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EDITED BY

Margaret Grogan,
Chapman University, United States

REVIEWED BY

Laura Engel,
George Washington University, United States
Chanwoong Baek,
Graduate Institute of International
and Development Studies, Switzerland

*CORRESPONDENCE

Helen Seitzer
✉ seitzer@uni-bremen.de
Fabian Besche-Truthe
✉ fbesche@uni-bremen.de

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Testing for the money: an analysis on the interdependence of participation in international large-scale assessments and development aid networks

Fabian Besche-Truthe * and Helen Seitzer *

CRC 1342: Global Dynamics of Social Policy, University of Bremen, Bremen, Germany

Introduction: International Large-Scale Assessments (ILSAs) are widely utilized to benchmark to evaluate the quality of education systems globally. Since 2000, the number of participating countries in these assessments has increased dramatically, revealing the dominance of a few education systems while exposing the deficiencies of many others. Especially for the latter group the question, as to why they participate in ILSAs, is puzzling. Existing literature attributes this participation to domestic factors or the influence of International Organizations. However, we argue that the global spread of ILSAs can also be explained by direct country-to-country dependencies through development aid.

Methods: This study takes an interdependency-inspired approach, focusing on how bilateral development aid networks influence ILSA participation. Using advanced network diffusion and hurdle models, we analyse data from a global set of countries over the period from 1990 to 2012. The models examine the role of development aid distribution in shaping ILSA participation, with particular attention to how participation in ILSAs affects the likelihood of attracting additional donors and aid.

Results: Our analysis reveals that the distribution of development aid has a significant impact on countries' decisions to participate in ILSAs. Furthermore, we find that countries already involved in ILSAs are more likely to attract additional donors and aid within established donor-recipient dyads. These results demonstrate a clear connection between development aid distribution and the global spread of ILSAs.

Discussion: This study highlights the role of monetary incentives, facilitated by the distribution of development aid, in promoting participation in ILSAs. Our findings suggest that the rapid spread of ILSAs is not solely driven by domestic factors or international organizations but also by the interdependent relationships formed through aid distribution networks. These insights contribute to a broader understanding of the factors driving global educational assessments and provide implications for policy-making in education and development aid.

KEYWORDS

development aid, International Large-Scale Assessment, comparative education, social networks, institutionalization

1 Introduction

Formalized schooling as an institution is a nation-state's responsibility. However, in a globalized world, the design of this institution is increasingly influenced by a multitude of interest groups, such as Transnational Corporations, International Organizations (IOs), and expert networks. These actors significantly contribute to the transnationalization and diffusion of ideas, norms, and standards (Meyer et al., 1997). Therefore, the global diffusion of educational standards has produced a global isomorphism in education systems and a standard of testing and evidence-based policymaking rooted in international pressure (Besche-Truthe et al., 2024), sometimes even to the detriment of local educational practices (Kamens, 2013). Consequently, adopting global standards in education is regularly seen as a necessary but potentially performative act for countries to prove themselves as participants in a globalized education policy arena (Bromley and Powell, 2012; Gorur, 2016). The rise of International Large-Scale Assessments (ILSAs) like PISA (Programme for International Student Assessment) or TIMSS (Third International Mathematics and Science Study) is one concrete manifestation of this phenomenon. Consequently, non-participation in ILSAs can equally have political and social consequences. Therefore, global ILSA participation rates have been increasing rapidly since the 2000s. Most previous studies on why countries participate in ILSAs have focused on national determinants or what countries gain by participating. For example, countries can gain ideational value through capacity building or data for policymaking (Addey, 2017; Lockheed, 2013) or an increase in the dollar amount received in development aid (Kijima, 2010). To contrast these previous findings, we take an interdependency-inspired approach and ask how the networked patterns of bilateral development aid distribution correspond with ILSA participation. In doing this, we consider the relational character of aid interdependencies between countries and investigate (a) the networks' influence on participation and (b) the participations' influence back on the network. The structure of the paper is as follows: First, we will discuss our theoretical considerations and recent research on ILSAs and development aid. We then explicate the dyadic data and the methods used. Lastly, we present our results and the implications thereof.

1.1 Contextual embedding

With the increasing power of IOs, like the Organization for Economic Development and Co-operation (OECD), education systems are increasingly pressured to implement seemingly efficient market-based management tools. Supranational bodies are a driving force behind the diffusion of educational norms (Robertson and Dale, 2015: 160). This shift in influential actors and mechanisms leaves nation-states increasingly vulnerable to global forces (Niemann and Martens, 2021). Policies of decentralization, choice, privatization, expanded use of market mechanisms, and regular audit assessments are becoming standard. The evolution of new public management treats public education as a bureaucratic organization, subjecting it to the imperatives of efficiency, calculability, predictability, control, and ruled by numbers and

league tables (Meyer and Benavot, 2013). Consequently, education reforms and restructurings are sold as necessary to allow countries to follow the path of a Knowledge Society and fit their workforce into a globalized labor market (see, for example, the PISA advertising flyer: OECD, 2020)¹.

