WPS5635

Policy Research Working Paper 5635

A Second Look at the Pesticides Initiative Program

Evidence from Senegal

Melise Jaud
Olivier Cadot

The World Bank
Poverty Reduction and Economic Management Network
International Trade Department
April 2011

Abstract

This paper investigates whether the Pesticides Initiative Program has significantly affected the export performance of Senegal' shorticulture industry. The authors apply two main microeconometric techniques, difference-in-differences and matching difference-in-differences, to identify the effect of the Pesticides Initiative Program on exports of fresh fruits and vegetables. They use a unique firm-level dataset containing data on sales, employment, and exports by product and destination markets, as well as firm enrolment year, over 2000–2008. The results suggest that wile the program had no significant effect on exports pooled over all products and destinations, it had a positive effect when considering fresh fruits and vegetables exports to the European Union.

This paper is a product of the International Trade Department, Poverty Reduction and Economic Management Network. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at ocadot@worldbank.org.

A Second Look at the Pesticides Initiative Program: Evidence from Senegal *

Melise Jaud † Olivier Cadot ‡

Keywords: Senegal, EU, Agriculture, Export Promotion, Technical Assistance, Impact Evaluation.
JEL classification codes: F13, F14, L15, L25, O17, O24, C23.

*This paper is part of a joint program of Switzerland's NCCR and the World Bank on the application of impact-evaluation methods to trade-related interventions. Without implicating them, we would like to express our thanks to Céline Carrère, Ana Fernandes, Julien Gourdon, Daniel Lederman, Aaditya Mattoo, Jaime de Melo, Marcelo Olarreaga, Alberto Portugal and Akiko Suwa for useful comments. We are also grateful to the European Commission and to Senegal's *Direction Générale des Douanes* and *Direction Nationale des Statistiques* for access to their data.

†The World Bank and Paris School of Economics; mjaud@worldbank.org
‡The World Bank, University of Lausanne, and CEPR; ocadot@worldbank.org

1 Introduction

A poll featured in the *Financial Times* of July 12, 2010 highlighted two striking facts. First, between s60 and 80 percent of the respondents in Western countries felt that budget cuts would help rather than hurt the economy; second, aid to developing countries was ranked first as a candidate for cuts in the U.S. and U.K., and second in all other countries. Against this background, in the words of a recent OECD document, "[t]here is a growing political demand among academics, NGOs, international agencies and voters for results in development." (OECD 2010a).

The demand for evaluation applies to aid for trade (AFT) as well as to other forms of aid.[1] After declining as a share of Overseas Development Assistance (ODA) in the second half of the 1990s, AFT commitments have increased by 62% since the launch of the AFT initiative at the 2005 WTO Ministerial in Hong Kong, reaching $41.7 billion or 37% of "sector-allocable" ODA in 2008. For the EU, trade-related assistance (TRA) is an important part of the trade-and-development policy nexus, responding to a widely-perceived need to provide adjustment assistance to Southern partners affected by increasingly stringent product standards and by recent changes in the EU's system of preferences (see Cali et al. 2006).

What do we know about the impact of aid for trade (AFT)? The literature is limited. As for its allocation, Gamberoni and Newfarmer (2009) found that, after controlling for absorption capacity (governance etc.), it correlated with an indicator of 'demand' based on indices of under-trading. As for its impact, Wagner (2003) explored whether aid generated trade in the form of exports from the *donor* country to the recipient (up to the early 1990s, over half of all bilateral aid was at least partially tied to donor exports); he found, using a gravity equation, that this particular form of trade was indeed boosted. By contrast, Osei, Morrissey and Lloyd (2004) ran a gravity equation in first differences on a panel of four European donors and 26 African recipients after testing for the direction of causalitybetween bilateral aid and trade flows. They found an unstable and, on the whole, insignificant impact of aid on trade (also in the form of exportsfrom donor to recipient). Nelson and Juhasz Silva (2008) used a moreconventional gravity equation including bilateral aid flows as a regressor (instrumented by their one-year lagged value) and found a significant although small elasticity, again, for flows from donor to recipient.

[1] Aid for Trade was defined by the 2006 WTO AFT Task Force through six categories: (i) Trade policy & regulations; (ii) Trade development; (iii) Trade-related infrastructure; (iv) Building productive capacity; (v) Trade-related adjustment; (vi) Other trade-related needs. The first three are referred to as Trade-related assistance (TRA); the last three are referred to as the 'wider aid-for-trade agenda' (EC 2008).

Only some of the most recent studies have looked at whether aid raised the export capacity of *recipient* countries. Cali and te Velde (2009) regressed trade costs and the value of exports on control variables and lagged AFT disbursements, using data from the OECD's Credit Reporting System. Their sample was a panel of countries covering 1995-2007, and they dealt with endogeneity and measurement errors in AFT flows by instrumenting them with the World Bank's index of civil liberties. The message that seems to emerge across their various specifications is that aid to trade facilitation and infrastructure seems (by and large) to have a significant effect (the former on trade costs, the latter on export values), while aid to productive capacity is insignificant. When looking at sectorally-targeted aid, controlling for country × sector fixed effects (comparative advantage) they found, again, that aid to infrastructure had a significant impact but aid to productive capacity didn't. Brenton and von Uexkull (2009) combined mirrored product-level (HS4) export data with export-development (ED) aid data from the GTZ (covering 1975-2005) and from the OECD/WTO Trade Capacity Building Database (covering 2001-2005) for 48 countries. They useda difference-in-differences (DID)[2] approach where the performance variable was exports and regressors included lagged exports, country and year × product fixed effects, and contemporaneous and lagged aid coded in binary form (ED program in force = 1). By and large, once outliers were dropped, matching yielded insignificant coefficients in spite of the relatively large sample size, suggesting that once selection effects were taken into account, export-development programs provided little significant boost to exports. All in all, it is fair to say that, as the literature stands, the effect of AFT on the export performance of beneficiary countries has not been clearly established on the basis of aggregate numbers.

Among TRA programs, technical-assistance ones have scarcely been evaluated.[3] A brochure published by the EU Commission (EU 2006) tells the interesting story of a Kenyan fruit and vegetables exporter who got assistance from the EU's Pesticides Initiative program (PIP); the case study presents the program as

> "[...] to provide support to companies like Myner [the Kenyan exporter], to help them get up to speed with European food safety and traceability requirements. [...] Since it began in July 2001, the PIP has had a positive effect on more than 26'000 ACP producers, many of whom are small-scale farmers. Nearly 6.25 million Euros has been

[2]See section 3 below for a discussion of the DID and matching approaches.

[3]Marcano and Ruprah (2009) is one of the few papers looking specifically at technical-assistance programs. Using a multiple-treatment approach, they found a positive impact to Chile's Neighborhood Improvement Program and Guatemala's Social Investment Fund (both water-access program) over and above public-works spending.

> committed to the program, with each applicant allocated around 86'000 Euros. In line with the principles of the ACP-EU partnership agreement singed in Cotonou in 2000, the PIP aims to contribute to the development of the ACP's private sector and to promote regional integration."

