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Aid & innovation: a boost to the effectiveness of aid?*

Ayuda e Innovación: ¿un estímulo para la eficacia de la ayuda?

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Abstract

One of the most unanimous results of the economic literature is that innovation is a critical factor for sustained growth. Despite this consensus, previous research has not studied the impact of foreign aid devoted to promote developing countries' innovation capacities. For this reason, this paper analyzes the impact of Official Development Assistance for Science and Technology (ODA-ST) in the period prior to the last international economic recession. The analysis offers five important conclusions for better tailoring aid policies: i) ODA-ST effectively stimulates economic growth; ii) its impact may be higher in countries with low innovation capacities; iii) innovation exerts the strongest impact on growth; iv) income inequalities are an important obstacle for growth; and v) there is a a slow process of divergence in per capita income levels among developing countries. Therefore innovation is confirmed as a strategic "bet" on development, while focusing public foreign aid on enhancing developing countries' innovation capacities —specially in the least innovative ones— may constitute a "boost" to the effectiveness of aid.

Keywords: Innovation, aid for science and technology, aid effectiveness, Official Development Assistance (ODA).

Resumen

Uno de los resultados más unánimes de la investigación económica es que la innovación es uno de los principales determinantes de crecimiento económico sostenido. No obstante, ningún estudio ha contrastado el impacto que las ayudas para ciencia y tecnología ejercen sobre el ritmo de crecimiento de los países que las reciben. Este artículo analiza el impacto de la Ayuda Oficial al Desarrollo Científico-Tecnológica (AOD-CT) en el periodo anterior a la última crisis internacional, y ofrece cinco conclusiones relevantes para mejorar las políticas de ayuda: i) la AOD-CT estimula eficazmente el crecimiento; ii) el impacto de estas ayudas puede ser mayor en los países con menores capacidades de innovación; iii) la innovación es el principal determinante del crecimiento, iv) las desigualdades de rentas constituyen una importante obstáculo; y v) los dispares ritmos de progreso de los países en desarrollo se traducen en un lento proceso de divergencia en niveles de renta per cápita. Por lo tanto la innovación se confirma como una "apuesta" estratégica por el desarrollo, por lo que priorizar la mejora de las capacidades de innovación de los países en desarrollo -especialmente de los menos innovadores- puede impulsar la eficacia de la ayuda internacional.

Palabras Clave: Innovación, Ayuda para la ciencia y tecnología, eficacia de la ayuda, Ayuda Oficial para el Desarrollo.

INTRODUCTION

Innovation is essential for the nations' chances of progress, as it is evidenced by the fact that most innovative societies —and people— have progressed faster in the path of development. No wonder therefore that the Economic science has been concerned since its origins with the study of the role of innovation in the process of economic development. In fact, one of the most robust and unanimous result of the applied economic research is precisely that innovation is one of the main forces of the nations' economic growth[1]. Nevertheless, despite the importance of innovation, empirical studies on the macroeconomic effectiveness of foreign aid have never considered the impact of aid policies specifically devoted to enhancing the innovation capacities of developing countries.

Since most of the empirical studies on aid effectiveness have analyzed the macroeconomic "aggregate" impact, and few have distinguished different effects for different aid modalities, we focus on one of the —potentially— most important modalities of aid: those resources devoted to improve developing countries' innovation capacities. We thus analyze the impact that Official Development Assistance for Science and Technology (what we call ODA-ST) has exerted on the growth rate of developing countries' per capita income. We focus on the period previous to the last international economic recession that has negatively affected the aid budget of OECD countries, in order to avoid time inconsistencies that may bias the estimation results. After this introduction, the second section briefly reviews the recent literature on aid effectiveness. In the third section we propose an analytical model of the impact of ODA-ST on economic growth —adapted to the particularities of this type of aid and based on the new growth theory— and explain the econometric procedure for its estimation. The model compares the potentially different impacts of two types of aid: ODA-ST and the rest of the aid resources that are not aimed at innovation capacities. The fourth section explains the estimation results of the ODA-

[1] See the book edited by Helpman (1998) for a complete debate on the role of innovation in economic growth. See Quiñones (2012) for a shorter review of the prolific economic literature on the relationship between innovation and growth.

ST effectiveness model. Finally, we conclude summarizing the main findings of this study and discussing some policy implications for the effectiveness of public foreign aid policies.

1. RECENT STUDIES ON AGGREGATE AID EFFECTIVENESS

Aid impact on growth has been studied since the 1960s, generating, by 2015, a prolific literature of more than 100 macroeconomic studies[2]. The empirical exercises have tried to answer the question of whether aid promotes growth. According to this approach, the analysis of aid effectiveness falls within the broader debate of the forces that promote growth, understanding that aid may contribute —among many other factors— to the economic progress of the developing world. Provided that none of the theoretical models proposed to-date perfectly explains the process of economic growth, the theoretical foundation of the aid-growth connexion is still 'debatable'.

The most recent generation of research has produced relevant progress both in the definition of the theoretical framework, and in the econometric estimation. On one hand, most of the studies include the recent advances in growth theory. As an alternative to the models used in the first studies of aid effectiveness (Harrod-Domar model, Chenery-Strout two-gaps model, and Solow-Swan neoclassical model), new endogenous growth equations are used, emphasising a multiplicity of variables beyond physical capital, such as innovation, human capital, social capital and institutions. At the same time, some studies have considered that aid impact depends on recipient countries' circumstances, identifying non-linear relations between aid and growth.

On the other hand, econometric estimation is increasingly incorporating four notable advances: i) access to more complete statistical information; ii) use of panel data; iii) consideration of the endogeneity of some explanatory variables; and iv) modelling of non-linear aid-growth relations (due to aid decreasing marginal returns and conditional relations between aid and other explanatory variables).

[2] See, among others, the literature reviews of McGillivray et al. (2006), Dalgaard and Hansen (2010), Tarp (2010) and Tezanos (2010), and the meta-analysis carried out by Doucouliagos and Paldam (2008).