Therefore, participation in ILSAs is one of the long lines of transnational norms and standards in education that have been accepted globally. Not only compulsory schooling but also the structure of schooling itself has been adopted to the global standard, along with the notion of formalized schooling as a human right (Meyer et al., 1997). World polity theory states that this format of schooling originated in Western countries. Accordingly, most ILSAs were developed in and for the Global North, often with a Eurocentric and neoliberal perspective on education (e.g., Welsh, 2020). The diffusion of the corresponding standards has led to a focus on STEM-related subjects, ultimately focusing national curricula on these subjects and potentially diminishing the importance of local educational standards and practices (Bishop, 1990; Breakspear, 2014; Sjöberg, 2019). The constant comparisons, rankings, recommendations, and naming and shaming through ILSAs allow an increased rate of policy learning or emulation. At the same time, the included power dynamic and concrete mechanism are often unknown (Blatter et al., 2022).

The advent of benchmarking tools like ILSAs also sparks an accelerating spread of fast education policymaking and is, thus, intertwined with more extensive discussions on inefficient changes in education systems (Lewis and Hogan, 2019). Several studies show that even though the timing of the release of the results of ILSA often coincides with new reforms, the content of the reforms and the outcome of the assessments do not always correspond (Niemann et al., 2017). Instead, policy borrowing, standardization, and participation in ILSAs can also be interpreted as a symbolic integration into a larger system, allowing countries to reap other benefits besides an improved education system (Schriewer, 2012).

1.2 ILSA participation

Over the past 30 years, a substantial number of new national, regional, and global educational assessments were initiated (see Table 1). The practice of testing students and comparing countries' student achievement started in high-income countries in the 1960s with a pilot study in 12 developed countries (Lockheed, 2013). It has since spread around the globe to middle and low-income countries as well. While most countries today participate in pre-established ILSAs, additional regional assessments for low-income countries are being developed (Addey et al., 2017). In 1995, as many as 46 countries participated in TIMSS. The number of ILSA participants has more than doubled to 116 in a total of eight different international large-scale studies from 2014 to 2018 (see Table 1).

International Large-Scale Assessments participation has a variety of rationales. De Boer (2010), for example, argues that countries operating on a rational choice model utilize these studies to inform decision-making, primarily focusing on maintaining a country's reputation among nations viewed as competitors.

¹ <https://www.oecd.org/pisa/pisaproducts/37474503.pdf>

TABLE 1 International Large Scale Assessments overview.

Name	First study	Organizer	Geographic coverage	Subjects
PASEC - Programme d'Analyse des Systèmes Educatifs de la CONFEMEN	1993	CONFEMEN - La Conférence des Ministres de l'Éducation des pays ayant le français en partage	Francophone West Africa	Math, reading
TIMSS - Trends in International Mathematics and Science Study	1995	IEA - International Association for the Evaluation of Educational Achievement	Worldwide	Math, science
ERCE – Estudio Regional Comparativo y Explicativo	1997	LLECE - Latin American Laboratory for Assessment of the Quality of Education	Latin America and Caribbean	Reading, writing, math, science
SACMEQ - Southern and Eastern Africa Consortium for Monitoring Educational Quality	1999	SEACMEQ - The Southern and Eastern Africa Consortium for Monitoring Educational Quality	Anglophone East Africa	Math, reading
PISA - Programme for International Student Assessment	2000	OECD - Organization for Economic Co-operation and Development	Worldwide	Math, reading, science
PIRLS - Progress in International Reading Literacy Study	2001	IEA - International Association for the Evaluation of Educational Achievement	Worldwide	Reading
PILNA – Pacific Island Literacy and Numeracy Assessment	2012	Pacific Community – Educational Quality and Assessment Programme	Pacific Islands	Math, reading, writing
PISA for Development	2014	OECD - Organization for Economic Co-operation and Development	Low and middle-income countries	Math, reading, science