As for the case study itself, the brochure explains that

> "[w]hen Myner Exports began working with the Pesticides Initiative Program, or PIP in 2002, it was exporting about 300 tonnes of French beans, snow peas, passion fruit, and sugar snaps a year to the European Union. Today, the company exports some 900 tonnes a year. "

Quoting this particular case study in their assessment of the EU's TRA, te Velde et al. (2006) noted that "in an ideal world, one would compare this supported company with a similar one that was not supported" (p. 21). This is precisely what we set up to do in the present paper, although using Senegal instead of Kenya as our sample of study.

We chose Senegal because the data we had access to provided a unique combination. Through a World Bank project run by Denisse Pierola and Paul Brenton at the World Bank, we obtained raw files from Senegal's customs with export data at the transaction level for every year between 2000 and 2008. The data include the exporter's ID, the product code, the country of destination, and the export value for over 500 HS8 fresh fruit and vegetable (FFV) products. We were able to merge the customs' dataset with industrial-survey data and a list of PIP beneficiaries provided by the EU Commission.[4] This unique combination made it possible to construct a treatment group of firms that got assistance and a control group of firms that did not, and this for a sample period that ran from before the program to its end.[5]

Using this rich data set, we used a wide array of approaches to estimate the effect of the PIP on firm-level exports of treated products (FFV). We ran DID regressions of the value of exports, by product $\times$ firm $\times$ destination, on control variables as well as a dummy variable marking 'treatment' by the PIP. In order to deal with selection issues, we combined the DID approach with propensity-score matching, although the small size of the sample and the systematic differences in size between treatment- and control-group firms considerably reduced the power of

[4]Thanks to Morag Webb for providing us with the data.

[5]Although we had similar customs data from a number of other countries, none covered years *before* the start of the PIP. After merging, firm IDs have been deleted from the dataset for confidentiality reasons.

matching. We also used a control-function approach similar to Heckman's selection model (Heckman 1979).

In most specifications we tried, we failed to find a significant impact. Only when considering the firm aggregate exports of FFV to the EU, did we find a positive and significant effect of the program. Given the small size and peculiarities of the sample, our results should be treated very cautiously and we would certainly stop short of concluding that the PIP was useless on the basis of this single impact-evaluation exercise. Additionally, beneficiary firms self-selecting in the program would introduce a bias in the estimated treatment effect. However the direction of the bias is not clear. If self-selected firms are larger and potentially more efficient than others the estimated treatment effect should be biased upwards. Inversely less productive firms may be more likely to rely on financial aid or rent-seeking, biasing the effect downwards. If so, clearly more research is needed on this issue, possibly on other, larger samples to assess whether the PIP had any impact or not.

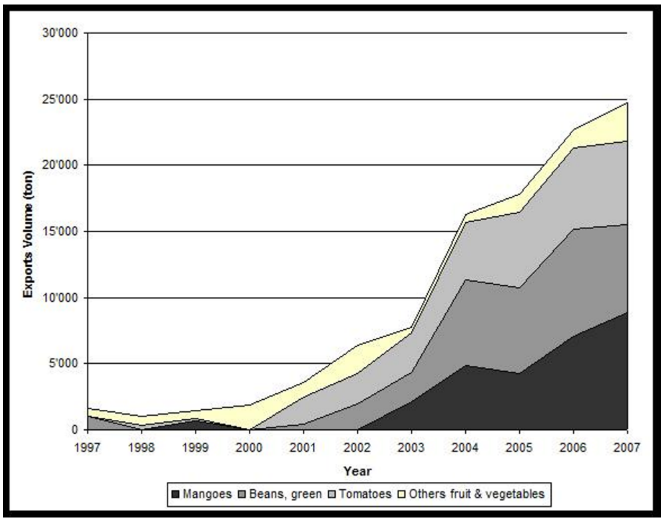
The paper is organized as follows. Section **??** presents some stylized facts on the exporting environment of Senegalese FFV producers and on how the PIP addresses its objective of alleviating some of the constraints that these producers face. Section **??** presents the impact evaluation: data, estimation issues. Section **??** presents the baseline results and some robustness tests. Finally section **??** concludes.

2 Stylized Facts

2.1 Senegal's Exports of Fresh Fruits & Vegetables

According to Senegal's National Horticultural Direction, national exports of fresh fruits and vegetables (FFV) have been rising at a rate of about 15% a year since 2001. French beans alone – the main export crop – account for most of this increase, with volumes up from 652 tons to almost 9'000 between 2001 and 2007 (Figure 1).

Figure 1: Horticulture Exports (in tons) from Senegal, 1997-2007.



Geographical and climatic conditions in the Niayes, Senegal River Valley, Casamance and Dakar regions make it possible to export out-of-season vegetables and tropical fruits crops in response to a rising demand for year-round availability in the European market.[6] Apart from minor volumes shipped to neighboring countries, the European Union (EU) remains the main destination market. In 2007, France accounted for 40% of Senegal's FFV export volumes, followed by the Netherlands (35%) and Belgium (16%). Exports are mostly fresh produce and include French beans (42% of the exported volume), cherry tomatoes (23%), mangoes (16%) and minor crops including melons, peppers and hibiscus. In 2008, Senegal ranked fourth among African suppliers of French beans to the EU, after Morocco, Egypt and Kenya.

Exporting companies are organized in two federations, ONAPES and SEPAS.[7] Most belong to SEPAS, the oldest of the two, which coordinates transport, provides market information and assists members in dealing with overseas buyers. ONAPES was created by the seven largest exporters in 2000 to coordinate compliance with traceability standards and to seek GlobalGAP certification.

To penetrate the EU fruit and vegetable market, Senegal's exporters must comply with strict and rising standards. The EU's legislation imposes (1) common

[6] EU imports of fresh fruit and vegetables have experienced a cumulative growth of 39% between 2002 and 2008, with an average 7% increase in value and 6% in volume per year.

[7] Organisation Nationale des Producteur- Exportateurs Senegalais. Sénégalaise d'Exportation de Produits Agricoles et de Services.

marketing standards for FFV; (2) sanitary and phytosanitary (SPS) measures; (3) general hygiene rules based on HACCP control mechanisms; and (4) traceability standards. The EU's SPS measures have become notably more stringent in the 1990s. Particularly relevant to FFV are reduced tolerance levels for chemical residues.[8] First, about 350 active substances initially approved for use in the EU have been gradually withdrawn (out of the 823 initially allowed). Second, Maximum Residue Levels (MRL)[9] and Import Tolerances (IT)[10] are imposed at levels specific to particular protection chemical-crop combinations. When an IT has not been established, a default value of 0.01 mg/kg corresponding to Level of Detection (LOD) in inspection labs are used. The registration of an IT is a complicated process involving the submission of a complete residue dossier including field trials and lab analysis results. For exporters of minor crops – most tropical crops except bananas– from developing countries, the challenge is compounded by the fact that agrochemical companies have little incentive to provide registration residue data for those crops because the benefit would not cover the cost.

