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# ABSTRACT

## What Do Market-Access Subsidies Do? Experimental Evidence from Tunisia*

Many countries seek to promote exports by subsidizing market access, but evidence on such efforts has been mixed. We present the first randomized evaluation of a government financial-support program explicitly targeting exports, the Tasdir+ program in Tunisia. The program offered matching grants for fixed market-access costs but not variable costs. Tracking outcomes in administrative data, we find positive effects on exports on average. We find limited impacts on the number of destinations or exported products, which were stated policy targets. The finding that the fixed-cost subsidies expanded exports on the intensive margin but not the extensive margins of destinations or products stands in contrast to the predictions of several workhorse trade models.

**JEL Classification:** F14, O14

**Keywords:** export promotion, market access, intensive margin

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# 1 Introduction

There is growing evidence that exporting has salutary effects on firms, especially in developing countries. It can improve product quality (Verhoogen, 2008; Atkin et al., 2017; Bastos et al., 2018; Hansman et al., 2020; Demir et al., 2024), raise productivity (De Loecker, 2007; Atkin et al., 2017; Garcia-Marin and Voigtländer, 2019), induce technology adoption (Lileeva and Trefler, 2010; Bustos, 2011), increase wages (Verhoogen, 2008; Brambilla et al., 2012; Frías et al., 2024), and improve working conditions (Tanaka, 2020).

It is less clear whether government interventions to promote exports are effective. Governments dedicate substantial resources to various strategies to facilitate market access, including tax rebates, duty drawbacks, foreign-country trade missions, high-level delegation visits, and direct subsidies. Between 2009 and 2020, more than 2,500 export-related measures and nearly 500 initiatives providing financial assistance in foreign markets were implemented globally (Juhász et al., 2023b). But the evidence on such interventions, reviewed briefly below, is mixed. Moreover, the evaluations to date have almost uniformly relied on non-experimental methods such as matching and difference-in-difference estimators, which are subject to concerns about unobserved differences between beneficiary and non-beneficiary firms.

This paper presents the first randomized evaluation of a government financial-support program explicitly targeting exports, focusing on the Tasdir+ program in Tunisia. The program provided matching grants to offset the costs of accessing export markets. A distinctive aspect of the program is that the grants were limited to fixed costs (i.e. costs that did not depend on the number of units produced) such as marketing expenditures, participation in trade fairs, and establishment of offices abroad. Variable costs such as salaries, materials, and transport costs were not eligible for reimbursement. The program thus offers an opportunity to study the effects of reductions specifically in fixed costs of export market access, which are commonly thought to be crucial for firms' entry into new destinations and products.

To help organize our thinking about the effects of market-access subsidies, we present a simple model of product-scope and market-penetration decisions by heterogeneous, multi-product firms, along the lines of one version of the model of Arkolakis et al. (2021), which incorporates market-penetration costs (as in Arkolakis (2010)) and

endogenous product scope (as in Eckel and Neary (2010), Bernard et al. (2011), and Mayer et al. (2014)) into a Melitz (2003)-type framework. The model generates two key implications: first, product-scope and destination-entry decisions may be insensitive to changes in fixed market-access costs over some ranges; and second, even without extensive-margin responses, sales within existing destinations and products are expected to respond to such changes.

Eligibility for the matching grants was randomized in five application rounds in 2018-2019. Pooling rounds, the randomization sample included 487 firms. The grants offered reimbursement of 50% of eligible expenditures incurred within one year as part of an approved business plan, with a cap of USD 50,000 (TND 150,000) per firm. The budget for the randomized grants was approximately USD 14 million (TND 42 million). The stated goals of the program were to increase the scale of exports and to diversify exports toward higher-value-added products and new markets.

We are able to track firms in data from several sources. We observe sales and exports from corporate tax records and employment and wages from social security records, all of which are collected in the *Repertoire National des Entreprises (RNE)* [National Repertory of Firms], a firm-level database. Importantly, this database includes exports for service firms as well as non-service firms. We also have access to transaction-level customs records, as well as administrative records from the Tasdir+ program. In addition, we conducted baseline and endline surveys.

To analyze exports, which contain many zeros, our preferred specification is a simple two-part ANCOVA with separate regressions for exporter status and for log exports among continuing exporters. We also present a Poisson Pseudo Maximum Likelihood (PPML) specification that combines the two margins. Using the linked customs records, we use similar specifications to examine the effects of the program on the numbers of destinations served and products exported. The study period spans the covid-19 crisis, which had a major impact in Tunisia as elsewhere. We focus primarily on outcomes in 2021, the most recent year we observe in the RNE data.

We find that the program had a positive, statistically and economically significant impact on exports. The estimates range from a 27% increase in the level of exports in the PPML specification to a 39 log point (48%) increase among continuing exporters in the ANCOVA specification. These estimates are large, but not out of line with the existing literature, as discussed below. We find positive point estimates of the effect on the

extensive margin of being an exporter, but these are not statistically significant. Using the customs records, we find little evidence that the numbers of destinations or products changed differentially between the treatment and control groups. Overall, it appears that the program achieved the goal of increasing the scale of exports, but had limited success in encouraging firms to expand the range of destinations or products exported.

Using the rich combination of datasets we have collected, we examine the mechanisms through which the program had these effects on exports. From our surveys, we find the strongest program impacts on actions to establish contracts with agents and/or distributors and to establish a foreign presence through affiliates or representatives abroad. Possibly related to this increase in foreign presence, we find that firms were more likely to become importers, although we see little increase in the value of imports conditional on being a continuing importer. Perhaps surprisingly, we do not see significant increases in employment, earnings per employee, or wage bills of permanent employees in response to the program; we discuss possible reasons below.

We also examine heterogeneity in the effects of the program by pre-program characteristics. Perhaps the most salient dimension is between "totally exporting" firms — which administratively are classified in a free trade zone, outside of the Tunisian customs area — and "non-totally exporting" firms. The increase in exports we find is driven entirely by the non-totally exporting firms. We also find significantly greater treatment effects among firms with at least one quality certification at baseline, consistent with the idea that the ability to upgrade quality is an important determinant of export success (Verhoogen, 2023). There is suggestive evidence that the benefits of the program were greater for smaller and more credit-constrained firms, although these estimates are not significant in all specifications.

Our findings that the subsidy for fixed market-access costs led to increases on the intensive margin of export sales but not the extensive margins of destinations or products stand in contrast with the predictions of workhorse trade models in the tradition of Melitz (2003) and multi-product variants such as Bernard et al. (2011). In models of this type, fixed costs typically matter for entry, either into destinations or (when multi-product firms are considered) into products, but not for sales conditional on entry. Our results point to the importance of market-penetration costs such as those modeled by Arkolakis (2010), in which marketing expenditures in a given destination

increase the share of consumers reached. More generally, we contribute to a growing literature suggesting that the costs of entering a destination are not well represented by one-time sunk costs or per-period fixed costs of accessing entire destination markets, reviewed by Alessandria et al. (2021).

Beyond the studies cited above, our paper is related to several strands of literature. It is most closely related to two non-experimental studies of an earlier matching-grants-for-exports program in Tunisia known as FAMEX II. Relying on matching methods, Gourdon et al. (2011) find positive effects on exports but no impacts on employment or total sales, and Cadot et al. (2015) find short-term effects on exports, the number of destinations, and the number of products, but no persistence in these effects past two years after the program. Relative to these studies, the key advantage of the current evaluation is that program eligibility was based on a lottery rather than the judgment of program staff. Our results differ both in that we find more persistent effects on exports and that we do not find effects on the number of destinations or products.

Our paper speaks to the broader literature on government export-promotion efforts. This literature has also had to rely on non-experimental methods such as difference-in-differences and matching estimators. Among the leading studies, Volpe Martincus and Carballo (2008) find that beneficiaries of Peruvian export-promotion programs over the 2001-2005 period saw increases on the extensive margins of products and destinations but not in total exports. Álvarez and Crespi (2000) find that three export-promotion instruments in Chile (exporter committees, presence in international fairs, and utilization of business information systems) had positive effects on technological innovation but not on the number of products exported. Other notable contributions include Bernard and Jensen (2004), Görg et al. (2008), Lederman et al. (2010), Volpe Martincus and Carballo (2010a,b,c, 2012), Volpe Martincus et al. (2012), Chandra and Long (2013), Van Biesebroeck et al. (2015, 2016), Munch and Schaur (2018), Defever et al. (2020b,a), Chávez et al. (2020), Olarreaga et al. (2020), Buus et al. (2025), and Matray et al. (2024).[1] The preponderance of evidence from existing studies suggests that the effects of export-promotion programs are primarily on the extensive margin of destinations, rather than the intensive margin of exports within destinations.[2]

[1] Volpe Martincus (2010), Van Biesebroeck et al. (2016), and Srhoj et al. (2023) provide overviews of this literature. Relatedly, Barteska and Lee (2023) analyze the rotation of bureaucrats within the South Korean export-promotion agency and find that individual bureaucrats matter for the effectiveness of export-promotion programs.

[2] For instance, Van Biesebroeck et al. (2015, p. 1483) write, "Virtually all papers in the literature agree that

But while the literature has generated many important insights, in the absence of randomization it is difficult to rule out the possibility that the patterns are due to unobserved differences between treated and untreated firms.

We are aware of eight experimental studies related to exporting. In collaboration with an international buyer, Atkin et al. (2017) randomized initial export contracts to Egyptian rug producers and find effects on rug quality and firm productivity, but are not able to speak to the effectiveness of government interventions. Iacovone et al. (forthcoming) mainly focus on a novel method of Bayesian estimation but at the same time evaluate a program that provided consulting about management practices and find little evidence of an impact on exports. Kim et al. (2018) find that informational seminars in Vietnam on average had no effect on export participation. Breinlich et al. (2017) find that informational brochures sent to firms by the UK export-promotion agency perversely made non-exporters more pessimistic about exporting. Cusolito et al. (2023) evaluate a business-training program in the Western Balkans that did not specifically target exports but that had an effect of increasing exports. The contemporaneous projects by Carvalho et al. (2024) in Brazil and Gonzalez et al. (2024) in Argentina are evaluating programs that offer information and/or consulting. Another contemporaneous project by Münch et al. (2025) randomized female entrepreneurs into consortia and examines the effects on export performance. Relative to these papers, the distinctive aspect of our study is the focus on government financial support aimed explicitly at increasing exports.

There is a small experimental literature on matching grants unrelated to exporting. Several experimental evaluations have failed because of political pressures or low take-up (Campos et al., 2014). Among the few successes, McKenzie et al. (2017) find positive short-term effects of matching grants for business services in Yemen on product innovation, marketing, and adoption of accounting systems, but are not able to look at longer-term impacts because of political instability. Bruhn et al. (2018) find that a program offering subsidized consulting services to micro, small, and medium enterprises in Mexico had positive effects on sales, profits, productivity, and long-run employment. Relative to this literature, we believe that there is value in focusing on matching grants to promote exports, widely viewed as a key driver of upgrading by developing-country firms (Verhoogen, 2023).

the dimension of export performance most affected by these programs is the extensive margin."

Our paper is related to work in international trade on entry costs and the responsiveness of firms on extensive and intensive margins, outside of the context of export-promotion programs. An influential study by Das et al. (2007) estimates a dynamic model of export entry by Colombian firms and infers that the sunk costs of export entry are large and that subsidizing them is unlikely to be effective in increasing exports.[3] One possible reading of our results, consistent with the first inference of Das et al. (2007), is that the matching grants were small relative to the sunk costs of entry into a new destination; that might explain the lack of response on the destination margin. But our finding that the market-access subsidies had a significant effect on the intensive margin of exports stands in contrast to the second inference. Related work on the question of whether exports expand primarily on the extensive margins of destinations and products or on the intensive margin of sales within particular destinations and products includes Kehoe and Ruhl (2013), Albornoz et al. (2023), Fitzgerald et al. (2024) and Erhardt and Gupta (2024). Relative to this literature, our study has the advantage of a clean source of exogenous variation and, specifically, variation in fixed costs as opposed to variable costs.

Finally, our paper is related to a growing literature on empirical evaluations of industrial-policy interventions, reviewed by Juhász et al. (2023a), Juhász and Steinwender (2023), Lane (2020), and Reed (2024). Relative to other forms of industrial policy, matching grants for exports have several attractive aspects: firms are required to have "skin in the game" and hence are arguably more likely to select promising investments; the subsidies are broad ("horizontal" in the terminology of Crespi et al. (2014) and others) and do not require governments to choose specific sectors or firms to support; and, as mentioned above, evidence is mounting that exporting can drive various forms of upgrading, which in turn generate positive externalities for other firms. As Reed (2024) and Juhász et al. (2023b) emphasize, export promotion has been the principal form of industrial policy in many developing countries. As one of the first randomized evaluations of an industrial-policy intervention, our paper is helping to strengthen the evidence base in this important policy area.

The paper is organized as follows. The next section presents our theoretical framework. Section 3 provides an overview of the program context and roll-out. Section 4 describes

[3] Das et al. (2007) argue that this is because "exporters that need a subsidy to get into export markets are almost always marginal suppliers" that face relatively high entry costs, and "large incumbent exporters, who account for most of the industry's foreign sales, are unaffected by entry subsidies" (p. 868). See also Cherkashin et al. (2015) and Arkolakis et al. (2021) and the review by Alessandria et al. (2021).

the data and estimation sample. Section 5 discusses our empirical strategy and Section 6 reports results. Section 7 concludes.

## 2 Conceptual Framework

To guide our empirical analysis, this section presents a partial-equilibrium model of market-penetration and product-scope decisions by heterogeneous, multi-product firms. It is essentially a simplified version of the framework of Arkolakis et al. (2021) Appendix S2, which introduces market-penetration costs (à la Arkolakis (2010)) and endogenous product scope (à la Eckel and Neary (2010), Bernard et al. (2011), and Mayer et al. (2014)) into a Melitz (2003)-type framework. We depart slightly from Arkolakis et al. (2021) in imposing approximations in order to derive explicit analytical solutions for product scope and market penetration, but our approach is broadly consistent with theirs.

### 2.1 Supply Side

In each source country $s$, there is an exogenously given continuum of potential producers of measure 1. Each has a productivity parameter, $\phi$, and a set of firm-destination-specific fixed market-access costs, $c_d$, as in Eaton et al. (2011), where $d$ indexes destinations. We order a firm's products in a destination ($g = 1, 2, 3, ...G_{sd}$) by increasing distance from the firm's core competence. Following Arkolakis et al. (2021), we assume that a firm's efficiency in producing a product declines in $g$ according to $\phi_g = \frac{\phi}{g^\alpha}$, where $\alpha \geq 0$. We normalize labor cost to 1 and allow for a destination-specific iceberg trade cost, $\tau_{sd}$. Marginal cost is then:

$$mc_{sdg} = \frac{\tau_{sd}}{\phi_g} = \frac{\tau_{sd} g^\alpha}{\phi} \tag{1}$$

Let $n_{sd}$ be the share of consumers in destination $d$ that are reached by firm $\phi$ from source country $s$. Again following Arkolakis et al. (2021), we assume that $n_{sd}$ is the same for all products of a firm in a given destination. We further assume that the total costs of market access are given by:

$$F_{sd}(G_{sd}, n_{sd}; c_d) = c_d \sum_{g=1}^{G_{sd}} f_{sd}(g, n_{sd}) \tag{2}$$

where for each product:

$$f_{sd}(g, n_{sd}) = \frac{g^{\delta_{sd}}}{\psi} \ln\left(\frac{1}{1 - n_{sd}}\right) \tag{3}$$

Here $\delta_{sd}$ governs how market-access costs vary with distance from core competence. The parameter $\psi$ captures the cost of marketing, for instance, the cost of posting an advertisement, defined (following Arkolakis (2010)) such that a higher $\psi$ corresponds to lower cost; we assume $\psi > 0$. Arkolakis (2010) provides a microfoundation for this specification based on a model of the visibility of advertisements.[4] The key properties are that the costs of access increase in market penetration ($\frac{\partial f_{sd}}{\partial n_{sd}} > 0$), at an increasing rate ($\frac{\partial^2 f_{sd}}{\partial n_{sd}^2} > 0$), and approach infinity as penetration approaches 1 ($\lim_{n\to 1} f_{sd} = \infty$), which guarantees less-than-full market penetration in equilibrium. Although $F_{sd}$ varies with market penetration and product scope, it does not depend directly on firm output; in this sense, it can be thought of as representing fixed market-access costs.

## 2.2 Demand Side

In each destination country, there is a continuum of consumers of measure 1. Each consumer, $\ell$, faces a potentially different set of firms from each source, $\Omega_{sd}^{\ell}$, and has constant-elasticity-of-substitution (CES) preferences over bundles of varieties offered by firms:

$$U_d = \left(\sum_{s=1}^{N} \int_{\phi \in \Omega_{sd}^{\ell}} X_{sd}(\phi)^{\frac{\sigma-1}{\sigma}} d\phi\right)^{\frac{\sigma}{\sigma-1}} \tag{4}$$

where the firm-specific bundle $X_{sd}(\phi)$ is itself a CES combination of varieties:

$$X_{sd}(\phi) = \left(\sum_{g=1}^{G_{sd}(\phi)} x_{sdg}(\phi)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} \tag{5}$$

Here $x_{sdg}(\phi)$ is consumption of variety $g$ and $G_{sd}(\phi)$ is the set of varieties offered by firm $\phi$ in destination $d$. Following Arkolakis et al. (2021), we assume that the elasticities of substitution at the variety and firm level are both equal to $\sigma$; setting the elasticities equal in the two nests simplifies the algebra but is not crucial for our predictions.[5]

[4] Arkolakis (2010) allows the rate at which returns to advertising diminish, captured by his parameter $\beta$, to vary. Here we focus on the case where $\beta = 1$ in his model. This greatly simplifies the exposition without (in our view) sacrificing insights that are important in our setting. Note that a minus sign is missing in the second part of equation (2) of Arkolakis (2010), which corresponds to (3) above.

[5] To keep the framework as simple as possible, we do not introduce an explicit term capturing product quality; note that $x_{sdg}(\phi)$ can be considered to be consumption in quality-adjusted units. See e.g. Appendix D of Kugler and Verhoogen (2012) for a discussion.

Assuming a large number of firms and consumers in each country, the demand for each product in each destination is:

$$x_{sdg}(\phi) = p_{sdg}(\phi)^{-\sigma} n_{sd}(\phi) T_d {P_d}^{\sigma-1} \tag{6}$$

where $p_{sdg}(\phi)$ is the price of variety $g$ offered by firm $\phi$; $n_{sd}(\phi)$ is the firm's probability of reaching a given consumer; $T_d$ is total consumer expenditure, and $P_d$ is the aggregate CES price index corresponding to (4)-(5).[6]

## 2.3 Optimal Product Scope and Market Penetration

We can now consider the firm's choices of product scope and market penetration. To reduce clutter, we focus on the decisions of a single firm, with productivity $\phi$, from a single origin, $s$, selling to a single destination, $d$, and suppress the $sd$ subscripts and the dependence on $\phi$. Similar relationships hold for each firm-source-destination combination.

Given the CES demand structure, the firm's markup over costs is constant and the optimal price is:

$$p_g = \left(\frac{\sigma}{\sigma-1}\right) mc_g = \frac{\sigma}{\sigma-1}\frac{\tau g^{\alpha}}{\phi} \tag{7}$$

Using (1), (2), (3), (6) and (7), the profit of the firm can then be written as a function of product scope, $G$, market penetration, $n$, and variables that the firm takes as exogenous:

$$\pi(G,n) = \sum_{g=1}^{G}(p_g - mc_g)x_g - c_d \sum_{g=1}^{G} f(g,n) = \Theta n \left(\sum_{g=1}^{G} g^{-\alpha(\sigma-1)}\right) - \frac{c_d}{\psi}\ln\left(\frac{1}{1-n}\right)\sum_{g=1}^{G} g^{\delta} \tag{8}$$

where $\Theta \coloneqq \left(\frac{\sigma-1}{\sigma}\frac{\phi}{\tau}\right)^{\sigma-1}\frac{T_d {P_d}^{\sigma-1}}{\sigma}$.