Policy diffusion is often inspired by the desire to identify effective education policies and the subsequent promotion of transfer or emulation of specific practices. A macro-dissatisfaction perspective allows for redirecting public attention due to scandalization and a perceived crisis. Therefore, for policymakers, ILSAs offer an opportunity to, on the one side, scandalize the state of education (Steiner-Khamsi and Waldow, 2018), pushing for further education reform (Verger et al., 2019) and on the other side, cherry-pick results (Guadalupe, 2024), which can be used to justify specific reforms, regardless of local needs and ILSA results. Other studies (Lockheed and Wagemaker, 2013) point out that ILSAs are being used to motivate countries to comply with global educational standards, improve education systems through naming and shaming, and evaluate the effectiveness of national systems (Niemann and Martens, 2018). Another study (Addey, 2017) further argues that ILSAs serve multiple purposes, and this flexibility has contributed to their rapid growth. Benefits include evidence for policymaking and institutional capacity building for further (possibly national) assessments. Regional assessments, for example, SACMEQ, aim to support national capacity building through technical and statistical training of national staff to provide countries with the know-how to establish their own national large-scale assessments (Addey, 2017). Further, numbers as a product of ILSAs are viewed as a credible source of data, leading to the transnational accreditation of public education, especially as the detachment of numbers from the local context allows the rewriting of a narrative benefitting political goals (Liu and Steiner-Khamsi, 2022). Lockheed (2015) further focuses on globalness, the capacity-building effects, and the role of economists in creating a demand for information on education systems. Therefore, countries benefit from ILSAs for policy evaluation and capacity building and utilize the studies regardless of results as a signaling tool toward other

countries, attracting financing, proving as a modern, competitive country, and facilitating policy emulation and learning (Lopo et al., 2024). However, Riddell and Niño-Zarazúa (2016) showed that national bureaus of low-income countries are often unequipped to deal with the data produced by ILSAs. This can explain why ILSA results are frequently not used to their full potential. In addition, the cost of participating in the larger ILSAs, such as PISA, often supersedes national financial tolerance, requiring additional support, as countries pay around 210,000€ over 3 years as base cost alone, with an additional 170,000€ for capacity building and implementation or 250,000€ for analysis and reporting for the 2025 cycle of PISA². And while participation in ILSAs is not a requirement for IO members, it might be a “hidden requirement” for countries aiming to join organizations.

Another benefit Addey et al. (2017) discussed is the potential to attract development aid donors, a finding especially relevant to this study. They assert that, despite aid not being the sole driver for ILSA participation, it influences ILSA participation in several ways: donors might require data to demonstrate progress in the targets aimed at; participation can, in turn, signal commitment to accountability and transparency in the use of donations; ILSA data might also be used to decide on the allocation of funds.

The consequences of bad ILSA results and comparative ratings might have detrimental effects on countries' reputations in the eyes of their citizens and other countries (Martens and Niemann, 2013). However, not participating altogether might have similarly damaging effects, as it portrays a country as unwilling to improve its education systems. For example, the World Bank's Human Capital

² <https://www.oecd.org/en/about/programmes/pisa/how-to-join-pisa.html> accessed 05.03.2025, 16:02

Index has been revealed to penalize non-participation (Liu and Steiner-Khamsi, 2020). Thus, participation in ILSAs is not just about education but also adherence to global norms (Kamens, 2013). In this paper, we argue that compliance with these norms, in this case, participation in ILSAs, may be additionally enforced through material power, for example, through the provision of development aid. Therefore, benefits for countries could include increased interaction and connectedness within the global market (Robertson and Dale, 2015) or the attraction of development aid donations (Addey and Sellar, 2018). Thus, education system development and evaluation through international testing has various mixed national effects but can also be interpreted as enabling and stabilizing interactions between countries, an assumption on which we build our analysis.

1.3 ILSAs and development aid

Development aid is an economic and normative interaction through conditions on donations, tying a giving country (donor) and a receiving one (recipient) together. Previous research shows that the distribution of development aid is influenced by factors such as the recipient's needs and/or donor's interests, i.e., economic considerations or a shared colonial past. Additionally, so-called targeted distribution, aid distribution based on political and strategic decision-making, can be observed (Alesina and Dollar, 2000; Bermeo, 2017). As early as 1962, Morgenthau had argued that foreign aid usually serves at least some political function: "The transfer of money and services from one government to another performs here the function of a price paid for political services rendered or to be rendered" (Morgenthau, 1962: 302). The offer of assistance and grants poses a big challenge for middle and low-income countries. It is almost impossible to reject the offer of aid. Yet, accepting a donation means also accepting its conditions. On the other hand, in anticipation of conditions, countries might implement laws to attract more foreign and financial investment to improve social conditions and educational opportunities (Rizvi and Lingard, 2010).

