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Export Promotion: what works?*

Marcelo Olarreaga
Stefan Sperlich
Virginie Trachsel

Marcelo Olarreaga, Geneva School of Economics and Management, University of Geneva, CEPII, CEPR and FERDI.
Email : marcelo.olarreaga@unige.ch

Stefan Sperlich, Geneva School of Economics and Management, University of Geneva, **Email: stefan.sperlich@unige.ch**

Virginie Trachsel, Geneva School of Economics and Management, University of Geneva, **Email: virginie.trachsel@unige.ch**

Abstract

We explore the heterogeneity in returns to export promotion across countries using a semi-parametric varying coefficient model. We find that a one percent increase in export promotion budgets generates an increase in export growth between 0.03 and 0.08 percent. Returns in terms of GDP per capita show less heterogeneity and vary from 0.05 to 0.07. Differences in the characteristics of export promotion agencies drive the heterogeneity in returns to export promotion across countries. More importantly, characteristics that may help export growth are not necessarily those that help GDP per capita growth.

JEL Codes : F13, C14
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1 Introduction

Export Promotion Agencies (EPAs) are present in most countries. EPAs' activities range from providing financial assistance (credit, insurance), to market intelligence (firms and products), technical assistance for transport logistics, product certification, and participation in trade fairs. They differ in their economic size, their governance, and they engage in different type of activities. For instance, the export promotion budget to export ratio varies from 0.22 percent in Portugal to 0.15 percent in Chile and Colombia and 0.03 percent in Bolivia and Tanzania. The budgets vary from 500 million dollars in the United Kingdom to 60 thousand dollars in Sierra Leone. Few are fully financed by the private sector (Hong Kong), while most are fully financed by the government (Chile). Some EPAs spend more than 75 percent of their budget on established exporters (Canada), others only focus on new or non-exporters. Some only focus on small and medium size firms (Uruguay); others spend more than 75 percent of their budget on large firms (Honduras). Some promote exports across all sectors (Philippines) while others focus on a more limited range of sectors (France). The objective of this project is to find out which of these EPAs' characteristics are more effective at promoting exports and GDP per capita growth.

Merging data from three rounds of EPAs' surveys conducted between 2005 and 2014, we obtain an unbalanced panel across developing and developed countries with information on EPAs' budget, funding sources and activities. To better understand why some EPAs may be more efficient than others, we explicitly model the heterogeneity in returns to export promotion budgets as a function of EPAs's characteristics with the help of a semi-parametric varying coefficient model (see Park et al., 2013, for a recent review). Aggregating at the country level the different returns as a function of each agency's characteristics, we find that the returns in terms of export growth associated with a one percent increase in export promotion budgets vary from 0.03 percent in Jordan to 0.08 percent in Bangladesh. The returns in terms of GDP per capita vary from 0.05 in Malawi to 0.07 in Egypt. These differences at the country level are explained by differences in agencies characteristics. We find that EPAs that have a larger share of their executive board in the hands of the private sector, target only a few sectors and markets, spend a smaller share of their budget on small firms, and a larger share on established exporters have higher export returns. Some of these characteristics also tend to matter for GDP per capita returns, as for example the focus on established exporters. But there are also several other EPAs' characteristics that seem to matter more for GDP per capita. For example, focusing on medium size firms, rather than large firms, yields higher GDP per capita returns. Also, a larger share of the budget spent on country image and other marketing activities seem to generate larger gains in terms of GDP per capita, whereas we did not observe any clear relationship for export returns.[1] A larger share of the budget coming from public sources and a larger share of the budget spent on export support services yields lower returns in terms of GDP per capita.[2]

[1] In the survey, we explicitly define marketing activities as including trade fairs, trade missions, follow-up services offered by representatives abroad and importer missions.

[2] In the survey, we explicitly define export support services as including export training, technical assistance and capacity building (regulatory compliance, information on trade finance, logistics, customs, packaging, pricing).

These results are important for at least three reasons. First, they help identify the export promotion strategies and EPAs' characteristics that provide higher returns. They are therefore a valuable guide to EPAs that want to help exporters. Second, to our knowledge we are the first to measure returns in terms of GDP per capita. This is important because export growth cannot be the ultimate goal of export promotion policies, but rather an instrument to achieve economic growth. Interestingly, our results highlight that what may be good for export growth may not necessarily be good for GDP per capita growth, probably explained by externalities on non-exporting firms. This is crucial and suggests that the exclusive focus on exports in the evaluation of EPAs may be misleading. Some interventions, such as expenditure in country image and market activities, may not generate much export growth, but they lead to important GDP per capita growth. Third, the results are based on stronger identification strategies than existing cross-country studies (e.g., Lederman et al. 2010) that only measured average effects, and therefore may help validate statistically less robust results regarding the desirability of export promotion.

We face several econometric challenges when estimating the returns to export promotion. Before considering the estimation of heterogeneous returns to export promotion budgets as a function of EPA characteristics, let us address problems associated with the estimation of average returns in a standard linear regression model. First, exports (or GDP per capita) and EPA's budget may be jointly determined, which may lead to omitted variable bias. This was an important problem with earlier cross-section studies where addressing omitted variable bias relied on adding as many controls as possible and instrumental variable strategies. Second, we also may face an endogeneity problem often referred to as 'reversed causality' which requires modeling self-selection. Indeed, economic policies and programs are endogenous and subject to lobbying. In such an environment, large sectors are more likely to obtain government assistance. Thus, it may well be that the causality runs from larger exports to larger export promotion programs. The panel data structure of our dataset allows us to partly circumvent these problems using country-specific and year-specific fixed effects to control for unobserved heterogeneity. We can then identify the impact of increases in export promotion budgets within countries rather than across countries, which largely circumvents the concerns regarding omitted variable bias in cross-country studies. Another problem is measurement error in the size of the export promotion budget. In many countries the budget is part of a larger institutional budget (export and investment promotion for example) and disentangling what belongs to export promotion may be tricky. The country-specific fixed effects partly help us address this, but we also use the rank of the budget as an instrument, which is widely accepted as a correction for measurement problems.

We first address these three problems using an instrumental variable estimator as in the previous literature, which assumes that the returns to export promotion are homogeneous across countries (see for example, Lederman, Olarreaga and Payton, 2010). We use as instruments some EPAs' characteristics, such as the share of the budget coming from public funding, and the share of the seats in the EPA's board which are in the hands of the private sector. The identifying assumption is that they are correlated with the size of the budget, but else uncorrelated with exports or GDP per capita. The first stage results suggest that both

instruments are statistically significant determinants of the budget, but a Hansen over-identification test suggests that they are valid instruments for GDP per capita equation, but not for exports.

Note that the exclusion restriction is not satisfied if the heterogeneity of the impact of export promotion depends on EPA's characteristics that we use as instrumental variables. Hence, as long as the econometrician does not model this heterogeneity, it appears in the error term, which is then correlated with the instruments, leading to the violation of the exclusion restriction. Furthermore, the use of instrumental variables changes the interpretation of estimated coefficients. They actually identify the average returns associated with variations in export promotion budgets that are caused by variations in the instrumental variables. Clearly, the larger the unexplained heterogeneity in the returns to EPA budgets, the larger the difference between the returns identified by altering IVs (the so-called local average treatment effects, or LATE, which vary with the choice and values of IVs), and the larger their difference with respect to the average returns over the entire population (the so-called average treatment effect, or ATE). In other words, the parameter (or function) identified by an instrument is itself a function of the choice and value of the instruments used. This and its consequences has been in various articles, see for example Heckman, Urzua, and Vytlacil (2006).

To explicitly capture the heterogeneity in returns we use an identification strategy that relies on the use of a semi-parametric varying coefficient model. It has at least two interesting properties:[3] First, by reducing the extent of unexplained heterogeneity, it reduces the variation of the LATE (and thus its distance to the ATE). To see this note that if we could explicitly model all the heterogeneity in returns, the LATE would necessarily be equal to the ATE. In such a case, the identified returns do no longer depend on which instruments we have used, although their estimates would (numerically) still do. Even though this extreme case may be infeasible in practice, it suggests that a reasonable modeling of the heterogeneity correlated with the IVs will provide reasonably interpretable parameter estimates. Second, it makes the exogeneity assumptions required by the IV estimator more credible. Indeed, in the presence of unmodeled heterogeneity, the error term necessarily includes the heterogeneous impact of export promotion budgets, and the exclusion restriction would then require finding an instrument that is uncorrelated with this unmodeled heterogeneity in the error term. On the other hand the inclusion restriction would require that the instrument is highly correlated with the export promotion budget itself. Such an instrument is unlikely to exist.

The semi-parametric varying coefficient model we use, explicitly models the heterogeneous impact of the export promotion budget on exports or GDP per capita as a function of different EPAs' characteristics. The motivation is twofold. First, the EPAs' characteristics are supposed to only impact on export volume or GDP per capita by turning the budget investments to be more or less efficient, whereas without a budget they are ineffective. Second, this modeling accounts for the fact that the average return to export promotion budgets that can be identified by IVs is just the weighted average of LATEs obtained by different IV values (EPA characteristics) which is hardly interpretable and of little help to policy makers. It is arguably more

[3]For details on why and how varying coefficient models have these two properties see Sperlich and Theler (2015) or Benini, Sperlich, and Theler (2016).

helpful to directly estimate the returns as a function of these IV values.[4] In our case the causal impact is easily identified since we are provided with some instruments that were excluded from the main model, namely those EPA characteristics that were expelled from the main model because they do not help to explain the heterogenity in returns.[5] These fulfill therefore the classic exclusion condition as they do not help in modeling the heterogenous impact of export promotion on exports or GDP per capita, respectively.[6] In sum, the explicit modeling of the heterogenous impact as a function of EPAs' characteristics helps us to simultaneously address the potential endogeneity bias, as well as the question of what agencies' characteristics lead to higher returns.

Early assessments of the impact of EPAs (Keesing and Singer, 1991, 1991a) were quite critical of their performance in developing countries. EPAs in those countries were criticized for being inadequately funded, suffering from government involvement, and hiring staff that was burocratic rather than client oriented. As a result, many development institutions withdrew their support to EPAs. These criticisms of early EPAs led to important reforms in the way EPAs operate in most countries today. Moreover, the anti-export bias due to protectionist policies in most developing countries up to the 1980s has been significantly reduced. When EPAs were evaluated twenty years later, quantitative assessments of the role of export promotion were more positive. Rose (2007) stated that the presence of a diplomatic representation (i.e., a consulate) can increase bilateral exports by 6 to 10 percent. Lederman, Olarreaga and Payton (2010) estimated that on average a 1 percent increase in export promotion budgets leads to a 0.05 percent increase in exports.

While the more recent literature tends to conclude that EPA activities increase exports, it only focuses on the average impact. None of the above papers explored the heterogeneity of the impact on exports of different types of governance, funding sources or activities of EPAs, or the returns in terms of GDP per capita. None of them is discussing the problem of having only identified a LATE, i.e. a parameter that is intrinsically related to the IV choice and the IV variation in their sample. All these are important unanswered questions for policy makers. Our paper fills this gap.

There is also a large and growing literature using firm level data that explores which are the types of firms that benefit the most from export promotion. Volpe and Carballo (2008) found that export promotion affects exports mainly along firm's extensive margin in terms of both new export markets and products, but has little impact on the intensive margins of exports in a sample of Peruvian firms. Volpe and Carvallo (2010) found that smaller firms are more likely to benefit from export promotion services in Chile. Schminke and Van Biesebroeck (2013) confirm that export promotion works mainly through the extensive margin in a sample of Belgian firms, but experienced exporters observe increases in their intensive margin. Vargas da Cruz (2014) provides evidence of export promotion services helping Brazilian medium size firms enter

[4]This idea is actually related to the so-called LIV estimation of Heckman (2010) or the so-called MTE estimation of Moffit (2008). Both concentrate more on the heterogeneity of returns with respect to the propensity score whereas we look at the IVs directly. Moffit (2008) proposed a varying coefficient model that is somewhat related to ours.

[5]These were identified in a prior study where we applied a variable selection method for semiparametric varying coefficient models.

