratified survey among approximately 6,000 firms (GATS modes 1, 2 and 4), where the largest firms in terms of turnover or trade are regularly included. Trade in services is defined as a cross-border transaction related to a contract on services sales (UN, 2002). For further details on the foreign trade in services statistics, see, e.g., Growth Analysis (2010b).

³³Our population frame of firms is contained in the Structural Business Statistics (SBS), which contains all active and registered firms in all industries, except for firms in the financial industry. A firm is considered active if it has paid taxes for employees, value-added or income that year. The main source of information in the SBS is the Swedish Tax Authority.

TABLE 2
EKN data merged with register data, 2000-2015.

Year	EKN data		EKN data merged with register data				Firms in register data in the current year but not the previous year		
	<i>Count (Trans.)</i>	<i>Million USD</i>	<i>Count (Trans.)</i>	<i>Count (Firm)</i>	<i>Count (Unique firms)</i>	<i>Million USD</i>	<i>Count (Firm)</i>	<i>Count (Unique firms)</i>	<i>Million USD</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2000	453	1,255.3	384	234	96	422.8	/	/	/
2001	563	1,463.5	494	324	120	729.9	96	66	118.7
2002	588	1,131.9	514	303	106	967.8	43	41	24.9
2003	566	920.3	502	292	114	711.1	56	52	32.7
2004	544	1,883.9	491	301	99	1,758.2	46	35	41.9
2005	645	1,973.3	579	273	98	1,045.5	50	42	45.7
2006	713	1,896.1	677	325	113	1,175.6	71	52	234.7
2007	778	1,329.1	726	345	129	895.5	67	57	141.0
2008	826	3,438.9	740	377	126	2,335.6	59	51	46.8
2009	1,221	11,940.9	1,028	527	168	9,156.1	101	86	6,917.3
2010	1,273	3,901.0	1,120	539	184	2,699.4	118	84	471.0
2011	1,019	3,060.0	872	427	138	2,094.0	53	42	1,123.6
2012	1,298	3,767.2	1,118	446	133	1,719.4	55	44	76.7
2013	1,232	2,476.4	1,122	418	143	1,807.1	77	61	258.1
2014	1,178	1,723.1	1,052	442	141	1,118.8	73	60	54.6
2015	1,292	2,683.5	1,158	462	136	943.5	63	53	85.9
Total	14,189	44,907.3	12,577	6,035	2,044	29,580.3	1,028*	826*	9,673.6*

Notes: The unit of observation in columns (1) and (2) is an individual transaction of guarantees that a firm has with the agency in a given year. In columns (3) to (6), we merge the transactions with register data. The unit of observation in column (3) is an individual transaction. In column (4), we collapse the transactions within the firm-year-destination. In columns (5) and (8), we collapse within the firm-year. In columns (7) to (9), we display statistics on first-time users of guarantees in the merged dataset. The unit of observation in column (7) is firm-year-destination. Notice that numbers in the totals in columns (1) to (9) are the sum for all years. (/) Missing due to a lack of data from 1999. (*) 2001-2015.

doing so, we lose approximately one-tenth of the transactions and one-third of the export values. The main reason for this loss is that the EKN issued guarantees for a number of foreign deals for which the exporting firms' identification numbers cannot be matched with Swedish register data.³⁴ Another reason is that the exporter identification number is not known to the EKN, primarily for a minority of guarantees for lenders.

Next, in columns 4 and 5, we aggregate transaction data on the firm-destination and firm levels, respectively. In 2015, we have 462 firm-destination observations by 136 unique firms.³⁵ These firms' exports amounted to two billion USD and almost half of the exports of these firms were guaranteed by the agency (see Table 5 in the Online Appendix). The exports covered by the agency went to 99 countries and consisted of some 1,397 unique products

³⁴Mismatches occur for two reasons: (1) the firm is not registered in Sweden or (2) the firm is excluded from SBS of Statistics Sweden, since the firm either belongs to the financial industry or has no employees. Note that firms not registered in Sweden can apply for guarantees, provided that the transaction involves $\geq 50\%$ Swedish input (before 2007) or is in the Swedish interest (the wider definition used since 2007). However, foreign firms – particularly firms within the extended agency mandate – constitute a small share of guarantees of the agency see, e.g., [Growth Analysis \(2010a\)](#).

³⁵SMEs constitute approximately 80 percent of the firms applying for LOCGs in the 2000-2015 period. The rest of the firms are large. Moreover, we note that slightly less than half of the firms applying did not apply in the previous year.

at the 8-digit CN level.³⁶ For comparison, exports covered by the agency’s export credit guarantees constituted a small share of total Swedish exports of goods and services in 2015, as captured by our merged dataset, approximately 0.7 percent, down from 7.1 percent during the financial crisis.³⁷

Finally, we focus on firm-destination dyads that acquired agency backing in the current year but not in the previous year. We regard these dyads as subject to treatment. Our main identification strategy is to compare these dyads with very similar dyads that did not acquire backing in the previous nor the present year. Focusing on the “treated” firm-destinations narrows the export value guaranteed to USD 9.7 billion in column 9, representing 33 percent of the total value covered in column 6. We will compare these firm-destinations with a control group of very similar firm-destinations. The number of unique first-time buyers of guarantees is displayed in column 8. In 2015, 53 firms were “treated”, compared to the total of 136 firms receiving guarantees that year. The control group consists of firms that were neither in an issue stage nor a guarantee stage in years $t - 1$ and t .³⁸

Response Variables and Confounding Factors

Using our matched longitudinal dataset, we wish to test whether export credit guarantees subsequently promote exports and ultimately contribute to jobs and value added. The response variables are therefore the probability of exporting; (log) total value of exports (goods and services);³⁹ (log) value added; (log) employment; and (log) labour productivity.

³⁶In the 2000-2015 period, Swedish exporters exported to 247 countries, and guarantees were applied and issued for 66% and 60% of those countries, respectively, according to our matched dataset.

³⁷When including all types of guarantees, the share of newly issued guarantees in exports is higher and in the range of several other similar agencies’ shares ([Growth Analysis, 2015b](#)), despite being low from a global perspective ([Kokko, 2013](#)). However, most trade is financed via an open account, a minority via financial intermediaries, and another smaller minority via cash-in-advance payments ([Chauffour *et al.*, 2011](#)). Government-backed agencies, with credits and/or guarantees, are typically involved only in a minor share of trade financing, as are private insurers. Private insurers, including, e.g., firms such as Euler-Hermes, Coface or Atradius – the latter is one of the global market leaders – cover mainly whole turnover portfolios rather than single risks, which ECAs cover.

³⁸We then trim this group of firms to firms that are in the same industries, as indicated by their 2-digit NACE codes, as the treated firms.

³⁹A small constant ($1e - 7$) is added to avoid truncation.

To avoid confounding the effects of export insurance, we need to meticulously control for the influence of a range of other factors. Fortunately, our dataset is uniquely suited to this task because of its comprehensiveness and fine level of detail. We now proceed to describe the confounding factors we consider.

First, we include variables related to trade, output and input. To ensure similar initial conditions, we lag these variables by one period, and we include the pre-trend of the response variable.⁴⁰ All continuous variables are in log format. We begin by adding trade intensities and firm exporter and importer status. Then, we include firm output in the form of turnover and value added. Next, firm input is included in the form of: intermediate goods (raw materials, goods and services); workforce size (the number of full-time employees); human capital stock (proxied by the share of post-secondary educated employees and by wages and social benefits paid to workers); and physical capital stock. Additionally, we include firm age, which has been associated with both firm growth and exports (e.g., Wagner 2015).

Next, we wish to control for affiliations that may confound the results. We add indicator variables for multinational status, foreign ownership and the two-digit industry (SNI2007, corresponding to NACE Rev. 2 and ISIC Rev. 4).

We also add year-specific effects to control, for example, for macroeconomic shocks such as the global financial crisis.⁴¹

At this stage, we have considered key trade, output and input characteristics, as well as firms' affiliations. By doing so, we have, in effect, controlled for firm productivity, drawing on [Hummels *et al.* \(2014\)](#), while avoiding a range of assumptions and pitfalls associated with measuring and then including total factor productivity estimates in further estimations. Moreover, our control variables are likely to capture the financial constraints of the firm,

⁴⁰Using an alternative lag structure does not affect our results, and these results are available upon request.

⁴¹Discussions with industry members highlight the counter-cyclical demand for export credit guarantees, with private financial intermediaries offering their services in more risky ventures in good times while being reluctant or unwilling to do so in worse times.

which relate to aspects of a firm’s operations.⁴²

Third, we use information related to sectors, in addition to industry affiliation, and to destination countries. To capture the financial vulnerability of the firm’s sector, we compute the two-digit sector average external financial dependence and the asset tangibility of the sector, closely following [Braun and Larrain \(2005\)](#) and [Manova \(2013\)](#). External financial dependence is the share of capital expenditures not financed with cash flows from operations.⁴³ Asset tangibility measures the share of net property, plant, and equipment in the total book value of assets.⁴⁴

At the country level, we add the usual gravity variables (GDP, bilateral distance to export markets, and membership in the WTO and free trade agreements) plus financial development indicators and country credit risk. In the estimations of export effects, these variables are included at the firm-destination-year level, while in the firm-level estimations, they are included as the weighted mean of the country-level variables, with the weights being the firm’s bilateral share of exports in its total global exports.

