The Impact of Trade Promotion Services on Canadian Exporter Performance

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Abstract: We evaluate the impact of the programs delivered by the Canadian Trade Commissioner Service (TCS) on export performance by Canadian firms. We draw on a unique set of microdata created by linking three separate firm-level databases: Statistics Canada's Exporter Register and its Business Register, which provide information on export activity and firm characteristics, and the TCS client management database maintained by Foreign Affairs and International Trade Canada, which contains details on trade promotion services provided to Canadian firms. We apply the treatment effects analytical framework to isolate the effects of public sector trade promotion. We find that TCS programs have a consistent and positive impact on Canadian exporter performance, both in terms of the value of exports and the growth of exports. In our preferred specification, exporters that access TCS services export, on average, 17.9 percent more than comparable exporters that do not. Furthermore, we also find that TCS assistance benefits exporters in terms of product and market diversification.

Key words: Export Promotion, Heterogeneous Firms, Canada
JEL No.: F13, F14, L15

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1. Introduction

The recent firm-level trade literature emphasizes the role of sunk costs in the presence of uncertainty about future market conditions to explain why the proportion of firms that participate in international trade is (at least in some countries[1]) surprisingly low. Sunk costs of entering foreign markets are distinct from those incurred to serve home markets; they must be borne to make export sales. They are not recoverable if the attempt to export fails. These include costs of obtaining market information for foreign countries, identifying foreign customers, finding reliable suppliers, developing distribution channels in foreign markets, dealing with the local regulations, learning how to adapt a product to local market conditions, and many others (Rauch, 2001 and Copeland, 2008 provide surveys).

Recognizing that firms have to overcome additional costs to break into foreign markets, governments worldwide operate export promotion programs to assist their exporters (see Lederman et al., 2010 for an international overview). These export promotion programs aim in general to reduce sunk costs by providing information on foreign markets, and by helping firms to adapt a product to local market conditions.

From an economic welfare perspective, such intervention is only justified if there is market failure[2]. This paper does not explore the welfare dimensions of public sector trade promotion programs; rather it simply seeks to ascertain if they have an

[1] For example, Bernard et al. (2007) found only 18 percent of U.S. manufacturing firms exported in 2002, while Baldwin and Gu (2003) found that only 24 percent of Canadian manufacturers exported in 1996. By contrast, Wagner (2007) reports that 64.4 percent of West German manufacturing firms exported in 2004.

[2] Copeland (2008) sets out the theoretical case for trade and investment promotion policy. He argues that general information relevant for doing business abroad has many of the characteristics of a public good in the sense that there are information spillovers. Such spillovers could result in under-provision of services, a market failure that would result in less exporting than is economically efficient. As well, if there are economies of scale in maintaining a base of knowledge about foreign markets, new entrants and small firms would be at a disadvantage, another source of market failure.

impact on export performance, an important question given the resource implications of funding export promotion programs.

The empirical literature on the effectiveness of trade promotion services has not reached consistent conclusions. For example, Bernard and Jensen (2004) found that U.S. state-level export promotion expenditures had no significant effect on the probability of local firms exporting. On the contrary, Rose (2007) used a gravity model to show that diplomatic representation abroad did appear to boost trade; bilateral exports were approximately 6 to 10 percent higher for each additional consulate in a foreign market. A number of studies using microdata for various countries also tended to show more positive results. Alvarez and Crespi (2000) found that Chilean export promotion programs had a direct positive effect in terms of expanding the number of markets and an indirect effect on product diversification. Görg et al. (2008) using Irish manufacturing firm data from 1983-2002 found that grants to promote investments in technology, training and physical capital were effective in increasing exports of continuing exporters but ineffective in promoting market diversification. Volpe Martincus and Carballo (2008) found that Peru's export promotion agency had a positive effect on the value of exports and the effect was significant on both market and product diversification. Finally, Volpe Martincus, Carballo and Garcia (2010) found that trade promotion boost exports primarily by smaller exporters.

In this paper, we assess the impact of the Canadian Trade Commissioner Service (TCS) on Canadian exporter performance by linking TCS client data with Statistics Canada's firm-level data in the Exporter Register and the Business Register. We take particular pains to control for reverse causality in the sense that characteristics of the firm that lead it to seek TCS assistance may also influence the post-assistance performance.

TCS programs are offered through 140 offices around the world and 12 regional offices across Canada. The services provided can be subdivided into six groups: information on market prospects, key contacts search, local company information, visits information, face-to-face briefings and

trouble shooting. The first three information-related services are those most-requested by TCS clients.

The TCS client management database is maintained by Foreign Affairs and International Trade Canada; it provides descriptive details on trade promotion services delivered by Canadian trade commissioners in Canada and abroad. This information can be broken down by mission, country, sector, the size and age of firms, their financial resources, and types of TCS services they accessed, all at the firm level.

The first channel through which TCS programs affect exporters' performance is initial assistance to new exporter clients; this, we infer, involves reducing entry barriers and thus impacts on exports along the *extensive* margin of trade. A second channel is continuing assistance to existing exporters; this, we infer, involves helping clients to adapt products to local market conditions and to build market presence which results in export growth along the *intensive* margin.

Unfortunately, our TCS assistance dataset does not allow us to identify the impact of TCS services separately on the extensive and intensive margins of trade. That is, the dataset does not indicate whether the service provided was for a returning client is for the same product and same market (in which case the evaluated increase in value sales would be along the intensive margin) or if the service was intended for a different product in a different market (in which case the impact on sales would be along the extensive margin).

In this paper, we focus on the impact of TCS on overall export flows. In, particular, we seek to answer the following two questions: Did exporters that received TCS assistance export more compared to those without TCS assistance? Did previously received TCS assistance continue to enhance exporter performance? We contribute to the literature by linking the detailed firm-level export promotion data to firm characteristics and examining the TCS impact on the performance of Canadian exporters using the statistical tools from the treatment effects literature. We examine the effect of TCS assistance in three time frames: concurrent, lagged and

lingering. Our analysis shows that TCS assistance has a lasting positive effect on Canadian export performance.

The rest of the paper is organized as follows. Section 2 presents a detailed overview of our data. Section 3 describes the econometric framework. Section 4 presents the estimation results. Section 5 concludes.

2. Canadian Exporters and Trade Commissioner Services

The data for this study come from three sources: 1) Statistics Canada's Exporter Register which produces annual estimates of the number of firms exporting, their province of residence and the value of their domestic exports by industry, product, and export destination; 2) Statistics Canada's Business Register, which contains information on the characteristics of firms that operate in Canada; and 3) The TCS client management database maintained by Foreign Affairs and International Trade Canada.

We link these datasets as follows. First, each exporter registered in the Exporter Register database is identified by an assigned enterprise number that is common to both the Exporter Register and the Business Register. This allows us to associate the detailed enterprise-level characteristics data from the Business Register with each exporting firm. Second, if an identified exporter is a TCS client, its information is linked to the TCS client management database through name and address matching. The combined dataset provides, for each identified exporting firm, information on the trade promotion services it received, identified by location and time, its export sales by export destination and year, and its economic characteristics. The linked dataset covers the period from 1999 to 2006.

In the following discussion, we summarize the key characteristics and export performance of the Canadian exporter population in general and of those that were TCS clients in particular.

2.1 Canadian Exporter Population

From 1999 to 2006, there were on average 47,174 active exporters in Canada. The number of exporters increased from 43,568 in 1999 to 49,314 in 2004 before dropping to 44,127 in 2006[3]. Total export values increased almost 20 percent over the same period. However, only marginal increases in the total number of export markets and number of products exported were observed during this period (see Table 1).

Table 1: Canadian Exporters by Number of Markets, Products and Value of Sales

Year	Number of Exporters	Number of Markets	Number of Products	Value of Exports (CAD billions.)
1999	43,568	225	5,422	321
2000	46,465	221	5,435	373
2001	48,140	226	5,429	360
2002	49,146	227	5,457	351
2003	48,504	230	5,528	337
2004	49,314	231	5,551	366
2005	48,126	234	5,557	388
2006	44,127	230	5,539	381
Ave.	**47,174**	**228**	**5,490**	**360**

Source: Calculated from the Exporter Register.

Over the period 1999-2006, a Canadian exporter was, on average, in business for 8.8 years, employed 73 people, exported 4.6 products to 2.0 countries, and generated total export sales worth $7.6 million (see Table 2). The main trends in this period were in the average number of markets per exporter, which grew from an average of 1.7 at the beginning of the period to 2.5 at the end, and the age of exporters, which doubled from 6 years at the beginning of the period to almost 12 years at the end. The picture is thus one of a stable population of maturing firms gradually diversifying their export markets but not their product palette.

[3] Statistics Canada's annual publication on the profile of Canadian exporters excludes firms with annual exports less than $30,000. In this study, all exporters are included; therefore, the number of exporters (enterprises) reported in this paper is greater than that reported by Statistics Canada.