With this mechanism in mind, we argue that participation in ILSAs can be fostered through development aid. While countries, as recipients of development aid, demonstrate their willingness to adapt to standards by accepting the terms of donations, donors increase their level of influence through regulation of use. Thus, we suggest that although ILSA participation is not an official condition of bilateral aid, both still correspond.

The most frequent approaches to allocating and disbursing development aid distinguish donor interests and recipient needs (McGillivray, 2003). Analyses of development aid distribution, thus, rely on two different assumptions. On the one hand, recipient-oriented explanations assume that donors' development aid distribution follows humanitarian motives and is solely oriented on the recipient country's needs. In contrast, aid distribution can be – at least in large parts – based on the donor country's commercial, political, and strategic interests. We presume the latter explanation to be relevant to our study. After all, project-based bilateral donations are usually tied to conditions. Past research confirms that forming and maintaining political and economic alliances are among the main reasons for development

aid donations. Former colonies, for example, receive a significantly higher amount of donations from their former occupiers than other countries (Alesina and Dollar, 2000; Kijima, 2010; Shields and Menashy, 2019). Peacekeeping, democratization, and imports from the recipient also affect donation patterns. Taking this approach to the extreme, Bermeo (2017) stipulates that aid distribution is solely oriented on donor interests, ignoring the recipient's capacity to utilize the donation effectively.

These approaches assume a relative inability of potential recipients to attract development aid intentionally. The distribution of aid is thus considered to be influenced by donor motives rather than recipient action. We, however, consider ILSA participation as a potential behavior recipients adopt to attract more development aid. Thus, we view participation in ILSAs to be, in part, a signal intended to attract donations. Connecting participation in ILSAs with development aid distribution, Kijima (2010) first studied the positive impact of ILSA participation on the dollar amount donated. Kijima demonstrates that countries participating in ILSAs receive more development aid from bilateral agencies than those who do not. Countries' development agencies and ministries face internal responsibility to account for the effectiveness of money sent abroad. However, a thorough analysis of aid impact and outcomes is expensive and difficult to administer (Chapman and Quijada, 2009). Providing a tool for evaluating the effective use of these donations might give an advantage in the quest for development aid. Therefore, one goal for low-income countries could be to adopt or improve their own national assessments, implement monitoring and auditing for accountability purposes, and place the results on a common, international scale (Lockheed, 2013).

Since some multilateral donors are tying donations to participation in ILSAs, we want to establish if this expectation is also implicitly true for bilateral donors. Hence, we seek to evaluate the state of bilateral development aid commitments before countries participate in the ILSA. Is ILSA participation a political service to be rendered?

Most key bilateral agencies – in particular, OECD member states – "are strong proponents of international assessments and want more countries to participate in them" (Kijima, 2010: 55). Accordingly, Lockheed (2013) emphasizes the pressure from multilateral donors such as the World Bank to participate in these studies as a means to test educational effectiveness. She also notes the difference in countries' motivation to participate. While high-income countries are motivated by their interest in improving the quality of their educational systems, low-income countries are more often encouraged by others to participate in ILSAs.

Despite the designation of only a few aid streams specifically targeted at participation in ILSAs, previous studies have successfully linked development aid distribution to participation in these studies (Addey and Sellar, 2018; Addey et al., 2017; Kijima, 2010; Lockheed et al., 2015). However, these studies primarily demonstrate the involvement of multilateral development funds, which is aid administered by IOs and other transnational actors. The effect of ILSA participation on the network of bilateral aid distribution and vice versa remains unclear. In this case, bilateral assistance encompasses state-to-state development aid targeted at education. These funds can establish unique interdependencies defined by stark power imbalances and possibilities of coercive influence streams. Thus, we gauge the dyadic data structure for

our analyses and use methodologies accounting for the networked nature of nation-state interdependencies through development aid.

Furthermore, while Kijima (2010) focused solely on the dollar amount of development aid per youth, we are asking whether a tie between countries – formed through aid commitment – has a more specific effect. We investigate if ILSA participation itself potentially influences new relations between nations, i.e., an ILSA participant becoming a recipient of a more extensive array of donor countries. This relational approach adds to the understanding of the real impact of ILSA participation not only in terms of purely financial incentives but also aid activity and attractiveness. The methods and predictors used in our paper are inspired by Shields and Menashy's (2019) study on the overall changing distribution of development aid to education. Using a relational network approach, they found especially strong effects for imports and exports, the importance of donor and recipient to each other, and colonial ties. Adding to their findings, however, we highlight the impact of ILSA participation on the development aid distribution network and the donor-recipient network's impact on participation in ILSAs. Thus, we are adding empirical analyses to the existing research. On the one hand, our research takes a relational approach to the causes of ILSA participation. On the other hand, it includes ILSA participation as a possibly influential variable in building the education aid network.