HACCP and tracability requirements came into force with the General Food Law of 2002 (EC R 178/2002). Traceability means that EU food companies must document from (to) whom they are buying (selling) so that products can be traced back to their origin if they prove defective or dangerous. Although traceability is legally limited to a 'one step forward, one step back' principle within the EU (with no obligation to keep records in third countries), in practice EU buyers tend to go beyond the strict legal requirement. Complete traceability throughout the chain all the way up to the overseas producers is part of many private standards like the GlobalGAP. Legislative changes in EU standards and their potential detrimental effects on small growers/exporters were one of the primary drivers behind the establishment of the COLEACP's Pesticides Initiative Program (PIP).[11] The Pesticide Initiative Program (PIP) is financed by the European Development Fund (EDF) and implemented by the COLEACP. With an overall budget of 34.1 million euros, the PIP's first phase started in 2001, initially for a five-year period; it was

[8] In the late 1990s, an updated harmonised legislation package on pesticide Maximum Residue Limits (MRL) – EC Directive 91/414 and subsequent Regulation 396/2005– created concern for ACP horticultural exporters because of its stringency.

[9] The MRL is the level of residue legally permitted to remain in/on a food or animal feedstuff following the use of a Crop-Protection-Chemical (CPC) under Good Agriculture Practice (GAP), i.e. under the specific label instructions of the approved product.

[10] An import tolerance is an MRL set for imported products containing active plant-protection substances not authorised in the EU for reasons other than public health, or when a different level is appropriate because the existing Community MRL was set for reasons other than public health.

[11] The purpose of the Europe-Africa-Caribbean-Pacific Liaison Committee (COLEACP) is to facilitate the flow of trade in fresh fruit and vegetables between Africa-Caribbean-Pacific (ACP) countries and the EU.

extended by two additional years. The program has two main objectives. The first is to enable ACP exporters of FFV to comply with European traceability and food-safety requirements (in particular as regards pesticide residues). The second is to consolidate the position of small-scale producers in the ACP horticultural value chain. The PIP's support activities are organised around five components: (i) good company practises, (ii) training, (iii) capacity building, (iv) regulation & standards, and (v) information & communication. The core of the support (almost 30% of program budget) goes to component (i), which consists of helping producers and exporters to set up internal food-safety management systems in production and marketing operations. The regulation & standards component ensures that all substances recommended in crop protocols ('technical itineraries') are authorised in both the EU and origin country. Additionally, when needed, the program introduces registration of active substances as well as import-tolerance applications. This is especially important for minor crops of interest to smallholders. Finally, the capacity-building component aims at developing national capacity to provide the services needed by the industry. Beneficiaries of capacity-building activities include private consultants (training courses on food safety, pesticide use, and IPM); accredited laboratories (pesticide residue analysis); public services (including extension services and pesticide registration bodies); and strong professional organizations.

2.2 Selection into the Program

Eligibility starts with the completion and submission of a request for PIP intervention addressing the applicant's particular needs and objectives. The request identifies by self-assessment the problem to be resolved —e.g. MRL, non-accredited plant-protection products, or traceability— and puts forward possible fixes such as training in ICM/IPM systems or safe use of pesticides, implementation of food-safety and traceability systems, or 'technical itineraries'. It also specifies anticipated results, like getting into conformity or maintaining current export volumes. Finally, the request assesses a time line and budget, specifying what is requested from the PIP and what is provided by the applicant. Applications are considered on a first-come first-served basis, with no prioritization or selection criteria. To be accepted, a requested intervention must help to achieve product compliance with EU traceability and food-safety (pesticide residues) regulations. Upon acceptance, a protocol stating the actions to be implemented by each party on a cost-sharing basis (50% for each, except for smallholders who are expected to contribute only 20%) is signed. Wages and investment costs are *de facto* excluded. The actions listed in the protocol are chosen among a menu offered by the PIP under its five components; however, the combination in each protocol is specific to a firm and varies across beneficiaries. So far, most of the financing has gone to training costs, technical support and the development of a food-safety toolbox containing crop protocols, GAP guidelines, and Hortitrace, a traceability software developed by the PIP. The program's first phase has covered 21 countries[12] and 320 export companies. Out of those, 219 firms benefited from the 'good company practices' component (advice and assistance for setting up sanitary quality and traceability systems, and certification pre-audits). 153 benefited from training under the capacity-building component.

2.3 The PIP in Senegal

New traceability requirements and recent changes in the EU's pesticides regulation have been of particular concern to Senegal's horticultural industry—mainly the green bean industry. Senegal ranks fourth, after Kenya, Ghana and Uganda, for the number of PIP protocols signed. PIP beneficiaries produce and export essentially green beans, cherry tomatoes and mangoes to the European market. Their needs relate essentially to traceability systems, staff training, access to information, advice on pesticide MRLs, and infrastructure improvement. Over the project's life, several missions went to Senegal and met with beneficiary companies to review and adjust the activities carried out as part of the program. PIP support activities in Senegal have consisted of in-company training on hygiene and food-safety procedures, development of traceability systems, safe use of pesticides, and recognition of mango pests for mango exporters. Four companies also requested support to obtain GlobalGAP certification; for those, pre-audits were conducted to help identify and correct problem areas. SEPAM obtained its certification in 2004; Soleil Vert, Baniang and AgriConcept obtained theirs in 2007. Remaining exporters, mainly smaller ones, are neither certified nor undertaking particular investments to get it. Except for SEPAM, SAFINA and GDS, Senegal's FFV exporters have outgrower contracts with smallholders (involving training and support) rather than own production sites. In 2006, in cooperation with Senegal's ANCAR (*Agence Nationale de Conseil Agricole et Rural*) the PIP launched 'Golden Bean', an awareness campaign directly targeting 1'000 small FFV producers.

Finally, under the regulations component, field trials have been conducted on PIP priority crops including green beans, cherry tomatoes, okra, avocado, passion fruit, mango, papaya and pineapple.[13] Trials were initiated in November 2003

[12]The countries covered are Benin, Burkina Faso, Cameroon, the Ivory Coast, Gambia, Ghana, Guinea, Mauritius, Jamaica, Kenya, Mali, Mozambique, Namibia, Uganda, the Dominican Republic, Senegal, Surinam, Tanzania, Togo, Zambia, and Zimbabwe.

[13]Field trials are an important part of the establishment or amendment of crop protocols, enabling experts to analyze pesticide residual levels in fruit and vegetables. Following field trials, crop protocols are revised as required to achieve compliance with EU MRLs, and the

on green beans and cherry tomatoes, and in early 2004 on the remaining crops, with crop samples collected and shipped to European GLP-certified laboratories for residual analysis. A particular technical itinerary was developped for mangoes with the objective of bringing mango production in line with European regulations.

2.4 The PIP's Evaluation

An evaluation of the PIP's first phase was undertaken in June 2008. Appendix 2 summarizes the report's findings and details objectives, expected results, performance indicators, and outcomes. Performance indicators are both quantitative and qualitative. The evaluation relies on trade data reported by the firms themselves and from Eurostat. Additionally, a survey was conducted among PIP beneficiaries and EU importers. As highligthed in Appendix 2, program impacts are evaluated at the aggregate level. Outcomes for beneficiary firms are generally reported without controlling for location, size or experience in exporting FFV to the EU market, with the exception of specific objective (S1), for which outcomes are reported by ACP country or type of intervention (O1, O2, O3).

