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Evaluating the impact of export finance support on firm-level export performance: Evidence from Pakistan

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Abstract. This paper evaluates the impact of two large export finance support schemes on firm-level export performance. The Export Finance Scheme (EFS) and the Long-Term Finance Facility for Plant & Machinery (LTFF) provide loans at subsidized interest rates for Pakistani exporters to finance working capital and the purchase of machinery and equipment, respectively. We combine customs data with information on firms' participation in each program between 2015 and 2017 and use matching combined with difference-in-differences to estimate the effect of the subsidies on firms' export values, the number of products exported and the number of destinations they serve. We find that both programs deliver a large and positive impact on export growth rates—primarily along the intensive margin—and do so in an effective way relative to the direct financial cost of the subsidies.

Résumé. Évaluation de l'incidence du soutien financier à l'exportation sur le résultat des exportations à l'échelle de l'entreprise : l'exemple du Pakistan. Cet article évalue l'impact de deux programmes massifs de soutien au financement des exportations sur la performance des exportations des entreprises. Le Programme de Financement des Exportations (EFS) et la Facilité de Financement à Long Terme pour les Usines et Machines (LTFF) fournissent des prêts à des taux d'intérêt avantageux aux exportateurs pakistanais pour financer le fonds de roulement et l'achat de machines et d'équipements respectivement. Nous combinons les données douanières avec des informations sur la participation des entreprises à chacun de ces programmes entre 2015 et 2017 et utilisons une méthode d'appariement combinée à

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une analyse en différences-différences pour estimer l'effet des subventions sur les valeurs d'exportation des entreprises, le nombre de produits exportés et le nombre de destinations servies. Nous observons que les deux programmes ont un impact important et positif sur les taux de croissance des exportations – principalement sur la marge intensive – et ce, de manière efficace par rapport au coût financier direct des subventions

JEL classification: G21, F13, F14, F61, F65

1. Introduction

The global financial crisis of 2008 has forcefully demonstrated that access to finance is vital for firms to survive and grow in international markets.[1] In the short run, longer lags between production and payment make exporters more vulnerable to liquidity shocks and defaults and thus render them more reliant on working capital financing than domestic firms (Amiti and Weinstein 2011, Manova 2013, Feenstra et al. 2014, Paravisini et al. 2015). At the same time, large adjustment costs and credit constraints can hinder exporters' ability to invest in physical capital, stunting their growth prospects in the long run (Riaño 2011, Rho and Rodrigue 2016, Brooks and Dovis 2020, Leibovici 2021, Kohn et al. 2022b). According to the World Economic Forum (2016), trade finance is one of the top three obstacles for exporters in developing countries. Governments around the world have a long history of providing credit to exporters at subsidized interest rates to mitigate the financial frictions that affect international trade (Fleisig and Hill 1984).[2] While developed countries now rely more on other instruments, such as export credit guarantees (Moser et al. 2008, Felbermayr and Yalcin 2013), direct subsidized credit to exporters remains popular among developing countries.[3]

In this paper we estimate the impact of subsidized loans—to finance both short-term working capital needs and long-term investment in machinery and equipment—on firm-level export performance. To do so, we analyze two large export finance support schemes offered by the State Bank of Pakistan (Pakistan's central bank, SBP hereafter)—The Export Finance Scheme (EFS) and the Long-Term Finance Facility for Plant & Machinery (LTFF) between 2015 and 2017. EFS allows exporters to borrow funds over a period of up to 180 days to finance working capital at an interest rate 7 percentage points lower than the average lending rate during our period of analysis. LTFF, in turn, is targeted towards the purchase of machinery and equipment, offering exporters loans denominated in local currency at a fixed interest rate of 6% per annum over the duration of the credit (i.e., 3 percentage points below the average lending rate), with a maturity of up to 10 years.

A striking feature of these subsidy programs is their sheer scale. The average value of loans provided by EFS over our period of analysis was US$3.66 billion per annum—or 16.75%

1 See, e.g., Chor and Manova (2012), Bricongne et al. (2012) and Paravisini et al. (2015).

2 Fleisig and Hill (1984) report that in 1978, Canada, France, Germany, Italy, Japan, the United Kingdom and the United States provided direct subsidized export credit worth US$55 billion.

3 To name but a few examples, the central bank of Bangladesh maintains an Export Development Fund of US$3 billion that intends to facilitate access to financing in foreign exchange at subsidized interest rates for input procurement by manufacturing exporters (WTO 2019). The Interest Equalisation Scheme on Pre and Post Shipment Rupee Export Credit offered by the government of India allows manufacturing exporters an interest subsidy of 3% on pre- and postshipment rupee credit for exports of 416 products. And the Central Bank of the Republic of Türkiye's rediscount credit program is a pre- and postshipment export financing facility that provides subsidized credit to exporters at low interest rates with little collateral requirement (Akgündüz et al. 2018).

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of Pakistan's total exports—while loans financed by LTFF amounted to US$263 million per annum, or 1.2% of the country's exports. These figures are orders of magnitude larger than the expenditure in most subsidies and other export promotion policies analyzed in the literature (see, e.g., Volpe Martincus and Carballo 2008, 2010a; Görg et al. 2008; Cadot et al. 2015; Van Biesebroeck et al. 2015, 2016; Munch and Schaur 2018; Defever et al. 2019, 2020; Chávez et al. 2020). Thus, our work provides a unique perspective to examine how a large-scale trade policy shapes export performance at the firm level.

Pakistan offers an especially suitable environment to investigate the consequences of providing subsidized credit to exporters. After undertaking major trade liberalization reforms in the 1990s, its trade policy stance has significantly turned inward in the past two decades. High levels of protectionism have produced lacklustre export performance relative to neighbouring countries (Reis and Taglioni 2013), while limited support for export promotion and political favouritism in the allocation of credit have lowered firms' productivity and increased barriers to export for firms (Khwaja and Mian 2005, Zia 2008, World Bank 2021). Our work sheds light on the role that lowering the cost of short- and long-term financing can play in alleviating distortions that hinder firms' export performance. These lessons are relevant not only for Pakistan but also for other developing countries struggling to improve the dynamism of their exporters.

Both schemes operate in two stages: First, a commercial bank screens a firm's loan applications and decides whether to grant the credit it requested; upon approval of this first stage, the commercial bank submits an application to refinance the loan with SBP at a lower interest rate. Approval of the application by SBP in the second stage determines both the interest rate that the firm pays to the commercial bank providing the credit and the refinancing interest rate at which the bank borrows from SBP. If an application is rejected by SBP in the second stage, the firm can still borrow from the commercial bank, but at a higher interest rate.

We estimate the effect of using EFS and LTFF on firm-level export performance using a range of matching estimators combined with difference-in-differences to account for the nonrandom selection of firms in taking advantage of the schemes. Our empirical strategy is underpinned by two identification assumptions. The first is that once we control for a broad range of characteristics observed prior to a firm using a scheme, we can ascribe any differences in performance between treated and control firms to the effect of the subsidies we study. The variables we include in the estimation of the treatment selection model are firms' export sales, the number of products exported and destination market served, number of foreign buyers that firms sell to (all in levels and growth rates), importing status, and main export product-destination fixed effects. Our objective is to control for any factors that simultaneously affect the likelihood of firms using the subsidies and their export performance. Putting it differently, we try to ensure that the estimation of the effects of the subsidy is based on the comparison of firms undergoing similar pretreatment export growth trends.

