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In-firm training, innovation and productivity: The case of Caribbean small island developing states

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IDB WORKING PAPER SERIES Nº IDB-WP-778

In-Firm Training, Innovation and Productivity:

The Case of Caribbean Small Island Developing States

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Abstract*

In-firm training is a crucial innovative activity in modern knowledge-based economies which face increasing global competition and rapidly changing technology. Nevertheless, there are few studies which look at in-firm training in the Caribbean. This study uses the World Bank Enterprise Survey (WBES) 2010 and Compete Caribbean's Productivity Technology Innovation Survey (PROTEqIN) 2014 to provide empirical evidence on in-firm training in the region. The results suggest that there is a relatively low incidence of training in the region, although there are significant differences across countries and this may be because of heterogeneities in public support and barriers to in-firm training. Also, various firm characteristics affect in-firm training, including size, ownership, whether the firm exports, whether the firm is part of a larger organization, innovative activity and workforce structure and educational level. Lastly, the findings suggest that in-firm training in the region may play a relatively small role and may not even matter for innovation and productivity.

JEL classifications: D22, J24, M53

Keywords: In-firm training, Innovation, Productivity, Small Island Developing States (SIDS)

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1. Introduction

In-firm training is a core component of human capital development. Studies have shown that, although formal education is necessary, fostering the appropriate firm and/or industry specific skills, which complement education through in-firm training, may be of even greater importance (OECD, 2010). More specifically, in-firm training is often essential for new graduates who have recently entered the workforce and need specific skills suited to their particular job, which formal education may not provide. Moreover, from the empirical evidence there appears to be a disconnect between the skills the formal education system is providing to young people who make up the largest group of new workers moving from secondary school to the work place and what the market requires in Latin America and the Caribbean (Bassi et al., 2012). The importance of worker skills and training have been emphasized by trade unions, employers and policy makers as a crucial innovative activity in modern knowledge-based economies, which face increasing global competition and rapidly changing technology (Arundel, Bordoy and Kanerva, 2008; and European Commission, 2009). Additionally, existing workers may need their skills improved and upgraded as the firm introduces new equipment and technology in the production process. The extant literature has shown that firms that engage in innovative type activities are more technologically advanced and have higher labor productivity enabling them to better compete internationally (Schumpeter, 1939; Griliches, 1998; Freeman, 1994; Griffith et al., 2006; and Mairesse and Monhen, 2010). Further, there is evidence that investment in innovation results in sustainable long-run growth and development of a country (Hall and Jones, 1999; OECD, 2009a; and Rouvinen, 2002).

Given the importance of in-firm training in the skill development process of workers and firm performance, it may be expected that firms place considerable emphasis on training. However, many employers are usually hesitant to provide training since the benefits of training are not tangible and the cost may outweigh the benefits if workers can take their skills to other firms (Ismail, Noor and Awang, 2008). Moreover, small firms in particular may not have the resources to invest in training and may not be able to afford the down time employees require for training. Additionally, despite the importance of in-firm training to firm performance and innovation and productivity, there is limited empirical evidence on in-firm training, particularly in developing countries. Most of the literature on the returns to investment in human capital focuses on formal education and shows that the accumulation of human capital through formal

education increases wages, innovation and productivity (Moretti, 2004; Bartel, 1995; and Dearden, Reed and Van Reenen, 2006). In contrast, there is relatively less evidence on the accumulation of human capital through in-firm training and factors driving in-firm training, and more specifically, on the effects of such training on innovation and productivity.

In Caribbean Small Island Developing States (SIDS), there appears to be insufficient in-firm training opportunities for persons in the labor market. Based on existing studies, the incidence of training is considerably lower in most Caribbean islands compared to their larger Latin American counterparts. For example, in Grenada, Trinidad and Tobago, and Haiti only 48 percent, 41 percent, and 51 percent of companies, respectively, provided training, compared to an average of 75 percent for Latin America (McArdle, 2004). Another factor to consider is that the population of Caribbean countries is rapidly aging due to declining birth rates. Thus, if Caribbean countries are to meet rapidly changing needs and adopt new technology to increase innovation and productivity, then improvements to the stock of human capital may have to come from skill enhancement of the labor force through in-firm training rather than from entry into the labor force of new generations with higher levels of formal education (McArdle, 2004). Nevertheless, there is limited empirical evidence on in-firm training in the Caribbean. This is not surprising given that there are limited data available on training and its link to innovation and productivity, since labor market and household surveys do not capture the relevant information.

There are two main studies on training in the region and both studies place greater emphasis on public finance training programs and formal education rather than in-firm training. McArdle (2004) assessed to what extent governments, the private sector and unions have succeeded in promoting productivity through public support and in-firm training programs as well as reducing constraints to improve efficiency, quality and relevance of the training. Blom and Hobbs (2008) studied education and training in the Eastern Caribbean and made policy suggestions to improve the employability and competitiveness of the workforce. Given the paucity of data on training in the Caribbean, these studies had to rely on disconnected pockets of data from several sources, such as administrative records of training agencies, firm surveys, household/labor force surveys and sectoral analyses conducted by the International Labour Organization (ILO), the Inter-American Development Bank (IDB) and the World Bank (WB).

More recently, however, there have been two firm-level surveys in the Caribbean, which contain information on in-firm training. The World Bank Enterprise Survey (WBES) was

conducted in 2010 and Compete Caribbean's Productivity Technology Innovation (PROTEqIN) survey was conducted in 2014. Both surveys attempt to provide a representative sample of an economy's private sector and cover a broad range of business topics and performance measures through face-to-face interviews with top managers and business owners. With regard to in-firm training, both surveys provide data on firms which have training programs, the type of worker that received training, public support for training and obstacles to training. From these surveys, many firms in the Caribbean identified inadequate training of the workforce as one of the biggest obstacles to hiring workers and business operations and performance, and as a major constraint to innovation and productivity. Based on data from the WBES, 35 percent of firms in the region identified worker skills as a major constraint to business operations and, based on the PROTEqIN survey, a lack of job-related skills was a major obstacle for 30 percent of firms surveyed when recruiting new employees and for 41 percent of firms for employee productivity.

The objective of this paper is to fill some of the gaps on in-firm training in the Caribbean, using the WBES and the PROTEqIN survey. Specifically the factors that affect a firm's decision to train workers, public support for in-firm training, obstacles to training and the impact of in-firm training on innovation and productivity are investigated. The results suggest that there is a relatively low incidence of training in the region, although there are significant differences across countries, and this may be because of limited public support and several barriers to in-firm training. Additionally, various firm characteristics affect in-firm training, including size, ownership, whether the firm exports, whether the firm is part of a larger organization, whether the firm engages in innovative activity, workforce structure and educational level. Lastly, the findings suggest that in-firm training in the region may play a relatively small role and may even not matter for innovation and productivity.

The paper contains six sections including the introduction. Section 2 is the literature review on in-firm training, innovation and productivity. Details on the methodology and data used are given in Section 3. Section 4 provides the descriptive analysis. Section 5 gives the econometric results. Finally, Section 6 provides the conclusion.

2. Literature Review

2.1. In-firm Training, Innovation and Productivity

A skilled and educated workforce is a key factor for firm innovation and productivity and is critical for a country's long-term economic growth and development (Becker, 1964; Lucas, 1993; and Acemoglu and Pischke, 1998). Empirical studies generally tend to focus on formal education when investigating the impact of human capital on innovation and productivity. However, a significant amount of human capital accumulation takes place after an employee enters the labor market through in-firm training to provide workers with industry-specific skills. In-firm training complements formal education and is probably as important a component of human capital as formal education, or may be of even greater importance, in contributing to innovation and productivity (OECD, 2010). As a matter of fact, Baldwin et al. (1998) found evidence that a lack of training was an important obstacle to innovation for 22 percent of Canadian firms in the communications sector and 30 percent of firms in the business services sector. Baldwin (1999) additionally found that a lack of training for skilled workers was a major impediment to innovation in over 46 percent of Canadian manufacturing firms.

In-firm training provides companies with many advantages over formal education, enabling them to be more innovative and productive. Firms that offer such training are able to decide on and implement the most appropriate and useful skills required to raise innovation and productivity of their workforce. Firms that offer training have employees who can better cope with, and adapt to, fast-changing consumer demand and technology (Bartel and Lichtenberg, 1987). In-firm training increases workers' productivity above their wages, and this benefits the firms (Acemoglu and Pischke, 1999). Furthermore, training guarantees worker access to the latest information and knowledge, thereby increasing the firm's propensity to innovate and, as a result, increases its productivity (Bauernschuster, Falck and Heblich, 2009).

In-firm training may be firm-specific or general in nature (Becker 1964): general training provides a worker with skills that are equally applicable in other firms, while firm-specific training leads to skills that are lost when the trained worker leaves the firm that provided training. Most firms provide and pay for training that is general in nature, although firm-specific training may be more beneficial (Acemoglu and Pischke, 1998). Training may also take the form of job-related skills, personal development or academics. The modality of training may take the form of on-the-job or apprenticeship training, where the worker learns in his/her actual work

environment, and classroom training, where training takes place in a classroom setting through seminars, conferences, workshops and short courses. On-the-job training however, has been shown to have a larger impact on innovation and productivity (Dostie, 2013; Zwick, 2005; Barrett and O'Connell, 2001; Black and Lynch, 1996; and Pischke, 2005).

Firms may use internal staff to carry out training or external consultants and training institutions. In a study on Canadian firms, Baldwin, Gray and Johnson (1997) found that training programs are more likely to be done in-house when a firm is more advanced and has its own R&D facility, when it is foreign-owned, or when it develops its own technologies. In another study on Canadian firms, Baldwin and Peters (1999) demonstrated that innovative firms that used advanced technologies are more likely to use on-the-job or other forms of in-house training than non-technology users. Also, in-firm training costs may be covered by the firm, workers or government or a combination of the three.