Overall, the evaluation report drew up a very positive image of the program's impact, contributing to the launch of a second five-year phase in 2009. While fairly comprehensive, the PIP's evaluation suffers from a typical drawback of this type of exercise—namely, the lack of a counterfactual to benchmark the performance of treated firms and products.

3 Impact Evaluation

3.1 The Data

Our dataset is constructed using three primary databases which together form a rich and unique combination. First, we have export data at the transaction level (aggregated to the firm level) from raw customs files over 2000–2008. Each record includes the firm's tax ID, the product code, the country of destination, and the export value (in US dollars) and quantity (in tons) for over 500 HS8 products to 90 countries. Exports flows are reported annually. Second, the PIP's administration in Brussels provided us with a list of the Senegalese firms that got assistance from the program in each year of the sample period.[14] Finally, we obtained data on

information gathered in the process feeds back into farming practices.

[14]Variation in the intensity of the treatment across firms would induce a bias in the estimation of the effect. Unfortunately, we do not have data on the intensity of the treatment.

employment and sales from the CNI, Senegal's National Statistics Direction.[15] As the CNI also identifies firms by their tax ID, we could merge the three datasets. Among the reporting firms, almost 3% appear only once in the dataset. That is, they export only one product to one destination one year. As these observations are likely to be mis-reports or individuals, we drop them from our sample. We also drop international organizations and embassies, as well as trading and transport companies (the latter group represents about a quarter of all observations). This leaves us with a sample of almost 2'000 observations.

Let i an exporting firm, k be a product, j a destination country, and t a year. As the PIP targets *products* (FFV), some of a firm's products may be covered and some others not. In addition, technical assitance provided under the PIP helps make FFV marketable on EU markets, but does not necessarily help on other markets with different (or no) food-safety requirements. In view of this, we take the (i, k, j, t) vector as our Primary Sample Unit (PSU). Our dependent variable is the annual flow of exports of product k to destination j by firm i in year t, y_{ikjt}. That is, we take the intensive margin as our baseline measure of performance. Table 1 gives descriptive statistics of firm-level covariates and performance indicators for treated and non-treated flows. Covariates include firm i's annual (overall) turnover, $sales_{it}$, and employment, $Nemployee_{it}$, the number of products it exports. We also include $Nprod_{it}$, the number of products it exports to destination j $Nprod_{ijt}$, the number of destinations to which it exports product k, $Ndest_{ikt}$ and a binary variable equal to one if firm i has more than one year of experience in exporting product k to destination j, exp_{ikj} are included. Performance indicators at the intensive margin include firm i's exports of product k to destination j in year t, $export_{ijkt}$; its total exports of FFV to country j in year t, $total\_export_{ijt}^{FFV}$; its total exports of product k worldwide, $total\_export_{ikt}$; its total exports of FFV worldwide, $total\_exportsit^{FFV}$; and its total exports worldwide, $total\_export_{it}$. Export performance indicators at the extensive margin include firm i's number of destinations with product k in year t, $Ndest_{ikt}$; its number of destinations with FFV, $Ndest_{it}^{FFV}$; its total number of destinations, $Ndest_{it}$; its number of products to destination j, $Nprod_{ijt}$; its number of FFV products to destination j, $Nprod_{ict}^{FFV}$; its number of FFV products wordwide, $Nprod_{it}^{FFV}$, and its total number of products wordwide, $Nprod_{it}$.

Table 3.1 shows descriptive statistics for participating and non-participating *firms*. Two observations are in point. First, participating firms are larger than non-participating. Thus, size must be controlled for in order for non-participating

[15]The data is collected by the *Centre National d'Identification* (CNI), part of the National Statistics Direction.

Table 1: Descriptive Statistics, non-Treated and Treated Flows.

	Non-Treated Flows	Treated Flows		
	Mean	Mean	t-Stat	p t
Sample	1370	492		
Firm characteristics				
sales_{it}	21.7	21.1	4.9	***
Nemployee_{it}	4.4	5.3	-6.9	***
Export performace: intensive margin				
export_{ikjt}	8	10.1	-17.6	***
$\text{total\_export}_{ijt}^{FFV}$	8.2	11.9	-22.8	***
$\text{total\_export}_{ikt}$	8.5	11.1	-20.9	***
$\text{total\_export}_{it}^{FFV}$	8.6	13.21	-34.9	***
total_export_{it}	12.4	13.1	-7.7	***
Export performace: extensive margin				
Ndest_{ikt}	1.5	2.2	-11.5	***
Ndest_{it}^{FFV}	1.3	8	-19.5	***
Ndest_{it}	5.08	3.4	12.3	***
Nprod_{ijt}	14.9	3.2	20	***
Nprod_{ijt}^{FFV}	0.6	2.7	-20.1	***
Nprod_{it}^{FFV}	1.3	8	-19.5	***
Nprod_{it}	38.9	9.3	231	***

Variables are in logs. *, **, and *** denote statistical significance of the t-statistics at the 10%, 5%, and 1% levels, respectively.

Table 2: Descriptive Statistics, non-Treated and Treated Firms.

	Non-treated firms	Treated firms		
	Mean	Mean	t-Stat	p t
Sample	131	100		
Firm characteristics				
sales_{it}	19.5	20.3	-2.0	**
Nemployee_{it}	2.9	4.7	-4.7	***
Export performace: intensive margin				
$\text{total\_export}_{it}^{eu}$	10.1	11.9	-6.7	***
$\text{total\_export}_{it}^{ffv}$	10.0	12.0	-6.8	***
total_export_{it}	10.7	11.9	-4.7	***
Export performace: extensive margin				
Ndest_{it}^{ffv}	1.6	4.2	-5.9	***
Ndest_{it}	2.4	2.5	-0.3	
Nprod_{it}^{ffv}	1.6	4.2	-5.9	***
Nprod_{it}	5.1	4.8	0.4	

Variables are detailed in Table 1. *, **, and *** denote statistical significance of the t statistics at the 10%, 5%, and 1% levels, respectively.

firms to provide a credible counterfactual. Second, these are all small firms, as average numbers of products and destinations are very small.

3.2 Estimation Issues

Estimating the effect of the PIP poses a standard missing-data problem—estimating how much smaller would have been the export flows that got assistance, had they not gotten assistance.[16] Formally, let

$$d_{ikjt} = \begin{cases} 1 & \text{if } (i,k,j,t) \text{ is treated at } t \\ 0 & \text{otherwise} \end{cases}$$

and

$$d_{ikj} = \begin{cases} 1 & \text{if } \exists : t \text{ such that } d_{ikjt} = 1 \\ 0 & \text{otherwise.} \end{cases}$$

That is, d_{ikj} marks the treatment group. The basic estimator for the problem at hand is the difference-in-differences (DID):

[16]Exports to non-EU destinations may be reduced because of a reallocation effect. If this is the case, the effect of the treatment on the treated would be further increased.

$$y_{ikjt} = \mathbf{x}_{ikjt}\beta + \gamma d_{ikjt} + \delta_{ikj} + \delta_t + u_{ikjt} \quad (1)$$

where δ_{ikj} and δ_t are respectively firm × destination × product and time fixed effects, and u_{ikjt} is an error term. Fixed effects δ_{ikj} control for time-invariant firm characteristics potentially affecting both performance and selection into the program, like managerial ability (see Angrist and Krueger 1999, Smith 2000, or Jaffee 2002).