The procedure for estimating the growth equation emulates that developed by Barro's studies on growth factors, in which theory "suggests" the explanatory variables, but the selection is –to a great extent– determined by information availability[3]. The estimated models have the following general expression:

$$G_{i,t} = \alpha_1 + \alpha_2 \log y_{i,t_0} + \beta_1 A_{i,t} + \beta_2 A_{i,t}^2 + \sum_{l=1}^{L} \gamma_l R_{i,t} + \prod_{\substack{k=1 \\ l=1}}^{K,L} \varphi_{k,l} R_{i,t} A_{i,t} + \sum_{k=1}^{K} \lambda_k X_{i,t} + u_{i,t} \quad [1]$$

where $G_{i,t}$ is the income per capita growth rate of country i between years t_0 and T; $y_{i,t0}$ is the initial income per capital; $A_{i,t}$ is aid (percentage of national income) in year t; $R_{i,t}$ is a vector of aid-conditioning variables; and $X_{i,t}$ is a vector of other growth explanatory variables.

This line of research was boosted by the studies carried out by Burnside and Dollar (2000 and 2004), who were pioneers in considering the existence of a series of circumstances specific to each country that determine the aid impact. Burnside and Dollar claimed that developing countries' growth positively depends on the quality of their economic policies, and not on the amount of aid received. Moreover, the interrelation between both variables (the interactive parameter φ in equation [1]) revealed that aid is effective when there are sound policies, a result that was interpreted as a "necessary condition" for the effectiveness of aid. Nevertheless, Burnside and Dollar's thesis on sound policies has been strongly criticised, and the debate on which policies stimulate the effectiveness of aid is still open and controversial[4].

The most recent aid-effectiveness studies continue to test the existence of different aid impact determinants, not all of them in relation to the recipients' characteristics, but also in relation to the donors' managing procedures. On one hand,

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[3] See, for example, Barro (1991). In the case of the aid effectiveness literature it is not infrequent to find studies that estimate the equations without first discussing the theoretical foundation of the model.

[4] E.g. the meta-analysis carried out by Doucouliagos and Paldam (2008) concludes that the aid-policies' interactive term is close to zero.

these studies "tentatively" suggest that aid may be especially effective in four circumstances related to the characteristics of the recipient economies:

1. When countries have sound institutions, such as rule of law and respect for civil and political rights (Burnside and Dollar, 2004); stability of the political system (Chauvet and Guillaumont, 2004); democracy (Svensson, 1999; Kosack, 2002); macroeconomic stability (Durbarry et al., 1998); and Government effectiveness and control of corruption (Tezanos et al., 2009 and 2012).
2. When countries suffer from adverse shocks, such as climate (Guillaumont and Chauvet, 2001) and trade shocks (Collier and Dehn, 2001; Guillaumont and Chauvet, 2001; Chauvet and Guillaumont, 2004; Collier and Goderis, 2009)[5].
3. When countries suffer from structural disadvantages, such as their geographic location within the tropics (Dalgaard et al., 2004).
4. During post-conflict periods (Collier and Hoeffler, 2004).

On the other hand, some studies suggest that donors' managing procedures also determine the effectiveness of aid. Three detrimental procedures are —other things being equal:

1. Aid volatility (Lensink and Morrissey, 2000; Bulir and Hamman, 2008; Hudson and Mosley, 2008; Tezanos et al., 2009).
2. Donors' insufficient coordination, which generates problems of "aid-fragmentation" (Djankov et al., 2009; Tezanos et al., 2009).
3. The preponderance of foreign interest —not always in accord with development goals— in the geographical allocation of aid (Minoiu and Reddy, 2010).

[5] Although these shocks negatively affect economic growth, in these contexts aid 'softens' their adverse effects.

Also, four recent studies have considered the possibility that, given the heterogeneity of aid flows, different "modalities" may exert dissimilar impacts on growth. In this way, the pioneer study of Clemens et al. (2004) examined the effectiveness of "short term aid" (i.e. aid resources that could plausibly stimulate growth in the short run, including budget and balance of payments support, investments in infrastructure, and aid for productive sectors such as agriculture and industry). Their estimations revealed an economically and statistically significant impact from short term aid —in fact, its impact was two-to-three times larger than in studies using aggregate aid. Furthermore, the studies of Ouattara and Strobl (2008) and Annen and Kosempel (2009) evaluated the effectiveness of "technical assistance", assuming that this type of aid stimulates human capital accumulation by facilitating knowledge transfer; nonetheless, these two studies achieved opposite results: the first one claimed the ineffectiveness of this aid, and the second asserted its effectiveness. Finally, Tezanos et al. (2012) studied the effectiveness of aid grants and aid loans in Latin America and the Caribbean, suggesting that both were economically and statistically significant, although the estimated growth impact of concessional loans was greater than the impact of grants.

2. SPECIFICATION OF THE GROWTH IMPACT MODEL OF AID FOR SCIENCE AND TECHNOLOGY

In this section we propose a model for analyzing the potential impact mechanisms of aid on growth, distinguishing two types of aid: aid devoted to improving developing countries' innovation capacities (what be call "aid for science and technology", aid-ST)[6] and the rest of aid resources. Specifically, our goal is to

[6] According to Quiñones and Tezanos (2011: 162) aid-ST consist of a set of activities intended to promote technological, scientific and innovative progress in developing countries. The main objectives are: i) creating sound National Innovation Systems in developing countries; ii) transferring knowledge and technology; iii) educating and training human resources in science and technology; iv) facilitating the international mobility of researchers; v) facilitating technological learning; vi) building institutional capacity and R&D infrastructure, vii) raising people consciousness about the relevance of science and technology; viii) meeting developing countries' national demands for innovation in order to overcome the main development "bottlenecks" by providing specific solutions to specific development problems; and ix) recovering local technological knowledge.

assess the macroeconomic impact of aid-ST, rather than estimating a growth model or a model of the impact of aggregate aid (regardless of modalities). However, in order to accurately capture the aid-growth relationship it is necessary to draw a broader framework of growth, incorporating its main forces and limiting factors (especially innovation, which is ultimately the factor that aid-ST tries to enhance); otherwise, estimations will be biased due to the omission of relevant explanatory variables and due to the insufficient explanatory capacity of the model.