The financial development indicators are from the Fraser Institute. We use them as proxies for the capacity of the country to provide external financing, for example, for trade.⁴⁵ The first variable, *bank ownership*, provides evidence on the extent to which the banking industry is privately owned. The second variable, *private sector credit*, indicates the extent to which credit is supplied to the private sector. The third variable, *interest rate controls/negative real interest rates*, shows whether controls on interest rates interfere with the credit market. Additionally, the Fraser Institute’s aggregated financial development index is used for sub-

⁴²For example, the output and size of a firm are proxies for the firm’s financial risk ([Cowling and Westhead, 1996](#)), while physical capital is related to the availability of collateral, which affects a firms’ ability to receive loans ([Bester, 1985](#)).

⁴³Specifically, we compute financial dependence (F_s) as $F_s = \frac{L_s - C_s}{L_s}$, where L_s represents the funds used to add property, plant, and equipment; C_s denotes the funds used for operating activities; and C_s is equal to the adjusted funds from operations (A_s) plus the change in inventory (I_s), where A_s is the net income less equipment depreciation.

⁴⁴Constructing the measures at the sector level attenuates our concern that the measures could be endogenous to the firm’s financial development.

⁴⁵While direct measures are not available, the indicators we use reflect actual country barriers to external finance.

analysis. Finally, we include the EKN’s information on *country credit risk*, ranging from very safe to very risky on a scale of 0 – 7, as mentioned above. This variable is intended to reflect both the risk of a government imposing barriers to transfer funds abroad (in local or foreign currencies) and the risk of force majeure, such as political or natural disasters, for example, war. EKN continuously updates this variable, but we aggregate it at the year level, using the duration of the risk in a year as the weight.

Fourth, we add a number of first-differenced variables (turnover, human and physical capital and wages) and a measure of the foreign demand shocks for the firm’s existing export portfolio. Our underlying conjecture is that firms’ intention to export, their realized exports and interest in backing from the EKN all are related both to foreign demand shocks and the firm’s trajectory, with growing (shrinking) firms being more (less) prone to expand abroad, while the expected relation to seeking EKN backing is not as clear cut.⁴⁶

Our foreign demand and supply shock variables draw on [Hummels *et al.* \(2014\)](#) and [Munch and Schaur \(2018\)](#). The idea is to create a firm-specific measure of foreign demand (supply) shocks by combining firm-product-level export (import) data from Statistics Sweden and bilateral product-level import (export) data from United Nations COMTRADE database. Both sources of data provide trade values at the six-digit harmonized system level. Specifically, we compute the firm shock variable as follows for demand (and analogously for supply):

$$FS_{jt} = \sum_k ex_{jkt-1} \frac{IM_{kt} - IM_{kt-1}}{IM_{kt-1}} \quad (1)$$

with ex_{jkt-1} being firm j ’s export share of product k in the pre-treatment year, with k belonging to the firm’s set of export products, while IM_{kt} measures the imports of all countries except Sweden of that product in year t .⁴⁷

Fifth and finally, we use information on foreign buyers to assist in identification and sub-

⁴⁶A growing firm may be attentive to means to assist in expansion abroad, but it is also feasible that shrinking firms are under even stronger pressure to find such means.

⁴⁷If a firm’s export information is missing in $t - 1$, we replace it with information from the previous year.

analyses in parts of the paper. We can retrieve foreign buyer information by exploiting the fact that the EKN dataset contains identification numbers for the foreign buyers of the exporting Swedish firms. Specifically, we have the worldwide unique Dun & Bradstreet (DNB) identification number (DUNS) or the organisational number of the foreign buyer. Through these numbers, we can add information on foreign buyers' most updated financial composition and corporate structure, all from the Global Reference Solution (GRS) database of the DNB.⁴⁸

4.3. *A Portrait of Guaranteed Firms and their Foreign Buyers*

Finally, in this section, we turn to describe both the firms with export credit guarantees in our matched longitudinal dataset and subsequently their foreign buyers, see Table 6 and Table 7 in the Online Appendix.⁴⁹ There are 671 unique exporting firms in the dataset. Although all of these firms are registered in Sweden, approximately one-quarter of them are foreign owned, and an overwhelming majority belong to a multinational company.

Most firms in our dataset are SMEs.⁵⁰ Two-thirds of the firms are classified as SMEs, with a median of 58 employees. Over time, the share of SMEs increased, from 60 percent in 2000 to 69 percent in 2015.⁵¹ However, large firms clearly dominate in terms of employment and turnover, with the average firm having 734 employees and a turnover of USD 499 mil-

⁴⁸From 2000 to 2016, we have 4,104 foreign buyers with a DUNS number in the agency's dataset. When DUNS numbers are missing, we can additionally identify 320 foreign buyers by using their organisation numbers. Therefore, in total, we can retrieve information on 4,420 import firms from the GRS database. Since the database contains the most up-to-date information, we have foreign buyer information only from the most recent financial report, that is, year 2016.

⁴⁹These are firms registered in Sweden. During the same period, there are 40 additional firms that can be identified with an organisation number and use a guarantee are not registered in Sweden or cannot be identified in the registers of Statistics Sweden, representing 5.6% of the sample.

⁵⁰Note that the agency formerly defined SMEs as firms having fewer than 500 employees and a turnover of less than SEK 1 bn, while the EU defines them as firms having fewer than 250 employees and a turnover of less than SEK 500 mn. Since 2014, the agency has been instructed to use the EU definition, which we also use in this paper.

⁵¹This increase is according to the EU definition of SMEs. Industry representatives report that a likely contributor to this trend is the increased costs that SMEs have faced for using private financial intermediaries since the late 2000s, which have induced them to consider the agency instead. New laws and regulations to prevent money laundering and terrorist financing have meant higher compliance costs for financial intermediaries, costs that have trickled down to their customers.

lion.⁵² Most firms using guarantees are multinational but not foreign owned. Most firms export but not intensively, with the average *total* export intensity being 8.7 percent and the bilateral one being 3 percent. Regarding the sectoral distribution of firms that use the guarantees, manufacturing and wholesale jointly dominate, capturing an 81 percent share of the firms.⁵³

With respect to the foreign buyers, they are rather similar in size to the exporting firms in Sweden, see Table 7 in the Online Appendix. Most of the buyers are medium-sized in terms of employment, although large ones account for a substantial share of their employment. In terms of commercial activity, the foreign buyers are somewhat smaller than the Swedish firms. The largest share of foreign buyers is found in Latin America, accounting for 31 percent (see Table 8 in the Online Appendix). Interestingly, the second most important region of foreign buyers is Europe. The sectoral distribution of the foreign firms mimics that of the exporting firms in Sweden, in that the manufacturing and wholesale sectors represent the largest share of firms (62 percent) (see Table 9 in the Online Appendix).⁵⁴

5. IDENTIFICATION STRATEGY

We set out to estimate the effects of export credit guarantees on firms' performance. In identifying the causal effects of such a voluntary act, we encounter two problems. First, the selection into the "treatment" of guarantees may be non-random and confound the effects. For example, large firms are traditionally more established users of export credit guarantees.

⁵²Large firms represent approximately 83 percent of the guarantee value in the EKN data. Large firms are also overrepresented as users of guarantees in the 2000-2015 period. Of the large exporting firms, 7.1% use guarantees, while, e.g., only 0.5% and 2.7% of SMEs in 2000 and 2015, respectively, use guarantees. The dominance of large firms as users of guarantees is also found in other studies, e.g., [Badinger and Url \(2013\)](#).

⁵³The share of the manufacturing sector is even larger if other types of guarantees are included, with manufacturing then representing close to 65 percent of the firms. For comparison, note that manufacturing and wholesale are major industries in Sweden, in terms of employment, and account for approximately one-fifth of firms in private business (excluding primary industries). However, the manufacturing sector is clearly overrepresented among firms that use the agency's guarantees in comparison with their overall presence in Sweden, except for exports.

⁵⁴In the study period, the majority of the buyers, 92.8 percent, are private firms, while 5.5 percent are classified as banks and other financial institutions, 1.6 percent as foreign public institutions, and the remaining ones as other buyers, including private persons.

Such differences between firms with and without agency backing may be correlated with the outcomes in which we are interested, for example, large firms are also known to be more strongly associated with exports. Second, outcomes for both states – using and not using a guarantee – cannot simultaneously be observed for the same firm, that is, we are missing the counterfactual, the so-called fundamental problem of causal inference (Holland, 1986).

Our key identification strategy to solve the two problems is to employ a DD propensity score matching estimator (e.g., Rosenbaum and Rubin, 1983, Heckman *et al.*, 1997). (Furthermore, we apply a FRDD on a quasi-natural experiment in Sweden, see Section 6.3..) With respect to the first problem, the DD matching approach controls for selection into treatment and for time-invariant and time-varying heterogeneity in unobserved individual characteristics. The approach is especially suitable in our case because we have access to rich and detailed data (e.g., Heckman *et al.*, 1999, Smith and Todd, 2005). It offers the possibility to control for common support, that is, that both firm-destinations using guarantees (treated) and those that do not (controls) have similar pre-treatment distributions of selection variables. The DD matching estimator also offers flexibility in the form of fewer parametric assumptions than in ordinary least squares (OLS) regression.⁵⁵ With respect to the second problem, our approach mimics a comparison of the de facto outcome with its counterfactual. We gauge the effect in the form of the average treatment on the treated (*ATT*), where the *ATT* estimate stems from comparing the treated with similar controls rather than comparing both similar and dissimilar subjects, as in OLS.