Next, we combine the DID estimator (1) with matching, following Heckman, Ichimura and Todd (1997). From now on, for simplicity of exposition, let us denote by a 'flow' a (firm × product × destination) triplet. Using results by Rosenbaum and Rubin (1983), matching is done on the basis of the estimated propensity score (PS), using a probit or logit regression of the participation status on a vector $\mathbf{z}$ of observable firm characteristics. Letting v_{ikjt} be an error term orthogonal to u_{ikjt}, the first-stage selection equation can be written as

$$\Pr(d_{ikj} = 1) = f(\mathbf{z}_{ikj0}\alpha + v_{ikj}). \quad (2)$$

In (2), the vector $\mathbf{z}$, which contains $\mathbf{x}$ and may be identical to it if no outside determinant of participation is available, must be evaluated at the time the participation decision is made–typically its initial value. The estimated propensity score is then retrieved from (2), and the control group is constructed by selecting untreated firms whose propensity scores are "close enough" to those of treated ones. How close is close is the analyst's choice. Under nearest-neighbour matching, each treated flow is matched with the untreated flow having the closest PS, or with a combination of the n closest untreated flows. Under kernel matching, flow g is matched with a weighted average of untreated flows within a chosen radius, using either uniform weights or weights that decrease with distance in the PS space.[17]

Practically, DID-with-matching estimation is done in two steps: In the first, the participation equation is estimated, yielding an estimated PS and a common support; in the second, the DID equation is estimated on the common support. The latter is formed by disregarding unmatched individuals as well as those with estimated PS of zero or one. Note that, if the first-stage regression predicts treatment-group status too well, it will reduce the common support and thus the sample on which the DID regression is run; if it predicts it too badly, the matching will be poor and the conditional-independence assumption will be unlikely to hold. The choice of RHS variables to include in $\mathbf{z}$ is thus a matter of judgement. The quality of the matching can be assessed by so-called 'balancing tests'. One, proposed by Rosenbaum and Rubin (1985), compares the mean value of each covariate between

[17]On this, see Leuven and Sianesi (2003) or Smith and Todd (2005).

the treatment and control group. When the difference is too large, the null hypothesis (that the samples are balanced with respect to the covariates when they are balanced with respect to the propensity score) is rejected.

We also control for selection using a control-function approach that closely resembles the Heckit procedure (Heckman 1979). The approach proceeds, again, in two steps. The first-step regression is as before, i.e. (2). In the second step, inverse Mills ratios retrieved from the first step are added to (1) as additional regressors.

Before we turn to the results, note that, besides selection bias, other issues may complicate the estimation of γ in (1). One is serial correlation. Persistence in the process driving the error term may be aggravated by the extreme form of serial correlation in the treatment variable. Bertrand, Duflo and Mulainathan (2004) show that ignoring this source of serial correlation can lead to an inflated probability of type-I errors (wrongly rejecting the null hypothesis of no effect, i.e. being over-optimistic in the evaluation of the treatment's impact). This calls for a correction that they suggest. The correction consists of a two-step procedure in which, in Step 1, individual performance for both treated and untreated individuals is regressed on all observables except the treatment. In Step two, residuals from Step 1 for the treated individuals only are retrieved and averaged for (i) the pre-treatment period, (ii) the treatment period. The procedure requires a common treatment period, since otherwise the pre- and post-treatment periods would be undefined for the control group. Those average residuals form a two-period panel. They are then regressed on

$$d_{ikj\tau} = \begin{cases} 1 & \text{if } \tau = 1 \text{ and } (i,j,k) \in T \\ 0 & \text{otherwise,} \end{cases}$$

where $\tau = 1$ denotes the treatment period. The estimated ATT is the coefficient on $d_{ikj\tau}$ in the second step.

4 Results

4.1 Baseline Results

Balancing properties are addressed by testing for equality of means between treated and matched controls for nearest-neighbour matching. Table 4.1 reports results from balancing tests. The table reports, for each covariate included in the probit model determining selection into treatment, the percentage bias after matching, the reduction in the bias, and the t-test statistics for the difference in means between treated and control groups after matching. Variables included in the propensity score specification are the natural logarithm of firm i's initial turnover, ln($sales_{it0}$, the natural logarithm of its initial number of employees, $ln(NEmployees_{it0})$, the initial number of products exported by firm i to destination j, $Nprod_{ij0}$, the initial number of countries served with product k, $Ndest_{ikt}$, the initial natural logarithm of total export value of FFV products from firm i to destination j.

Table 3: Balancing Properties of Covariates in Treated and Control Groups

	Sample	Mean treated "flows"	Mean control "flows"	% bias between treated and controls	% reduction bias	t-test Mean(treated) =Mean(control) t	p ¿ t
$\ln(\text{sales}_{it_0})$	Unmatched	21.39	21.25	11.5		1.3	0.19
	Matched	21.39	21.56	-13.6	-18.6	-1.72	0.08
$\ln(\text{Nemployees}_{it_0})$	Unmatched	5.02	4.18	55.2		7.05	0.00
	Matched	5.02	4.94	4.7	91.6	0.44	0.66
Nprod_{ij_0}	Unmatched	2.38	32.03	-144.2		-14.77	0.00
	Matched	2.38	2.37	0.1	100	0.16	0.87
Ndest_{ikt}	Unmatched	2.41	1.37	114.5		15.1	0.00
	Matched	2.41	2.3	9.7	91.6	0.84	0.40
$\ln(\text{total\_export}^{FFV}_{ijt_0})$	Unmatched	11.93	7.51	154		16.63	0.00
	Matched	11.93	12.13	-7	95.4	-1.21	0.23

Matching is by nearest neighbour. *, **, and *** denote statistical significance of the t statistics at the 10%, 5%, and 1% levels, respectively.

Results show that, for many covariates, there is a strong bias before matching but matching eliminates it. The null hypothesis of balanced sub-samples is not rejected except for turnover.

Table 4 reports difference-in-difference (DID) estimates on the treated, for our baseline specification. That is, the average effect of the PIP on assisted firms where the export performance indicator is the export value in US dollars, of product k, from firm i, to destination country j, in year t. Column (1-3) reports DID estimates without matching, and with or without covariates. Column (4) reports

DID estimates with matching, i.e. restricting the sample to the common support defined in the NN-PSM procedure. Matching is done at the firm, product destination level. Column (5) reports treatment-effect estimates using Heckman's two-step procedure, i.e. estimates from the second-step regression run with the inverse Mills ratio. Finally, column (6) reports results from the second stage of the procedure suggested by Bertrand, Duflo and Mulainathan (BDM) (2004).

Results for the first step of the Heckman and BDM procedures are reported in Appendix 9 and 10. All regressions are run at the i, k, j, t level and standard errors are clustered at the firm level. Here the variable of interest is the treatment indicator variable $treatment_{ikjt}$ taking value one if firm i exporting product k to destination country j in year t, benefited from the PIP program.