2.1 Analytical model

We use a theoretical framework for analysing the potential mechanisms of aid-ST on developing countries' economic growth that follows the pioneer approach of Robert Barro (1991) by assuming that the rate of growth of per capita income ($G_{i,t}$) of country i, between years t_0 and T, depends on its initial level of per capita income ($y_{i,t0}$), and a vector of k explanatory variables that determines the steady state ($X^k{}_{i,t}$), according to the following equation:

$$G_{i,t} = \alpha_i + \beta y_{i,t_0} + \delta_k X^{k}_{i,t} \qquad [2]$$

where α_i is the fixed effect of country i. The parameter β shows the existence of conditional convergence across developing countries (the so-called *β-convergence*, provided that $\beta<0$)[7]. The parameter δ indicates the joint effect of those factors that explain long-term economic growth. Obviously, the key element for the explanatory power of the model depends on the composition of the growth vector $X_{i,t}$, which —in order to capture the aid-growth relation— we define, for each i and t, as:

$$X^{k}_{i,t} = \delta_1 I_{i,t} + \delta_2 A^{ST}_{i,t} + \delta_3 A^{ST}_{i,t} \cdot I_{i,t} + \delta_4 A^{ST}_{i,t} \cdot R_{i,t} + \delta_5 A^{nonST}_{i,t} + \delta_6 Z_{i,t} \qquad [3]$$

7 See Garcimartín (2007) for a critical analysis of convergence regressions.

Where:

$I_{i,t}$	Innovation capacity of country *i* in year *t.*
$A^{ST}{}_{i,t}$	Aid-ST.
$A^{ST}{}_{i,t} \cdot I_{i,t}$	Interaction between aid-ST and innovation capacity.
$A^{ST}{}_{i,t} \cdot R_{i,t}$	Interaction between aid-ST and those variables related to the characteristics of the recipient economies that determine the eventual impact of aid.
$A^{nonST}{}_{i,t}$	Aid not related to innovation capacities.
$Z_{i,t}$	Vector of other growth explanatory variables.

Thus, the model described in equation [3] explains the triple relationship among growth, innovation and aid-ST in the following way:

- δ_1 measures the relative elasticity of innovation with respect to growth.
- δ_2 and δ_3 measure, respectively, the growth relative elasticities in relation to two different aid types**:** aid-ST and the rest of aid resources. Thus, the model does not assume equal impact coefficients of these two aid types (i.e. $\delta_2 \neq \delta_3$) in order to be consistent with their different objectives. The estimation of the parameters δ_2 and δ_3 will allow us to compare the potential impacts of these resources.
- δ_3 measures the interaction between developing countries' innovation capacities and their reception of aid-ST. If δ_3 <0, aid-ST reveals a greater impact on least innovative countries, supporting the use of this co-operation policies in order to close the global innovation gap. On the contrary, if δ_3> 0, then aid-ST is more effective the higher the innovation capacities of the recipient countries.
- δ_4 measures the interaction between the effectiveness of aid-ST and the variables that determine the impact of aid in recipient countries (e.g. good governance, economic shocks and structural disadvantages). If δ_4> 0, aid-ST is more effective the higher the value of the conditioning variable (*vice versa* if δ_4 <0).

- δ_6 measures the direct impact of other relevant growth factors, such as good governance, human capital, equality and natural resource endowment.

2.2 Econometric procedure

The estimation of the aid-ST effectiveness model defined in equations [2] and [3] is performed using the following panel data regression model:

$$G_{i,t} = \alpha_i + \beta y_{i,t0} + \delta X^{k}_{i,t} + \mu_{i,t}$$

$$\varepsilon_{i,t} = \alpha_i + \mu_{i,t}$$
$$E[\alpha_i] = E[\mu_{i,t}] = E[\alpha_i \mu_{i,t}] = 0 \qquad [4]$$

Where the error term ($\varepsilon_{i,t}$) is the sum of two orthogonal components: the fixed effects associated with each country (α_i) and the idiosyncratic effects ($\mu_{i,t}$).

If there were variables not strictly exogenous (i.e. correlated with past or actual realisations of the error term), the model will not satisfy the assumptions of the classic regression model, leading to biased estimations. This may be the case of two explanatory variables (initial per capita income and governance), either because they have a double direction of causation with the dependent variable (for example, the growth-governance relationship), or because they are related to other explanatory variables (such as initial per capita income and aid flows, to the extent that low income countries "should" receive greater amounts of foreign aid).

One way to solve this problem is to apply consistent estimation methods which take into account fixed effects and non-exogenous independent variables. Instrumental variable models, which replace non-strictly exogenous variables by strictly exogenous instrumental variables, are generally used in these cases; the instruments are correlated with the explanatory variables and turn out to be orthogonal to the error term. Dynamic regression models with panel data are estimated by the Generalised Method of Moments (GMM), proposed by Arellano and Bond (1991), as a particular case of instrumental variable models. The advantage of the GMM is the use of "internal" instruments, which may include lagged values of the non-exogenous regressors, leading to an improvement in the estimation results[8].

The GMM approach is particularly suitable for panel data estimations when: *i)* the number of periods, *T,* is small and the number of cross section units, *N*, is large; *ii)* there are non-strictly exogenous regressors; *iii)* there are fixed effects; and *iv)* there are heteroscedasticity and autocorrelation within each country's data but not among different countries' data. According to Roodman (2009, p. 15), GMM estimations are part of a "[...] broader historical trend in econometric practice toward estimators that make fewer assumptions about the underlying data-generating process and use more complex techniques to isolate useful information" [9].

We use the GMM system proposed by Arellano and Bover (1995) and Blundell and Bond (1998), instead of the difference GMM proposed initially by Arellano and Bond (1991). The latter transforms the model by doing first differences to remove unobserved fixed country-specific effects, and instruments the non-strictly exogenous explanatory variables by a moment condition's matrix. On the other hand, the system GMM makes up two equations: the original equation in levels and the first-difference equation; this system, free from correlated fixed effects, allows the use of more instruments and, consequently, improves the efficiency of the estimation[10].

[8] Aid has been usually instrumented by variables that are related to the donors' geographical allocation patterns, either using "recipients' needs" variables (assuming that aid is altruistically distributed), or/and other variables relating to donors' foreign policy interests (assuming that these interests determine the aid allocation). In both cases, the procedure becomes problematic, since the proposed instruments are neither specifically correlated with the instrumented variables (and, therefore, the instruments are not 'ideal'), nor perfectly orthogonal to the dependent variable (for example, recipients' needs variables are not strictly exogenous to the rate of growth). In addition, donors' foreign policy interests do not properly explain the geographical allocation of multilateral flows (which we include in this study).