As in Arkolakis et al. (2021), we need to impose a restriction on the parameters to ensure that the firm's product-scope choice problem is well defined:

$$\delta + \alpha(\sigma-1) > 0 \tag{9}$$

[6] That is,

$$P_d = \left(\sum_{s=1}^{N}\int_0^{+\infty}\sum_{g=1}^{G_{sd}(\phi)} p_{sdg}(\phi)^{1-\sigma} n_{sd}(\phi) h_s(\phi) d\phi\right)^{\frac{1}{1-\sigma}}$$

where $h_s(\phi)$ is the probability density of productivities in $s$. See Arkolakis (2010) and Arkolakis et al. (2021).

This condition ensures that the incremental costs from adding a new product will increase more quickly than incremental revenues and hence that we will have an interior solution to the choice of product scope.[7] Below we use approximations that require additional restrictions on these parameters.

In this context, Tasdir+-type matching grants can be interpreted either as reducing destination-level market-access costs, $c_d$, or as lowering marketing costs within a given destination, here captured by an increase in $\psi$. Given our functional-form assumptions, reductions in $c_d$ and increases in $\psi$ are isomorphic; only the ratio $c_d/\psi$ appears in (8). Let $a \coloneqq c_d/\psi$ represent combined market-access costs.

The fact that $g$ and $G$ take on only integer values makes the optimization problem non-standard — in particular, a mixed integer programming problem. Such problems are often difficult to solve analytically (see e.g. Boyd et al. (2007, Sec. 9.2)), and this case is no exception. For the purpose of guiding the interpretation of our experimental results, we feel that it is useful to derive explicit analytical results. To do so, we approximate the summations in (8) by Riemann integrals:[8]

$$\sum_{g=1}^{G} g^{\delta} \approx \frac{G^{1+\delta}}{1+\delta}, \qquad \sum_{g=1}^{G} g^{-\alpha(\sigma-1)} \approx \frac{G^{1-\alpha(\sigma-1)}}{1-\alpha(\sigma-1)} \tag{10}$$

These integrals are well-defined only if the exponents in the summations are greater than -1,[9] i.e.

$$\delta > -1, \qquad \alpha(\sigma-1) < 1 \tag{11}$$

We impose these restrictions hereafter.

Using an envelope theorem with an arbitrary choice set from Milgrom and Segal (2002), optimal market penetration can be written as a function of product scope, $G$:

$$n^*(G) = 1 - \frac{a\Lambda}{\Theta} G^{\delta+\alpha(\sigma-1)} \tag{12}$$

[7] This condition is an analogue in our context of the assumption in Arkolakis et al. (2021) that combined incremental scope costs are strictly increasing (their Assumption 1).

[8] These approximations are increasingly good as $G$ grows large. To see this, let $z_g = g/G$ and note that $z_1, z_2, ..., z_G$ form a regular partition of the interval $[0,1]$. Then:

$$\lim_{G\to\infty} \sum_{g=1}^{G} g^{\delta} = G^{1+\delta} \lim_{G\to\infty} \sum_{g=1}^{G} z_g^{\delta} \triangle z_g = G^{1+\delta} \int_0^1 z^{\delta} dz = \frac{G^{1+\delta}}{1+\delta}$$

where $\triangle z_g = z_g - z_{g-1}$. A similar argument holds for $\sum_{g=1}^{G} g^{-\alpha(\sigma-1)}$.

[9] See e.g. Hunter (2014, ex. 12.25).

where $\Lambda \coloneqq \frac{1-\alpha(\sigma-1)}{1+\delta}$ and $0 < \Lambda < 1$ by (9) and (11). See Appendix A.1.

To characterize the optimal choice of product scope, we first consider a relaxation of the problem in which product scope is treated as a continuous variable, call it $\widetilde{G}$. In Appendix A.2, we derive an analytical solution for the optimal $\widetilde{G}$:

$$\widetilde{G}^* = \left[\frac{\Theta}{a\,|W_{-1}\left(-\Lambda e^{-\Lambda}\right)|}\right]^{\frac{1}{\delta+\alpha(\sigma-1)}} \tag{13}$$

where $W_{-1}(\cdot)$ is one branch of the Lambert W function (Corless et al., 1996).[10] Note that optimal product scope is declining in market-access costs ($\frac{\partial \widetilde{G}^*}{\partial a} < 0$). Plugging (13) into (12) gives the optimal market penetration in the relaxed case — call it $\widetilde{n}^*$ — which does not vary with market-access costs ($\frac{\partial \widetilde{n}^*}{\partial a} = 0$).

Turning back to the integer-constrained problem, we show in Appendix A.3 that optimal *integer* product scope, $G^*$, is a decreasing step function of $a$, defined by the following cutoffs:

$$\widehat{a}_k = \frac{\Theta H}{\Lambda |W_{-1}(-He^J)|} \tag{14}$$

where $H \coloneqq \frac{\left((k+1)^{1-\alpha(\sigma-1)} - k^{1-\alpha(\sigma-1)}\right)}{\left((k+1)^{1+\delta} - k^{1+\delta}\right)}$, $J \coloneqq (\delta + \alpha(\sigma-1)) \frac{\left((k+1)^{1+\delta}\ln(k+1) - k^{1+\delta}\ln k\right)}{(k+1)^{1+\delta} - k^{1+\delta}} - 1$, and $k$ indexes the steps. It follows from (12) that optimal market penetration in the integer-constrained problem, $n^*(a)$, is declining in $a$ within each range $(\widehat{a}_{k+1}, \widehat{a}_k)$ and that the optimal market penetration increases discontinuously at each cutoff (i.e. $\lim_{a \to \widehat{a}_k^-} n^*(a) < \lim_{a \to \widehat{a}_k^+} n^*(a)$). It follows from (14) that the cutoff for introducing the first product in a destination is $\widehat{a}_0 = \frac{\Theta}{\Lambda}$.

The key patterns are illustrated in Figures 1 and 2. In Figure 1, the green curve represents the optimal (continuous) $\widetilde{G}^*(a)$, which declines in $a$; the $\{a_k\}$ are the values of $a$ at which $\widetilde{G}^*(a)$ happens to take on integer values (i.e. at which $\widetilde{G}^*(a_k) = k$ for $k = 1, 2, 3, 4, ...$). The blue step function, with cutoffs $..., \widehat{a}_4, \widehat{a}_3, \widehat{a}_2, ...$, represents the optimal product scope under the integer constraint, $G^*(a)$. In Figure 2, optimal market penetration in the relaxed problem is given by the red dotted horizontal line at $\widetilde{n}^*$. The purple sawtooth curve represents $n^*(a)$, the optimal market penetration under the integer constraint, which declines in market-access costs between consecutive cutoffs

[10] The Lambert W function is also sometimes referred to as a product logarithm, since if (and only if) $ye^y = x$ then $y = W_j(x)$; the function has two branches, indicated by $j \in \{-1, 0\}$. For $x \geq 0$, $y = W_0(x)$; for $-\frac{1}{e} \leq x < 0$, $y = W_0(x)$ or $W_{-1}(x)$. We show in Appendix A.2 that $W_{-1}(\cdot)$ is the relevant branch in (13). It will be useful below to note that $W_{-1}(x) < -1$ for $-\frac{1}{e} \leq x < 0$.

$\widehat{a}_{k+1}$ and $\widehat{a}_k$.

## 2.4 How Product Scope, Market Penetration, and Exports Respond to Market-Access Subsidies

Market-access subsidies of the type provided by the Tasdir+ program in our experiment can be thought of as reducing market-access costs, $a$. What impacts would we expect on product scope, market penetration, and total exports? We draw two main implications from the model.

First, product scope may be insensitive to changes in market-access costs. As is evident in Figure 1, $G$ is weakly decreasing in $a$ (and hence weakly increasing in reductions in $a$), but, crucially, a reduction in $a$ will only affect $G$ if the change shifts $a$ across one of the cutoffs, $\widehat{a}_k$. Depending on the values of the various parameters, the ranges over which destination entry and destination-specific product scope remain unchanged may be wide. If so, product scope may not respond to the market-access subsidies.

Second, market penetration and export sales can be expected to respond even in the absence of changes in product scope. Even when they do not shift $a$ across one of the cutoffs, reductions in $a$ have an impact on the intensive margin of market penetration within a given destination-product. As can be seen in Figure 2, between any two thresholds, $\widehat{a}_{k+1}$ and $\widehat{a}_k$, a reduction in $a$ increases $n$. As a consequence, a firm's exports can be expected to increase with the reduction in market-access costs, even when there is no change in product scope. Using (6), (7), and (12), we can write total firm export revenues from a destination, call them $E$, as follows (refer to Appendix A.4):

$$E = \sum_{g=1}^{G} px_g = \left[\Theta - a\Lambda G^{\delta+\alpha(\sigma-1)}\right] \frac{\sigma G^{1-\alpha(\sigma-1)}}{1-\alpha(\sigma-1)} \tag{15}$$

It is evident from (15) that for a given product scope, $G$, exports are declining in market-access costs, $a$. In the empirical work below, we will consider proportional changes in exports in response to reductions in market-access costs. If there are no changes in product scope, then such changes can be written:

$$\frac{dE/da}{E} = -\frac{\Lambda G^{\delta+\alpha(\sigma-1)}}{\Theta - a\Lambda G^{\delta+\alpha(\sigma-1)}} < 0 \tag{16}$$

If the reduction in $a$ induces changes in product scope, then the proportional change in

exports will be a complicated mix of intensive- and extensive-margin changes. But we will see below that the empirically relevant case is the one in which there is no change in product scope. In this case, we have an unambiguous prediction that exports increase proportionally in response to a reduction in market-access costs. As noted above, the implication that exports might respond on the intensive margin to reductions in the fixed costs of market access, even in the absence of changes in product scope, stands in contrast to the predictions of now-standard heterogeneous-firm models of trade such as Melitz (2003) and Bernard et al. (2011), in which fixed market-access costs matter for firms' entry into destinations and products but not for market penetration or sales conditional on entry.

Although we consider them to be of lower importance, our framework also carries implications for heterogeneous treatment effects in response to the subsidies. In particular, the response of exports can be expected to vary with the level of market-access costs that a firm faces, other things equal. From (16), if there is no change in product scope, it follows that:

$$\frac{\partial}{\partial a}\left(\frac{dE/da}{E}\right) < 0 \tag{17}$$

That is, lower market-access costs dampen the responsiveness of exports to reductions in market-access costs (i.e. $\frac{dE/da}{E}$ is less negative for firms facing lower $a$). Similarly, it can be shown that the responsiveness of exports in proportional terms is lower for higher-productivity (and hence larger) firms. Recalling from the definition of $\Theta$ following equation (8) that $\Theta$ is increasing in firm productivity, $\phi$, we have:

$$\frac{\partial}{\partial \phi}\left(\frac{dE/da}{E}\right) > 0 \tag{18}$$

That is, for a given product scope and level of market-access costs, higher productivity dampens the responsiveness of exports to reductions in market-access costs (i.e. $\frac{dE/da}{E}$ is less negative).

## 3 Context and Experimental Design

A key motivation for Tunisian export-promotion programs has been limited diversification of the country's export destinations and products (Lopez-Calix et al.,

2010). Approximately 75% of Tunisia's exports go to Western Europe — 58.1% to France, Italy, and Germany alone. Exports are concentrated in a small number of sectors, including machinery and transport equipment, textiles, and agricultural products.[11]

The Tunisian government has devoted substantial resources to a series of export-promotion programs, administered by its export-promotion agency, CEPEX. In 1999, it launched a matching-grants-for-exports program known as FAMEX I with a budget of USD 24 million (over multiple years). This was followed in 2006 by FAMEX II — the subject of Gourdon et al. (2011) and Cadot et al. (2015) — with a budget of USD 37.6 million. Since 1989, CEPEX has also managed a large program to defray transportation costs for Tunisian exporters, known as FOPRODEX, with a recent budget of USD 17-25 million per year.

The Tasdir+ program, known officially as the Fund for Competitiveness and Export Development Support [*Fonds d'Appui à la Compétitivité et au Développement des Exportations*], was created in 2014 with a budget of USD 23.5 million. The stated objectives were to increase exports in a sustained manner and to promote diversification towards higher-value-added exports and new markets. The program funded non-randomized waves of matching grants in 2015 and 2017.

Given the large expenditures on export promotion, the Tunisian government has been keenly interested in the cost-effectiveness of its subsidies. It decided in 2018, with encouragement from the World Bank, to randomize grants in the third and fourth waves of the Tasdir+ program.[12] The budget for the randomization sample was USD 14 million. There were four calls for applications as part of the third wave and one call as part of the fourth wave. We refer to these calls as "rounds" and focus on these five rounds hereafter.

As part of the application, firms were required to submit a "business plan" listing expenditures to be subsidized by the grant. CEPEX staff reviewed the applications to determine eligibility. To be eligible, a firm had to fulfill the following criteria: (1) be privately owned; (2) be legally based in Tunisia; (3) not be a retailer or wholesaler;[13] (4) not be an artisanal firm; (5a) (for non-agricultural firms) have a liquidity ratio, defined as assets over liabilities averaged for the three calendar years preceding the program

[11] These figures are from our own calculations using World Integrated Trade System (WITS) data.

[12] A small number of firms received support in the third and fourth waves without being included in the randomization sample; see Appendix B for details.

[13] An exception to this rule was made for import-export firms, known locally as "trading firms."

year, greater than or equal to 1,[14] or (5b) (for agricultural firms) have five or more permanent employees or at least one export operation during the three calendar years preceding the program year; and (6) be established prior to Jan. 1, 2015 for Rounds 1-4 or Jan. 1, 2017 for Round 5. Further details on the eligibility rules are in Appendix B.

In their applications, firms could propose a budget of up to TND 300,000 (USD 100,000),[15] of which the matching grant would cover 50%. Business plans could be of two types: support for exporting (*appui a l'export*) or setting up an affiliate abroad (*implantation a l'étranger*). Approximately 75% of firms chose the former. For this type of plan, eligible expenses included visits to expositions and trade fairs; market research expenditures; marketing expenditures; creation of websites and other forms of online marketing; and certification and regulatory compliance expenditures for products. For the second type of plan, eligible expenses included rent and other costs of maintaining the foreign office; travel abroad to monitor the foreign office; costs of trademark registration in the foreign country; and technical assistance required to set up or maintain the foreign office. A full list of eligible expenditure categories appears in Table 1. Importantly for our study, variable costs such as wages and material input expenditures were not eligible for support, nor were capital investments such as purchase or installation of equipment. In their applications, firms were required to list 2-3 target export destinations, of which at least half had to be new destinations. Firms' business plans had to be approved by CEPEX staff in order for the firms to be included in the randomization sample. Once the business plans were approved, firms were also required to respond to our baseline survey to be included in the randomization.

Figure 3 summarizes the timeline of the experiment. The first call for applications to the experimental phase was launched in July of 2018. Randomization for the five rounds was carried out in public meetings in Sept. 2018, Nov. 2018, Feb. 2019, May 2019, and Dec. 2019. Following each randomization, the Tasdir+ steering committee formally approved the grants for selected firms and the firms were officially enrolled; this process typically took 2-3 months. Firms then had 12 months in which to incur the expenses in their business plans. Note that part of the Round 4 spending period and almost all of the Round 5 spending period coincided with the covid-19 pandemic; we return to this issue below. Control firms were excluded from re-applying to the program for at least 12

[14] For round 5, the liquidity threshold was lowered to 0.9.

[15] The average exchange rate over our study period was approximately 3 TND/USD, and we use that rate throughout the paper.

months.[16] Although we primarily rely on administrative data to track outcomes, we conducted a follow-up survey with Rounds 1-3 in July-Dec. 2020 and with Rounds 4-5 in March-Dec. 2021. When referring to pre-program information, we follow Tasdir+ practice in using 2017 as the reference year for Rounds 1-4 and 2018 for Round 5.

Within each round, randomization was stratified by sector, size, and type of business plan. Firms were classified into 6 sectors: agriculture/fishing (5% of randomization sample), trading (10%), food processing (7%), non-food manufacturing (34%), information and communication technology (ICT) services (14%), and non-ICT services (30%). Size categories for each sector (small, medium, large) were calculated based on the revenue distribution of previous beneficiaries of Tasdir+. In some rounds, because of prohibitively small numbers of firms in some strata, we pooled strata prior to randomization; see Appendix B for details. At the most disaggregated level, there were 28 strata.

The experiment faced a key difficulty in implementation. The original design included a "pay for performance" treatment arm in which firms that succeeded in increasing exports would receive an additional rebate, up to 40% of eligible expenses, beyond the 50% matching grant (i.e. up to 90% together). To conform to World Trade Organization (WTO) rules, these performance rebates were limited to firms selling food and agricultural goods. See Appendix B.2 for details. Approximately midway through our study, an external government auditor prohibited the Tasdir+ program from reimbursing more than 50% of expenses, effectively eliminating the rebates. In total, of the 41 firms selected to be eligible for rebates, only 5 submitted rebate requests and none received a rebate. Thus, in practice, the "Matching Grant + Rebate" arm was effectively the same as the "Matching Grant Only" arm and we treat them as a single treatment in our analysis.

Pooling rounds, 487 firms were included in the randomization sample. In Rounds 1-4, two-thirds of firms in the rebate-eligible sectors and one-half of other firms were assigned to receive matching grants. In Round 5, two-thirds of all firms were assigned to receive matching grants. Overall, among the 487 firms in the randomization sample, 281 were assigned to receive grants and 206 were assigned to control. Of the 281 firms assigned to treatment, 269 signed a contract with CEPEX and officially enrolled. For the

[16] Four control firms from Round 1 re-applied in Round 5; these firms were not included in the the Round 5 randomization sample.

enrolled firms, the average approved matching grant was approximately USD 30,000 (TND 90,000), based on a total business-plan budget of USD 60,000. Of the 269 enrolled firms, 187 eventually submitted at least one reimbursement request to CEPEX. Among these 187 firms, the average "realization rate," i.e. the share of the approved grant that was reimbursed by the end of the program, was 22%.[17] Thirty-five of the 187 firms that submitted at least one request received no reimbursement.

Two additional features of the institutional context are particularly relevant. First, a significant share of Tunisian firms (about 30% of our randomization sample) are classified legally as "totally exporting." Administratively, these firms are in a free trade zone, outside of the Tunisian customs area. Firms in this regime sell most of their production abroad, but are allowed to sell part of their output (usually up to 30% of sales) on the domestic market.[18] Second, wages in Tunisia are in large part determined by sectoral bargaining agreements (World Bank, 2014; Angel-Urdinola et al., 2015). According to the International Labour Organization, these agreements covered around 63% of private- and public-sector workers in 2019 (ILO, 2023). The agreements stipulate base salary grids that are binding for many firms.

# 4 Data

This section reviews the data sources we use and the estimation samples we construct. Additional details are in Appendices C and D.

## 4.1 Sources

Several sources of administrative records are collected in the *Repertoire National des Entreprises (RNE)* [National Repertory of Firms], a database of registered firms maintained by the Tunisian national statistical agency, the *Institut National des Statistiques (INS)*. In particular, the RNE contains annual domestic sales and exports from corporate tax declarations to the *Direction Générale des Impôts (DGI)* [General Tax

[17] A natural question is why this realization rate was so low. Conversations with firms suggest two possible explanations. One is that firms were worried that administrative delays or policy-related factors would prevent CEPEX, the implementing agency, from actually issuing the reimbursements. A second is that there were frictions in the process of changing business plans. Although in principle firms were able to modify their plans with CEPEX approval, firms reported that in practice the process was difficult.

[18] Totally exporting firms have benefited historically from an array of advantages such as VAT exemption, a reduced 10% corporate tax rate, import tax exemptions on inputs, and hiring incentives.

Authority] and firm-level employment and wages from the *Caisse Nationale de Sécurité Sociale (CNSS)* [National Social Security Fund]. We have been able to link all 487 firms from the Tasdir+ randomization sample to the RNE, although not all variables are available for all firms, as discussed below. Importantly, the RNE data contain information on exports for service firms as well as non-service firms (from the corporate tax records). We use the RNE from 2015 to 2021, the latest year to which we have access.

