Discussion Paper

Public export credit insurance in the Netherlands: an input-output approach

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Marcel van den Berg
Ilke Van Beveren
Oscar Lemmers
Tommy Span
Adam Walker

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Abstract

This study assesses the contribution of the Dutch public export credit insurance facility (ECIF) to Dutch GDP and employment. Unlike previous studies, which generally adopt the gravity model of trade, we adopt an input-output approach. The results show that the contribution of economic activity insured by the public ECIF to GDP averages 0.24 percent annually. This concerns value added generated both by exporters and their domestic suppliers in the value chain. The contribution to employment shows an average of 0.27 percent, accumulating to 95,000 jobs (FTE) over 5 years. The estimated contribution of the public ECIF to the Dutch economy should be considered an upper boundary of its true contribution. Therefore, we examine the extent to which the above economic gains would be realized if the facility was unavailable using highly disaggregated trade data. The basic idea is that if certain products are only exported to certain destinations with the aid of the public ECIF, then this suggests 100 percent additionality. The inconclusiveness of our results underlines the difficulties in assessing the degree of additionality.

Keywords Exports, credit insurance, gdp, input-output analysis
JEL-classification F23, F14, H42, O52, D57

*Corresponding author, e-mail: m.r.vandenberg@cbs.nl. All authors are affiliated with Statistics Netherlands, the Hague/Heerlen, the Netherlands. This paper is derived from research commissioned by the Dutch Ministry of Financial Affairs, see Van den Berg et al (2016). The content of this publication does not reflect the official opinion of Statistics Netherlands or the Dutch Ministry of Financial Affairs. Responsibility for the information and views expressed in the paper lies entirely with the authors. Any errors are our own.

1 Introduction

One of the most widespread forms of export promotion around the globe is public export credit insurance. Public export credit insurance provides firms with the possibility to insure credit risks associated with high risk export transactions. The facility is available for transactions which are impossible to insure on the private commercial insurance market because of the specific combination of the maturity of the credit provided, the sheer size of the transaction, the risk profile of the debtor and the destination country of the exports. This paper concerns the economic impact of public export credit insurance in the Netherlands. Typical examples of activities that frequently rely on public export credit insurance in the Netherlands include ship building and offshore and dredging works.

Public export credit insurance is a common form of export promotion amongst governments around the world, with both private and public export credit insurance agencies from 73 countries united in the Berne Union.[1] The United Kingdom was the first country to put a public export credit facility in place 1919. Soon other European governments followed and 15 countries, including the Netherlands, were providing some form of public export credit insurance by the year 1934 (Dietrich, 1935). Despite its commonness public export credit insurance has been subjected to surprisingly little academic research thus far. The few studies available (see section 2) generally rely on the standard gravity model of trade, investigating to what extent credit insurance is associated with gross exports. We add to this literature by adopting a novel input-output (IO) approach. This alternative approach enables us to be the first to analyze the effects of public export credit insurance on employment, value added and GDP.

Ideally, we would purge the relationship between export credit insurance and employment and GDP from that part of exports that would have been realized even without the backing of the public export credit insurance facility (ECIF) and in doing so move from a 'gross' to a 'net' contribution to employment and GDP. Even though the degree of additionality of the public ECIF is theoretically considerable, given that only exports that cannot be insured on the private market are eligible for insurance, the possibility remains that part of the exports would have been realized even without the backing of the public ECIF. Nonetheless, assessing the degree of additionality is far from trivial since the counterfactual scenario is essentially unobserved. With this context in mind we arrive at the research questions of this paper:

- What is the contribution of the exports insured by the public export

[1] See www.berneunion.org

credit insurance facility to Dutch GDP and employment?

- Is it possible to assess the degree of additionality of public export credit insurance and move from a gross to a net contribution of the public ECIF to Dutch GDP and employment?

Our contribution to the literature is twofold. First, to the best of our knowledge we are the first to investigate the impact of the public ECIF in an input-output framework as existing work is principally based on the gravity model of trade. Using the input-output approach not only reveals the value added and employment generated by ECIF-insured exports, but also assigns both to the industries involved in the value chains of these exports. Second, even though many governments offer public export credit insurance facilities of some form, academic research of the impact and effectiveness of this type of export promotion is still scant. We add to the still small body of evidence by investigating public export credit insurance in the Netherlands, a small and open economy that depends on foreign demand for about 30 percent of its GDP (Voncken et al, 2015).

Our results show that the contribution of the public export credit insurance facility to Dutch GDP averages 0.24 percent annually, with the ratio of value added to insured exports more or less constant over time at about 70 percent. In the five year period under investigation (2010-2014) total value added induced by the ECIF amounts to about 7.8 billion euros, stemming from gross exports worth 11.2 billion euros. Banking stands out as an industry that mainly benefits from the public ECIF indirectly as a supplier to exporters. The employment induced by ECIF-insured exports largely aligns with the value added. The contribution of the ECIF to Dutch employment shows a 5 year average of 0.27 percent, accumulating to a total of 95,000 jobs (FTE) in 5 years.

In order to investigate if we are able to move from calculating a 'gross' to a 'net' contribution of the ECIF to GDP by adjusting the ECIF for a certain degree of additionality we combine transaction-level data concerning insured exports by destination with aggregated Dutch exports of goods to narrowly defined product-destination markets. The basic idea is that if the degree of additionality of the public ECIF is high, no or little uninsured exports of products to destination countries where we observe ECIF-insured exports would be observable. Unfortunately, the combination of transaction-level insured exports with exports disaggregated to narrowly defined product-destination markets does not yield the desired information regarding the degree of additionality of the public export credit insurance facility. This renders adjusting the ECIF-insured exports for a certain degree of addition-

ality in order to calculate the desired 'net' contribution of the ECIF to Dutch GDP unjustified.

We proceed as follows. Section 2 gives a flavor of existing empirical research of public export credit insurance. Section 3 first presents the specifics of the Dutch equivalent of the ECIF, followed by a discussion of the data preparations and our empirical strategy. Section 4 presents the results of our endeavours followed by some concluding remarks and discussion in section 5.