The second identification assumption is that firms with a similar export trajectory can, nevertheless, experience different treatment status due to factors that are not correlated with their export performance. Anecdotal evidence suggests that this can be the case because creditworthy exporters are, not infrequently, rejected by SBP in the second stage of their application. Interviews with SBP officials indicate that the most common reason for these rejections is that commercial banks have reached a specific refinancing limit set by SBP in an opaque way, and which—notably—appears to be unknown to the bank's managers.

We find that both subsidy programs have a large and positive effect on the export performance of recipient firms. We estimate that the growth rate of export sales for firms using EFS (the program financing working capital) is 11.5 to 20.1 percentage points higher than if they had not used the subsidy, while LTFF (the scheme that subsidizes investment in physical capital), increases the growth of export sales by between 7.9 and 31.1 percentage points

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relative to counterfactual.[4] Our results also show that both subsidies have a significant, albeit smaller, positive effect on growth along the extensive margin (i.e., in terms of the number of products a firm exports and the number of destinations it serves). The large effects we estimate are consistent with a broad literature in international trade and macroeconomics showing that a lower cost of working capital and cheaper financing of machinery and equipment allow firms to increase the scale of their operation (Manova 2013, Feenstra et al. 2014) and achieve this transition more rapidly (Rho and Rodrigue 2016, Kohn et al. 2022a), as well as with evidence suggestive of a high elasticity of exports with respect to changes in trade finance (Zia 2008, Paravisini et al. 2015, Demir et al. 2017, Akgündüz et al. 2018).

This paper contributes to several strands of research. In evaluating the effects of two policy instruments that subsidize distinct margins of firms' financing needs, our paper provides an overarching perspective about the critical role that the cost of finance plays in shaping export performance and speaks to the extensive literature studying the role of financial factors and credit constraints in international trade (e.g., Greenaway et al. 2007, Amiti and Weinstein 2011, Manova 2013, Feenstra et al. 2014, Paravisini et al. 2015, Muûls 2015). Our analysis of a subsidy to the purchase of machinery and equipment complements the body of work in macroeconomics examining how credit frictions affect firms' capital accumulation and export dynamics (Caggese and Cuñat 2013, Kohn et al. 2016, Brooks and Dovis 2020, Kohn et al. 2022b). Last, our work is closely related to Zia (2008) and Akgündüz et al. (2018), who also investigate the consequences of subsidizing working capital for exporters in Pakistan and Turkey respectively. We add to the latter by investigating the impact of incentives to long-term investment and analyzing the consequences of these subsidies for firms' export diversification along the extensive margin.

The rest of the paper is structured as follows: Section 2 describes the two export finance support schemes we evaluate. Section 3 introduces the data we employ and provides summary statistics on firm-level export performance and usage of export finance support schemes. Section 4 describes our empirical strategy. Section 5 presents our estimates, and Section 6 presents a back-of-the-envelope cost-benefit analysis of both schemes; Section 7 concludes.

2. Export finance support schemes

This section describes the main features of the two export finance support schemes we evaluate in this paper: EFS and LTFF.

2.1. Export Finance Scheme

EFS was established in 1973 with the objective of increasing Pakistan's manufacturing exports. The scheme is currently available to firms exporting most manufacturing products, with the exception of 20 products included in a negative list, which was last updated in 2011 (see table A.1 in online appendix A).

EFS offers short-term loans (with a maturity up to 180 days) to finance working capital for exporters at subsidized interest rates. More specifically, the scheme allows commercial banks to refinance loans they provide to exporters by borrowing from the State Bank of Pakistan (SBP) at below-market interest rates. Thus, EFS provides incentives to commercial banks to finance the short-term capital needs of exporters by making liquid funds available

4 The broad range of estimates we find, particularly for LTFF, is affected by the inclusion or not of main export product-destination fixed effects in the empirical specification. We discuss the trade-offs involved in this choice in detail in Section 5 below.

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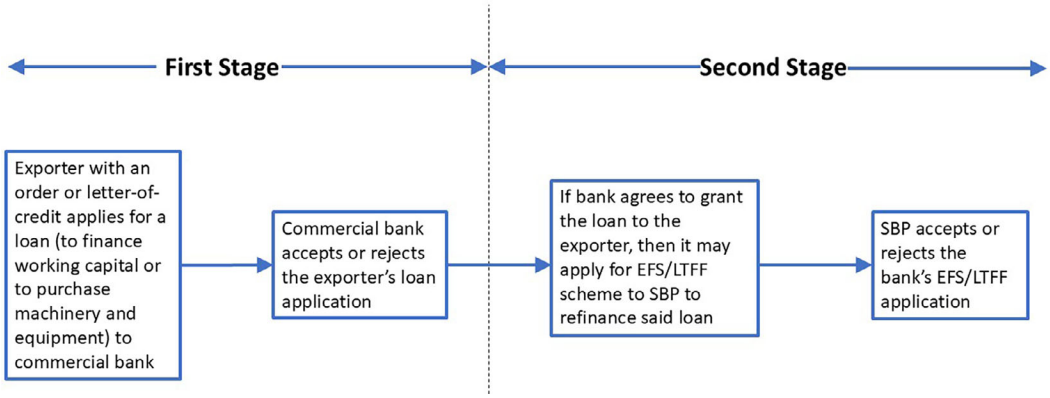

FIGURE 1 Export finance support schemes: Application timeline

to them at subsidized rates. Note that SBP does *not* provide loans directly to exporters; commercial banks bear the credit risk if an exporter defaults on its loan. EFS specifies both the interest rate that the commercial bank charges to the exporter and the refinancing rate at which the commercial bank borrows from SBP, and it therefore fixes the intermediation margin that the commercial bank earns by providing the loan to the exporter. Conversations with bank managers indicated that this margin is sufficiently attractive to motivate commercial banks to participate in the scheme. The scheme operates in two stages summarized in figure 1. First, a firm with an export order or letter of credit at hand approaches a commercial bank to request a working capital loan, and the bank evaluates the firm's request as it does any standard loan application. If the bank decides to extend credit to the exporter, then—in the second stage—the bank has the option to submit an application to SBP, supported by documentation provided by the exporter, to take advantage of the refinancing facility offered by EFS. If SBP approves the application submitted in the second stage, then the commercial bank obtains funds from SBP equal to the value of the loan it disbursed to the exporter.

Between 2015 and 2017, the interest rate charged to exporters borrowing under EFS was 2% per annum, and the refinancing rate for commercial banks was 1%. Since the average market lending rate over the same period was 9%, the interest rate subsidy provided to exporters—that is, the difference between the market lending rate and interest rate charged on EFS loans—was 7 percentage points, a similar figure to the subsidization rate of 6 percentage points calculated by Zia (2008) during the 1990s and early 2000s.