Through an agreement between two government ministries that we helped to facilitate, we have also been able to access data on firms' international transactions from 2017-2022 from the Tunisian customs authority. In these data, we observe transaction-level export records at the level of destination country, date of shipment, and 11-digit product category.[19] A shortcoming of the customs data is that firms are required to submit declarations only when they ship physical goods; service firms typically are not required to submit declarations for exported services. For this reason, we primarily rely on the RNE for information on exports, although we use the customs data when focusing on the number of destinations or products.

We also have access to administrative data from the Tasdir+ program itself, for all firms in the randomization sample. Data from firms' applications include sector, quality certifications, number of employees, sales, targeted countries, and expected effects. We also observe reimbursement requests and amounts disbursed for treated firms.

Finally, we conducted baseline and follow-up surveys. We asked about the actions firms took to increase exports and about the amounts spent on innovative activities, among other variables. Since responding to the baseline survey was a condition for eligibility for the matching grant, we have complete coverage at baseline. But response rates to the endline survey were much lower, in part due to the covid-19 pandemic and in part to the fact that CEPEX had little leverage to oblige firms to respond.[20] For this reason, we rely primarily on the information from administrative records to evaluate the impact of the program, although we present some results from the survey below.

[19] The 11-digit categories are from the *Nomenclature de Dédouanement des Produits (NDP)* [Customs Clearance Product Nomenclature], Tunisia's most detailed product classification; the first 6 digits are harmonized with the international Harmonized System (HS) trade categories.

[20] Lower-than-usual responses during the pandemic were documented even in established surveys like the Current Population Survey in the US (Rothbaum and Bee, 2021).

## 4.2 Samples

Given the incomplete information in the RNE, customs and survey datasets, we must use different samples when analyzing different outcomes. The five samples we use are the following.

1. The *Randomization Sample* contains information from the Tasdir+ applications for all 487 firms included in the randomization.
2. The *RNE Export Sample* includes the 377 firms for which sales and exports from the DGI (tax authority) are available in the RNE in both the reference year (2017 for Rounds 1-4, 2018 for Round 5) and in 2021 (and for which sales are observed in the application data at baseline).
3. The *RNE Employment Sample* includes the 327 firms in the *RNE Export Sample* for which the RNE also reports employment and wages from the CNSS (social security agency) in both the reference year and in 2021.
4. The *Customs Sample* contains the 210 non-service firms from the RNE Export Sample. If a non-service firm from the RNE Export Sample has no reported exports in a given year, we impute zero exports, and similarly for imports. Although service firms occasionally show up in the customs data as exporters or importers of physical goods, the customs data do not give a true picture of their engagement in international markets and we exclude them.
5. The *Survey Sample* contains the 204 firms for which we observe information on actions and spending in both the baseline and endline surveys.

## 4.3 Descriptive Statistics

Table 2 reports balance between the treatment and control groups for the Randomization Sample. Appendix Tables A1-A4 present similar balance tables for the other samples. To facilitate comparison, we include five key variables from the administrative data for each sample — export regime, firm age, domestic capital share, employment, and sales — in addition to variables specific to each sample. In these balance tables, as well as in the regressions below, monetary variables have been winsorized at the 3%/97% level to reduce the influence of outliers. We observe balance between the treatment and control groups, conditional on round and stratum fixed

effects, in the Randomization, RNE Export, RNE Employment, and Customs Samples. At the same time, it is important to note that the patterns of missing data create differences across samples (without generating imbalance between treatment and control); in particular, firms in the RNE and Customs Samples tend to be older and larger than firms in the full Randomization Sample. Also, there is some indication of imbalance in the Survey Sample; in particular, it appears that larger (higher-sales) treated firms were more likely to respond to the endline than larger control firms. Although we do not reject the joint null of no treatment-control differences (conditional on round and stratum effects) in this sample, below we show that the results are robust to controlling for the baseline characteristics that display a lack of balance.

# 5 Empirical Strategy

Given that we have a randomized experiment, the empirical analysis is straightforward. The main complication is that the outcome of primary interest is exports, a variable with a significant number of zeros. There is an active econometric debate about the best way to analyze outcomes in such cases (Chen and Roth, 2024). The literature has not converged on a consensus solution. Our approach is to present estimates using what we perceive to be the two leading approaches and show that the results are robust.

Our preferred specification is a simple two-part ANCOVA specification, where we run separate regressions with (binary) exporter status and log exports as outcomes and control for values of the dependent variable in the reference year (pre-program). The basic specification is:

$$Y_{i,2021} = \beta Treated_i + \alpha Y_{i,refyear} + \gamma_r + \delta_s + \epsilon_i \tag{19}$$

where $Y_{i,2021}$ denotes outcome $Y$ for firm $i$ in year 2021 (e.g. either exporter status or log exports), $Y_{i,refyear}$ denotes outcome $Y$ for firm $i$ in the reference year (2017 for rounds 1-4, 2018 for round 5), $Treated_i$ is an indicator for being assigned to receive the matching grant in the randomization, $\gamma_r$ are round fixed effects, $\delta_s$ are strata fixed effects, and $\epsilon_i$ is an error term. The approach of controlling for baseline values of the outcome has been shown to have higher power than standard difference-in-differences when autocorrelation is low (McKenzie, 2012). Note that the regression with log exports as the outcome can only be implemented among continuous exporters, and only

captures the intensive margin of exports, conditional on exporting. When analyzing outcomes without zeros (for example, sales and employment), we simply estimate (19) with the log of the outcome as the dependent variable.

For outcomes with many zeros, we also present estimates from a Poisson Pseudo Maximum Likelihood (PPML) estimator (Gourieroux et al., 1984; Santos Silva and Tenreyro, 2006; Wooldridge, 2010, section 18.2; Chen and Roth, 2024), where we include firm fixed effects to increase precision. The model is:

$$Y_{it} = \exp(\beta Treated_i \times Post_t + \gamma_i + \lambda_t)\eta_{it} \tag{20}$$

where $Y_{it}$ denotes the level of the outcome (e.g. exports) for firm $i$ in the reference year (2017 for rounds 1-4, 2018 for round 5) or 2021, $Treated_i$ is an indicator for being assigned to receive the matching grant in the randomization, $Post_t$ is an indicator for the year 2021, $\gamma_i$ are firm fixed effects, $\lambda_t$ are year fixed effects, and $\eta_{it}$ is an error term (with mean 1) clustered by firm. In this context, $e^{\beta} - 1$ is equal to the population-average treatment effect as a proportion of the control mean. Note that this estimand combines effects on the extensive and intensive margins (e.g. of entry into exporter status and exports conditional on entry).

Our choice of outcome year merits some discussion. The RNE is an annual dataset, covering calendar years. Three of our five randomization rounds occurred in 2019 (refer to Figure 3). The first year of the covid-19 outbreak, 2020, saw a sharp contraction of economic activity in Tunisia, as elsewhere, and events in that year are difficult to interpret. We therefore focus on 2021, the latest year to which we have access in the RNE, to study post-intervention outcomes.

# 6 Results

## 6.1 Export Outcomes

Panel A of Table 3 reports two-part ANCOVA estimates of (19) in the RNE Export Sample of 377 firms. Column 1 reports a linear probability model with a 0/1 exporter indicator as the outcome. Although the point estimate is positive, indicating an increase of 5% in the probability of having positive exports, on a baseline value of 78%, we are not able to reject the null of no effect at conventional levels of confidence. When we focus in Column 2 on

continuous exporters (i.e. the 244 firms with positive exports in both the reference year and 2021), we find a significant positive effect of 39 log points (48%).

Panel B of Table 3 reports PPML estimates of (20) for exporter status (Column 1) and the level of exports (Column 2). Although the point estimate is positive, the estimate of the treatment effect on exporter status is not significant. In Column 2, we find a marginally significant positive estimate of 0.24, equivalent to a proportional average treatment effect of (exp(0.24)-1)=27%. Given that this PPML estimates combines the intensive margin of exports with the extensive margin of entry into exporting, on which there is relatively little adjustment, it is not surprising that the magnitude is smaller in percentage terms that in Column 2 of Panel A.

Whichever specification we focus on, the estimated effect on exports is large in economic terms. Average exports in the reference year were approximately USD 720,000 (TND 2.15 million). The increase in exports over the 3-4 years between the reference year and 2021 is thus estimated to be on the order of USD 200,000-350,000. Recall that the program offered reimbursement of up to USD 50,000, but that the average realization rate was 22% on matching grants of approximately USD 30,000 among the 187 firms (of 281 treated firms) that submitted at least one reimbursement request. Hence the average payout was approximately US 4,400 per firm (30,000 * .22 * (187/281)). Our estimates thus suggest that the program generated an increase of USD 58-68 in exports on average for every dollar spent. This effect is large, but not out of line with the existing literature. For instance, using a non-experimental approach, it has been estimated that a USD 1 increase in the budget of trade promotion organizations is associated was an increase of approximately USD 100 in exports (ITC, 2016; Olarreaga et al., 2020; Olarreaga, 2024). In percentage terms, our estimates range from 27% to 48% over 3-4 years. Volpe Martincus and Carballo (2008) find that participation in a Peruvian export-promotion program was associated with an increase in exports of 16-36 log points (17-43%), over a shorter time period than we consider here. Volpe Martincus (2010) reports an effect size of approximately 20% for an Argentinian export-promotion program and 24% for a Colombian one.

The program thus appears to have been quite successful in realizing one of its primary aims, to increase Tunisian exports overall. How successful was it in realizing its other main aim, of helping firms diversify their export destinations and products? To investigate, we turn to the Customs Sample, in which we see destinations of exports and

export volumes at the 11-digit product level. Table 4 reports estimates of the effect of the program on the numbers of export destinations and products. Panel A reports our ANCOVA specification, (19), and Panel B reports the PPML specification, (20). For comparison purposes, we include exporter status and exports as outcomes in Columns 1-2, which are directly comparable to Table 3, and the estimates are similar, with slightly larger standard errors (as would be expected given the reduced sample). In Columns 3-4, there is no evidence of a positive effect on the numbers of destinations or products. Indeed, the point estimates in Panel A and in Column 4 of Panel B are negative.

Another way of evaluating the success of the matching grants in diversifying exports is to look at the effect on the numbers of *new* destinations or products. If the matching grants led firms both to add new destinations and products and drop old ones, we might see no effect in total numbers of destinations and products but positive effects on new destinations and products. We consider a destination or product to be new if it did not appear in the customs data in the reference year for a given firm. Recall that firms had to identify 2-3 targeted destinations in their Tasdir+ applications, of which at least half had to be new destinations, so we can also examine whether firms added new targeted destinations. Table 5 presents simple regressions with different measures of new destinations or products as outcomes. With the outcomes defined in this way, there are no baseline values to control for; we present OLS estimates in Panel A and PPML estimates in Panel B, and we only include data from 2021. There is one marginally significant coefficient for the number of new targeted destinations in Column 4, Panel B. But generally the estimates reinforce the above observation that there is little evidence of an effect on the destination or product margins.

Overall, it appears that the matching grants did not meaningfully increase the diversification of treated firms' exports. Because of imprecision in the estimates, we cannot rule out modest positive effects on the order of 0.20 more destinations or 0.33 new products in response to the program. But with the standard models of Melitz (2003) and Bernard et al. (2011) in mind, one would likely have expected a larger response on these margins, especially given the large increase in exports overall. In contrast, the non-results for destinations and products accord quite naturally with the model presented above. In particular, the results are consistent with the two main implications highlighted in Section 2.4, that product scope may be insensitive to subsidies to market-access costs (first implication), even as market penetration and exports rise with

such subsidies (second implication).

## 6.2 Mechanisms

The rich combination of datasets we have collected allows us to explore the mechanisms underlying the reduced-form relationship between the matching grants and exports documented in Table 3. In this subsection, we consider the impacts of the matching grants on a variety of other outcomes. When the frequency of zeros is not an issue, we focus on the ANCOVA specification (equation (19)).

We first consider the effects of the program on domestic and total sales. In the presence of capacity constraints, an increase in exports induced by the program might have been expected to reduce domestic sales — the flip side of the dynamic highlighted by Almunia et al. (2021), in which firms reacted to a domestic slump by selling more abroad. But it does not appear that this was the case. Table 6 reports both ANCOVA (equation (19)) and PPML (equation (20)) results for domestic and total sales in the RNE Export Sample. (Because some firms, particularly "totally exporting" firms, have zero domestic sales, the sample size drops in Column 2 of Panel A, when log domestic sales is the outcome.) There is little evidence of increased exports crowding out domestic sales; the point estimates for domestic sales are positive. There is some suggestive evidence of a positive effect on total sales, in particular a marginally significant estimate in the PPML results in Column 3 of Panel B, although given the noisiness of the data and the size of the standard errors, it is difficult to make definitive statements.

The grants appear not to have led firms to increase employment or wages. Table 7 considers employment and average earnings per worker at the firm level using the RNE Employment Sample. For comparison purposes, Columns 1-2 report estimates for a 0/1 exporter indicator and log exports; the coefficients are similar to those in Table 3. The main new information is in Columns 3-5: we find no effects on log employment, log quarterly earnings per employee, or log total wage bills; the point estimates are -0.01, 0.01, and 0.00 respectively. Given the imprecision in our estimates, we cannot rule out modest positive effects. But we nevertheless view the lack of effects on employment and earnings as surprising, given the substantial effects on exporting. Studies have typically found positive effects of exporting on wages (see e.g. Verhoogen (2008); Brambilla et al. (2012); Hummels et al. (2014); Frías et al. (2024)). One possible explanation relates to Tunisian labor-market institutions. As noted above, sectoral bargaining agreements are

prevalent and often binding at the firm level, which may explain the lack of wage effects. Given high costs of hiring and firing in Tunisia, many firms prefer to hire workers informally or on short-term contracts (Rijkers et al., 2014; Angel-Urdinola et al., 2015). These may not show up, or may show up only partially, in the RNE employment numbers.[21] Another possible explanation is that the grants simply led to reduced slack, in line with recent research finding that many developing-country firms can increase output without significant increases in input purchases (Egger et al., 2022; Walker et al., 2024).

Rather than increasing employment, it appears that firms' main response to the matching grants was to expand their presence abroad. In our surveys, we asked a series of questions about the actions and expenditures undertaken by firms. Table 8 reports results for several survey outcomes for the Survey Sample: an indicator for whether the firm established a new contract with a foreign distributor, agent, or partner following randomization (Column 1); an indicator for whether the firm established a new foreign affiliate or representative following randomization (Column 2); an indicator for whether the firm participated in an international fair after randomization (Column 3); and indicators for whether the firm had positive spending on certifications, new technology, travel or consulting in the previous calendar year (Columns 4-7). We simply regress the outcomes on an indicator for treatment, strata dummies and round dummies in 2021 data.[22] The statistically significant coefficients are in Columns 1-2; it appears that the main effect of the matching grants was to induce firms to strengthen their ties to destination markets through contracting relationships or through subsidiaries. There are suggestive positive estimates for participating in international fairs, travel and consulting, but these are not statistically significant at conventional levels. As noted above, there is some reason for concern that differential response rates to our survey between treated and control firms led to a lack of balance. To explore the robustness of the patterns, Appendix Table A6 reports specifications similar to Table 8 but where we also control for baseline sales, exporter status, and exports; the results are very similar to Table 8.

The greater presence abroad may in part be responsible for the pattern observed in Panel

[21] Informal employment is not recorded in the RNE, our primary dataset, and short-term employment is recorded only if it involves a formal contract and payments to the social security agency.

[22] The fact that the Column 1-3 outcomes are about new actions lead us to prefer this simple specification to the ANCOVA specification (equation (19)), but we also report the latter in Appendix Table A5. The results are very similar.

A of Table 9, namely that treated firms are more likely to be importers. Having a foreign partner or affiliate in a destination may also facilitate search for input suppliers from that market. However, we do not see an effect on the intensive margin of imports (Column 2 of Panel A), nor do we see an effect on the importer margin in the PPML specification (Column 1 of Panel B).

One would expect the program to have had positive effects on firms' profits. Accounting profits appear in the RNE data, and results for profits as an outcome are reported in Table 10, using the ANCOVA specification of equation (19). In Column 1, the outcome is the level of profits, in millions of 2015 dinars. In Column 2, the outcome is profits as a share of total sales. Profits are notoriously difficult to measure and noisy, and the estimates are not statistically significant. But the point estimates are positive for both measures.

Overall, the results in this subsection support the interpretation that the subsidies for fixed costs of accessing foreign markets led firms to expand their marketing and customer search efforts primarily in destinations to which they were already exporting.

### 6.3 Heterogeneous Impacts

In this subsection, we briefly explore heterogeneity of program impacts by pre-program characteristics of firms. We focus on the main exporting outcomes using the RNE Export Sample and ANCOVA specification as in Panel A of Table 3. Here we pursue a simple split-sample approach, focusing on dimensions that are suggested by our theoretical framework or that seem particularly salient. In Appendix E, we supplement this simple approach with a data-driven approach using two state-of-the-art machine-learning (ML) methods: Generalized Random Forest (GRF) framework of Athey et al. (2019), and the Generic Machine Learning (GenericML) approach of Chernozhukov et al. (forthcoming).

As noted above, a key institutional feature in the Tunisian context is the difference between "totally exporting" firms, which are administratively outside the Tunisian customs area, and non-totally exporting firms. In the context of our theoretical model, totally exporting firms can be viewed as facing low market-access costs (i.e. low $a$); the theory then predicts (refer to (17)) that we will see a smaller proportional export response for this group. Panel A of Table 11 reports separate results for non-totally exporting (Columns 1-2) and totally exporting (Columns 3-4) firms. For non-totally

exporting firms, we see a marginally significant response along the extensive margin of exporting and a very strong response on the intensive margin. By contrast, the point estimate for the intensive margin for totally exporting firms is zero.[23] That is, the average program effects documented above are entirely driven by the non-totally exporting firms. It appears that the matching grants were of most help to firms that were not already fully integrated into world markets.

Another implication of our framework is that we would expect larger, higher-productivity firms to respond less than smaller firms to the subsidies. (Refer to (18).) Panel B of Table 11 splits the RNE Export Sample by employment, using 50 employees as a cutoff. Effects on the extensive margin (for the 0/1 exporter variable in Columns 1 and 3) are similar. The point estimate of the effect on the intensive margin is larger for smaller firms (Column 2 vs. Column 4), although this difference is not statistically significant. Given the lack of statistical significance, this pattern should not be over-interpreted, but it is worth noting that the difference in point estimates is in the direction predicted by the theory.

Although our theoretical model does feature quality choices, previous work has suggested that the ability to upgrade quality is an important determinant of export success (Verhoogen, 2023). It is natural to ask whether the effects of the market-access subsidies differ along this dimension. As a proxy for the potential for quality upgrading, we use an indicator for whether a firm has any quality certification at baseline. Panel C of Table 11 presents split-sample results using this indicator. We find little evidence of an effect of the subsidy on firms without a quality certification at baseline — indeed, the point estimate is negative — and strong evidence of an effect on firms with a quality certification.

In Table 12, we use the richness of our data to explore heterogeneity along other salient dimensions. As a matching grant, the Tasdir+ program may alleviate constraints on spending especially for cash-strapped firms, allowing them to undertake profitable investments that would otherwise be outside their budget set. To explore heterogeneity on this dimension, we calculate firms' assets-to-liabilities ratios, using information provided in their Tasdir+ applications. In Panel A of Table 12, we split the RNE Export Sample by whether firms are above or below the median of this ratio. The fact that the

[23] Given that the totally exporting firms are all exporters, there is no variation in the 0/1 exporter indicator for this group.

intensive-margin coefficient in Column 2 is larger than in Column 4 is suggestive evidence in favor of this hypothesis, although the difference across the subsamples is not statistically significant.

In Panel B of Table 12, we present estimates separately by the type of business plan the firm submitted, the standard export business plan (74%) or a plan that involved setting up a foreign office. In Panel C, we present results separately for firms that had plans to introduce new products and/or tailor existing products to export destinations. There are no statistically significant differences across the split samples, but the results are suggestive that firms that implemented a standard export business plan and that had plans to innovate were better able to take advantage of the matching grants.