2 Public export credit insurance

Ample empirical research is available concerning the effectiveness of export promotion.[2] Research on this matter has been done both at the micro-level of individual firms and at the macro-level, mainly employing the framework of the gravity model of trade. In very general terms, the results of this literature can be summarized by the notion that export promotion efforts are most effective when they are aimed at creating new trade relations (in terms of new products or export destinations, i.e. dimensions of the extensive margin). In addition, because of the relative importance of perceived barriers to trade, export promotion seems to be most fruitful when the effort is focused on small and medium sized enterprises (SMEs) and exports of heterogeneous goods. However, insights from these strands of literature cannot be readily extended to the case of public export credit insurance because of the specific nature of the transactions the public ECIF generally concerns and because of its focus on one very specific type of market failure.

Empirical research of public export credit insurance is much more scarce. To the best of our knowledge, no research has been done on this matter in the setting of the input-output framework. Nonetheless, foreign equivalents of the public export credit insurance facility have been subject to empirical research several times. Empirical studies of the public ECIF are either set at the level of individual firms or at higher levels of aggregation such as industries or even at country level. Studies of the latter type are generally conducted within the framework of the standard gravity model of international trade. Examples of research employing the gravity model of trade include Egger and Url (2006); Moser et al (2008); Felbermayr and Yalcin (2013). These studies tend to reveal a positive correlation between the supply of public export credit insurance and exports. Egger and Url (2006) in particular show that the public ECIF is positively correlated with exports in the longer run, whereas Felbermayr and Yalcin (2013) find an instant and

[2]See amongst others the extensive work of Volpe Martincus and Carballo (2010a,b,c); Volpe Martincus et al (2010, 2011, 2012)

one-time relationship between the public ECIF and exports and no long-run effects. Moser et al (2008) also find a stronger correlation between exports and public export credit insurance in their static model specification, in which they also control for the political risk of the destination country, relative to their dynamic model. Considering the nature of the publicly insured export transactions, frequently spanning a period of years, the lack of long-run effects is surprising.

Felbermayr and Yalcin (2013) are the only ones to explicitly address the issue of additionality in their empirical investigation of the public ECIF. They argue that their model specification allows an interpretation of the relevant regression coefficient in terms of a degree of additionality of the public ECIF. A coefficient of 1 would imply 100 percent additionality of the facility, any value short of 1 would imply a less than perfect degree of additionality. Their results return a coefficient of 0.66, suggesting that more than 30 percent of the insured exports would also have been generated without support from the public ECIF.

Auboin and Engemann (2014) investigate the impact of export credit insurance, both publicly and privately supplied, in a multilateral framework. They particularly focus on the issue of causality: does trade decline if the supply of credit insurance is limited or does the demand for credit insurance decrease if trade declines? This question is tackled by employing an instrumental variables approach. Their results indicate that a 1 percent increase in the supply of insured export credit leads to a 0.4 percent increase in trade. However, these empirical findings cannot readily be extended to the Dutch practice due to differences between the characteristics of the insurance instruments under investigation.

Baltensperger and Herger (2009) also investigate the relationship between export and export credit insurance in a multilateral setting with a focus on public supply. Their results corroborate the empirical regularity emerging, suggesting a positive correlation between export and export credit insurance. A more surprising finding is that they only find significant results for exports to advanced countries, not for exports to high-risk or developing countries. This raises concerns regarding the degree of additionality of public export credit insurance, since it seems reasonable to expect that private insurance companies should be able to serve that market to a large extent.

Finally, employing an instrumental variables approach, Badinger and Url (2013) investigate the Austrian ECIF at the micro-level. Their results suggest a substantial and positive impact of public export credit supply on exports.

To sum up, research concerning public export credit insurance is generally set at the micro-level or at the macro-level in the framework of the standard gravity model of trade. To the best of our knowledge, no attempts have

been made thus far to frame this issue within the boundaries of an input-output analysis. The general picture emerging from the literature is that public export credit insurance supply is positively correlated with exports. However, no consensus has been reached regarding the degree of correlation and the direction of causality. In addition, the degree of additionality of public export credit insurance supply has hardly been subjected to empirical research.

3 Data and methodology

3.1 The Dutch public export credit insurance facility

The Dutch public export credit insurance facility was developed by the ministry of Financial Affairs and has been executed by Atradius Dutch State Business (ADSB) and its predecessors since 1932. ADSB currently handles about 250 insurance applications annually. This results in about 200 insurance commitments. About 50 applications are turned down by the insurer annually. Applications are turned down because the transaction is either not risky enough (the transaction is insurable on the private insurance market) or too risky to merit providing the insurance publicly. Some risks are too great even for the public ECIF. This can occur because the transaction is commissioned by firms or governments from war-torn regions. Firms are allowed to submit multiple applications annually. In order to be able to arrange the necessary funding for a particular project firms need to make arrangements to insure the risks associated with the export transaction early on in the process. Therefore, ADSB provides insurance commitments before deals are signed in order to facilitate the process of arranging funding for the project. Should the process ultimately result in a contract then the firm must fulfil its commitment to purchase the insurance from ADSB.

The aforementioned 200 insurance commitments translate into about 100 insurance policies annually. Firms applying for export credit insurance generally compete in international tenders. Naturally, the insurance commitment does not translate into a policy should the firm not be granted the assignment. In many cases an export transaction is covered by two separate insurance policies. The first policy insures the cost of production and reimburses the firm for the incurred cost of production should the buyer pull out unexpectedly during the production stage. The second policy insures the risk of non-payment by the buyer after the goods or services have been delivered and credit has been extended to the buyer. Considering the fact that the focus of our analysis is on the underlying cross-border flow of goods and ser-

vices we take the insured value of the export contract as the starting point of our data process. We do not take the additional insurance policy covering the production stage into account. Including those policies as well would lead to double counting, since both insurance policies just concern a single export transaction. In doing so we ultimately take an annual total of about 80 unique insured export transactions into consideration in our analysis.