2.2. Long-Term Finance Facility for Plant & Machinery (LTFF)

The LTFF is a financing facility established by SBP in 2007 with the objective of promoting export-led industrial growth. It offers subsidized loans in local currency with a maximum maturity of 10 years to export-oriented firms (i.e., firms that either export at least 50% of their sales or have an export turnover of at least US$5 million) to finance long-term investments in physical capital, such as plant and machinery of up to 1.5 billion Pakistani rupees (approximately US$9 million). In contrast to EFS, during our period of analysis LTFF was available only to firms operating in 20 sectors (see table A.2 in online appendix A; the scheme became available to exporters in all sectors in January 2020).

LTFF also operates in two stages. First, a firm approaches a commercial bank to obtain a loan for the purchase of new machinery or equipment. Conditional on approving the credit,

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the bank then submits an application to SBP to refinance the loan by taking advantage of LTFF. Upon approval of the second stage by SBP, LTFF specifies the interest rate that the exporter pays for the loan and the refinancing rate for the commercial bank. During our period of analysis, the interest rate faced by firms was 6% per annum throughout the term of the loan and regardless of its maturity; the refinancing rate for commercial banks, on the other hand, decreased with the loan's maturity, from 4.5% per annum for loans up to 3 years to 3% for loans up to 10 years.

2.3. How are the schemes administered by the SBP?

The total allocation of funds for export finance support schemes is decided by SBP every fiscal year. Disbursement is carried out on a first-come, first-served basis subject to commercial banks not surpassing their specific refinancing limit, which is also set by SBP. Conversations with SBP officials revealed that bank limits are chosen on the basis of a wide range of factors, including banks' rating given by SBP inspectors, volume of foreign exchange deposits, and market share in trade and long-term financing, in addition to other unspecified considerations. Notably, when we asked commercial bank managers about their refinancing limits, not only they did not know what the specific limit for their own institution was, but each listed different criteria when we asked them about how SBP determined such limits!

Data on stage two rejections by SBP (unfortunately, only available to us for the period 2018 to 2020) show that a high number of firms—103 over these two years—are unable to use the subsidies after commercial banks have approved their credit, and that a substantial share of these have taken advantage of the subsidies during our period of analysis.[5] Interviews with SBP officials indicated that the main reason for rejecting applications in the second stage was that the commercial bank from which an exporter had requested credit had already reached its refinancing limit.[6] The institutional design of the export finance schemes, therefore, provides ample scope for creditworthy exporters to not being able to take advantage of them.

3. Data and summary statistics

This section describes the data used in the empirical analysis. It provides summary statistics regarding firm-level export performance as well as participation in EFS and LTFF and the value of loans outstanding financed by each scheme during our period of study.

We use two data sets in this paper. Customs data collected by the Federal Board of Revenue contain the universe of export and import transactions for firms in Pakistan over the period 2014 to 2017. These data have information on the value of firms' exports and imports by product at the Harmonized System (HS) 8-digit level as well as the country of origin and destination of trade flows. For the years 2014 and 2015 we also observe the number of foreign buyers that exporters sell to. Between 2015 and 2017, 20,052 firms reported at least one positive export transaction in at least one of 2,844 HS 8-digit products sold to 202 countries. The data on export finance support schemes provided by SBP includes information

5 More specifically, 3 of 4 firms rejected from the schemes between 2018 and 2020 had successfully obtained EFS funds during our period of analysis, and half of them had made use of LTFF.

6 In this event, the exporter still has the option to obtain credit from the commercial bank, but paying a higher interest rate. Because of Pakistan's low level of financial development, it is unlikely that exporters would be able to request a loan from another bank that has not reached their refinancing limit (Khwaja and Mian 2008, Zia 2008).

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TABLE 1
Export patterns in Pakistan, per exporter, 2015–2017

Year	No. exporters	Median exports	*M* exports	*M* no. HS-8	*M* destinations
2015	14,765	89.33	1,587	5.12	3.48
2016	14,433	87.45	1,468	5.12	3.50
2017	14,536	86.17	1,445	5.17	3.35

NOTES: Export values are denominated in thousands of US dollars. *M* indicates mean.

TABLE 2
Usage of export finance support schemes, 2015–2017

	No. of exporters receiving		Total value loans outstanding		Value of loans/ total exports (%)	
Year	EFS	LTFF	EFS	LTFF	EFS	LTFF
2015	832	64	3.42	0.14	14.6	0.6
2016	812	80	3.77	0.22	17.8	1.0
2017	814	125	3.79	0.43	18.1	2.1

NOTES: Total value of loans outstanding is denominated in billions of US dollars.

on which firms used EFS and LTFF and the value of the loans they received between 2015 and 2017.[7] Both data sets are linked using firms' National Tax Number.

Table 1 provides a first look at the number of exporters and their performance over the period of analysis. The number of active exporters remains stable, with approximately 14,500 firms exporting each year. Table 1 reassuringly shows that firm-level export patterns in Pakistan are in line with figures for countries at a similar stage of development, as documented by Fernandes et al. (2016).

We now turn to document the extent to which firms utilize export finance support schemes. The first two columns of table 2 reveal that approximately 5% of exporters participate in EFS and fewer than 1% utilize LTFF in a given fiscal year. While the number of exporters using EFS remains roughly constant between 2015 and 2017, the number of exporters taking advantage from LTFF doubled, albeit from a much lower base.

The last four columns of table 2 demonstrate the remarkably large scale of the financing made available by EFS and LTFF. Loans granted under EFS amount to US$3.66 billion per year on average, or 16.75% of Pakistan's exports between 2015 and 2017. Even accounting for its narrower scope and most recent implementation, LTFF finances loans worth US$263 million per year, on average, or 1.2% of total exports over the same period. To put these figures in context, the entire annual budget of export promotion agencies, including those of developed countries like Australia, Japan and the United Kingdom, does not exceed US$500 million (Volpe Martincus 2010).

4. Empirical strategy

Our objective is to estimate the effect of EFS and LTFF on firm-level export performance, that is, on firms' export sales, number of products exported, and number of destination

7 We observe only the total value of loans obtained by a firm through each scheme in a given year. Thus, the data does not allow us to distinguish whether loans are provided for certain export transactions and not others.

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countries served over the period 2015 to 2017. The main challenge we face is to credibly estimate what would have been the export outcomes of firms using export finance support schemes had they not received these subsidies. It is unlikely that the performance of unsubsidized producers would provide an unbiased estimate of the average counterfactual outcomes for treated firms because the latter have deliberately chosen to participate in these programs. Following the literature that evaluates the effects of export promotion policies on firm-level export performance (see, e.g., Volpe Martincus and Carballo 2008, Görg et al. 2008, Cadot et al. 2015, Van Biesebroeck et al. 2015, Munch and Schaur 2018, among others), we use matching estimators combined with difference-in-differences to estimate the average treatment effect of participating in export finance support schemes.[8,9]

We consider an exporting firm as being treated if it did *not* use a given export finance support scheme in 2015 (the first year in which we observe firms usage of the subsidy programs), but did so in 2016 and/or 2017.[10] There are two identification assumptions that underpin our estimation strategy of the average treatment effect of each scheme. The first is that selection into treatment is fully determined by observable characteristics. This means that once we control for all relevant factors that determine firms' decision to use an export finance support scheme—observed in 2015, before the treatment takes place—we attribute any differences in export performance between treated firms and those in the comparison group to the respective subsidy.