[6]Note that this is not a necessary condition for the varying coefficient model we use, but it simplifies a lot the estimation strategy relative to Moffit (2008).

the export market, as well as new exporting firms in terms of their managerial organization. Lederman, Olarreaga and Zavala (2016) show in a sample of Latin American firms that export promotion helps firms enter into and survive in export markets, but has little impact on the intensive margin. Van Biesebroeck, Konings and Volpe (2017) show the export promotion has helped Belgian and Peruvian firms survive in export markets during the great recession.

More recently, randomized experiments at the firm level have shown that the returns to export promotion can be large. Atkin, Khandelwal and Osman (2017) conduct an experiment where they offer to a random set of firms the opportunity to export high quality carpets to retailers in the United States and Europe. They found that treated firms had an increase in profits of around 20 percent and larger increases in the quality of goods they produced, which is consistent with learning-by-exporting. Breinlich, Donaldson, Nole and Wright (2015) also conduct a controlled trial by providing targeted information to a randomly selected set of firms regarding the benefits and costs of exporting. Their objective is to assess the role that information plays on the perceptions that firms have about costs and benefits of selling in international markets. They found that treated non-exporters become less likely to export, whereas treated exporters become more likely to export, suggesting that the provision of information can have an impact on firms' behavior.

The advantage of the literature using firm level data is that it can better identify the type of firm or worker that is benefiting from the program, and the channels through which export promotion affects export growth (e.g., extensive versus intensive margins). The disadvantage of micro-data is that it is not clear how to aggregate results from individual firms or workers to obtain an impact on total exports or GDP. This is important, because the case for export promotion is often based on externalities (positive and negative). By simply observing that firms benefitting from export promotion export larger amounts than firms that do not benefit from the program, we have no indication of how big is the aggregate impact and even the sign of that impact. It is potentially conceivable that badly designed export promotion schemes will lead to a larger fall in exports of firms not benefitting from the program than the increase in exports of firms that benefit from the program. In this paper we take the alternative route which is to work with aggregate data directly. But it should be clear that these two types of analysis complement each other as they address different type of questions.

Section 2 discusses the surveys of EPAs used to construct our dataset, and provides some descriptive statistics regarding the budget, sources of funding, governance and activities of EPAs. Section 3 presents the empirical strategy we follow to estimate the determinants of the export and GDP per capita returns to export promotion, as well as the heterogeneity of these returns across EPAs' characteristics. Section 4 presents the results and section 5 concludes.

2 Data sources and summary statistics

We merged information from three rounds of EPAs' surveys. The first survey was conducted in the fall of 2005 by the World Bank.The second round was conducted in the fall of 2010 also by the World Bank, and the final round was conducted in the fall of 2014 by the International Trade Center (ITC).

The initial survey contacted all EPAs in the ITC's contact information database available in the ITC's web page in 2005. The list was complemented with the help of World Bank country economists who provided contact information on national EPAs that were not listed in the ITC database. A total of 116 EPAs were contacted by email; 92 answered of which only 4 percent declined. In 2010, the same 116 EPAs were contacted, and 93 answered positively.[7] In the fall of 2014 the ITC survey concentrated in EPAs in fourteen European countries, which all responded positively.[8] This leaves with an unbalanced panel containing information on EPAs' budget, sources of funding, governance, and activities for 94 countries.

The survey contains 19 questions to better understand the budget, sources of funding, governance, and activities of EPAs around the world.[9] Table 1 provides summary statistics for the variables used in this paper. It is important to note that this is an unbalanced panel so the average are not necessarily for the same time period for each variable. Also, for non-European countries the sample stops in 2010, whereas for some European countries the sample only starts in 2010.[10] The unbalanced nature of the panel is addressed using country and year fixed-effects in our econometric specifications.

Also note that all questions regarding the share of the budget spent on different activities or type of firms, or coming from different sources vary in a scale from 1 to 6. It takes the value 1 if this share is 0, the value 2 if the share is between 0 and 10 percent, the value 3 if the share is between 10 and 25 percent, the value 4 if the share is between 25 and 50 percent, the value 5 if the share is between 50 and 75 percent and the value 6 if the share is between 75 and 100 percent.

The share of the private sector seats in the executive board is measured in percentage points by simply taking the number of seats in the hands of the private sector and dividing them by the number of total seats in the executive board.

The rank of EPA responsibility takes the value 1 if export promotion is the only responsibility of the agency; 2 if it is the top two priorities, 3 if it is one of the two top priorities, 4 if it is one of three or more top priorities and 5 if it is secondary to other priorities. Thus as its number increase the focus of the agency in export promotion is diluted.

Whether the strategy of the agency is to target all sectors and destinations ranks from 1 to 8 the importance of this strategy relative to strategies that focus on certain types of products, destinations or

[7] The response rates is around 80 percent, which is astonishing for an email survey. The high response rate is probably explained by the numerous follow-ups done by phone.

[8] These are Austria, Belgium, Bosnia, Cyprus, Denmark, Estonia, Iceland, Italy, Lithuania, Malta, Netherlands, Slovenia, Switzerland, and the United Kingdom.

[9] The survey is available from the authors upon request.

[10] The survey contains other variables not reported in Table 1 but available upon request. These include: the number of years the EPA existed and the number of employees.

firms. The higher is the value of this variable, the more targeted by sector and destination are EPAs interventions.

The numbers in Table 1 suggest that EPAs have an average budget of USD 8 million (exponential of 15.904), but there is a lot variance behind these averages with an average budget of USD 60 thousands for SLEDIC in Sierra Leone and USD 500 million for UKTI in the United Kingdom. If we distinguish between developed and developing countries using the World Bank threshold of a GNP per capita above and below USD 12'736, the budget of EPAs in developed countries is twice as large as the budget of EPAs in developing countries. We can also see from the averages reported in Table 1 that the average share of executive board seats in the hands of the private sector is 48 percent. But this varies between 0 and 100 percent. In fact, as can be seen in Table 1 all the variables that have to do with EPA characteristics span from their minimum possible value to their maximum possible value. For example if the share of public fuding in the EPA budget is close to 5 (meaning that the share is on average somewhere between 50 to 75 percent), it spans from 0 (meaning a share of 0 percent) to 6 (meaning a share of 100 percent).

To better illustrate the variance behind some of these average numbers, Figures 1 to 5 provide boxplots with the distribution of some of variables in Table 1.[11] Figure 1 focuses on sources of funding. The distributions in the boxplots suggest that most agencies are financed by public funding and the source of private funding is much smaller, but there are a few agencies that are exclusively financed by private funding.

Figure 2 provides the distribution of EPA budgets to exports in different regions. The first important point is that the export promotion budget represents a very small share of exports. The sample median is below 0.05 percent. But there is quite a bit of heterogeneity and in a country like Rwanda the EPA budget represents as much as 4.7 percent of exports. Importantly, the differences within regions are often larger than the differences across regions, which suggests that the heterogeneity may not be associated with geographic factors or the level of development in different countries.

Figure 3 shows the relative importance of the budget spent on export support services, marketing services and non-matching grants. As shown in Table 1 on average EPAs spend the largest share of their budget on marketing, then comes export support services and then non-matching grants. More importantly, Figure 3 tends to suggest that in most countries the largest share is spent in marketing as its distribution tends to be above the distribution of the share spent on export support services or non-matching grants.

Figure 4 illustrates the share of budget spent on small, medium and large firms. If the distribution of the share spent on small or medimum size firms are quite similar, the share spent on large firms tends to have a distribution with values that are much smaller, suggesting that most EPAs tend to focus on either small or medium size firms. Note however that in the top 10 percent of the distribution for shares spent on large firms there are some EPAs that spend more than half of their budget on large firms.

Figure 5 provides the distribution of the share of the budget spent on exporters, occasional exporters,

[11] The bottom of the boxplot gives the value at the 25 percentile, the top of the box the value at the 75 percentile. The line in the middle of the box provides median value. The whiskers provide the top and bottom 90 percentile, and the dots above and below the wiskers, the outliers.

and non-exporters. The priority seems to be given to established exporters, and then on new or occasional exporters. The budget spent on non-exporters tends to be significantly smaller, but there are a few EPAs that spend all their budget on non-exporters.

An important message to take away from these Figures and the summary statistics is that there are important differences in EPAs characteristics in our sample. In our empirical exercise we we will exploit these differences to examine the impact that they have on the export and GDP per capita returns associated with export promotion.

3 Empirical strategy

Our objective is to measure the returns to export promotion budgets on exports and GDP per capita, and determine what types of EPAs' characteristics (governance, activities, funding) lead to higher returns. We start with the presentation of the standard linear fixed effects panel model that assumes that returns to export promotion are homogenous, and then move towards an extension using a semiparametric varying coefficient model with fixed effects that allows for heterogeneous returns.

3.1 Standard linear fixed effects panel models

In order to give some perspective to our contribution, we first replicate the standard approach to estimating returns in the literature. The basic specification of fixed effects panel models is the following:

$$\begin{aligned} \ln(\text{exports})_{c,t} &= \beta^x \ln(\text{budget})_{c,t} + \gamma_c^x + \gamma_t^x + \epsilon_{c,t}^x \\ \ln(\text{GDP/capita})_{c,t} &= \beta^y \ln(\text{budget})_{c,t} + \gamma_c^y + \gamma_t^y + \epsilon_{c,t}^y \end{aligned} \tag{1}$$

where $\ln(\text{exports})_{c,t}$ is log of exports of goods and services in country c at time t; $\ln(\text{GDP/capita})_{c,t}$ is log of GDP per capita in country c at time t; ln(budget) is the log of the budget of the EPA in country c at time t; β^x and β^y are our coefficient of interest that capture the export and GDP per capita returns associated with export promotion (defined as the percentage increase in exports following a 1% increase in the export promotion budget); γ_c^x γ_c^y, γ_t^x and γ_t^y are country-specific and year-specific fixed effects in the export and GDP equations, respectively; $\epsilon_{c,t}^x$ $\epsilon_{c,t}^y$ are mean zero error terms with finite variances independent from the covariates unless it is otherwise specified.

The country fixed effects control partly for the size of the country among other unobserved time invariant country characteristics. As size is time variant the country fixed effect may not perfectly control for it. We prefer not to include GDP as a control because (a) it is clearly endogenous as exports are part of GDP, and (b) it has a (mutually causal) relation with the export promotion budget that could blur the measurement of the total impact of budget on exports. However, population is unlikely to be endogenous (over the relatively short time span of our dataset: 2005-2014) or affected by budget so that we use it as a proxy to control for

size. Equation (1) becomes:

$$\begin{aligned} \ln(\text{exports})_{c,t} &= \beta^x \ln(\text{budget})_{c,t} + \delta^x \ln(\text{pop})_{c,t} + \gamma_c^x + \gamma_t^x + \epsilon_{c,t}^x \\ \ln(\text{GDP/capita})_{c,t} &= \beta^y \ln(\text{budget})_{c,t} + \delta^y \ln(\text{pop})_{c,t} + \gamma_c^y + \gamma_t^y + \epsilon_{c,t}^y \end{aligned} \tag{2}$$

where $\ln(\text{pop}_{c,t})$ is the population in country c at time t, and δ^x and δ^y are parameters to be estimated.

As discussed earlier, measurement error of the export promotion budget is a potential problem. Indeed, many EPAs are embedded in larger institutions with larger budgets, and it is not always easy to assess the share of the budget granted to export promotion rather than other activities. For instance many EPAs are part of trade and investment promotion agencies, where it is not always possible to disentangle the share allocated to export promotion from the one given to investment promotion. The country fixed effects partly solve this problem.

Reverse causality or simultaneity and time varying omitted variables correlated with the export promotion budget might cause endogeneity problems. For example, in a political economy setting where larger firms tend to have more political clout, it is likely that as exports grow, more lobbying by exporting firms may lead to stronger export promotion programs. Also export growth is likely to lead to GDP growth, which in turn will affect the size of governments' programs. In order to correct for this, we will use a series of instruments based on EPAs characteristics. One typically chooses instruments that are correlated with the size of the budget, but are less likely to be correlated with the error term. We propose two instruments: the share of the budget that comes from public funding and the share of the executive board seats in the hands of the private sector. A larger number of seats in the hands of the private sector may lead to more trust by public authorities than if the agency is run by public officials, and therefore a larger budget. A larger share of the budget being funded by the government may indicate a more strategic importance given to export promotion. However, note that in these parametric specifications the assumption of constant returns is essential for identification and consistent estimation - but in practice hardly ever realistic. It crucially ignores the important heterogeneity of EPAs and their policies described in the previous section.