The results from the GRF and GenericML approaches presented in Appendix E are somewhat inconclusive, due in part to the fact that our sample size (487 firms, with only 264 firms having positive exports in the post period) is smaller than is typically needed for such applications. Although the GRF approach yields strong evidence of heterogeneity, we are not able to detect overall heterogeneity using the more conservative GenericML approach. But in both approaches we find some evidence consistent with the discussion above. In particular, we find significant heterogeneity along the totally exporting/non-totally exporting and no quality certification/has quality certification dimensions. We also find some evidence that larger firms (measured either by employment or baseline exports) responded less to the subsidies.

## 7 Conclusion

We have presented what we believe is the first successful randomized evaluation of a government financial-support program aimed explicitly at promoting exports. A distinctive aspect of the program is that the grants could be used only for fixed market-access costs, not variable costs. Trade theories in the tradition of Melitz (2003) and Bernard et al. (2011) predict that such subsidies will affect the extensive margins of entry into destinations and products but not the intensive margin of sales conditional on entry. Our results contrast with these predictions. We find positive effects of the subsidies on the intensive margin of exports but little evidence of impacts on the extensive margins of destinations or products. These patterns are consistent with the theoretical model we present, which embeds the Arkolakis (2010) idea that fixed costs

are required to reach more customers within a given destination. Because of an integer constraint on the number of products sold in a market, product scope and destination entry may be insensitive to shocks to fixed market-access costs over some ranges, but the shocks are still expected to affect market penetration for existing products and destinations.

It remains an open question how generalizable these findings are to other contexts. The non-experimental literature on export promotion has generally found stronger effects on the extensive margin of destinations than on the intensive margin of sales within destinations. What accounts for the differing results in this case? One possibility is that the random assignment is better at purging the estimates of unobservable differences between beneficiary and non-beneficiary firms than the matching and difference-in-difference estimators that have typically been employed. Another possibility is that the covid-19 pandemic, which occurred during the period of our study, made it difficult to explore new markets and encouraged firms to focus on established sales channels. A third possibility is that the specific features of the Tasdir+ program were responsible for the different impacts. In particular, to be eligible for the matching grants, firms had to submit a business plan and have it approved by Tasdir+ staff. Although in principle the plans could be changed, in practice there were frictions in doing so. Firms may have been more comfortable in developing plans for destinations and products that they were familiar with.

One hopes that further research (especially further randomized evaluations) will soon allow us to make stronger statements about which aspects of our findings are robust across contexts. But at the least, we interpret our results as providing strong evidence that fixed market-access costs *can* affect the intensive margin of market penetration, and that modeling of the behavior of firms in international markets should take this into account.

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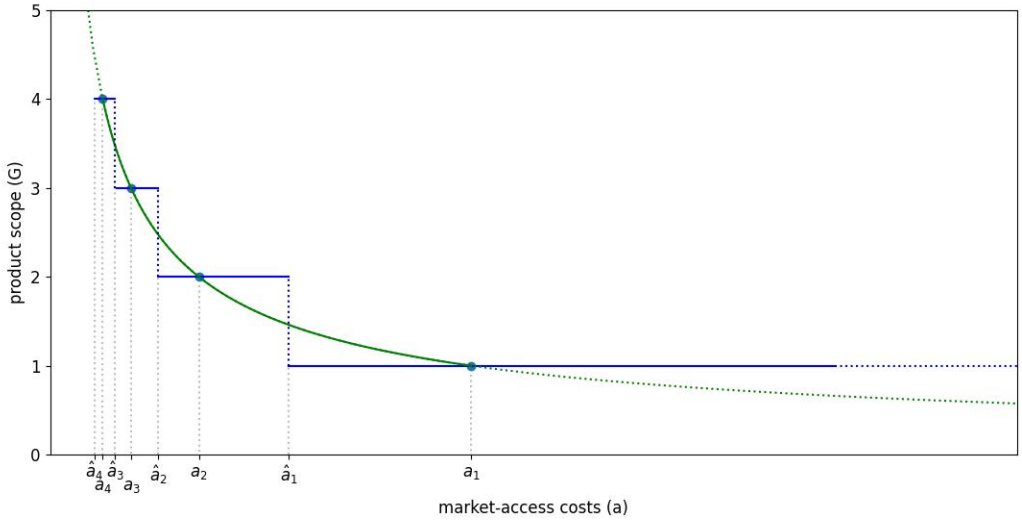
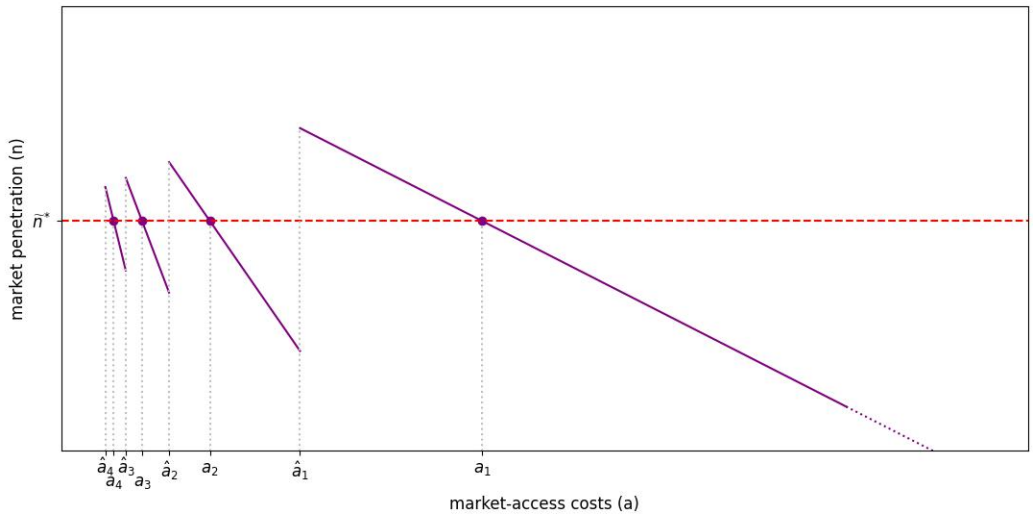
Figure 1. **Product Scope vs. Market-Access Costs**



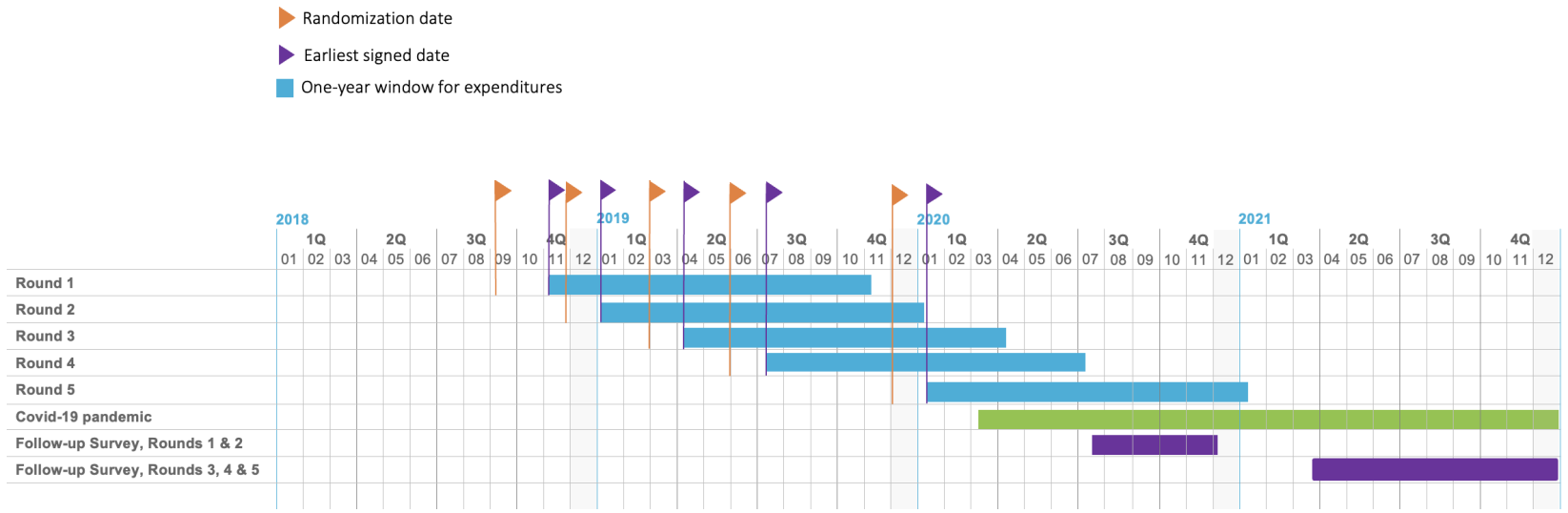

Notes: The figure is generated by a simulation of our model with the following parameter values: $\delta = 1$, $\alpha = 0.5$, $\sigma = 2$, $\Theta = 1$ (and hence $\Lambda = 0.25$). The green curve is $\widetilde{G}^*(a)$, optimal product scope in the relaxed problem (no integer constraint). The blue step function is $G^*(a)$, optimal product scope under the integer constraint. The $\{a_k\}$ are the values of $a$ at which $\widetilde{G}^*(a)$ takes on integer values. As $a \to 0$ , $k \to \infty$; for visual clarity, we omit values of $k > 4$ from the graph. The $\widetilde{G}^*(a)$ and $G^*(a)$ curves continue to the right, to the point where $a = \Theta/\Lambda$; again for visual clarity we truncate the graph.

Figure 2. **Market Penetration vs. Market-Access Costs**




Notes: The figure is generated by the same simulation as in Figure 1; see the notes to that figure. The red horizontal dotted line is the optimal market penetration in the relaxed problem (no integer constraint), $\widetilde{n}^*$, which takes on the value 0.90 in this simulation. (The y-axis extends from 0.8 to 1.0.) The sawtooth purple curve is optimal market penetration under the integer constraint, $n^*(a)$. For visual clarity, we truncate the graph as in Figure 1.

Figure 3. **Experiment Timeline**




Notes: The dates of the public randomization meetings were Sept. 6, 2018, Nov. 29, 2018, Feb. 29 2019, May 30, 2019, and Dec. 5, 2019. The figure reports the earliest date of enrollment for a firm from the corresponding randomization round; there was variation in the dates on which enrollment agreements were signed by firms from a given round.

Table 1. **Eligible Expenditures**

| Category | Action |
|---|---|
| Distribution | Marketing/sales activities at points of sale |
| | Search costs in distribution channels |
| Firm development | Acquisition of export development software tools |
| | Certification fees |
| | Consulting in the creation of the export business plan |
| | Consulting in the implementation of the export business plan |
| | Development of skills related to exports |
| | Other actions related to export development |
| | Support for setting up an export unit |
| Foreign office set-up | Consulting in the creation of the export business plan |
| | Consulting in the implementation of the export business plan |
| | Incorporation costs (lawyer fees, publication, etc.) |
| | Missions abroad to follow-up on the office set-up |
| | Missions abroad to prepare the office set-up |
| | Promotional actions linked to establishment abroad |
| | Rent for office abroad |
| | Technical and/or commercial assistance linked to implementation |
| Product development | Acquisition of brands |
| | Adaptation of packaging to the target market(s) |
| | Analysis, control and testing of products intended for export |
| | Certification and approval of products (Halal, CE marking, etc.) |
| | Creation of brands |
| | Design/adaptation of products for target markets (prototyping, new collections) |
| | Registration of brands |
| Promotion | Creation of promotional materials |
| | Design and implementation of digital actions |
| | Organization of events, open houses etc. |
| | Participation in exhibits, fairs, and B2B meetings |
| | Website creation |
| | Written, audiovisual and web advertising actions |
| Prospecting | Broker commissions |
| | Development and/or acquisition of market studies |
| | Invitation/hosting of buyers and contractors |
| | Participation in calls for tenders |
| | Prospecting missions |
| | Subscription to reviews and websites |
| | Visits to exhibits and fairs |

Notes: Translated by authors. Source is Tasdir+ internal documents, also publicized on Tasdir+ website (url: http://www.cepex.nat.tn/article/article.php?id=233).

Table 2. **Balance, Randomization Sample**

| | (1) Control Mean/SD | (2) Treatment Mean/SD | (3) P-value |
|---|---|---|---|
| Totally Exporting firm | 0.28 | 0.31 | 0.45 |
| | (0.45) | (0.46) | |
| Age of firm (as of randomization) | 14.59 | 14.54 | 0.96 |
| | (10.78) | (10.66) | |
| Domestic capital share | 96.89 | 96.66 | 0.90 |
| | (13.04) | (12.70) | |
| Employment | 39.98 | 44.52 | 0.56 |
| | (70.52) | (114.31) | |
| Sales (millions 2015 dinars) | 6.97 | 6.28 | 0.51 |
| | (15.23) | (12.60) | |
| Exporter | 0.71 | 0.73 | 0.56 |
| | (0.46) | (0.45) | |
| Exports (millions 2015 dinars) | 2.28 | 2.07 | 0.86 |
| | (7.24) | (6.29) | |
| N | 206 | 281 | |

Notes: Source is application data for reference year (2017 for Rounds 1-4, 2018 for Round 5) for Randomization Sample. (See Section 4 for details.) Standard deviations in parentheses. First row reports 0/1 indicator for being a "totally exporting" firm (administratively in a free-trade zone). Sales and exports are winsorized at the 3%/97% level. Agricultural firms were not required to report sales, export status, or exports in their applications, hence sample size is slightly smaller for these three variables (N=473, instead of 487). P-values in Column 3 are from OLS regressions of variable on treatment indicator controlling for round and stratum fixed effects. F test of joint null of no treatment-control differences (conditional on round, stratum fixed effects) for first four variables (N=487) has p-value 0.92; for all variables (N=473), the p-value also happens to be 0.92. Monetary values were deflated to 2015 dinars using the CPI provided by INS. The average exchange rate over our study period was approximately 3 TND/USD and we use that rate throughout the paper. Additional details are in Section 4 and Appendices C and D.

Table 3. **Exports, Two-Part ANCOVA and PPML**

| | Dependent variable: | |
|---|---|---|
| | exporter (0/1) | exports |
| | (1) | (2) |
| **A. ANCOVA (exports in logs)** | | |
| Treated | 0.05 | 0.39** |
| | (0.04) | (0.19) |
| Dep. var., refyear | 0.61*** | 0.63*** |
| | (0.05) | (0.05) |
| R2 | 0.46 | 0.65 |
| N | 377 | 244 |
| Strata dummies | Y | Y |
| Round dummies | Y | Y |
| Mean of dep. var. (level) | 0.66 | 3.92 |
| **B. PPML (exports in levels)** | | |
| Treated × Post | 0.09 | 0.24* |
| | (0.06) | (0.15) |
| Proportional effect: $\exp(\hat{\beta}) - 1$ | 0.10 | 0.27 |
| | (0.07) | (0.19) |
| Pseudo R2 | 0.18 | 0.82 |
| N | 754 | 754 |
| Clusters | 377 | 377 |
| Firm FE | Y | Y |
| Year FE | Y | Y |
| Mean of dep. var. (level) | 0.66 | 2.47 |

Notes: Sample is RNE Export Sample, for which sales and exports information is available in RNE in reference year and 2021. The reference year (refyear) is 2017 for Rounds 1-4 and 2018 for Round 5. Panel A reports estimates of equation (19) in text. Panel B reports Poisson Pseudo Maximum Likelihood (PPML) estimates of equation (20). Column 1 outcome is a 0/1 indicator for whether the firm has positive exports. Column 2 outcome is ln(exports) in Panel A, level of exports in Panel B. Means of dependent variables are for control firms at endline (2021). Column 2 dependent variable means are for the level of exports (including in Panel A). The second row of Panel B transforms the parameter estimate from the first row so that it can be interpreted as a proportional effect. In Panel B, errors are clustered at the firm level. Exports are in millions of 2015 dinars. Exchange rate: 3 TND/USD. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. **Numbers of Destinations and Products**

| | Dependent variable: | | | |
|---|---|---|---|---|
| | exporter (0/1) | exports | # destinations | # products |
| | (1) | (2) | (3) | (4) |
| **A. ANCOVA (exports in logs)** | | | | |
| Treated | 0.04 | 0.42* | -0.21 | -0.53 |
| | (0.05) | (0.23) | (0.34) | (1.16) |
| Dep. var., refyear | 0.54*** | 0.67*** | 0.81*** | 0.78*** |
| | (0.06) | (0.06) | (0.04) | (0.09) |
| R2 | 0.44 | 0.63 | 0.75 | 0.42 |
| N | 210 | 168 | 210 | 210 |
| Strata dummies | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y |
| Mean of dep. var. (level) | 0.74 | 4.42 | 3.54 | 5.96 |
| **B. PPML (exports in levels)** | | | | |
| Treated × Post | 0.05 | 0.29* | 0.00 | -0.09 |
| | (0.07) | (0.17) | (0.10) | (0.21) |
| Proportional effect: $\exp(\hat{\beta}) - 1$ | 0.05 | 0.33 | 0.00 | -0.09 |
| | (0.08) | (0.22) | (0.10) | (0.19) |
| Pseudo R2 | 0.17 | 0.81 | 0.61 | 0.69 |
| N | 420 | 420 | 420 | 420 |
| Clusters | 210 | 210 | 210 | 210 |
| Firm FE | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |
| Mean of dep. var. (level) | 0.74 | 3.64 | 3.54 | 5.96 |

Notes: Sample is Customs Sample, the non-service firms in RNE Export Sample, with zeros imputed for firms that do not appear in the customs records in a given year. The reference year (refyear) is 2017 for Rounds 1-4 and 2018 for Round 5. Panel A reports estimates of equation (19) in text. Panel B reports Poisson Pseudo Maximum Likelihood (PPML) estimates of equation (20). Column 2 outcome is ln(exports) in Panel A and the level of exports in Panel B. # destinations is number of countries to which firm has positive exports. # products is number of distinct 11-digit trade categories in which firm has positive exports. Means of dependent variables are for control firms at endline (2021). Column 2 dependent variable means are for the level of exports (including in Panel A). The second row of Panel B transforms the parameter estimate from the first row so that it can be interpreted as a proportional effect. In Panel B, errors are clustered at the firm level. Exports are in millions of 2015 dinars. Exchange rate: 3 TND/USD. See Section 4 and Appendices for details. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. **Numbers of *New* Destinations and Products**

| | Dependent variable: | | | | | |
|---|---|---|---|---|---|---|
| | any new dest. (0/1) | # new dests. | any new targeted dest. (0/1) | # new targeted dests. | any new product (0/1) | # new products |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **A. OLS** | | | | | | |
| Treated | 0.03 | -0.14 | 0.07 | 0.10 | 0.08 | -0.42 |
| | (0.07) | (0.33) | (0.06) | (0.08) | (0.07) | (1.17) |
| R2 | 0.17 | 0.23 | 0.11 | 0.12 | 0.15 | 0.22 |
| N | 210 | 210 | 210 | 210 | 210 | 210 |
| Strata dummies | Y | Y | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y | Y | Y |
| Mean of dep. var. | 0.57 | 1.67 | 0.17 | 0.19 | 0.60 | 3.97 |
| **B. PPML** | | | | | | |
| Treated × Post | 0.04 | -0.08 | 0.33 | 0.42 | 0.13 | -0.10 |
| | (0.11) | (0.17) | (0.27) | (0.29) | (0.10) | (0.27) |
| Proportional effect: $\exp(\hat{\beta}) - 1$ | 0.04 | -0.07 | 0.39 | 0.52 | 0.14 | -0.10 |
| | (0.11) | (0.16) | (0.38) | (0.44) | (0.12) | (0.25) |
| Pseudo R2 | 0.04 | 0.17 | 0.08 | 0.10 | 0.03 | 0.23 |
| N | 210 | 210 | 210 | 210 | 210 | 210 |
| Strata dummies | Y | Y | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y | Y | Y |
| Mean of dep. var. | 0.57 | 1.67 | 0.17 | 0.19 | 0.60 | 3.97 |