The public export credit insurance facility aims to break-even in the longer run. That is, over a range of years the sum of the execution costs of the facility and the insurance claims paid are supposed to be covered by insurance premium payments and recoveries of claims paid. This has indeed been the case in recent years. There is no cap on the number of export contracts that can be insured annually, but there is an annual limit on new business of 10 billion euro of insured transactions. In addition, the cumulative insured export value by country is capped to insure that sufficient geographical dispersion exists and to avoid excessive risk exposure on specific markets. There are a number of criteria that need to be met for export transactions to be eligible for insurance by the public ECIF. Without being exhaustive, only the export of goods or services with production or credit stages lasting more than a year are eligible for the public ECIF. In addition, at least 20 percent of the export value needs to be generated in the Netherlands. There is no formal requirement on the minimum value of export contracts, although small transactions are rarely insured by the public ECIF.

3.2 Data preparations

In our analysis we reconcile data from two different levels of aggregation: (1) micro-level data concerning information on individual ECIF-insured transactions and (2) macro-level data in the form of conventional input-output tables. The micro-data on insured export transactions by ADSB cover all contracts in effect at some point in time during the period 2010-2014 irrespective of the date on which they took effect. This concerns a cumulative total of 451 transactions. We include the total value of the insured goods and services provided to the foreign buyer as the key parameter in our analysis. The costs and benefits associated with the financial arrangements accompanying the export transaction, such as the aforementioned insurance policies covering the production stage, can be considered an example of an indirect effect of the export transaction itself. Indeed, the direct economic activity that is generated by the public ECIF is the value of the insured export contract. The IO-analysis makes the indirect effects explicit in terms of value added generated in supplying industries such as the insurance and banking industry in this case.

We divide the value of the insured export contracts proportionally over the production stage on a monthly basis, since it is highly likely, in accordance with IFRS-guidelines, that firms will also book the turnover associated with the export contract proportionally over the time span of the contract instead of lump sum at some point in time. The information provided by ADSB about each contract enables us to reconstruct the length of the production stage, but not the maturity of the extended credit. However, this does not pose a problem for the purposes of our analysis, because the value added is generated during the production stage rather than after delivery of the goods or services during the credit stage. In addition, we convert the value of each contract to euro values based on monthly averages of daily exchange rates in case the contract concerned a foreign currency. The export turnover associated with individual months is then converted to euro values using the monthly averaged exchange rate.

Finally, we interpret the self-reported foreign content of the export contract as that part of the contract that is fulfilled with production outside the Netherlands. We subtract this part from the total value of the export contract to arrive at the value of the exports produced in the Netherlands. An argument could also be made to interpret the foreign content of the export contract as the foreign value added embodied in the Dutch exports. However, this would be very difficult to estimate by a firm. For example, it seems unlikely that a shipbuilder takes the iron ore into account that the steel producer imported in order to supply steel to the shipbuilder.[3]

The resulting monthly export turnover is ultimately aggregated by firm and year, resulting in unique firm-year combinations for the years 2010 through 2014 with the corresponding ECIF-insured export value.

In the next step we assign the ECIF-insured exports to the industries distinguished in the input-output tables in two steps. In the first step we merge the firms with ECIF-insured exports to the General Business Register (GBR). This register is the backbone of firm-level statistics in the Netherlands and contains basic information about each firm in the Netherlands such as the industry in which it is active according to the ISIC Rev. 4 classification.

Merging the ECIF-data from ADSB to the GBR is an elaborate process. Firms in the ECIF-data are registered on their identification key in the business register of the Dutch Chamber of Commerce. The GBR follows an alternative registry system of individual firms. The GBR distinguishes between business units and enterprise groups. The business unit comprises

[3]In the remainder of the paper we refer to the value of the insured exports produced in the Netherlands when we speak of (ECIF)-insured exports unless explicitly stated otherwise.

a coherent set of economic activities jointly enveloping a production process and consists of one or more entries in the Chamber of Commerce registry. The enterprise group is the highest national level of aggregation of the conglomerate. Larger enterprise groups generally consist of more than one business unit. In many cases, entries in the business register of the Chamber of Commerce map evidently to a business unit from the GBR. However, this is not always the case. Occasionally, an entry does not map to a firm in the GBR, or it maps to more than one business unit or vice versa. In addition, the structure of conglomerates is dynamic, causing the mapping between entries in the business register and the GBR to break down at some point in time. In those cases, where mapping firms from the ECIF-data to the GBR is not evident, we manually investigate the data to determine the most appropriate mapping. This mapping procedure yields good results; all firms but one (reporting a foreign commercial business registry key) from the ECIF source data map evidently to the GBR.

In the next step, we manually assign the ECIF-insured exports of each firm in our dataset to an industry from the IO-table of the National Accounts. The IO-table distinguishes between 128 industries which generally concord well with the ISIC-classification. All available circumstantial information is combined to assign insured exports to specific industries; the ISIC-industry in which the firm is active, the description of the ECIF-insured goods and services as reported in the application and the self-reported 'trade sector'. Generally, this results in the ISIC-classification of the firm being the leading indicator for the assignment of exports to industries. However, in some cases we deviate from this procedure in order to align with definitions of the National Accounts. An example of such a deviation is the ISIC-industry "wholesale trading". In the system of National Accounts, exports of wholesalers are assigned to the producing industry, and not to the wholesale industry, despite the fact that it is the wholesale industry which actually sells the goods to foreign buyers. This convention is adopted because the wholesaler is considered, in National Accounting terms, to only produce the trade margin (mark-up) and not the goods themselves. We follow this convention in our analysis. In a few cases, more than one plausible assignment is possible. To investigate the impact of the assignment, we perform a robustness test of the assignment of exports to industries.[4]

[4]In order to test for the robustness of the assignment two researchers independently worked out a complete assignment of exports to industries followed by IO-analyses employing both assignments. The differences in outcomes between the two sets of assignments were negligible. The results of this sensitivity analysis are available from the authors upon request.