The covariates we use to explain selection into treatment determine a comparison group of firms that shares the same observable characteristics as treated firms and is subject to similar shocks but that did not use export finance support. The control variables we include in our estimation include the share of exports accounted for by products eligible in each scheme, total export sales, the number of foreign buyers an exporter sells to, the number of products exported and destination markets reached (all in levels and growth rates between 2014 and 2015 to ensure that treated and control firms have similar pretreatment trends in export performance),[11] an importing status indicator and main export product-destination

8 An alternative empirical strategy to estimate the effect of LTFF specifically would have been to use a regression discontinuity design, or intention-to-treat regression, that exploited the US$5 million turnover threshold required to participate in the scheme. Unfortunately, only one of the firms using LTFF has export sales below this threshold. Excluding all firms that do not use LTFF and have a turnover below US$5 million from the estimation has a negligible impact on our matching-based estimates.

9 Another alternative empirical strategy would have been to employ a difference-in-differences design using the exports of ineligible products as a control group for the exports of eligible products. The main drawback of this strategy is that eligible products account for approximately 90% of exports for most firms that use EFS. Due to the small share of these products in treated firms' exports, ineligible products display large swings in the annual growth rates of export outcomes. This makes it hard to justify the assumption that the performance of ineligible products provides an adequate estimate for the counterfactual growth rate of exports of eligible products for treated firms.

10 This entails excluding a substantial number of firms that use an export finance support scheme in every year of our period of analysis—a restriction that is most important for EFS.

11 In online appendix C, we probe the assumption that, conditional on covariates, treated and control firms were already experiencing different growth trajectories before the former receive subsidies.

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fixed effects.[12] Although we acknowledge that there is no "perfect" solution to dealing with confounding demand shocks, the inclusion of the aforementioned fixed effects restricts the comparison between subsidized and control firms to those sharing the same main export product-destination, and it would therefore account for potential demand shocks that would affect both groups of firms in a similar way. The results obtained when we estimate the same empirical specification without main export product-destination fixed effects are reported in online appendix B.

Larger firms are more likely to continue exporting, have a relationship with a commercial bank and use external finance to fund their working capital needs and investment in machinery and equipment (Beck et al. 2008, Blum et al. 2013). Similarly, firms that export a higher share of products eligible for a certain scheme are more likely to use the it. The inclusion of a broad range of pretreatment export outcomes and main export product-destination fixed effects implies that control firms not only have export performance across a broad range of dimensions that is similar to the subsidized firms they are compared against but also, crucially, focus their exports in the same products and destination markets. This approach is intended to allay concerns that our results could be contaminated by positive demand shocks that would simultaneously increase the likelihood of firms using export finance schemes and their export sales (Munch and Schaur 2018). Nevertheless, it is worth noting that the presence of time-varying unobservables that affect both firms' usage of the schemes and export performance can bias the average treatment effects we estimate.

The second key identification assumption is that there are plausible factors, uncorrelated with export performance, that explain why firms with similar observable characteristics prior to treatment eventually end up with different treatment status (Imbens and Rubin 2015, McKenzie 2021). As we noted in Section 2.3, institutional features of the process through which SBP administers the export finance schemes offer a likely explanation for this event. The most common reason for SBP to reject applications of firms to use the subsidies is that the commercial banks they are borrowing from have exceeded their refinancing limit; however, neither exporters nor their banks appear to know the likelihood of this occurrence. In the end, it is likely that a non-negligible number of creditworthy exporters are not able to take advantage of the subsidies due to reasons that have nothing to do with their potential export performance.

We use the doubly robust estimator proposed by Wooldridge (2007), which integrates inverse probability weighing with covariate adjustment, to implement different matching procedures. This estimator provides two opportunities to adjust for selection on observables, thereby delivering unbiased inference of causal effects as long as either the conditional mean (outcome) regression or the selection-into-treatment models are correctly specified. The estimation proceeds in two steps. First, we estimate the probability that a firm is treated as a function of a vector of observable characteristics by means of a probit model—$\widehat{P}\left(T_i = 1 \middle| \mathbf{X_i}\right)$—where T_i is an indicator taking the value 1 when firm i is treated, $\mathbf{X_i}$ is the vector of covariates measured in 2015 (including the main export product-destination fixed effects) and $\widehat{P}$ denotes the estimated propensity score. In the second stage, we estimate outcome regressions of the type

$$g_i = \alpha + \beta T_i + \mathbf{X_i}'\boldsymbol{\gamma} + \varepsilon_i \tag{1}$$

12 More precisely, this is the interaction of two dummy variables indicating the most important HS 4-digit export product and export destination (in terms of value) for each firm.

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for each measure of export performance and for each export finance support scheme.[13] The dependent variable g_i is the average growth rate of a given export performance outcome for firm i between 2015 and 2017, calculated using the midpoint annual growth rate between two years, t and $t-1$—that is, $g_{i,t} = (y_{i,t} - y_{i,t-1}) / [0.5 \times (y_{i,t} + y_{i,t-1})]$.[14] Estimating the outcome regression (1) in growth rates ensures that time-invariant factors that affect both the use of export finance support schemes and export performance are duly controlled for.

We use the propensity score estimated in the first stage to construct three different sets of weights for treated and untreated firms when we estimate (1); namely, (1) inverse probability (IPW), (2) propensity score matching (PSM) and (3) Mahalanobis or nearest neighbor matching (NNM). When using IPW, we give the weight $1/\widehat{P}$ to treated firms and $1/(1-\widehat{P})$ to control firms. Doing so gives greater importance both to treated firms, which have a relatively low estimated probability of using a given subsidy and to untreated firms, which are more likely to use the same scheme based on their observed characteristics. Propensity score matching assigns a weight of 1 to every treated firm and its respective control, that is, the untreated firm that is closest in terms of its propensity score, and 0 otherwise. NNM operates in the same way as PSM, but treated and control firms are matched according to the Mahalanobis norm between covariates rather than according to their propensity score (once again, using only the closest neighbor for the match). Note that we always include the vector of covariates $\mathbf{X_i}$ we used to estimate the propensity score in the outcome regression (equation 1), too. We also ensure that the estimation in equation 1 includes only observations for which there is overlap in the distribution of the propensity score between treated and nontreated firms in order to satisfy the common support assumption.

5. Results

In this section we present the estimates of the effect of export finance support schemes on export performance. We begin by discussing the estimates of the model predicting the probability that an exporter uses a given subsidy program and assess the quality of the matching procedure. We then move to the estimates of the average treatment effect of EFS and LTFF on firm-level export outcomes.

Table 3 presents the estimates of the probit models used to calculate the propensity score for each subsidy. While the key objective of propensity score estimation is to achieve a balancing score—that is, weighting the observations to eliminate biases in estimated treatment effects due to differences in the distribution of the baseline covariates—these estimates also shed light on the forces that determine firms' participation in each export finance scheme.

The propensity score specification for each subsidy program predicts treatment status reasonably well, but crucially, a substantial share of the variation in firms' usage of export finance schemes remains unexplained. This is important because, as Blundell and Costa Dias (2009) note, on the one hand, if the treatment model predicts "too well," then

13 An important caveat of our analysis is that we evaluate the impact of each export finance support scheme independently; therefore, we are not able to determine whether there are synergies between the two programs in terms of their impact on export performance. Unfortunately, only a handful of firms in our data use LTFF without using EFS; this precludes us from estimating the joint effect of both schemes, as Volpe Martincus and Carballo (2010b) do, for instance.