Formally, using the DD matching estimator, we compare the difference in outcomes between the firms that use an export credit guarantee vis-a-vis a destination in t but not $t - 1$ and those that did neither in t nor in $t - 1$.⁵⁶ For each firm-destination dyad, there are two potential outcomes: Y_1 and Y_0 – for the case of treatment and non-treatment, respectively.

⁵⁵An additional advantage relative to, e.g., within regressions, is that we can abstain from assuming that past outcomes (such as exports and employment) do not affect selection into treatment (Imai and Kim, 2017).

⁵⁶We consider an issued guarantee as the treatment, excluding offered but not issued guarantees.

The DD outcome can be written as

$$Y_1 - Y_0 = (Y_{1t+i} - Y_{1t-1}) - (Y_{0t+i} - Y_{0t-1}) \quad (2)$$

where Y_{1t-1} is the outcome variable of the treated firm-dyads before treatment, and Y_{1t+i} is the corresponding outcome in year i after treatment. Analogously, Y_{0t-1} is the outcome variable of the control dyads before treatment and Y_{0t+i} the corresponding outcome in year i after treatment. The DD outcome eliminates confounding time-invariant heterogeneity across firm-destination dyads.

Now, let D denote treatment, which, in this case, is equal to 1 for firms that use EKN support for a specific export destination in t but not in the previous year, $t - 1$. The average treatment effect on the treated (ATT) is then

$$\delta_{ATET} = E[Y_1 - Y_0 | D = 1] = E(Y_1 | D = 1) - E(Y_0 | D = 1) \quad (3)$$

where $Y_1 | D = 1$ is the outcome of interest for the treatment group, and $Y_0 | D = 1$ is the hypothetical outcome in the treatment group in the absence of using export guarantees.

Since we cannot observe the counterfactual for treated firm-destination dyads, we estimate it. We do so by using information on firms in the control group. The treated and untreated dyads are thus matched on the conditional ex ante probability, $P(X)$, of using agency guarantees for exports to the foreign destination. X is a vector of covariates observed prior to treatment that are assumed to affect the selection into treatment. The parameter of interest δ_{ATT} , which measures the mean changes in the outcomes of the treated and untreated, is estimated as follows:

$$\hat{\delta}_{ATT} = [Y_1 | D = 1, P(X)] - [Y_0 | D = 0, P(X)] \quad (4)$$

The estimated parameter $\hat{\delta}_{ATT}$ can be causally interpreted under certain conditions, namely,

that there is a strictly positive probability to be selected into treatment (captured by the propensity score in our estimations) – which is ensured by imposing it as a common support condition in the estimation; no mutual exclusivity in treatment – which can be reasonably assumed in the context of the EKN; independence between treatment assignment and outcome for the non-treated, conditioning on a vector of observable characteristics, as captured by the the $P(X)$ – as argued above (the conditional independence assumption); and a matching “control” for each firm-destination dyad that receives treatment, to be verified. When these conditions hold, [Rosenbaum and Rubin \(1983\)](#) show that the respective outcomes Y_1 and Y_0 are independent of treatment assignment and that the estimator of δ_{ATT} will give unbiased estimates of the treatment effect. Further, to identify causal effects of EKN guarantees, it is important that the variables we select for the propensity score estimation affect both the selection into using export credit guarantees and the outcome ([De Luna *et al.*, 2011](#)).

As discussed above, our rich dataset allows us to condition on an unusually large number of observable pre-treatment characteristics of firms, industries and countries. In this way, we substantially limit the risk that unobserved heterogeneity between the treated and controls will affect the response variables. Practically, we include the observed covariates in a propensity score estimation, using a probit model. Next, we employ a three nearest-neighbour matching procedure with replacement, where the treated firm-destination dyad is matched with its three closest non-treated matches in the propensity score from the same year.⁵⁷

An advantage with our DD matching estimator is that it is unbiased even in the presence of systematic differences in remaining unobserved time-invariant characteristics (between treated and controls) that may affect the outcome, given that these characteristics will be

⁵⁷Matching with replacement means that the treated dyads are allowed to share the same neighbours. Matching with replacement reduces bias, overall and in sub-samples, and makes the order of matching irrelevant. For clarity, note that dyads are not allowed to be their own controls in years when they did not acquire guarantees since matching is at the firm-destination-year level. In the subsequent DD stage, the three nearest neighbours’ results are weighted to reduce bias, with the weights being positively related to the propensity score.

differenced out. We augment our approach by adding several specific effects. We do this to further control for any remaining unobserved time-varying heterogeneity that could bias the results (if the distribution of the unobserved characteristics differs across treatment groups) and to control for multilateral resistance. Specifically, we include firm-/industry-year and destination-year specific effects.

Again, we are interested in the effects of export credit guarantees on exports and, ultimately, jobs, value added and productivity. We measure the effects as the DD in the outcome variables between the year before acquiring EKN backing ($t - 1$) and the years thereafter (t , $t + 1$ and $t + 2$). Specifically, we estimate four different outcomes, namely, the changes in export status, export level, employment, value added and labour productivity. The first two outcome variables are studied at the firm-destination level, while the other three are considered at the firm level.

6. ECONOMETRIC RESULTS

In this section, we present and discuss our econometric results. We begin with the firm-destination propensity to use the agency’s guarantees and then turn to the estimations of the treatment effects on firm-destination exports and firm jobs, value added and labour productivity.

6.1. *Main Results*

The Propensity to use the EKN Guarantees

In Table 3, columns 1–2, we display the coefficient estimates of the probit model that matches firm-destination dyads that use EKN guarantees with control dyads that do not.⁵⁸ The model facilitates identification since it incorporates a high dimension of observable characteristics

⁵⁸The total number of observations is approximately 13.8 mn, including all observations with a firm-destination treatment and all those without (potential controls). After propensity score matching, for the treated, we are left with 1,032 observations, 863 firm-destinations and 307 firms, while for the matched controls, we have 2,610 observations, 2,551 firm-destinations and 1,270 firms.

from an unusually rich and detailed longitudinal dataset. Based on the resulting propensity scores from the probit model, we then choose the three nearest-neighbour matches among the set of potential control firm-destinations, see columns 3–7. The matching performs well, with the percentage bias being low overall and individually across variables, as well as hardly ever being close to statistically significant.

TABLE 3
Probit model and mean characteristics for treatment and selected control firms.

	Probit coefficient (1)	SE (2)	Treatment firms (3)	Control firms (4)	Percent bias (5)	t-stat (6)	$p > t $ (7)
log (employment)	-0.009	0.008	5.238	5.253	-0.7	-0.12	0.771
log (wage bill)	-0.006	0.010	2.779	2.850	-3.1	-0.58	0.559
log (physical capital stock)	0.001	0.006	1.486	1.574	-2.5	-0.55	0.582
Firm age	0.005***	0.001	16.256	16.189	0.8	0.18	0.854
Share post-sec. educ.	0.573***	0.057	0.412	0.413	-0.5	-0.11	0.915
log (turnover)	0.237***	0.016	4.768	4.826	-2.8	-0.53	0.593
log (value added)	-0.098***	0.018	3.222	3.288	-3.3	-0.60	0.546
Export status _{<i>i</i>}	1.079***	0.031	0.811	0.802	2.7	0.47	0.638
Import status _{<i>i</i>}	0.147***	0.030	0.422	0.418	1.0	0.17	0.863
Export intensity _{<i>i</i>}	0.004	0.008	0.018	0.011	3.4	1.73	0.096
Import intensity _{<i>i</i>}	-4.470***	1.225	0.001	0.001	-0.3	-0.42	0.678
Multinational status	0.060*	0.029	0.829	0.832	-0.9	-0.23	0.821
Foreign ownership	-0.239***	0.024	0.273	0.267	1.3	0.26	0.793
log(distance to export market) _{<i>i</i>}	0.075***	0.018	8.396	8.425	-3.7	-0.82	0.412
log(GDP) _{<i>i</i>}	0.088***	0.008	26.213	26.214	-0.1	-0.01	0.991
WTO membership _{<i>i</i>}	0.013	0.031	0.346	0.331	3.2	0.69	0.492
FTA membership _{<i>i</i>}	-0.333***	0.034	0.823	0.829	-1.9	-0.35	0.728
Ownership of banks _{<i>i</i>}	-0.02***	0.004	6.317	6.237	2.6	0.54	0.590
Private sector credit _{<i>i</i>}	-0.018***	0.005	8.011	8.033	-1.0	-0.21	0.835
Interest rates of banks _{<i>i</i>}	0.054***	0.009	9.340	9.353	-1.0	-0.22	0.825
Country risk _{<i>i</i>}	0.126***	0.007	4.011	4.001	0.4	0.09	0.924
Δ log (turnover)	-0.021	0.022	0.094	0.064	5.4	1.11	0.268
Δ share of post-sec. educ.	-0.152	0.174	0.009	0.011	-1.5	-0.47	0.640
Δ log (wage bill)	0.008	0.009	0.090	0.021	5.7	1.12	0.263
Δ log (physical capital stock)	0.013	0.008	0.058	0.035	1.5	0.40	0.865
Δ log (value added)	0.026	0.022	0.058	0.048	0.6	0.17	0.689
Δ log (export value) _{<i>i</i>}	-0.026***	0.003	0.579	0.451	3.8	0.67	0.502
Δ log (import value) _{<i>i</i>}	-0.009**	0.003	0.022	0.071	-1.7	-0.27	0.788
Δ foreign demand, $t - 1$ to t	-0.019*	0.008	0.172	0.188	-0.0	-0.30	0.762
Δ foreign supply, $t - 1$ to t	-7.49e-08	1.99e-07	1.820	1.609	1.9	0.83	0.423
Δ foreign demand, $t - 2$ to $t - 1$	-5.07e-04	7.50e-04	0.726	1.681	-0.0	-0.50	0.615
Δ foreign supply, $t - 2$ to $t - 1$	-4.03e-05	1.32e-04	1.711	2.720	-0.0	-0.70	0.487
Observations	13,844,444		1,032	2,610			