3.3 Assessing the degree of additionality of the ECIF

Before turning to the input-output analysis yielding the contribution of the public ECIF to Dutch GDP we investigate to what extent insured export contracts would have fallen through should the insurance policy not have been approved. Indeed, this counterfactual scenario is unobserved by definition.[5] At first glance, the additionality of the public ECIF is considerable, due to the fact that only exports that cannot be insured on the private market due to the associated risk profile are eligible for the public ECIF. In addition, the insured contracts are generally of considerable size with payment periods of considerable length. In many cases, the bank requires an export credit insurance policy to be tied to the transaction before agreeing to finance the contract. However, the possibility remains that part of the exports would have been realized even without the backing of the public ECIF. For example, some firms might have been willing to bear the risk associated with the transaction themselves if they consider it a worthwhile investment. In addition, moral hazard issues could also pose a threat, although that does not seem very likely. Firms could deliberately seek high-risk markets, while they would have focused on alternative markets should the ECIF not have been available. Ideally, we would only consider insured export contracts in our analysis that would have fallen through if there had not been a public ECIF available. Of course, assessing the degree of additionality of the public ECIF to individual contracts is far from trivial. Nonetheless, employing disaggregated trade data, we try to gain an understanding of the extent to which the closing of export contracts crucially hinged upon approval of the ECIF-policy and in doing so move from calculating what we coin the 'gross' to the 'net' contribution of the ECIF to GDP.

The idea is that if the degree of additionality of the public ECIF is high, no or little uninsured exports of products to destination countries where we observe ECIF-insured exports would be observable. For example, suppose an insurance policy is provided to a shipbuilder exporting a ship to Mozambique. If the degree of additionality is sufficiently high, we should not observe uninsured exports of ships to Mozambique. Or put differently, the value of the exports of ships to Mozambique in the International Trade in Goods database should more or less equal the value of the insured export contract in our insurance data.

To this end, we combine data about insured goods and services including their export destination with goods exports by destination country and

[5]We also considered techniques such as Propensity Score Matching (PSM) to tackle this question. However, if the public ECIF does what it is supposed to do PSM is not an option, simply because a proper control group does not exist.

product type from the International Trade in Goods database from Statistics Netherlands.[6] We employ trade data at level 3 (4 digits) of the Combined Nomenclature (CN) to ensure a sufficient level of detail for the purpose of our analysis. A few illustrative examples of 'products' at this level of aggregation include *Harvesting or threshing machinery, including straw or fodder balers; grass or hay mowers; machines for cleaning, sorting or grading eggs, fruit or other agricultural produce* (CN-code 8433) and *Cruise ships, excursion boats, ferry-boats, cargo ships, barges and similar vessels for the transport of persons or goods* (CN-code 8901). The total value of Dutch exports in each of these unique destination-product markets is then confronted with the value of ECIF-insured exports which have been assigned to a level-3 product class of the CN-classification system. This assignment is done manually and derived from information regarding the exported goods and services as described in the insurance application. This procedure yields 127 unique destination-product markets in which ECIF-insured exports are recorded. This is less than the reported total number of 451 insured export contracts e.g. because we only investigate goods exports in this context (and not exports of services) and multiple export contracts can concern exports of the same product to the same country.

The connection between exports from the insurance data and goods exports from Statistics Netherlands needs to be made with caution. Indeed, besides statistical noise, contract information will not be perfectly traceable in trade statistics for various reasons. First, the export turnover associated with the contract might show up in the books following a time path different from our calculations. Second, currency conversions could lead to differences. Third, the outsourcing of specific elements of the production process to other (Dutch) sub-contractors could lead to differences if the sub-contractor exports the goods or services directly to the customer. Finally, the same holds for export contracts entailing a combination of goods and services, since service trade is currently not available at the same level of disaggregation and the insured export value cannot be separated between the goods and services provided. Nonetheless, the proposed confrontation between insured exports and aggregate exports at the product-destination country level is a potentially insightful way to gain an understanding of the degree of additionality

[6]Insured export transactions frequently concern a combination of goods and services exports. For example, a transaction might entail the delivery of a food processing machine and the training of local staff to operate the machine. Unfortunately, we cannot separate the value of the goods exports from the service component of the transaction. In addition, firm-level data concerning trade in services is yet insufficiently available in the Netherlands to include in our analysis. This results in an asymmetry in our analysis that we partially solve by employing a harmonized classification of goods trade.

of the public export credit insurance facility.

3.4 Estimating the contribution of ECIF-insured exports to GDP

We investigate the impact of the public ECIF on the Dutch economy in the setting of the input-output (IO) framework to be able to take the step from gross exports to value added terms. This poses a prominent advantage of the IO-framework over the gravity model of trade which is usually employed to study the impact of export credit insurance on gross exports (instead of value added or employment). Our empirical strategy to calculate the contribution of public export credit insurance to GDP is derived from traditional input-output analysis techniques aimed at investigating the input content of exports such as value added or CO_2 emissions (see for example Hummels et al (2001); Su et al (2010). This framework for input-output analysis can be transferred easily to the case of domestic value added or employment embodied in publicly insured exports. We discuss the case of value added below, but the analogy can be transferred to employment as an input factor as well. The basic input-output model (Miller and Blair, 2009) can be expressed in matrix form as:

$$x = Zi + f = Ax + f \tag{1}$$

Or, in words, each industry's total output (x) is equal to the summation of intermediate (Z) and final demand (f) for its product, with i being a column vector of 1's and A representing a matrix of direct production coefficients. Rewriting this equation gives us the basic formula for input-output analysis:

$$x = (I - A)^{-1} f = Lf \tag{2}$$

Where L is known as the Leontief inverse; the matrix element L_{ij} expresses the amount of output industry i needs to supply, both directly and indirectly, for 1 unit of production for final demand of industry j. Define vector v as a vector representing the value added generated per euro of output by industry (and $\hat{v}$ as the diagonal matrix of v), so that total value added by industry (V) can be expressed as follows:

$$V = \hat{v}x = \hat{v}(I - A)^{-1} f = \hat{v}L(f_d + f_s + f_e) \tag{3}$$

Where, following the notation of (Su et al, 2010), f_d denotes the vector of domestic final demand, f_s the vector of publicly insured foreign final demand