Notes: Sample is Customs Sample, the non-service firms in RNE Export Sample, with zeros imputed for firms that do not appear in the customs records in a given year. Panel A reports OLS regressions of dependent variable on treatment indicator, with strata and round dummies in 2021 data. Panel B reports PPML, also with strata and round dummies in 2021 data. New destinations and products are those with positive exports in 2021 and zero exports in reference year (2017 for Rounds 1-4, 2018 for Round 5). New targeted destinations are new destinations included in list of 2-3 targeted destinations in Tasdir+ applications. A product is defined as an 11-digit trade category. Means of dependent variables are for control firms at endline (2021). Column 2 dependent variable means are for the level of exports (including in Panel A). The second row of Panel B transforms the parameter estimate from the first row so that it can be interpreted as a proportional effect. In Panel B, errors are clustered at the firm level. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. **Domestic & Total Sales**

| | Dependent variable: | | |
|---|---|---|---|
| | sells domestically | dom. sales | tot. sales |
| | (1) | (2) | (3) |
| **A. ANCOVA (dom. and total sales in logs)** | | | |
| Treated | 0.03 | 0.08 | 0.08 |
| | (0.02) | (0.10) | (0.07) |
| Dep. var., refyear | 0.82*** | 0.73*** | 1.00*** |
| | (0.02) | (0.04) | (0.04) |
| R2 | 0.85 | 0.86 | 0.90 |
| N | 377 | 288 | 377 |
| Strata dummies | Y | Y | Y |
| Round dummies | Y | Y | Y |
| Mean of dep. var. (level) | 0.79 | 6.70 | 7.66 |
| **B. PPML (dom. and total sales in levels)** | | | |
| Treated × Post | 0.03 | 0.05 | 0.11* |
| | (0.02) | (0.06) | (0.06) |
| Proportional effect: $\exp(\hat{\beta}) - 1$ | 0.03 | 0.05 | 0.12* |
| | (0.02) | (0.07) | (0.07) |
| Pseudo R2 | 0.19 | 0.88 | 0.85 |
| N | 754 | 754 | 754 |
| Clusters | 377 | 377 | 377 |
| Firm FE | Y | Y | Y |
| Year FE | Y | Y | Y |
| Mean of dep. var. (level) | 0.79 | 5.19 | 7.66 |

Notes: Sample is RNE Export Sample, for which sales and exports information is available in RNE in reference year and 2021. The reference year (refyear) is 2017 for Rounds 1-4 and 2018 for Round 5. Panel A reports estimates of equation (19) in text. Panel B reports Poisson Pseudo Maximum Likelihood (PPML) estimates of equation (20). Column 1 outcome is a 0/1 indicator for whether the firm has positive domestic sales. Column 2-3 outcomes are log domestic and total sales in Panel A, levels of domestic and total sales in Panel B. Means of dependent variables are for control firms at endline (2021). Columns 2-3 dependent variable means are for the level of domestic and total sales (including in Panel A). The second row of Panel B transforms the parameter estimate from the first row so that it can be interpreted as a proportional effect. In Panel B, errors are clustered at the firm level. Domestic and total sales are in millions of 2015 dinars. Exchange rate: 3 TND/USD. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. **Employment**

| | Dependent variable: | | | | |
|---|---|---|---|---|---|
| | exporter (0/1) | ln(exports) | ln(emp.) | ln(avg qtr earnings) | ln(wage bill) |
| | (1) | (2) | (3) | (4) | (5) |
| Treated | 0.04 | 0.40* | -0.01 | 0.01 | 0.00 |
| | (0.04) | (0.20) | (0.06) | (0.03) | (0.07) |
| Dep. var., refyear | 0.61*** | 0.67*** | 0.87*** | 0.76*** | 0.85*** |
| | (0.05) | (0.05) | (0.03) | (0.04) | (0.03) |
| R2 | 0.48 | 0.66 | 0.90 | 0.75 | 0.88 |
| N | 327 | 209 | 327 | 327 | 327 |
| Strata dummies | Y | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y | Y |
| Mean of dep. var. (level) | 0.66 | 4.18 | 64.60 | 11.14 | 712.73 |

Notes: Sample is RNE Employment Sample, the subset of RNE Export Sample for which employment and earnings (from social security agency) are available in RNE in reference year and 2021. The reference year (refyear) is 2017 for Rounds 1-4 and 2018 for Round 5. Table reports ANCOVA estimates of equation (19) in text. Means of dependent variables are for control firms at endline (2021). Columns 2-5 dependent variable means are for levels (not logs). Earnings and wage bill are in thousands of 2015 dinars. Exchange rate: 3 TND/USD. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8. **Survey Outcomes**

| | Dependent variable: | | | | | | |
|---|---|---|---|---|---|---|---|
| | new contract with foreign dist./ agent/partner | new foreign affiliate/ representative | participated in int'l fair | spent on certifications | spent on new tech. | spent on travel | spent on consulting |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Treated | 0.12* | 0.09** | 0.07 | 0.03 | 0.01 | 0.07 | 0.07 |
| | (0.06) | (0.04) | (0.06) | (0.06) | (0.07) | (0.07) | (0.07) |
| R2 | 0.32 | 0.34 | 0.29 | 0.22 | 0.22 | 0.24 | 0.23 |
| N | 204 | 204 | 204 | 204 | 204 | 204 | 204 |
| Strata dummies | Y | Y | Y | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y | Y | Y | Y |
| Mean of dep. var. | 0.24 | 0.06 | 0.23 | 0.19 | 0.54 | 0.57 | 0.30 |

Notes: Sample is Survey Sample, omitting round 5 firms. Table reports OLS estimates of simple regressions of dependent variable on treatment indicator, strata and round dummies. Dependent variable in Column 1 is indicator for whether firm contracted with distributor, local agent or partner in foreign market since randomization. In Column 2, it is indicator for having established a new foreign affiliate or representative. In Column 3, it is indicator for having participated in international fair/expo. In Columns 4-7, they are indicators for having positive spending in indicated category in calendar year 2019. ANCOVA specifications including the dependent variable at baseline are reported in Appendix Table A5. Means of dependent variables are for control firms at endline. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9. **Imports**

| | Dependent variable: | |
|---|---|---|
| | importer (0/1) | imports |
| | (1) | (2) |
| **A. ANCOVA (imports in logs)** | | |
| Treated | 0.09** | -0.02 |
| | (0.04) | (0.18) |
| Dep. var., refyear | 0.50*** | 0.85*** |
| | (0.06) | (0.05) |
| R2 | 0.61 | 0.78 |
| N | 210 | 161 |
| Strata dummies | Y | Y |
| Round dummies | Y | Y |
| Mean of dep. var. (level) | 0.79 | 9.30 |
| **B. PPML (imports in levels)** | | |
| Treated × Post | 0.07 | -0.07 |
| | (0.05) | (0.12) |
| Proportional effect: $\exp(\hat{\beta}) - 1$ | 0.08 | -0.07 |
| | (0.05) | (0.11) |
| Pseudo R2 | 0.11 | 0.86 |
| N | 494 | 494 |
| Clusters | 255 | 255 |
| Firm FE | Y | Y |
| Year FE | Y | Y |
| Mean of dep. var. (level) | 0.81 | 6.38 |

Notes: Sample is Customs Sample, the non-service firms in RNE Export Sample, with zeros imputed for firms that do not appear in the customs records in a given year. The reference year (refyear) is 2017 for Rounds 1-4 and 2018 for Round 5. Panel A reports estimates of equation (19) in text. Panel B reports Poisson Pseudo Maximum Likelihood (PPML) estimates of equation (20). Column 2 outcome is ln(imports) in Panel A and the level of imports in Panel B. Means of dependent variables are for control firms at endline (2021). Column 2 dependent variable means are for the level of imports (including in Panel A). The second row of Panel B transforms the parameter estimate from the first row so that it can be interpreted as a proportional effect. In Panel B, errors are clustered at the firm level. Imports are in millions of 2015 dinars. Exchange rate: 3 TND/USD. See Section 4 and Appendices for details. Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10. **Profits**

| | Dependent variable: | |
|---|---|---|
| | profit (level) | profit/sales |
| | (1) | (2) |
| Treated | 0.19 | 0.03 |
| | (0.12) | (0.03) |
| Dep. var., refyear | 0.43*** | 0.45*** |
| | (0.05) | (0.06) |
| R2 | 0.31 | 0.23 |
| N | 341 | 341 |
| Strata dummies | Y | Y |
| Round dummies | Y | Y |
| Mean of dep. var. | 0.40 | 0.02 |

Notes: Sample is firms in RNE Export Sample for which profits are reported both in the reference year and 2021. Table reports ANCOVA estimates of equation (19) in text. Column 1 dependent variable is level of reported profits, in millions of 2015 dinars. Column 2 dependent variable is ratio of profits to sales in same year. The reference year is 2017 for Rounds 1-4 and 2018 for Round 5. Means of dependent variables are for control firms at endline (2021). Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11. **Heterogeneity by Trade Regime, Size, Quality Certification**

| | exporter (0/1) (1) | ln(exports) (2) | exporter (0/1) (3) | ln(exports) (4) |
|---|---|---|---|---|
| **A. By Trade Regime** | | | | |
| | Non-totally exporting | | Totally exporting | |
| Treated | 0.08* | 0.71** | | 0.00 |
| | (0.05) | (0.28) | | (0.20) |
| Dep. var., refyear | 0.52*** | 0.55*** | | 1.00*** |
| | (0.06) | (0.07) | | (0.09) |
| R2 | 0.43 | 0.61 | | 0.87 |
| N | 277 | 144 | | 100 |
| Mean of dep. var. (level) | 0.54 | 2.72 | | 5.66 |
| **B. By Initial Employment** | | | | |
| | <50 employees | | >50 employees | |
| Treated | 0.05 | 0.48* | 0.04 | 0.34 |
| | (0.05) | (0.26) | (0.06) | (0.27) |
| Dep. var., refyear | 0.63*** | 0.70*** | 0.54*** | 0.53*** |
| | (0.06) | (0.07) | (0.09) | (0.06) |
| R2 | 0.47 | 0.67 | 0.52 | 0.53 |
| N | 240 | 139 | 137 | 105 |
| Mean of dep. var. (level) | 0.58 | 0.96 | 0.80 | 7.59 |
| **C. By Baseline Quality Certification** | | | | |
| | No certification | | Has certification | |
| Treated | 0.07 | -0.12 | -0.02 | 0.60** |
| | (0.05) | (0.29) | (0.06) | (0.24) |
| Dep. var., refyear | 0.62*** | 0.44*** | 0.49*** | 0.82*** |
| | (0.06) | (0.07) | (0.11) | (0.06) |
| R2 | 0.47 | 0.58 | 0.50 | 0.81 |
| N | 241 | 137 | 123 | 98 |
| Mean of dep. var. (level) | 0.57 | 2.71 | 0.83 | 5.97 |

Notes: Table reports regressions similar to Panel A of Table 3 using the RNE Export Sample split along the indicated dimensions. All regressions include strata and round dummies. Means of dependent variables are for control firms at endline (2021). Columns 2 and 4 dependent variable means are for the level of exports. Quality certifications variable is missing for 13 firms in the application data, hence the smaller number of observations in Panel C. Additional details are in Section 4 and Appendices C and D. T tests of null of no coefficient differences for exporter have p-values 0.98 and 0.66 for Panels B and C, respectively; for ln(exports), they have p-values 0.01, 0.61, and 0.03 for Panels A, B, and C, respectively. Exports are in millions of 2015 dinars. Exchange rate: 3 TND/USD. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12. **Heterogeneity by Financial Condition, Business Plan Characteristics**

| | exporter (0/1) (1) | ln(exports) (2) | exporter (0/1) (3) | ln(exports) (4) |
|---|---|---|---|---|
| **A. By Financial Condition** | | | | |
| | Low assets/liabilities | | High assets/liabilities | |
| Treated | 0.05 | 0.66** | 0.07 | 0.33 |
| | (0.06) | (0.26) | (0.06) | (0.31) |
| Dep. var., refyear | 0.52*** | 0.69*** | 0.65*** | 0.61*** |
| | (0.07) | (0.08) | (0.07) | (0.07) |
| R2 | 0.44 | 0.72 | 0.54 | 0.68 |
| N | 201 | 125 | 176 | 119 |
| Mean of dep. var. (level) | 0.66 | 3.46 | 0.65 | 4.42 |
| **B. By Type of Business Plan** | | | | |
| | Affiliate abroad | | Support for exporting | |
| Treated | 0.02 | 0.18 | 0.05 | 0.46** |
| | (0.07) | (0.49) | (0.04) | (0.20) |
| Dep. var., refyear | 0.72*** | 0.44*** | 0.56*** | 0.75*** |
| | (0.08) | (0.10) | (0.06) | (0.06) |
| R2 | 0.68 | 0.70 | 0.42 | 0.68 |
| N | 82 | 55 | 295 | 189 |
| Mean of dep. var. (level) | 0.67 | 4.44 | 0.66 | 3.76 |
| **C. By Plan to Spend on Product Tailoring/Innovation** | | | | |
| | No tailoring/innovation plan | | Has tailoring/innovation plan | |
| Treated | 0.07 | 0.22 | 0.02 | 0.54 |
| | (0.05) | (0.22) | (0.07) | (0.40) |
| Dep. var., refyear | 0.60*** | 0.62*** | 0.64*** | 0.68*** |
| | (0.06) | (0.06) | (0.08) | (0.10) |
| R2 | 0.48 | 0.73 | 0.55 | 0.56 |
| N | 259 | 163 | 118 | 81 |
| Mean of dep. var. (level) | 0.62 | 4.21 | 0.76 | 3.30 |

Notes: Table reports regressions similar to Panel A of Table 3 using the RNE Export Sample split along the indicated dimensions. All regressions include strata and round dummies. Means of dependent variables are for control firms at endline (2021). Columns 2 and 4 dependent variable means are for the level of exports. Additional details are in Section 4 and Appendices C and D. T tests of null of no coefficient differences for exporter have p-values 0.52, 0.95, and 0.73 for Panels A, B and C, respectively; for ln(exports), they have p-values 0.35, 0.46, and 0.35for Panels A, B, and C, respectively. Exports are in millions of 2015 dinars. Exchange rate: 3 TND/USD. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

# What Do Market-Access Subsidies Do? Experimental Evidence from Tunisia*

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July 2025

ONLINE APPENDIX

## A Theory

### A.1 Optimal Market Penetration as a Function of Product Scope

We derive the optimal market penetration as a function of $G$ using an envelope theorem for arbitrary choice sets from Milgrom and Segal (2002). Using the approximations in (10), profit can be written:

$$\pi(G,n) = \Theta n\left(\frac{G^{1-\alpha(\sigma-1)}}{1-\alpha(\sigma-1)}\right) - a\ln\left(\frac{1}{1-n}\right)\frac{G^{1+\delta}}{1+\delta} \tag{A1}$$

Define $V(n)$ as the value function corresponding to the upper envelope of the profit functions: $V(n) = \sup_{G\in\mathbb{N}}\pi(G,n)$. Let $G^*(n) = \{G \in \mathbb{N} : \pi(G,n) = V(n)\}$, i.e., the optimal $G$ for a given $n$. Theorem 2 of Milgrom and Segal (2002) implies $\frac{dV(n)}{dn} = \frac{\partial\pi(G,n)}{\partial n}$ for $G \in G^*(n)$. We thus have the first-order condition:

$$\frac{\partial\pi}{\partial n} = \Theta\left(\frac{G^{1-\alpha(\sigma-1)}}{1-\alpha(\sigma-1)}\right) - a\left(\frac{1}{1-n}\right)\frac{G^{1+\delta}}{1+\delta} = 0$$

Solving for the optimal $n$ for a given $G$:

$$n^*(G) = 1 - \frac{a\Lambda}{\Theta}G^{\delta+\alpha(\sigma-1)}$$

which is (12).

## A.2 Optimal Product Scope and Market Penetration in the Relaxed Problem

In this section, we solve for optimal product scope and market penetration in the relaxed problem. Here we can apply a standard envelope theorem to derive the partial derivative of total profits with respect to $\widetilde{G}$ for a given (optimized) value of $n$. The first-order condition is:

$$\frac{\partial \widetilde{\pi}(\widetilde{G}, n)}{\partial \widetilde{G}} = \Theta n \widetilde{G}^{-\alpha(\sigma-1)} - a \ln\left(\frac{1}{1-n}\right) \widetilde{G}^{\delta} = 0 \tag{A2}$$

Together, (12) and (A2) imply (13). To see this, note that (A2) can be rewritten:

$$\widetilde{G}^{\delta+\alpha(\sigma-1)} = \frac{\Theta n}{a \ln\left(\frac{1}{1-n}\right)} \tag{A3}$$

Using (12) and re-arranging:

$$-\frac{\Lambda}{1-n} e^{-\frac{\Lambda}{1-n}} = -\Lambda e^{-\Lambda} \tag{A4}$$

Given that $0 < \Lambda < 1$, there are two solutions to (A4) corresponding to the two branches of the Lambert W function (Corless et al., 1996). One is simply $n = 0$; this is inconsistent with entry. The solution consistent with entry is:

$$-\frac{\Lambda}{1-n} = W_{-1}\left(-\Lambda e^{-\Lambda}\right) \tag{A5}$$

This solution holds for $-\frac{1}{e} \leq -\Lambda e^{-\Lambda} < 0$, which is implied by $0 < \Lambda \leq 1$. Re-arranging (A5) gives:

$$\widetilde{n}^* = 1 - \frac{\Lambda}{\left|W_{-1}\left(-\Lambda e^{-\Lambda}\right)\right|} \tag{A6}$$

The solution for $\widetilde{G}$, (13), then follows from (12).

## A.3 Optimal Product Scope and Market Penetration in the Integer-Constrained Problem

In this section, we return to the integer-constrained problem and derive explicit solutions for product scope and market penetration as functions of market-access costs, $a$, for a given level of productivity, $\phi$. To begin, let $a_1$, $a_2$, ... be the values of $a$ at which $\widetilde{G}^*$ happens to take on integer values, i.e. $\widetilde{G}^*(a_k) = k$ for $k \in \mathbb{N}$. Using (13), we can solve explicitly for these values:

$$a_k = \frac{\Theta}{k^{\delta+\alpha(\sigma-1)} \left|W_{-1}\left(-\Lambda e^{-\Lambda}\right)\right|} \tag{A7}$$

Consider two such values, $a_{k+1}$ and $a_k$, where $a_{k+1} < a_k$. By the definition of $a_k$, $k+1$ is the optimal scope at $a_{k+1}$, and $k$ is optimal at $a_k$, hence:

$$\widetilde{\pi}(k, n^*(k))|_{a=a_k} > \widetilde{\pi}(k+1, n^*(k+1))|_{a=a_k} \tag{A8}$$

$$\widetilde{\pi}(k, n^*(k))|_{a=a_{k+1}} < \widetilde{\pi}(k+1, n^*(k+1))|_{a=a_{k+1}} \tag{A9}$$

Between $a_{k+1}$ and $a_k$ there is a single critical value, call it $\widehat{a}_k$, below which $k+1$ is the optimal integer product scope and above which $k$ is optimal. This is the value of $a$ for which:

$$\widetilde{\pi}(k, n^*(k)) = \widetilde{\pi}(k+1, n^*(k+1)) \tag{A10}$$

We can solve for this value explicitly. With a fair amount of algebra, (A10) can be rewritten:

$$\widehat{a}_k \ln \widehat{a}_k + \left[\ln\left(\frac{\Lambda}{\Theta}\right) + J\right]\widehat{a}_k + \frac{\Theta H}{\Lambda} = 0 \tag{A11}$$

where

$$H \coloneqq \frac{\left((k+1)^{1-\alpha(\sigma-1)} - k^{1-\alpha(\sigma-1)}\right)}{\left((k+1)^{1+\delta} - k^{1+\delta}\right)}$$

$$J \coloneqq (\delta + \alpha(\sigma-1)) \frac{\left((k+1)^{1+\delta}\ln(k+1) - k^{1+\delta}\ln k\right)}{(k+1)^{1+\delta} - k^{1+\delta}} - 1$$

Re-arranging,

$$-\frac{\Theta H}{\Lambda \widehat{a}_k} e^{-\frac{\Theta H}{\Lambda \widehat{a}_k}} = -He^J$$

Again using the Lambert W function (Corless et al., 1996):

$$-\frac{\Theta H}{\Lambda \widehat{a}_k} = W_i\left(-He^J\right)$$

Re-arranging again, we have:

$$\widehat{a}_k = \frac{\Theta H}{\Lambda |W_i(-He^J)|}$$

It can be shown that $-\frac{1}{e} < -He^J < 0$. In this range, the Lambert W function can take on two values, $W_0(\cdot)$ and $W_{-1}(\cdot)$, but only $W_{-1}(\cdot)$ yields a solution for $\widehat{a}_k$ between $a_{k+1}$ and $a_k$. Hence we have (14).