In the presence of unmodeled heterogeneity, neither the standard least square methods nor the standard instrumental variable estimation methods are valid. To illustrate this, consider a very general model that allows the returns to export promotion to vary over countries and time. Then equation (2) becomes:

$$\begin{aligned} \ln(\text{exports})_{c,t} &= \beta_{c,t}^x \ln(\text{budget})_{c,t} + \delta^x \ln(\text{pop})_{c,t} + \gamma_c^x + \gamma_t^x + \epsilon_{c,t}^x \\ &= \beta^x \ln(\text{budget})_{c,t} + \delta^x \ln(\text{pop})_{c,t} + \gamma_c^x + \gamma_t^x + \left(\beta_{c,t}^x - \beta^x\right) \ln(\text{budget})_{c,t} + \epsilon_{c,t}^x \end{aligned} \tag{3}$$

where β^x is as before the average return, which is now averaged over all $\beta_{c,t}^x$. Then you may interpret $\left(\beta_{c,t}^x - \beta^x\right)$ as the country and time specific individual (i.e. on top of the average) marginal gain for investing a one percent higher budget in export promotion. If this heterogeneity is not modeled by the econometrician,

then the two last terms on the right-hand-side of (3) will form the error term. A valid instrument would then have to be (strongly) correlated with ln(budget), while the exclusion restriction requires it to be uncorrelated with $\left(\beta^x_{c,t} - \beta^x\right)$ ln(budget). Such an instrument will be difficult to find. For example, being uncorrelated with the individual marginal gain is not sufficient. Therefore, in the next subsection we turn to the modeling of the heterogeneous returns to export promotion.

3.2 Modeling heterogeneous impact across EPA characteristics

As discussed in section 2 EPAs differ in terms of governance, funding, and priorities given to different activities. It is unlikely that the impact of the budget on exports is not sensitive to these characteristics. Understanding what type of EPA characteristic yields higher export and GDP per capita returns can help design better functioning EPAs.

The EPA characteristics we are interested in can be divided into three broad categories (summary statistics are provided for all these variables in Table 1). First, characteristics regarding the sources and allocation of the export promotion budget: share of public funding ($public-funding$); share of budget coming from user fees ($fees$); share of budget allocated to marketing activities ($marketing$) and share of budget allocated to export support services (ESS). Second characteristics associated with the targeting of certain types of firms in export promotion programs: share of budget spent on established exporters ($established-exporters$); share of budget spent on non-exporters ($non-exporters$); share of budget spent on small firms ($small$); and share of budget spent on medium size firms ($medium$). Finally, characteristics regarding the structure and governance of EPAs: share of the executive board in the hands of the private sector ($private-board$); the extent to which export promotion is the main responsibility of the EPA ($responsibility$); the importance of the use of matching grants ($matching-grants$), and the extent to which its strategy involves targeting all sectors and destinations versus only some sectors and destinations ($strategy$).

A possibility to answer the question of how EPA's characteristics, say Z, affect the returns to export promotion budgets would be to use a linear model with standard interactions between budget and EPA characteristics, e.g. by including $\alpha^y \ z_{c,t}\ln(\text{budget})_{c,t}$ in model (2).[12] However, this would only be shifting the problem, as such a modeling requires strong assumptions regarding the functional relationship between returns and EPA characteristics. If functional misspecification is present, they automatically lead to an endogeneity bias due to the unmodeled heterogeneity. And similarly as in (2), estimating and interpreting β^x and β^y as *average* effects of ln($budget$) with IVs requires that the instruments exhibit no correlation with the unmodeled heterogeneity while having a strong correlation with the log-budget itself. By design, this is very unlikely.

To circumvent this and allow the impact of export promotion budgets on exports to vary across EPA characteristics, we use a semi-parametric varying coefficient model. That is, instead of trying to manage the

[12] Simply adding Zs linearly to model (2) would not make sense when the EPA characteristics we described capture how the budget is spent. In this case Z can explain the efficiency of the budget, but in principle, there should not be any direct budget-decoupled impact of Z on output exports or GDP.

endogeneity problem caused by heterogeneity in returns using instruments based on untestable assumptions, we directly model this heterogeneity. This gives not only more credible results but also makes it much easier to see and understand the heterogeneous returns to export promotion. Moreover, because we can test which of the EPA characteristics explain the heterogeneity of the impact of export promotion budgets on exports, we can use those that do not explain the heterogeneity as (excluded) instruments of the budget when instrumenting log-budget with the EPA characteristics.

The most general varying coefficient model version would imply letting the coefficients on the export budget to arbitrarily vary over a set of EPA characteristics that we consider to be interesting or important. While this requires few assumptions, given the large number of EPA characteristics we are considering, it will be difficult then to draw any further conclusions regarding the type of characteristic that leads to higher or lower returns. Indeed, if the number of characteristics is equal to three, then the coefficient on the export budget would be a three dimensional surface which could only be made visible with 3D contour plots that are difficult to interpret. But the number of characteristics we are interested in is twelve. It then becomes impossible to visualized how EPA characteristics affect returns. Because our objective is to understand how different characteristics affect returns, we need to simplify the problem. This could for example be done by excluding interactions between the different EPA characteristics. While it is true that the assumption of additive separability for varying coefficients is also a restriction, additive separability is nonetheless one of the most accepted simplifications in empirical economics.

The equation to be estimated then becomes:

$$\begin{aligned}\ln(\text{outcome})_{c,t} \quad = \quad & \big\{b_{con} + b_f(fees_{c,t}) + b_g(public - funding_{c,t}) + b_h(marketing_{c,t}) + b_j(ESS_{c,t}) \\ & + b_k(non - exporters_{c,t}) + b_l(established - exporters_{c,t}) + b_m(small_{c,t}) + b_n(medium_{c,t}) \\ & + b_o(private - board_{c,t}) + b_p(strategy_{c,t}) + b_q(matching - grants_{c,t}) \\ & + b_r(responsibility_{c,t})\big\}\ln(\text{budget})_{c,t} + \delta\ \ln(\text{population})_{c,t} + \gamma_c + \gamma_t + \epsilon_{c,t} \qquad (4)\end{aligned}$$

where *outcome* is either exports or GDP per capita, b_{con} is a constant (you can think of as a kind of intercept) and $b_f, \ldots, b_r$ are unknown smooth functions. For identification reasons each of them is centered such that it integrates to zero. This is why you need to include b_{con}. We approximate them by penalized cubic polynomials (so-called P-splines). We select the varying components of the model based on null space penalization. That is by adding a penalty for each term. Adding such a penalty to all the (smooth) terms in the model allows for parameter selection which removes terms from the model altogether. As we will see in the results section, some variables are "penalized out" (such as the share of public funding, the share of the budget spent on export support services in the export equation), meaning that they do not exhibit a significant impact in explaining the outcome. In simple words, if you consider all b_j as piecewise polynomials, this is a method of parameter selection. When $fees$ is penalized out of the model, it implies that $fees$ does not help explain the heterogeneity in returns to $\ln(budget)$ (at least as long as the other characteristics are

included). We then re-estimate the model without those terms and report results for the characteristics that remain in the model, using an instrumental variable estimator following Marra and Radice (2011). The "penalized out" variables are therefore instruments excluded from the main model.

More specifically, we use a two-stage procedure, where in the first stage we regress the instrumental variables (all EPA characteristics) on the endogenous budget:

$$ln(budget) = f_0 + \sum_j f_j(z_j) + \xi \ , \ f_j \text{ nonparametric functions} \tag{5}$$

where z_j are the instruments and other exogenous variables, and ξ contains the endogenous variation. Again the functions are normalized for identification reasons such that we add a constant f_0. After calculating $\hat{\xi} := ln(budget) - \hat{f}_0 - \sum_j \hat{f}_j(z_j)$, we include it in the second stage to control for the endogeneity of ln(budget):[13]

$$\begin{aligned}
\ln(\text{outcome})_{c,t} \quad = \quad & \big\{b^u_{con} + b^u_f(fees_{c,t}) + b^u_g(public - funding_{c,t}) + b^u_h(marketing_{c,t}) + b^u_j(ESS_{c,t}) \\
& + b^u_k(non - exporters_{c,t}) + b^u_l(established - exporters_{c,t}) + b^u_m(small_{c,t}) + b^u_n(medium_{c,t}) \\
& + b^u_o(private - board_{c,t}) + b^u_p(strategy_{c,t}) + b^u_q(matching - grants_{c,t}) \\
& + b^u_r(responsibility_{c,t})\big\}\ln(\text{budget})_{c,t} + \delta^u \ \ln(\text{population})_{c,t} + \gamma^u_c + \gamma^u_t + b^u_c(\hat{\xi}) \\
& + e^u_{c,t} \ , \quad \text{outcome} = x, y \ .
\end{aligned} \tag{6}$$

Note that the variables that are penalized out of model (6) are not necessarily the same for outcome $= x$ (exports) as for outcome $= y$ (GDP per capita). In other words, the determinants of the heterogeneity of the impact of export promotion budgets on exports are not necessarily the same as those for GDP per capita.[14]

While the figures we obtain for the non-linear impacts b^u_i, $u = x, y$, $i = f, g, h, j, k, l, m, n, o, p, q, r$ on budget-returns to exports and GDP/capita are quite informative, we are interested in the marginal impacts of ln(budget) on the respective outcome variables. Thus, we need to compute the derivatives of these nonlinear functions. This is somewhat easier for parametric models where we get analytic expressions for the marginal impact functions. We therefore take $\hat{b}^x_i$, $\hat{b}^y_i$ to guide us on how to properly specify the regression models

[13] As shown by Terza, Basu and Rathouz (2009) a control function approach is consistent when dealing with non-linear models with endogeneous variables, whereas the two-stage predictor substitution equivalent to the linear 2SLS is not.

[14] Recall that the variable selection for the varying coefficient specifications (i.e. the penalization tests) were run on a model without any control for endogeneity. As this could potentially bias the results, we rerun them including the control function $b^u_c(\hat{\xi})$ to address potential endogeneity. Note that this corresponds to an overidentification test of the exclusion restriction of instruments. We found that the same variables were penalized out of the export and GDP per capita models, i.e., the exclusion restrictions hold.

parametrically. We end up with the following parametric polynomial models:

$$\begin{aligned}
\ln(\text{exports})_{c,t} &= \big\{\beta^x_{con} + \beta^x_f fees_{c,t} + \beta^x_g fees^2_{c,t} + \beta^x_h marketing_{c,t} + \beta^x_i marketing^2_{c,t} + \beta^x_j marketing^3_{c,t} \\
&\quad + \beta^u_k non-exporters_{c,t} + \beta^u_l non-exporters^2_{c,t} + \beta^x_m established-exporters_{c,t} \\
&\quad + \beta^x_n small_{c,t} + \beta^x_o private-board_{c,t} + \beta^x_p strategy_{c,t}\big\}\ln(\text{budget})_{c,t} \\
&\quad + \delta^x \ln(\text{population})_{c,t} + \zeta^x \ln(\text{population})^2_{c,t} + \kappa^x \ln(\text{population})^3_{c,t} \\
&\quad + \gamma^x_c + \gamma^x_t + b^x_c(\hat{\xi}) + e^x_{c,t} \qquad (7) \\
\ln(\text{GDP/capita})_{c,t} &= \big\{\beta^y_{con} + \beta^y_f public-funding_{c,t} + \beta^y_g marketing_{c,t} + \beta^y_h ESS_{c,t} \\
&\quad + \beta^y_i established-exporters_{c,t} \\
&\quad + \beta^y_j medium_{c,t}\big\}\ln(\text{budget})_{c,t} + \delta^y \ln(\text{population})_{c,t} + \zeta^y \ln(\text{population})^2_{c,t} \\
&\quad + \kappa^y \ln(\text{population})^3_{c,t} + \gamma^y_c + \gamma^y_t + b^y_c(\hat{\xi}) + e^y_{c,t} \ . \qquad (8)
\end{aligned}$$

with all β being now coefficients but $b(\cdot)$ still indicating nonparametric functions (as we must not functionally restrict the control functions). Finally, to estimate marginal returns by country, we take the derivative of (7) and (8) with respect to the log of the budget and calculate the average marginal returns over the sample period for each country separately as a function of EPA characteristics.