Coefficients in all specifications are not significant, suggesting no effect of the program on firms export performance. The dependent variable is the natural logarithm of the export value of product k from firm i to country j in time t. All regressions control for (firm *times* product *times* country) and time fixed effects. Our main variable of interest is $treatment_{ikjt}$, a dummy variable taking value 1 if firm i exporting product k to country j benefited from the PIP in year t. Columns 1-3 show difference-in-difference estimations, where the control variables include the natural logarithm of annual turnover of firm i in year t $\ln(sales_{it}$, the natural logarithm of the number of employees for firm i in year t, $\ln(Nemployees_{it})$, firm i's experience in servicing product k to country j, and a dummy variable taking value 1 if the firm exported at least two years product k to country j before time t, $experience_{ikjt}$. Column 4 shows matching difference-in-difference estimation where results are reported using the Nearest Neighbourg (NN) estimator with caliper (0.04). Column 5 shows two-stage Heckman estimation where λ is the inverse Mill's ratio retrieved from the first step. The first-step is a regression of the participation status on a vector of observable firm characteristics (see Appendix 9). Column 6 shows two stage BDM estimation where residuals from the first step are retrieved and averaged for (i) the pre-treatment period, (ii) the treatment period. Step 1, individual performance for both treated and untreated individuals is regressed on all observables except the treatment (see Appendix 10).

Table 4: Baseline Results, Average Effect of the PIP on Assisted Firms.

	(1) Diff in Diff	(2) Diff in Diff	(3) Diff in Diff	(4) Diff_in_Diff with Matching	(5) Two stage Heckman	(6) BDM Correction
treatment_{ikjt}	0.354	0.216	0.112	-0.013	0.238	0.111
	(0.235)	(0.288)	(0.322)	(0.418)	(0.362)	(0.293)
ln_sales_{it}		1.062***	1.125***	1.246***	1.263***	
		(0.212)	(0.262)	(0.243)	(0.246)	
ln_Nemployee_{it}			-0.099	0.017	0.009	
			(0.155)	(0.152)	(0.148)	
experience_{ikjt}	0.183*	-0.047	0.018	-0.143	-0.145	
	(0.104)	(0.168)	(0.172)	(0.169)	(0.169)	
λ					-0.153	
					(0.153)	
constant	7.94***	-14.59***	-15.94***	-18.98***	-19.39***	-0.073
	(0.225)	(4.552)	(5.422)	(5.128)	(5.246)	(0.166)
Observations	1,862	1,193	1,071	698	698	176
R-squared	0.132	0.179	0.188	0.207	0.207	0.007
Number of id	1,134	657	577	369	369	155

Robust standard errors clustered at firm level are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

4.2 Robustness

In this section we present estimation results of the effect of the PIP on assited firms, for two alternative export performance indicators.

Table 5 reports DID estimates when considering firm i export of product k to the EU-15 in year t, as the export performance indicator. Balancing tests results are provided in Appendix 7. There is no problem of unbalanced covariates in our model. All regressions are run at the i, k, t level. The coefficients on the treatment variable are not significant for any of the specifications in Table 5. Results for the first step of the Heckman and BDM procedures are reported in Appendix 9 and

10.

Finally, Table 6 reports results from regressions run at the level of the firm instead of the firm $\times$ product $\times$ destination combination. Estimation at the firm level may drastically reduces sample size and means mixing up exports that are covered by the program with exports that are not (namely, products other than FFV). However, it is advisable, since the decision to participate and some of the covariates are at the firm level. The export performance indicator is the export value of FFV to the EU-15 exported by firm i in year t. All regressions are run at the i, t level. The coefficient on the treatment variable is significant at the 5% level only in column (1). Results for the first step of the Heckman and BDM procedures are reported in Appendix 9 and 10.

All in all, results suggest that while there seem to be an effect of the program when considering total FFV exports to the EU, the effect disappears when looking at a more disaggregated level (Table 4 and 5). These results are in line with findings in the program evaluation report.

In Table 5, the dependent variable is the natural logarithm of the export value of product k from firm i to the EU-15 at time t. All regressions control for firm x product and time fixed effects.

Table 5: Robustness I, Average Effect of the PIP on Assisted Firms.

	(1) Diff in Diff	(2) Diff in Diff	(3) Diff in Diff	(4) Diff_in_Diff with Matching	(5) Two stage Heckman	(6) BDM Correction
treatment_{ikt}	0.100	-0.023	-0.115	-0.114	-0.669	-0.410
	(0.215)	(0.264)	(0.305)	(0.327)	(0.813)	(0.564)
ln_sales_{it}		0.909***	0.923***	0.948***	0.890***	
		(0.217)	(0.287)	(0.293)	(0.290)	
ln_Nemployee_{it}			0.063	0.074	0.078	
			(0.105)	(0.107)	(0.103)	
experience_{ikjt}	0.299	-0.252	-0.228	-0.253	-0.213	
	(0.248)	(0.373)	(0.473)	(0.504)	(0.485)	
λ					0.333	
					(0.357)	
constant	8.95***	-9.36	-10.01	-18.98***	-8.54	0.17
	(1.008)	(5.834)	(5.975)	(5.128)	(6.054)	(0.311)
Observations	681	368	288	281	286	93
R-squared	0.153	0.211	0.227	0.218	0.230	0.036
Number of id	373	189	142	139	140	78

Robust standard errors clustered at firm level are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Robustness II, Average Effect of the PIP on Assisted Firms.

	(1) Diff in Diff	(2) Diff in Diff	(3) Diff in Diff	(4) Diff_in_Diff with Matching	(5) Two stage Heckman	(6) BDM Correction
treatment_{it}	0.533**	0.381	0.666	0.666	0.711	0.477
	(0.239)	(0.128)	(0.421)	(0.426)	(2.898)	(0.292)
ln_sales_{it}		0.529	0.496	0.520	0.518	
		(0.372)	(0.532)	(0.538)	(0.626)	
ln_Nemployee_{it}			-0.181	-0.188	-0.187	
			(0.262)	(0.266)	(0.265)	
experience_{it}	-0.007	-0.007	-0.218	-0.237	-0.236	
	(0.233)	(0.233)	(0.460)	(0.468)	(0.530)	
λ					-0.026	
					(1.570)	
constant	10.07***	0.855	2.193	1.992	2.017	-0.278
	(0.704)	(7.943)	(11.724)	(11.795)	(12.850)	(0.214)
Observations	199	119	85	79	79	16
R-squared	0.301	0.380	0.354	0.362	0.362	0.308
Number of id	69	38	26	21	21	9

Robust standard errors clustered at firm level are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

5 Concluding Remarks

By and large, we find no significant impact of the PIP on Senegal's FFV export flows when taking similar, untreated export flows as the counterfactual. There are two ways of interpreting such a no-impact result.