(insured exports) and f_e the vector of non-insured foreign final demand (non-insured exports). Where square matrix M is defined as $\hat{v}L$, note that the element M_{ij} represents the amount of value added generated by industry i for 1 unit of production for final demand of industry j. Total value added embodied in publicly insured exports by industry can then be expressed as:

$$V_s = \hat{v}Lf_s \tag{4}$$

This value added is generated through the complete value chain connected to the insured exports, not just by the exporter, but also by its upstream suppliers.[7] For example, the metal industry serves as a supplier to the ship-builder exporting an insured oil tanker, but the bank of the exporter is also part of the value chain, as is the banks accountant and so on.

All necessary information in addition to industry-level insured exports is derived from the annual input-output tables covering the years 2010 through 2014 which are constructed by Statistics Netherlands. The input-output analyses are derived from the most detailed IO-tables available distinguishing between 128 industries. The results are reported at a higher level of aggregation, distinguishing between 76 industries, for technical considerations.

4 Empirical findings

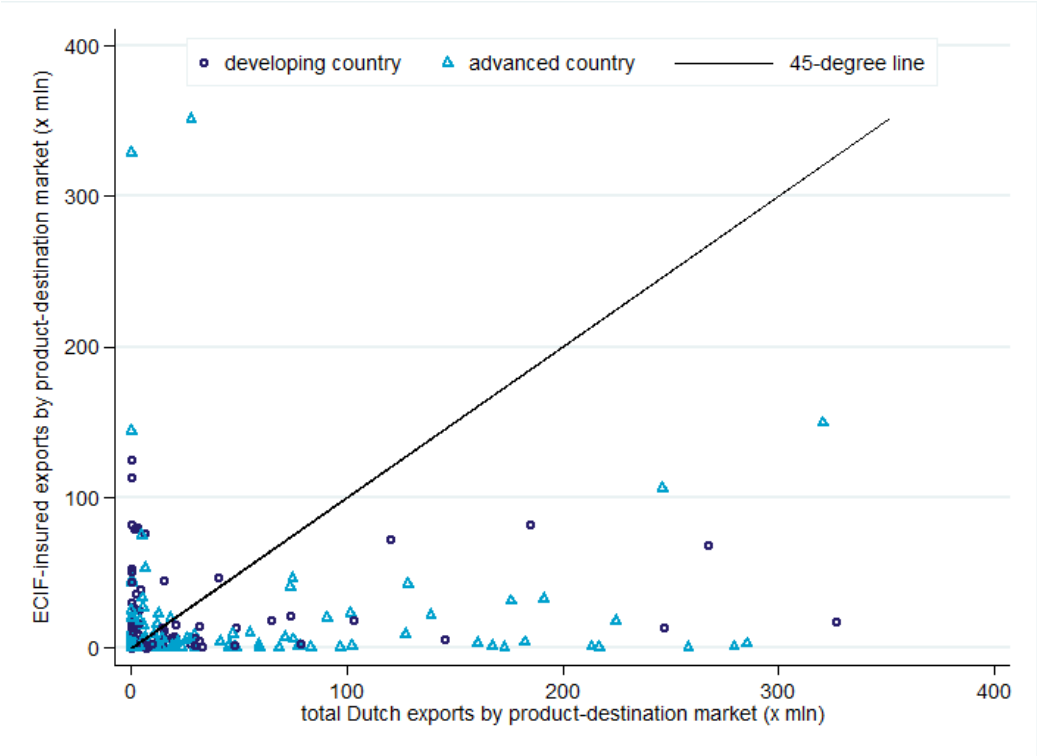
4.1 The degree of additionality of the ECIF

Figures 1 and 2 show the result of confronting the ECIF-insured exports by product-destination market with aggregate Dutch goods exports to the corresponding product-destination market. Both figures contain the same information, except Figure 2 zooms in on the clustering of observations closer to the origin. In case of 100 percent additionality of the public ECIF and lack of statistical noise each observation should be located on the 45-degree line. Indeed, only then would there be no uninsured exports in addition to the ECIF-insured exports to a specific product-destination market. Observations to the left of the 45-degree line concern cases where insured exports exceed total Dutch exports to that particular product-destination market. This would only be possible in case of statistical noise. Observations to the right of the 45-degree line concern cases where total export exceed insured exports. In

[7]Note that we use the term value added for the sake of notational brevity where value added in terms of our input-output framework is defined as value added plus taxes less subsidies on products. This enables us to relate value added to GDP.

the absence of statistical noise, these cases would provide empirical evidence for a degree of additionality of the public ECIF of less than 100 percent.