In the literature there are numerous factors which affect in-firm training. According to Long et al. (1999) these factors can broadly be divided into job characteristics (occupation, hours worked, part-time versus full-time employment and wages); employee characteristics (age, gender, ethnicity, socio-economic status, education, skill, union membership and motivation); firm characteristics (size, age, ownership, exporter, sector, educational level of workforce and human resource and innovation policy); and macroeconomic and political factors (national unemployment rates, a country's income, government training policy, government assistance for training and public sector training programs). Several studies have looked at these factors using data from developed countries including Long et al. (1999), Blundell, Dearden and Meghir (1996), Groot (1997) and OECD (1999b). These studies have found that large firms operating in high-technology sectors with highly educated workers are more likely to have training programs. Studies on developed countries have also found that manufacturing firms are more likely to invest in training than service firms since manufacturing firms often purchase new equipment and develop new technologies which may require employee training in new skills (Konings 2008). On the other hand, Baldwin (1999) found that training in the services sector is also important, as human resources are critical to a firm's success and innovation relies less on new capital and more on new skills.

Innovative firms are also likely to have higher levels of in-firm training. Baldwin and Johnson (1996) reported that innovative firms that introduce new products and processes place a

larger emphasis on training and generally have higher sales and profit, and Johnson, Baldwin and Hinchley (1997) found that 80 percent of firms that report a product or process innovation have a formal training program. Skill shortages and, consequently, training are generally higher in firms that are more innovative. It is no surprise, then, that the need for training often arises during the innovation process. Baldwin and Da Pont (1996) reported that over 50 percent of innovative firms in the manufacturing sector experienced an increase in their skill requirements as a result of innovation, in particular for the adoption of new technology and equipment. The results of the study also indicated that firms that develop more novel innovations are more likely to require training than those that introduce imitative innovations. Additionally, Baldwin and Sabourin (1996) and Baldwin, Sabourin and Rafiquzzaman (1996) reported that a lack of training was identified as the second most important impediment to technology adoption in manufacturing plants after capital cost and that 39 percent of technology users indicated that either a shortage of skills or training difficulties provided a significant impediment to the introduction of advanced technologies, while 25 percent indicated that skill shortages was the most important impediment. Baldwin, Gray and Johnson (1997) also reported that manufacturing firms that adopt new technologies experience a substantial increase in their training costs.

The level of in-firm training may also affect firm innovation and productivity. Ballot et al (2001), in a study of French and Swedish firms found that in-firm training has a positive impact on productivity. Böheim, Schneewis and Wakolbinger (2009) showed that training has a positive productivity elasticity of 0.04 in Austrian firms. Konings (2008) studied 13,000 Belgian firms and concluded that trained workers are more productive and on-the-job training increased productivity by 1-2 percent. Further, the average output for workers with training is 23 percent higher than those without (Konings and Vanormelingenz, 2009). Groot (1999) found that the elasticity of productivity of training increased by 0.12 for a 140-day training course. Bishop (1994) found that workers who received training from their previous employers were 16 percent more productive. Bartel (1994) estimated that United States (US) firms that provide training programs increased their productivity by 19 percent. Cassidy, Görg and Strobl (2005) found that training increased domestic firms' productivity in Ireland. Ichniowski, Shaw and Prennushi (1997) showed that training improved productivity in US steel mills when combined with a variety of complementary human resource practices.

In a study of 1,900 Danish firms, Laursen and Foss (2003) showed that in-firm, as well as external training positively influences the firm's ability to innovate. Similarly, Zhou, Dekker and Kleinknecht (2011) found evidence that training has a positive impact on firm innovation in the Netherlands and contributed positively to new product sales. Gallié and Legros (2012) used data for 1,000 French firms and found that training has a positive impact on product innovation and patenting activities. In a study of German firms over the period 1997-2001, Bauernschuster, Falk and Heblich (2009) concluded that a 10 percentage-point increase in training intensity translates into a 10 percentage-point increase in the firm's propensity to innovate. González et al. (2012) employed panel data of 10,000 Spanish manufacturing firms for the period 2001-2006 and found that training has a significant positive effect on firm innovation and complements R&D.

There are few studies on in-firm training in developing countries. Tan and Batra (1996) used firm-level data from Colombia, Indonesia, Malaysia, Mexico and Taiwan to investigate training incidence and its impact on productivity. The findings suggest that firms are more likely to train workers when they are large, employ an educated and skilled workforce, invest in R&D and technology licenses, emphasize quality control methods, have foreign capital participation and export to foreign markets. Furthermore, training was found to improve productivity. However, a large and significant impact of training on productivity was found for skilled workers but not unskilled workers, and for internal formal training rather than external training. Van Uden, Knoben and Vermeulen (2014) examined whether the human capital stock of firms and their human resource practices, including in-firm training, positively affected innovative output in Kenya, Tanzania and Uganda using data from the WBES. In-firm training was found to increase the likelihood of a firm being innovative from 23 percent to 47 percent.

There are some limitations to the above studies which examine in-firm training, innovation and productivity. These studies are generally unable to calculate the rate or return on investing in training because of the absence of data on training expenditure and because findings are limited to productivity impacts (Bartel, 2000). In addition, without data on training expenditure it is difficult to compare benefits against costs. Further, the extent to which the results can be interpreted as true productivity impacts depends on the authors' success in correcting for endogeneity, that is, the firm's performance level influences its decision to invest in training, and in some cases the productivity impacts may disappear after endogeneity is corrected. In particular, the cross-sectional approach is unable to address the endogeneity

problem. The use of cross section data are generally not best suited to study cause and effect relationships but assess the significance and intensity of the correlation relationships between the main variables of interest. Further, in studies which use panel data in an attempt to take account of endogeneity the system of equations may not be properly identified (Bartel, 2000). Variables that are used in the training equation and eliminated from the productivity equation could arguably belong to the productivity equation also. The results of this misspecification would be an overestimation of the true effect of training on productivity.

2.2. Caribbean In-firm Training, Innovation and Productivity

There are very few empirical studies on in-firm training, innovation and productivity in the Caribbean. This may be a consequence of the paucity of data available on training and its link to innovation and productivity since labor market and household surveys do not capture the relevant information. Existing studies rely on disconnected pockets of data from several sources such as administrative records of training agencies, firm surveys, household/labor force surveys and sectoral analyses conducted by the International Labour Organization (ILO), the Inter-American Development Bank (IDB) and the World Bank (WB). These studies have examined training in the wider context of human capital development through formal education and public sector training programs together with in-firm training.

Márquez (2002), in a study of training in Latin American and the Caribbean (Belize, Dominican Republic, Haiti and Trinidad and Tobago), stated that the proportion of firms in the region that train workers, firm characteristics and the type of worker that receive training are not very different from developed countries when compared to the United States and Canada. The study found that 3 out of 4 firms train employees and firms that have recently introduced a product or process innovation are about 30 percent more likely to train workers. In terms of factors affecting training, firms in the services sector are more likely to train workers. Also, large firms are more likely to have training programs. Additionally, foreign firms are more likely to have training programs than local firms. Older, more established firms were more likely to train employees, but this factor was minor relative to others. The study also found that family-owned firms are less likely to train workers than professionally run companies. When looking at the type of worker that receives training, more educated and skilled workers were more likely to receive training.

In another study McArdle (2004) showed that an average of 67 percent of firms provided training in the Caribbean (Trinidad and Tobago, 41 percent; Haiti, 54; Dominican Republic, 85 percent; Belize, 65 percent; and Jamaica, 90 percent) compared to an average of 75 percent for Latin America. The paper also compared public sector training programs and in-firm training in the Caribbean and found that training in firms is short term and linked mainly to work routines and tasks when compared to public sector training programs. Furthermore, McArdle (2004) found that the public sector training programs in various Caribbean countries involve close collaboration with firms and even training in firms and may be jointly funded by firms and governments.

In the Caribbean there are some public institutions that support in-firm training. The National Institute for Vocational Training (INFOTEP) in the Dominican Republic carries out its largest proportion of training in firms and assists firms in designing training programs. The Technical and Vocational Education and Training (TVET) Council of Barbados also works closely with firms to carry out training and charges applicants 25 percent of the training costs. It carries out training in a wide range of industries including construction, agriculture, manufacturing, retail, petroleum and hotel and restaurant. In Jamaica, the Human Employment and Resource Training Trust (HEART) and the National Training Agency provide a consultative service to firms to plan and implement customized training programs on a cost-sharing basis with firms paying for the instructional costs and a 3 percent payroll tax. Additionally, special programs are financed to enable in-firm training, especially in start-ups in Information and Communications Technologies (ICT). In Trinidad and Tobago the National Training Agency funds the On-the-Job Training (OJT) program to provide young persons with the opportunity to acquire work experience in the workplace.

In a study of the Eastern Caribbean islands (Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines), Blom and Hobbs (2008) concluded that the population was rapidly aging because of falling birth rates and future improvements in human capital have to come from enhancing the skills of the labor force rather than from new generations entering the labor force with higher education levels. Training for the Eastern Caribbean is also important for innovation and productivity in order for workers to keep up with rapidly changing technology, particularly low and medium-skilled workers. However, the study concluded that there are inadequate training opportunities in the Eastern Caribbean.

The report found that training in these islands was lower than in most Latin American and other Caribbean countries. For instance, in Grenada only 48 percent of firms provided training, compared to an average of 75 percent in Latin America. The report concluded that there is significant potential for training and the government could help through policies and funding and the private sector and trade unions also have an important role to play. In addition, several factors affect in-firm training including sector, firm size, domestic versus foreign ownership and the skill level of workers.¹

The study by Blom and Hobbs (2008) listed several reasons for the low level of training and obstacles to training in the Eastern Caribbean and stated that these factors are similar to factors in larger countries. However, according to Blom and Hobbs (2008) the combined effect in an economy that is small, and thus has many small companies, and that has no formal recognition of training suggests a relatively lower incidence of training in the Eastern Caribbean than elsewhere. Micro and small firms stated that problems identifying training needs, locating training providers, finding the time or replacements and undertaking the paperwork to receive public subsidies as important hindrances to in-firm training. Given that most firms in the Eastern Caribbean are relatively small, overcoming these obstacles is important. The small size of the training market was found to be another key obstacle. Each country has individual trainers, but there are no firms that specialize in training for the private sector compared to larger countries since there is not enough demand for in-firm training. Blom and Hobbs (2008) stated that there is some poaching of skilled workers and migration abroad after workers have been trained. Another major barrier is the formal recognition of training and its applicability in Eastern Caribbean countries. The value of training depends on whether training is recognized and the learned skills are transferrable to other firms. There has, however, been some improvement as the Caribbean Vocational Qualification (CVQ), established in 2007, now formally recognizes job training in Caribbean Community (CARICOM) countries and sets occupational standards.