Table 2: Characteristics of the Average Canadian Exporter

Year	Number of Markets	Number of Products	Employees	Value of Exports (CAD millions)	Firm Age
1999	1.7	4.8	76.5	7.4	6.0
2000	1.7	4.7	73.3	8.0	6.8
2001	1.8	4.6	72.5	7.5	7.5
2002	1.8	4.2	69.8	7.2	8.3
2003	2.0	4.4	70.0	6.9	9.1
2004	2.2	4.6	71.2	7.4	9.8
2005	2.4	4.8	74.4	8.0	10.8
2006	2.5	5.0	77.0	8.6	11.9
Ave.	**2.0**	**4.6**	**73.1**	**7.6**	**8.8**

Source: Calculated from the Exporter Register.

Canada has a large share of single market (country) exporters (first column of Table 3). They accounted for about three-quarters of all exporters and 30 percent of the value of exports on average over the period[4]. Reflecting the trend to increased market diversification noted in Table 2, the share of single market exporters fell by almost 10 percentage points from 1999 to 2006. It is also noted that, in Canada, there are more multi-product firms than multi-market firms (Table 4).

Table 3: Percentage of Exporters by Number of Export Markets

Year	Number of Markets						
	1	2	3	4	5	6 to 10	11 or more
1999	82.0	8.0	3.2	1.8	1.0	2.2	1.8
2000	82.8	7.8	3.1	1.7	1.0	2.1	1.7
2001	82.2	7.8	3.2	1.6	1.0	2.2	1.9
2002	81.1	8.2	3.2	1.8	1.1	2.5	2.1
2003	77.5	9.2	3.8	2.2	1.3	3.2	2.8
2004	75.3	9.7	4.3	2.4	1.5	3.6	3.2
2005	74.0	9.8	4.2	2.6	1.7	3.9	3.8
2006	73.2	9.7	4.6	2.7	1.6	4.1	4.2
Ave.	**78.5**	**8.8**	**3.7**	**2.1**	**1.3**	**2.9**	**2.7**

Source: Calculated from the Exporter Register.

[4] By comparison, single market exporters accounted for 60 percent of all exporters in Peru (Volpe Martincus and Carballo, 2008) and about 30-40 percent in Ireland (Lawless, 2009) and France (Eaton et al., 2004). Single market exporters also account for a much smaller share of total exports in some other countries; e.g., 3.7 percent in the United States in 2000 (Bernard et al., 2005).

Table 4: Percentage of Exporters by Number of Products

Year	Number of Products							
	1	2	3	4	5	6 to 10	11 to 20	21 or more
1999	37.3	18.0	10.6	7.2	5.0	11.9	6.6	3.5
2000	38.6	17.9	10.5	6.9	4.7	11.4	6.4	3.6
2001	39.9	17.8	10.5	6.8	4.8	10.8	6.0	3.4
2002	41.1	18.3	10.4	6.8	4.6	10.8	5.2	2.7
2003	41.2	17.6	10.4	6.7	4.7	10.8	5.5	3.0
2004	41.2	17.6	10.2	6.7	4.5	10.8	5.7	3.2
2005	40.0	17.6	10.3	6.8	4.7	11.0	6.0	3.6
2006	38.5	17.7	10.7	6.8	4.8	11.4	6.4	3.8
Ave.	**39.7**	**17.8**	**10.5**	**6.8**	**4.7**	**11.1**	**6.0**	**3.4**

Source: Calculated from the Exporter Register.

Table 5 shows that most new exporters start in a single market, usually with a single product. Thus, of the 13,164 new exporters in 2000, 96 percent started in one market and about two-thirds started in one market with a single product. Even as the number of new entrants plummeted to no more than 4,736 in 2006, these ratios remained stable, with the share of single market entrants falling only marginally to 92 percent and the share of single market and single product entrants rising marginally to about 71 percent over the period. The single most notable trend in Table 5 is the decline in the share of the exporter population accounted for by firms exporting to a single market and the associated rise of the multi-market (in most cases also multi-product) firm.

In terms of firm size, we divide the Canadian exporter population into four groups: micro (1 to 10 employees), small (11 to 50 employees), medium (51 to 200 employees) and large (more than 200 employees). It can be seen from Table 6 that most Canadian exporters belong to the micro and small size categories. Exporters of these two sizes made up almost four-fifths of the exporter population. Large size exporters constitute a very small proportion of the total, around 5 percent. This size distribution did not change much from 1999 to 2006.

Table 5: Market and Product Diversification—Entrants versus Continuing Exporters

Year	Single Market and Single Product		Single Market and Multiple Products		Total Single market
	Entrant	Continuing	Entrant	Continuing	
2000	8,842	8,702	3,803	17,131	38,478
2001	7,888	10,828	2,995	17,880	39,591
2002	7,638	11,945	2,666	17,587	39,836
2003	6,525	12,518	2,075	16,457	37,575
2004	6,495	12,669	2,112	15,877	37,153
2005	5,349	12,733	1,676	15,841	35,599
2006	3,275	12,549	1,105	15,367	32,296
	Multiple Markets and Single Product		Multiple Markets and Multiple Products		Total Multiple Market
	Entrant	Continuing	Entrant	Continuing	
2000	69	336	450	7,132	7,987
2001	81	420	354	7,694	8,549
2002	116	524	535	8,135	9,310
2003	168	796	579	9,386	10,929
2004	181	964	641	10,375	12,161
2005	151	1,011	524	10,841	12,527
2006	86	1,061	270	10,414	11,831

Source: Calculated from the Exporter Register.

Table 6: Canadian Exporters by Size

Year	Micro	Small	Medium	Large
1999	22,379	11,541	7,304	2,344
2000	24,019	12,357	7,648	2,441
2001	24,920	12,959	7,821	2,440
2002	25,310	13,423	7,981	2,432
2003	24,655	13,492	7,918	2,439
2004	25,060	13,842	7,933	2,479
2005	24,257	13,613	7,703	2,553
2006	21,254	13,037	7,429	2,407
Ave	**23,982**	**13,033**	**7,717**	**2,442**
Memo: Ave. Percent Share	50.8%	27.6%	16.4%	5.2%

Source: Calculated from the Exporter Register.

Table 7 shows the average export value, the average number of markets and the average number of products of Canadian exporters by size.

Table 7: Average Exports, Number of Markets and Number of Products by Size

Year	Average Export (CAD millions)	Average Number of Markets	Average Number of Products
		Micro	
1999	1.2	1.3	2.9
2000	1.6	1.2	2.8
2001	1.5	1.2	2.7
2002	1.3	1.3	2.5
2003	1.4	1.4	2.6
2004	1.6	1.5	2.7
2005	2.1	1.6	2.9
2006	2.1	1.7	3.0
		Small	
1999	1.6	1.6	4.3
2000	1.7	1.5	4.2
2001	1.7	1.6	4.1
2002	1.8	1.7	3.8
2003	1.7	1.9	4.0
2004	1.8	2.0	4.2
2005	2.1	2.2	4.3
2006	2.5	2.3	4.5
		Medium	
1999	5.5	2.2	6.9
2000	6.4	2.3	7.0
2001	6.5	2.3	6.9
2002	6.7	2.5	6.3
2003	6.7	2.9	6.5
2004	7.3	3.1	6.7
2005	7.9	3.3	7.0
2006	7.7	3.4	7.2
		Large	
1999	100.2	5.8	19.0
2000	108.8	5.6	19.0
2001	102.0	6.0	18.4
2002	99.6	6.3	17.0
2003	92.6	7.1	17.5
2004	98.5	7.6	18.3
2005	96.4	7.7	18.8
2006	102.6	7.7	19.5

Source: Calculated from the Exporter Register.

Large exporters account for almost 70 percent of exports even though they made up only around 5 percent of the exporter

population. A typical large Canadian export firm in this period shipped about 18 products to about 7 markets, generating about $100 million in export revenues. By contrast, a typical medium-sized firm shipped about 7 products to 3 markets and generated only about $7 million in export revenues. Thus, in Canada, larger firms tend to export more products to more destinations and generate much higher export revenues than smaller firms.

These findings mirror those in other country studies[5]. The most notable feature from Table 7 in terms of trends is again the stability in terms of product diversification but the increasing market diversification, across all sizes of exporters.

Table 8 shows the geographic dimension of Canada's exports. As can be seen, the share of exporters that exported to

Table 8: Exporters by Region of Destination

Year	United States	Asia Pacific	Europe	Latin America
		Number of Exporters		
1999	38,862	4,502	6,371	2,675
2000	41,578	4,731	6,451	2,675
2001	42,876	5,166	6,973	2,888
2002	43,111	5,880	7,638	3,118
2003	41,219	6,798	9,092	3,784
2004	40,553	7,853	10,169	4,508
2005	39,519	8,126	10,253	4,903
2006	36,276	7,784	9,552	4,670
		Percentage of Total Exporters		
1999	89.2	10.3	14.6	6.1
2000	89.5	10.2	13.9	5.8
2001	89.1	10.7	14.5	6.0
2002	87.7	12.0	15.5	6.3
2003	85.0	14.0	18.7	7.8
2004	82.2	15.9	20.6	9.1
2005	82.1	16.9	21.3	10.2
2006	82.2	17.6	21.6	10.6

Source: Calculated from the Exporter Register. Note: percentages do not add to 100, as firms can be exporting to more than one region at the same time.