[9] Previous studies on aid effectiveness that have estimated dynamic panel data models using the GMM are: Hansen and Tarp (2001), Dalgraad et al. (2004), Clemens et al. (2004), Chauvet and Guillaumont (2004), Rajan and Subramanian (2007), Roodman (2007), Heady (2008), Djankov et al. (2009), and Tezanos et al. (2009 and 2012).

[10] Simulation exercises by Kiviet (1995), Blundell and Bond (1998) and Hsiao et al. (1999) show that the estimators obtained by the difference GMM are biased on finite samples for two reasons: first, due to the presence of autocorrelation in the error terms with finite samples and many moment conditions, and secondly, because whenever the coefficient of the autoregressive variable is very close to 1 (that is, the series are highly persistent or near a unit root process), the parameter cannot be identified using the moment conditions for equations in first differences. In these cases, the simulations show that the difference GMM provides biased downwards estimators, especially when *T* is small (Blundell and Bond, 1998).

The model is estimated using the econometric software STATA, with three commands that optimise the estimation[11]: i) White standard errors that are robust to arbitrary heteroscedasticity for the same country[12]; ii) restriction of the matrix of instruments, creating an instrument for each variable and lag distance, rather than an instrument for each period, variable and lag distance, which, in small samples, reduces the bias that arises when the number of instruments approaches (or exceeds) the number of observations and, iii) two-step estimations, applying Windmeijer's finite samples correction in order to eliminate standard error biases. Finally, in order to check the validity of the instruments matrix in levels, Sargan and Hansen tests are carried out, as well as the Arellano-Bond test for autocorrelation of the idiosyncratic effect (if this kind of autocorrelation exists, the use of lagged values as instruments will be invalidated).

2.3 Sample and period

The target population comprise 162 developing countries that received ODA in any of the 16 years included in our period of analysis (1993-2008), according to the Development Assistance Committee (DAC) database[13]. However, 99 countries were ultimately excluded from the analysis due to lack of necessary information[14]. Annexe 1 shows the 63 countries and 183 observations finally analysed.

Regarding the period of analysis, we focus in the years prior to the last international economic recession, which has negatively affected the aid budget of OECD countries, in order to avoid time inconsistencies that may bias the estimation

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[11] We use STATA's "xtabond2" command developed by Roodman (2009).

[12] I.e. it is assumed that observations are independent across countries, although the errors of the same country are not necessarily independent over time.

[13] The DAC database reports information on aid activities ("sectors") since 1993; therefore, this is the first year of our period of analysis.

[14] The excluded are countries with less than one million inhabitants, mostly islands (Antigua and Barbuda, Bahrain, Bermuda, Brunei, Cape Verde, Comoros, Dominica, Tuvalu, Kiribati, Macao, New Caledonia, Marshall Islands, Aruba, Barbados, Bahamas, Guyana, Malta, Micronesia, French Polynesia, Palau, Sao Tome and Principe, Seychelles, Solomon Islands, Saint Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Tonga and Vanuatu); countries with little availability of statistical information (such as Afghanistan, Cuba, Fiji, Haiti, Madagascar, Trinidad and Tobago, Mauritius, North Korea, Equatorial Guinea, Papua New Guinea, Iraq and East Timor); countries whose independence has not been officially recognized (Palestine and Western Sahara); and autonomous regions linked to other States (Puerto Rico and Hong Kong).

results. In relation to the time structure, literature on aid effectiveness has often used panel data sets in which most of the variables are averages over four or five-year periods. This is an alternative procedure to that proposed by Barro (with longer periods), which entails an attribution problem of the aid impact. Ultimately, the choice between periods of four or five years has not been empirically justified and is, therefore, arbitrary. However, the choice of four-year periods is the most commonly used because it maximises the temporal dimension of the sample, so it is the one we choose in this research.

2.4 VARIABLES

The choice of the proxies for the estimation of the aid-ST effectiveness model tries to maximize the availability of data (thus reducing the data selection bias that stems from a non-random omission of information)[15], and to avoid redundant information (which causes problems of multicollinearity). **Annexes 2** and **3** show several descriptive measures and detailed information about the data sources and the elaboration procedures of the variables.

- Dependent variable

We use the dependent variable most commonly used in aid effectiveness studies: the average growth rate of the GDP per capita in each four-year period (*G*).

- Independent variables

We measure the *β*-convergence by means of the natural logarithm of the GDP per capita in the initial year of each four-year period (ln*GDPpc0*).

[15] The poorest countries often lack statistical information, so their exclusion could systematically bias estimations. Therefore, it is important to use a set of explanatory variables widely available in these countries.

Innovation capacities ($I_{i,t}$) are approximated by the number of scientific papers published per 100 inhabitants (*Papers*), expecting a positive relationship with the growth rate. This is one of the indicators recommended by the OECD's *Frascati Manual* (2002) for measuring innovation capacities.

Aid flows are proxied by ODA flows channelled to developing countries by multilateral agencies and bilateral donors (DAC and other donors who are not members of this Committee but do report information)[16]. Data is extracted from the DAC's CRS (*Creditor Reporting System*) database; we use "ODA commitments" because it is the most comprehensive and accurate information available in this database[17].

For the computation of ODA-ST, we use the approach proposed by UNCTAD (2007), which identifies 28 aid sectors (according to the DAC's sector classification) related to innovation. These sectors can be classified into two main groups: "aid for research and technological development" (agriculture, forestry, fishery, education, health, energy and environment) and "aid for improving advanced and specific innovation skills" (vocational training, higher education, statistical capacity building, and various types of training related to social, productive and trade sectors).

The two aid variables (ODA^{ST} y ODA^{nonST}) are transformed by the natural logarithm for two reasons: to reduce heteroscedasticity and dispersion among observations, and to linearize the relationship between aid and growth[18].

In relation to the vector of variables that determine the eventual impact of aid in recipient countries ($R_{i,t}$), we use three proxies to analyze their interactive effect with aid:

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[16] In accordance with DAC's criteria, ODA consists of grants and loans that meet the following four conditions: *i)* are disbursed to developing countries, *ii)* are granted by the official sector, *iii)* their main objective is the promotion of economic growth and welfare, and *iv)* in the case of loans, they are granted on concessional financial terms, with a grant element of at least 25%.

[17] The amount of aid can be expressed in terms of the "commitments" made by the donor or the "disbursements" (net or gross) finally disbursed. Nonetheless, the DAC does not recommend the use of the information provided by the CRS database on aid disbursements prior to 2002 due to its low coverage (less than 60% of ODA activities). From this year the coverage rises to 90%, and reaches 100% from 2007 onwards. In contrast, the information coverage on commitments is much higher: 70% in 1995, 90% in 2000 and 100% from 2003 onwards.