14 Using the midpoint growth rate bounds the growth rate between −2 and +2 and thus limits the influence of large swings in export values.

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TABLE 3
First-stage probit for the probability of participating in an export finance scheme

	EFS (1)	LTFF (2)
Share of exports in EFS negative list	−0.096	
	(0.186)	
Share of exports in LTFF eligible list		2.040
		(1.299)
Log export value	0.233***	0.516***
	(0.045)	(0.128)
Log no. of buyers	−0.034	−0.112
	(0.095)	(0.191)
Log no. of destinations	0.022	0.478**
	(0.101)	(0.222)
Log no. of products	0.165**	−0.096
	(0.080)	(0.159)
Δ Log export value	0.030	0.334*
	(0.084)	(0.187)
Δ Log no. of buyers	−0.100	−0.429
	(0.127)	(0.272)
Δ Log no. of destinations	0.040	−0.149
	(0.138)	(0.321)
Δ Log no. of products	−0.059	0.690***
	(0.111)	(0.234)
Importer status	−0.074	0.230
	(0.126)	(0.328)
HS4 × destination fixed effects	Yes	
Observations	8,135	8,839
Excluding singletons	2,027	745
Pseudo R-squared	0.225	0.515
Joint significance test (p value)	0.00	0.00

NOTES: The table reports coefficients of probit models estimated among firms observed in 2015. The dependent variable in column (1) [(2)] takes the value 1 if a firm that did not participate in EFS [LTFF] in 2015 uses EFS [LTFF] in 2016 and/or 2017, and 0 otherwise. All covariates are measured in 2015 (Δ denotes the difference between the value of a given variable in 2015 relative to its value in 2014). Standard errors are in parentheses. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

the distributions of propensity scores for treated and control firms do not overlap, making it hard to find suitable nontreated firms to use as comparison; on the other hand, the conditional independence assumption necessary to recover consistent average treatment effects is difficult to justify.

The results reported in table 3 show that firm size is the main factor predicting firms' use of subsidies. Larger exporters not only have higher working capital and machinery and equipment needs but also are more likely to use commercial banks to finance these investments—a prerequisite to taking advantage of EFS and LTFF—rather than rely on other financing methods, like trade credit provided by suppliers or retained earnings (Petersen and Rajan 1997, Auboin 2007). Other indicators of past export performance, for the most part, do not appear to have a strong impact on exporters' usage of subsidies. This finding suggests that firms that are growing faster between 2014 and 2015 are not, for the most part, more likely to use export finance support schemes in 2016 or 2017. Table C.1 in online appendix C shows that export performance growth trends prior to treatment remain nonsignificant in explaining firms' subsidy use after reweighting. We interpret these results as an indication that our choice of pretreatment controls is effective in selecting comparison firms that are on a similar export performance trajectory as treated firms before they receive subsidies.

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TABLE 4
Indicators of matching quality

	Standardized differences				Variance ratio			
	Raw	IPW	PSM	NMM	Raw	IPW	PSM	NMM
Panel A: EFS								
Share of exports in EFS in negative list	−0.46	−0.04	−0.18	−0.11	0.59	0.96	0.77	0.87
Log export value	0.92	−0.00	−0.09	0.34	0.59	0.62	0.70	0.74
Log no. of buyers	0.69	−0.00	0.12	0.26	0.88	0.67	0.73	1.00
Log no. of destinations	0.63	−0.02	0.15	0.14	1.05	0.80	0.97	1.02
Log no. of products	0.40	0.03	0.20	0.21	1.13	0.97	1.00	1.10
Δ Log export value	−0.03	0.00	0.19	0.12	0.50	0.70	0.75	0.99
Δ Log no. of buyers	−0.07	−0.00	−0.03	0.07	0.77	1.00	0.72	1.37
Δ Log no. of destinations	0.01	−0.02	−0.10	−0.02	1.01	1.19	1.02	1.55
Δ Log no. of products	−0.04	−0.05	−0.06	0.09	0.67	0.91	1.16	1.30
Importer status	0.37	−0.02	−0.07	0.16	1.18	1.00	1.00	1.04
Panel B: LTFF								
Share of exports of LTFF in eligible list	−0.06	−0.10	−0.10	−0.01	1.17	1.21	1.29	0.99
Log export value	1.86	0.11	−0.10	0.72	0.43	1.06	0.72	0.73
Log no. of buyers	1.57	0.05	−0.23	0.51	0.89	1.29	0.94	1.26
Log no. of destinations	1.46	0.18	−0.21	0.56	0.87	1.18	1.05	1.29
Log no. of products	0.74	0.31	−0.15	0.38	0.99	1.10	1.39	1.12
Δ Log export value	0.01	0.12	0.12	0.31	0.32	0.55	0.26	0.81
Δ Log no. of buyers	−0.04	0.15	0.08	0.11	0.42	0.81	0.92	1.05
Δ Log no. of destinations	0.09	0.07	0.14	0.20	0.45	1.18	1.33	1.09
Δ Log no. of products	0.21	0.09	0.27	0.31	0.39	0.90	0.49	0.84
Importer status	1.25	0.01	0.06	0.28	0.22	0.95	0.81	0.44

NOTES: The standardized difference for each covariate X_k is given by $SD_k = (\overline{X}_{k,1} - \overline{X}_{k,0})/\sqrt{(s^2_{k,1} + s^2_{k,0})/2}$, where $\overline{X}_{k,1}$ and $\overline{X}_{k,0}$ denote the sample mean of covariate X_k in the treatment and comparison groups, respectively, and $s^2_{k,1}$ and $s^2_{k,0}$ are the sample variances of covariate X_k in the treatment and comparison groups, respectively. The variance ratio is defined as $VR = s^2_{k,1}/s^2_{k,0}$. IPW stands for inverse probability weighting, PSM stands for propensity score matching weighting, and NNM stands for Mahalanobis matching weighting.

The inclusion of main export product-destination fixed effects in our estimating equations has two main implications. First, they improve the accuracy of prediction of the treatment model, particularly for EFS (estimates of treatment effects without fixed effects are presented in tables B.4 and B.5 in online appendix B). Second, a substantial number of firms for which these fixed effects perfectly predict treatment status (which we denote as "singletons") are dropped from the estimation. This is important, because by construction we are restricting the potential set of comparison firms to those for which their main export product-destination is such that at least one firm in the same main export product-destination has received the subsidy; this restriction helps us to control for potential demand shocks in a given product-destination cell that affect treated and control firms in the same way.