[5] See Bernard, Jensen and Schott (2005), Buono, Fadinger and Berger (2008) and Lawless (2009).

the United States fell from nearly 90 percent in the period 1999-2001 to 82 percent in 2006, mainly due to some exporters exiting from the U.S. market[6]. The biggest increase in number of exporters can be observed for Asia Pacific destinations, followed by Europe and then Latin America.

2.2 TCS Clients vs. Non-Clients

This section compares exporters that utilized the Canadian Trade Commissioner Service (TCS) to those that did not. From Table 9, it can be seen that only about 5 percent of exporters each year sought assistance, while from Table 10 we see that the propensity to seek TCS assistance increases steadily with size of firm, rising from only about 3 percent of the micro-sized exporters to almost 17 percent of the large-sized exporters.

Table 9: Number of Exporters with TCS Assistance

Year	TCS Assisted	Percentage of Total
1999	1,356	3.1
2000	2,640	5.7
2001	2,316	4.8
2002	2,159	4.4
2003	2,298	4.7
2004	2,654	5.4
2005	2,281	4.7
2006	2,452	5.6
Average	**2,270**	**4.8**

Source: Calculated from the Exporter Register, Business Register and DFAIT Client Information. Note: The number of firms in this and the following tables only includes firms that have been successfully matched to the Exporter Register. Some TCS clients could not be matched, implying that they did not record exports of goods (they might have exported services, or been assisted of investment activities) or that matching of the firm's identifiers in the two datasets was not possible.

[6] Note that exporters exiting the U.S. market might continue to export to other markets, e.g., faster-growing emerging markets.

Table 10: TCS-Assisted Exporters by Size Group

Year	Number	Percentage	Number	Percentage
1999	345	1.5	362	3.1
2000	691	2.9	767	6.2
2001	598	2.4	667	5.1
2002	589	2.3	643	4.8
2003	637	2.6	681	5.0
2004	778	3.1	808	5.8
2005	634	2.6	683	5.0
2006	685	3.2	732	5.6
Average	**620**	**2.6**	**668**	**5.1**
	Medium		Large	
1999	366	5.0	283	12.1
2000	721	9.4	461	18.9
2001	618	7.9	433	17.7
2002	548	6.9	379	15.6
2003	571	7.2	409	16.8
2004	631	8.0	437	17.6
2005	531	6.9	433	17.0
2006	588	7.9	447	18.6
Average	**572**	**7.4**	**410**	**16.8**

Source: See Table 9.

Table 11 compares average firm-level characteristics of TCS-assisted and non-TCS-assisted exporters. On average, TCS-assisted firms were older, larger, exported more products to more destinations, but were only marginally more productive and, perhaps surprisingly in light of the foregoing, had only marginally more experience in the export market than non-TCS-assisted exporters.

Table 11: Characteristics of TCS Clients versus Non-Clients

Year	Number of Markets		Number of Products	
	TCS	Non-TCS	TCS	Non-TCS
1999	5.4	1.6	13.9	4.5
2000	4.2	1.5	11.8	4.3
2001	5.0	1.6	12.2	4.2
2002	5.5	1.7	11.5	3.9
2003	6.3	1.9	12.2	4.0
2004	6.9	2.0	12.4	4.1
2005	7.8	2.1	13.3	4.3
2006	7.5	2.2	13.5	4.5
Year	Productivity (in log)		Employment (in log)	
	TCS	Non-TCS	TCS	Non-TCS
1999	11.8	11.6	432	65
2000	12.0	11.8	263	62
2001	12.1	11.8	300	61
2002	12.0	11.8	290	60
2003	12.0	11.8	287	59
2004	12.0	11.8	286	59
2005	12.1	11.8	332	62
2006	-	-	335	62
Year	Export Experience*		Age of Firm	
	TCS	Non-TCS	TCS	Non-TCS
1999	-	-	8.3	6.0
2000	0.89	0.71	9.7	6.6
2001	1.74	1.39	10.0	7.4
2002	2.48	2.02	10.0	8.2
2003	3.19	2.67	10.9	9.0
2004	3.96	3.23	11.7	9.7
2005	4.69	3.91	12.5	10.7
2006	5.59	4.78	13.5	11.8

Source: See Table 9. * Export experience is 0 years in the first year of entry.

Table 12 shows that firms that export to non-U.S. markets rely more frequently on TCS assistance. Only 5 percent of firms that exported to the U.S. market accessed TCS assistance, compared to 12 percent of those that exported to Europe, 13.5 percent of those that exported to Asia-Pacific and 16 percent of those that exported to Latin America. This indicates that the sunk costs for market access were typically higher in more remote markets that in nearby markets.

Table 12: TCS Clients by Export Destination, Number & Percent

Year	TCS Assisted	Percentage of Total	TCS Assisted	Percentage of Total
	United States		Europe	
1999	1,203	3.1	580	9.1
2000	2,357	5.7	908	14.1
2001	2,065	4.8	908	13.0
2002	1,894	4.4	897	11.7
2003	2,006	4.9	1,035	11.4
2004	2,223	5.5	1,267	12.5
2005	1,897	4.8	1,149	11.2
2006	2,078	5.7	1,234	12.9
Ave.	**1,965**	**4.9**	**997**	**12.0**
	Asia-Pacific		Latin America	
1999	434	9.6	317	11.9
2000	741	15.7	524	19.6
2001	733	14.2	523	18.1
2002	771	13.1	492	15.8
2003	911	13.4	599	15.8
2004	1,140	14.5	782	17.3
2005	1,058	13.0	712	14.5
2006	1,108	14.2	751	16.1
Ave.	**862**	**13.5**	**588**	**16.1**

Source: See Table 9. Note: the number of clients by region does not add to the total number of clients as firms can be exporting to more than one region at the same time.

Table 13 shows the sectoral distribution of TCS-assisted and non-TCS-assisted exporters. The sectoral distribution of TCS assisted exporters was fairly stable in the sample years. The *Wholesale & Retail* and *Other Services* sectors had the largest number of firms, but these firms were proportionately less likely to seek TCS assistance. The merchandise sectors with the largest number of TCS clients were *Food & Beverage*, *Petroleum, Chemical and Plastics*, *Computer, Electronics & Electrical Equipment*, and *Miscellaneous Manufacturing*. Exporters in the *Food & Beverage* and *Computer, Electronic & Electrical Equipment* sectors, which produce differentiated products, were proportionately more likely to seek assistance.

Table 13: Distribution of Exporters by Sector—TCS Clients and Non-Clients (Average Annual Percentage Share, 1999-2006)

Sector (NAICS code)	Non-TCS	TCS
Agriculture (100)	5.5	3.0
Mining (200)	4.3	4.0
Food & Beverage (311-312)	2.4	9.1
Textiles & Clothing (313-315)	3.3	3.2
Wood & Paper Products (321-323)	5.3	4.0
Petroleum, Chemicals & Plastics (324-327)	6.1	8.7
Primary & Fabricated Metal (331-332)	6.3	5.3
Machinery (333)	5.4	8.6
Computer, Electronic & Electrical Equipment (334-335)	3.6	8.2
Transportation Equipment (336)	2.1	2.5
Miscellaneous Manufacturing (316, 337-339)	5.7	6.1
Wholesale & Retail (400)	32.1	20.9
Other Services (500-900)	17.9	16.6

Source: See Table 9.

Tables 14 and 15 show that firms that seek TCS assistance are much more likely to be multi-market and multi-product firms, respectively; a much larger proportion of the non-TCS-assisted exporters were single-market and/or single-product exporters as compared to the TCS-assisted exporters. In both cases, TCS clients are roughly half as likely as the general population to be single-market or single-product exporters.

Table 14: Single-Market Exporters, TCS Clients and Non-Clients

Year	TCS Assisted	Percentage of Total TCS clients	Non-TCS	Percentage of Total Non-TCS clients
1999	643	47.4	35,079	83.1
2000	1,402	53.1	37,076	84.6
2001	1,115	48.1	38,476	84.0
2002	993	46.0	38,843	82.7
2003	957	41.6	36,618	79.2
2004	1,019	38.4	36,134	77.4
2005	849	37.2	34,750	75.8
2006	920	37.5	31,376	75.3
Ave.	**987**	**43.7**	**36,044**	**80.3**

Source: See Table 9.

Table 15: Single-Product Exporters

Year	TCS Assisted	Percentage of Total	Non-TCS	Percentage of Total
1999	229	16.9	16,022	38.0
2000	464	17.6	17,485	39.9
2001	403	17.4	18,814	41.1
2002	391	18.1	19,832	42.2
2003	431	18.8	19,576	42.4
2004	492	18.5	19,817	42.5
2005	444	19.5	19,800	41.0
2006	425	17.3	16,546	39.7
Ave.	**410**	**18.0**	**18,487**	**40.9**

Source: See Table 9.

Finally, Table 16 shows that Market Prospect Information and Key Contacts Search are the most frequently requested types of assistance, which suggests that information asymmetry is a key factor for firms seeking to expand in export markets.