This paper will explore if and how bilateral development aid distribution patterns correspond with ILSA participation. We are specifically interested to see whether the network of countries built through donations impacts their susceptibility to participate in ILSAs. Reversing the causal direction, we also test for changes in the development aid networks after participation in ILSAs.

2 The expected influence of development aid on ILSA participation and vice versa

In line with the relational approach taken, our hypotheses focus on interdependencies built between countries via development aid to education. We distinguish the *donor* from the *donation* level: The donor level includes the number of distinct donors, irrespective of the number of donations each donor makes to a single recipient. Due to the project orientation of development aid, donors often donate to several distinct projects to the same recipient. Hence, the donation level focuses on the number of donations a country receives, irrespective of the number of donors distributing them.

In our first set of hypotheses, the donors induce the recipients' behavior through donation. In the second set, the recipients attract donations through preceding behavior. First, we assume that the number of countries donating aid to education in one specific country induces the recipient's first participation in an ILSA. We argue that this might be especially true when donor countries are already participating in an ILSA. Incentivizing countries to participate in ILSAs can serve as a way of spreading neoliberal policy-making rationales, i.e., actively producing institutional change (Lewis and Hogan, 2019). Thus, enhanced ILSA participation can successfully meet the rising demand for information on education systems (see, e.g., Lockheed, 2015, 2013). The more donors need to evaluate the effective use of their donations, the higher the pressure for the receiving country to

implement an evaluation system to meet those needs (Kamens and McNeely, 2010). Turning to the donation level, we hypothesize that the more donations one country gets, irrespective of (but correlated to) the number of distinct donors, the more likely the recipient will adopt ILSA participation.

H1a: A higher number of distinct donors has a positive effect on the first participation of the recipient in any ILSA.

H1b: A higher number of donors participating in ILSAs (exposure) has a positive effect on the first participation of the recipient in any ILSA.

H1c: A higher number of distinct donations has a positive effect on the first participation of the recipient in any ILSA.

In our second set of hypotheses, we turn to the effects of participation on donation behavior. We suspect that previous participation in ILSAs raises the probability of gaining funds through development aid (see Kijima, 2010). Participation demonstrates a commitment to accountability (see Addey et al., 2017). The monitoring process becomes transparent and predictable, and evaluations and results can be expected after every new assessment cycle. This makes the conditions for aid to education easier because evaluation tools are already implemented (Kamens and McNeely, 2010). Again, this is extended to the donation level, where we suspect the participation in ILSAs to increase the probability of having more donations within an already established donor-recipient relationship.

H2a: The participation in any ILSA by a recipient positively affects the number of donors from which this country receives donations.

H2b: The participation in any ILSA by a recipient positively affects the number of donations this country receives from each donor it receives.

3 Data and methods

Our data includes dyadic data describing the relationship between donor and recipient, such as the number of donations, number of shared IO memberships, shared colonial past, or Export and Import percentages. We also include recipient- and donor-level indicators such as recipient GDP, index of democracy, and ILSA participation.

3.1 The aid network

We draw dyadic network data for aid distribution from the 2016 AidData Core Research Release version 3.1 dataset (Tierney

et al., 2011). This dataset provides the most comprehensive project-level data for tracking international development finance because it combines ODA, OOF flows, Equity Investments, and Export Credits where available. It depicts annual dyadic data on development aid commitments: the donor, recipient, information on the development project (category, title, descriptions, etc.), and the donation amount in United States Dollars. In the first step, we filtered for bilateral development aid targeted at education; other development aid streams were not considered. Interestingly, no bilateral donation was intended for ILSA participation. Similar findings are reported by Kijima (2010). The dataset spans a time frame from 1990 until 2018. Most other studies on development aid use datasets such as the OECD's DAC³, which strictly separate donor and recipient countries. In those datasets, recipient countries are defined by their status as developing countries (see McGillivray, 2003).

In contrast, we consider as possible recipients/donors those countries who received/donated at least once during the respective time frame (see, for example, McGillivray, 2003). Consequently, 25 countries are considered donors, 151 countries are considered recipients, and 21 are considered both donors and recipients. The United States has been excluded from the recipient sample, as they only received four scholarship donations in 2007 from Qatar. In the last step, we expand the dataset by modeling all possible donor-recipient pairings. Through this modeling technique, many ties have the value of zero because no aid was exchanged between these countries. The data is organized as directed dyad-years, i.e., each donor country could potentially donate to every recipient country yearly (country - country - year).