We next examine how the different matching procedures we use perform in terms of achieving balance in the covariates used to predict treatment status. Table 4 presents standardized differences and variance ratios for all combinations of subsidy program and method of matching. Large differences in covariates in the raw data reinforce the notion that export outcomes of firms that did not use export finance support schemes do not provide an accurate estimate of the counterfactual outcome for treated firms. Table 4 shows that weighting substantially reduces the differences in the first and second moments of covariates determining the probability of treatment. In most cases, the standardized differences of covariates fall well below the 20% threshold criterion commonly employed in the literature on treatment

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TABLE 5
Joint significance and pseudo R-squared of treatment status model

EFS	Benchmark	IPW	PSM	NNM
Pseudo R-squared	0.22	0.01	0.12	0.07
Joint significance test (p value)	0.00	1.00	1.00	1.00
LTFF				
Pseudo R-squared	0.52	0.08	0.20	0.23
Joint significance test (p value)	0.00	0.02	0.00	0.98

NOTES: The table reports the pseudo R-squared and the p value associated with the chi-squared joint significance test from running the probit model of the probability of participating in each export finance scheme, and the same statistics when the model is estimated using only the treated and relevant comparison firms. IPW stands for inverse probability weighting, PSM stands for propensity score matching weighting and NNM stands for Mahalanobis matching weighting.

effects (Görg et al. 2008, Caliendo and Kopeinig 2008), and variance ratios tend to move closer to unity after weighting.

Table 5 presents the pseudo R-squared and joint significance tests obtained after re-estimating the propensity score probit model using only treated firms and their respective controls (Caliendo and Kopeinig 2008). The pseudo R-squared of these regressions falls substantially compared to the value of the same statistic reported in table 3, indicating that weighting produces a notable improvement in the balance of pretreatment covariates between the treated and comparison groups. While we clearly cannot reject the null hypothesis of joint insignificance of all covariates for EFS, the opposite result obtains for LTFF when using inverse probability and propensity score weighting. The diagnostic tests presented in tables 4 and 5 do not indicate that one particular weighting scheme clearly dominates the others in terms of balancing covariates. While NNM is the only weighting procedure that avoids rejecting the joint significance of covariates to explain treatment status after weighting for LTFF, the other two weighting schemes (IPW and PSM) tend to achieve a greater reduction in standardized differences as well as variance ratios that are closer to unity—thus, in what follows we report average treatment effect estimates using all three weighting schemes.

We now move to discuss the effect of EFS and LTFF on export outcomes. The sample we use for the estimation consists of firms that export in every year between 2014 and in 2017 and for which the main export product-destination fixed effects do not perfectly predict the usage of subsidies. Among the 2,027 firms we use to estimate the effect of EFS, 122 are treated (they do not use EFS in 2015 and use it in either 2016 and/or 2017); among the 745 firms included in the sample used to evaluate LTFF, 71 are treated. Since the distribution of propensity scores for treated and comparison firms exhibits full overlap for each subsidy, we do not exclude any treated firms of our estimation on this account.

Table 6 presents our estimates of the average treatment effect on the treated for EFS in terms of its impact on the growth rate firms' total value of exports, number of products exported (at the HS 8-digit level) and the number of countries to which a firm exports. Ordinary least squares (OLS) estimates reveal a positive and highly significant impact of EFS on export performance along both intensive and extensive margins, with the former experiencing a stronger response. The results reported in rows 2 to 4 of column (1) in table 6 indicate that using EFS increases the annual growth rate of exports for participant firms between 11.5 and 14.3 percentage points. Controlling for the large degree of imbalance in firms'

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TABLE 6
Average treatment effect of Export Finance Scheme (EFS) on the average growth rate of export outcomes

	Export value	No. of destinations	No. of products
OLS	0.174***	0.070***	0.027
	(0.038)	(0.025)	(0.025)
Inverse probability (IPW)	0.143***	0.060**	0.025
	(0.041)	(0.025)	(0.027)
Propensity score (PSM)	0.115***	0.076***	0.006
	(0.041)	(0.020)	(0.020)
Mahalanobis matching (NNM)	0.139***	0.087***	0.011
	(0.048)	(0.034)	(0.035)
Average growth rate of treated firms	0.042	0.044	−0.025

NOTES: Each entry in the table reports the average treatment effect on the treated firms that made use of EFS—that is, the estimated coefficient associated with a treatment dummy in outcome regression (1), where the dependent variable is the average growth rate of the corresponding export performance measure indicated in the column header. All the covariates used to estimate the propensity score, including main export product-destination fixed effects, are also included in the estimated regression. The number of exported products is defined at the HS 8-digit level. The sample of firms used in these estimations consists of 2,027 (non-singleton) firms with positive export sales in both 2015 and 2017. There are 122 firms that did not receive the EFS subsidy in 2015 but did so in 2016 and/or 2017 (treated firms). Standard errors are in parenthesis. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

observable characteristics prior to using EFS (i.e., comparing the matching estimates with the unweighted OLS ones) reduces the magnitude of the subsidy on export sales by 25%.[15]

A reduction in the interest rate for working capital loans not only has a direct impact on firms' marginal costs, as emphasized by Manova (2013) and Feenstra et al. (2014), but can also induce firms to increase the scale of their operation by weakening the need to self-insure against negative shocks (Arellano et al. 2019). In terms of its magnitude, the strong impact on exports that we estimate for EFS is in line with the existing empirical evidence evaluating this type of subsidies. Zia (2008) finds that when cotton yarn was included in EFS's negative list in 2001, affected producers saw their exports decline by 31% vis-à-vis firms exporting non-yarn textiles. Akgündüz et al. (2018) in turn, find that firms that use the export rediscount credit program offered by the Central Bank of Türkiye—an interest rate subsidy to working capital loans similar to EFS both in its scope and the magnitude of its outlays—increased their export sales by 65% following a substantial increase in the program's expenditure. The fact that the subsidy provided under EFS affects primarily the intensive margin of exports echoes the findings of Paravisini et al. (2015) for Peruvian exporters affected by the capital flow reversals that hit the banks they borrowed from during the global financial crisis of 2008. The more muted response along the extensive margin for firms receiving EFS could be indicative of diseconomies of scope or that market access costs are not highly responsive to a lower cost of working capital.

Table 7 presents the estimates for the average impact of LTFF on export performance. We find that using LTFF has a large and positive effect on firms' export performance, along

15 Table C.2 in online appendix C presents the estimated coefficients of the pretreatment growth rates of export outcomes in the outcome regressions reported in column (1)—that is, when the dependent variable is the average growth rate of export value. Similarly to what we have reported in the estimation of the selection to treatment model, these estimates indicate that pretreatment export performance does not have significant explanatory power in explaining the effect of export finance support subsidies on the growth rate of export sales.

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TABLE 7

Average treatment effect of Long-Term Financing Facility for Machinery & Equipment (LTFF) on the average growth rate of export outcomes

	Export value	No. of destinations	No. of products
OLS	0.219***	0.181***	0.095***
	(0.043)	(0.027)	(0.034)
Inverse probability (IPW)	0.226***	0.190***	0.103***
	(0.064)	(0.035)	(0.039)
Propensity score (PSM)	0.311***	0.182***	0.078
	(0.089)	(0.044)	(0.065)
Mahalanobis matching (NNM)	0.208***	0.162***	0.140***
	(0.077)	(0.047)	(0.052)
Average growth rate of treated firms	−0.037	0.041	−0.007

NOTES: Each entry in the table reports the average treatment effect on the treated firms that made use of LTFF—that is, the estimated coefficient associated with the treatment dummy in outcome regression (1), where the dependent variable is the average growth rate of the corresponding export performance measure indicated in the column header. All the covariates used to estimate the propensity score, including main export product-destination fixed effects, are also included in the estimated regression. Number of exported products is defined at the HS 8-digit level. The sample of firms used in these estimations consists of 745 (non-singleton) firms with positive export sales in both 2015 and 2017. There are 71 firms that did not receive the LTFF subsidy in 2015 but did so in 2016 and/or 2017 (treated firms). Standard errors are in parenthesis. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

both the intensive and extensive margins, too. More precisely, using LTFF results in an increase of 20 to 31 percentage points in the growth rate of exports for treated firms relative to the comparison group. With respect to the extensive margin, and similarly to EFS, treatment effects are stronger for the number of destinations served than for the number of products that firms export. The relaxation of credit frictions brought about by the use of LTFF—particularly in a country with low levels of financial development and prone to crises, like Pakistan—could enable exporters to accelerate their accumulation of physical capital and increase their sales, consistent with the findings of Rho and Rodrigue (2016), Brooks and Dovis (2020), Leibovici (2021) and Alessandria et al. (2021).