Notes: We estimate the propensity with a probit model based on the pre-treatment firm characteristics in year $t-1$. Our DD matching estimator employs three nearest-neighbour matching with replacement. A common support restriction is imposed. Response is measured as the probability of using agency guarantees in t , conditional on confounding factors in $t - 1$. We also include logs of input costs (raw material, intermediate goods, intermediate services); two-digit industry-varying information on external financial dependence and asset tangibility; and two-digit industry and year indicator variables in t . Furthermore, we require firms to be present not only in $t - 1$ and t but also in $t + 1$ and $t + 2$. The average mean bias and median bias per variable is 2.2% and 1.9%, respectively. Pseudo- R^2 is 0.303 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Although our interest is in the treatment effects of export credit guarantees, we identify several patterns with respect to the determinants of using the guarantees. A firm's trade experience is the primary factor associated with guarantee usage. Export experience increases

the likelihood of guarantee usage, while relying on a larger share of imported products decreases it. The factor second-most associated with guarantee usage is the share of workers with post-secondary education. A more educated workforce is linked to a higher probability of using guarantees.

Affiliations also matter. Foreign-owned firms are less likely to use guarantees, whereas being a multinational firm is positively linked to usage, albeit only weakly significantly so.⁵⁹ With respect to firm size, we find that firms with a larger turnover are more likely to use the guarantees but that the relation with workforce size is insignificant, both economically and statistically. We also note that firms are less likely to use guarantees with respect to a foreign market with which there is a free trade agreement. However, they are more likely to use guarantees for exports to distant, riskier foreign destinations and to those that are less financially developed.⁶⁰

The Treatment Effects

Having matched firm-destination dyads with guarantees from the EKN (treated) at time t with similar dyads without such guarantees (controls), we proceed to display the average treatment effects on the treated from equation (4) in Table 4. In conjecture 1, we posit that export credit guarantees have a positive effect on firm-destination exports. We expect the effect to be particularly strong for smaller firms. Our corollary 1 posits a weakly positive real economic effect.

We find that the overall pattern is one of positive average treatment effects on the treated from using guarantees, but they are not necessarily economically or statistically significant throughout.⁶¹ The first two panels (A and B) of Table 4 display the average effects of the export credit guarantee treatment at time t on exports to firm-destinations where guarantees

⁵⁹We interpret the former as indicating that foreign-owned firms primarily serve the Swedish market.

⁶⁰Note that the results for the non-displayed two-digit firm logs of input costs and two-digit financial vulnerability variables are not statistically significant, nor is there statistically significant bias in the matching.

⁶¹Remember that treatment consists of a firm being a “first-time” user of a guarantee vis-a-vis a foreign destination, meaning that the firm did not acquire any guarantee for that destination in the previous year.

TABLE 4
Average treatment effects on the treated.

	ATT, t (1)	t-stat (2)	ATT, t+1 (3)	t-stat (4)	ATT, t+2 (5)	t-stat (6)	Observations (7)
<i>(A) Change in the probability of exporting</i>							
All firms	0.179	12.93	0.179	11.42	0.124	7.99	3,636
Micro and small firms	0.458	9.11	0.410	8.28	0.339	6.39	967
Medium firms	0.197	6.78	0.222	6.35	0.206	5.95	1,017
Large firms	0.114	7.56	0.121	6.73	0.077	4.18	1,624
<i>(B) Change in export values</i>							
All firms	1.723	9.59	1.396	6.38	0.722	2.83	2,686
Micro and small firms	3.567	8.50	3.122	4.33	3.230	4.01	524
Medium firms	1.396	3.92	1.649	4.29	1.464	2.74	759
Large firms	0.907	4.15	0.975	3.50	0.394	1.24	1,390
<i>(C) Change in value added</i>							
All firms	0.041	1.31	0.009	0.19	0.179	2.35	3,550
Micro and small firms	-0.278	-1.38	-0.353	-1.78	-0.176	-1.41	957
Medium firms	0.100	1.15	0.217	0.92	1.032	2.11	999
Large firms	0.055	1.60	0.003	0.07	0.073	1.69	1,573
<i>(D) Change in employment</i>							
All firms	0.118	1.63	0.113	1.61	0.067	0.76	3,633
Micro and small firms	-0.013	-0.06	-0.013	-0.06	-0.107	-0.33	967
Medium firms	-0.035	-0.26	0.283	1.14	0.303	1.08	1,017
Large firms	0.015	1.10	-0.005	-0.19	0.029	0.92	1,624
<i>(E) Change in value added/worker</i>							
All firms	-0.014	-1.21	-0.012	-1.09	0.003	1.48	3,550
Micro and small firms	-0.251	-1.32	-0.255	-1.44	-0.010	-0.71	957
Medium firms	3.100e-04	0.34	0.001	0.76	0.006	1.93	999
Large firms	1.468e-05	0.36	-5.970e-05	-1.03	1.505e-05	0.26	1,573

Notes: All effects are estimated using three nearest-neighbour matching with replacement and DD with firm-/industry-year and destination-year fixed effects. Response is measured as the difference in outcomes between $t - 1$ (the year before treatment) and t , $t + 1$, or $t + 2$. A common support restriction has been imposed.

are used. Using guarantees is positively associated with contemporaneous (column 1) and subsequent (columns 3 and 5) export performance, relative to control firm-destinations.⁶² The magnitude of the impact on exports decreases somewhat over time.⁶³ In the year after treatment ($t + 1$), the probability of exporting increases by 18 percentage points relative to controls and the value of exports grows by approximately 213 percentage points relative to control firm-destinations.⁶⁴

Firm size matters for the treatment effects. Micro and small firms experience the largest increase in the probability of exporting to a foreign destination. For large firms, the effects on the probability of exporting are much smaller. Turning to export values, the contemporaneous average treatment effect is more than 50 percent larger for micro and small firms than for firms in general.

We interpret the large impact on micro and small firms as such firms substantially benefiting when transitioning from little or no foreign trade with a foreign market – and the consequently limited experience of trade finance and limited risk diversification – to trade that is backed by guarantees, which may reduce default risks and improve liquidity.⁶⁵

Economically, the results are non-trivial and in line with our main conjecture (1). Firms that

⁶²Decomposing the results reveals that treated firms experience an increase in export probability and values, whereas controls experience a decrease in export probability and values. Overall, the results across performance measures and time are driven primarily by the improved performance of the treated firms. These results are available upon request.

⁶³The conclusions in Table 4 persist when considering effects in year $t + X$, $X \in (3, 4, 5)$, see Table 11 in the Online Appendix.

⁶⁴Throughout, we use exponentiation of the log difference in fitted values when interpreting the sizeable effects on export values in percentage points.

⁶⁵We have compared our results on export values with those of the two other micro-level studies on the subject, with our estimates being in between (Badinger and Url, 2013, Heiland and Yalcin, 2015). We note that our empirical setting is quite different from those studies and we study the impact in greater isolation (firm-destination-year guarantee impact on firm-destination-year exports, rather than impact of guarantee usage on firm or firm-year exports). Recall that we exploit panel data (16 years) for the population of firms, match on a uniquely wide range of pre-treatment characteristics at several levels, and estimate the DD results of guarantee treatment for all the treated firms. For comparison, Badinger and Url (2013) provide estimates corresponding to a 164-253% increase in total (non-bilateral) exports of the 71 guarantee-receiving firms in their cross-sectional survey-based study of Austria in 2008, while Heiland and Yalcin (2015) find a 1.2 percentage point increase in the within-firm probability of having larger than usual expected total (non-bilateral) stock of foreign orders in their partly survey- and commercial-data-based study that includes 571 guarantee-receiving firms in Germany in the 2000-2010 period.

acquire guarantees for export to a foreign destination increase their probability of exporting and substantially increase their value of exports to that destination, relative to similar firms that did not acquire such guarantees. The contemporaneous impact is not surprising. A firm would hardly be expected to acquire a guarantee for export to a destination if it did not expect to sign and deliver on that foreign deal. However, it is interesting that the impact remains economically significant during the subsequent years and is the largest for micro and small firms. We interpret the latter as an indication that the export credit guarantees facilitate the entry of less well-endowed and less internationalised firms into foreign destinations and substantially sustain existing exports there. We cautiously interpret the longevity of the impact as firms benefiting from the guarantees in subsequent business deals with customers in the same foreign market (Lee and Stowe, 1993).