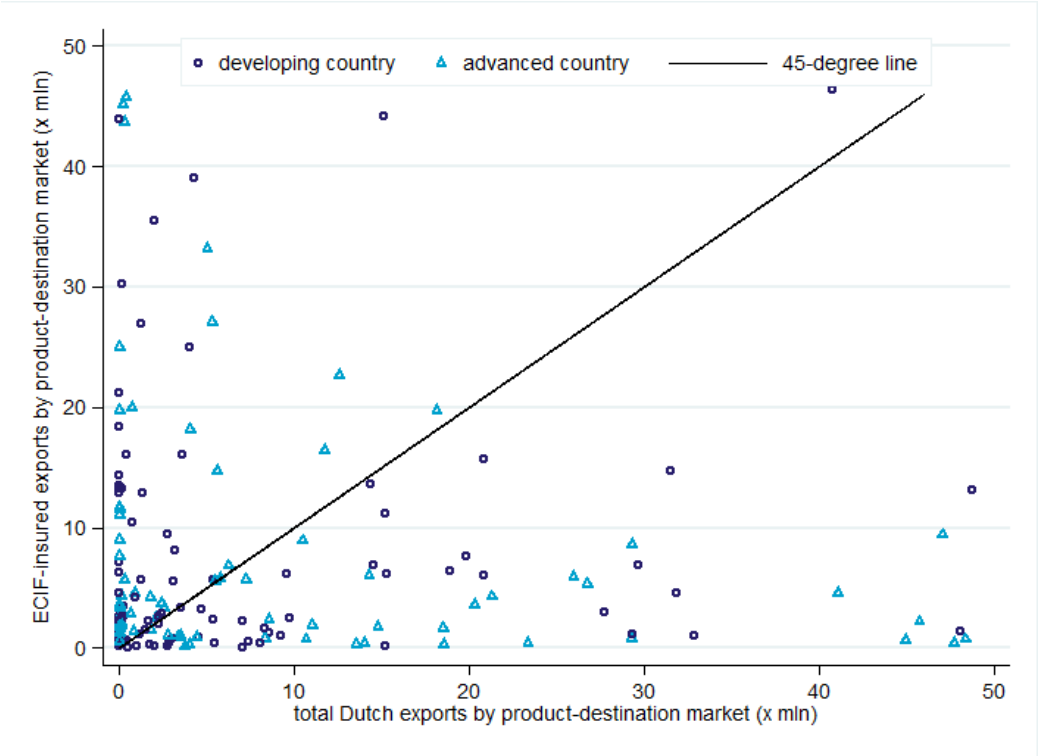
Figure 1: ECIF-insured exports and Dutch exports by product-destination market (accumulated over 2010-2014, × mln euro, capped at 400 million euro)



The figures obviously show this is not the case. Almost half of the 127 observations (product-destination markets) are located left of the 45-degree line, or put differently, in half of the cases insured exports exceed total recorded exports. In 40 percent of these cases zero exports to the product-destination market at hand are recorded at Statistics Netherlands. This can only be explained by statistical noise; the data preparations discussed in section 3.2, differing moments of the registering of exports, lacking data concerning exports of services, etc. An alternative source of administrative noise is posed by the possibility that the insured risk is tied to a party in another country than the country to which the goods and services are actually being shipped. This is particularly relevant in cases where special purpose vehicles (SPVs) are involved in an export transaction. In those cases, the destination country registered in the insurance application differs from the destination

country recorded in trade statistics. Unfortunately, we are unable to investigate the degree to which this actually poses a problem, although public officials involved in the public ECIF indicate that the majority of the insured transactions does not involve SPVs.

Figure 2: ECIF-insured exports and Dutch exports by product-destination market (accumulated over 2010-2014, × mln euro, capped at 50 million euro)



In more than half of the 127 cases we observe aggregate exports exceeding insured exports to a particular product-destination market. Indeed, the more sizeable product-destination markets largely seem to concern developed countries. Three possible explanations emerge: (1) statistical noise, (2) the additionality of the public export credit insurance facility falls below 100 percent, (3) the design of the facility. Exports to highly developed economies nearby are also eligible for ECIF-insurance if certain criteria are being met regarding e.g. size of the transaction or the maturity of the credit. However, this obscures the mapping of insured exports to aggregate exports, since it is likely that in those cases uninsured exports of products to destination countries will be recorded even in narrowly defined product-destination markets simply because those exports are not eligible for the public ECIF. Unfortunately, we are unable to separate aggregate exports by product-destination

market for the share of exports that is eligible for the public ECIF.

Unfortunately, the confrontation of ECIF-insured exports with exports disaggregated to narrowly defined product-destination markets does not yield the desired information regarding the degree of additionality of the public export credit insurance facility.[8] This renders adjusting the ECIF-insured exports for a certain degree of additionality in order to calculate the desired 'net' contribution of the ECIF to Dutch GDP unjustified. Any quantification of the degree of additionality would be poorly motivated at best. Therefore, the remainder of this section concerns the contribution of the public ECIF to Dutch GDP in 'gross' terms rather than in 'net' terms. In other words, we are able to estimate the contribution of ECIF-insured exports to GDP ('gross' contribution), but not the contribution to GDP if we only take these export transactions into account that would have fallen through if there had not been a public ECIF available ('net' contribution).

4.2 The gross contribution of the ECIF to the Dutch economy

The total value of publicly insured exports amounts to 11.2 billion euros over the years 2010 through 2014. Table 1 shows the insured export values and the underlying number of insurance policies for the ten most prominent industries. The use of the public export credit insurance facility is highly concentrated in two industries: civil engineering and manufacture of other transport equipment. The former industry concerns for example large scale dredging and offshore projects in which the Netherlands is an important player. The latter concerns mainly shipbuilding, in which the Netherlands also holds a strong position worldwide. Particularly ECIF-insured projects in this industry are of considerable size on average considering the relatively small number of insurance policies; 5 percent of the total number of insurance policies represents 38 percent of insured exports worth 4.2 billion euro. Civil engineering and manufacture of other transport equipment jointly account for 79 percent of the ECIF-insured exports worth 8.9 billion euro in five years. The manufacture of machinery is also a relatively large user of the ECIF, accounting for the largest number of insurance policies. 32 percent of all ECIF-policies falls in this industry, covering 10 percent of the value of insured exports.

[8] As a robustness check we replicated the analysis only including product-destination markets concerning only fully completed export projects in the period 2011-2013 and no recorded ECIF-insured projects in 2010 and 2014, in order to mitigate the impact of proportionally distributing the export turnover over the production phase. The results of this robustness check do not differ to a notable extent.