The naive interpretation is that the PIP simply fails to achieve its objective. That may well be true, but our failure to reject the null of no impact is not sufficient to reach that conclusion. First, as we briefly discussed in the introduction, the choice of Senegal as a testing ground was driven by data availability (Senegal was the only country for which we had data for the pre-treatment period). It has no claim to be a representative or random sample. Different conclusions may be reached from other samples, and clearly a full, cross-country impact evaluation should be undertaken. Second and more importantly, it is possible that the PIP affected not only the treated export flows, but also untreated ones, through spillovers. Participating firms are the largest and more efficient of Senegal's FFV sector. On one hand. this means that they are more susceptible than others to benefit from the program. Thus, what we obtain is an estimate of the average effect of the treatment on the treated (ATT), which may over-state the program's potential effect on the whole population of producers. On the other hand, it may also mean that smaller firms, although left out of the program, can benefit from it through imitation of best practices and even unobserved assistance from larger firms. The argument is even more potent for untreated *products*: when a firm gets PIP assistance for its FFV activities, it is quite possible (indeed, likely) that its other activities benefit as well from improved managerial practices; or *destination countries*: export flows to non-EU destinations may benefit from the program for the same reason. In the presence of such unmeasured spillovers, the PIP's impact would be underestimated by impact-evaluation methods. This is important to keep in mind, as public assistance (whether from local governments or donors) should be justified by market failures, like spillovers, rather than a positive rate of return to beneficiaries (which would simply create a market demand for assistance services without justifying use of public funds). Thus, impact evaluation of technical-assistance programs like the PIP is a double-edged sword and must be interpreted with caution.

The second conclusion that should be *avoided* is that, either because the data are not sufficiently reliable or comprehensive or because of the caveats just discussed, rigorous impact evaluation should not be undertaken. The lack of rigorous impact evaluation undermines the credibility of claims about the program's benefits made on the basis of case studies, because it is impossible to know whether they are representative or not. Indeed, this is the message conveyed by the 2006 assessment of the impact of EU TRA (te Velde et al. 2006). Worse, in a context where taxpayers are asking for acccountability and results in development aid, Paul Milgrom's 'unraveling principle' applies: Rational taxpayers are likely to take all the news that is not told to be detrimental. In other words, the bad news that impact evaluation can possibly generate (as in the present case) is probably fully anticipated. The more the development community can provide rigorous evidence that at least some programs do make a difference; or that some components do; or that, when not, failure is part of useful experimentation and action is being taken to remedy the observed ineffectiveness, the more support there will be for development aid.

However, as the present study highlights, it is difficult to 'improvise' impact evaluation *ex-post* when a program was not designed to be evaluated. Far better would be to think seriously about evaluation *ex-ante*, so that TRA programs generate experimental settings out of which useful lessons could be drawn. We hope that this study will help convince the European Commission and other development agencies of the need to plan for impact evaluation at program-design time. By this, we mean to (i) clarify what measurable performance indicator the program seeks to improve; (ii) collect, before, during and after the program period, the data needed to track this indicator for treated and non-treated firms and products, as well as its non-program determinants; (iii) amend the design of the program (in particular the assignment rule) to ensure the existence of a proper control group against which to benchmark its impact.

6 Appendices

Table 7: Balancing Test Results for Table 5

The table reports, for each covariate included in the probit model determining selection into treatment, the percentage bias after matching, the reduction in the bias, and the t-test statistics for the difference in means between treated and control groups after matching. Variables included in the propensity score specification are: initial natural logarithm of firm i turnover ($sales_{it_0}$), initial natural logarithm of number of employees in firm i ($NEmployees_{it_0}$), initial number of products exported by firm i to destination to the EU ($N\mathrm{Pro}d^{eu}_{it_0}$), initial number of countries j served with product k ($NDest_{ikt_0}$), initial natural logarithm of total export value of product k from firm i to the EU($\mathrm{total\_export}^{eu}_{ikt_0}$). *, **, and *** denote statistical significance of the t statistics at the 10%, 5%, and 1% levels, respectively.

	Sample	Mean treated "flows"	Mean control "flows"	% bias between treated and controls	% reduction bias	t-test Mean(treated) =Mean(control) t	p ¿ t
$\ln(\mathrm{sales}_{it_0})$	Unmatched	21.44	20.34	74.3		5.83	0
	Matched	21.46	21.53	-5	93.2	-0.5	0.618
$\ln(\mathrm{Nemployees}_{it_0})$	Unmatched	4.87	3.68	69.2		5.73	0
	Matched	4.83	4.93	-6	91.3	-0.43	0.666
$\mathrm{Nprod}^{eu}_{it_0}$	Unmatched	6.58	4.26	103.8		8.21	0
	Matched	6.56	6.51	2.1	98	0.2	0.845
Ndest_{ikt_0}	Unmatched	2.02	1.35	78		6.79	0
	Matched	1.97	1.95	2.2	97.2	0.14	0.892
$\ln(\mathrm{total\_export}^{eu}_{ikt_0})$	Unmatched	11.12	9.74	58.2		4.81	0
	Matched	11	10.80	8.7	85.1	0.6	0.548

Table 8: Balancing Tests Results for Table 6

The table reports, for each covariate included in the probit model determining selection into treatment, the percentage bias after matching, the reduction in the bias, and the t-test statistics for the difference in means between treated and control groups after matching. Variables included in the propensity score specification are: initial natural logarithm of firm i turnover ($sales_{it_0}$), initial natural logarithm of number of employees in firm i ($NEmployees_{it_0}$), initial number of FFV products exported by firm i to the EU ($N\mathrm{Prod}_{ieut_0}^{ffv}$), initial number of countries served with FFV product ($NDest_{ikt_0}^{ffv}$), initial natural logarithm of total export value of FFV product from firm i to the EU ($\mathrm{total\_export}_{ieut_0}^{ffv}$). *, **, and *** denote statistical significance of the t statistics at the 10%, 5%, and 1% levels, respectively.

	Sample	Mean treated "flows"	Mean control "flows"	% bias between treated and controls	% reduction bias	t-test Mean(treated) =Mean(control) t	p ¿ t
$\ln(\mathrm{sales}_{it_0})$	Unmatched	21.49	20.02	91.9		3.96	0
	Matched	21.49	21.55	-3.6	96.1	-0.17	0.869
$\ln(\mathrm{Nemployees}_{it_0})$	Unmatched	4.75	3.28	86.6		3.82	0
	Matched	4.75	4.45	17.9	79.4	0.68	0.5
$\mathrm{Nprod}_{it_0}^{ffv}$	Unmatched	5	3.1957	83.9		3.7	0
	Matched	5	5	0	100	0	1
$\mathrm{Ndest}_{it_0}^{ffv}$	Unmatched	5	3.1957	83.9		3.7	0
	Matched	5	5	0	100	0	1
$\ln(\mathrm{total\_export}_{ieut_0}^{ffv})$	Unmatched	12.88	11.67	69.6	2.98	0.004	
	Matched	12.88	12.73	8.9	87.2	0.37	0.711

Table 9: First Stage Estimation: Probability of Selection into the Treatement

In column (1) the dependent variable is the probability of treatement: for a firm i product k and destination j (treatement$_{ikjt}$). In column (2) the dependent variable is the probability of treatement for a firm i product k (treatement$_{ikt}$). And in column (3) the dependent variable is the probability of treatement for and for a firm i (treatement$_{it}$). Control variables are detailled in Appendix 7 and 8. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Two stage BDM estimation (column 6): residuals from the first step are retrieved and averaged for (i) the pre-treatment period, (ii) the treatment period. Step 1, individual performance for both treated and untreated individuals is regressed on all observables except the treatment (see Appendix 10).