4 Results

Table 2 presents the results of the estimation of (1) and (2) assuming that the returns are homogeneous. Columns (1) to (4) provide the estimation of the export equation and columns (5) to (8) the estimation of the GDP per capita equation. Columns (1), (2), (5) and (6) use an ordinary least square estimator and columns (3), (4), (7) and (8) an instrumental variable estimator using EPA characteristics (share of public funding and share of private seats in the board as well as their interaction) and the rank of the budget to address endogeneity concerns.

The coefficients on the export promotion budget are always statistically significant at least at the 5 percent level. The returns to export promotion in terms of export growth suggest that a 1 percent increase in the export budget leads to an average increase in exports between 0.046 and 0.076 depending on whether we control for the log of population and endogeneity. Similarly, the returns in terms of GDP per capita vary between 0.049 and 0.065 percent.

The Anderson canonical correlation test suggest that the instruments we used in columns (3), (4), (7) and (8) are relevant, but the Hansen overidentification test suggests that the instruments are valid only in the GDP per capita equation. The Hansen overidentification test rejects the null that the instruments are valid in the export equation in columns (7) and (8). This puts some doubt on the causal interpretation of the estimates in the export equation. As argued earlier, part of the problem could be the unmodeled

heterogeneity associated with the impact of the EPA's budget on exports which may depend on the EPAs' characteristics that we used as instruments in the export equation.

This suggests that an approach that directly models this heterogeneity in returns as well as the direct impact of EPA's characteristics on exports and GDP per capita may be more appropriate. We therefore turn to the the semi-parametric estimates in the next subsection.

4.1 What works?

Figure 6 reports the non-parametric results of the first stage given by the estimation of (5). A reliance on public funding leads to a reduction in the total size of the budget. Similarly, a larger share spent on non-exporting firms, or on established exporters seem to reduce the size of the budget, which suggests that agencies focusing on new exporters have larger budgets. Also, a larger share spent on non-matching grants reduces the overall budget. Agencies have larger budgets when they have other responsibilities than export promotion, when the focus on small firms, or they target a few sectors or destinations. For the share of the budget spent on export support services, on marketing, or the share coming from fees they are some interesting non-linearities that are illustrated in Figure 6.[15] The Figure also provides 95 percent confidence bands to asses the statistical significance of the EPA characteristics in explaining the variation in export promotion budgets. We can compare the graphs and confidence bands with Table 3. The numbers in the column called 'Estimated DoF' indicate the degree of the best fitting polynomial. As our spline estimator allows for piece-wise polynomials, the degrees of freedom approximates do not necessarily take integer numbers. You see that if the number equals one, you just have a linear function. If further, zero is included in the entire confidence band, this integer 1 has no stars in the table, i.e. is insignificant. The results suggest that the share of public funding, the share of funding through fees, the share of the budget spent on marketing, the share of the budget spent on small exporters and the degree of sector or destination targeting have all an impact on the heterogeneity of returns to export promotion budgets that is statistically different from zero. The others contain the zero in their confidence band over the entire range.[16]

After estimating (5) we can calculate $\hat{\xi}$ that we then use as a control variable in the estimation of the non-parametric varying coefficient model (6). We first perform a so-called null space penalization procedure (a variable selection method for varying coefficient models with P-splines) to see which of the EPA characteristics are important in explaining the heterogeneity of returns in the export and GDP per capita models. The share of public funding, the share of budget spent on export support services, the share of budget spent on medium exporters, the share of budget spent on non-matching grants for exporters, and the importance of export promotion in the objectives of the EPA are penalized out from the export equation as can be seen from the results in Table 4. The variables that are penalized out of the GDP per capita equation are the share of

[15] Figure 7 provides the postestimation plots of the residuals, and goodness of fit analysis. They confirm that we cannot find any anomalies in the residuals (no indication of model mis-specification, outliers, poor fit, etc.).

[16] As all functions are centered around zero, i.e., they all integrate to zero for identification reasons –explaing why we included f_0– it is clear that the zero is always included in the confidence band.

user fees, the share of the budget spent on non-exporters, the share of the budget spent on small exporters, the share of the executive boards seats in the hands of the private sector, the share of budget spent on non-matching grants for exporters, the targeting of certain sectors, and the importance of export promotion in the objectives of the EPA as can be seen from Table 4. These variables do not to add any information that help us explain the heterogeneity in returns, and are therefore suppressed from the respective models. Note that this does not imply that these EPA characteristics are not important determinants in general, they still might be through their impact on the size of the export promotion budget. They simply do not explain the heterogeneous returns to changes in export promotion budgets across countries.

The results of the non-parametric instrumental variable estimation of the final models for exports and GDP per capita are reported in Figures 8 and 10, respectively. Regarding exports, the plots suggest that increases in the share of EPAs' funding coming from user fees tend to initially increase the impact of export promotion on exports, but when the share of funding from user fees is very high, further increases seem to marginally decline export returns as indicated by the inverted u-shape form of the regression plot. For the share of the budget spent on marketing activities, there are some important non-linearities which do not really allow to have a clear view of how it affects returns on exports. A larger share of the budget spent on non-exporters initially increases marginal export returns and then it reduces them. A larger focus on established exporters relative to occasional exporters increases marginal export returns. Targeting small firms rather than large and medium size firms declines the marginal returns in terms of exports. Having a larger share of the executive board seats in the hands of the private sector also increases marginal export returns. Targeting of a few sectors, firms or destinations rather than promoting all sectors and destinations increases marginal export returns.[17]

The regression plots in Figure 10 suggest that a higher share of funding from public sources reduces the impact of export promotion budgets on GDP per capita. Increases in the share of the budget spent on marketing activities increases the marginal returns of export promotion budgets in terms of GDP per capita. Increases in the share of the budget spent on export support services reduces GDP per capita returns. A larger share of the budget spent on established exporters tends to increase GDP per capita returns as for the case of export returns. Targeting medium size firms rather than large and small size firms increases the marginal returns in terms of GDP per capita.[18]

Some of these impacts may not be statistically significant. Table 5 provides information regarding the statistical significance and can (as discussed above for Figure 6 and Table 3) should be compared with Figures 8 and 10, respectively. We see that all variables are statistically different from zero at the 5 percent level, except for the share of budget spent on non-exporters, and the targeting of sectors or destinations in the export equation, but interestingly also the control function. The latter indicates that in our case, once the heterogeneity of returns to export promotion budgets is modeled adequately, there is no endogeneity

[17] Recall that a higher value in this variable indicates that the agency tends to target only a few sectors or markets.

[18] Figures 9 and 11 contain the postestimation plots of the residuals, and further goodness of fit analysis. They confirm that we cannot find any anomalies in the residuals (no indication of model mis-specification, outliers, poor fit, etc.); they even exhibit normality.

problem left when estimating the impact of export promotion budgets on exports and GDP per capita.

The results provided in Figure 8 and 10 can help design more effective EPAs. More importantly, it is clear from figures 8 and 10 that what may be effective in promoting exports (focusing in a few sectors and destinations or in large firms for example) may be less effective in increasing GDP per capita. Similarly, what works for GDP per capita, such as increases in the share spent on marketing activities may be less effective in promoting exports. One important message that comes out of this is that trying to evaluate the performance of EPAs by looking at increases in exports may create the wrong incentives when the ultimate goal of the EPAs is social and economic growth proxied by GDP per capita.

4.2 Marginal export and GDP per capita returns by country

The information on the heterogeneity of returns across EPA characteristics can then be summarized by looking at the marginal returns of each EPA in terms of exports and GDP per capita. The returns vary depending on the combination of characteristics of each EPA. We compute these returns parametrically, but using the information provided by the non-parametric regression plots regarding the shape of the relationship between each characteristic and exports or GDP per capita. Figure 8 suggests that in the export equation the share of funding coming from user fees and the importance given to non-exporters interacted with the export promotion budget should enter with a quadratic term, whereas the share of budget spent on marketing activities interacted with the budget should enter with a cubic term. Similarly, Figure 10 suggests that all of the interactions only enter linearly. Table 6 provides the results of the estimation of the export and GDP per capita equations where we allow for these parametric non-linearities. They largely confirm the results of the non-parametric exercise in terms of the signs of the interaction terms between the export promotion budget and each of the EPA characteristics kept in the final non-parametric model.

In order to compute the marginal export and GDP per capita returns to increases in the export promotion budget, we take the derivative of the export and GDP per capita equation with respect to the log of the export promotion budget and simply calculate the corresponding elasticities at the average values of each promotion agency. In other words, the marginal returns are simply given by the sum of the products of coefficients and EPAs' average characteristics in each country. Table 7 provides these marginal export and GDP per capita returns by EPA, as well as their wild bootstrapped standard errors.[19] Note that all returns are positive and statistically significant at least at the 95% level. Note that the average returns computed

[19] We are using the so-called wild bootstrap version introduced in this version by Mammen (1992) for non-linear cross-sectional regression models, and studied in Franke, Kreiss and Mammen (2002) for non-linear time series data. A main advantage in our case is that it automatically accounts for the presence of unknown heteroscedasticity and autocorrelation. The procedure is actually quite simple; for a sample $\{(V_{c,t}, W_{c,t})\}_{t,c=1}^{T,n_t}$ with n_t countries in year t, and estimates $\widehat{E}[V,_{ct}|W_{c,t}]$ we generate bootstrap samples

$$V^*_{,ct} = \widehat{E}[V_{c,t}|W_{c,t}] + \Big(V_{c,t} - \widehat{E}[V_{c,t}|W_{c,t}]\Big) \cdot \epsilon \ , \qquad \epsilon \sim N(0,1).$$

Note that for each bootstrap sample the exogenous variables are kept unchanged from the original data. That is, we generate $B = 1000$ bootstrap samples $\{(V^*_{c,t}, W_{c,t})\}_{t,c=1}^{T,n_t}$ and re-estimate the parameter of interest, say β. From the original sample we have $\hat{\beta}$, and the $\{\hat{\beta}^*_b\}_{b=1}^{B}$ can now be used to estimate the confidence intervals. Note that the same can be done to get a confidence band for $\widehat{E}[V_{c,t}|W_{c,t}]$.

across countries at the bottom of Table 7 are not too differently from the average returns estimates reported in Table 2.

Figure 12 provides the distribution of marginal export and GDP per capita returns. There is a larger variance in the distribution of export returns across countries than on the distribution of GDP per capita returns. Interestingly, the two distributions seem to be distributed around a common mean. This suggests that the average marginal returns to exports is similar to the average marginal returns to GDP per capita. Note however, that because exports are generally only a fraction of GDP, dollar returns in terms of GDP are likely to be larger.

There is a weak but positive correlation between export and GDP per capita returns as illustrated in Figure 13. Because the correlation is quite weak, this does not imply that high returns in terms of exports necessarily lead to high returns in terms of GDP per capita. This matters because if the ultimate objective is GDP per capita growth, benchmarking policies, institutional setups or interventions against export growth could be misleading. Indeed, the correlation between the two types of returns is only 0.2. For example while Malawi and Portugal have a similar return in terms of exports, the difference in EPA characteristics between AICEP Portugal and MEPC Malawi lead to much larger return in terms of GDP per capita in Portugal.[20]

5 Concluding remarks

The literature on export promotion using both firm and country level data has focused on estimating the impact that export promotion programs have on average. While most of the literature tends to suggest that export promotion helps increase exports, we move further in two important dimensions. First, we examine not only the impact of export promotion on exports, but also on GDP per capita. Indeed, the ultimate objective of export promotion policies is not exports per se, but social and economic growth. We use GDP per capita as a proxy for social and economic growth and found that the returns in terms of GDP per capita are larger than the export returns, which suggests the presence of positive externalities associated with export promotion.

Second, we explore which export promotion policies or EPA characteristics are likely to generate higher returns in terms of export and GDP per capita. We found that EPAs' characteristics matter. EPAs that have a larger share of their executive board in the hands of the private sector, spend a smaller share of their budget on small firms, a larger share on established exporters, and target a few sectors, firms or markets have higher export returns. Some of these characteristics also tend to matter for GDP per capita returns: a larger share of the budget spent on established exporters seem to generate larger GDP per capita returns. But there are also some differences: a larger share of the budget spent on country image and other marketing activities seem to generate larger gains in terms of GDP per capita. Similarly, a larger focus on medium size firms, a smaller share of public funding and smaller focus on export support services generate higher GDP

[20]Countries to the left of the red line in Figure 13 have larger returns in terms of GDP per capita, and countries to the right of the red line have larger returns in terms of exports.

per capita returns.