Table 1: ECIF-insured exports by industry (top-10)

2010-2014	ECIF-insured exports (* mln euro)	%	# insured contracts	%
Civil engineering	4,663	41.6	111	24.6
Manufacture of other transport equipment	4,204	37.5	21	4.7
Manufacture of machinery	1,138	10.2	142	31.5
Manufacture of metal products	562	5.0	56	12.4
Architectural and engineering services	206	1.8	28	6.2
Manufacture of electrotechnical products	X		X	
Specialised construction activities	X		X	
Mining of oil and gas	X		X	
General construction and building	62	0.5	18	4.0
Manufacture of motor vehicles	53	0.5	14	3.1
Other industries	69	0.6	41	9.1
Total	11,201	100.0	451	100.0

Notes: Some values in the table are suppressed due to confidentiality issues. The cases at hand are marked with an 'X', but have not been dropped from the analysis.

The key findings of the input-output analysis discussed in section 3.4 are presented in Table 2. The table shows the value added and employment induced by the public export credit insurance facility in the exporting industry itself and in supplying industries jointly. The process of the IO-analysis enables us to account for the value added and employment induced by the ECIF all through the value chain back to upstream supplying industries at the beginning of the production process. The results show that the contribution of the public export credit insurance facility to Dutch GDP ranges from 0.12 to 0.39 percent annually. On average, the contribution to GDP amounts to 0.24 percent. The difference in the annual contribution to GDP hinges on variations in the underlying insured export values, which ranges from 1.1 billion euro in 2010 to 3.4 billion euro in 2012. The ratio of value added to insured exports is more or less constant over time at about 70 percent, or, in other words, every euro of ECIF-insured exports translates into 70 cents of value added earned in the Netherlands. The total value added induced by the ECIF, both directly and indirectly, ranges from 760 million euro in 2010 to 2.5 billion euro in 2012. In the five year period under investigation total value added induced by the ECIF amounts to about 7.8 billion euro.

The employment induced by ECIF-insured exports largely aligns with the value added. The contribution of the ECIF to Dutch employment ranges from 0.12 to 0.45 period with a 5 year average of 0.27 percent. The total annual number of jobs supported by the ECIF ranges from 8,500 in 2010 to 31,800 in 2012 accumulating to a total of 95,000 jobs (FTE) in 5 years.

Table 2: Gross contribution of ECIF to the Dutch economy

	2010	2011	2012	2013	2014	2010-2014
ECIF-insured exports (* bn euro)	1.1	2.2	3.4	2.5	1.9	11.2
value added (bn euro)*						
GDP (the Netherlands)	631.5	642.9	645.2	650.9	662.8	3,233.2
value added induced by ECIF	0.76	1.57	2.50	1.68	1.33	7.84
% of GDP induced by ECIF	0.12	0.24	0.39	0.26	0.20	0.24
ratio value added to exports	0.72	0.71	0.72	0.66	0.69	0.70
employment (1,000 fte)*						
total employment (the Netherlands)	7,056	7,099	7,055	6,998	6,977	35,185
employment induced by ECIF	8.5	18.4	31.8	20.4	15.7	94.8
% of total employment induced by ECIF	0.12	0.26	0.45	0.29	0.23	0.27

Table 3 presents the breakdown of value added induced by ECIF-insured exports both directly and indirectly by industry for the 10 most important industries. Again, the industries benefitting the most from the ECIF are civil engineering and manufacture of other transport equipment. This is not surprising considering the fact that almost 80 percent of the ECIF-insured exports stems from these industries. About 20 percent of the value added induced by the ECIF is generated in civil engineering, amounting to 1.6 billion euro. The manufacture of other transport equipment accounts for 975 million euro of ECIF-induced value added, amounting to about 12 percent of total ECIF-insured value added. The manufacture of metal products also benefits considerably from the ECIF; 10 percent (775 million euro) of value added is tied to ECIF-insured exports in this industry.

Table 3: Value added induced by ECIF-insured exports by industry (top-10)

2010-2014	value added (* mln euro)	%
Civil engineering	1,561	19.9
Manufacture of other transport equipment	975	12.5
Manufacture of metal products	775	9.9
Specialised construction activities	572	7.3
Manufacture of machinery	498	6.4
Wholesale	461	5.9
Employment activities	390	5.0
Architectural and engineering services	260	3.3
Banking	214	2.7
Repair and installation of machinery	208	2.7
Other industries	1,915	24.5
Total	7,829	100.0

Just outside the top-3 are the industries specialized construction activities, manufacture of machinery and wholesale with value added shares of 6 to

7 percent. The input-output analysis clearly shows the impact of the ECIF on supplying industries; the concentration of ECIF-induced value added in civil engineering and manufacture of other transport equipment (Table 3) is much lower than the concentration of insured gross exports in these industries (Table 1). A relatively large fraction of ECIF-insured value added is indirectly generated by the banking industry. This finding is a reflection of the contribution of the financial industry in general; supplying credits, facilitating the payment system, insuring, etc., including the economic activity spurred by the financial arrangements accompanying the export transaction, such as insurance policies covering the production stage of ECIF-insured transactions.

The sectoral composition of employment directly and indirectly induced by the ECIF (Table 4) resembles that of value added closely. A few differences stand out. Specialized construction activities and employment activities are more prominent in terms of employment than in terms of value added. Both industries account for about 10 percent of jobs compared to 5 to 7 percent of value added. In manufacture of machinery and wholesale the picture emerging is reversed. Banking does not show up in the top-10 in terms of employment, while holding companies and management consultancy emerges. Concerning the banking industry the difference is noteworthy; this industry indirectly generates 2.7 percent of the value added tied to the ECIF while accounting for only 0.8 percent of the employment equivalent. These difference can be explained by differences in the labour intensity of the underlying activities performed in the respective industries.