The optimal product scope is $k+1$ in the range $[a_{k+1}, \widehat{a}_k)$ and $k$ in the range $[\widehat{a}_k, a_k)$. Thus the range of market-access costs can be partitioned into a set of intervals $[\widehat{a}_{k+1}, \widehat{a}_k)$ within which $k+1$ is the optimal integer product scope. Within each of these intervals, optimal market penetration is given by (12) and is declining in $a$.

To solve for the cutoff for entry into the destination, $\widehat{a}_0$, we note that $H = 1$ for $k = 0$ and that $\lim_{k\to 0} J = -1$. Since $W_{-1}(-\frac{1}{e}) = -1$, we have that $\widehat{a}_0 = \frac{\Theta}{\Lambda}$.

Note from (12) that $n^* = 0$ at $\widehat{a}_0$. For a given $G$, $n^*$ is declining in $a$. Hence for $\widehat{a}_1 \leq a < \widehat{a}_0$, where $G = 1$, $n^* > 0$. For all other cutoffs $\widehat{a}_k$, we have $n^* > 0$ for $a \to \widehat{a}_k^-$ (i.e. as $a$ approaches $\widehat{a}_k$ from the left). To see this, note that combining (12) and (14) we have:

$$\begin{aligned} n^*(G)|_{a\to\widehat{a}_k^-} &= 1 - \frac{\Lambda}{\Theta}\frac{\Theta H}{\Lambda|W_{-1}(-He^J)|}k^{\delta+\alpha(\sigma-1)} \\ &= 1 - \frac{H}{|W_{-1}(-He^J)|}\frac{k^{1+\delta}}{k^{1-\alpha(\sigma-1)}} \\ &= 1 - \frac{1}{|W_{-1}(-He^J)|}\frac{\left(\frac{k+1}{k}\right)^{1+\delta}-1}{\left(\frac{k+1}{k}\right)^{1-\alpha(\sigma-1)}-1} > 0 \text{ for } k \in \{1,2,3,...\} \end{aligned} \tag{A12}$$

where the inequality follows from (9) and (11) and the fact that $|W_{-1}(-He^J)| > 1$. Hence we have $n^* > 0$ for $a \in [0, \widehat{a}_0)$. That is, unlike in Arkolakis et al. (2021), the constraint that market penetration be non-negative does not bind for any value of market-access costs for which the firm has positive product scope.

### A.4 Impact on Exports

Using (6), (7), and (12), we can write total firm exports to a destination as follows:

$$\begin{aligned} E &= \sum_{g=1}^{G} px_g = \sum_{g=1}^{G} p_g^{1-\sigma} nTP^{\sigma-1} \\ &= \sum_{g=1}^{G}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left(\frac{\tau g^\alpha}{\phi}\right)^{1-\sigma}\left[1 - \frac{a\Lambda}{\Theta}G^{\delta+\alpha(\sigma-1)}\right]TP^{\sigma-1} \\ &= \sigma\Theta\left[1 - \frac{a\Lambda}{\Theta}G^{\delta+\alpha(\sigma-1)}\right]\sum_{g=1}^{G} g^{-\alpha(\sigma-1)} \end{aligned}$$

Using the approximation in (10),

$$E = \left[\Theta - a\Lambda G^{\delta+\alpha(\sigma-1)}\right]\frac{\sigma G^{1-\alpha(\sigma-1)}}{1-\alpha(\sigma-1)} \tag{A13}$$

which is (15). The fact that $n^* > 0$ for all $a \in [0, \widehat{a}_0)$ (see Appendix A.3) implies that the term in brackets is positive. Equations (16) and (18) follow immediately.

## B Details: Tasdir+ Program and Randomization

### B.1 Program Overview

The Tasdir+ program, known officially as the Fund for Competitiveness and Export Development Support [*Fonds d'Appui à la Compétitivité et au Développement des*

*Exportations*], was created in 2014 with a budget of USD 23.5 million. The program was housed in the *Centre de Promotion des Exports (CEPEX)* [Export Promotion Center]. The Tasdir+ program included 4 waves of matching grants (*Lots*, in French). In *Lot 1* (launched in 2015), 106 firms were selected; in *Lot 2* (launched in 2017), 194 firms were selected. The selection was not randomized in these waves. In collaboration with the World Bank, we helped Tasdir+ implement a randomized selection process in *Lots 3* and *4*. Each wave had application "rounds"; there were four rounds in *Lot 3* and one in *Lot 4*. The randomization sample (across the five randomized rounds) included 487 firms.[1]

In each wave, the program conducted a communication campaign to invite firms from around the country to apply. In *Lots 3* and *4*, our team supported these efforts, including by hiring a consultant to help Tasdir+ identify firms likely to be eligible for the program and contacting these firms to share information about the program and to assist them with completing the Tasdir+ application.

As part of the Tasdir+ application, firms were required to submit a business plan (with the possibility of modifying the plan later). The maximum budget for the business plan was TND 300,000 (USD 100,000).[2] Firms chose between two types of plan: one for standard export activities, referred to as an "Export Development Plan" (*appui a l'export*), and one for setting up a foreign office, referred to as a "Foreign Affiliate Plan" (*implantation a l'étranger*).

Tasdir+ used the three calendar years preceding the program year as a time frame for various eligibility criteria. These were 2015-2017 for Rounds 1-4 and 2016-2018 for Round 5. We refer to these years as the "reference period." As noted in the main text, when referring to pre-program information from a single year, we follow Tasdir+ practice in using 2017 as the reference year for Rounds 1-4 and 2018 for Round 5.[3]

The business plan had to list up to three target countries, of which ≥ 50% had to be new destinations. Tasdir+ defined a new destination as a country to which the firm did not export in the last year of the reference period.

The eligible actions for business plans were organized by Tasdir+ into six categories (*rubrics* in French). The categories and actions are listed in Table 1 in the main text. In their applications, firms indicated their estimated budget, timeline, and desired objective for each chosen action.

[1] Parallel to the randomized selection process, Tasdir+ continued to use the traditional non-randomized method for a separate set of firms. In total, 122 firms in *Lot 3* and 21 firms in *Lot 4* were offered the program based on the traditional, non-randomized selection method; these firms are not part of our study.

[2] The average exchange rate of Tunisian dinars to US dollars over our study period was approximately 3 TND/USD.

[3] When determining eligibility, Tasdir+ staff used as the reference year the most recent calendar year for which finalized accounting data were available. Finalized accounting data are often not available until late spring of the following year. Hence even as late as Round 4 in May 2019, 2017 was still used as the reference year.

Tasdir+ staff reviewed the applications to determine eligibility. To be eligible, a firm had to fulfill a number of criteria: (1) be privately owned; (2) be legally based in Tunisia; (3) not be a retailer or wholesaler, with the exception of importing and exporting firms, known locally as "trading firms"; (4) not be an artisanal firm; (5a) (for non-agriculture/fishing firms) have a "liquidity ratio," defined as assets over liabilities averaged for the reference period, greater than or equal to 1 in Rounds 1-4, and greater than or equal to 0.9 in Round 5;[4] (5b) (for agriculture/fishing firms) have five or more permanent employees or at least one export operation during the reference period;[5] (6) be established prior to Jan. 1, 2015 for Rounds 1-4 or Jan. 1, 2017 for Round 5.

When applying, firms self-classified into six sectors defined by the Tasdir+ program: (1) agriculture/fishing, (2) trading, (3) food processing, (4) non-food manufacturing, (5) information and communication technology (ICT), and (6) services.

Our team conducted a survey of the eligible firms in collaboration with a local survey firm. Firms were invited to complete the survey online, through the Tasdir+ program's web portal. The survey firm followed up in person with firms that did not complete the survey online. The baseline surveys took place in August 2018 (Round 1), November 2018 (Round 2), February 2019 (Round 3), May 2019 (Round 4), and November 2019 (Round 5). The follow-up surveys took place in July-December 2020 (Rounds 1-3) and March-December 2021 (Rounds 4-5).

In each round, randomization took place in a public meeting. We describe the randomization in detail in Appendix B.3 below.

Following randomization, firms assigned to treatment were able to revise their business plan in consultation with Tasdir+ staff (the business plan type, used in stratification, could not be changed). Tasdir+ staff reviewed the plan to ensure that, for instance, the number of new destinations was $\geq$ 50% and that firms' text descriptions of actions corresponded to the declared action types and desired objectives.

Treatment firms were then approved by the Tasdir+ steering committee (*Comité de Pilotage*).[6] The treatment period of 12 months, referred to as the "business plan period", started on the date of approval by the steering committee. Each firm signed a contract with CEPEX to enroll officially.

In order to remain in the program, firms were technically required to meet two conditions. First, the firm had to implement at least one action within the first three months of its business plan period. Second, it had to spend 30% of its approved budget

[4] The Tasdir+ program relaxed the liquidity threshold in round 5 in order to increase the number of eligible firms. This change was implemented prior to Round-5 randomization.

[5] For agriculture/fishing firms, the liquidity criterion was replaced by the employment/export criterion because many agricultural firms did not have formal accounting of assets and liabilities.

[6] In principle, the steering committee could have exercised discretion at this stage, but in practice it approved all firms assigned to treatment.

within the first six months of its business plan period. The Tasdir+ rationale for these conditions was to encourage inactive firms to exit the program to free up unused funds for future applicants. In practice, the program was stricter in enforcing these conditions as the end of the program neared. In Rounds 1-4, 24% of firms were removed for failing to meet these conditions; in Round 5, which largely coincided with the covid-19 pandemic, 68% of firms were removed.

After incurring expenditures, firms submitted reimbursement requests. The required supporting documents depended on the type of action. Receipts were required for travel expenses, and contracts and proofs of payment were required for consulting expenditures. Tasdir+ staff checked whether the expenditures corresponded to actions in the approved business plans and whether the supporting documents were satisfactory. If so, CEPEX then issued a transfer order, signed by the CEPEX president, to the Central Bank of Tunisia (the *Banque Central de Tunisie (BCT)*). The BCT then disbursed the funds to the firm. The reimbursement rate was 50% for eligible expenses.

### B.2 The Rebate Arm

Our experimental design originally included two treatment arms, a "Matching Grant Only" arm and a "Matching Grant + Rebate" treatment with a pay-for-performance element, in which firms that were successful in increasing exports would be eligible to be reimbursed for a greater share of eligible expenses. In practice, however, the implementation of the rebate was not successful.

Although subsidies conditioned on exports are normally inconsistent with World Trade Organization (WTO) rules, the WTO allowed for an exception in the case of some developing countries' exports of food products. Initially, in Round 1, this exception was interpreted to apply to two of the six sectors listed above: agriculture/fishing and food processing. Starting in Round 2, the interpretation was broadened to include trading companies (since essentially all trading firms exported food products). We refer to firms deemed eligible for the rebates as the "rebate-eligible sample."

The rebate was intended to be given as a supplement to the 50% subsidy in the main matching-grant program. The amount was designed to be the minimum of (a) 20% of the cumulative value of exports to new markets and (b) 40% of the firm's eligible expenses. Firms in the Matching Grant + Rebate arm could thus in principle have received reimbursement of up to 90% of their eligible expenses.

In practice, however, the design for the rebates was not implemented. Midway through our study, a government audit of the Tasdir+ program resulted in new, more stringent constraints on disbursements. These constraints included a prohibition on reimbursing more than 50% of firms' expenditures. Although 41 firms were assigned to the Matching

Grant + Rebate arm and 5 of these firms submitted rebate requests, no rebates were paid out. Firms in the Matching Grant + Rebate arm were effectively treated by Tasdir+ as if they were in the Matching Grant Only arm. In our main analysis, we treat the Matching Grant + Rebate and the Matching Grant Only as a single treatment.

### B.3 Randomization

Randomization was carried out in public meetings in each round. Here we explain the randomization procedure in detail.

Because of the planned rebate arm explained above in Appendix B.2, the probability of selection in the randomization procedure differed by sector. In Rounds 1-4, in non-rebate-eligible sectors, the probability of selection (for the Matching Grant Only treatment) was 1/2. In Round 5, Tasdir+ leadership decided to increase the selection probability to 2/3. In rebate-eligible sectors, the probability of selection for Matching Grant Only treatment was 1/3 and for the Matching Grant + Rebate treatment was 1/3.[7] (When we treat the Matching Grant Only and Matching Grant + Rebate as a single treatment, the effective selection probability is thus 2/3 for these sectors.)

Non-rebate-eligible firms were stratified based on size, business plan type, and sector. For size, firms were classified as small, medium, or large based on their average sales in the reference period. The sales bounds (in TND) by size for each sector were: a) for non-food manufacturing, small = sales < 1.6 million; medium = sales between 1.6 million and 5 million; large: = sales > 5 million; b) for services and trading, small = sales < 0.3 million; medium = sales between 0.3 million and 2 million, large = sales > 2 million; for ICT, small = sales < 0.45 million; medium = sales between 0.45 million and 2 million; large = sales > 2 million.

For rebate-eligible firms, the stratification differed by round. In Round 1, there were only four rebate-eligible firms and no stratification was implemented in this round. In Rounds 2-5, rebate-eligible firms were stratified by sector and business plan type. No agreement was reached about the appropriate stratification by size for the rebate-eligible firms; as a result, the rebate-eligible sample (including trading firms in Rounds 2-5) was not stratified by size. Because of these changes, the number of strata varies across rounds. We obtained 18 strata for Round 1, 22 strata for Round 2, 20 strata for Round 3, 21 strata for Round 4, and 22 strata for Round 5.

The randomization sessions were held in public meetings at the CEPEX offices (Rounds 1-2) and the office of a national small business association (*Union Tunisienne de l'Industrie, du Commerce et de l'Artisanat* (UTICA) [Tunisian Union of Industry, Trade and Handicrafts], Rounds 3-5). Firms, Tasdir+ staff, CEPEX/UTICA leaders, and

[7] The definition of rebate-eligible sectors changed in Round 2 as described above.

reporters from local news outlets attended the sessions. The randomization was conducted in excel, following a methodology recommended by Gertler et al. (2016). Within each stratum, a random number between 0 and 1 was generated for each firm, and random numbers were sorted in decreasing order. Firms were selected highest numbers first, according to the probabilities explained above. Following each session, results were published on the CEPEX website. Although the randomization had the potential to be politically contentious, especially given the large amounts of money involved, the procedure was generally well-received in the local media (L'Économiste Maghrébien, 2018; Kapitalis, 2018). This may in part have been because the transparency of the procedure contrasted with the practices for allocating government support under the regime of former President Ben Ali (Rijkers et al., 2017).

### B.4 Foreign Affiliate Plan Implementation Issues

In practice, the implementation of "Foreign Affiliate Plans" was impeded by a number of administrative and regulatory issues. To set up a foreign affiliate, firms needed to transfer money to their target destination. Capital outflows were subject to strict regulations in Tunisia and required authorizations from the Central Bank. These authorizations could take up to six months to clear. As a result, foreign-affiliate-plan firms had a difficult time initiating their business plans. Even if firms were able to transfer funds to their target destinations, they could still face issues in implementing their actions. For example, many transactions in sub-Saharan countries were conducted in cash. Tasdir+ staff considered cash transactions to be ineligible and rejected reimbursement requests for them. As a result, many foreign-affiliate-plan firms were not able to meet the two performance conditions summarized in Appendix B.1 above.

### B.5 Other Issues

The covid-19 pandemic and ensuing lockdown were a blow to the Tasdir+ program on several dimensions. There was uncertainty regarding when each covid-19 wave would occur (and end), when vaccines would arrive, and when a return to normal was expected, affecting firms' ability to stick to their original business plans. Crucially, there were unexpected difficulties in implementing most eligible actions. As the pandemic worsened and the government put in place harsh restrictions on movement and gatherings, many Tasdir+-eligible actions were no longer feasible. Plans for travel, prospecting missions, and fairs were canceled as commercial flights were completely halted. Certification, marketing events, invitation of buyers and contractors, etc., were also cancelled or postponed. All rounds were exposed to the pandemic shock during their treatment period, but earlier rounds less so than later rounds. Unsurprisingly, the average matching grant realization rates (spending as a share of the approved business

plan amount) decrease markedly by round. For instance, Round 5 firms have on average a realization rate of 5.7%, compared to 32.8% for Round 1 firms (Table 4).

# C Details on Data Sources and Samples

## C.1 *Repertoire National des Entreprises (RNE)*

The *Repertoire National des Entreprises (RNE)* [National Repertory of Firms] is a database of all formally registered private-sector firms in Tunisia, managed by the national statistical agency (*Institut National des Statistiques (INS)* [National Institute of Statistics]). It combines firm-level total quarterly employment and wages from the Tunisian social-security agency (*Caisse Nationale de Sécurité Sociale (CNSS)* [National Social Security Fund]), annual local sales, export sales, and total sales (pre- and post-tax) from the Tunisian tax agency (*Direction Générale des Impôts (DGI)* [General Tax Authority]), and annual export and import flows from Tunisian customs (*Direction Générale des Douanes* (DGD) [General Customs Authority]). The years available to us are 1996 to 2021. The RNE uses the first 7 digits of the firm's unique tax identifier to identify firms. We used this RNE unique identifier to match all 487 firms in our randomization sample to this dataset, for the years beginning in the firm's opening year and ending in 2021. In line with RNE guidelines, all analysis using this data was carried out in person at the RNE office in Tunis by one of the authors.

## C.2 Customs Transactions

At the time of applying to Tasdir+, firms provided written authorization for CEPEX to access their customs records. For the purposes of our study, the Ministry of Finance (which oversees the Tunisian customs agency) and CEPEX signed a data-sharing agreement. This allowed us to access, for the 487 randomization-sample firms, all export and import transactions for Jan. 1, 2017-Dec. 31, 2022. Information is available at the firm-shipment-product (11-digit *Nomenclature de Dédouanement des Produits (NDP)* [Customs Clearance Product Nomenclature]) level.[8] The data include the declaration type (a 2-letter code that denotes whether the declaration is that of an export, import, re-import, etc.), the "customs regime" (a 3-digit code that denotes the sub-type of declaration, e.g. simple import, import following product transformation, simple export, etc.), origin/destination country, shipment value, net invoice price, shipment gross weight in kilograms, and declaration date. Using the firm's unique tax identifier, customs staff matched 421 firms out of the 487 randomization-sample firms in their database of firms that have ever had a trade operation. The remaining 66 firms

[8] The first six digits of this classification correspond to the Harmonized System (HS).

had never engaged in trade through customs. Of these 421 firms, 322 firms had an import or export operation during Jan. 1, 2017-Dec. 31, 2022.

In Tunisia, exporters and importers may fill out a temporary declaration for an expedited clearance by customs when the traded good is perishable or flammable. Firms are expected to fill out a complete (final) declaration at a later date. The dataset contains both temporary and final declarations. The customs agency kept track of firms that used the expedited process but did not submit the final declaration. We received from the customs agency a list of the firms in our randomization sample that fell in this group. We explain in Appendix D.3 how we used this list to deal with temporary declarations.

### C.3 Tasdir+ Administrative Data

Each firm's application to the Tasdir+ program included information the firm's unique tax identifier, self-identified sector, export regime (totally-exporting or non-totally exporting), list of quality certifications, and contact information.[9] The application also included employment and data from financial statements (sales, exports, assets, and liabilities) for the reference period. Financial information in the application was verified against firms' financial statements both by the Tasdir+ team and by us. The application also listed the firm's type of business plan, the approved budget, target destinations, actions, and estimated costs and quarter of implementation for each action. The application data was the source for information on size, sector and business plan used in stratification (see Appendix B.3).