[18] The relationship between aid and growth is not linear due to the existence of diminishing marginal returns to aid. Various empirical studies have verified the concavity of the aid-growth relationship: from the early study of Dudley and Montmarquette, (1976), to the more recent studies of Hansen and Tarp (2001), Lensink and White (2001), Collier and Dollar (2002) and Clemens et al. (2004).

i. Institutional quality of recipient countries, assuming that aid is more effective in countries with good policies and institutions. In this study we use the governance indicators developed by Kaufmann et al. (2014), which provide comprehensive information on six governance dimensions: i) voice and accountability, ii) political stability and absence of violence, iii) government effectiveness, iv) regulatory quality, v) rule of law, and vi) control of corruption. Governance indicators are constructed using the methodology of unobserved components and their distribution is centred on zero and has a dispersion of approximately ±2.5, which lets us add multiple dimensions into a single indicator. Specifically, we calculate the arithmetic average of these six dimensions of good governance (*Governance*).

ii. Economic shocks, assuming that aid can be particularly effective in these situations, "smoothing" the adverse effects on growth. In particular, we evaluate trade shocks (as did Collier and Dehn, 2001; Guillaumont and Chauvet, 2001, Chauvet and Guillaumont, 2004, and Collier and Goderis, 2009) by means of the terms of trade (*Voltrade*).

iii. Structural disadvantages that limit developing countries' chances to progress, assuming that the impact of aid is particularly high in countries with these disadvantages. We use the proxy proposed by Dalgraad *et al.* (2004): proportion of each country's land located within the Tropics (*Tropical*).

In relation to the vector of other growth explanatory variables ($Z_{i,t}$), we use four additional proxies:

i. Institutional quality, which has a positive impact on economic growth (Kaufmann and Kraay, 2002; Kaufmann et al., 2009, Alonso and Garcimartín, 2010). Again we use the *Governance* variable previously described[19].

ii. Human capital, assuming a positive contribution to growth (Lucas, 1988; De la Fuente and Doménech, 2006). This variable is proxied by Barro and Lee's average years of total schooling of people over 25 years old (*Hk*).

[19] Note that this variable acts simultaneously as an aid impact condition (see δ_4 parameter of equation [5]) and as an endogenous growth factor (parameter δ_8).

iii. Inequalities, which negatively affect economic growth (Easterly, 2007), are proxied through the Gini index of income inequality (*Gini*).[20]

iv. The endowment of natural resources, which we assume that adversely affects the growth rate as predicted by the hypothesis of the "natural resource curse" (Sachs and Warner, 1999; Leite and Weideman, 2002; Isham et al., 2005). We proxy this variable by the fuel exports (percentage of merchandise exports) (*Expoil*).

v. Macroeconomic instability, which may negatively affect growth (Fischer, 1993), is proxied by the inflation rate (*Inflation*).

In sum, the final regression equation has the following expression:

$$G_{i,t} = \beta \ln GDPpc0_{i,t} + \delta_1 Papers_{i,t} + \delta_2 \ln ODA^{ST}_{i,t} + \delta_3 ODA^{nonST}_{i,t} \cdot Papers_{i,t} +$$
$$+\delta_4 ODA^{ST}_{i,t} \cdot Governance_{i,t} + \delta_5 ODA^{ST}_{i,t} \cdot Voltrade_{i,t} + \delta_6 ODA^{ST}_{i,t} \cdot Tropical_{i,t} +$$
$$+\delta_7 \ln ODA^{nonST}_{i,t} + \delta_8 Governance + \delta_9 Hk - \delta_{10} Gini_{i,t} - \delta_{11} Expoil - \delta_{12} Inflation + \varepsilon_{i,t} \quad [5]$$

In this regression model, three explanatory variables may be non-strictly exogenous: initial per capita income, governance and the interactive variable between governance and ODA-ST. Therefore, the estimation of the model requires to instrument them. In any case, since expanding the number of instruments results in inefficient estimates (Roodman, 2008 and 2009), we limit the number of instruments to a minimum[21].

Finally, the model estimation includes time dummies in order to reduce the degree of autocorrelation across countries and the error idiosyncratic term, which leads to more robust estimators (Roodman, 2009).

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[20] A good literature review on the relationship between growth and equality can be found in Alonso (2005).
[21] In our case, we have 63 countries and 22 instruments.

3. RESULTS: GROWTH IMPACT OF AID FOR INNOVATION

In aggregate terms, aid-ST has had a positive and statistically significant effect on developing countries' GDP per capita growth in the period 1993-2008 (**Figure 1**). According to our baseline estimates (see equation [1]), a 1% increase in ODA-ST may increase the growth rate by around 0.007 percentage points[22]. Although it may seem a limited impact, it is in fact noteworthy given that the contribution of ODA-ST to the sample countries' GDP is exiguous, accounting for approximately 0.18% (see Annexe 3). Furthermore, this result holds regardless of other aid effectiveness determinants (such as good governance, economic shocks and structural disadvantages). In contrast, the estimated effect of the rest of aid flows is statistically non-significant.

Figure 1. Estimation of the aid-ST effectiveness model

	[1]	[2]	[3]	[4]
ln *GDPpc0*	**1.520177** (0.032)	**1.510161** (0.032)	**1.586129** (0.039)	**1.528689** (0.031)
Papers	**0.2772586** (0.053)	**0.2697485** (0.075)	**0.2678725** (0.048)	**0.240892** (0.084)
ln ODA^{ST}	**0.6612229** (0.061)	**0.6396501** (0.052)	**0.6655648** (0.069)	**0.7064022** (0.062)
$ODA^{ST} \cdot Papers$	**-6.213506** (0.050)	**-5.942183** (0.033)	**-6.213052** (0.047)	**-6.10464** (0.048)
$ODA^{ST} \cdot Governance$	2.208733 (0.247)	2.502509 (0.106)	2.252518 (0.135)	2.358579 (0.210)
$ODA^{ST} \cdot Voltrade$	0.0107225 (0.277)	0.0084759 (0.441)	0.0114145 (0.252)	0.0116128 (0.234)
$ODA^{ST} \cdot Tropical$	-0.0061589 (0.754)		-0.0065875 (0.730)	-0.0053071 (0.787)
lnODA^{nonST}	0.0933586 (0.514)	0.0907501 (0.527)	0.0803285 (0.552)	
Governance	0.0923718 (0.947)	0.0835293 (0.953)		-0.0743938 (0.956)

[22] Since aid is expressed in logarithms, the interpretation of the aid impact coefficient requires to divide by 100 the estimated coefficient of δ_2, thus reflecting the increased growth rate (in percentage points) that generates a 1% relative increase in the aid variable.