¹ The incidence of training in manufacturing and service firms were found to be equal. In Grenada it was found that training in tourism and manufacturing were almost the same. In St. Vincent and the Grenadines the financial, communication and air transportation sectors were more likely to offer training to secondary school graduates compared to hotels and restaurants, while manufacturing and construction did not provide any training. Further, the study reported that 65 percent of large firms in Grenada provided training compared to 39 percent of micro firms, while 57 percent of foreign-owned firms offered training, compared to less than 50 percent of domestic firms (Blom and Hobbs, 2008). In Grenada 8 out of every 10 firms provide training to skilled workers, while only 3 out of 10 firms offer training to unskilled workers.

There are also studies on training for individual countries in the Caribbean. Ashton (2000) found that in Barbados larger firms are more likely to provide training: 66.5 percent of larger firms trained workers, compared to 40.4 percent of small firms and 55.8 percent of medium firms. The study also examined the modality of training. The results showed that 98 percent of firms surveyed that carried out training used on-the-job training, 65 percent conferences, 64 percent formal education, 62 percent coaching, 49 percent video training and 34 percent computer-based training. Furthermore, the study reported that 94 percent of the total firms surveyed that conducted training supported external courses, 91 percent supplied books and manuals, 80 percent hired consultants to conduct training and 47 percent invested in internal training. In addition, the study found that over 60 percent of firms provided employees with 5 days of training annually, and this figure was higher (70 percent) for firms in finance and public administration. Half of the firms that provided training led to formal qualification for managers, professional and white collar workers, but only 27 percent for manual workers. Among larger firms, however, 53 percent of firms provided training with formal qualifications for manual workers and 49 percent for managerial staff. Lastly, the majority of in-firm training is determined by requests from supervisors (74 percent of the time) rather than from formal training needs analysis such as business plans (49 percent) or training audits (32 percent).

A World Bank study in 2001 by the Jamaica Employers' Federation (JEF) surveyed 70 public and private sector institutions on training. The study found that over 90 percent of firms provided training, 84 percent of firms reported sending workers on short courses, 80 percent sent employees to conferences and seminars, 38 percent supported long-term formal training and 28 percent provided apprenticeship training. Further, over 90 percent of firms surveyed provided opportunities for employee upgrading to complement existing skills rather than to compensate for deficiencies. The most common areas for training were basic and advanced job-related skills, although there was some emphasis on personal development and academics. The most common skills for which training was provided were technical, team work, computing, and problem-solving. Although foreign language was identified as an important shortcoming, few firms provided this type of training. Firms generally rely on internal training provided by persons employed by the organization than by external trainers. However, for academic training external persons were more frequently used. From the survey, 80 percent of firms were satisfied by their investments in training.

Blank and McArdle (2003) surveyed 99 private firms in addition to using the JEF survey and also found that training in Jamaica was substantial. Moreover, firms undertook a significant share of training costs, as 65 percent of the firms indicated that they fully subsidized the costs of training and less than 10 percent of firms had employees finance 50 percent of the cost. Surprisingly, smaller firms were more likely to provide fully paid training, while larger firms were more likely to partially subsidize training. Firms provided various types of employee development, and the most common was on-the-job training, followed by conferences, seminars and short courses. Based on both surveys, approximately 40 percent of firms did not have formal training policies and training plans. Furthermore, companies that did not have a formal training policy were unlikely to have training plans. Additionally, based on the JEF formal training assessments were carried out in only half of the firms surveyed.

3. Methodology and Data

This study examines in-firm training in 14 Caribbean SIDS using descriptive and econometric analyses. Two sources of data are used: the WBES, which was conducted in 2010, and the PROTEqIN survey, which was carried out by the IDB, in collaboration with Compete Caribbean in 2014. The WBES collects data in every region of the world and uses a standardized survey instrument and a uniform sampling methodology to minimize measurement error and to collect data that are comparable across countries. The sampling methodology generates samples appropriate to benchmark the investment climate of individual countries and to conduct firm performance analyses. It also ensures that the sample is representative of the non-agricultural sector, that is, manufacturing and services. Moreover, sample sizes are large enough for selected industries to conduct robust statistical analyses. The samples are stratified by industry (proportion of businesses) and size (average sales per industrial sector). The PROTEqIN survey was the first of its kind conducted for the Caribbean only, as a follow-up to the WBES. The sample was also stratified by industry and size. It targeted firms used in the WBES in 2010 but in some instances drew additional firms. PROTEqIN includes a number of questions contained in the WBES but also contains a significantly larger number of variables, some of which are related to in-firm training. Most of the questions of interest in both surveys have relatively high response rates. However, in some cases, the PROTEqIN survey offers more complete data. Nevertheless, the main variable of interest used in the econometric analysis, which is whether the firm ran

training programs, has a high response rate from both surveys. Other variables, such as the proportion of skilled versus unskilled production workers that received training, government support for in-firm training and obstacles to in-firm training had relatively lower response rates and were only used in the descriptive analysis.

The use of both surveys allows for better data availability on the variables of interest since one survey may contain a high level of non-response for certain variables or may not have the variable at all. The use of both surveys also allows for cross-checking the results against each other. Both datasets are a firm-level survey of a representative sample of an economy's private sector: each covers a wide range of concerns and these are not limited only to concerns about training, innovation and productivity. The survey was administered face-to-face by private contractors to business owners and top managers. The dataset was used to construct variables related to in-firm training, product and process innovation as well as control variables such as firm size, age, whether the firm is part of a larger establishment, ownership and exporter/non-exporter. The in-firm training variables include whether the firm had training programs, the proportion of skilled versus unskilled workers that received training, whether the firm received public support for training and reasons for not running training programs.

The descriptive analysis is based on the use of summary statistics of key variables, from which stylized facts on training in Caribbean SIDS may be drawn. The descriptive analysis examined the factors affecting in-firm training in the Caribbean, the type of worker more likely to receive training and public support and obstacles to in-firm training. The econometric analysis looked at the factors affecting in-firm training in the Caribbean as well as the effect of training on innovation and productivity.

To investigate the factors affecting in-firm training, a probit model is used: the dependent variable is a binary variable indicating whether the firm ran a training program or not. The independent variables are firm size, age, whether the firm is part of a larger organization, type of ownership (foreign or local), whether the firm is an exporter or not, whether the firm has a R&D department or not, workforce structure (proportion managers and other professional staff and the proportion of skilled production workers), and workforce education level.

To estimate the probit model, let $i=1, \dots, N$ represent an index of firms:

$$Training_i = \beta_0 + \beta_1 size_i + \beta_2 age_i + \beta_3 part_i + \beta_4 ownership_i + \beta_5 export_i + \beta_6 R\&D_i + \beta_7 skilled_production_i + \beta_8 non_production_i + \beta_9 education_i + \varepsilon_i \quad (1)$$

where *Training* is a binary variable equal to 1 if the firm ran a training program and 0 otherwise; *size* is measured by the number of workers employed; age is measured by the number of years the firm has been in operation using four categories: newly established firms (≤ 10 years), young firms (11-20 years), established firms (21-50 years) and well established firms (> 50 years); *part* is a dummy variable equal to 1 if the firm is part of a larger organization; *ownership* is a dummy variable equal to 1 if the firm is foreign owned, *export* is a dummy variable equal to 1 if the firm exports, *R&D* is a dummy variable equal to 1 if the firm has a R&D department; *education* measures the proportion of the firm's workforce that has at least a degree; *skilled_production* is the proportion of skilled production workers relative to the firm's workforce; *non_production* is the proportion of non-production workers relative to the firm's workforce, which includes management and other professional staff; and ε is the error term. The model also includes country and industry dummy variables.

In the literature the impact of R&D on innovation and productivity is commonly modelled using an econometric model by Crépon, Duguet and Mairesse (1998), also referred to as the CDM model, where the innovative effort of the firm increases innovation, which in turn increases productivity in a recursive equation system. The model is often extended to include a range of innovative activity besides R&D such as firm spending on training, along, with other inputs related to labour productivity (Griffith et al., 2006; and Crespi and Zuniga, 2012). The model is a system of equations that link the firm's innovative activity and expenditure to its innovation output, and its innovation output to productivity. The first step investigates whether or not the firm decides to perform R&D and other innovative activity and the level of investment they are prepared to spend. To correct for potential selectivity bias a Heckman selection approach is used. This is followed by the knowledge production function equation, which links innovative activity to innovation output and a Cobb-Douglas production function is estimated that links innovation to productivity. Importantly one should note that the CDM model allows for arbitrary correlations among the error terms and innovative activity is endogenous in the innovation equation, and innovation output is endogenous in the productivity equation.

Mohan, Strobl and Watson (2014) have applied the model to Caribbean SIDS in studying innovation and productivity. Training was however not taken into account. In the case of this study, the WBES and the PROTEqIN survey do not provide information on the amount a firm spends on training and we are unable to perform the Heckman selection. The innovation decision

of the firm is therefore modelled as whether the firm ran a training program or not and we used a reduced form CDM model. In the reduced model, the first equation explains training on innovation performance in a linear probability model in which firm innovation is determined by whether the firm ran a training program and other determinants of innovation performance are included as control variables. The second equation explains labor productivity using, as explanatory variables, innovation and training intensities: it is really a knowledge production function, which relates innovation output to innovation input and other factors. As such, the model summarizes the process from the firm's decision about whether to carry out workforce training and the impact of such on innovation and productivity.

In the reduced form CDM model we are not able to do the Heckman selection equation. This leads to problems of selectivity and simultaneity bias, and unfortunately the nature of the data does not allow us to address this issue. Selectivity bias is likely to exist since the sample is limited only to firms which are engaged in innovative activities and such a sample cannot be considered to be randomly drawn and thus does not represent the entire population. Simultaneity bias arises since firms that do in-firm training are also those that spend more on training and do so because they spend more on innovation in general, and/or there are other factors that affect in-firm training and innovation expenditure for which we do not have data (for example, manager quality) but which not only affect innovation but also training. Furthermore, firm-level innovation in itself can lead to or require training (for example new software). Thus, the real impact of training will be lower than previously estimated. Here we have to assume that we have enough covariates to control for these concerns. Nevertheless, in the end the results must be viewed with caution.