Table 4: Employment induced by ECIF-insured exports by industry (top-10)

2010-2014	employment (* 1,000 fte)	%
Civil engineering	19.2	20.2
Manufacture of other transport equipment	9.9	10.5
Specialised construction activities	9.9	10.4
Employment activities	9.8	10.3
Manufacture of metal products	9.8	10.3
Manufacture of machinery	4.3	4.6
Wholesale	4.2	4.4
Architectural and engineering services	3.4	3.6
Repair and installation of machinery	2.6	2.7
Holding companies and management consultancy	2.1	2.2
Other industries	19.7	20.7
Total	94.8	100.0

5 Conclusion and discussion

Combining transaction-level data covering the years 2010-2014 concerning exports backed by the public export credit insurance facility, we assess the contribution of the ECIF to the Dutch economy. Contrary to most existing work on the economic impact of export credit insurance we do not rely on the standard gravity model of trade for our analysis, but adopt input-output analysis in order to be able to estimate the contribution of the ECIF to GDP and employment. Without adjusting for the degree of additionality of the ECIF (the degree to which the ECIF was crucial to the closing of the deal) the contribution of the facility in terms of GDP seems rather small in percentages, but is considerable in monetary terms.

Our empirical analysis reveals that the total value of publicly insured exports amounts to 11.2 billion euros over the years 2010 through 2014. Civil engineering (mostly offshore works and dredging) and manufacture of other transport equipment (mainly shipbuilding) are the most prominent industries relying on public export credit insurance. These two industries jointly account for 79 percent of the ECIF-insured exports worth 8.9 billion euro in five years. The input-output analysis shows that the contribution of the public export credit insurance facility to Dutch GDP ranges from 0.12 to 0.39 percent annually. On average, the contribution to GDP amounts to 0.24 percent. The difference in the annual contribution to GDP hinges on variations in the underlying insured export values, since the ratio of value added to insured exports is more or less constant over time at about 70 percent. In the five year period under investigation total value added induced by the ECIF amounts to about 7.8 billion euro. Banking stands out as an industry that mainly benefits from the public ECIF indirectly as a supplier to exporters. This finding is a reflection of the contribution of the financial industry in general; supplying credits, facilitating the payment system, insuring, etc., including the economic activity spurred by the financial arrangements accompanying the export transaction, such as insurance policies covering the production stage of ECIF-insured transactions. The employment induced by ECIF-insured exports largely aligns with the value added. The contribution of the ECIF to Dutch employment shows a 5 year average of 0.27 percent, accumulating to a total of 95,000 jobs (FTE) in 5 years. The industry employment activities stands out as an important supplier to exporting industries, which is likely to be tied to the types of businesses frequenting the public ECIF, of which some, such as shipbuilding, frequently rely heavily on temporary employment.

The figures presented in this paper provide an indicative picture of the contribution of the public export credit insurance facility to the Dutch econ-

omy. Input-output analysis as a research technique provides stable and reliable but coarse empirical results on this matter. This is tied to the assumptions underlying the analysis, such as the premise that all firms operating within the same industry are homogeneous in the sense that they face the same production function. However, empirical research shows that at the micro-level of individual firms considerable differences between firms in narrowly defined industries exist (Van den Berg, 2014). Abundant research has shown that internationally active firms, such as exporters, perform better on average than firms that solely focus on domestic markets on numerous dimensions. For example, exporters are shown to be, on average, larger, more productive, more innovative and have a higher probability of survival. Accounting for such forms of heterogeneity would be a valuable extension of our analysis, since firms relying on the public ECIF are of course internationally active by default. However, this does not necessarily imply that the value added induced by the public ECIF would turn out to be larger should we be able to account for these types of firm heterogeneity, since the productivity of exporters is higher than that of non-exporters and they most likely depend on foreign markets for inputs to their production processes more heavily than do non-exporters. As a consequence, we expect that Dutch value added and employment embodied in insured exports would be lower if we would accommodate this dimension of firm heterogeneity in the IO-framework. Accommodating a distinction between small and medium-sized enterprises (SMEs) and larger firms would also be a useful extension of the analysis, since large firms, as firms relying on the public ECIF generally are, differ fundamentally from SMEs in terms of performance, production structure and dependency on foreign markets (Chong et al, 2017). Nonetheless, such dimensions of firm heterogeneity are complex to accommodate in the input-output framework.[9]

The estimated contribution of the public ECIF to Dutch GDP and employment should be considered an upper boundary of the true contribution of the facility. The analysis inevitably relies on the premise that each insured transaction would have fallen through without backing from the public ECIF, or, put differently, an additionality of 100 percent. However, it is possible that some transactions would have been successfully completed in the absence of a public ECIF. In order to obtain a clear picture of the true contribution of the public ECIF to the Dutch economy, the analysis should ideally be purged of transactions to which the presence of the public ECIF was not crucial. Unfortunately, the confrontation of transaction-level insured

[9] As a case in point, Chong et al (2017) distinguish between SMEs and large firms in the input-output framework by rebuilding the underlying supply and use tables all the way from the ground up for the year 2012.

exports with exports disaggregated to narrowly defined product-destination markets does not yield the desired information regarding the degree of additionality of the public export credit insurance facility due to considerable statistical noise that cannot be separated from either the impact of the design of the ECIF or the degree of additionality of the facility. This renders adjusting the ECIF-insured exports for a certain degree of additionality in order to calculate the desired 'net' contribution of the ECIF to Dutch GDP unjustified.

On the other hand, it is possible that the effects of the public ECIF are larger than the value added and employment related to the additional exports due to the public ECIF. Namely, the public ECIF might enable economies of scale. For example, a considerable part of the insured exports is concentrated in two industries: ship building and civil engineering. Insured exports will most likely constitute a substantial part of the output of the firms involved. If the public ECIF would be discontinued these insured exports might not persist. In that case, the costs per unit of product would increase and value added would decrease assuming that the fixed costs of production remain unchanged. In a worst case scenario, firms even may not prevail without the exports insured by the public ECIF. Unfortunately, the extent to which this is an issue is impossible to assess with the information at hand.

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Explanation of symbols

Empty cell	Figure not applicable
.	Figure is unknown, insufficiently reliable or confidential
*	Provisional figure
**	Revised provisional figure
2016–2017	2016 to 2017 inclusive
2016/2017	Average for 2016 to 2017 inclusive
2016/'17	Crop year, financial year, school year, etc., beginning in 2016 and ending in 2017
2014/'15–2016/'17	Crop year, financial year, etc., 2014/'15 to 2016/'17 inclusive

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