Hk	-0.3969601 (0.533)	-0.3633199 (0.549)	-0.4761187 (0.467)	-0.418962 (0.516)
Gini	**-0.1312041** (0.036)	**-0.1327905** (0.04)	**-0.136988** (0.050)	**-0.128381** (0.036)
Expoil	-0.0200732 (0.234)	-0.020139 (0.235)	-0.0227506 (0.058)	-0.0232863 (0.135)
Inflation	-0.0041647 (0.656)	-0.0041007 (0.666)	-0.0039629 (0.721)	-0.0041098 (0.657)
Post-estimation tests (*p*-values)				
χ^2 (22,63)/(21,63)/(19,63)/(21,63)	0.000	0.000	0.000	0.000
Sargan	0.976	0.978	0.950	0.976
Hansen	0.964	0.963	0.925	0.956
Arellano-Bond AR(1)	0.004	0.004	0.004	0.004
Arellano-Bond AR(2)	0.893	0.881	0.873	0.762

Sample: Number of observations = 183 Number of groups (countries) = 63
No. periods: 4-year periods (1993-1996, 1997-2000, 2001-2004, 2005-2008)
Obs. per group: min=1, max=4, Average=2.9
Number of instruments = 22

Instruments for GMM system equations: ln*GDPpc0*, *Governance* and $ODA^{ST}\cdot$ *Governance* (2 and deeper lags, endogenous variables).

Panel data regressions, system GMM, two-step estimations, White's (heteroskedasticity-adjusted) robust errors, Windmeijer correction for finite samples, and instrument matrix collapsed. We include time *dummies* in all regressions (not reported). *p*-values are shown within brackets. See Annexe 2 for explanation of the variables.

Furthermore, the interaction term between ODA-ST and innovation is also statistically significant with a negative estimated coefficient. This result is particularly interesting, as it suggests that the impact of ODA-ST is higher in countries with low innovation capacities, which in turn justifies a prioritized allocation of resources to these developing countries. Therefore, if ODA-ST is effective, and it seems to be particularly effective in the least innovative countries, this type of aid could be appropriate for closing the world innovation gap, provided that it is targeted to the appropriate countries. In this sense, the study of Quiñones and Tezanos (2011) supports this argument as it points out that the geographical allocation of ODA-ST has been moderately progressive since 1993 (i.e. least innovative developing countries receive proportionally more aid-ST than most innovative countries).

Regarding the growth determinant variables, two are statistically significant. On the one hand, innovation capacities exert a positive effect on growth; according to our estimations, a 1% increase in the ratio of scientific papers generates a growth stimulus of 0.28 percentage points, thus supporting the argument that innovation is a relevant determinant of economic progress. On the other hand, income inequalities operate to the detriment of growth, to the extent that a 1% increase in the Gini index detracts approximately 0.13 percentage points of the growth rate. This result may stem from the fact that inequality generates "public bads" (such as crime, violence and insecurity), which limit the investment and growth possibilities and reduce the economy's productive capacity due to the exclusion of the poor (Fajnzylber et al., 1998; Easterly, 2007; Alonso, 2005).

Regarding the β*-convergence,* the estimated coefficient is positive and statistically significant, therefore depicting a possible scenario of *divergence* in terms of per capita incomes (with an estimated β-parameter approximately equal to 1.64). This result is due both to the comparatively slower growth in some of the poorest developing countries included in the sample (low and low-middle income countries such as Burundi, Benin, Bolivia, Cameroon, Ivory Coast, El Salvador, Nicaragua, Pakistan and Yemen), and the rapid pace of growth experienced in recent years by the "emerging" middle-income economies (specially China, Brazil and India), which implies a widening gap in the developing world in terms of per capita incomes. Moreover, this result supports the thesis of those authors who argue that international income inequalities have not decreased in recent decades (Milanovic, 2005 and 2010).

Regarding the goodness of fit of the model, the joint significance test strongly rejects that all coefficients are simultaneously equal to zero (see p-value=0 in **Figure 1**). Furthermore, the Sargan and Hansen tests for joint validity of the instruments are not rejected, as it happens with the Arellano-Bond test for autocorrelation in the idiosyncratic error term. Consequently, these post-estimation tests support the validity of the estimates.

It is worth mentioning that some regressors may be correlated, as they try to capture similar determinants of economic growth, thus creating a problem of multicollinearity. This may be the case of the variables included in the vectors R and Z of equation [3]. As a first precautionary measure to avoid multicollinearity problems, we have chosen the proxies trying to avoid redundant information. Also, the high number of observations included in the analysis (183) and the high variability of the dependent variable assures the efficiency of the results. Moreover, the pairwise correlations matrix of the full set of explanatory variables used in the analysis shows that the majority of the correlations are reasonably low (**Figure 4**)[23]. There are, however, three high correlations that require further consideration:

i. The correlation between *Governance* and *lnGDPpc0* (+0.71), because countries with high per capita incomes tend to have the best records of governance.

ii. The correlation between ODA^{ST} and ODA^{nonST} (+0.77), indicating that these two modalities of aid tend to be geographically allocated in similar ways (i.e. countries that receive high ODA-ST ratios also tend to be those with higher receptions of other aid modalities).

iii. The correlation between $ODA^{ST} \cdot Voltrade$ and $ODA^{ST} \cdot Trop$ (+0,909), which is, partially, due to the fact that the tropical variable is invariant over time.

However, these relatively high correlations do not significantly alter the estimation results, as can be seen when we run again the regressions successively removing the three variables that are causing the high correlation coefficients ($ODA^{S} \cdot Trop$, *Governance* and ODA^{nonST}) (see columns [2] to [4] in **Figure 4**). Thus, the three last estimated regressions do not significantly differ from our base regression (equation [1]), thus reassuring the robustness of the estimations.