Additionally, we are dealing with a particular network structure: Donors hardly ever appear on the receiving side, and only 21 countries do so. Thus, even though there could be reciprocity in tie formation, we assume that recipients have relatively little agency when establishing a donation link. Recipients can only become more attractive to potential donors by changing behavior, which we suspect might be participation in ILSAs.

3.2 ILSAs

Table 1 shows the ILSAs that were included in our data as participation. Those ILSAs were specifically chosen because they are highly standardized assessments conducted in different states with the distinct motivation to compare countries with the same standardized metric. We coded countries' participation according to the assessments' websites and final reports. In the analysis, we do not distinguish between these assessments.

Considering that participation in an ILSA begins long before the actual commencement and publication of the study, we suspect that the decision to participate in one is made roughly 3 years before the assessment. We base this on the timeline the PISA study follows (OECD, 2020:14) and, therefore, consider that participation starts 3 years before the commencement of the study. The [Supplementary materials](#) contains models with different time lags to prove the results' robustness.

³ <https://www.oecd.org/dac/financing-sustainable-development/development-finance-data/>

3.3 Predictors

We selected additional predictors and control variables based on Shields and Menashy's (2019) and Kijima's (2010) previous analyses. We believe that the developmental status of a country can determine whether it participates in ILSAs and receives development aid. Hence, we include the GDP per Capita to control for domestic economic development (World Bank, 2019a). Furthermore, by including a democracy index, we operationalize the political development and openness to transparency tools like ILSAs (Lührmann et al., 2018). With the Gross Enrolment Rate of primary and secondary schools combined, we model the status and effectiveness of the domestic education system at large (Unesco Institute for Statistics, 2019). Since we are dealing with different and sometimes regional ILSAs, World Regions (World Bank, 2019b) are included as fixed effects to mitigate potential omitted variable bias. We try to minimize the risk of overestimating the general dependence on development aid to education by including the proportion of total aid received on the GDP of the receiving country (World Bank, 2019b). As a proxy for influences of economic globalization and dependence on economic relations, in the first estimation, we include the Foreign Trade Quota (World Bank, 2019c).

Furthermore, we add membership data in International Organizations (IO) to control for the thesis that countries' embeddedness in the *World Society* corresponds strongly to both ILSA participation (Meyer et al., 1997) and the receiving of development aid (see Shields and Menashy, 2019; and Kijima, 2010). However, we restrict the sample of these IOs to those "populating the organizational field of international education policy" (Niemann and Martens, 2021: 167). Hence, the variable depicts the sum of a country's membership in specific IOs which (a) mention education as a designated task, (b) have their own permanent organizational component dealing with education issues, and (c) address specifically education policy issues (Niemann and Martens, 2021: 167). We differ here from the studies by Shields and Menashy (2019) and Kijima (2010) because we believe that an operationalization that is more focused on education policy gives greater accuracy in estimation. The data for the 29 organizations has been collected from the Correlates of War IGO dataset (Pevehouse et al., 2019) and the respective organizations' websites⁴.

Since our estimation techniques hinge on network connections, we include variables controlling for the relationship in a dyad. Thus, a more accurate variable depicting economic interdependencies is represented by the exports and imports between the two countries (Barbieri and Keshk, 2016). Following Shields and Menashy (2019), we include a binary variable representing a possible colonial relationship between the two countries (Hensel, 2018). Additionally, we include a variable that measures the weighted shared membership in the education IOs mentioned above. [Supplementary Table 1](#) summarizes all used variables.

⁴ The organizations considered are: ABEGS, AfDB, ALECSO, APEC, ASEF, ADB, ASEAN, AU, CARICOM, CBSS, Commonwealth, ECCAS, EFTA, EU, IABE, IADB, IBRD, ICESCO, IFESCCO, ILO, Mercosur, OAS, OECD, OECS, SAARC, SEAMEO, UN, UNASUR, and UNESCO.

Lastly, the main predictor in our first model is the so-called *indegree*, which is the total number of donors a country has per year (donor level) or the total number of donations a country receives per year (donation level). Additionally, we include the exposure to donors that have already participated in an ILSA by estimating the weighted ratio of connected countries that had adopted and those that did not (Valente, 1995: 43).

In the second set of estimations, the dependent variable is the formation of a donor-recipient relationship and, subsequently, the number of donations between these two. Participation in ILSAs is the main predictor. To account for possible recency biases of participation and aid distribution, we include dummy variables to represent ILSA participation 1, 2, or 3 years before a potential donation.