The model is estimated in two steps. In the first step, firm-level innovation performance is explained in a probit model by variables related to in-firm training and other variables that can affect innovation.

Let $i=1, \dots, N$. represent an index of firms, the first equation to be estimated is:

$$TI_i = T_i \gamma + x_i' \delta + u_i \quad (2)$$

where TI is a binary variable measuring knowledge outputs from the firm's innovative activity (it is equal to 1 if the firm introduces a new product or service), T is a dummy variable equal to 1 when the firm ran a training program, x is a vector of other determinants of knowledge production, (γ, δ) are vectors of parameters of interest, and u an error term. The other

determinants of innovation included are firm size, ownership, exporter/non-exporter, whether the firm has a R&D department and industry and country dummies as defined previously.

In step 2 of the estimation, equation (3) below is the output production function/productivity equation, which links the firm's innovation output to productivity by including it as an input in an augmented Cobb-Douglas production function. The equation is estimated using the predicted values of TI from the probit model in the first step since it controls for selection in training and therefore accounts for endogeneity of the innovation output variables. Firms produce output using constant returns to scale production function with labor, capital, and knowledge inputs as follows:

$$y_i = \theta_1 k_i + \theta_2 TI_i + v_i \quad (3)$$

where output y is labor productivity (log of sales per worker); k is the log of physical capital per worker (proxied by physical investment per worker); and v is the error term.

4. Descriptive Analysis

4.1. Incidence of In-firm Training

Both the WBES and PROTEqIN survey asked the same question in terms of measuring the incidence of in-firm training: "In the last fiscal year, did the establishment run formal training programs for permanent, full-time employees?" Additionally, the PROTEqIN survey mainly targeted firms that were covered in the WBES, although in some instances it surveyed additional firms. Both the WBES and PROTEqIN survey samples are stratified by industry and size. This section therefore presents the results using one of the dataset only in cases where appropriate and highlights the differences and similarities between both.

For the Caribbean as a whole, 40 percent of firms surveyed in 2010 (based on the WBES) and 56 percent of firms surveyed in 2014 (based on the PROTEqIN survey) had training programs (Figure 1). When comparing the average percentage of firms that had training programs for the Caribbean to Latin America based on the WBES the figure for the Caribbean is much lower (40 percent versus 56 percent). Moreover, the average for the Caribbean is much lower than Latin American countries with a high incidence of training, which include Ecuador and Peru with a 73 percent and 70 percent incidence, respectively, of in-firm training. However, the average for the Caribbean is close to Honduras (43 percent) but much higher than Panama

(12 percent). Similarly, McArdle (2004) found a lower average for the incidence of in-firm training for the Caribbean compared to Latin America (67 percent versus 75 percent).

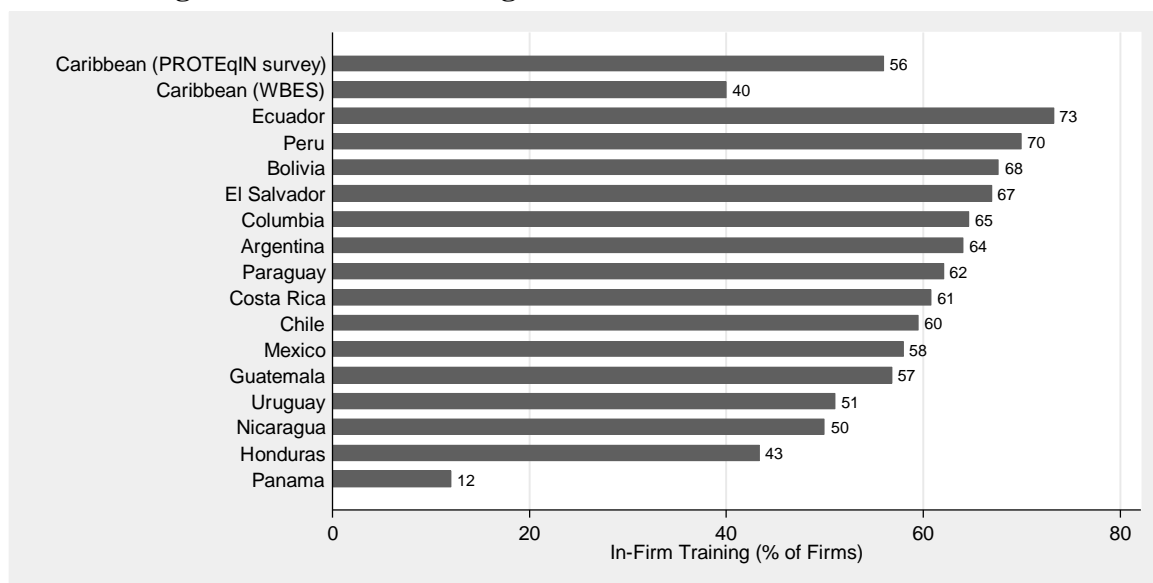
There are various possible explanations for the lower level of in-firm training in the Caribbean compared to Latin America. Latin American countries have a significantly larger number of large manufacturing firms compared to Caribbean countries where there is a larger number of small manufacturing firms, and also many small firms in the services sector which play a relatively more important role. Large manufacturing firms are more likely to invest in in-firm training. On average, 3 out of every 4 large manufacturing firms in Latin America and the Caribbean provide formal training to employees, compared to 1 in 3 small manufacturing firms (World Bank, 2014). Blom and Hobbs (2008) also proposed several reasons for the lower level of training in the Eastern Caribbean compared to Latin America. While there are a limited number of individual trainers, there is also a lack of specialized training firms for the private sector. Also, in the Caribbean there is a large number of unskilled workers and firms are less likely to invest in these workers. In Grenada, for instance, 8 of every 10 firms provide training to skilled workers, while only 3 of every 10 firms offer training to unskilled workers. Blom and Hobbs (2008) also state that there is a lack of formal recognition of training and its value in the Caribbean. Poaching of workers after they have been trained and migration abroad is also frequent in the Caribbean.

In Figures 2 and 3, the scatter plot shows the percentage of firms in the Caribbean that ran in-firm training programs by country. Based on the WBES in 2010, countries with the highest share of firms that offered training were the Dominican Republic (64 percent), Guyana (63 percent) and St. Kitts and Nevis (50 percent). When looking at the PROTEqIN data in 2014, the incidence of in-firm training was higher among a larger number of countries that include The Bahamas (77 percent), St. Kitts and Nevis (71 percent), Trinidad and Tobago (67 percent), Dominica (63 percent), St. Vincent and the Grenadines (62 percent), Antigua and Barbuda (60 percent), Grenada (60 percent), St. Lucia (59 percent) and Barbados (50 percent).

Nevertheless, there are some countries in the region where in-firm training is quite low. As shown in Figure 2, based on the WBES in 2010, only 2 percent of all firms surveyed in Suriname offered in-firm training. From Figure 3, based on the PROTEqIN survey in 2014, countries with the lowest percentage of firms offering training (less than 40 percent) were Belize, Jamaica and Suriname. However, it must be noted that the relatively low level of in-firm training

for Jamaica (34 percent in the WBES and 38 percent in the PROTEqIN survey) is in conflict with other studies: JEF (2001) found that 90 percent of firms surveyed in Jamaica provided training, and Blank and McArdle (2001) also concluded that in-firm training in Jamaica was substantial. Both the PROTEqIN survey and WBES showed a much lower incidence of in-firm training in Jamaica compared to the JEF (2001) and McArdle (2001) studies. The higher figures may be explained by the wider definition of training used by JEF (2001) and McArdle (2001), where both studies examine the different ways that firms support training and development of employees through on-the-job training, conferences, seminars and short courses to provide basic and advanced job related training, personal development, remedial training, academic upgrading and quantitative reasoning/problem solving.

Figure 1. In-Firm Training in the Caribbean and Latin America



Source: Authors' compilation based on the WBES and PROTEqIN survey.

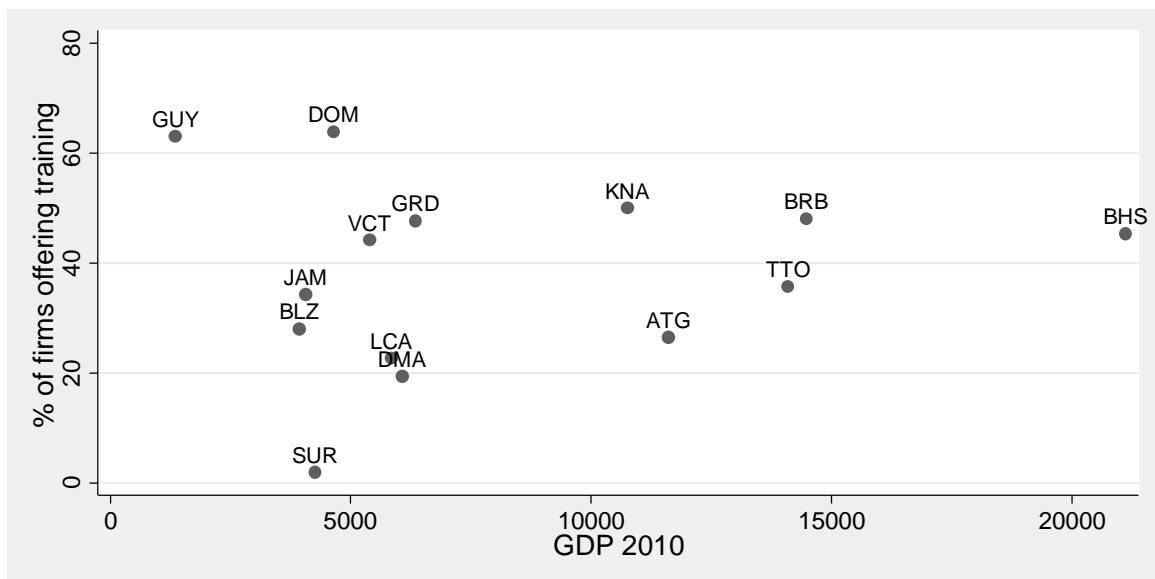
4.2. Factors Affecting In-firm Training

The descriptive analysis focuses on the factors likely to be affecting the firm's decision to undertake training of its employees in the Caribbean, and also at the more disaggregated country, sector and firm level. This is important in generating different stylized facts for the region and allowing for comparisons to be made with other countries. Firm training may be related to GDP per capita. It may be argued that a country with a higher GDP per capita has more resources to

invest in human capital development and potentially provides more training to its workers. On the other hand, a country where in-firm training is more easily available often has higher production levels and therefore higher GDP per capita than a country that does not offer training.