Table 16: Number of Exporters by TCS Service Type

Year	Type of TCS Service		
	Key Contacts Search	Local Company Information	Market Prospect Information
1999	638	539	768
2000	882	817	1,987
2001	952	871	1,513
2002	1,075	907	1,213
2003	1,239	998	1,241
2004	1,434	965	1,520
2005	1,257	799	1,238
2006	1,249	732	1,186
	Face-to-face Briefing	Visit Information	Troubleshooting
1999	499	214	160
2000	643	298	162
2001	870	431	293
2002	945	471	330
2003	1,073	401	330
2004	1,292	521	350
2005	1,101	392	322
2006	1,145	365	327

Source: DFAIT Client Information

3. Econometric Analytical Framework

We have shown that Canadian exporters, over our sample period, became more diversified in terms of markets but not in terms of products. While only a small proportion of Canadian exporters sought TCS services (about 5 percent on average), we have also shown that exporters that did seek out TCS assistance were older, larger, more likely to be multi-market and/or multi-product exporters, but only marginally more experienced in export market and marginally more productive compared to the general population of exporters. Firms that export to Asia, Europe and Latin America relied more frequently on TCS assistance than those exporting to the United States. We have also learned that the most important reasons for seeking TCS assistance appear to be related to reducing information-related sunk costs.

We now address the question of whether TCS assistance is able to enhance exporter performance. The main analytical issue is to establish causality. Is the observed tendency of TCS clients to achieve a more diversified export-market presence a result of TCS assistance? Or do firms that are generally more committed to export-market development, and thus tend to be multi-market and multi-product exporters in the first place, self-select into the TCS client category? Similarly, does TCS assistance promote growth of export sales in established markets?

Consistent with other studies of this question we adopt as our empirical framework the treatment effects approach[7]. That is, exporters that accessed TCS assistance are considered as having received a treatment of "export promotion assistance". As we are unable to observe what the value of exports of the treated

[7] The treatment effects technique is an adaption of studies with randomized experimental trials, as in medical clinical trials, which involve a treatment group and a randomly assigned control group. For use with observed (non-experimental) data, statistical techniques have to be used to identify a counterpart to the control group. See Wooldridge (2002); Imbens (2004) provides a survey of this literature. See Volpe Martincus et.al. (2008 and 2010), Lederman et al. (2010), and Girma et al. (2009) for applications of this technique to identify the effects of trade promotion activities.

would be if they had not received the assistance, we must compare their performance to firms that did not receive such treatment. However, the effect of treatment cannot be estimated directly by comparing the value of exports for firms in the two groups, since we cannot exclude the possibility that factors that caused a firm to seek out assistance also affect its success in export markets. To address this issue, we proceed as follows.

Assume that y_i^j is the potential value of exports by exporter *i* if it receives treatment *j*, *i* = 1, 2, ..., *N* and *j* = 0, 1. Thus, y_i^1 is the value of exports by exporter *i* with treatment and y_i^0 is the value of exports by the same exporter *i* without treatment. Of course, only one of these two quantities will be observed. Next, let ω_i be the treatment variable such that $\omega_i = 1$ if exporter *i* has received TCS assistance and $\omega_i = 0$ otherwise. There is a vector of **x**-covariates of observed firm characteristics.

To evaluate the effect of the treatment, we estimate the Average Treatment Effect (ATE) which measures the expected effect of treatment on a random sample of the population or the average effect across the entire population. ATE is estimated as the expected difference between y^1 and y^0, i.e. $E[y^1 - y^0]$. An alternative object of policy interest, especially if treatment effects are heterogeneous and firms can self-select into treatment, is the Average Treatment Effect on the Treated (ATT). This measures the average effect of the treatment only for those firms that received the treatment, compared to the counterfactual case, if the firm had not received the treatment. ATT is estimated as the expected difference between y^1 and y^0 given that treatment is received: i.e., $E[y^1 - y^0 \mid \mathbf{x}, \omega = 1]$.

Because an exporter chooses to receive or not to receive TCS assistance, the effects of such assistance are subject to selection bias. Characteristics of the firm that lead it to seek TCS assistance may also influence the measured post-assistance performance. In the treatment effect framework with potential outcomes, this is basically a missing data problem. We cannot hope to observe the sample analog of $E[y^1] - E[y^0]$. At best, we

can estimate the sample analog of: $E[y^1 \mid \varpi = 1] - E[y^0 \mid \varpi = 0]$. If the treatment regime is not independent of the potential outcome under the regime, which is highly likely, the two differences will not be equal.

One way out is to apply an, admittedly very strong, assumption that the treatment variable, ω_i is independent of y_i^0. This additional assumption implies that the choice of receiving TCS assistance is independent of the values of export without TCS assistance, i.e., $E[y^0 \mid \omega] = E[y^0]$, in which case the problem is basically assumed away.

A weaker version of the assumption is "ignorability of treatment" that assumes that ω_i and y_i^1 are only independent after conditioning on a set of covariates **x,** or more generally,

$$E[y^0 \mid \mathrm{x}, \omega] = E[y^0 \mid \mathrm{x}] \tag{1}$$

and

$$E[y^1 \mid \mathbf{x}, \omega] = E[y^1 \mid \mathbf{x}] \tag{2}$$

Essentially, this means, conditional on observable **x**-covariates, y_i^1 and y_i^0 are mean independent of ω_i, for all exporters *i*. Therefore, under this weaker assumption, we can estimate the sample analog to:

$$\mathrm{ATE} = E[y^1 - y^0 \mid x], \text{ and}$$

$$\mathrm{ATT} = E[y^1 - y^0 \mid x, \omega = 1].$$

By applying the weak "ignorability" assumption both ATE and ATT become estimable, in the sense that we can make direct comparisons of export performance between TCS clients and non-TCS clients based on the observable **x**-covariates.

There are different ways to carry out the conditioning covariates—see Wooldridge (2002) for an extensive discussion. We perform propensity score matching estimators as a

robustness check, but in the benchmark case, we regress the value of exports y_i, or another outcome variable of interest, on ω_i, $\mathbf{x}$ and $\omega_i(\mathbf{x}-\bar{\mathbf{x}})$ such that the estimating equation is,

$$E[y \mid \omega, \mathbf{x}] = \gamma + \alpha\omega + \mathbf{x}\boldsymbol{\beta} + \omega(\mathbf{x} - \psi)\delta \tag{3}$$

where $\psi \equiv E[\mathbf{x}]$.

The introduction of the demeaned term $(\mathbf{x} - \psi)$ into the estimating equation allows for a straightforward recovering of the ATE and ATT after conditioning on the **x**-covariates. The estimated regression coefficient of ω_i, $\hat{\alpha}$ measures the ATE effect—the population average effect of treatment relative to not being treated. To calculate the ATT effect—the same estimate, but only for the firms that actually opted for treatment—we need to control for the fact that treated firms might differ from average firms in terms of observables. It can be calculated as,[8]

$$ATT = \hat{\alpha} + \left(\sum_{i=1}^{N} \omega_i\right)^{-1} \left[\sum_{i=1}^{N} \omega_i (\mathrm{x}_i - \bar{\mathrm{x}})\hat{\delta}\right] \tag{4}$$

Finally, we can calculate the ATE given **x**, which shows the average treatment effect on a given level of **x** as the following,

$$ATE(\mathrm{x}) = E[y^1 - y^0 \mid \mathrm{x}] = \hat{\alpha} + (\mathrm{x} - \bar{\mathrm{x}})\hat{\delta} \tag{5}$$

This measures the additional benefits of treatment, on top of the estimated $\hat{\alpha}$. Through the cross term (given **x**-covariates and $\omega = 1$), we can evaluate which group of TCS clients benefits most from TCS assistance.

[8] This boils down to averaging the interaction terms only over the sample of treated firms, evaluating the **x**-covariates at the appropriate values for the treated firms (which will not generally average to the total sample average and hence not drop out).

We assess the impact of export promotion on Canadian exporter performance using five specifications of equation (3) while using the value of total exports per firm in a given year as an dependent variable, except as noted below in specifications 4), 6a) and 6b). Each specification includes the same **x**-covariates except for the treatment variable, which varies as follows:

1) The concurrent effect of TCS on the values of exports. The treatment variable under this specification, *TCS*, is a dummy variable that indicates if an exporter had received TCS assistance in the current year.
2) The lagged effect of TCS on the values of exports. The treatment variable under this specification, *TCSlag*, is a dummy variable that indicates if an exporter received TCS assistance in the preceding year.
3) The lingering effect of TCS on the value of exports. The treatment variable under this specification, *TCSever*, is a dummy variable that indicates if an exporter received TCS assistance in any of the years preceding the current period, but not in the current period.
4) The location effect of TCS on the value of exports. The treatment variable, *TCSloc*, indicates if an exporter received concurrent TCS assistance from a post in the market or markets to which it exported. The estimated export promotion effect in this case represents the effect of TCS assistance received at posts, while the impact of the assistance provided in Canada is excluded in this specification.
5) The panel fixed effect model. This specification uses the panel fixed effect model as a robustness check to control for possible unobservable firm characteristics in the panel data setup that are by definition not captured in the **x**-covariates. Failing to control for unobservable firm characteristics could result in correlation in error terms and bias the results. The panel fixed effect model is only applied to exporters who export consecutively at least for two years. This reduces the sample size significantly compared to other pooled regressions. Further, the estimation result is expressed as the impact of the TCS on the growth rather than the level of exports and is therefore not directly comparable to the results

from the other specifications. The treatment under this specification, *TCS*, is a dummy variable that indicates if an exporter had received TCS assistance in the current year.