In terms of the characteristics of the foreign customers for which guarantees are provided, we find the strongest effects for exports to micro and small firms, and only statistically significant effects for exports to foreign customers that are domestically owned (Table 12 and Table 13 in the Online Appendix).⁶⁶ Thus, we find the effects on exports not only to be inversely related to the size of the exporter but also to the size of the foreign buyer. These results suggest that guarantees are instrumental for both exporters and importers in reducing costs related to information frictions in cross-border trade.

Turning to conjecture 2 on firm productivity and corollary 1 on the effects on total firm performance, we study change in value added, employment and labour productivity. Panels C to E display the results. We find that the effects of export credit guarantees on jobs and labour productivity are both economically and statistically insignificant. (However, utilising guarantees leads to higher value added in the third year for medium-sized firms.) Our results on jobs contrast with those of a German study with a sample of predominantly larger firms, which finds a positive firm-level job impact of firm-level guarantees (Felbermayr *et al.*, 2012). Furthermore, additional analysis demonstrates that guarantees contribute to

⁶⁶These effects are from a rolling cross-section of exporting firm-destinations and their foreign buyers.

total firm exports (Table 14 in the Online Appendix).

In sum, we find that guarantees assist firms in expanding along the extensive country margin and even more so along the intensive country margin of exports, while we find largely no impacts on jobs and labour productivity but selective impacts on value added and positive impacts on total firm exports. The impacts on firm-destination trade margins are inversely related to the size of exporters and foreign buyers, with disproportional impacts on micro and small firms. Apparently, the effects of guarantees are heterogeneous across both performance measures and firm size.

6.2. *Heterogeneous Impacts and Mechanisms*

Guided by our conceptual discussion, we now further explore heterogeneity in impacts of guarantees, for example, across industries and across firms with different experience of using guarantees. We also examine the effects during the most recent financial crisis. Then we take our corollaries on the mechanisms by which guarantees impact exports to our data. We conclude with a note and analysis of potentially distortive effects of guarantees.

We begin by analysing the impacts of guarantees across industries, which are associated with different levels of tangible assets. As noted above, the manufacturing industry, in particular, and the wholesale industry represent a dominant share of firms using guarantees and of the private sector in Sweden in general.⁶⁷ However, the micro-level impact of guarantees across industries is unknown. In Table 5, we display the first firm-destination-/firm-level estimation results across industries.

We generally find the impacts on exports to be larger for firms in services industries than for firms in manufacturing. Firms in the extended business service industry category (professional, scientific and technical and other services industries) experience an especially strong increase in the bilateral probability of exporting and in export values in t and $t+1$. However, the positive impacts are not restricted to the services industries. Across all four of our broad

⁶⁷The manufacturing industry is still overrepresented among firms using guarantees.

TABLE 5
Average treatment effects on the treated by sector.

	ATT, t (1)	t-stat (2)	ATT, t+1 (3)	t-stat (4)	ATT, t+2 (5)	t-stat (6)	Observations (7)
<i>(A) Change in the probability of exporting</i>							
All firms	0.179	12.93	0.179	11.42	0.124	7.99	3,636
Engineering industry	0.158	9.50	0.165	8.61	0.113	5.90	1,892
Other manufacturing industries	0.175	5.68	0.150	4.39	0.122	3.65	824
Wholesale and retail industries	0.332	6.82	0.341	6.61	0.290	5.45	726
Professional, scientific, technical and other service industries	0.404	4.49	0.389	4.48	0.207	2.86	194
<i>(B) Change in export values</i>							
All firms	1.723	9.59	1.396	6.38	0.722	2.83	2,686
Engineering industry	1.515	6.24	1.333	4.88	0.670	2.12	1,535
Other manufacturing industries	2.076	5.61	1.415	2.87	1.286	2.18	613
Wholesale and retail industries	1.324	3.18	2.107	3.42	1.831	2.00	410
Professional, scientific, technical and other service industries	4.321	4.12	4.331	4.32	1.595	1.62	128
<i>(C) Change in value added</i>							
All firms	0.041	1.31	0.009	0.19	0.179	2.35	3,550
Engineering industry	0.060	1.42	0.027	0.43	0.254	2.43	1,836
Other manufacturing industries	0.006	0.11	0.008	0.12	0.104	1.64	819
Wholesale and retail industries	-0.114	-1.60	-0.123	-1.63	-0.169	-1.58	714
Professional, scientific, technical and other service industries	0.271	1.49	0.214	1.20	0.208	0.68	181
<i>(D) Change in employment</i>							
All firms	0.118	1.63	0.113	1.61	0.067	0.76	3,633
Engineering industry	0.212	1.92	0.183	1.90	0.132	1.06	1,891
Other manufacturing industries	-0.003	-0.13	-0.007	-0.23	0.022	0.46	822
Wholesale and retail industries	-0.051	-0.96	0.368	1.03	0.363	0.81	726
Professional, scientific, technical and other service industries	0.232	0.44	-0.312	-0.44	-0.693	-0.97	194
<i>(E) Change in value added/worker</i>							
All firms	-0.014	-1.21	-0.012	-1.09	0.003	1.48	3,550
Engineering industry	-0.022	-1.39	-0.019	-1.31	0.003	2.16	1,830
Other manufacturing industries	0.004	1.70	0.006	1.70	0.007	1.84	819
Wholesale and retail industries	5.867e-05	0.01	0.002	0.18	-0.008	-0.48	714
Professional, scientific, technical and other service industries	0.031	1.12	0.003	0.39	0.007	0.89	178

Notes: All effects are estimated using three nearest-neighbour matching with replacement. Response is measured as the difference in outcomes between $t - 1$ (the year before treatment) and t , $t + 1$ or $t + 2$. The DD includes firm-/industry-year and destination-year specific effects. A common support restriction has been imposed, and firms are required to be present from $t - 1$ to $t + 2$. All variables are in logs, except for the probability of exporting. See Table 15 in the Online Appendix for sector definitions.

categories of industries, there are positive and significant associations between guarantees and export performance, in contrast to control firm-destinations.

We find it interesting that guarantees have a relatively large impact on the firm-destination export values in the services industries. These industries are relatively constrained in terms of collateral and not as experienced in trade. Therefore, we would expect the impact of guarantees to be particularly strong. However, on the one hand, this might be a somewhat unexpected result since export credit guarantees traditionally have been used for exports of goods.⁶⁸ On the other hand, this finding may be less surprising when considering the role of business services firms for servicifying manufacturing industries in Sweden and given the trend toward outsourcing non-core services activities (Lodefalk, 2013, 2016). In larger business deals, we could also imagine exports to potentially consist of bundles of goods and services related both to delivery and maintenance.

According to our conceptual framework, and as confirmed in Table 4, smaller firms are expected to experience relatively strong export effects from guarantees.⁶⁹ However, being a micro or small firm is no longer wholly synonymous with limited export experience, including experience using export credit guarantees. Some start-ups begin exporting almost from their inception and export early to multiple countries, so-called born global firms, while other small firms do so much later, and still others rarely or never export. Being small is therefore an imperfect proxy for limited export experience, the associated information and liquidity issues, limited access to trade finance, low diversification of the risk portfolio, and the use of export credit guarantees. Therefore, we re-examine the impact of firm size by focusing on *inexperience* in using export credit guarantees. We do this by exploiting the panel dimension of our data, excluding large export transactions, and modifying the construction

⁶⁸Felbermayr and Yalcin (2013) find impacts of guarantees to be the strongest for sectors that are more dependent on external financing, such as shipbuilding.

⁶⁹As mentioned above, smaller firms may be less able to bear the costs of trade in general and particularly when distributed over previously non-existent or small-scale trade, and they are also known to have difficulties in attracting external finance.

of the treatment and control groups.⁷⁰ In Table 6, we perform additional estimations where we distinguish between firms without much and with extensive experience using guarantees, as well as estimations only for smaller transactions.

TABLE 6
Experience with guarantees and smaller transactions.