(1)		(2)		(3)	
treatment_ikc		treatment_ik		treatment_i	
1st Step Probit		1st Step Probit		1st Step Probit	
ln(sales$_{it_0}$)	0.122**	ln(sales$_{it_0}$)	0.157**	ln(sales$_{it_0}$)	0.165
	(0.059)		(0.080)		(0.142)
ln(Nemployees$_{it_0}$)	0.086*	ln(Nemployees$_{it_0}$)	0.107	ln(Nemployees$_{it_0}$)	0.109
	(0.048)		(0.066)		(0.137)
Ndest$_{ikt_0}$	0.432***	Ndest$_{ikt_0}$	0.356***	Ndest$^{ffv}_{it_0}$	0.332
	(0.069)		(0.122)		(0.214)
Nprod$_{ijt_0}$	-0.039***	Nprod$^{eu}_{it_0}$	0.178***	Nprod$^{ffv}_{it_0}$	-0.029
	(0.014)		(0.036)		(0.080)
ln(total_export$^{ffv}_{ijt_0}$)	0.113***	ln(total_export$^{eu}_{ikt_0}$)	0.029	ln(total_export$^{ffv}_{ieut_0}$)	0.035
	(0.034)		(0.041)		(0.113)
Constant	-5.076***	Constant	-5.899***	Constant	-5.339**
	(1.164)		(1.487)		(2.613)
Observations	698		286		79

Table 10: First Stage BDM Procedure

Step 1 of the two stage BDM estimation: individual performance for both treated and untreated individuals is regressed on all observables except the treatment. In column (1) the dependent variable is the natural logarithm of the export value of product k from firm i to country j in time t. In column (2) The dependent variable is the natural logarithm of the export value of product k from firm i to the EU in time t. In column (3) the dependent variable is the natural logarithm of the export value of FFV product from firm i in time t. Control variables are detailled in Appendix 7 and 8. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)		(2)		(3)
	Yijkt		Yikt		Yit
	1st Step BDM		1st Step BDM		1st Step BDM
$\ln(\text{sales}_{it_0})$	1.122***	$\ln(\text{sales}_{it_0})$	0.934**	$\ln(\text{sales}_{it_0})$	0.449
	(0.389)		(0.412)		(0.676)
$\ln(\text{Nemployees}_{it_0})$	-0.098	$\ln(\text{Nemployees}_{it_0})$	0.047	$\ln(\text{Nemployees}_{it_0})$	-0.126
	(0.233)		(0.181)		(0.329)
experience_{ikjt}	0.030	experience_{ikt}	-0.259	experience_{it}	-0.110
	(0.237)		(0.584)		(0.613)
Constant	-15.86*	Constant	-9.495		2.888
	(8.052)		(8.281)		(15.049)
Observations	1,071		288		85
R-squared	0.921		0.920		0.913

Figure 2: The PIP's evaluation matrix

Program component	Objective or Expected results	Performance indicator	Outcome	Conclusion of the report
Global	ACP countries maintain their share (in value terms) in EU imports of fresh fruits and vegetables.	**Indicator G1:** The share in EU Extra-EU imports of FFV remains stable at 7% in value.	**O1:** Share of ACP exporters in EU imports value of FFV increased from 6.1% (371'116 thousands euros) in 2001 to 6.2% (534'681 thousands euros) in 2006.:	Achieved
			Share with regards to volumes decreased from 7% (335'647 tons) to 6% (384'437 tons).	
Specifique	ACP FFV suppliers meet european Maximum Residues Limit (MRL) and traceability regulations requirements.	**Indicator S1:** Exporters with established internal systems of food safety management in the production and marketing process account for 80% of exports of FFV to the EU by the end of the program.	**O1:** The 219 firms that signed a protocle with PIP account for 74% of ACP FFV exports to the EU in 2006 (276'000 tons*).	Achieved
			O2: The 145 firms that set up a traceability system account for 60% of ACP FFV exports to the EU in 2006 (229'084 tons*).	
			O3: The 191 firms that benefited from staff training in food safety procedures account for 70% of ACP FFV exports to the EU in 2006 (265'395 tons*). Out of these, 56 obtained certification for their food safety management system, and account for 37% of exports in 2006 (142'233	
		Indicator S2: Thoses exporters suffer less shipments rejections due to food safety issues on the EU market.	**NA.** Data on rejections and removals (once the product entered in the EU market) was not available.	NA
		Indicator S3: Improvement in the degree of satisfaction of european importers regarding the level of conformity of ACP exports with public and private standards requirements.	**O1:** 47% of importers (34 respondents) believe the impact of PIP was determinant in bringing ACP exports in conformity with regulations requirements.	Achieved
			O2: 15% believe its was not sufficient.	
			O3: With regards to private standards requirements 35% believe PIP intervention was determinant. While 21% estimate it as not sufficient.	
			O4: 55% fear that the end of the program will negatively impact the quality of products.	
Information and communication	Producers and exporters in ACP countries are informed in time of destination markets requirements with a focus on MRL and Import Tolerances (IT). Therfore, they can adapt their production and production pratices to changes in importers requirements.	**Indicator R1:** Is the information system** effective and efficient in providing the needed information to both importers and exporters.	**O1:** Among the 176 beneficiaries that answered, 80% are satisfied with the information/communication toolkit developped by the program.	Achieved
			O2: Among inporters (34 respondents), 59% know about the PIP, and 50% are aware that their suppliers benefited from the PIP.	
	Importers are informed of exporters compliance efforts.			
Regulation and standards	Crop protocols (technical itineraries) are drawn up by the PIP for the main crops exported to the EU market. Applications for Tolerances Import are submited for combinations of product and active substance for which the pesticide use led to residue levels above the	**Indicator R2:** Products targeted by the component account for 90% of export flows by the end of the project	**O1:** Products for which technical itineraries were elaborated account for 91.4% of ACP FFV exports to the EU in 2006 (384'437 thousands euros).	Achieved
Good company practices	Producers adopt Good Agricultural and Production Practices (GAP and GPP). Exporters set up contol and traceability systems to insure food safety.	**Indicator R4: Indicator S1**	See above	Achieved
	Export flows from small scale producers are maintained (in value terms) as must as possible.	**Indicator R5:** The decrease in small scale producers export values of FFV to the EU is bounded to 20%.	NA	NA
Capacity building	ACP actors of the FFV industry participate in at least ten national task forces. These task forces act as coordination platforms between the producers/exporters, the private professional organisations, the relevant public services and the authorities in charge of pesticide controls.	**Indicator R6:** At least ten task forces are created and are financially viable by the end of the program.	NA	NA
	ACP exporters and professional organisations in the FFV industry develop an european network of technical structures which serve as	**Indicator R7:** An european network is established	NA	NA

Notes

EU is the EU-15 EU imports correspond to extra -EU imports.

FFV = Fresh fruits and vegetables excluding bananas and citrus fruits that are not covered by PIP

* Based on firms' own declarations.

** Include website, technical documents, newsletter INFOPIP, technical itineraries.