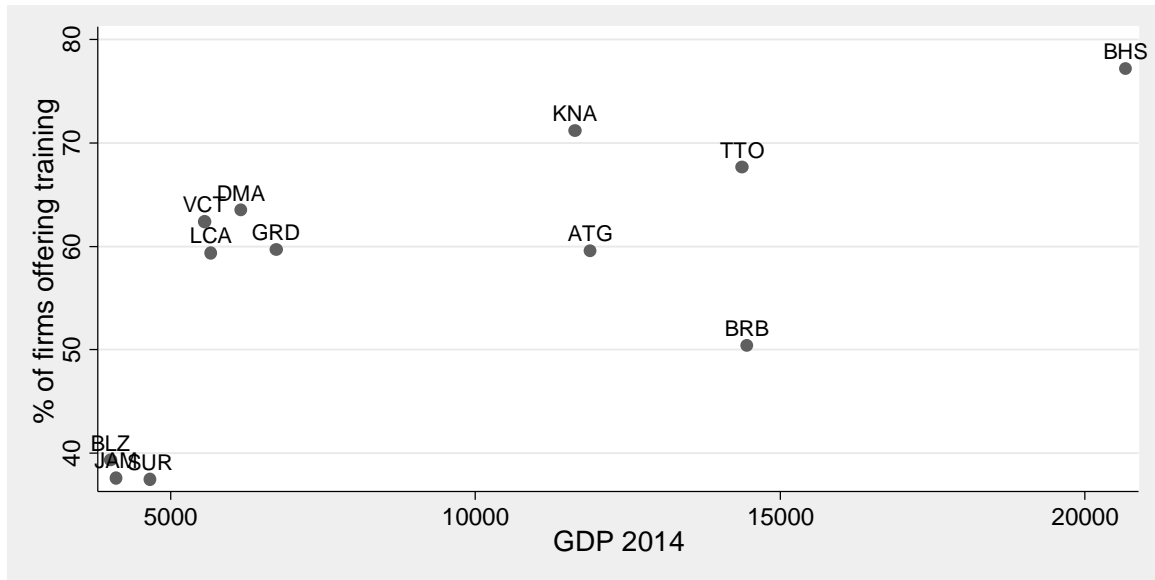
In Figures 2 and 3, the scatter plot shows the percentage of firms in each country that provided training to their workers based on the WBES and PROTEqIN survey respectively, and the line graph represents GDP per capita in US dollars in 2010 for the WBES and GDP per capita in US dollars in 2014 for the PROTEqIN survey. From both figures there appears to be no clear correlation between GDP per capita and in-firm training.

Figure 2. In-firm Training versus GDP Per Capita, WBES



Source: Authors' compilation based on WBES data.

Figure 3. In-firm Training versus GDP Per Capita, PROTEqIN Survey



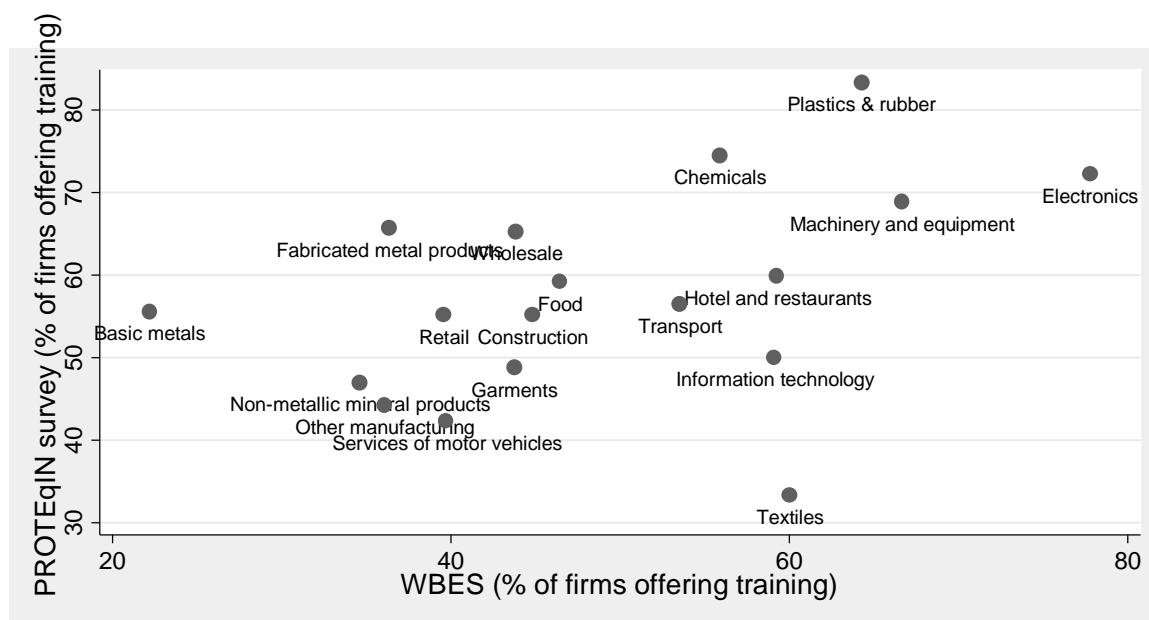
Source: Authors' compilation based on PROTEqIN Survey.

Next we examine in-firm training by economic sector. In order to look at the extent to which in-firm training differs with respect to economic sector two different levels of aggregation are used, manufacturing versus services and the 18 sector classification used by both surveys. In the literature it is generally expected that firms in the manufacturing sector are more likely to provide in-firm training than firms in the services sector (Konings, 2008). This is an important factor to consider for the Caribbean given that it has a relatively large services sector. Looking at manufacturing versus services firms in the region, there appears to be an almost equal proportion of firms in both sectors that ran training programs in 2010 and in 2014 based on the WBES and PROTEqIN survey respectively (Figure 5). Thus, in-firm training in the Caribbean may not necessarily occur more in the manufacturing than services sector. Blom and Hobbs (2008) also reported that in Grenada training in tourism and manufacturing were almost equal, while Márquez (2002) found that services firms in the region were 5 percent more likely to train workers than manufacturing firms.

We now consider the 18 sector industry classification. The relationship between the percentage of firms that provided training and economic sector is very heterogeneous suggesting that sector may be a relevant factor in determining in-firm training in the Caribbean. For instance, the WBES shows that electronics had 78 percent of firms offering training and basic

metals had only 22 percent (Figure 4). Long et al (1999), Blundell et al. (1996), Groot (1997) and OECD (1999b) also found that firms operating in high technology sectors have a high incidence of training. Similarly, the PROTEqIN survey shows that plastics and rubber had 83 percent of firms offering training and textiles 33 percent (Figure 4). Sectors with the largest percentage of in-firm training in 2010 were electronics (78 percent), machinery and equipment (67 percent), plastics and rubber (64 percent), textiles (60 percent), hotel and restaurants (59 percent), information technology (59 percent), chemicals (56 percent) and transport (53 percent). Sectors with the highest percentage of in-firm training in 2014 were plastics and rubber (83 percent), chemicals (75 percent), electronics (72 percent), machinery and equipment (69 percent), fabricated metal products (66 percent), wholesale (65 percent), hotel and restaurants (60 percent), food (59 percent), transport (56 percent), basic metals (56 percent), retail (55 percent), construction (55 percent) and information technology (50 percent). There is also considerable heterogeneity in the sectors. The highest percentage of firms that ran training programs include knowledge-intensive services (information technology) and other services (wholesale, hotel and restaurants and retail) as well as high-skill technology intensive manufactures (electronics and chemicals), low-skill technology manufactures (plastic and rubber and machinery and equipment) and labor and resource-intensive manufactures (textiles).

Figure 4. In-firm Training by Sector



Source: Authors' compilation based on PROTEqIN survey WBES data.

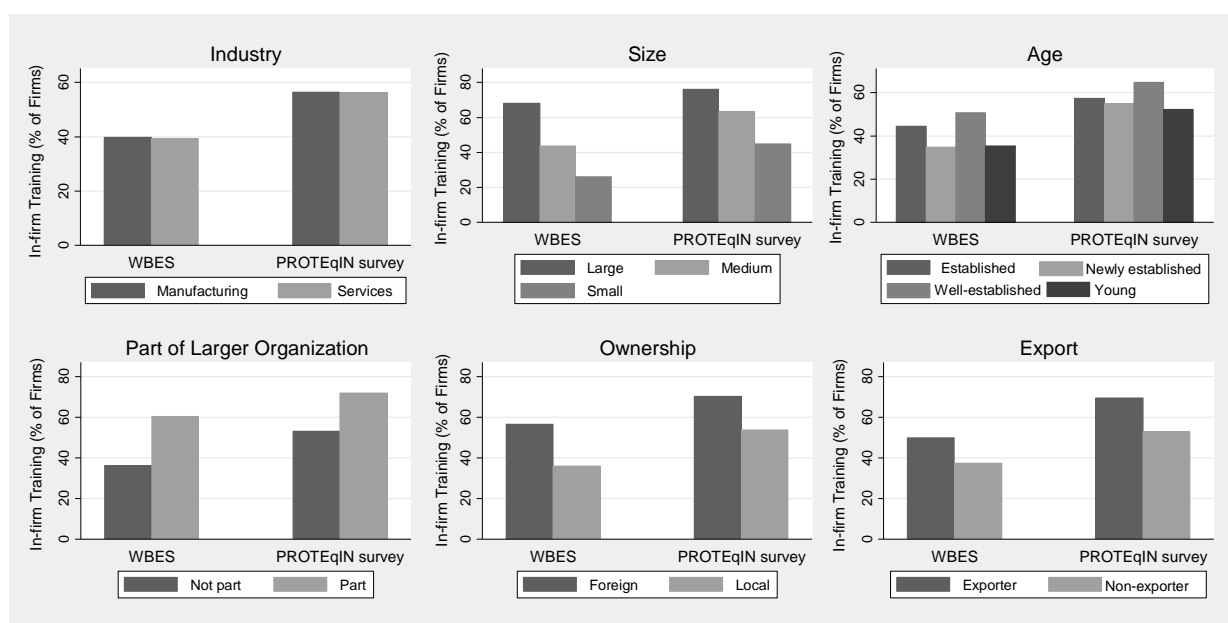
The relationship between firm-level characteristics and in-firm training is also investigated (shown in Figure 5). More specifically, we study whether firm size is important in determining in-firm training. Firm size was measured by the number of workers employed and three groups were used: small firms (<20 employees), medium firms (20-99 employees) and large firms (≥ 100 employees). Both the WBES and the PROTEqIN survey suggest that larger firms generally ran training programs. From the WBES in 2010, 26 percent of small firms, 44 percent of medium firms and 68 percent of large firms ran training programs, and from the PROTEqIN survey in 2014 45 percent of small firms, 64 percent of medium firms and 76 percent of large firms ran training programs. Firm size may therefore be an important factor in determining in-firm training in the Caribbean, where larger firms are more likely to train workers. These results are in line with studies for the Caribbean and other studies as well listed in the literature review earlier.