These results put together suggest that export promotion has a strong and positive impact on GDP per capita. However, what works in terms of export revenue may not necessarily work in terms of GDP per capita. This has two important implications. First, it is important that EPAs clearly define their objective: is it export or GDP per capita growth? This has implications for the type of policies and strategies that should be pursued. Second, when evaluating the performance of these agencies and recommending institutional or policy changes, it is important to use the correct benchmark. If agencies are evaluated against increases in export revenue, this may create the wrong incentives when the objective of the EPA is social and economic growth.

References

Atkin, David, Amit Khandelwal, and Adam Osman (2017). Exporting and Firm Performance: Evidence from a Randomized Trial. Quarterly Journal of Economics, forthcoming.

Bai, Jushan (2013). Fixed-effects dynamic panel models, a factor analytical method. Econometrica, 81: 285-314.

Baldwin, Richard and Frédéric Robert-Nicoud (2015). A simply model of the juggernaut effect of trade liberalization. International Economics 143, 70-79.

Baltagi, Badi (2008). Econometric Analysis of Panel Data. Wiley & Sons.

Benini, Giacomo, Stefan Sperlich and Raoul Theler (2016) Varying Coefficient Models Revisited: an Econometric View. Proceedings of the conference ISNPS2014.

van Biesebroeck, Johannes, Jozef Konings and Christian Volpe Martincus (2017). Did export promotion help firms weather the crisis? Economic Policy, forthcoming.

Breilich, Holger, Dave Donaldson, Patrick Nolen, and G. Wright (2015). Information and Attitudes towards Exporting Evidence from a Randomized Controlled Trial. Paper presented at GEP conference in Ningbo.

Cruz, Marcio (2014). Essays in trade and development economics, Phd dissertation: Graduate Institute of International and Development Studies, Geneva.

de Melo, Jaime and Sherman Robinson (1992). Productivity and externalities: models of export-led growth. Journal of International Trade and Economic Development 1 (1), 41-68.

Franke, Jürgen, Jens-Peter Kreiss and Enno Mammen (2002). Bootstrap of kernel smoothing in nonlinear time series. Bernoulli, 8(1), 1-37.

Heckman, James J., Sergio Urzua, and Edward Vytlacil (2006). Understanding Instrumental Variables in Models with Essential Heterogeneity. Review of Economics and Statistics 88, 389-432.

Heckman, James J. (2010). Building bridges between structural and program evaluation approaches to evaluate policy. Journal of Economic Literature, 48(2), 356-398.

Keesing, Don and Andrew Singer Andrew (1991). Development assistance gone wrong: failures in services to promote and support manufactured exports. The Role of Support Services In Expanding Manufactured Exports in Developing Countries, Economic Development Institute, World Bank.

Keesing, Don and Andrew Singer (1991a). Assisting manufactured exports through services: New methods and improved policies. The Role of Support Services In Expanding Manufactured Exports in Developing Countries, Economic Development Institute, World Bank.

Lederman, Daniel, Marcelo Olarreaga and Lucy Payton (2010). Export promotion agencies: Do they work?. Journal of Development Economics, 91(2), 257-265.

Lederman, Daniel, Marcelo Olarreaga and Lucas Zavala (2016). Export promotion and firm entry into and survival in export markets. Canadian Journal of Development Economics, forthcoming.

Mammen, E. (1992) When Does Bootstrap Work? Asymptotic Results and Simulations, Lecture Notes in Statistics 77. Berlin: Springer-Verlag.

Marra, Giampiero and Rosalba Radice (2011). A flexible instrumental variable approach. Statistical Modelling, 11(6), 581-603.

Moreira, Marcelo J. (2009). A maximum likelihood method for the incidental parameter problem. The Annals of Statistics, 37: 3660-3696.

Park, Byeong U., Enno Mammen, Young K. Lee and Eun Ryung Lee (2015). Varying Coefficient Regression Models: A Review and New Developments. International Statistical Review 83(1), 36-64.

Rauch, James (1999). Networks Versus Markets in International Trade. Journal of International Economics 48(1), 7-35.

Rose, Andrew K. (2007). The foreign service and foreign trade: embassies as export promotion. The World Economy, 30(1), 22-38.

Schminke, Annette and Johannes Van Biesebroeck (2015). The Impact of Export Promotion on Export Market Entry, mimeo, University of Leuven.

Sperlich, Stefan and Raoul Theler (2015) Modeling Heterogeneity: A Praise for Varying-coefficient Models

in Causal Analysis. Computational Statistics, 30: 693-718.

Terza, Joseph, Anirban Basu, and Paul Rathouz (2009). Two-stage residual inclusion estimation: addressing endogeneity in health econometric modeling. Journal of Health Economics 27(3): 531-543.

Van Biesebroeck, Johannes, Jozef Konings and Christian Volpe Martincus (2017). Did export promotion help firms weather the crisis? Economic Policy, forthcoming.

Volpe, Christian and Jerónimo Carballo (2008). Is export promotion effective in developing countries? Firm-level evidence on the intensive and the extensive margins of exports. Journal of International Economics, 76: 89-106.

Volpe, Christian and Jerónimo Carballo (2010). Beyond the average effects: The distributional impacts of export promotion programs in developing countries. Journal of Development Economics, 92: 201-214.

Wood, Simon N. (2006). Generalized Additive Models: An Introduction with R. Chapman and Hall/CRC Press.

Wooldridge, Jeffrey M. (2010) Econometric analysis of cross section and panel data. The MIT Press.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Log of non oil exports of goods and services (USD)	22.910	2.427	16.251	28.51
Log of EPA budget (USD)	15.904	2.121	11.512	20.22
Log of GDP per capita (USD)	8.469	1.570	4.968	12.18
Log of population	15.924	1.726	11.123	21.01
Budget coming from fees from services	1.940	1.197	1	6.00
Public source of funding	4.924	1.656	1	6.00
Budget spent on marketing	3.512	1.087	1	6.00
Budget spent on export support services	2.658	0.976	1	6.00
Budget spent on non-matching grants	1.77	1.22	1.00	6.00
Budget spent on non exporters	2.166	1.130	1	6.00
Budget spent on established exporters	4.309	1.241	1	6.00
Budget spent on small firms	3.759	1.020	1	6.00
Budget spent on medium size firms	3.807	0.982	1	6.00
Share of private sector over total at board	0.477	0.295	0	1.00
Rank of EPA responsibility	2.532	1.094	1	5.00
Strategy targets exports in all sectors and destinations	1.665	1.245	1	7.00

Table 2: Average impact of EPA budgets on exports
(panel data 2005-2013)[a]

	Exports				GDP per capita			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log of EPA budget	0.046∗	0.051∗	0.062∗∗	0.076∗∗	0.049∗∗	0.057∗∗	0.052∗∗	0.065∗∗
	(0.018)	(0.022)	(0.019)	(0.022)	(0.013)	(0.015)	(0.016)	(0.016)
Log of population		2.119∗∗		2.193∗∗		0.661∗		0.552∗
		(0.507)		(0.450)		(0.282)		(0.249)
Intercept	25.339∗∗	-5.719	19.601∗∗	-6.888	9.458∗∗	-4.819	6.201∗∗	-1.415
	(0.340)	(5.674)	(0.238)	(5.071)	(0.240)	(0.166)	(4.640)	(2.828)
N	533	530	508	505	552	549	527	524
R^2	0.997	0.997	0.997	0.997	0.997	0.996	0.997	0.999
Anderson 1st stage p-value:	NA	NA	0.000	0.000	NA	NA	0.000	0.000
Hansen over-id p-value:	NA	NA	0.000	0.000	NA	NA	0.502	0.387

[a]All regressions include country and year fixed effects. Robust standard errors are provided in parenthesis. Significance levels are as follows: † stands for 10 percent statistical significance; ∗ for 5 percent, and ∗∗ for 1 percent. The first four columns explain the log of non oil exports of goods and services. The last four columns explain GDP per capita. Columns (1), (2), (5) and (6) use an OLS estimator. Columns (3), (4), (7) and (8) an instrumental variable estimator where the rank of the budget, the share of private seats in the executive board of the EPA, the share of public funding, and the interaction of these two agencies characteristics are used as instruments.

Table 3: Approximate significance of smooth terms of estimates in equation (5)

	Dependent variable: ln (budget)	
	Estimated DoF	Est. residual DoF
b_g(Public source of funding)	2.142**	2.562
b_h(Budget spent on export support services)	3.009*	3.679
b_i(Rank of TPO responsability)	1.000	1.000
b_j(Budget spent on non-matching grants to exporters)	1.000	1.000
b_k(Budget coming from fees from services)	2.898***	2.989
b_l(Budget spent on marketing)	3.000***	3.000
b_m(Budget on non-exporters)	1.000	1.000
b_n(Budget on established exporters)	1.000	1.000
b_o(Budget on small exporters)	1.000**	1.000
b_p(Budget on medium exporters)	3.182*	3.680
b_q(Share of private sector over total at board)	1.000	1.000
b_r(Strategy targets exports in all sectors and destinations)	1.000***	1.000
Parametric coefficient		
Constant	12.196***	
	(1.387)	
Observations	397	
Adjusted R^2	0.966	
Log Likelihood	-215.407	
UBRE	0.184	

Standard errors in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4: Non parametric model selection for exports and GDP per capita models (panel data 2005-2013)[a]

Variables	Exports	GDP per capita
Log of population	7.486	9.814
Budget coming from fees from services	1.662	0.000
Public source of funding	0.000	2.000
Budget spent on marketing	2.886	0.849
Budget spent on export support services	0.000	0.902
Budget on non-exporters	0.983	0.000
Budget on established exporters	0.926	1.108
Budget on small exporters	0.839	0.000
Budget on medium exporters	0.000	0.196
Share of private sector over total at board	0.695	0.000
Budget spent on non-matching grants to exporters	0.000	0.000
Rank of strategy targeting all sectors and destinations	2.000	0.000
Rank of EPA responsibility	0.000	0.000

[a]We report degrees of freedom statistics for each variable of both full models. A value of zero means that the variable is penalized out of the model.

Table 5: Approximate significance of smooth terms in equations (7) and (8)

	Dependent variable (y):			
	ln (exports)		ln (GDP per capita)	
	(1)	(2)	(3)	(4)
	Est. DoF	Res. DoF	Est. DoF	Res. DoF
Log of population	8.672***	8.961	7.676***	8.020
$\{b_f$(Budget coming from fees from services)$\}$ y	2.099**	2.510		
$\{b_g$(Public source of funding)$\}$ y			1.200***	1.200
$\{b_h$(Budget spent on marketing)$\}$ y	3.078***	3.138	1.200***	1.200
$\{b_i$(Budget spent on export support services)$\}$ y			1.410***	1.587
$\{b_j$(Budget on non exporters)$\}$ y	1.692	1.960		
$\{b_k$(Budget on established exporters)$\}$ y	1.143***	1.143	1.200***	1.200
$\{b_l$(Budget on small firms)$\}$ y	1.155***	1.167		
$\{b_m$(Budget on medium size firms)$\}$ y			1.200***	1.200
$\{b_n$(Share of private sector over total at board)$\}$ y	1.173***	1.203		
$\{b_o$(Strategy targets exports in all sectors and destinations)$\}$ y	1.143	1.143		
$b_p(\xi)$	3.264	4.137	1.000	1.000
Parametric coefficient				
Constant	22.618***		8.369***	
	(0.497)		(0.337)	
Observations	368		381	
Adjusted R^2	0.998		0.997	
Log Likelihood	269.354		369.530	
UBRE	0.015		0.009	

Note: Standard errors in parenthesis. *p<0.1; **p<0.05; ***p<0.01 .