We next assess the impact of export promotion services on market and product diversification:

6a) The market diversification effect of TCS. In this case the treatment variable is *TCS*, but the dependent variable is the number of markets served by the exporter, rather than the value of total exports by that exporter.

6b) The product diversification effect of TCS. In this case, the treatment variable is *TCS*, but the dependent variable is the number of products exported by the exporter, rather than the value of total exports by that exporter.

We also assess the impact of export promotion services controlling for the possibility of spillovers from the export activity of peer exporters, and using non-parametric techniques:

7) The effect of TCS controlling for peer influence. In this specification, we use the treatment variable *TCSlag* and include a control that is equal to the lagged total export value of fellow exporters that export to the same destination as the exporter in the current year.

8) The effect of TCS evaluated with non-parametric techniques. Finally, we apply propensity score matching using the kernel matching algorithm as a robustness check to further validate the ATE estimation results.

All **x**-covariate variables are organized at the firm level in a given year. They include the age of enterprise, number of export products, number of export markets, number of employees, lagged value-added productivity and years of export experience.

Age of enterprise is the number of years of business operation; it is calculated as the difference between the observation year and the year the exporter registered as a business in Canada.

The number of export products is the number of different products (as defined by the 10-digit Harmonized System) that an exporter exports in an observation year.

The number of markets is the number of different countries to which an exporter exports in an observation year.

An exporter's value-added productivity in an observation year is calculated by dividing the value-added by the number of employees. We chose to use lagged productivity in the regression analysis because there is a possible endogeneity issue with productivity[9].

Years of export experience is calculated as the difference between the observation year and the year that the exporter began to export. As noted above, years of export experience for all exporters equals zero in the first year of our data; for new entrants during the sample period, it equals zero in the first year of exporting.

To capture the possibility of diminishing returns of explanatory factors, we include the quadratic terms of **x**, except for productivity. Diminishing returns would be indicated by a negative coefficient on the quadratic version of the explanatory variable (a positive coefficient would of course indicate increasing returns).

4. Empirical Results

In this section, we describe and discuss the empirical results obtained using the different specifications and the alternative empirical strategies described above. We organize this discussion in seven subsections following the numbering at the end of the previous section.

4.1 The concurrent effect of TCS on export values

Table 17a provides the regression results for the concurrent effect of export promotion services (*TCS*) on export values. The coefficient of the variable *TCS* in the regression is equal to the estimated ATE, in this case, 0.165. This indicates that,

[9] Endogeneity arises from the possibility that more productive firms choose to export (self-selection effect), and in turn firms improve their productivity through exporting (learning by exporting effect). Sorting out these two effects is the subject of an extensive literature. See Wagner (2007) for a recent survey.

conditioned on all **x**-covariates, the average value of exports for firms that received assistance is 17.9 percent (17.9= (exp(0.165)−1)*100) higher than those that had not received assistance. It should be noted that the reported ATE coefficient captures more than the concurrent effect. For instance, for exporters that received the assistance continuously over the sample period, the estimated ATE coefficient might capture both the concurrent and any lagged effects (it will be shown later that the lagged effect is stronger than the current effect).

The calculated ATT is averaged only across the assisted exporters. It includes the average deviations for this group from the population means of the **x**-covariates, as treatment effects vary with differing characteristics. The ATT of 0.148 implies a 16 percent boost to exports (16.0 = (exp(0.148)−1)*100), not very different from the estimated ATE effect.

The following summarizes the additional benefits of TCS given particular values of the **x**-covariates, namely the treatment effect plus the interaction terms as expressed in (5). This calculation will tell us which groups of TCS clients benefit most from TCS assistance. The ATE given values of **x**-covariates is:

- increasing with the age of enterprise—thus the positive effect of TCS assistance is larger for clients with more years of business operation experience compared to younger clients;
- increasing with the number of employees—so the effect of TCS assistance is greater for larger-size clients;
- decreasing with the number of markets—thus TCS assistance is more effective for exporters serving fewer destinations;
- decreasing with the number of products—so exporters with few products benefit more from TCS assistance than assisted exporters with a small number of products; and
- decreasing with lagged productivity and export experience—thus TCS assistance is stronger for exporters with lower productivity and less export experience.

We find the decreasing effect of TCS for exporters with a greater number of markets or products to be intuitively plausible. This indicates that firms with already a wide export portfolio stand to benefit less from the programs. We provide

evidence below that TCS support is particularly helpful to diversify exports (see section 4.5).

Table 17a: Regression Results with Treatment Variable *TCS*

Variable	Estimated Coefficient	Standard Error
TCS	0.165[a]	0.027
Age of enterprise	–0.087[a]	0.018
(Age of enterprise)^2	–0.023[a]	0.005
Number of products	1.858[a]	0.012
(Number of products)^2	–0.196[a]	0.004
Number of markets	0.351[a]	0.017
(Number of markets)^2	0.077[a]	0.007
Number of employees	0.090[a]	0.009
(Number of employees)^2	0.034[a]	0.001
Lagged Productivity	0.081[a]	0.004
Export experience	0.140[a]	0.015
(Export experience)^2	–0.002[b]	0.001
TCS*Age of enterprise	0.107	0.069
TCS* (Age of enterprise)^2	0.012	0.017
TCS* Number of products	–0.320[a]	0.046
TCS* (Number of products)^2	0.067[a]	0.011
TCS* Number of markets	0.083[c]	0.049
TCS* (Number of markets)^2	–0.033[b]	0.015
TCS* Number of employees	0.081[b]	0.033
TCS* (Number of employees)^2	–0.006	0.004
TCS* Lagged Productivity	–0.003	0.013
TCS* Export experience	–0.207[a]	0.057
TCS* (Export experience)^2	0.002	0.002

Source: Authors' calculations. Note that variables ending in superscript "2" are entered in quadratic form. Note also that a, b and c represent significance levels of 1 percent, 5 percent and 10 percent, respectively.

Table 17b: Treatment Effects for Concurrent TCS Support

	Coefficient	Export Gain
Average Treatment Effect (ATE)	0.165	17.9%
Average Treatment Effect on the Treated (ATT)	0.148	16.0%

Source: Authors' calculations.

4.2 The lagged effects of TCS on export values

We now examine the effect of TCS assistance received in the preceding year on the value of exports in the current year, after controlling for TCS assistance received in the current year. We interact the treatment variables *TCS* and *TCSlag* with the current and lagged values of the **x**-covariates respectively. This allows us to isolate the effect of *TCSlag*[10]**.** The estimated results based on *TCS* and *TCSlag* are listed in Table 18a. Table 18b provides the summary treatment effect results.

The estimation results show that assistance received in a previous year increases clients' exports by 12.4 percent (12.4=(exp(0.117)−1)*100) compared to non-clients. The estimated coefficient for the current year is only 0.052, which indicates that TCS assistance received in a preceding year has a stronger effect on current exports than does concurrent assistance, at least if assistance is ongoing. This suggests that it takes time for the full effect of TCS to be realized: i.e., an exporter that received TCS assistance last year can expect a stronger boost in export values this year.

However, the lagged effect and current effect reported here are not additive; hence we cannot calculate the cumulative effect of TCS assistance. The estimation includes firms that received assistance only in the previous period, only in the current period, or in both periods. We would need to isolate at least two of these three groups to identify both TCS coefficients. As a result, the estimation does not solely trace back any assistance received in the preceding periods. As in the previous specification for the concurrent effect, the estimated coefficient here represents a combination of current and lagged TCS effects. What we learn from this is that the effect of TCS builds with time.

[10] The treatment variables for lagged two and three periods have been included in the estimation but this approach results in a singular matrix and OLS estimates could not be calculated.