When considering firm age, the data show that generally older firms in the Caribbean are more likely to train their workers. Consequently firm age may possibly influence in-firm training in the region where older firms are more inclined to provide training. Four age categories are used: newly established firms (≤ 10 years), young firms (11-20 years), established firms (21-50 years) and well established firms (> 50 years). The WBES had 35 percent of newly established firms, 35 percent of young firms, 44 percent of established firms and 51 percent of well-established firms providing training to workers in 2010 and the PROTEqIN survey had 55 percent of newly established firms, 52 percent of young firms, 57 percent of established firms and 65 percent of well-established firms providing training to workers in 2014.

Both surveys indicate that firms that are part of a larger organization have a higher proportion of firms that offered training. In 2010 60 percent of firms that were part of a larger firm and 36 percent of firms that were not part of a larger firm ran training programs, and in 2014 72 percent of firms that were part of a larger firm and 53 percent of firms that were not part of a larger firm had training programs. Accordingly being part of a larger firm may positively impact in-firm training in the Caribbean. In examining foreign versus local ownership, a higher percent of foreign compared to local firms ran training programs. The WBES had 36 percent of local and 57 percent of foreign firms providing training in 2010. The PROTEqIN survey had an even higher percentage of foreign firms compared to local firms that provided training in 2014,

70 percent and 54 percent, respectively. As a consequence ownership may be another important factor affecting in-firm training in the Caribbean and foreign ownership may positively affect in-firm training. In the paper by Márquez (2002) foreign firms were also more likely to have training programs than local firms in the Caribbean. Similarly, Blom and Hobbs (2008) found that 57 percent of foreign-owned firms offered training compared to less than 50 percent of domestic firms. When looking at exporters compared to non-exporters, a higher percentage of firms that export trained their employees. In the WBES 50 percent of exporters and 37 percent of non-exporters had training programs in 2010, and in the PROTEqIN survey 69 percent of exporters and 53 percent of non-exporters had training programs in 2014. Exporting may therefore be another relevant variable positively affecting in-firm training in the region.

Figure 5. In-firm Training and Firm Characteristics



Source: Authors' compilation based on WBES and PROTEqIN data.

Table 1 illustrates the descriptive statistics for the workforce composition for firms that introduced training programs and firms without training programs. The workforce categories consist of the proportion of managers, the proportion of skilled production workers and the proportion of unskilled production workers. The data comes from the PROTEqIN survey only since the WBES has many missing values for these variables. Table 1 also gives descriptive statistics for the proportion of workers with at least a degree for firms with training programs

versus firms without using the WBES based of data availability, which gives an indication of the education level of firms with training programs and firms without.

The proportion of managers for firms that train workers is only 1 percent more than the proportion of firms that do not train workers. The proportion of managers may therefore not be important in influencing a firm's decision to train workers. The mean for the proportion of skilled and unskilled production workers is higher for firms that train workers (30 percent and 20 percent, respectively) than firms that do not (26 percent and 16 percent, respectively). A higher proportion of production workers may therefore increase in-firm training. If a firm stated that it ran a training program the firm was asked what percentage of production versus non-production workers received training. The PROTEqIN survey shows that the mean for the proportion of production workers (skilled and unskilled) that received training (11 percent) was lower than the proportion of non-production workers that received training (14 percent). The descriptive statistics therefore gives an unclear picture on whether the share of non-production workers may positively affect in-firm training.²

When looking at education level the mean for proportion of the workforce with at least a degree is much higher (19 percent) for firms with training programs compared to firms without (14 percent). Worker education level may therefore positively affect in-firm training. Márquez (2002) also concluded that worker education level positively impact training in the Caribbean. In addition, Long et al (1999), Blundell, Dearden and Meghir (1996), Groot (1997) and OECD (1999b) found that education increases in-firm training in developed countries.

² The difference in mean for the proportion of managers and skilled and unskilled workers is statistically significant at 1%.

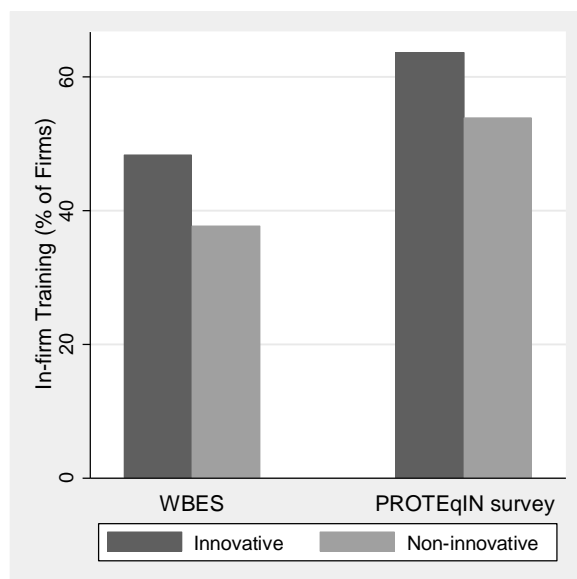
Table 1. Workforce Composition and Education Level

	Obs	Mean	Standard deviation	Min	Max
Firms with training programs					
Proportion of managers	1109	27	12	0	71
Proportion of skilled production workers	1109	30	14	0	89
Proportion of unskilled production workers	1109	20	11	0	82
Proportion of workforce with at least a degree	1024	13	19	0	100
Proportion of production workers (skilled and unskilled) that received training	1109	11	23	0	100
Proportion of non-production workers that received training	1109	14	22	0	100
Firms without training programs					
Proportion of managers	857	26	15	0	100
Proportion of skilled production workers	857	26	19	0	89
Proportion of unskilled production workers	857	16	14	0	84
Proportion of workforce with at least a degree	1597	8	14	0	100

Source: Authors' compilation based on WBES and PROTEqIN survey.

Considering innovative and non-innovative firms based on the introduction of a product or process innovation the group of innovators had a larger percent of firms that undertook in-firm training than non-innovators. For Figure 6 in 2010 the WBES had 48 percent of firms that provided training were innovative and 38 percent of non-innovators provided training. For the PROTEqIN survey 64 percent of firms that offered training were innovative and 54 percent of firms that were not innovative offered training in 2014. In the PROTEqIN survey firms were asked whether “the introduction of a new product led to training of workers.” From the data 20 percent of firms that introduced a new product trained their workers as a consequence. Hence, firm innovation may positively affect training and the introduction of a product or process innovation may require that employees be trained. Studies from developed countries also show that innovative firms are more likely to have higher levels of in-firm training (Baldwin and Johnson 1996; Baldwin and Da Pont, 1996; and Johnson, Baldwin and Hinchley, 1997).

Figure 6. In-firm Training, Innovative versus Non-Innovative Firms



Source: Authors' compilation based on WBES and PROTEqIN survey.

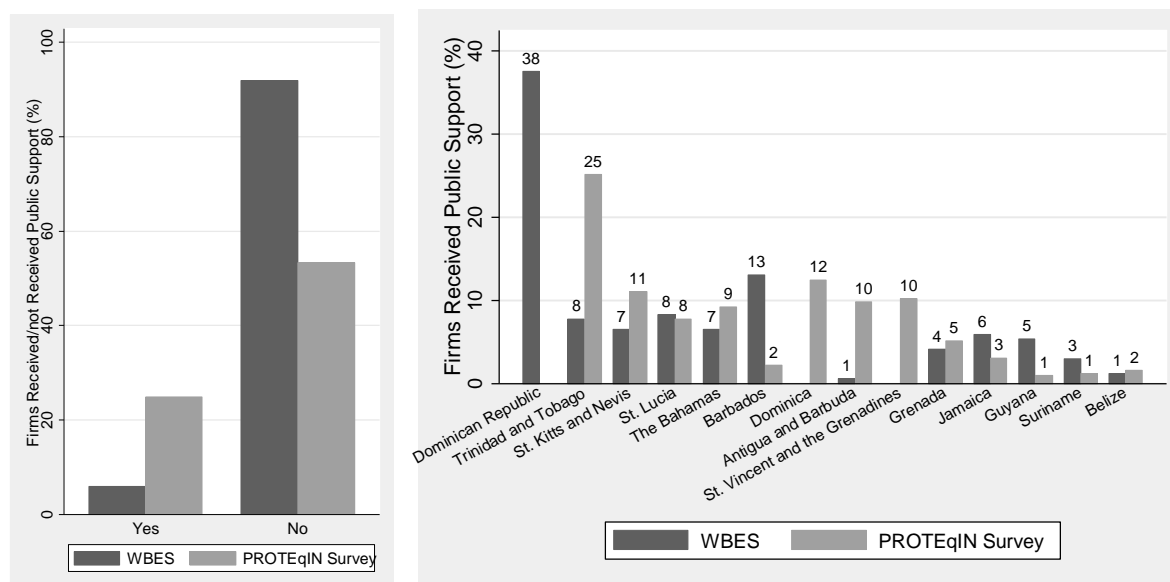
4.3. Public Support and In-firm Training

We now look at public support and in-firm training in the Caribbean. In both the WBES and PROTEqIN survey firms are asked whether they received any public support (financial or other types of assistance) for in-firm training related activities. Figure 7 indicates that the number of firms that received public support for training in the region is somewhat low. In 2010 6 percent of all firms in the WBES or 12 percent of firms with training programs, and in 2014 25 percent of all firms in the PROTEqIN survey or 44 percent of firms with training programs indicated that they received public support for training. Public support for training by country is considered based on the total share of firms that received assistance (Figure 7b). Countries where public support was highest were the Dominican Republic (38 percent WBES), Trinidad and Tobago (8 percent WBES and 25 percent PROTEqIN survey), St. Kitts and Nevis (7 percent WBES and 11 percent PROTEqIN survey), St Lucia (8 percent WBES and PROTEqIN survey), the Bahamas (7 percent WBES and 9 percent PROTEqIN survey) and Barbados (13 percent WBES and 2 percent PROTEqIN survey).