Table 6: What works?
(functional form is based on non-parametric estimates)[a]

Variables	Exports	GDP per capita
Log of EPA budget in USD	0.131∗∗	0.050∗∗
	(0.033)	(0.012)
Budget x share of public funding		-0.000
		(0.000)
Budget x share of fees	0.011∗∗	
	(0.003)	
Budget x share of fees squared	-0.002∗∗	
	(0.001)	
Budget x share of marketing activ.	-0.085∗∗	0.002∗∗
	(0.023)	(0.001)
Budget x share of marketing activ. squared	0.024∗∗	
	(0.007)	
Budget x share of marketing activ. cube	-0.002∗∗	
	(0.001)	
Budget x share of export support services		-0.001∗
		(0.001)
Budget x share of non exporters	0.013†	
	(0.007)	
Budget x share of non exporters squared	-0.003	
	(0.002)	
Budget x established exporters	0.002∗	0.001
	(0.001)	(0.001)
Budget x small size firms	-0.002∗	
	(0.001)	
Budget x medium size firms		0.002∗
		(0.001)
Budget x share of private seats	-0.000	
	(0.003)	
Budget x targeting few sectors	-0.004	
	(0.015)	
Log of population	-79.918∗∗	-28.299∗
	(23.782)	(13.957)
Log of population squared	5.237∗∗	1.666†
	(1.606)	(0.936)
Log of population cube	-0.111∗∗	-0.032
	(0.036)	(0.021)
Control function exports[b]	-0.000∗∗	
	(0.000)	
Control function GDP per capita		-0.000†
		(0.000)
Intercept	411.002∗∗	159.847∗
	(117.088)	(69.466)
N	368	381
R^2	0.998	0.998

[a]All regressions include country and year fixed effects as well as the error term of a first stage regression which also includes quadratic and cubic terms of instrumental and exogenous variables to control for endogeneity. The missing variables were penalized out of the non-parametric models. Standard errors are provided in parenthesis. Significance levels are as follows: † stands for 10 percent statistical significance; ∗ for 5 percent, and ∗∗ for 1 percent.

[b]Note that the control functions have no direct interpretability. They are the "error" term of a first stage regression to control for endogeneity as described in the methodology.

Table 7: Exports and GDP per capita returns to export promotion

Country	Exports	Wild Boot. SE	GDP/capita	Wild Boot. SE
Albania	0.058	0.019	0.060	0.014
Armenia	0.061	0.020	0.064	0.015
Australia	0.065	0.019	0.060	0.014
Austria	0.062	0.019	0.062	0.014
Bangladesh	0.078	0.019	0.067	0.015
Barbados	0.063	0.019	0.060	0.014
Belgium	0.059	0.019	0.061	0.014
Belize	0.064	0.018	0.058	0.014
Bosnia and Herze	0.045	0.017	0.058	0.014
Botswana	0.050	0.019	0.056	0.014
Brazil	0.060	0.039	0.064	0.015
Bulgaria	0.047	0.020	0.065	0.015
Burkina Faso	0.068	0.019	0.060	0.014
Costa Rica	0.067	0.019	0.061	0.014
Cote d'Ivoire	0.059	0.020	0.059	0.014
Croatia	0.057	0.019	0.054	0.013
Cyprus	0.063	0.019	0.065	0.015
Denmark	0.063	0.019	0.060	0.014
Dominica	0.056	0.020	0.056	0.013
Dominican Republ	0.074	0.018	0.063	0.015
Ecuador	0.069	0.019	0.064	0.015
Egypt, Arab Rep.	0.070	0.019	0.073	0.016
El Salvador	0.056	0.019	0.056	0.014
Estonia	0.050	0.017	0.059	0.014
Finland	0.065	0.026	0.058	0.014
France	0.047	0.078	0.064	0.015
Germany	0.065	0.019	0.063	0.015
Guatemala	0.058	0.018	0.064	0.015
Guyana	0.047	0.021	0.061	0.014
Honduras	0.063	0.026	0.058	0.014
Hungary	0.054	0.026	0.059	0.014
Iceland	0.062	0.019	0.060	0.014
Indonesia	0.059	0.027	0.066	0.015
Ireland	0.061	0.018	0.062	0.015
Israel	0.063	0.019	0.061	0.014
Italy	0.066	0.018	0.062	0.015
Jamaica	0.067	0.019	0.060	0.014
Jordan	0.029	0.024	0.061	0.014
Kenya	0.072	0.019	0.063	0.015
Korea, Rep.	0.059	0.017	0.061	0.014
Lao PDR	0.047	0.017	0.060	0.014

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... table 7 continued

Country	Exports	Wild Boot. SE	GDP/capita	Wild Boot. SE
Lebanon	0.053	0.019	0.058	0.014
Lithuania	0.068	0.018	0.064	0.015
Macedonia, FYR	0.056	0.019	0.054	0.014
Malawi	0.062	0.020	0.053	0.013
Malaysia	0.061	0.037	0.061	0.014
Malta	0.052	0.044	0.057	0.014
Mexico	0.071	0.016	0.064	0.015
Moldova	0.061	0.019	0.063	0.015
Nepal	0.069	0.019	0.063	0.015
Netherlands	0.058	0.019	0.064	0.015
Nicaragua	0.057	0.040	0.065	0.015
Norway	0.068	0.018	0.056	0.014
Oman	0.057	0.020	0.059	0.014
Panama	0.043	0.038	0.062	0.014
Paraguay	0.065	0.019	0.061	0.014
Peru	0.070	0.026	0.064	0.015
Philippines	0.074	0.019	0.064	0.015
Portugal	0.061	0.051	0.068	0.015
Rwanda	0.057	0.020	0.059	0.014
Senegal	0.055	0.019	0.061	0.014
Serbia	0.058	0.026	0.062	0.015
Sierra Leone	0.073	0.019	0.056	0.014
Slovenia	0.054	0.022	0.059	0.014
Spain	0.069	0.020	0.066	0.015
Sweden	0.072	0.019	0.057	0.014
Switzerland	0.064	0.019	0.062	0.015
Syrian Arab Repu	0.072	0.020	0.058	0.014
Tanzania	0.063	0.018	0.057	0.014
Trinidad and Tob	0.048	0.018	0.063	0.015
Turkey	0.043	0.025	0.060	0.014
Uganda	0.042	0.051	0.061	0.014
United Kingdom	0.065	0.019	0.060	0.014
Uruguay	0.059	0.016	0.062	0.014
Vietnam	0.061	0.019	0.063	0.015
West Bank and Ga	0.078	0.018	0.066	0.015
Yemen, Rep.	0.065	0.018	0.062	0.015
Zambia	0.070	0.018	0.061	0.014
Average	0.061	0.022	0.061	0.014