We utilized the software R (R Core Team, 2019) and the package *netdiffuseR* (Vega Yon and Valente, 2023) to calculate indegree and exposure and the *glmmTMB* framework for the second set of analyses (Brooks et al., 2017).

4 Results

4.1 Development aid's impact on ILSA participation

Processes of social diffusion, e.g., the spread of innovation in a community, often follow a logistic growth function. This is represented by the classic S-shaped curve of cumulative adoptions, in that a small number of the population adopt the trait early, and the number of adopters increases significantly until a saturation point. Figure 1 shows this development for the first participation in an ILSA. After an initial spike through the PISA study, the total number of countries that participated at least once in an ILSA rises continuously, with a differing number of countries joining the ranks of the adopters. This adoption resembles the mentioned S curve.

Initially, all countries are at risk⁵ of participating in an ILSA. In our first set of hypotheses, we are interested in the differences in time until the moment of participation. Consequently, we apply an event history model to analyze the influence of domestic and relational variances on the duration until the country participates in an ILSA (Windzio, 2013). In these models (Equation 1), the dependent variable is defined as the probability P that the event at time T occurs within a particular interval between t and $t + \Delta t$, given that the event has not yet occurred at t , that is, T is greater than or equal to t .

$$r(t) = P(t \leq T < t + \Delta t | T \geq t) = \frac{P(t \leq T < t + \Delta t)}{P(T \geq t)}$$

In this paper, we can estimate the event history model by using the binary outcome variable of countries that either participated in an ILSA (= 1) or have not participated yet (= 0). Consequently,

we can predict the hazard rate $r(t)$ using a logit regression (Singer and Willett, 2003). Thus, we can estimate the effects of indegree, exposure, and our control variables β_x . To control for time-dependency, i.e., unobserved heterogeneity, we include time dummies α of 3 years, representing newly beginning ILSA cycles and functioning to determine the baseline hazard, comparable to the regression constant (Windzio, 2013).

$$r(t) = 1 / (1 + \exp(1 - (\alpha_1 t_1 + \dots + \alpha_j t_j + \beta_1 \text{exposure} + \beta_2 \text{indegree} + \dots + \beta'_x)))$$

Table 2 presents the estimations in hazard ratios for both levels. These are interpretable analogous to odds ratios, i.e., a positive relationship is signified by ratios larger than 1, and a negative relationship by estimations between 0 and 1. All independent variables have been scaled by subtracting the mean and dividing by the standard deviation. Thus, the coefficients represent the change in the hazard rate for a change of one *standard deviation* in the independent variable. We did this to standardize across the various variables scales and increase comparability.

In both models, exposure to a donor already participating in an ILSA significantly increases the risk of the receiving country participating in an ILSA for the first time. However, almost all donors participated quite early in an ILSA. Thus, this result was anticipated. Still, it is worth noting that this pattern evolved over time; not every donor had participated in ILSAs in the early years of our study. More importantly, indegree on the donation level has a positive, significant influence. Thus, more education aid donations are associated with an increased risk of participating in an ILSA for the first time.