In online appendix B we investigate the sensitivity of our estimates of the treatment effect of each subsidy with regards to the inclusion of main export product-destination fixed effects in the empirical specification. Although balancing appears better without fixed effects (see appendix B tables B.2 and B.3), this is partly because when we include fixed effects, the number of matching variables is substantially larger, thus worsening the balancing for the observable covariates reported in the diagnostic test.

Although the results without fixed effects (reported in appendix tables B.4 and B.5) are qualitatively similar to our benchmark estimates, it is worth noting that the magnitude of the treatment effects, particularly for LTFF, can be sensitive to the inclusion of these fixed effects. Without main export product-destination fixed effects, we find that the use of EFS increases the growth rate of export sales between 16.7 and 20.1 percentage points, whereas the corresponding estimates for the LTFF range indicate that subsidized firms increase the growth rate of their exports between 7.9 and 9.5 percentage points.

Nevertheless, the inclusion of main export product-destination fixed effects makes the unconfoundedness assumption that underpins our identification strategy more credible, thus making it our preferred specification. Including fixed effects ensures that we compare treated and untreated firms within the same main export product-destination cell to estimate the treatment effect of subsidies. This helps us control for potential demand shocks that could induce firms to simultaneously increase their exports and seek export finance support.

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It is helpful to put the evaluation of the impact of export finance support schemes in context by comparing it to the estimated impact of other export promotion policies in developing countries. In contrast to our findings, the literature finds that these instruments act primarily through the extensive margin and have a more limited impact on export sales. This could be because several interventions undertaken by export promotion agencies, such as offering logistic help to meet foreign buyers or providing market research and information on customs clearance procedures, tend to lower product- and market-access fixed costs (Álvarez and Crespi 2000, Volpe Martincus and Carballo 2008; 2010a, Cadot et al. 2015), while reducing the user cost of capital has a large and direct effect on firms' marginal costs and sales instead. Another critical dimension in which the export finance schemes offered by SBP differ from other promotion instruments analyzed in the literature is in terms of their scale. Defever et al. (2020), for instance, find that when subsidy rates are not very high (like in the case of a 1% to 2% ad valorem cash subsidy offered in Nepal they study), benefitting firms do not drastically alter the value of their exports. This is certainly not the case for EFS and LTFF; the value of loans refinanced under these schemes is so large that the attractive provisions they offer to exporters are likely to be a strong driving force in explaining the large positive effects we find they produce in the value of treated firms' exports.[16]

Since EFS and LTFF are both available to firms exporting only certain products, we investigate the effect of subsidies on export outcomes according to product eligibility status. The results reported in online appendix D (in tables D.1 and D.2), suggest, somewhat surprisingly, that both EFS and LTFF also have a positive impact on export performance of products that are not eligible to be subsidized. These findings could reflect selection effects (i.e., firms increasing their exports across the board due a to unobserved demand shock) not fully controlled for by our empirical strategy, but an alternative explanation could be that the subsidies might help to relax credit constraints for treated exporters, since several of the ineligible "commodities" (particularly for EFS) feature exceptions for specific products that might be quite similar such as basmati and husked rice (see table A.1 in online appendix A). Nevertheless, it is worth stressing that these results need to be interpreted with caution because they are based on a small number of firms that export both eligible and ineligible products for a given subsidy.

6. A back-of-the-envelope cost-benefit analysis

The results presented in the previous section indicate that both EFS and LTFF provide a large boost to the exports of firms that use these programs. Nevertheless, given the considerable reduction in interest rates they offer and the scale of loans they finance, it is important to evaluate how effective they are in achieving these results. This is all the more pressing for

16 Although we observe the value of the subsidized loans that firms obtain when using the schemes, using a continuous measure of treatment exposure to estimate a dose-response function along the lines of Hirano and Imbens (2004) lies beyond the scope of this paper because of the stronger identification assumptions and data requirements that this approach demands. In terms of identification, the use of the generalized propensity score requires that assignment to treatment levels (i.e., the value of the loan that exporters receive) to be as good as random, given pretreatment covariates. This assumption is hard to justify without balance sheet data that allow us to control for the size of loans that a firm could secure from a commercial bank. Furthermore, since this method aims at estimating counterfactual outcomes for each level of treatment, it is crucial to have a larger number of treated observations than what we currently have.

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TABLE 8
Cost-benefit analysis of export subsidies

	Direct cost-benefit		Internal rate of return	
	EFS (1)	LTFF (2)	EFS (3)	LTFF (4)
Estimated growth rate of exports	13.2%	24.8%		
Growth rate of exports s.t. net benefit = 0			2.62%	0.10%
Benefits:				
Exports of first-treated firms in 2017	635m	3,025m		
Additional exports generated by scheme	79m	667m		
Exports of all treated firms in 2017			8,032m	6,407m
Costs:				
Loans outstanding	108m	143m	3,780m	325m
SBP opportunity cost	6.5%	6.5%	6.5%	6.5%
Refinancing rate	1%	4.5%	1%	4.5%
Financial cost SBP	5.9m	2.9m	2.9m	6.5m
Net benefit:	72.7m	664.6m	0m	0m

NOTES: All monetary values (i.e. exports, loans outstanding, and the financial cost for SBP) are denominated in millions of US dollars. Treated firms are those that did not participate in EFS (LTFF) in 2015 but did so in at least one year between 2016 and 2017. The estimated average treatment effect for the treated used to calculate the additional exports generated by each scheme are the simple averages of the matching estimates reported in column (1) of table 6 and 7 for EFS and LTFF respectively. Outstanding loans refer to the total loans received by treated firms averaged between 2016 and 2017. The opportunity cost for SBP to raise external funds is the average 6-month treasury bill rate issued by the government of Pakistan over the period of analysis. The financial cost for SBP is calculated as Loans outstanding × (SBP opportunity cost − Refinancing rate). Net benefits are defined as the difference between the additional exports generated by a given scheme and its financial cost for SBP. Equation (2) describes how the growth rate of export sales that yields net zero benefits for a given scheme is calculated.

Pakistan, a country that systematically runs large fiscal deficits which are, to a large extent, financed by direct borrowing from SBP and are considered an important source of risk to macroeconomic stability International Monetary Fund 2019.