### C.4 Baseline and Follow-up Survey

We conducted baseline and follow-up surveys for the randomization sample. The survey collected standard firm characteristics and also elicited information about innovative activities, including spending on marketing, consulting, certifications, and software purchases. At baseline, applicant firms were required to answer the survey before the randomization; all 487 firms in the randomization sample responded. As mentioned in the main text, response rates to the endline survey were much lower than for the baseline, in part due to the fact that CEPEX had little leverage to oblige firms to respond.[10] The follow-up survey for Rounds 1-2 included all questions from the baseline survey. as well as new questions about (1) new quality certifications, (2) participation in Tasdir+ (for treatment firms), and (3) the impact of the covid-19

[9] An export regime indicator is also available in the RNE data. We explain in Appendix D.2 how we harmonize the two variables.

[10] Lower-than-usual responses during the pandemic were documented even in established surveys like the Current Population Survey in the US (Rothbaum and Bee, 2021).

pandemic (changes in exports, sales, and employment; adaptation efforts such as remote work and supply chain diversification; and access to government support programs), and (4) feedback about Tasdir+. After experiencing low response rates in Rounds 1 and 2 (in July 2020-December 2020), we shortened the survey for firms in Rounds 3-5 (March 2021-August 2021). Of the 487 firms in the randomization sample, 332 (68%) answered the follow-up survey at least partially.

# D Cleaning Procedures

In this section, we describe our cleaning procedures. In cases where variables are available from more than one source (e.g. exports, sales, employment, firm export regime), we took the RNE information as the most authoritative source, in the absence of compelling alternative information. The main reason is that the RNE reports exports for service firms, which do not appear in the customs data — a major advantage for our purposes.

## D.1 Cleaning Procedure for Application Data

We checked reported sales, assets and liabilities against firms' financial statements, which were submitted with their Tasdir+ applications. If reported exports were greater than reported sales, we assumed that sales were correct and set exports equal to sales. We winsorized sales at the tails, replacing values in the lower or upper 3% tails with values at the $3^{rd}$ or $97^{th}$ percentiles, respectively, for the reference year (2017 for rounds 1-4, 2018 for round 5). To keep the values of exports and export shares consistent with the winsorized values of sales, we calculated "winsorized" exports from winsorized sales and directly observed values of export shares.

## D.2 Cleaning Procedure for RNE Data

We first cleaned the RNE sales and exports data. Where possible, we used information from the application data (for the reference period years, 2015-18) or the customs data (for the available years, 2017-2022) to improve the measures. We used the following rules:

1. If total sales were reported as zero in the RNE, we set them to missing.
2. If both exports and local sales in the RNE were zero, we set both to missing.
3. If (i) a firm was listed as a "totally exporting" firm, (ii) had zero exports, and (iii) had positive local sales, we assumed that local sales and exports had been reversed.
4. If a firm had never exported then immediately shifted to an export share of one, we assumed that local sales and exports had been reversed.

5. If RNE sales were missing and sales in the application data were not, we used the application data to impute sales.

6. If RNE exports were missing and application exports were positive and less than or equal to RNE sales, we used application exports to impute exports.

7. If RNE exports were zero and application data exports were positive and less than or equal to RNE sales, we used application exports to impute exports.

8. If RNE exports (from corporate tax records) were missing, we used customs transactions data to impute exports.[11]

9. If exports were still missing or were zero, and the exports variable from customs available in the RNE was positive and less than total sales, we used the this variable to impute exports.

We used the newly imputed information to calculate consistent values for local and total sales. If local sales were non-missing, we added newly imputed exports to local sales to arrive at total pre-tax sales, conditional on this new value being lower than total post-tax sales in the RNE. If local sales were missing but total sales were non-missing, we subtracted newly imputed exports from total pre-tax sales to calculate local sales.

We then cleaned the RNE employment/wages information. If total employment or total wages were reported as zero, we set them to missing. Although in principle the RNE employment variable should include both permanent and temporary employees, we determined that it is closer to permanent employment reported in the application data. Hence we used permanent employment in the application data (available for the last year in the reference period) to impute missing employment in the RNE in the corresponding year.

We then imputed new values for missing values using the sequential regression multivariate imputation technique implemented by Abowd and Woodcock (2001). We grouped our key production-relevant variables of total sales, employment, and average quarterly wages. We deflated monetary variables using the Consumer Price Index (CPI) from the INS, using the CPI from July of each year. Following Verhoogen (2008), for our key production-relevant variables, we set to missing the values that changed by more than a factor of five from one year to the next. We then proceeded as follows:

1. We regressed sales on employment, a lead and lag of sales, and a lead and lag of employment and used the predicted values to replace missing values of sales.

2. We regressed employment on sales, a lead and lag of employment, and a lead and lag of sales and used the predicted values to replace missing values of employment.

[11] In doing so, we prioritized the exports we calculated from the customs transactions data, rather than the customs variables that appeared in the RNE, which appeared to be incomplete.

3. We regressed wages on employment and sales, a lead and lag of wages, and a lead and lag of employment and sales and used the predicted values to replace missing values of wages.

4. We imputed exports and local sales using the export share variable and newly imputed sales.

We winsorized sales at the tails, replacing values in the lower or upper 3% tails with values at the $3^{rd}$ or $97^{th}$ percentiles, respectively. To keep the values of exports and export shares consistent with the winsorized values of sales, we calculated "winsorized" exports from winsorized sales and directly observed values of export shares.

Finally, we defined consistent exports and local sales based on winsorized sales and the reported export share, and defined a consistent wage bill variable based on winsorized employment and average quarterly wages.

### D.3 Cleaning Procedure for Customs Transactions

For the customs transactions data, we first classified records into import and export transactions using the 3-digit customs regime variable. In Tunisia, firms can engage in indirect export by selling to totally exporting firms. As a result, some of our observations list "totally exporting firm" as destinations. In a few cases, a unique destination country is not specified, with the country denoted as "various." These observations represent 8% of all transactions and 6% of total export value. We keep these observations for our main analysis.

The customs data contain both temporary (expedited declarations associated with perishable or flammable products) and final declarations. When a final declaration was available, we dropped the corresponding temporary declaration. We received from the customs agency a list of the firms in each year that used the expedited process but did not submit the final declaration. Using the firm's unique tax identifier, we matched these firms in our dataset. In each year, we dropped all temporary declarations that were not reported by these firms.

We deflated imports, exports, and prices using the July CPI from the INS. We summed values at the firm-year level and used the raw totals to impute missing exports in the RNE for non-service firms as explained in Appendix D.2.

There were many discrepancies between total exports per firm-year reported in the customs transactions data and firm self-reports of exports from the tax agency (DGI) in the RNE. This could happen for several reasons. For example, an export operation could be realized in one calendar year but reported by the firm to the tax authority in the following fiscal year. Or some firms may count indirect exports towards their exports

sales while some may not. When reconciling differences between the customs and RNE data, we gave priority to the RNE data. We re-scaled the exports variable in customs transactions to equate total exports in the customs data to the RNE total exports, while maintaining the same composition of exports across destinations and products within firms.

For service and ICT firms, which generally do not appear in the customs data (unless they also happen to export or import physical goods), we left customs outcomes as missing. For non-service firms that did not appear in the customs data, we used RNE exports to impute missing customs exports; if customs exports were still missing, we set them equal to zero and set other customs outcomes (number of destinations, number of products, number of shipments, imports) to zero.

# E More on Treatment Effect Heterogeneity

In Section 6.3, we provide a simple discussion of heterogeneity by characteristics that are suggested by our theoretical model or seem particularly salient. The discussion relies on our discretion in choosing the dimensions of heterogeneity to focus on. In addition, in finite samples it becomes unfeasible to do even an exploratory analysis across several underlying characteristics at once. In this appendix, we complement the simple approach of Section 6.3 with data-driven methods to elicit the extent of heterogeneous policy responses in a more disciplined — albeit demanding for our limited sample — fashion. These Machine Learning (ML) methods have the advantage that they leave to the data the choice of which dimensions of heterogeneity to focus on. (For overviews, see Mullainathan and Spiess (2017), Athey and Imbens (2019), Chernozhukov et al. (2024), and Gaillac and L'Hour (2025).)

Here we apply two approaches: the Generalized Random Forest (GRF) framework of Athey et al. (2019), and the Generic Machine Learning (GenericML) approach of Chernozhukov et al. (forthcoming). In both cases, we use the ML methods to predict the Conditional Average Treatment Effects (CATEs). That is, in the notation of Chernozhukov et al. (forthcoming), we find a predictor $S(Z)$ of $s_0(Z) = E(Y(1)|Z) - E(Y(0)|Z)$, where $Y(1)$ and $Y(0)$ are potential outcomes under treatment and control and $Z$ is a set of covariates. As an outcome, we focus on the intensive margin of exporting, as in Column 2 of Table 3 and Columns 2 and 4 of Tables 11-12. We first ask whether any heterogeneity can be detected and then examine the most salient dimensions of heterogeneity. Recall that our sample consists of approximately 500 firms, with only 264 firms having positive exports in the post period — a relatively modest sample, smaller than is typically recommended for such methods. We therefore see this exercise as suggestive rather than definitive.

## E.1 Generalized Random Forests (GRF)

The Generalized Random Forest (GRF) algorithm (Athey et al., 2019; Wager and Athey, 2018) extends the random forest framework to estimate CATEs, among other features. The method relies on a splitting criterion that directly targets heterogeneity in the treatment effect. As a result, it may be too generous in the detection of heterogeneity. In addition, the inferential problem is not well defined for CATE estimates. (See Chernozhukov et al. (forthcoming) for a discussion of both points.) In our analysis, we use 2,000 trees with a 50% split of the sample for each tree ("honest splitting") as the default option.

We start with a large set of available covariates and we investigate the heterogeneity of the treatment effects among a restricted set based on the variable importance above a pre-specified threshold (2% in our case).[12] Figure A1 plots average CATE within quartiles of estimated CATEs. The figure displays significant heterogeneity, in particular for the comparison between Q1 and Q4. On average, the CATE is about 28 log points or about 32%, with the first quartile at about -12 log points, the second at about 2 log points, the third at about 32 log points, and the fourth at 47 log points or 60%. One caveat is that there is no guarantee that the $S(Z)$ generated by this procedure is unbiased; the confidence intervals displayed in Figure A1, which use the estimated variation in CATEs, should therefore be interpreted with caution.

In Figure A2, to get a sense of which variables are contributing most to the heterogeneity, we plot the shares of firms with particular characteristics across CATE quartiles, in the spirit of, for instance, Athey et al. (2023) Table 1. We again focus on variables with having an importance above 2%. A high share of firms with a specific characteristic in the highest quartile suggests that the characteristic is an important contributor to the large CATE. The two variables that stand out are (1) having any certification at baseline, which is positively correlated with CATE quartile, and (2) being a totally exporting firm, which is negatively correlated, consistent with Table 11 and our theoretical framework.

[12] The analysis includes the following variables: strata dummies, selection round dummies, reference-year log Exports, intended expenditures categories (Certifications, Product Marketing, Publicity/Ads), general firm characteristics (whether firm has high liquidity, defined as with below or above-median values of assets-to-liabilities ratios in reference year, whether firm is large (50+ employees), whether firm chose Export Plan subsidy, whether firm is a totally exporting firm), other indicators (whether owner responded to our survey, whether firm is importer in the reference year, whether the CEO/owner formerly lived outside of Tunisia), innovation indicators (indicators for whether the firm introduced a new product or new process, indicator for whether firm uses data in decision-making), spending types (on travel, technology, marketing, machinery, innovation, digital, consulting, certification), whether firm has foreign presence, whether firm has unit dedicated to exporting, performance metrics (whether tracks key performance indicator (KPIs), whether the firm has any certification, whether the firm targeted $> 2$ countries in business plan), sector dummies, and a set of flag indicators for missing values in the included covariates. Variable importance is determined by how often the GRF procedure selects the variable to split the data in order to capture treatment effect heterogeneity.

## E.2 Generic Machine Learning (GenericML)

We also implement the GenericML method proposed by Chernozhukov et al. (forthcoming). This approach has the advantages that it is more conservative in detecting heterogeneity and is also clearer on how to do inference on features of CATEs. At the same time, it is more demanding in terms of data and, especially in small samples such as ours, may fail to detect even economically significant heterogeneity.[13] We again proceed by choosing an initial list of variables and letting the machine pick the relevant ones.[14] Our preferred analysis uses a lasso with 100 splits and a 50% training sample as chosen options.[15] To get a sense of overall heterogeneity, Figure A3 plots Group Average Treatment Effects (GATES) for quartiles of the predicted CATEs. (We follow the notation in Chernozhukov et al. (forthcoming) and refer to the groups as G1-G4; these correspond to Q1-Q4.) The figure shows that the point estimates across quartiles are economically different — going from about -8 log points in G1 to about 32 log points in G4 — but the confidence intervals are very large and the treatment effects across quartiles are not statistically different. This overall lack of significance however masks some relevant heterogeneity across underlying covariates. Figure A4 presents the Chernozhukov et al. (forthcoming) Classification Analysis (CLAN) for a selected set of characteristics, again following their notation. The figure presents the difference in the predicted CATE across quartiles ($\delta.1$ to $\delta.4$) and the difference between top-bottom quartile ($\delta.4 - \delta.1$) We confirm the heterogeneity based on totally exporting status as well as on having any certification at baseline. There is evidence of heterogeneous effects by firm size (with smaller effects of the matching grants on larger firms, consistent with our theoretical model) and by whether the firms has any consulting expenditure at baseline. There is suggestive but not statistically significant evidence of heterogeneity by whether the firm uses data in decision-making at baseline,

Although the estimates are noisy and should be treated with caution, we see the data-driven analysis in this section as supportive of the simple split-sample approach in the main text (Section 6). In particular, it is reassuring that the results of smaller treatment effects for totally exporting firms and larger treatment effects for firms having any quality certification at baseline are largely confirmed. In addition, here there is stronger evidence of smaller effects for large firms than in Section 6.

[13] Recent applications of the method include Beam et al. (2025) and Davies et al. (2024).

[14] We include the following variables: strata, flags, and selection round dummies; reference year log exports; indicators for being large (50+ employees), high-liquidity, or totally exporting firms; indicators for having introduced a new product in the year preceding the baseline, having any quality certification, using data in decision-making, and having consulting expenditures in the reference year. We experimented with two learners: random forest and lasso. The lasso learner appeared to perform best (in the sense of having the best goodness-of-fit for the CATE) and is what we use below. The random forest learner produces similar results.

[15] This analysis was carried out using the GenericML R package from Welz et al. (2022).

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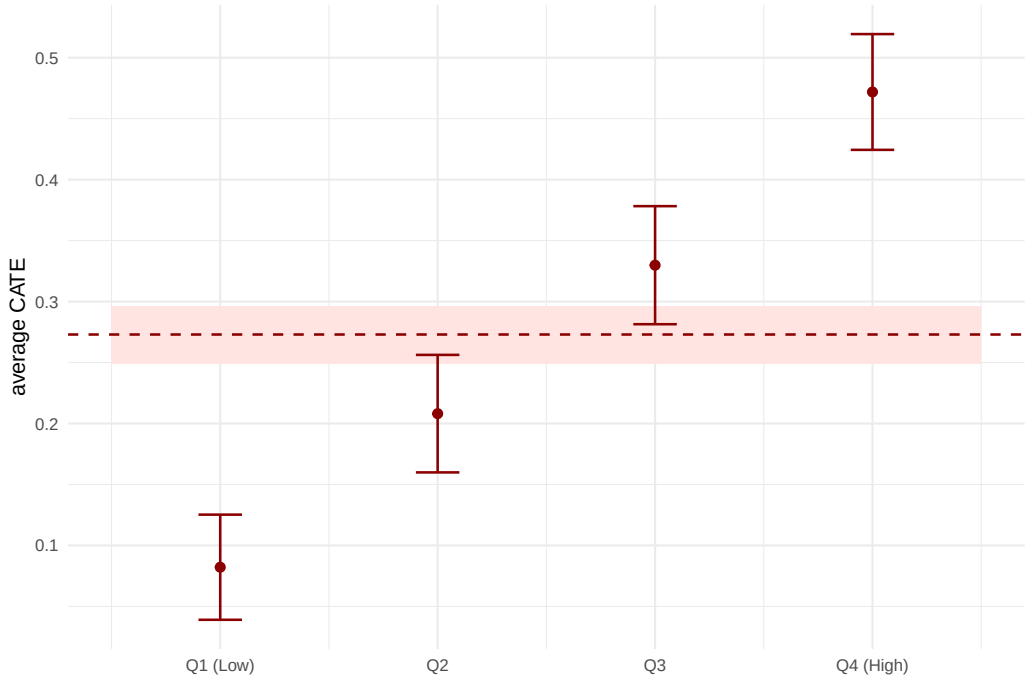
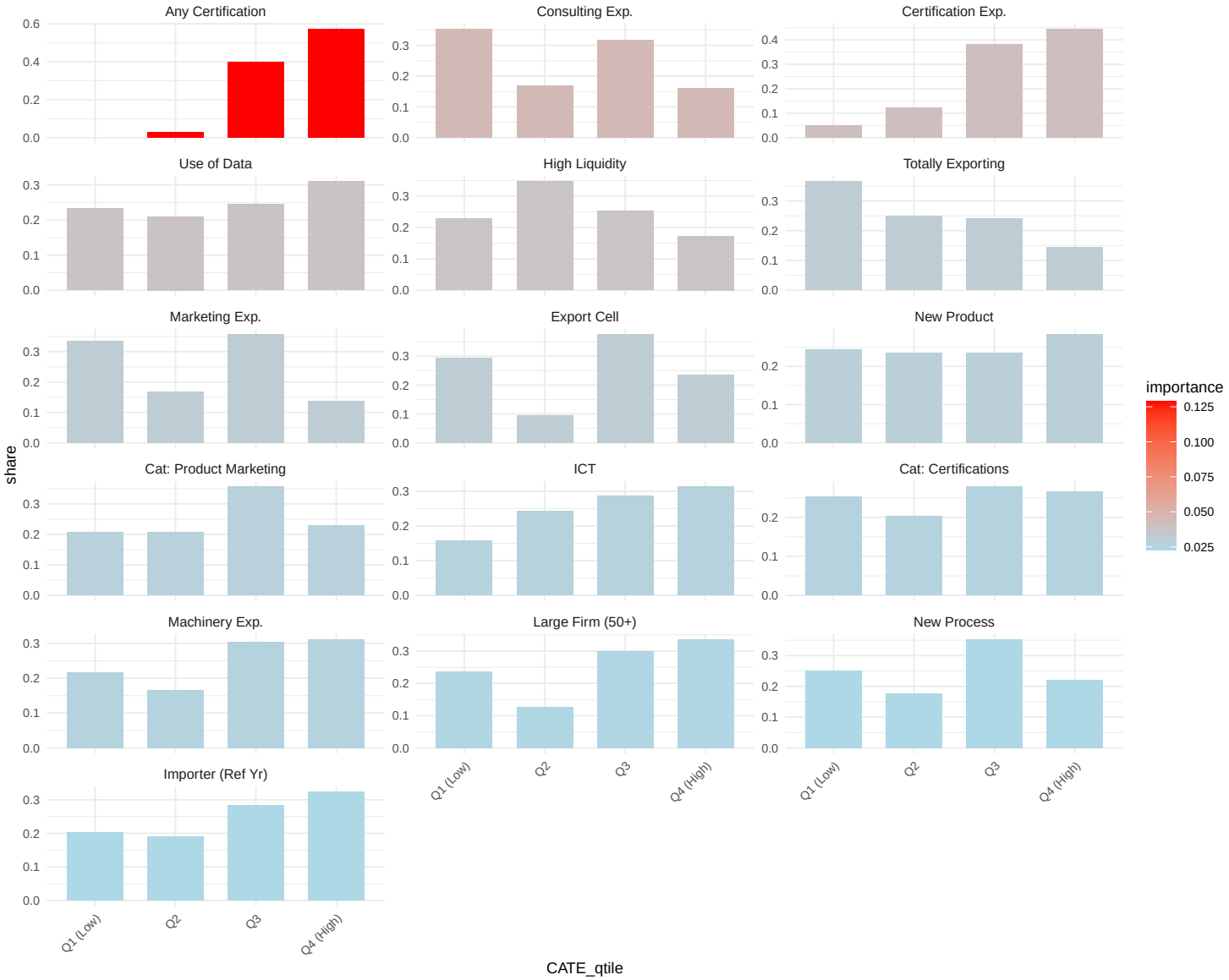
Figure A1. **CATE by Quartile from Generalized Random Forest**