Table 18a: Regression Results with Two Treatment Variables *TCS* and *TCSlag*

Variable	Estimated Coefficient	Standard Error
TCS	0.052	0.038
TCSlag	0.117[a]	0.029
Age of enterprise	−0.679[a]	0.133
(Age of enterprise)^2	−0.114[c]	0.060
Number of products	1.480[a]	0.018
(Number of products)^2	0.156[a]	0.006
Number of markets	0.294[a]	0.025
(Number of markets)^2	0.045[a]	0.011
Number of employees	0.026	0.061
(Number of employees)^2	0.024[a]	0.007
Lagged Productivity	0.061[a]	0.008
Export experience	−1.943[a]	0.115
(Export experience)^2	−0.009[a]	0.003
Lagged Age of enterprise	0.357a	0.078
(Lagged Age of enterprise)^2	0.119	0.054
Lagged Number of products	0.344a	0.018
(Lagged Number of products)^2	−0.044a	0.007
Lagged Number of markets	−0.068[a]	0.026
(Lagged Number of markets)^2	0.065[a]	0.012
Lagged Number of employees	0.064	0.061
(Lagged Number of employees)^2	0.011[c]	0.007
Lag2 Productivity	0.029[a]	0.007
Lagged Export experience	0.945[a]	0.071
(Lagged Export experience)^2	0.380[a]	0.045
TCS*Age of enterprise	0.324[b]	0.145
TCS* (Age of enterprise)^2	−0.049	0.032
TCS* Number of products	−0.230[a]	0.057
TCS* (Number of products)^2	0.051[a]	0.014
TCS* Number of markets	0.106[c]	0.060
TCS* (Number of markets)^2	−0.030	0.019
TCS* Number of employees	0.058	0.045
TCS* (Number of employees)^2	−0.009	0.006
TCS* Lagged Productivity	−0.005	0.018
TCS* Export experience	−0.043	0.153
TCS* (Export experience)^2	−0.001	0.004
TCSlag* Lagged Age of enterprise	−0.007	0.087
TCSlag* (Lagged Age of enterprise)^2	0.029	0.022
TCSlag* Lagged Number of products	−0.199[a]	0.058
TCSlag* (Lagged Number of products)^2	0.036[b]	0.015
TCSlag* Lagged Number of markets	0.039	0.059
TCSlag* (Lagged Number of markets)^2	−0.023	0.020
TCSlag* Lagged Number of employees	0.056	0.046
TCSlag* (Lagged Number of employees)^2	0.001	0.006
TCSlag* Lag2 Productivity	−0.023	0.017
TCSlag* Lagged Export experience	−0.177	0.122
TCSlag* (Lagged Export experience)^2	0.045	0.068

Sources and notes: See Table 17a.

We again calculate the effect of ATE for given values of the **x**-covariates. We find that the ATE results given **x**-covariates with the presence of lagged effects have the same signs as those we found for the concurrent effect estimation. The TCS-assisted exporters with the following characteristics benefit more from TCS assistance: older, less efficient, and larger firms with little exporting experience that exported fewer products to fewer export destinations.

The calculated ATT is again very close to the ATE (see Table 18b).

Table 18b: Treatment Effects with Two Treatment Variables *TCS* and *TCSlag*

	Coefficient	Export Gain
Average Treatment Effect (ATE)	0.117	12.4%
Average Treatment Effect on the Treated (ATT)	0.119	12.6%

Source: Authors' calculations.

4.3 The lingering effect of TCS on export values

Next we examine how previously received TCS assistance affects the performance of an exporter on a longer-term basis—i.e., we look at the effect of all TCS assistance received previously on exporter performance in all following years. In this estimation, we define a new treatment variable *TCSever* that is equal to one when an exporter had received TCS assistance at least once in any of the preceding years, and zero otherwise. This estimation only includes exporters that are active in the export market more than one year over the sample period. Table 19a lists the regression results for the specifications with the treatment variable *TCSever*. The estimated coefficient of *TCSever* is positive and highly significant; this suggests that TCS assistance received at any time in the (recent) past has a lingering effect, boosting exports on average by around 25.6 percent (25.6 =(exp(0.228)−1)*100) compared to comparable firms that had never received TCS assistance.

Table 19a: Regression Results with Treatment Variable *TCSever*

Variable	Estimated Coefficient	Standard Error
TCSever	0.228[a]	0.018
Age of enterprise	–0.094[a]	0.018
(Age of enterprise)^2	–0.025[a]	0.005
Number of products	1.864[a]	0.013
(Number of products)^2	–0.196[a]	0.005
Number of markets	0.339[a]	0.019
(Number of markets)^2	0.087[a]	0.008
Number of employees	0.095[a]	0.009
(Number of employees)^2	0.030[a]	0.001
Lagged Productivity	0.080[a]	0.004
Export experience	0.132[a]	0.016
(Export experience)^2	–0.001[b]	0.001
TCSever*Age of enterprise	0.214[a]	0.055
TCSever* (Age of enterprise)^2	–0.017	0.013
TCSever* Number of products	–0.285[a]	0.033
TCSever* (Number of products)^2	0.046[a]	0.009
TCSever* Number of markets	0.013	0.037
TCSever* (Number of markets)^2	–0.030[b]	0.013
TCSever* Number of employees	0.104[a]	0.025
TCSever* (Number of employees)^2	0.000	0.003
TCSever* Lagged Productivity	–0.003	0.01
TCSever* Export experience	–0.122[a]	0.045
TCSever* (Export experience)^2	0.001	0.002

Sources and notes: See Table 17a.

In this specification, the estimated ATE coefficient for the population is greater than the corresponding coefficients estimated for the concurrent or the lagged effects. This is primarily because the specification is applied only to continuing exporters. The estimated lingering effect of TCS may include overlapping lagged TCS effects if an exporter had received assistance multiple times prior to the current year.

The calculated ATT of 0.202 (Table 19b) is marginally smaller than, but still very close to, the estimated ATE effect.

Table 19b: Treatment Effects with *TCSever*

	Coefficient	Export Gain
Average Treatment Effect (ATE)	0.228	25.6%
Average Treatment Effect on the Treated (ATT)	0.202	22.4%

Source: Authors' calculations.

We again calculate the effect of ATE for given values of the **x**-covariates. We find that the ATE results given **x**-covariates for the specification of lingering effects have the same signs as those we found in other specifications. The TCS-assisted exporters with the following characteristics benefit more from TCS assistance: older, less efficient, and larger firms with little exporting experience that exported fewer products to fewer export destinations.

We repeated the regression of *TCSever* but including two additional variables, *Times of TCS* which represents the number of times an exporter had received TCS assistance before the observation year, and *Years since first TCS* which represents the number of years since an exporter first received TCS assistance. As neither variable is found to be significant statistically and the coefficient estimates are little changed, we do not report the results, but they are available upon request.

4.4 Location effect of TCS on export values

We now test the effect of the location at which TCS assistance is obtained. The treatment variable is a dummy variable, *TCSloc,* that takes on a value of one only if an exporter received concurrent TCS assistance from a post in the market or markets to which it exported. The results of these regressions are provided in Tables 20a and 20b.

The estimated export promotion effect in this case represents the combined effect of TCS assistance and the location effect. As before, the coefficient is positive and highly significant. Receiving TCS assistance in the destination market boosts exports by about 19.2 percent (19.2=(exp(0.176)-1)*100) compared to comparable exporters without TCS assistance. As would be expected, the estimated TCS effect with the presence of the location effect is larger than the general effect reported in Table 17 as the assistance is now tied to an export flow to a market.

The ATE effect under this specification is stronger than the ATT effect, compared to the previous specifications. These

estimates suggest that firms already exporting to a foreign market would benefit more from TCS assistance at the posts in that country than they might realize. The effect for non-clients would be higher than for the clients that already take advantage of the services.

Table 20a: Regression Results with *TCSloc*

Variable	Estimated Coefficient	Standard Error
TCSloc	0.176[a]	0.038
Age of enterprise	–0.077[a]	0.017
(Age of enterprise)^2	–0.025[a]	0.004
Number of products	1.854[a]	0.012
(Number of products)^2	–0.193[a]	0.004
Number of markets	0.346[a]	0.017
(Number of markets)^2	0.077[a]	0.007
Number of employees	0.097[a]	0.009
(Number of employees)^2	0.032[a]	0.001
Lagged Productivity	0.077[a]	0.004
Export experience	0.126[a]	0.015
(Export experience)^2	–0.001[b]	0.001
TCSloc*Age of enterprise	0.044	0.087
TCSloc* (Age of enterprise)^2	0.029	0.021
TCSloc* Number of products	–0.551[a]	0.060
TCSloc* (Number of products)^2	0.087[a]	0.013
TCSloc* Number of markets	0.276[a]	0.061
TCSloc* (Number of markets)^2	–0.073[b]	0.017
TCSloc* Number of employees	0.085[b]	0.040
TCSloc* (Number of employees)^2	–0.001	0.005
TCSloc* Lagged Productivity	0.070[a]	0.017
TCSloc* Export experience	–0.118[c]	0.071
TCSloc* (Export experience)^2	–0.002	0.003

Sources and notes: see Table 17a.

Table 20b: Summary Treatment Effect Results, *TCSloc*

	Coefficient	Export Gain
Average Treatment Effect (ATE)	0.176	19.2%
Average Treatment Effect on the Treated (ATT)	0.115	12.2%

Source: Authors' calculations.

We again calculate the effect of ATE for given values of the **x**-covariates. We find that the ATE results given **x**-covariates have the same sign as those we found in other specifications.

The TCS-assisted exporters with the following characteristics benefit more from TCS assistance: older, less efficient, and larger firms with little exporting experience that exported fewer products to fewer export destinations.

In summary, the four specifications presented above show that the effect of TCS assistance on exporter performance is consistently positive. Each specification provides an insight into the TCS impact from a different perspective. The lingering effect estimation is applied only to continuous exporters. The lagged effect estimation reports the lagging effect, but it is not additive to the current effect. The location effect estimation is designed to identify the effect of assistance received only at the destination market. Given these limitations, we prefer the first one—the concurrent effect as it captures both the current effect and some lagged effects.