	ATT, t	t-stat	ATT, $t+1$	t-stat	ATT, $t+2$	t-stat	Observations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>(A) Change in the probability of exporting</i>							
All firms	0.179	12.93	0.179	11.42	0.124	7.99	3,636
Use guarantees for the first time	0.329	8.92	0.377	8.89	0.326	7.26	1,031
Use guarantees for the first time to a specific destination	0.186	12.26	0.174	10.29	0.146	8.03	3,161
Continually using guarantees	0.101	14.67	0.101	13.04	0.086	10.60	11,997
Excluding the top-10 largest transactions	0.178	12.49	0.167	10.64	0.124	7.86	3,611
Excluding transactions > SEK 500 mn	0.195	12.99	0.193	11.74	0.119	7.59	3,589
<i>(B) Change in export values</i>							
All firms	1.723	9.59	1.396	6.38	0.722	2.83	2,686
Use guarantees for the first time	3.162	6.74	3.138	4.99	2.550	3.60	658
Use guarantees for the first time to a specific destination	2.026	10.13	1.586	6.75	1.269	4.50	2,298
Continually using guarantees	0.655	7.39	0.395	3.41	0.218	1.60	9,297
Excluding the top-10 largest transactions	1.737	9.59	1.281	6.05	0.769	3.02	2,692
Excluding transactions > SEK 500 mn	1.871	10.44	1.644	7.39	0.870	3.38	2,666
<i>(C) Change in value added</i>							
All firms	0.041	1.31	0.009	0.19	0.179	2.35	3,550
Use guarantees for the first time	0.093	1.53	0.125	1.80	0.112	1.49	1,017
Use guarantees for the first time to a specific destination	0.071	2.05	0.324	2.13	0.520	2.90	3,074
Continually using guarantees	0.019	1.35	0.058	1.81	0.137	3.24	11,691
Excluding the top-10 largest transactions	0.062	2.05	0.053	0.92	0.217	2.52	3,528
Excluding transactions > SEK 500 mn	0.050	1.56	0.053	0.92	0.240	2.44	3,499
<i>(D) Change in employment</i>							
All firms	0.118	1.63	0.113	1.61	0.067	0.76	3,633
Use guarantees for the first time	0.366	1.37	0.509	1.78	0.176	0.91	1,028
Use guarantees for the first time to a specific destination	0.071	1.12	0.158	1.99	0.070	0.70	3,151
Continually using guarantees	0.040	1.59	0.077	2.45	0.013	0.33	11,978
Excluding the top-10 largest transactions	0.072	1.00	0.055	0.92	0.070	0.82	3,604
Excluding transactions > SEK 500 mn	0.138	2.10	0.196	2.90	0.172	1.83	3,585
<i>(E) Change in value added/worker</i>							
All firms	-0.014	-1.21	-0.012	-1.09	0.003	1.48	3,550
Use guarantees for the first time	0.016	1.80	0.021	1.91	0.017	1.35	1,017
Use guarantees for the first time to a specific destination	0.002	1.04	0.006	2.43	0.006	2.10	3,074
Continually using guarantees	7.424e-04	0.78	4.653e-04	0.49	0.002	1.77	11,691
Excluding the top-10 largest transactions	-0.004	-0.59	-0.002	-0.25	0.005	2.09	3,517
Excluding transactions > SEK 500 mn	9.026e-04	0.73	0.004	2.08	0.004	1.47	3,499

Notes: All effects are estimated using three nearest-neighbour matching with replacement. Response is measured as the difference in outcomes between $t - 1$ (the year before treatment) and t , $t + 1$ or $t + 2$. The DD includes firm-/industry-year and destination-year specific effects. A common support restriction has been imposed, and firms are required to be present from $t - 1$ to $t + 2$. All variables are in logs, except for the probability of export. Notice that the value of the export contract is included only in the offer stage in the EKN data, and in this stage, the value of the contract is not provided for all transactions. Therefore, the results when excluding transactions > 500 mn, which is based on the issued guarantee stage, should be interpreted with caution.

First, below the main results, we display results from limiting the analysis to firms that have never used guarantees for exports to any country. The treated are those firm-destination

⁷⁰Recall that in the main results, the treated firms have acquired a guarantee to a destination in t but not in $t - 1$, whereas the control firms had neither of the alternatives.

dyads that acquired guarantees in year t , and controls are those dyads that did not. The average treatment effects are generally stronger in these estimations, where neither treated nor controls had ever used guarantees to any market. For example, the association between using guarantees for the first time to any country and the probability of exporting to a foreign destination is especially large, more than 80 percent larger than for all firms. The results for first-time users to a specific destination are on par with those for all firms with respect to export probability but larger in terms of export values and substantially larger in terms of value added, with the latter result being statistically significant in $t + 2$. Additionally, we find that labour productivity in $t + 1$ increases for first-time users of guarantees for exports to a specific destination.

Second, we compare firms that continuously use guarantees with firms that cease using them in year t . Throughout, the treatment effects are substantially smaller in this setting. Whether or a not to acquire a guarantee does not appear to be as important a choice for continuous users as it is for firms that are less accustomed to using guarantees.

Third and finally, we exclude the largest transactions from the observations of the treatment group. The impacts are still similar to those in the main results.⁷¹ The only difference is that the impact on jobs is larger and statistically significant when we limit the analysis to transactions below SEK 500 million.

We interpret these results as further confirming our expectation that typical smaller firms – which are liquidity constrained, have limited access to trade finance, have little experience with exports and guarantees, and engage in low-value exports if exporting at all – benefit the most from export credit guarantees.⁷²

⁷¹Excluding the 5, 10 or 20 largest transactions produces nearly identical results (results available upon request). Note that the SEK AB limits its lending to export contracts larger than SEK 500 mn.

⁷²Note that additional estimations demonstrate that the positive association between guarantees and exports is stronger for exports with a higher share of guarantee value in exports, up to the fourth quantile of the distribution ($\leq 75\%$). Moreover, firms using guarantees to enter into minor export contracts benefit more strongly than the average firm in terms of the probability of exporting and the value of exports. These results are available upon request.

Another of our expectations is that the firm-level export effects of guarantees are stronger in the presence of a negative macroeconomic shock, which raises uncertainty, reduces demand and squeezes external finance.⁷³ Since the financial crisis in the late 2000s is included in our dataset and is an exogenous event, we exploit it to further corroborate a causal effect on firm performance.⁷⁴

In Table 16 of the Online Appendix, we estimate the average treatment effect on the treated of using guarantees before (2000-2007), during (2008-2012) and after the financial crisis (2013-2015). We find the treatment effects on the intensive firm-destination margin to be 30 percent larger during the financial crisis, on average, than the effect in the non-crisis period, while the effects on the extensive margin hardly differ in magnitude across the time periods. Moreover, there is positive, substantial and statistically significant contemporaneous impact on value added during the crisis. The value added impact during the crisis stands out in comparison with the much smaller positive pre-crisis and negative post-crisis impacts. Overall, the results seem to corroborate a stronger effect of guarantees on firm performance during negative macroeconomic shocks. We interpret this effect to mean that guarantees mitigate the risks of buyer default and financial constraints to promote firms' exports and value added.⁷⁵

Next in this section, we test our second corollary. We investigate whether guarantees affect exports primarily by addressing the default or the liquidity problem. To this end, we examine the firm-destination specificity of the treatment effects. In Table 7, we display estimation results where we compare the impact on firm-destination exports of starting to use guarantees for that country, versus for another country in the same region, versus for any other region in the world. If there is a causal link from guarantees to exports because guarantees reduce the risks to firms of default by foreign buyers, then we would expect the impact to be the

⁷³A quote from the bank Nordea illustrates this: "If EKN did not exist, not all that many deals could be financed. EKN will always be needed for difficult risks. And in today's market [Spring 2009], it is needed for everything" (NAO, 2014).

⁷⁴For a similar test, see Felbermayr *et al.* (2012).

⁷⁵The results corroborate those of Felbermayr *et al.* (2012) for a German sample of larger firms.

strongest for exports to the country for which the guarantee was acquired. We do find such a pattern. The impact on export performance vis-a-vis a country is positive but weaker for acquiring guarantees for neighbouring countries and still weaker for acquiring guarantees for the rest of the world.⁷⁶

How should we interpret the smaller yet statistically significant results on a firm’s exports to a country from guarantees to other countries or regions? Building on our previous conceptual discussion, we view these results as indicating that a firm’s acquisition of a guarantee assists the firm not only in handling the risk of buyer default for that contract but also in handling liquidity constraints. The guarantee may be discounted by the firm’s bank, enabling the firm to export to other customers across the world or to reduce liabilities on its balance sheet, as well as to improve free cash flow and, hence, firm valuation, by reducing net working capital. Overall, we regard the results in Table 7 as further evidence that guarantees for a foreign country have a causal effect on firm exports, mainly by addressing the default risk, thereby increasing firm-destination exports, and weakly by addressing the firm’s liquidity constraints in exports.

TABLE 7
Average treatment effects on the treated by region.

	ATT, t	t-stat	ATT, T+1	t-stat	ATT, t+2	t-stat	Observations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>(A) Change in probability of export</i>							
First time use of guarantees	0.329	8.92	0.377	8.89	0.326	7.26	1,031
First time use of guarantees in the same region	0.238	38.87	0.134	20.68	0.126	19.39	23,829
First time use of guarantees in other regions	0.031	16.83	0.053	25.24	0.056	26.60	185,427
<i>(B) Change in export values</i>							
First time use of guarantees	3.162	6.74	3.138	4.99	2.550	3.60	658
First time use of guarantees in the same region	1.868	26.51	0.974	11.13	1.113	11.16	18,032
First time use of guarantees in other regions	1.047	19.87	0.838	12.74	0.869	11.42	34,816

Notes: All effects are estimated using three nearest neighbour matching with replacement and DD with firm-year, destination-year fixed effect. Response is measured as the difference in outcome between $t - 1$ (the year before treatment) and t , $t + 1$ or $t + 2$. A common support restriction has been imposed. We divide the regions into Europe, other OECD, Asia, Africa, Latin America, Middle East and Islands.