Figure 1: Sources of funding

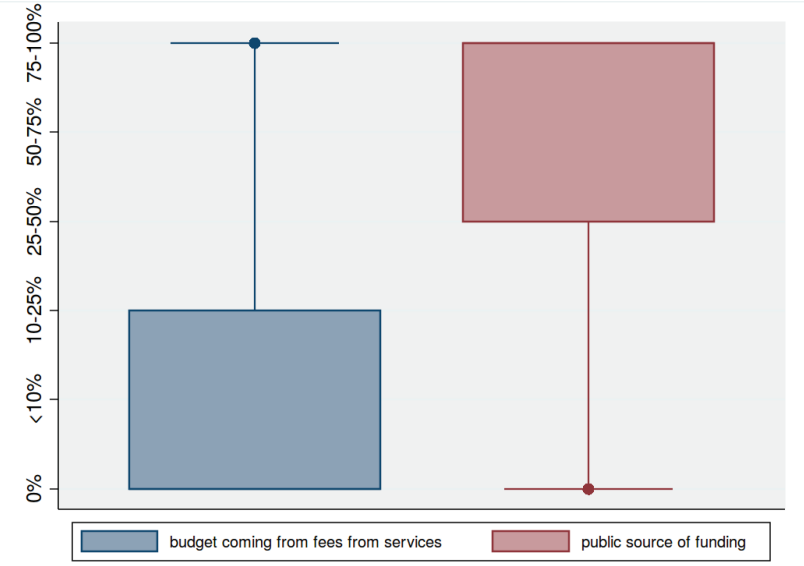


Figure 2: Budget to export ratio by region

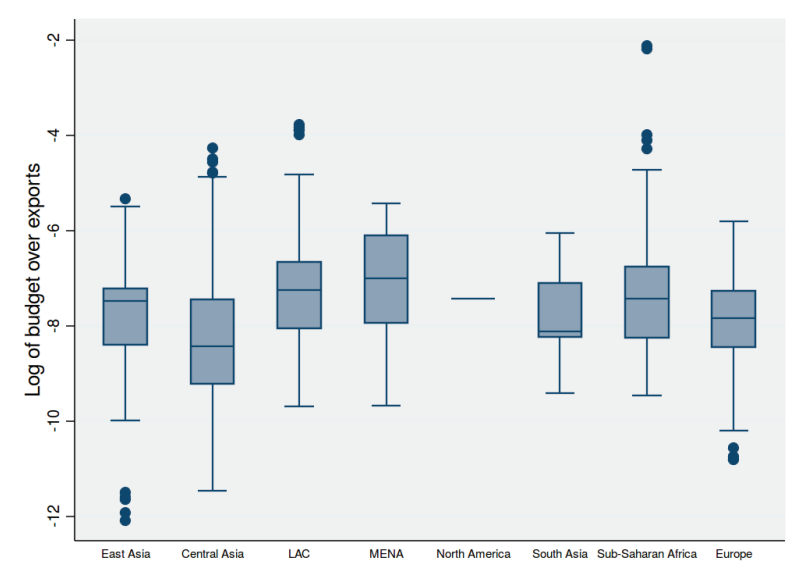


Figure 3: Share of Budget in export support services and marketing

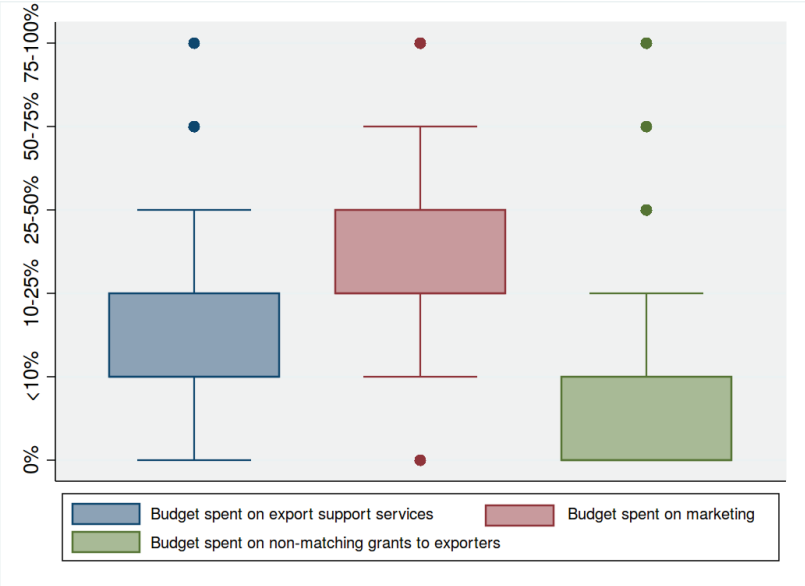


Figure 4: Share of budget spent on small, medium and large firms

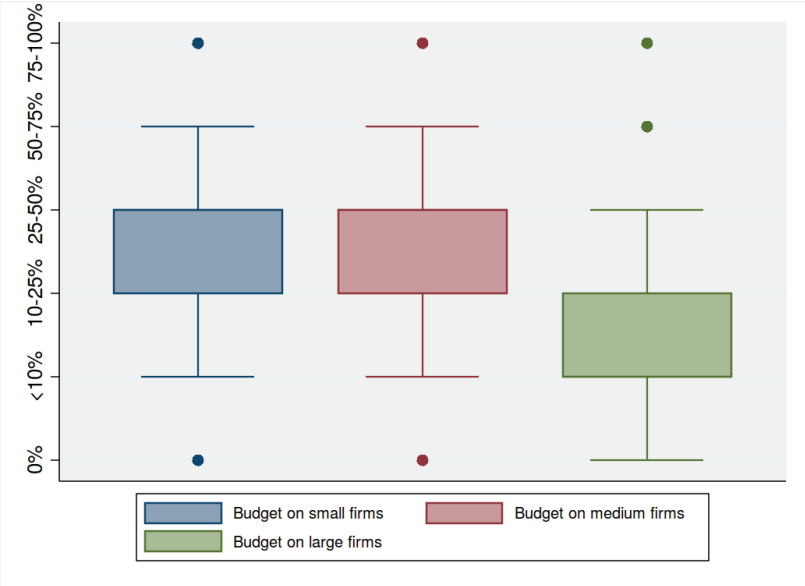


Figure 5: Share of budget spent by type of exporter

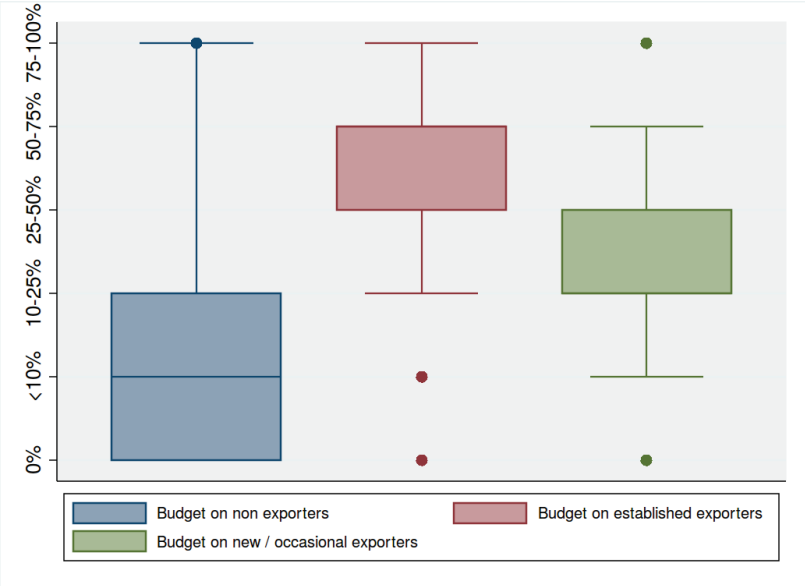


Figure 6: First stage regression explaining EPAs' budgets

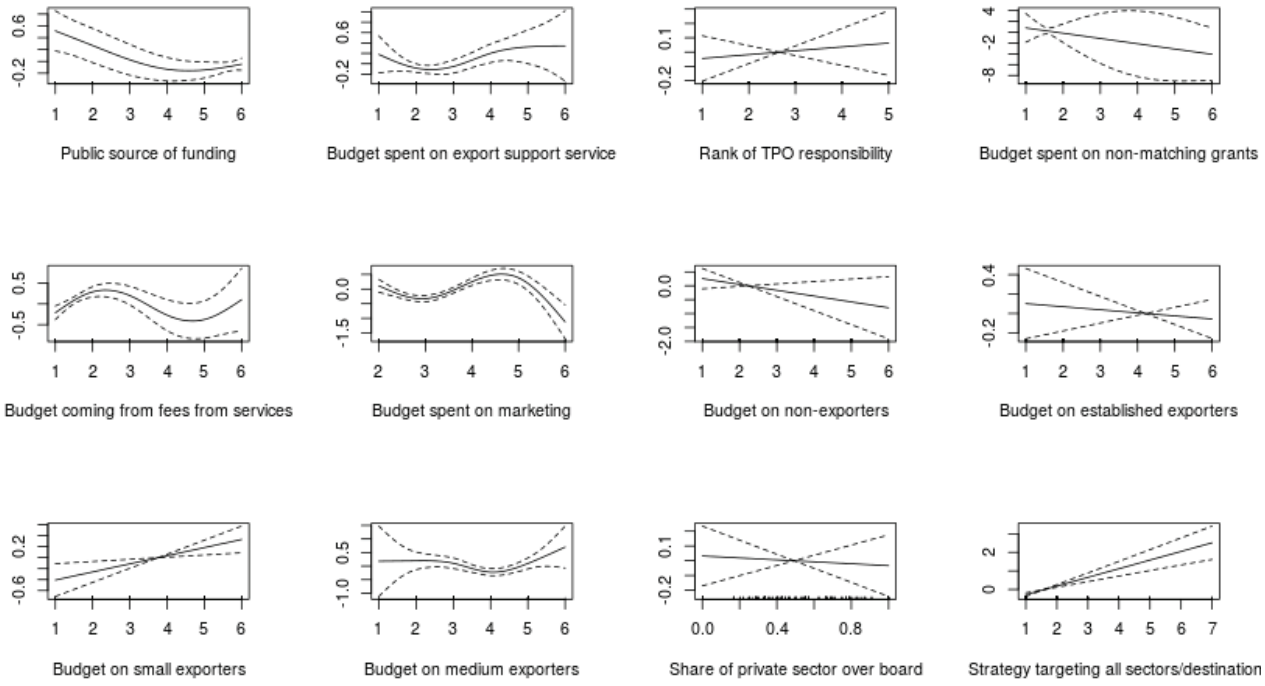


Figure 7: Postestimation plots of first stage regression

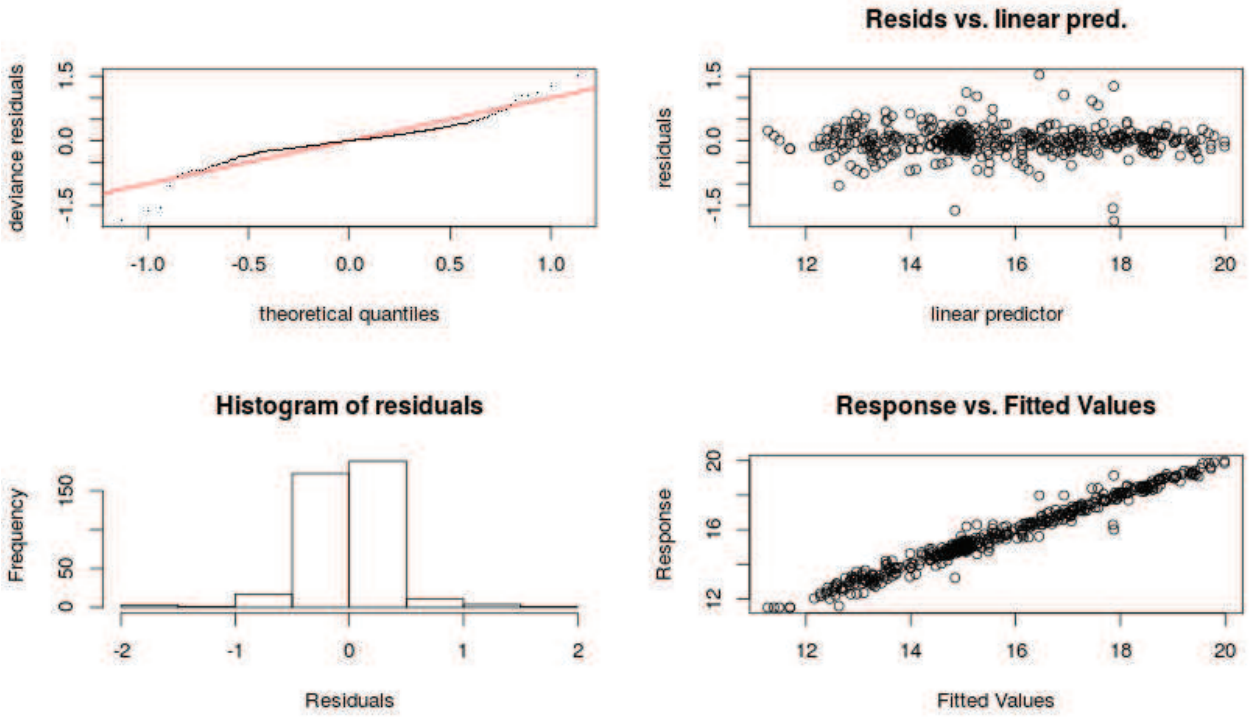


Figure 8: IV Regression plots of the penalized model on exports

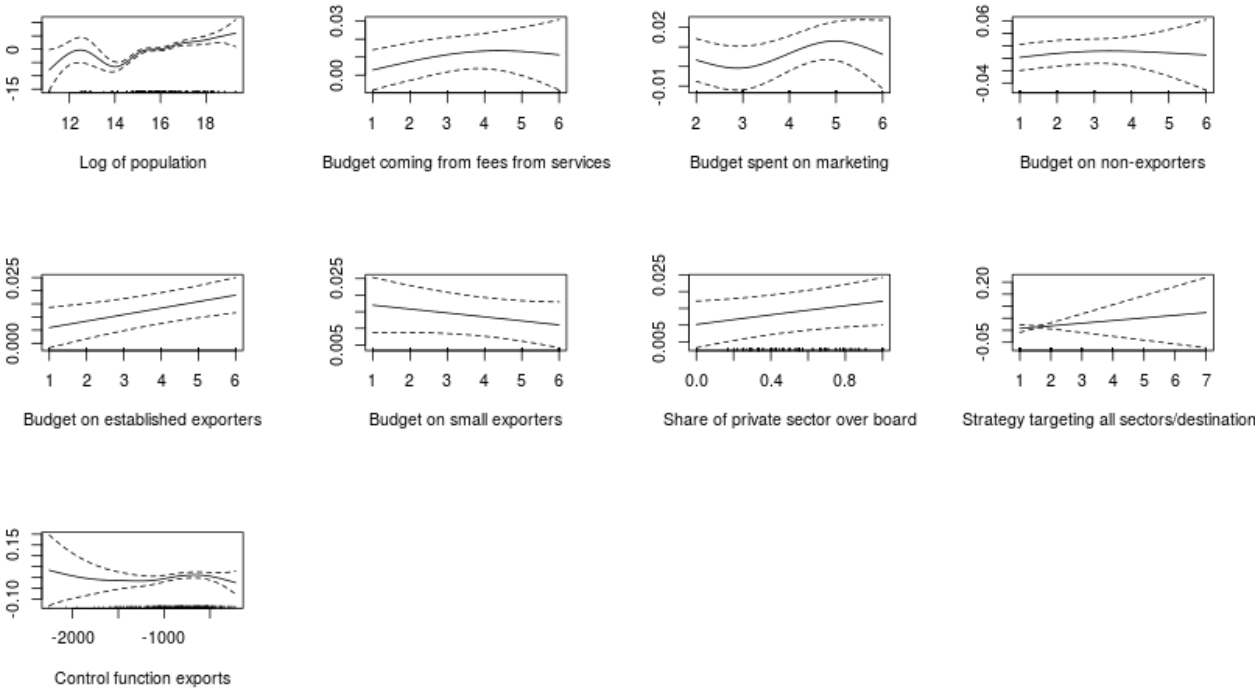


Figure 9: Postestimation plots of penalized IV regression on exports

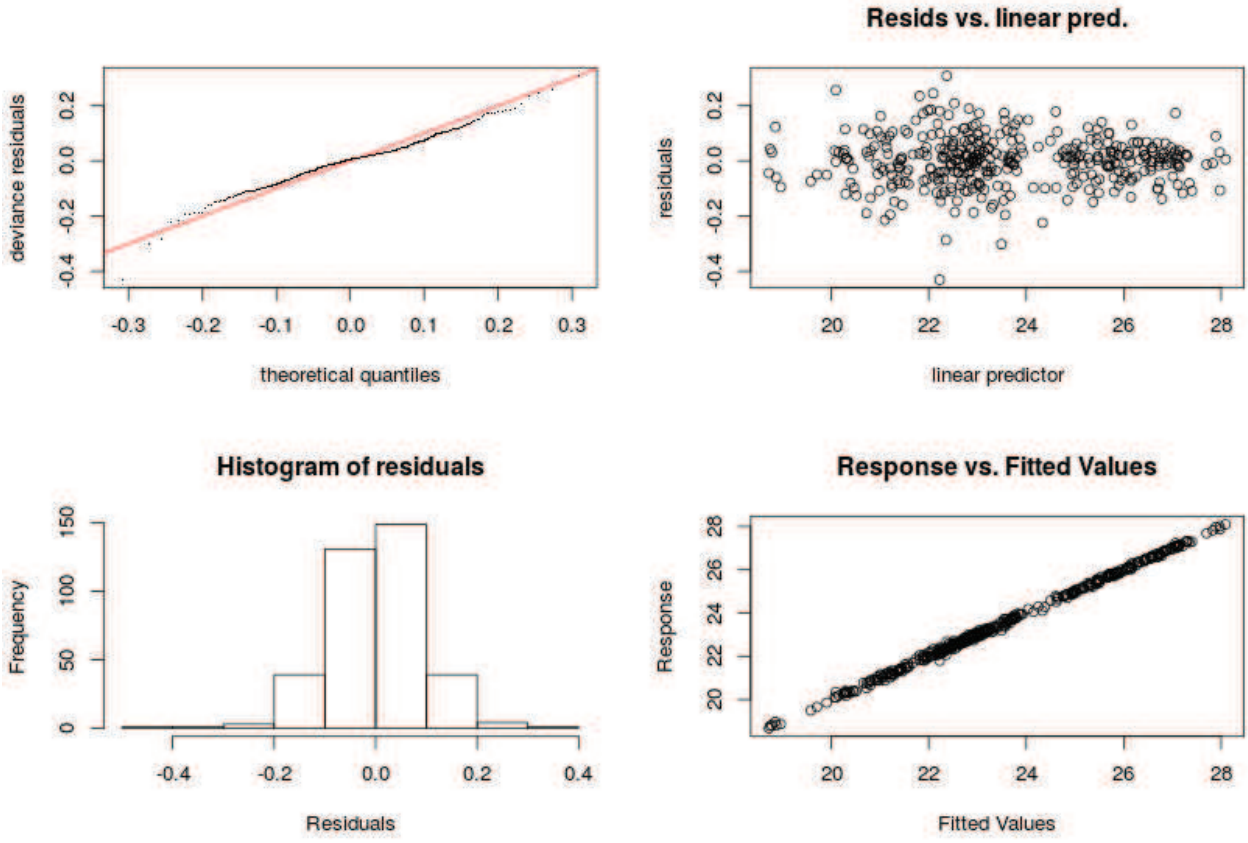