The estimation results show that controlling for firm-level characteristics, exporters that receive TCS assistance, on average, export 17.9 percent more than those that do not receive assistance. We also show, through the lagged effect estimation, that the effects of TCS assistance build up with time. The assistance received in the preceding year has a stronger effect on current exports than current assistance. Once TCS assistance starts to influence export performance, the effect can continue to provide benefits as long as the exporter continues to export.

We also show that regardless of which treatment variable is considered, the TCS-assisted exporters with the following characteristics benefit more from TCS assistance: older, less efficient, and larger firms with little exporting experience that exported fewer products to fewer export destinations.

4.5. The firm fixed effects model

In this specification, we examine the effect of TCS received in the current year on the growth of exports in the following year. The specification is only applied to a group of exporters who export consecutively at least for two years. As a result, the sample size in this specification is significantly smaller than those in pooled regressions. The estimation is implemented by

using the panel fixed effect model to control for unobservable factors that do not change over time, and that are not captured by specified x-covariates in the data setup. With this specification, TCS is assumed to have the same effect for each firm and the effect is constant over time. Further, the weak ignorability assumption required in the pooled regression is no longer needed in the panel data setup, as unobserved time constant factors are assumed to be cancelled out in the growth calculation. Table 21 shows the estimation results of the panel regression.

Table 21: Panel Regression Results with Treatment Variable *TCS*

Variable	Estimated Coefficient	Standard Error
TCS	0.046[b]	0.018
Age of enterprise	–0.082[a]	0.018
(Age of enterprise)^2	–0.016	0.014
Number of products	1.158[a]	0.010
(Number of products)^2	–0.095[a]	0.004
Number of markets	0.330[a]	0.014
(Number of markets)^2	0.057[a]	0.006
Number of employees	0.151[a]	0.040
(Number of employees)^2	−0.039	0.004
Lagged Productivity	0.050[a]	0.004
Export experience	0.011	0.010
(Export experience)^2	–0.006[a]	0.001
TCS*Age of enterprise	−0.003	0.046
TCS* (Age of enterprise)^2	0.012	0.011
TCS* Number of products	–0.063[b]	0.031
TCS* (Number of products)^2	0.010	0.008
TCS* Number of markets	−0.013	0.032
TCS* (Number of markets)^2	–0.002	0.011
TCS* Number of employees	−0.026	0.026
TCS* (Number of employees)^2	0.003	0.003
TCS* Lagged Productivity	0.001	0.009
TCS* Export experience	0.002	0.032
TCS* (Export experience)^2	0.002[c]	0.001

Source: Authors' calculations. Note that variables ending in superscript "2" are entered in quadratic form. Note also that a, b and c represent significance levels of 1 percent, 5 percent and 10 percent, respectively.

The estimated ATE in the panel regression is 0.046, which indicates, conditional on x-covariates, that exports by exporters

who received assistance grew on average 4.7 percentage points faster (4.7=(exp(0.046)-1)*100) than those of exporters who did not receive assistance. As in the case of the level comparison in the concurrent effect estimation, the estimated ATE coefficient may capture more than just the current effect, as some exporters might receive assistance consecutively over the sample period.

4.6 Export Markets and Products

The summary statistics at the start of the paper indicated that Canadian exporters have diversified in terms of serving, on average a greater number of markets but that there has been little evidence of a trend towards greater diversification of the product palette. We now extend our analysis to examine the impact of TCS on export diversification in terms of number of markets and number of products, or the extensive margin of trade. This is a narrowly defined "extensive margin of trade" in the sense that it captures only the diversification of existing exporters into other markets or other products, which translates into a higher average number of markets or products. It does not include the new entries from non-exporters to new exporters[11] or from non-tradable products to tradable products. The regressions in Tables 22a and 22b inform us on the effect of TCS assistance on market and product diversification of only those firms that were exporters in the reference period of our dataset.

The estimated coefficient of the treatment variable is larger in both cases, indicating the TCS has a positive impact on both market and product diversification. The coefficient is larger when the dependent variable is the number of export markets rather than the number of products, consistent with the observation that product diversification has not been as dynamic as market diversification[12]. Exporters that accessed TCS

[11] This reflects a basic limitation of our dataset; firms that sought out TCS assistance but did not become exporters may not be captured in our dataset as the TCS data could not then be linked to the Exporter Register data. See notes to Table 9.

[12] Clearly, production technology will play a role as it will be a lot harder for many firms to export different products than to export to different markets.

assistance export on average to 35.7 percent more markets than comparable exporters that did not access TCS services (35.7 = (exp(0.305)−1)*100). Similarly, exporters with TCS assistance export on average 15.5 percent more products than comparable exporters without assistance (15.5 = (exp(0.144)−1)*100).

Table 22a: Regression Results: Market and Product Diversification as Dependent Variables

Variable	Dependent Variable: Number of Markets		Dependent Variable: Number of Products	
	Estimated Coefficient	Standard Error	Estimated Coefficient	Standard Error
TCS	0.305[a]	0.008	0.144[a]	0.013
Age of enterprise	0.042[a]	0.006	–0.008	0.008
(Age of enterprise)^2	–0.013[a]	0.001	–0.010[a]	0.002
Number of products	0.074[a]	0.004		
(Number of products)^2	0.083[a]	0.001		
Number of markets			0.713[a]	0.008
(Number of markets)^2			–0.068[a]	0.003
Number of employees	–0.025[a]	0.003	0.086[a]	0.004
(Number of employees)^2	0.010[a]	0.000	0.013[a]	0.001
Lagged Productivity	0.024[a]	0.001	0.053[a]	0.002
Export experience	0.045[a]	0.005	–0.028[a]	0.008
(Export experience)^2	0.003[a]	0.000	0.002[a]	0.000
TCS*Age of enterprise	0.103[a]	0.023	–0.009	0.034
TCS* (Age of enterprise)^2	–0.028[a]	0.006	0.01	0.008
TCS* Number of products	0.263[a]	0.014		
TCS* (Number of products)^2	–0.034[a]	0.004		
TCS* Number of markets			–0.123[a]	0.023
TCS* (Number of markets)^2			0.030[a]	0.007
TCS* Number of employees	0.048[a]	0.011	0.083[a]	0.017
TCS* (Number of employees)^2	–0.007[a]	0.001	–0.003[c]	0.002
TCS* Lagged Productivity	–0.008[c]	0.004	0.035[a]	0.007
TCS* Export experience	0.185[a]	0.019	–0.088[c]	0.028
TCS* (Export experience)^2	–0.001[c]	0.000	0.001	0.001

Table 22b: Treatment Effects, Market and Product Diversification as Dependent Variables

	Market Diversification		Product Diversification	
	Coeff.	Export Gain	Coeff.	Export Gain
Average Treatment Effect (ATE)	0.305	35.7%	0.144	15.5%
Average Treatment Effect for the Treated (ATT)	0.442	55.6%	0.189	20.8%

These two specifications show some interesting results in terms of the ATE, given particular values of the **x**-covariates. If an exporter is market-diversified, TCS assistance is particularly advantageous in terms of expanding product diversification. Similarly, if an exporter is product-diversified, TCS assistance is helpful in diversifying markets. In other words, TCS is beneficial to extending one dimension of export performance if an exporter is already diversified on the other dimension.

Unlike the results in the previous sets of regressions using value of exports as the dependent variable, here ATT is larger than ATE in both specifications. The mean effect on those exporters that actually received TCS assistance is stronger than what it would have been on the general population of exporters. This is consistent with the diversifying effects discussed above. Selecting into treatment is not random. Firms that have a high market concentration and opt for TCS support see a large effect in that dimension; similar effects hold for the product dimension.

4.7 Peer Influences

In the following estimation, we examine whether the effect of TCS is reduced if we control for the influence of other exporters (peer influences). To this end, we first identify all the exporters that export to the same market destination as the exporter in each observation at time *t*. Then we construct a variable that equals the sum of the lagged export value of these peer exporters. By including the value of exports by peer exporters in the preceding period, we control for the spillover effect from peers. For treatment variables, we include both *TCS* and *TCSlag.* Tables 23a and b show the regression results.