[23] Gujarati (2003: 345) offers the tentative value of 0.8 as the limit beyond which multicollinearity becomes a "serious problem".

Figure 2. Pairwise correlation matrix of the variables included in the analysis

	G	ln $GDPpc0$	ln ODA^{ST}	ln ODA^{nonST}	$ODA^{ST}\cdot Papers$	$ODA^{ST}\cdot$ $Governace$	$Governance$	$ODA^{ST}\cdot$ $Voltrade$	ODA^{ST} $Tropica$
g	1,0000								
ln $GDPpc0$	0,0780	1,0000							
ln ODA^{ST}	0,0469	-0,5423	1,0000						
ln ODA^{nonST}	-0,0775	-0,7145	0,7735	1,0000					
$ODA^{ST}\cdot Papers$	0,0810	0,1208	0,3495	0,1903	1,0000				
$ODA^{ST}\cdot Governance$	0,0741	0,3749	-0,3609	-0,3116	0,0160	1,0000			
$Governance$	0,1014	0,7113	-0,2371	-0,3243	0,1426	0,4155	1,0000		
$ODA^{ST}\cdot Voltrade$	-0,0169	-0,2929	0,6317	0,4105	0,3515	-0,4270	-0,0694	1,0000	
$ODA^{ST}\cdot Tropical$	-0,0598	-0,2172	0,5217	0,3360	0,2510	-0,2343	-0,0239	0,9094	1,0000
$Papers$	0,0619	0,3766	-0,2474	-0,2742	0,1206	0,0869	0,3328	-0,1015	-0,0870
$Gini$	-0,2050	0,2320	-0,2123	-0,1757	-0,2104	0,1382	0,2193	-0,1453	-0,0202
Kh	0,1725	0,5474	-0,3180	-0,3552	0,2358	0,2896	0,4465	-0,2499	-0,3963
$Expoil$	0,0092	0,1890	-0,2737	-0,3118	-0,1383	0,0743	0,1816	-0,1301	-0,1414
$Inflation$	-0,1603	-0,1210	0,0098	0,0643	-0,0226	-0,1304	-0,2280	0,0151	0,0344

CONCLUSIONS

Perhaps one of the most unanimous results of the applied economic research is that innovation is a crucial force for sustained economic growth. Despite this consensus, previous research on aid effectiveness has not studied the impact that aid policies devoted to enhancing developing countries' innovation capacities has on their paces of growth. The truth is that the contribution of ODA-ST to the developing world' GDP is very limited (0.18% in our sample of countries), so we can hardly expect a tremendous impact on growth from these foreign resources. However, aid-ST may have a significant impact, as it helps to improve the developing countries' innovation capacities. Invested strategically, aid-ST can be an "effective" development strategy, contributing to enhance the innovation capacities of the developing world and to close the global innovation gap.

After 50 years of research and over 100 empirical studies, it is still controversial to assert that foreign aid fosters, in aggregate terms, the developing countries' pace of economic growth. However, most of the studies have analyzed the macroeconomic impact of "aggregate aid", without distinguishing potentially different impacts for dissimilar aid modalities. Therefore, the aim of this paper is to quantify the impact exerted by a specific aid type (ODA-ST) on the growth rate of developing countries' per capita income. To this end, we propose an analytical model of the impact of aid-ST on growth adapted to the characteristics of innovation and based on the new growth theory.

The estimation for the period prior to the last international economic recession (1993-2008) offers four relevant results:

First, ODA-ST has been effective in stimulating growth, in such a way that a 1% increase in this type of aid may increase the GDP per capita growth rate around 0.007 percentage points. Moreover, this result holds regardless of other aid effectiveness determinants (such as good governance, economic shocks and structural disadvantages). In contrast, the impact of aid is "diluted" when we consider other resources not intended to develop innovation capacities.

Second, we estimate a negative interaction coefficient between ODA-ST and innovation; a result that suggests that the impact of this resources may be higher the lower the innovation capacities of the recipients, which is a strong argument in favour of emphasizing the use of this type of aid in the least innovative countries. Therefore, if ODA-

ST is effective, and it is particularly effective in countries with low innovation capacities, this type of aid may be appropriate for closing the world innovation gap —provided that it is targeted to the appropriate countries.

Third, regarding the characteristics of the recipient economies that determine the different paces of economic growth, two variables are statistically significant: on one hand, innovation was the main force of progress for the analysed sample of developing countries. On the other hand, income inequalities were a major drag on growth; a result that may be related to the generation of "public bads" (such as crime, violence and insecurity) that seriously restrict the possibilities of growth.

Forth, the analysis suggests that the existence of substantial disparities among developing countries' rates of growth results in a slow process of divergence in terms of per capita income levels, because some of the poorest countries have tended to grow slower and some of the most advanced countries (especially the "emerging economies") have grown rapidly.

Ultimately, innovation is confirmed as a strategic "bet" on development, while focusing public foreign aid on enhancing developing countries' innovation capacities may constitute a "boost" to the "debatable" aggregate effectiveness of aid. In this sense, a more strategic selection of aid modalities —adapted to the specific socio-economic conditions of each partner country— and a greater emphasis on the resources devoted to foster innovation capacities, may be advisable for increasing the impact of aid. However, further research is needed for a better understanding of the conditions that determine the eventual impact of these resources.

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ANNEXES

Annexe 1

Figure 3. Countries and periods included in the regression analysis

	Country	*Periods*
	Algeria	1993-1996
	Argentina	1993-1996, 2005-2008
	Bangladesh	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Belize	2005-2008
	Benin	2001-2004
	Bolivia	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Brazil	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Burundi	1993-1996, 2005-2008
	Cambodia	2005-2008
	Cameroon	1997-2000, 2001-2004, 2005-2008
	China	2005-2008
	Colombia	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Costa Rica	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Ivory Coast	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Dominican Rep.	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Ecuador	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Egypt	1993-1996, 1997-2000, 2001-2004, 2005-2008
	El Salvador	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Gambia	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Ghana	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Guatemala	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Honduras	1993-1996, 1997-2000, 2001-2004, 2005-2008
	India	2005-2008
	Indonesia	2005-2008
	Iran	2001-2004, 2005-2008
	Jamaica	2001-2004, 2005-2008
	Jordan	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Kenya	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Korea	1993-1996, 1997-2000
	Malawi	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Malaysia	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Maldives	2005-2008
	Mali	2005-2008
	Mauritania	1993-1996
	Mexico	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Mongolia	2001-2004, 2005-2008
	Morocco	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Mozambique	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Nepal	2001-2004
	Nicaragua	1997-2000, 2001-2004, 2005-2008
	Niger	2005-2008
	Pakistan	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Panama	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Paraguay	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Peru	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Philippines	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Ruanda	2001-2004, 2005-2008
	Senegal	1997-2000, 2005-2008