Sector level and firm level characteristics and public support are examined using the PROTEqIN survey shown in Table 2, given the low level of responses from firms that received public support in the WBES. Accordingly, a larger percent of service firms (26 percent) received

public support compared to manufacturing firms (23 percent). The sectors that were the largest recipients of public support were: basic metals (37 percent), electronics and chemicals (33 percent), fabricated metals products (31 percent), construction (31 percent) and hotels and restaurants (29 percent). Looking at firm-level characteristics, in terms of size smaller firms generally benefited the most from public support (small 26 percent, medium 24 percent and large 23 percent). For firm age, older firms and newly established firms were more likely to receive public support (28 percent well established, newly established 27 percent, 26 percent young and 23 percent established). In terms of ownership local firms in the region benefited more from public support than foreign firms (25 percent local firms and 23 percent foreign firms). Firms that were not part of a larger organization had a larger share of firms receiving public support (26 percent were not part of a larger organization and 21 percent were part of a larger organization). Lastly, firms that export were more likely to receive public support for training than firms that do not (29 percent of exporters and 24 percent of non-exporters).

Figure .: a) Public Support for In-firm Training and b) Public Support by Country



Source: Authors' calculations based on WBES and PROTEqIN survey.

Table 2. Public Support and Firm-Level Characteristics

Firm Characteristics	percent of Firms	Firm Characteristics	percent of Firms
<i>Sector</i>		<i>Size</i>	
Manufacturing	23	Small (<20 employees)	26
Services	26	medium (20-99 employees)	24
		Large (≥100 employees)	23
Other manufacturing	14		
Food	23	<i>Age</i>	
Garments	22	Newly established (≤10 years)	27
Chemicals	33	Young (11-20 years)	26
Plastics & rubber	28	Established (21-50 years)	23
Non-metallic mineral products	24	Well established (> 50 years).	28
Basic metals	37		
Fabricated metal products	31	<i>Part of a larger organization</i>	
Machinery and equipment	24	Yes	21
Electronics	33	No	26
Construction	31		
Services of motor vehicles	12	<i>Ownership</i>	
Wholesale	21	Local	25
Retail	27	Foreign	23
Hotel and restaurants	29		
Transport	24	<i>Exporter/non-exporter</i>	
Information technology	18	Exporter	24
Textiles	14	Non-Exporter	29

Source: Authors' compilation based on PROTEqIN survey.

4.4. Obstacles to In-firm Training

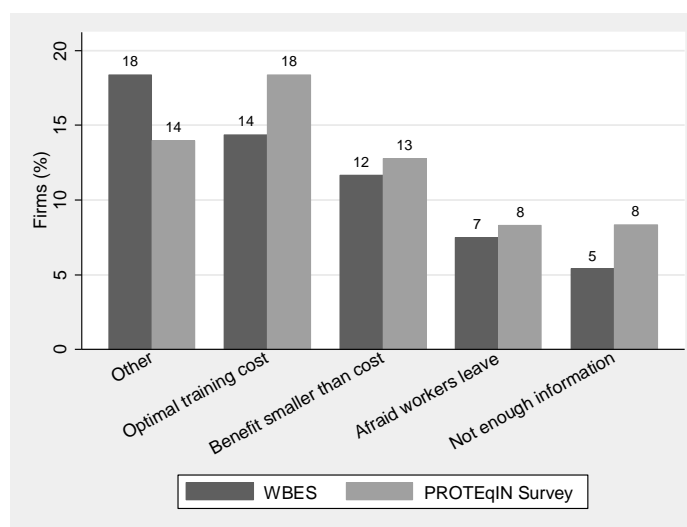
The WBES and the PROTEqIN survey asked firms that did not run training programs the main reason for not doing so. The reasons identified in order of importance based on the share of firms that did not train employees shown in Figure 8 were: the firm cannot afford the optimal training costs (WBES 14 percent and PROTEqIN 18 percent); other (WBES 18 percent and PROTEqIN 14 percent); the benefits of training are smaller than the costs (WBES 12 percent and PROTEqIN 12 percent); the firm is afraid that workers leave after training (WBES 7 percent and PROTEqIN 8 percent); and the firm does not have enough information about training programs (WBES 5 percent and PROTEqIN 8 percent). A significant per cent of firms that did not train employees listed “other” as an obstacle to in-firm training. Unfortunately the data do not allow us to identify what these “other” reasons for not running training programs were.

We consider the reasons for not running training programs by country shown in Figure 9 to determine which countries were most negatively affected by obstacles to training. The barrier “the firm cannot afford the optimal training costs” most negatively affected firms that did not train workers based on the WBES in Jamaica (21 percent), Barbados (12 percent) and Belize;

and based on the PROTEqIN survey in St. Lucia (17 percent), Dominica (14 percent), Belize (13 percent) and Jamaica and Suriname (10 percent). From the WBES in 2010 Jamaica had 25 percent of firms that did not run training programs responding “other” as the main reason, followed by Trinidad and Tobago with 24 percent and the Bahamas, Barbados, Dominican Republic and Suriname with 10 percent. In 2014 the PROTEqIN survey had 28 percent of firms that did not train workers in Trinidad and Tobago, 11 percent of firms in Grenada and 10 percent of firms in Jamaica responding “other” as the main obstacle to training.

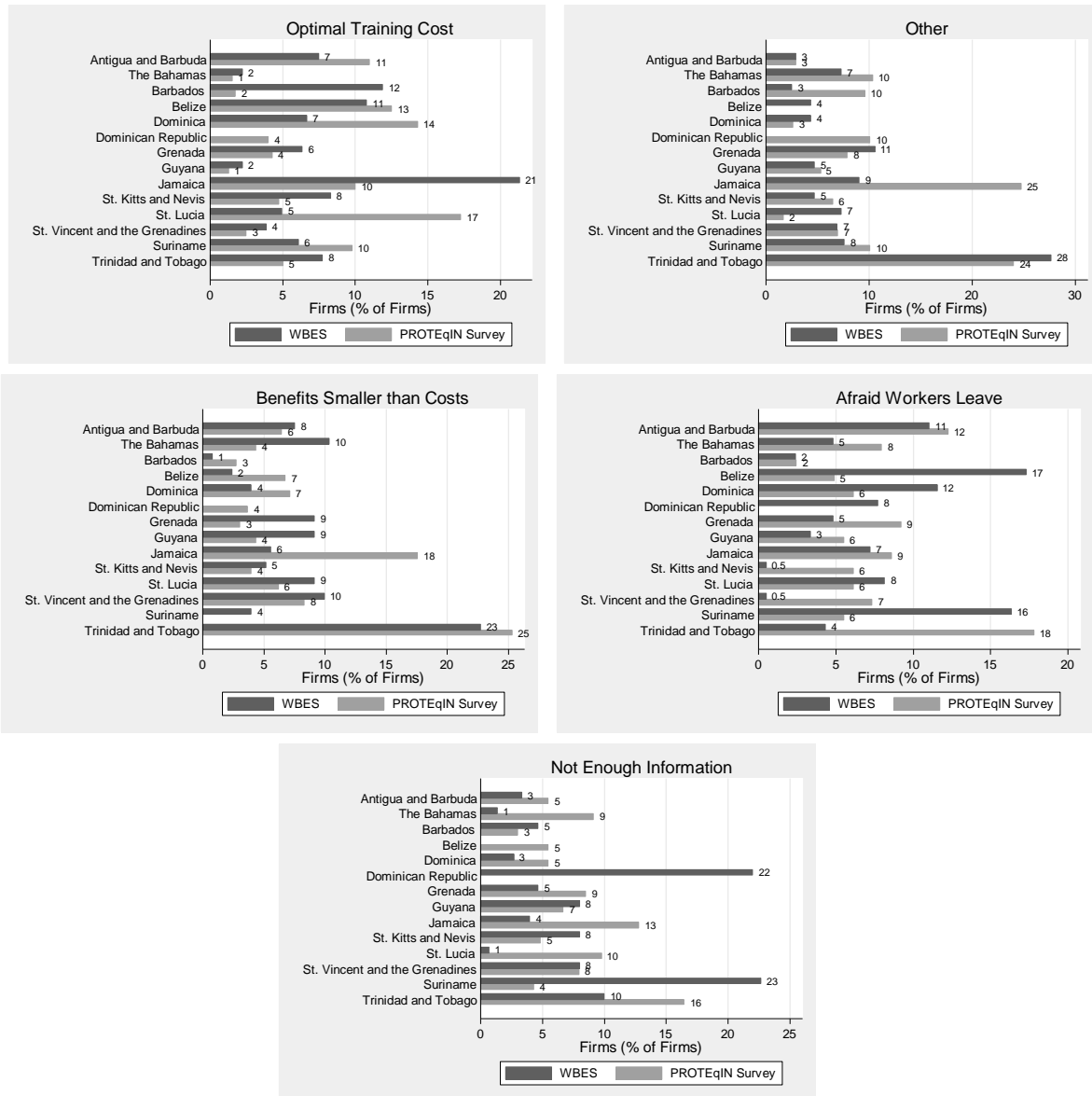
For the barrier “the benefits of training are smaller than the costs” the WBES had 25 percent of firms that did not train workers from Trinidad and Tobago identifying this as the main obstacle to in-firm training followed by 18 percent in Jamaica. The figures from the PROTEqIN survey show 23 percent of firms did not run training programs from Trinidad and Tobago and 10 percent from the Bahamas and St. Vincent and the Grenadines for this reason. The barrier that “the firm is afraid workers leave after investing in training” shows that firms that did not train workers in Suriname (16 percent) were most negatively affected followed by Belize (17 percent) and Antigua and Barbuda (11 percent) in 2010 and Trinidad and Tobago (18 percent) and Antigua and Barbuda (12 percent) in 2014 because of this. The barrier “the firm does not have enough information about training programs” shows that firms that did not train workers in Suriname (22 percent) were most impacted, followed by Trinidad and Tobago (10 percent) in 2010 and Trinidad and Tobago (16 percent) and Jamaica (12 percent) in 2014.