Table 23a: Regression Results, Controlling for Peer Influence

Variable	Estimated Coefficient	Standard Error
TCS	0.079[b]	0.038
TCSlag	0.136[a]	0.029
Lagged Total Export of Peer Exporters	0.099[a]	0.003
Age of enterprise	−0.704[a]	0.132
(Age of enterprise)^2	0.376[a]	0.078
Number of products	1.463[a]	0.018
(Number of products)^2	−0.151[a]	0.006
Number of markets	0.375[a]	0.025
(Number of markets)^2	0.022[b]	0.011
Number of employees	0.029	0.061
(Number of employees)^2	0.023[a]	0.007
Lagged Productivity	0.063[a]	0.008
Export experience	−1.909[a]	0.114
(Export experience)^2	−0.010[a]	0.002
Lagged Age of enterprise	0.376[a]	0.078
(Lagged Age of enterprise)^2	0.090[c]	0.053
Lagged Number of products	0.303[a]	0.018
(Lagged Number of products)^2	−0.037[a]	0.007
Lagged Number of markets	−0.046[c]	0.025
(Lagged Number of markets)^2	0.056[a]	0.012
Lagged Number of employees	0.038	0.061
(Lagged Number of employees)^2	0.014[b]	0.007
Lag2 Productivity	0.030[a]	0.007
Lagged Export experience	0.922[a]	0.070
(Lagged Export experience)^2	0.381[a]	0.045
TCS*Age of enterprise	0.320[b]	0.145
TCS* (Age of enterprise)^2	−0.048	0.032
TCS* Number of products	−0.247[a]	0.058
TCS* (Number of products)^2	0.052[a]	0.014
TCS* Number of markets	0.072	0.060
TCS* (Number of markets)^2	−0.019	0.019
TCS* Number of employees	0.051	0.045
TCS* (Number of employees)^2	−0.009	0.006
TCS* Lagged Productivity	−0.007	0.018
TCS* Export experience	−0.054	0.152
TCS* (Export experience)^2	−0.001	0.004
TCS* Lagged Total Export of Peer Exporters	0.000	0.012
TCSlag* Lagged Age of enterprise	−0.012	0.087
TCSlag* (Lagged Age of enterprise)^2	0.030	0.022
TCSlag* Lagged Number of products	−0.220[a]	0.058
TCSlag* (Lagged Number of products)^2	0.040[a]	0.015
TCSlag* Lagged Number of markets	0.015	0.059
TCSlag* (Lagged Number of markets)^2	−0.015	0.020
TCSlag* Lagged Number of employees	0.049	0.046
TCSlag* (Lagged Number of employees)^2	0.002	0.006
TCSlag* Lag2 Productivity	−0.024	0.017
TCSlag* Lagged Export experience	−0.175	0.122
TCSlag* (Lagged Export experience)^2	0.046	0.068

Source and notes: See Table 17a.

Table 23b: Treatment Effects, Controlling for Peer Influence

	Coefficient	Export Gain
TCSlag Average Treatment Effect (ATE)	0.136	14.6%
TCSlag Average Treatment Effect for the Treated (ATT)	0.123	13.1%

The estimated coefficient for the value of exports by peer exporters is positive and significance, which indicates the presence of the influence of peer exporters. The lagged TCS assistance is also positive and significant, which means an exporter with TCS assistance in the preceding year exports on average 14.6 percent more than one without assistance that year. (14.6% = (exp(0.136)−1)*100). Surprisingly, the estimate of *TCSlag* with a control for peer influence is even higher than the earlier estimate without the control for peer influence reported in Table 18a (12.4 percent). Thus, controlling for peer influence, the effect of lagged TCS assistance does not disappear or decline; in fact, it becomes marginally higher.

The estimated ATE coefficient is equal to 0.136 and that for ATT is 0.123. The mean effect of lagged TCS assistance relative to the whole population of exporters is similar to the mean effect on the treated, given their specific characteristics.

The ATE results given **x** with the presence of peer influence have the same signs as those we found for the lagged effect estimation.

4.8 Non-parametric Estimation

In this section, we apply a non-parametric method—propensity score matching—as an alternative estimation approach to validate our treatment effects estimates obtained using regression analysis. Propensity score matching was developed to reduce the potential for bias in estimating treatment effects by identifying a suitable untreated control group with similar characteristics to the treated group (Rosenbaum and Rubin, 1983). Propensity score matching is carried out in two stages. The first stage is a probit regression that converts all characteristics of the firms in the population into a single index,

the propensity score. In the second stage, each treated subject is matched with an untreated subject based on their respective scores to ensure that the control group has equivalent characteristics other than having received the "treatment". A number of different matching algorithms are available, such as "nearest neighbour", "kernel" and "stratification/ intervals", to name a few (see, for example, Caliendo and Kopeinig, 2005, Figure 2). We chose kernel matching, which has the advantage that good matches receive a heavier weight than poor matches.

We repeat the analysis of each treatment variable with the same set of firm-specific characteristics; the results of all specifications are shown in Table 23.

The recent literature expresses some reservations on the propensity scoring matching approach[13]. If the propensity score estimated in the first stage (probit regression) is parametric, which is necessarily the case with many covariates, the collapsing of all information in the **x**-covariates into a single dimension will not be satisfactory. In particular, a linear or a low order polynomial for the estimation of such scores does not provide good approximation to the conditional expectations $E[y^j \mid \mathrm{x}]$. Nevertheless, this method provides an alternative approach to validate our ATE parametric estimation.

The non-parametric estimation shows consistent results with our parametric estimation. Both ATE and ATT are positive. However, the magnitudes of the effects are higher than those estimated using the parametric method, with TCS clients exporting 54 percent more than comparable non-TCS clients.

Table 24: Propensity Score Matching Estimation

Treatment Variable	ATE		ATT	
	Coefficient	Export Gain	Coefficient	Export Gain
TCS	0.432	54.0%	0.329	39.0%
TCSever	0.270	31.0%	0.243	27.5%
TCSloc	0.507	66.0%	0.313	36.8%

Source: Authors' calculations.

[13] Imbens and Wooldridge (2009) based on a recent review of the literature recommend that this method not be used in practice.

4.9 Caveats

Two cautionary notes should be taken into account in interpreting the results. First, as noted in Section 2, the dataset links TCS clients with the Exporter Register. Therefore, firms that receive TCS services but do not export are excluded. In many cases, this is appropriate in that the service provided could be in support of a commercial activity other than export of merchandise and therefore outside the scope of this study (e.g., export of services, or support for investment abroad). However, there may be cases where service was provided for export of merchandise but no merchandise was exported by the client. In these cases, arguably the dataset should have included these firms with zeros for their export values, as to not do so could bias the result upwards. This issue could be addressed in future work by separating TCS services that are directed at merchandise exports from other services in the client management database and by including firms that receive services aimed at merchandise exports but that do not succeed in making export sales.

Second, as noted in the introduction, the issue of reverse causality must be taken into account in studies of this nature. Unlike controlled experiments where subjects are "blind" in terms of whether they are given the treatment, impact evaluation in economic studies usually involves subjects that are well aware of the purpose of the treatment (for instance, unemployed are given the job training in order to obtain future employment). In our case, clients self-select into treatment—the TCS assistance. There is a potential endogeneity issue that might bias the estimation results upward in the sense that exporters are successful not because of TCS assistance, but because they are more successful exporters.

The average treatment effect estimation adopted in this study is designed to address this type of the endogeneity problem. Firms are self-selected (not randomly) into the "treatment", but the outcome of the treatment is random—firms are not able to predict the outcomes from their treatments. This is the essential element underlying the weak ignorability of treatment

assumption used in our analysis—the independence between treatment and outcome of treatment conditioning on x-covariates. This assumption allows us to compare the performance of exporters who received treatment with that of comparable exporters who never received assistance, conditional upon the x-covariates.

Clearly, the quality of comparisons and treatment effect estimation critically depends on the choice of x-covariates. In our analysis, the choice of x-covariates is guided by economic theory, empirical firm-level research and available data. Research on firm heterogeneity shows that successful exporters are often those with higher productivity, which in turn allows these exporters to bring down destination-specific sunk costs associated with accessing foreign markets. Similarly, the size of firms, the years of exporting experiences, the number of export markets and the number of products are also found to be qualities associated with exporting. Thus, by controlling for these firm-level characteristics, we should be able to ensure comparison of "like" exporters. Nevertheless, it is still possible that there are unobservable firm characteristics influencing the success of exporting firms, leading to biased estimation results.

5. Concluding Remarks

In this paper, we use detailed firm-level data to assess the impact of Canadian Trade Commissioner Service (TCS) programs on Canadian exporter performance. Our results show that TCS assistance has a positive and consistent effect on the value of exports and the growth of exports. Exporters that received assistance, on average, export 17.9 percent more than comparable exporters that never received assistance. Further, the assistance received in the preceding year has a stronger effect on current exports than assistance in the current year. Once TCS assistance starts to influence export performance, the effect can continue to provide benefits as long as the exporter continues to export. The estimated TCS impact that takes into account the location where assistance is received is marginally stronger than the one without considering the location effect.

TCS assistance plays a very strong role in helping firms to diversify into new markets and to introduce new products into export markets, to facilitate transition from mature markets to emerging markets, and to support product innovation by encouraging export sales of new products.

As a robustness check, we examined the effect of TCS received in the current year on the growth of exports in the following year using the panel fixed effect model. We found that clients' exports grew faster than that of non-clients. We further examined whether the effect of TCS is diminished if we control for the influence of other exporters (peer influences). Again, we found that, after controlling for peer influence, the TCS impact remains significant and positive. A second robustness check using an alternative non-parametric method (propensity score matching) corroborates our findings.

Among all TCS-assisted exporters, the following clients tend to benefit more from TCS assistance: older, larger and less productive firms, those with little export experience, and those that export fewer products to fewer export destinations. The age and size indicators suggest export readiness is a factor in how effective TCS assistance is in practice. As well, the benefits of TCS assistance are greater for firms with lower productivity, less export experience, and exporting fewer products to fewer markets, all indicators suggesting a greater need for assistance.

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