	South Africa	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Sri Lanka	1993-1996, 2001-2004, 2005-2008
	Swaziland	1997-2000, 2001-2004, 2005-2008
	Tanzania	1997-2000, 2001-2004, 2005-2008
	Thailand	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Togo	2005-2008
	Tunisia	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Turkey	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Uganda	1993-1996, 1997-2000, 2005-2008
	Uruguay	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Venezuela	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Vietnam	2005-2008
	Yemen	2001-2004, 2005-2008
	Zambia	1993-1996, 1997-2000, 2001-2004, 2005-2008
	Zimbabwe	1993-1996

Annexe 2

Figure 4. Variables' description and information sources

Variable	Variable Code	Description	Source
Average rate of GDP per capita	*G*	Constant prices, US $, (year 2000=100).	World Bank (2014)
ln (GDP per capita)	ln *GDPpc0*	Natural logarithm of the GDP per capita of the initial year. Constant prices, US $, (year 2000=100).	World Bank (2014)
Papers	*Papers*	Number of scientific papers per 100 people.	World Bank (2014)
ln (ODA^{ST})	ln ODA^{ST}	Natural logarithm of the percentage of total donors' ODA-ST commitments over GDP in each period. Constant prices, US dollars, base year 2000.	DAC (2014)
Governance	*Governance*	Arithmetic average of six dimensions of governance.	Kaufmann et al. (2014)
Trade volatility	*Voltrade*	Percentage of export prices index over import prices index (year 2000=100).	World Bank (2014)
Tropical	*Tropical*	Proportion of the total area of the territorial land of a country situated within the tropics.	Gallup, Sachs and Mellinger (1999)
ln (ODA^{nonST})	ln ODA^{nonST}	Natural logarithm of the percentage of total donors´ ODA-non-ST commitments over GDP in each period. Constant prices, US dollars, base year 2000.	DAC (2014)
Human capital	*Kh*	Arithmetic average of the number of years of educational attainment among people over 25 years old.	World Bank (2014)
Gini	*Gini*	Geometric average of the Gini index values for each country in each period.	World Bank (2014)
Oil exports	*Expoil*	Percentage of oil exports over total merchandise exports.	World Bank (2014)
Inflation	*Inflation*	Rate of inflation.	World Bank (2014)

Average growth rates are calculated according to the general formula $\left(\sqrt[T-t_0]{y_T / y_{t_0}} - 1\right) \times 100$, where y_{t_0} and y_T are, respectively, the values of the variable at the initial and the last year of each four-year period.

The average of each variable for each country in each period is calculated by means of the geometric average since this is a more suitable location measure when dealing with ratios and indices, and because it is less sensitive to outliers. The exception to this rule are the governance and human capital variables; since they are not expressed as rates, we calculate the corresponding arithmetic averages.

Annexe 3

Figure 5. Descriptive statistics

Variable		Obs.	Average	Standard deviation	Min.	Max.
G	Total	183	1.8287	1.9476	-5.7961	8.5477
	Between	63		1.7671	-2.4056	8.5477
	Within			1.3815	-1.8403	6.2448
$\ln GDPpc0$	Total	183	7.042	1.0819	4.6731	9.2583
	Between	63		1.1069	4.8181	9.1380
	Within			0.0936	6.7943	7.3203
Papers	Total	183	0.5862	0.2655	0.0090	10.9092
	Between	63		0.2648	0.0207	6.9830
	Within			0.1342	-3.3400	4.5124
ODA^{ST}	Total	183	0.1756	0.2655	0.0007	1.9104
	Between	63		0.2648	0.0014	1.0621
	Within			0.1341	-0.7245	1.0758
$\ln ODA^{ST}$	Total	183	-2.8513	1.7027	-7.2456	0.6473
	Between	63		1.7034	-6.7214	0.0312
	Within			0.6142	-5.3897	-1.1395
$ODA^{ST} \cdot papers$	Total	183	0.0445	0.0899	0.0001	0.7814
	Between	63		0.0708	0.0001	0.3863
	Within			0.0491	-0.1983	0.4396
$ODA^{ST} \cdot Governance$	Total	183	-0.0760	0.1950	-2.2434	0.1254
	Between	63		0.1811	-1.1721	0.0377
	Within			0.1217	-1.1473	0.9953
$ODA^{ST} \cdot Voltrade$	Total	183	18.7955	30.4775	0.0952	233.7459
	Between	63		31.6980	0.1628	132.1072
	Within			14.8829	-90.294	127.8849
$ODA^{ST} \cdot Tropical$	Total	183	14.1311	24.4775	0.0000	191.0367
	Between	63		24.8196	0.0000	101.0172
	Within			12.7275	-75.8884	104.1506
ODA^{nonST}	Total	183	5.2930	7.4722	0.0005	52.2513
	Between	63		7.0265	0.0009	29.5311
	Within			2.7611	-17.4271	28.0132
$\ln ODA^{nonST}$	Total	183	0.3368	2.1177	-7.6646	3.9561
	Between	63		2.1641	-7.2067	3.2475
	Within			0.392	-1.2793	2.2076
Governance	Total	183	-0.3143	0.4147	-1.449	0.8243
	Between	63		0.3957	-1.227	0.6725
	Within			0.137	-0.8981	0.4260
Kh	Total	183	1.4314	0.6151	0.1992	4.1162
	Between	63		0.6376	0.2345	3.5581
	Within			0.1658	0.7603	2.6662
Gini	Total	183	45.6722	7.9283	30.1300	61.7800
	Between	63		7.4700	30.6788	58.5138
	Within			2.1440	37.9084	52.5897
Expoil	Total	183	11.6156	21.0033	0.0000	94.5871
	Between	63		22.7763	0.0000	94.5871

	Within			3.8381	-5.0592	36.6309
Inflation	Total	183	11.7956	21.7611	0.3855	254.0078
	Between	63		11.3048	0.6624	68.2105
	Within			17.8202	-51.4828	197.5929