Figure 10: IV Regression plots of the penalized regression on GDP per capita

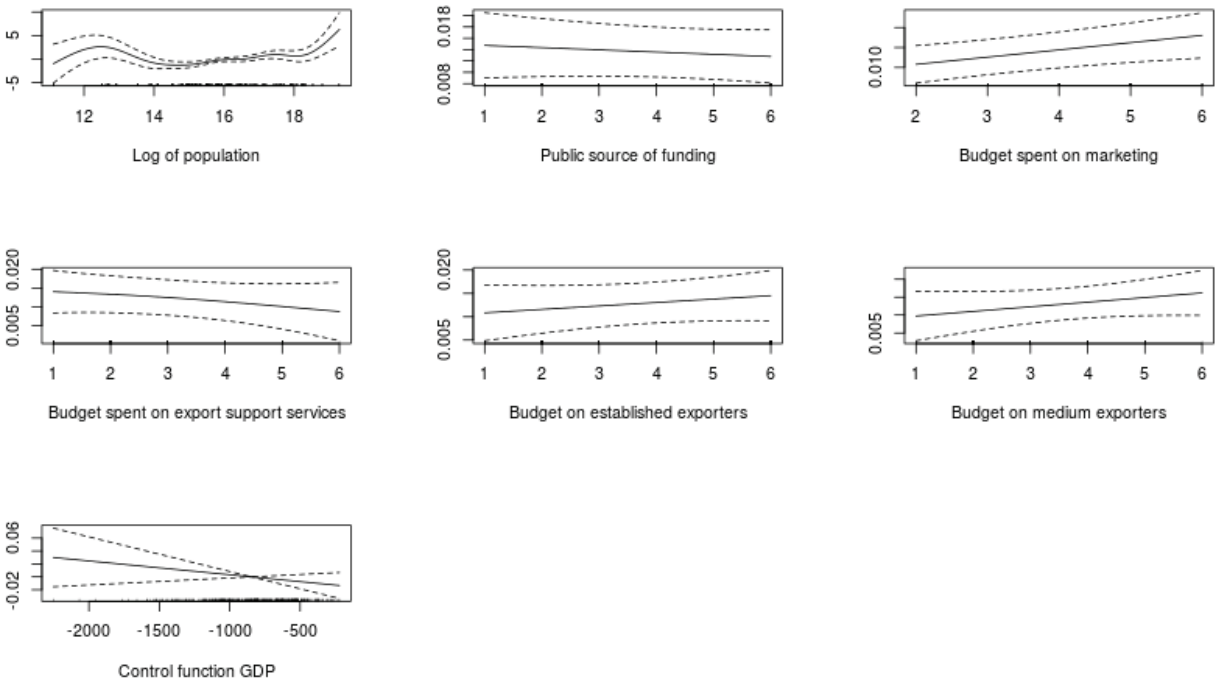


Figure 11: Postestimation plots of the penalized IV regression on GDP per capita

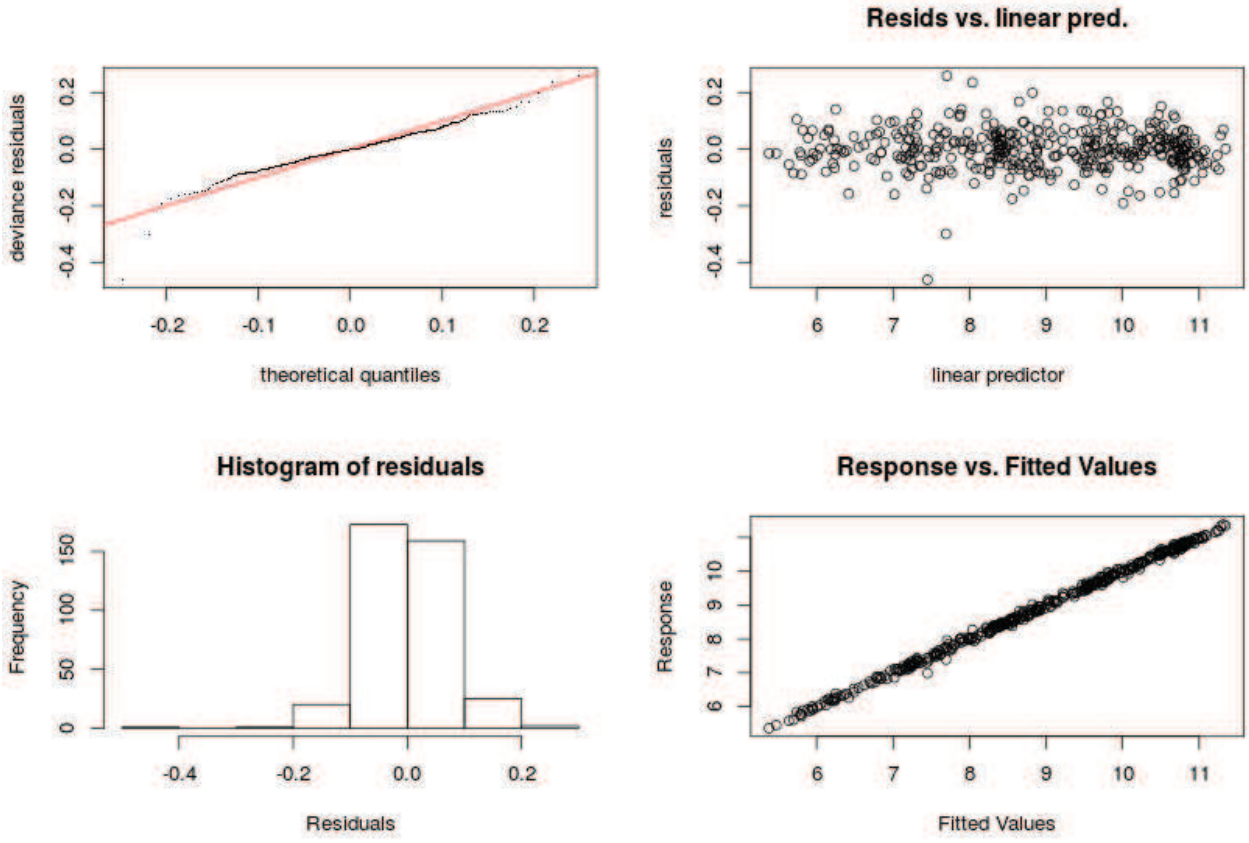
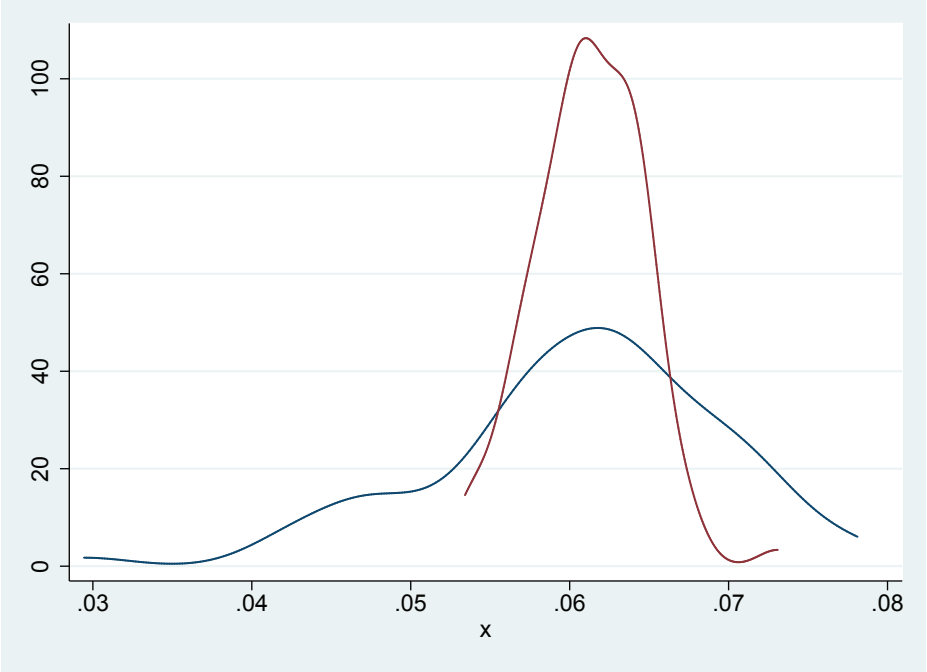
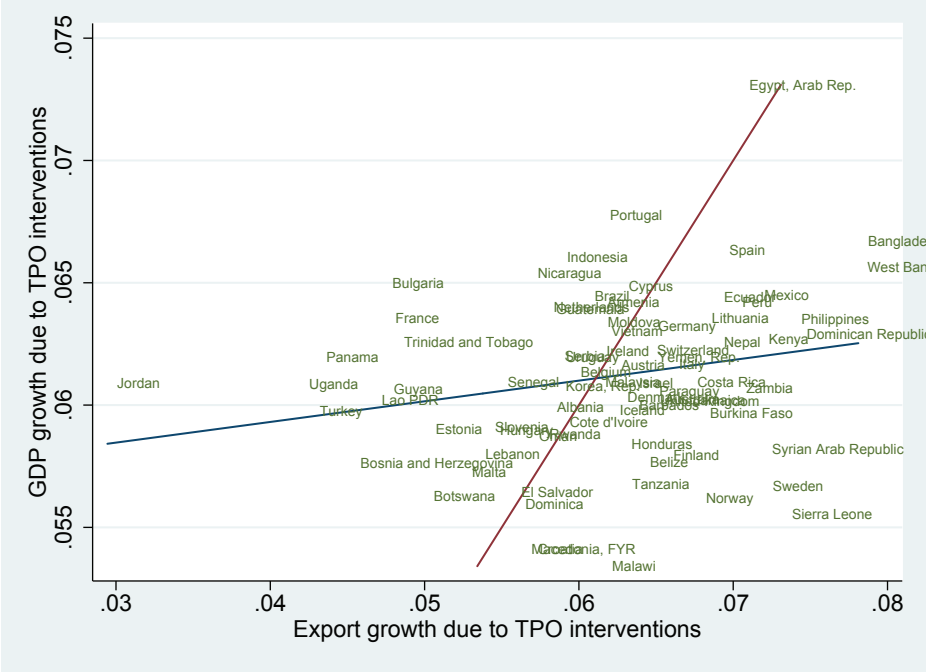


Figure 12: Distribution of export and GDP returns due to EPA interventions



Note: The blue line is the density of export returns and the red line the density of GDP per capita returns.

Figure 13: Correlation between exports and GDP per capita marginal returns



Note: The blue line is the linear fit between export and GDP per capita marginal returns and the red line is a 45°line.

"Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l'ignore."

Pascal

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Contact
www.ferdi.fr
contact@ferdi.fr
+33 (0)4 73 17 75 30