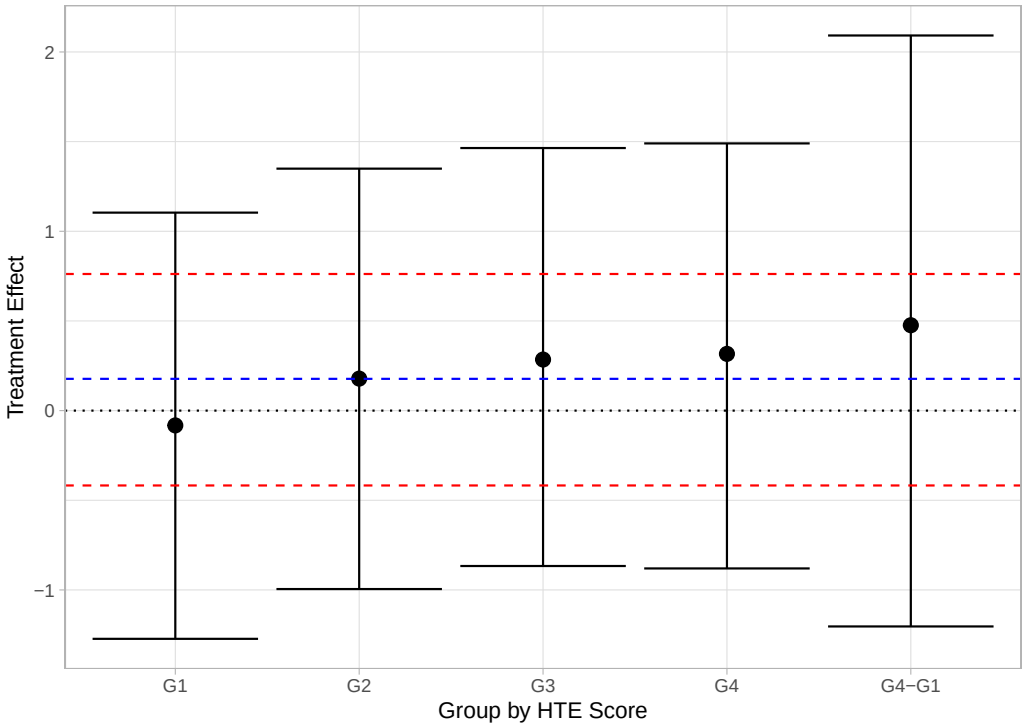

Notes: Figure presents averages of Conditional Average Treatment Effect (CATE), by quartiles of CATE, estimated with generalized random forest with 50% honest splits and 2,000 trees using the causal_forest R package (Athey et al., 2019). 90% confidence intervals are indicated for each CATE quartile. The dotted red line represents the Average Treatment Effect (ATE) and the shaded area the corresponding 90% confidence interval.

Figure A2. **Shares of Firms with Specific Xs by CATE Quartiles**



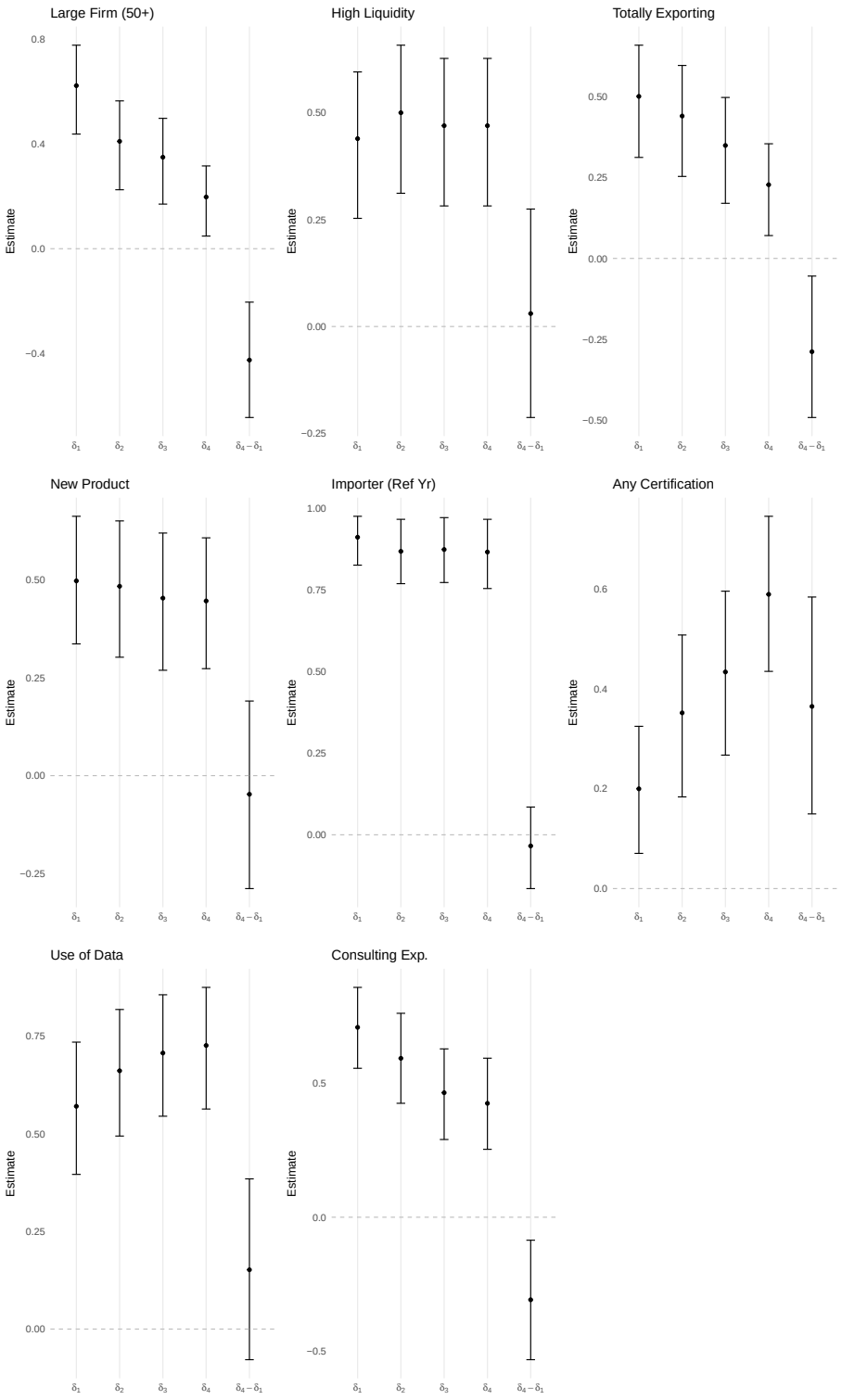

Notes: Share of firms, by quartile of CATE, with a specific characteristic, based on generalized random forest with 50% honest splits and 2,000 trees. Ordering and colors reflect the importance of each variable.

Figure A3. **Group Average Treatment Effects (GATES) from GenericML Method**




Notes: Figure plots medians and 90% confidence intervals of Group Average Treatment Effects (GATES) over four quartiles of predicted Conditional Average Treatment Effects (CATEs) for 100 splits. (G1-G4 correspond to Q1-Q4; HTE score (for "heterogeneous treatment effect score" refers to predicted CATE.) Lasso is used as causal learner. Analysis carried out using GenericML R Package (Welz et al., 2022). The dotted blue line indicates the Average Treatement Effect (ATE) and dotted red lines the 90% conference interval for the ATE.

Figure A4. **Classification Analysis (CLAN) on Covariates**




Notes: Figure presents results from a Classification Analysis (CLAN) following Chernozhukov et al. (forthcoming). For each covariate, we report the difference in the average predicted treatment effect (CATE) across quartiles ($\delta.1$ to $\delta.4$) and the difference between top and bottom quartile.

Table A1. **Balance, RNE Export Sample**

| | (1) Control Mean/SD | (2) Treatment Mean/SD | (3) P-value |
|---|---|---|---|
| **A. Application data** | | | |
| Totally Exporting | 0.26 | 0.27 | 0.76 |
| | (0.44) | (0.45) | |
| Age of firm (as of randomization) | 15.94 | 15.44 | 0.75 |
| | (11.42) | (11.26) | |
| Domestic capital share | 96.83 | 96.96 | 0.81 |
| | (12.68) | (11.28) | |
| Employment | 47.36 | 52.53 | 0.56 |
| | (76.67) | (127.59) | |
| Sales (millions 2015 dinars) | 8.12 | 7.66 | 0.72 |
| | (16.42) | (13.89) | |
| Exporter | 0.73 | 0.72 | 0.97 |
| | (0.44) | (0.45) | |
| Exports (millions 2015 dinars) | 2.51 | 2.40 | 0.95 |
| | (7.69) | (7.02) | |
| **B. RNE data** | | | |
| Sales (millions 2015 dinars) | 7.78 | 7.27 | 0.24 |
| | (15.63) | (13.14) | |
| Exports (millions 2015 dinars) | 2.51 | 2.23 | 0.60 |
| | (7.48) | (6.27) | |
| Export share | 0.38 | 0.41 | 0.58 |
| | (0.41) | (0.43) | |
| N | 164 | 213 | |

Notes: RNE Export Sample is firms for which sales and exports information is available in RNE both in reference year (2017 for rounds 1-4, 2018 for round 5) and in 2021. Panel A source is application data for reference year, comparable to Table 2 for the reduced sample. Panel B source is RNE data for reference year (2017 or 2018). Sales and exports from RNE data are winsorized at the 3%/97% level. Standard deviations in parentheses. P-values in Column 3 are from OLS regressions of variable on treatment indicator controlling for round and stratum fixed effects. P-value for F-test of joint null of no treatment-control differences for all variables (N=377) is 0.85. Monetary values were deflated to 2015 dinars using the CPI provided by INS. The average exchange rate over our study period is approximately 3 TND/USD. Additional details are in Appendices C and D.

Table A2. **Balance, RNE Employment Sample**

| | (1) Control Mean/SD | (2) Treatment Mean/SD | (3) P-value |
|---|---|---|---|
| **A. Application data** | | | |
| Totally Exporting | 0.23 | 0.24 | 0.89 |
| | (0.42) | (0.43) | |
| Age of firm (as of randomization) | 16.50 | 16.15 | 0.85 |
| | (11.60) | (11.42) | |
| Domestic capital share | 96.86 | 96.62 | 0.94 |
| | (12.69) | (11.85) | |
| Employment | 50.92 | 61.38 | 0.35 |
| | (79.01) | (138.03) | |
| Sales (millions 2015 dinars) | 8.76 | 8.89 | 0.98 |
| | (17.01) | (14.81) | |
| Exporter | 0.73 | 0.70 | 0.68 |
| | (0.44) | (0.46) | |
| Exports (millions 2015 dinars) | 2.64 | 2.72 | 0.75 |
| | (7.98) | (7.60) | |
| **B. RNE data** | | | |
| Employment | 59.47 | 64.54 | 1.00 |
| | (90.97) | (93.11) | |
| Annual Earnings/Employee (1k 2015 dinars) | 10.48 | 10.33 | 0.77 |
| | (5.41) | (5.63) | |
| N | 150 | 177 | |

Notes: RNE Employment Sample is subset of RNE Export Sample for which employment and earnings (from social security agency) are available in RNE in reference year (2017 for Rounds 1-4, 2018 for Round 5) and in 2021. Panel A source is application data for reference year, comparable to Table 2 for the reduced sample. Panel B source is RNE data for reference year. Employment and annual earnings from RNE data are winsorized at the 3%/97% level. Standard deviations in parentheses. P-values in Column 3 are from OLS regressions of variable on treatment indicator controlling for round and stratum fixed effects. P-value for F-test of joint null of no treatment-control differences for all variables (N=327) is 0.94. Monetary values were deflated to 2015 dinars using the CPI provided by INS. The average exchange rate over our study period is approximately 3 TND/USD. Additional details are in Appendices C and D.

Table A3. **Balance, Customs Sample**

| | (1) Control Mean/SD | (2) Treatment Mean/SD | (3) P-value |
|---|---|---|---|
| **A. Application data** | | | |
| Totally Exporting | 0.30 | 0.35 | 0.51 |
| | (0.46) | (0.48) | |
| Age of firm (as of randomization) | 18.63 | 17.92 | 0.75 |
| | (12.78) | (13.13) | |
| Domestic capital share | 94.75 | 96.95 | 0.20 |
| | (16.29) | (11.13) | |
| Employment | 65.84 | 69.09 | 0.86 |
| | (91.73) | (157.75) | |
| Sales (millions 2015 dinars) | 12.69 | 11.33 | 0.50 |
| | (20.50) | (16.34) | |
| Exporter | 0.81 | 0.79 | 0.69 |
| | (0.40) | (0.41) | |
| Exports (millions 2015 dinars) | 3.69 | 3.64 | 0.97 |
| | (9.53) | (8.99) | |
| **B. Customs data** | | | |
| Exports (millions 2015 dinars) | 3.68 | 3.35 | 0.53 |
| | (9.21) | (8.00) | |
| Imports (millions 2015 dinars) | 7.42 | 5.58 | 0.25 |
| | (16.22) | (12.16) | |
| Destinations | 3.20 | 3.20 | 0.71 |
| | (4.44) | (4.35) | |
| Products | 4.61 | 4.50 | 0.76 |
| | (7.22) | (6.34) | |
| N | 89 | 121 | |

Notes: Customs Sample is subset of non-service firms from RNE Export Sample. If a firm reported no exports in a given year, zero exports were imputed for that year, and similarly for imports. Panel A source is application data for reference year, comparable to Table 2 for the reduced sample. Panel B source is customs data for reference year. Exports and imports from customs are winsorized at the 3%/97% level. Standard deviations in parentheses. P-values in Column 3 are from OLS regressions of variable on treatment indicator controlling for round and stratum fixed effects. P-value for F-test of joint null of no treatment-control differences for all variables (N=210) is 0.79. Monetary values were deflated to 2015 dinars using the CPI provided by INS. The average exchange rate over our study period is approximately 3 TND/USD. Additional details are in Appendices C and D.

Table A4. **Balance, Survey Sample**

| | (1) Control Mean/SD | (2) Treatment Mean/SD | (3) P-value |
|---|---|---|---|
| **A. Application data** | | | |
| Totally Exporting | 0.33 | 0.33 | 0.78 |
| | (0.47) | (0.47) | |
| Age of firm (as of randomization) | 14.09 | 15.49 | 0.40 |
| | (9.79) | (11.38) | |
| Domestic capital share | 98.30 | 96.40 | 0.47 |
| | (7.73) | (14.13) | |
| Employment | 27.37 | 40.22 | 0.22 |
| | (45.04) | (78.43) | |
| Sales (millions 2015 dinars) | 2.31 | 6.08 | 0.03** |
| | (3.88) | (12.05) | |
| Exporter | 0.65 | 0.77 | 0.07* |
| | (0.48) | (0.42) | |
| Exports (millions 2015 dinars) | 0.89 | 2.46 | 0.09* |
| | (2.35) | (6.14) | |
| **B. Survey data** | | | |
| Has contract with foreign dist./ agent/partner | 0.19 | 0.26 | 0.16 |
| | (0.40) | (0.44) | |
| Has foreign affiliate/ representative | 0.08 | 0.13 | 0.07* |
| | (0.28) | (0.34) | |
| Participated in international fair | 0.45 | 0.45 | 0.96 |
| | (0.50) | (0.50) | |
| Spent on certifications | 0.14 | 0.28 | 0.06* |
| | (0.35) | (0.45) | |
| Spent on new technology | 0.71 | 0.77 | 0.41 |
| | (0.45) | (0.42) | |
| Spent on travel | 0.74 | 0.87 | 0.02** |
| | (0.44) | (0.34) | |
| Spent on consulting | 0.45 | 0.49 | 0.77 |
| | (0.50) | (0.50) | |
| N | 84 | 120 | |

Notes: Source is survey data at baseline for Survey Sample, omitting round 5 firms. (See Section 4 for details.) Standard deviations in parentheses. In applications, agricultural firms were not required to report sales or export status, hence sample size is slightly smaller for these two variables (N=198, instead of 204). P-values in Column 3 are from OLS regressions of variable on treatment indicator controlling for round and stratum fixed effects. F-test of joint null of no treatment-control differences for first four variables in Panel A and Panel B variables (N=204) has p-value 0.26; for all variables (N=198), the p-value is 0.26. See notes to Table 8 or A5 for variable definitions. Additional details are in Section 4 and Appendices C and D.

Table A5. **Survey Outcomes, ANCOVA**

| | Dependent variable: | | | | | | |
|---|---|---|---|---|---|---|---|
| | new contract with foreign dist./ agent/partner | new foreign affiliate/ representative | participated in int'l fair | spent on certifications | spent on new tech. | spent on travel | spent on consulting |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Treated | 0.12* | 0.09** | 0.08 | 0.01 | 0.00 | 0.05 | 0.06 |
| | (0.06) | (0.04) | (0.06) | (0.06) | (0.07) | (0.07) | (0.07) |
| Dep. var., baseline | 0.05 | 0.01 | 0.33*** | 0.26*** | 0.07 | 0.10 | 0.19*** |
| | (0.08) | (0.07) | (0.06) | (0.08) | (0.09) | (0.09) | (0.07) |
| R2 | 0.32 | 0.34 | 0.39 | 0.27 | 0.22 | 0.24 | 0.26 |
| N | 204 | 204 | 204 | 204 | 204 | 204 | 204 |
| Strata dummies | Y | Y | Y | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y | Y | Y | Y |
| Mean of dep. var. | 0.24 | 0.06 | 0.23 | 0.19 | 0.54 | 0.57 | 0.30 |

Notes: Sample is Survey Sample, omitting round 5 firms. Table reports ANCOVA estimates of equation (19) in text. Dependent variable in Column 1 is indicator for whether firm contracted with distributor, local agent or partner in foreign market since July 2017 (for baseline) or since randomization (for endline). In Column 2, it is indicator for already having a foreign affiliate or representative (baseline) or having established a new foreign affiliate/representative since randomization (endline). In Column 3, it is indicator for having participated in international fair/expo since July 2017 (baseline) or since randomization (endline). In Columns 4-7, they are indicators for having positive spending in indicated category in the reference year (baseline) or in calendar year 2019. Simple OLS specifications are reported in Table 8. Means of dependent variables are for control firms at endline (2021). Additional details are in Section 4 and Appendices C and D. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6. **Survey Outcomes, Controlling for Baseline Sales, Exports**

| | Dependent variable: | | | | | | |
|---|---|---|---|---|---|---|---|
| | new contract with foreign dist./ agent/partner | new foreign affiliate/ representative | participated in int'l fair | spent on certifications | spent on new tech. | spent on travel | spent on consulting |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Treated | 0.13* | 0.09** | 0.10 | 0.03 | 0.02 | 0.10 | 0.09 |
| | (0.07) | (0.04) | (0.07) | (0.06) | (0.07) | (0.07) | (0.07) |
| R2 | 0.31 | 0.31 | 0.29 | 0.23 | 0.24 | 0.25 | 0.26 |
| N | 198 | 198 | 198 | 198 | 198 | 198 | 198 |
| Strata dummies | Y | Y | Y | Y | Y | Y | Y |
| Round dummies | Y | Y | Y | Y | Y | Y | Y |
| Mean of dep. var. | 0.24 | 0.06 | 0.23 | 0.19 | 0.54 | 0.57 | 0.30 |

Notes: Table is similar to Table 8, but controls for sales, exporter status, and exports from application data. Six firms in Survey Sample were agricultural firms that were not required to report sales or exports in their Tasdir+ applications. Means of dependent variables are for control firms at endline (2021). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.