Figure 8. Obstacles to In-firm Training



Source: Authors' calculation based on WBES and PROTEqIN Survey.

Figure 9. Obstacles to In-firm Training, by Country



Source: Authors' calculation based on WBES and PROTEqIN Survey.

5. Econometric Results

5.1. Factors Affecting In-firm Training

To determine the factors which affect in-firm training the study used a probit model with a yes/no dependent variable on whether the firm carried out training programs. Various independent variables based on data availability are included. They are firm size, age, whether the firm is part of a larger organization, foreign ownership, whether the firm exports, whether the

firm has an R&D department and composition and education level of the workforce, as well as country and industry level dummy variables. Table 3 presents the coefficients for the marginal effects estimated using a probit model where column 1 shows the results for the PROTEqIN data and column 2 shows the results for the WBES data.

Both data sets give similar results on the factors affecting in-firm training in the Caribbean. All independent variables were significant except age. Márquez (2002) through econometric analyses found that age was a minor factor relative to the other firm characteristics for Latin America and the Caribbean and positively impacted in-firm training by 0.1 percent. From the results, larger firms are 12 percent more likely to train workers from the WBES and PROTEqIN survey. Studies on developed countries have also econometrically shown that larger firms are more likely to have training programs (Long et al., 1999; Blundell, Dearden and Meghir, 1996; Groot, 1997; and OECD, 1999b). Further, the econometric results show that firms in the Caribbean that are part of a larger organization are 11 percent more likely to have training programs than firms that are not part of a larger organization based on both surveys.

Firms that export are 6 percent (WBES) and 9 percent (PROTEqIN survey) more likely to train workers in the Caribbean than firms that do not export. Foreign ownership positively affects in-firm training, and foreign-owned firms are 7 percent (WBES) and 6 percent (PROTEqIN survey) more likely than local firms to have training programs in the region. Márquez (2002) also found that foreign firms are 9 percent more likely to train workers in the region. Firms that have an R&D department are 19 percent (WBES) and 16 percent (PROTEqIN) more likely to train workers. Innovative activity therefore plays a large role in positively affecting in-firm training in the Caribbean. The education level of the workforce can also positively affect in-firm training, although it is relatively less important compared to the other variables. Based on the results from the WBES firms that have a workforce with at least a degree qualification is 0.35 percent more likely to have training programs.

Looking at the results from the PROTEqIN survey the proportion of non-production workers which includes managers and other professional staff does not affect in-firm training in the Caribbean. A firm with more managers may therefore not necessarily result in more training for workers. The coefficient for proportion of skilled production workers is however significant and positive. Firms in the Caribbean with a higher proportion of skilled production workers are more likely to run training programs, although the coefficient is relatively small. This is similar

to the findings of Blom and Hobbs (2008) for the Caribbean where skilled workers are more likely to be train than unskilled workers. Alternatively, in a study of firm training in Latin America Eberhard et al. (2017) found a considerable amount of training was aimed at non-production workers, and this may be explained by the main reasons firms in Latin America carry out training. In a survey of firms in Chile, the study found that firms carry out training mainly to comply with international standards and hygienic or hazardous regulations, while increasing productivity was listed as a third reason. Perhaps Caribbean firms are less concerned with international standards and other regulations compared to Latin American firms, particularly since they are less likely to export.

Table 3. Factors Affecting In-firm Training

	(1) WBES	(2) PROTEqIN survey
Size	.117*** (.010)	.115*** (.013)
Age	.009 (.011)	.006 (.013)
Part of a large firm	.109*** (.031)	.113*** (.032)
Exporter	.064** (.030)	.088*** (.031)
Foreign Ownership	.073** (.029)	.056* (.034)
R&D	.194*** (.046)	.162*** (.041)
Education	.003*** (.001)	
Proportion of skilled production workers		.002* (.001)
Proportion of non-production workers		.001 (.001)
Observations	2610	1966
Wald	525.45***	346.10***
Log Psuedo Likelihood	-1446.885	-1155.121
Psuedo R ²	0.171	0.142
Observed probability	.390	.564
Predicted Probability (values at means)	.377	.576

Notes: (1) Coefficients reported are marginal effects. (2) Robust standard errors in parentheses. (3) * Coefficient is statistically significant at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level.

5.2. In-firm Training, Innovation and Productivity

To study the effect of training on innovation and the effect of innovation on productivity we utilized the adapted two equation CDM model since we do not have the amounts spent on training. To study the impact of training on innovation we first estimated a probit model where the dependent variable is whether the firm introduced a product or process innovation and the independent variables include training and firm characteristics as well as sector and country dummy variables, and secondly we included other innovative activity through a dummy variable for whether the firms has an R&D department. Table 4, column 1, presents the coefficients for the marginal effects estimated using a probit model without other innovative activity, and column 2 shows the results with other innovative activity using the PROTEqIN data.³ The results show the estimates of the knowledge production function and give the impact of training along with other variables on the probability of technological innovation, that is, the introduction of a new product or process.

Accordingly, the results in column 1 suggest that training is positively correlated with innovation and that a firm that provides training programs is 6 percent more likely to introduce a new product or process. A firm that is large and a firm that exports is also more likely to innovate, while foreign ownership does not increase innovation. Similar results on firm innovation in the Caribbean were obtained by Mohan, Strobl and Watson (2014). In column 2, however, when we add the dummy variable on whether the firm has a R&D department the training coefficient becomes insignificant, while the coefficient for the R&D dummy variable is large and significantly positive. The coefficient suggests that firms with an R&D department are 68 percent more likely to have a product or process innovation. The coefficients for firm size and exporting are again significant and positive. These results may suggest that, when taking into account other determinants of innovation, it is really other innovative activity, in this case having an R&D department, that is driving innovation, and thus the relationship between training and innovation is spurious. This may indicate that training plays a relatively small role and may not matter for innovation in the Caribbean.

In studying the impact of innovation on productivity Table 5 shows the results of the productivity equation, where the coefficients are reported as elasticities or semi-elasticities since the dependent variable is the log of sales per employee. Here we find that training does not have

³ The WBES gives similar results.

a significant effect on productivity. Also, innovation does not have a significant effect on labor productivity. However, non-technical innovation has a positive and significant effect on labor productivity. One may more generally, however, want to be careful in reading too much into these results on training, innovation and productivity, as our estimates do not account for selection bias and endogeneity.

Table 4. Probability of Technological Innovation/Product or Process Innovation

	(1)	(2)
Size	.049*** (.009)	.037*** (.011)
Exporter	.113*** (.028)	.089*** (.031)
Foreign Ownership	.012 (.029)	.030 (.031)
Training	.060*** (.022)	.036 (.024)
R&D		.681*** (.035)
Observations	1966	1966
Wald	362.73***	372.98***
Log Psuedo Likelihood	-900.755	-794.215
Psuedo R ²	0.197	0.292
Observed probability	.257	.257
Predicted Probability (values at means)	.222	.235

Notes: (1) Coefficients reported are marginal effects. (2) Robust standard errors in parentheses. (3) * Coefficient is statistically significant at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level.

Table 5. The Effect of Innovation on Labor Productivity/Log Sales per Employee

Innovation	-.647 (1.175)
Size	.162** (.077)
Non-technological innovation	6.054*** (1.821)
Capital per employee	-5.658 (1.839)
Training	-.231 (.148)
Observations	1966
Wald Test	1557.99***
R ²	0.304

Notes: (1) Bootstrapped standard errors in parentheses (100 replications). (2) The variable used to proxy for physical capital is investment made during the period considered the stock of physical capital. (3) * Coefficient is statistically significant at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level.

6. Conclusion

This study attempts to fill the gap on the extent and impact of in-firm training in the Caribbean using the WBES 2010 and Compete Caribbean's PROTEqIN survey 2014. It provides empirical evidence on the factors that correlate with a firm's decision to train workers, public support for in-firm training, obstacles to in-firm training and the effect of in-firm training on innovation and productivity. The paper shows that the incidence of training in the Caribbean is relatively low compared to Latin America, although there is significant heterogeneity across countries. While the region is comprised mainly of non-innovative, small, locally owned firms that are not part of a larger organization and do not export, the regression results show that larger firms, foreign owned firms, firms that are part of a larger organization, firms that export and innovative firms are more likely to train workers. Additionally, the study shows that many firms in the region have identified several obstacles to in-firm training, including that the firm cannot afford the optimal training costs, the benefits of training are smaller than the costs, the firm is afraid that workers leave after training and the firm does not have information about training programs. Furthermore, the data show that firms in the region reported very limited government support for in-firm training activity.

Given that the Caribbean is made up mainly of firms that are less likely to train workers, that is, small firms that are locally owned and are not part of a larger organization and do not export, accompanied by various barriers to in-firm training and limited government support, these factors may account for the relatively low levels of in-firm training in the region. Also, the findings suggest that in-firm training in the region may play a relatively small role and may even not matter for innovation and productivity. The relatively low level of training in the Caribbean may be responsible for this small and perhaps non-existent role of in-firm training on innovation and productivity. However, importantly, better-quality data would be necessary to argue so more conclusively.

More generally, however, there is clearly significant potential to increase in-firm training in the Caribbean. Given the evidence in the wider literature that in-firm training enables workers to acquire new skills and higher wages and leads to an increase in innovation and productivity, government policy in the Caribbean should place significant emphasis on increasing the incidence of in-firm training. Since certain types of firms are less able to provide training government policy should place special focus on these firms as well as the obstacles to in-firm

training identified. Our results concerning the lack of effect on training on innovation and productivity might also indicate that training may not be as efficient as in other regions. However, these results must be viewed with caution, as they do not account for selection bias and endogeneity.

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