We end this section with a cautionary note that export insurance might hypothetically not

⁷⁶The average impact on the export probability and the export value of the country from treatment for the neighbouring and the distant regions, across the estimates, is in the range of 9% and 72% of the guarantee-specific-country impacts, respectively.

only address but create market distortions.

One potential market distorting effect of guarantees could be the “crowding out” of private insurers or foreign competitors. Government-backed guarantees may crowd out rather than complement any guarantees of private financial intermediaries if the government-backed ones are priced below their market price (Freund, 2016). Exporters with guarantees may also “crowd out” foreign competitors that lack corresponding guarantees. This could divert trade from more-productive foreign firms to less-productive domestic firms.⁷⁷

To some extent, intergovernmental rules among many countries circumscribe such crowding out from using government-backed export credit guarantees.⁷⁸ Even though they fall short of being the preferred multilaterally agreed and enforced rules (Carmichael, 1987), they arguably reduce the risk of crowding out private intermediaries and beggar-thy-neighbour policies.

Another potentially market distorting effect could be a diversion of exports from more to less-productive exporters or from safer to more risky foreign markets. This concern is potentially more serious since the institutional framework hardly can prevent this.⁷⁹

We have therefore analysed diversion in both these respects (see Tables 17 and 18 in the Online Appendix.) Overall, our results do not support the notion that guarantees divert

⁷⁷In that sense, guarantees could arguably be viewed as a strategic unilateral trade policy tool that could result in foreign trade based on guarantees rather than competitive advantages, lowering the fees for guarantees and raising the amounts guaranteed beyond the societally optimal level (e.g., Dewit, 2001).

⁷⁸Since 1995, the WTO’s Agreement on Subsidies and Countervailing Measures has prohibited insurance for exports that is priced too low to “cover the long-term operating costs and losses” or that is in effect subsidised to gain a competitive advantage in terms of export credits (Annex I:j and k). Irrespective of those criteria, such insurance is allowed for parties to a grandfathered-in agreement among at least a dozen GATT parties to regulate such insurance, as well as for non-parties that conform to that arrangement. One such agreement is the OECD-supported “Arrangement on Officially Supported Export Credits” – the OECD Consensus or Arrangement, which originated in 1978 but has frequently been updated since. The arrangement prohibits subsidised insurance for exports and short-term insurance of intra-OECD trade. Eight countries plus the EU are parties to the arrangement: Australia, Canada, the European Union (EU), Japan, Korea (Republic of), New Zealand, Norway, Switzerland and the United States. In addition to the Agreement, ECAs are domestically regulated, where, e.g., the Swedish ECA has to follow the EU rules on state aid.

⁷⁹A welfare-reducing impact is also conceivable if more-productive firms use the guarantees primarily to hive-off the risk on their books to society so as to promote shareholder value, rather than to enable specific trade transactions.

exports to low-productivity firms or to riskier foreign customers and markets. First, we find rather mixed and small differences in the impact on exports across the distribution of labour productivity, using a quantile approach. Second, we find mixed results also regarding risk. At the extensive margin, the estimations suggest limited differential impacts across heterogeneous markets in terms of risk, with exports to the riskiest markets initially benefiting somewhat more than other markets. Regarding foreign buyer risk, the results do not suggest that guarantees divert export at the extensive margin. Turning to the intensive margin and the risk of markets and customers, we cannot find diversion across foreign markets but we do find it across foreign customers.

In sum, our data from Sweden do not suggest that the institution of export insurance create new market distortions, at least not within the current institutional framework.

6.3. Causality Revisited

In this section, we revisit the core issue of causal inference through two sets of additional estimations.

We employ a fuzzy regression discontinuity design approach (FRDD) on a quasi-natural experiment in Sweden. In this way we estimate local effects from exogenous variation in treatment to overcome self selection. The approach is closer to a randomised control trial than most other non-experimental designs (Cook and Wang, 2008). In the quasi-natural experimental setting, we can exploit information about occurrences when the Swedish export insurer has approached firms rather than the other way around. This research design more directly address the issue of self-selection, providing for cleaner identification.⁸⁰

Between 2012 and 2016 the Swedish agency ran several large-scale direct marketing campaigns, targeting approximately 15,000 firms annually. The aim was to increase awareness and attract customers among exporting SMEs. The agency approached a firm's chief ex-

⁸⁰Similar to experimental designs, ours is expected to be associated with strong internal validity, but weaker external validity.

ecutive or financial officer or their marketing or export manager. The responsible person would receive a cover letter from the regional contact person of the agency and a brochure on real-world examples of companies using the guarantees as well as some information about the offers of the agency. The key criterion for inclusion in the campaigns were having less than 250 employees, besides being an exporter in Sweden.

The approached firms constituted approximately 5 percent of all SMEs, but the overall majority (70 percent) of those that exported. However, most of the targeted firms were only marginal exporters. Their median export intensity was 2.4 percent and their mean and median numbers of foreign destinations were both one.

This setting is suitable for employing a FRDD estimator. We can use the key selection criterion to control for unobserved factors that may affect selection into using guarantees. We argue that the employee criterion make the probability of treatment random, around the threshold value of 250, since the controls were as likely to get the information, had they only had slightly fewer employees.

More specifically, we adopt a non-parametric FRDD to capture the local average treatment effects on the treated around the discontinuity of 250. We start by addressing potential covariate imbalance in the design. Following [Linden and Yarnold \(2016\)](#), we combine the approach of PSM and of constructing a weight based on the conditional probability of using the guarantees (i.e., ‘inverse probability of treatment weight’ or IPTW). Next, we decide the optimal bandwidth, using the data-driven technique of [Imbens and Kalyanaraman \(2012\)](#). We note that the optimal bandwidth represents a substantial share of the firms that has not previously used the guarantees.

In [Figure 2](#), we present the FRDD results. We find that the probability of exporting increases relative to the controls (0.124). The value of exports also increases substantially (1.16). These effects are only marginally different from our benchmark results of [Table 4](#).⁸¹

⁸¹The effects on the other response variables are also similar to the main ones.

Finally, we test the robustness of the FRDD estimates to bandwidth choice (See Table A2). Comfortingly, we find the results be both statistically and economically of similar sizes irrespective of using bandwidths of half or twice the optimal one (McCrary, 2008).

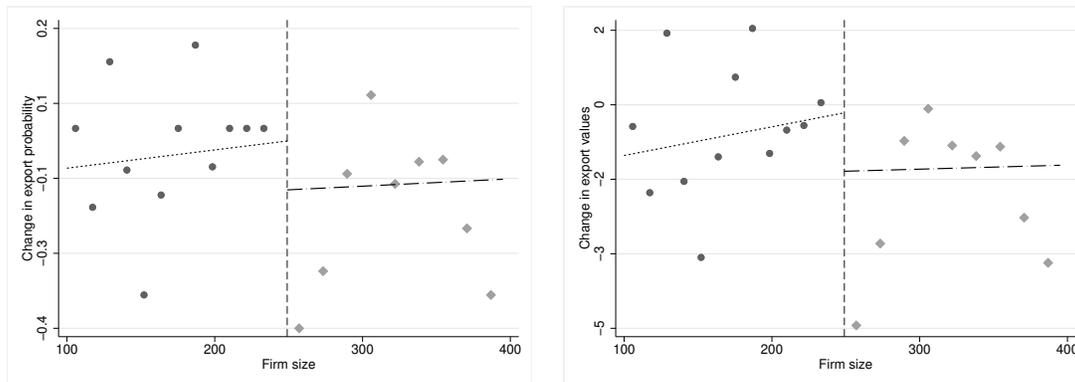


FIGURE 2
FRDD plot of treatment effects on the treated at t

Next, we compare the main treatment effects with those from a “pseudo-treatment” approach. The causal effect hinges on the treatment being exogenous – the so-called unconfoundedness assumption – and this can be tested by estimating the effect of a pseudo-treatment (Imbens and Wooldridge, 2009). Our “pseudo-treatment” consists of re-coding the data such that treatment appears to occur in destination-years when there was, in fact, no treatment.⁸² Then, we apply the DD matching estimator. If identification holds we should verify no impacts whatsoever.

We display the results in Table 19 in the Online Appendix. Overall, the estimated outcomes of the pseudo-treatment are not even weakly significantly different between firms that are treated and those that are not.⁸³ These results would seem to corroborate the causal link that we seek to identify.

We interpret the results from these two sets of estimations as evidence corroborating a causal effect of guarantees on firm performance.

⁸²The treated firms had no guarantees in the guarantee stage at $t - 2$, $t - 3$, $t - 4$ and $t - 5$.

⁸³In magnitudes, for exports, the insignificant results are much smaller or even have the opposite sign compared with those of the main estimations, while for firm-level outcomes, the magnitudes range from larger to having the opposite sign.

6.4. *Robustness Analysis*

We proceed to analyse the robustness of our main estimation results from equation (4) to alternative model specifications and matching methods.