We conduct a back-of-the-envelope cost-benefit analysis, following the approach used by Cadot et al. (2015) and Munch and Schaur (2018) to infer the value of additional exports "created" by each scheme, and compare this against the direct financial cost of providing the subsidies borne by SBP. It is important, however, to keep in mind that this exercise does not constitute a full-fledged welfare analysis. The latter would take into consideration important aspects like the extent to which lower interest rates ease credit constraints for exporters, general equilibrium effects—which might be quite substantial given the magnitude of the subsidies offered by the schemes—the distribution of costs and benefits across manufacturing firms that can shape selection into exporting, and the marginal cost of public funds required to administer the schemes, to name a few factors that are outside the scope of our analysis.

The results of our "direct" cost-benefit analysis of EFS and LTFF are summarized in columns (1) and (2), respectively, of table 8. We use the average of our matching estimates to infer the additional exports generated by each scheme, assuming that all firms that participated in a given subsidy program would experience a higher growth rate of export sales (relative to the counterfactual scenario) equal to the average treatment effect we estimate. More precisely, let $\overline{\hat{\beta}_S}$ denote the simple average of the matching estimates for the impact of scheme S on the growth rate of export sales for treated firms (the estimates reported in rows

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2 to 4 of column (1) of tables 6 and 7)—that is, 13.2 and 24.8 percentage points for EFS and LTFF respectively. Letting $Y_{2017,S} = \sum_{i \in S} y_{i,2017}$ denote the total export sales of firms using scheme $S \in \{\text{EFS}, \text{LTFF}\}$ in 2017, then we calculate the value of exports for treated firms had they not participated in scheme S as $Y^C_{2017,S} = [1 - \overline{\hat{\beta}_S}/2]/[1 + \overline{\hat{\beta}_S}/2] \times Y_{2017,S}$.[17] Thus, our results indicate that the additional exports among the treated firms included in the empirical analysis, $(Y_{2017,S} - Y^C_{2017,S})$, would have been US$72.7 and US$664.6 million for EFS and LTFF, respectively.

We calculate the financial cost for SBP as the difference between the interest rate at which SBP can raise funds, which we take as the yield of the 6-month treasury bill rate issued by the government of Pakistan (6.5% per annum, on average, between 2015 and 2017), and the corresponding refinancing rate it charges banks (1% for EFS and 4.5% for LTFF) times the amount of loans outstanding. We chose the yield of the 6-month treasury bill to represent SBP's opportunity cost of "printing money" to finance the schemes both because the interest rate charged to exporters on their loans and the refinancing rate charged to commercial banks are linked to the this benchmark rate, and because the 6-month treasury bill is the most important debt instrument used by the government (SBP, 2017).[18] Since the value of loans outstanding for the treated firms included in our analysis are US$108 and US$143 million for EFS and LTFF, respectively, the direct (i.e., without including potential administrative overhead costs) financial cost of these two schemes for SBP are $(0.065 - 0.01) \times 108 = 5.9$ and $(0.065 - 0.045) \times 143 =$ US$2.9 million.

Our analysis suggests that both EFS and LTFF are highly effective instruments to boost exports, as they both deliver a substantial positive direct net benefit—US$65 million and US$665 million, respectively. The net impact of LTFF is much higher for EFS, both because its estimated effect on firms' exports is higher and because the difference between the market and the subsidized interest rates it offers is smaller than for EFS. Redoing the cost-benefit exercise using the smaller impact of LTFF on export sales implied by the estimates without fixed effects (which indicates that treated firms see an average increase in their exports of 8.5 percentage points), still suggests that this subsidy delivers a substantial net benefit of US$244 million. These results are in line with the existing literature, which has found that the value of additional exports created by different export promotion policies, such as the services provided by the Danish Trade Council or matching grants provided to support the development of business plans in Tunisia, greatly exceed the direct financial cost of each policy (Munch and Schaur 2018, Cadot et al. 2015).

One way to gauge the robustness of our analysis is to calculate an internal rate of return for each scheme. In other words, determining the growth rate of export sales that would deliver zero net benefits, based on the *total* value of exports and refinanced loans, rather than only using the values of these variables for the firms included in our estimation—an important consideration given the large number of perennial subsidy users that we have to exclude from our estimation. Letting $Y^{ALL}_{2017,S}$ denote the total value of exports for all firms that used scheme S in 2017 and $\text{FinancialCost}^{ALL}_S = \text{Loans outstanding}^{ALL}_S \times (\text{SBP opportunity cost} - \text{Refinancing rate}_S)$

17 Recall that we have used the midpoint growth rate of export sales as our dependent variable in the regressions reported in column (1) of tables 6 and 7.

18 Since the 2015–2017 period is characterized by low and stable interest rates, the financial cost of the schemes is quite similar regardless of whether we use the discount rate, money market rate, or the yield on Pakistan's sovereign bonds to represent SBP's opportunity cost. These rates range 6% to 9%, on average, between 2015 and 2017.

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the corresponding direct financial cost of scheme S for SBP in 2017, then the growth rate of export sales that yields a zero net-benefit for scheme S, β_S^0, is implicitly defined by

$$\left[1 - \frac{1 - \beta_S^0/2}{1 + \beta_S^0/2}\right] Y_{2017,S}^{ALL} - \text{FinancialCost}_S^{ALL} = 0. \tag{2}$$

The solution to equation (2) is reported in the second row of columns (2) and (4) of table 8. We find that if the subsidy to working capital were to increase the growth rate of exports of treated firms by 2.62 percentage points—which is significantly different from the treatment effect we estimate—then the subsidy would not deliver any net benefits. We find that because of its substantially lower direct financial cost, LTFF would deliver net benefits as long as it induces firms to increase their exports.

It is worth noting that SBP did not (at least, not until quite recently) adjust refinancing rates frequently, even in response to large swings in market rates—which would significantly increase the financial cost of the schemes. For instance, in order to rein in domestic demand and stave off a balance-of-payments crisis, SBP more than doubled the discount rate from 6.25% to 13.75% over the course of 2018 without changing the refinancing rate of either EFS or LTFF (ADB, 2020). Under these circumstances, exporters using EFS would have to increase their exports by almost 6 percentage points for the subsidy to deliver net gains.

7. Conclusion

In this paper we evaluate the effect of two interest rate subsidies provided to exporters in Pakistan on their exporting performance. The Export Finance Scheme and the Long-Term Finance Facility for Plant & Machinery provide loans at below-market interest rates for exporters to finance investment in working capital and machinery and equipment respectively. A notable feature of these programs is that they finance a substantial share of Pakistan's total exports and, thus, are orders of magnitude larger than most instruments of export promotion that have previously been studied in the literature.

We use a matching combined with difference-in-differences empirical strategy to estimate the impact of receiving these subsidies on export performance while addressing the endogenous selection of firms into the programs. Our results show that both EFS and LTFF induce recipient firms to increase their export sales, with the overall effect being stronger for the subsidy targeted to investment in machinery and equipment. Both programs appear to operate primarily through the intensive margin; however, along the extensive margin, EFS has significant effects only in terms of the number of destinations that exporters serve, whereas using LTFF has a significantly positive impact on both the number of exported products and destinations. A back-of-the-envelope cost-benefit analysis suggests that both programs are effective in increasing exports given their direct financial cost.

Supporting information

The data and code that support the findings of this study are available in the Canadian Journal of Economics Dataverse at https://doi.org/10.5683/SP3/TRYP6N.

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