Starting with model specification and matching issues, in Table 20 in the Online Appendix, we summarize the results from a naive model, a first nearest-neighbour matching model and a kernel matching model. The naive model matches treated and control -destinations only on employment, turnover, firm age, physical capital stock, and export and import status, as well as intensities. Comparing our main results in row one with those of the naive model in row two suggests that omitting a wide range of firm, industry and country characteristics in the matching may severely bias the results. The naive model overestimates the impact on export values, whereas it generally underestimates the subsequent impact on value added and employment and produces statistically significant results for labour productivity.⁸⁴ In rows three and four, we compare our main results with those when we include only the first nearest neighbour in matching and when we use a kernel matching estimator, respectively. We find the key conclusions from the main specification to be robust to these matching issues.

7. CONCLUDING REMARKS

Trade has been risky throughout human history and long-distance trade particularly so. Traders, kin or middlemen have typically carried out trade and various arrangements have been made for protection and contract enforcement. With the event of institutions such as the community responsibility system in European communes and subsequent national courts, non-simultaneous exchange flourished (Greif, 2006). However, not until a century ago was a formal institution established to facilitate non-simultaneous exchange across borders – government-backed export insurance. We investigate the role of this innovative, neglected

⁸⁴In comparison to the naive model, both the AIC and BIC values are much smaller in the main specification, indicating its preference both in terms of goodness of fit and avoidance of overfitting.

and yet prominent institution, by analysing microeconomic evidence from Sweden.

We contribute with novel and robust causal evidence on the firm-destination-level and firm-level effects of export credit guarantees and on the heterogeneity of these effects across key dimensions. The contribution is enabled by employing a DD matching estimator on uniquely granular and exhaustive longitudinal data over almost two decades and a fuzzy regression discontinuity estimator in a quasi-natural experimental setting.

Although our focus is on the treatment effects, we note some patterns on selection into using guarantees. We find that having previously exported is strongly and positively associated with the use of guarantees. Firms with a larger share of post-secondary workers and firms with a larger turnover are also more likely to use guarantees. Firms are also more likely to use guarantees for distant and riskier destinations, as well as for destinations without a free trade agreement with the EU.

Turning to the treatment effects, the results support our conjecture that guarantees promote exports, with the effects being stronger for less well-endowed and internationalised firms. The treated firm-destinations – firms that acquire guarantees for a specific foreign market – experience a greater increase in the probability of exporting and in export values vis-a-vis that country than do the controls that do not acquire guarantees. The impacts on firm-destination exports in the next year are economically substantial, with the probability of exporting increasing by 18 percentage points and the export value by 213 percentage points relative to the controls. Our results for the universe of treated firm-destinations in Sweden in the 2000-2015 period are in between those of the two previous micro-level studies, which study firm-level effects and are based on a 2008 cross-section or 2000-2010 partial-sample-based dataset for Austria and Germany, respectively ([Badinger and Url, 2013](#), [Heiland and Yalcin, 2015](#)).

We find the effects to be strikingly heterogeneous across firms, industries and outcome measures. Export credit guarantees disproportionately assist micro and small firms (exporters

and foreign buyers) and first-time users of guarantees in expanding along the extensive and intensive firm-destination margins of trade. Interestingly, the impacts on exports are particularly strong in the services industries. These are industries with less collateral than in manufacturing. They are also increasingly linked to foreign trade in goods and to outsourcing of services activities from manufacturing firms.

Generally, we find no impact on firms' jobs, in contrast to the only previous study on the firm-level effects of guarantees on sales and jobs (Felbermayr *et al.*, 2012), which uses a sample of predominantly larger German exporters. However, we do find impacts on jobs and value added for novices in using guarantees for a specific market and for smaller transactions.

We note that guarantees had a larger positive impact on exports during the financial crisis – in the midst of uncertainty and reductions in demand and the provision of finance. These results, a fuzzy regression discontinuity design analysis of a quasi-natural experiment and a pseudo-treatment test lead us to conclude that there is a causal link from guarantees to firm performance.

Overall, we interpret our results as novel and preliminary evidence that the institution of export insurance facilitates non-simultaneous exchange. Regarding the underlying mechanisms from guarantees to firm performance, we analyzed the firm-destination-specificity of treatment in the form of guarantees. The results suggest that the main mechanism from guarantees to firm performance is via reducing the default risks facing exporters, rather than via improving firm liquidity. However, in both respects, further research on micro-level data is needed to corroborate and further explore the findings.

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APPENDIX

TABLE A1
Variable definitions and data sources.

<i>Control variables</i>	<i>Definitions</i>	<i>Sources</i>
Export status (0,1)	Exports to a specific destination, zero otherwise	FTS
Import status (0,1)	Imports to a specific destination, zero otherwise	FTS
Export intensity	Export value over sales regarding a specific destination	FTS
Import intensity	Import value over sales regarding a specific country	FTS
log (turnover)	Log value of the net turnover in millions of USD	SBS
log (value added)	Log value of the value added in millions of USD	SBS
log(cost of raw materials)	Log value of the cost of raw materials in millions of USD	SBS
log(cost of intermediate goods)	Log value of the cost of intermediate goods in millions of USD	SBS
log(cost of intermediate services)	Log value of the cost of intermediate services in millions of USD	SBS
log (employment)	Log value to the number of (full-time equivalent) employees	SBS
Share post-sec. educ.	Share of employees that have some years of post-secondary educations	LISA
log (wage bill)	Log value of the wage and social benefits in millions of USD	SBS
log (physical capital stock)	Log value of the physical capital stock in millions of USD	SBS
Firm age	The number of years since firms entered officially statistics	FPD
Multinational status (0,1)	Part of an enterprise with firms abroad, zero otherwise	EGR
Foreign ownership (0,1)	Larger than 50 percent foreign ownership, zero otherwise	EGR
Demand shock for importers in t	Change in demand shock for importers from t-1 to t	UN database and own calculation
Demand shock for exporters in t	Change in demand shock for exporters from t-1 to t	UN database and own calculation
Demand shock for importers in t-1	Change in demand shock for importers from t-2 to t-1	UN database and own calculation
Demand shock for exporters in t-1	Change in demand shock for exporters from t-2 to t-1	UN database and own calculation
Asset tangibility	The share of net property, plant, and equipment in total book-value assets	Own calculation
External financial dependence	External financial dependence	Own calculation
log(distance to export markets)	Bilateral distance to export markets	CEPII
log(GDP)	Gross domestic product (GDP) of destination countries	CEPII
WTO membership (0, 1)	Member of WTO, zero otherwise	CEPII
FTA membership (0, 1)	Part of free trade agreement with EU, zero otherwise	CEPII
Bank ownership	The extent that the banking industry is privately owned	FRASIER
Private sector credit	The extent that credit is supplied to the private sector	FRASIER
Interest rates of bank	The extent that controls on interest rates interfere with the credit market	FRASIER
Country risk	Scale of country risk	EKN
Δ log (turnover)	Changes in net turnover from t-2 to t-1	SBS and own calculation
Δ the share of post-sec. educ.	Changes in share of post-sec. educ from t-2 to t-1	LISA and own calculation
Δ log (wage bill)	Changes in wage bill from t-2 to t-1	SBS and own calculation
Δ log (physical capital stock)	Changes in physical capital stock from t-2 to t-1	SBS and own calculation
Δ log (export value)	Changes in export value from t-2 to t-1	FTS and own calculation
Δ log (import value)	Changes in import value from t-2 to t-1	FTS and own calculation
<i>Outcome variables</i>		
Change in the probability of exporting	Change in the probability of exporting from t-1 to t, t+1 or t+2	FTS and own calculation
Change in export intensity	Change in export intensity from t-1 to t, t+1 or t+2	FTS and own calculation
Change in value added	Change in value added from t-1 to t, t+1 or t+2	SBS and own calculation
Change in employment	Change in employment from t-1 to t, t+1 or t+2	SBS and own calculation
Change in value added per worker	Change in value added per worker from t-1 to t, t+1 or t+2	SBS and own calculation

Notes: Sources from Statistics Sweden are structural Business Statistics (Företagens ekonomi), SBS; Longitudinal Integration Database for Health Insurance and Labour Market Studies, LISA; Enterprise Group Register (Koncernregistret), EGR; Foreign Trade Statistics (Utrikeshandel med varor, Utrikeshandel med tjänster), FTS; Compensation of Employees and Current Transfers (Löner och transfereringar), FTS; and Business Register (Företagsdatabasen), FDB.

TABLE A2
Fuzzy regression discontinuity estimation, 2012-2015.

	Change in the probability of exporting	Change in export values
	(1)	(2)
Intention-to-treat effects	0.124** (0.550)	1.159** (7.621)
1st. stage estimates	-0.135*** (0.103)	-0.137*** (0.149)
1st. stage z -statistics	-3.310	-3.304
Obs.	3,519,869	3,519,869
BW Loc. Poly. (h_L)	92	89
BW Loc. Poly. (h_R)	92	89
Intention-to-treat effects (200% h)	0.094** (0.307)	0.802** (2.621)
Intention-to-treat effects (50% h)	0.460** (0.456)	8.366** (5.240)

Notes: An optimal bandwidth was determined using the data-driven technique proposed by Imbens and Kalyanaraman (2009), with a triangle kernel weight. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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