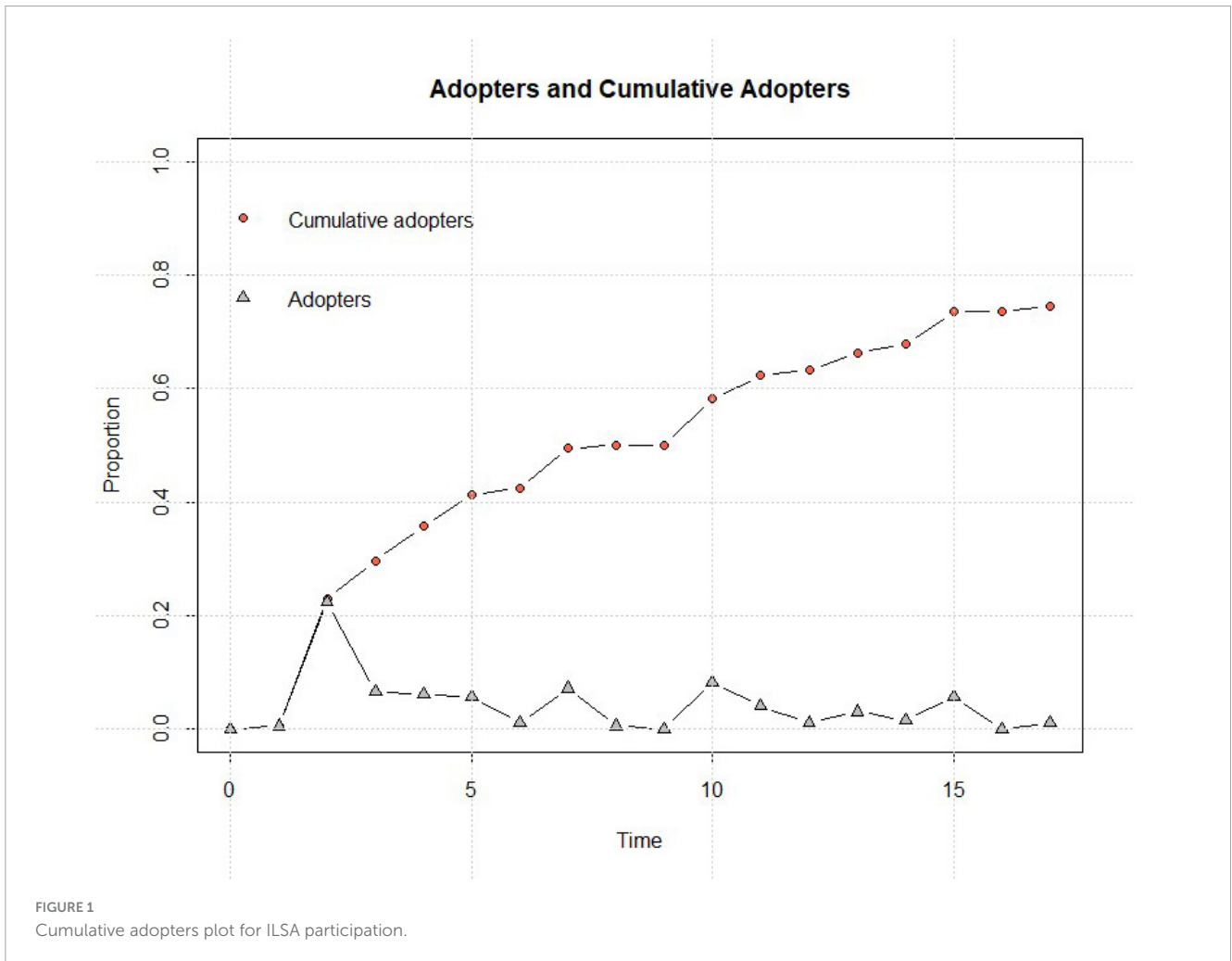
Economic development seems to have a small significant influence; however, while the coefficient for GDP per Capita has a positive sign, the one for Foreign Trade Quota is negative. The latter might be attributed to high quotas in smaller (island) states that do not yet participate in ILSAs. A one standard deviation increase in the Democracy Index is associated with an increase in risk by a factor of 1.64 or 1.69, respectively. When controlling for all these variables, the Gross Enrolment Rate has no significant impact across the levels. Considering the embeddedness in world society, we can deduce that the higher the amount of IO membership, the higher the associated risk of participation in ILSAs is. All in all, we observe an inherent network effect at play. The total amount of aid – normalized by the GDP of the receiving country – has no significant effect in our estimates.

In conclusion, a higher number of donors does not directly lead to a higher risk of taking part in an ILSA the first time; thus, we repeal hypothesis H1a. However, the estimation suggests that the risk for the receiving country increases when donating countries participate in an ILSA. Likewise, we conclude that the more donations a country receives, the higher the risk of adopting ILSA participation. Hence, we can confirm both hypotheses H1b and H1c.

To make an even stronger case, we ran additional regression estimates using a logit estimation on every participation in an ILSA over time. Supplementary Tables 2, 3 show the outcomes of these estimations⁶. The empirical evidence aligns with our hypotheses

⁵ The term "risk" might convey negative connotation, but please note that in the case of event history analysis "risk" is interpreted as the probability for a subject experiencing an event. Nevertheless, the term "risk" is used throughout this paper to stay true to the methodological concepts used (see also Windzio, 2013).

⁶ Also, we tested the inclusion of an exposure variable measuring the percentage of neighboring countries that had adopted an ILSA. This



and the estimations on first participation in ILSAs. In sum, indegree has a consistently positive and most often significant coefficient. However, as with the results of the event history model, we see this effect most vital and more accentuated when considering the number of single donations rather than the number of distinct donor countries. The effects of GDP per Capita and democracy score are corroborated as well. Thus, the more economically advanced and the more democratic a country is, the higher the odds of participating in an ILSA.

4.2 ILSA participation’s impact on development aid distribution

Hypotheses H2a and H2b suppose that participation in an ILSA is followed by an increase in distinct donors and an increase in distinct donations between an established donor-recipient pair (additional projects funded compared to previous years without ILSA participation). As explained in the general section, the data consists of the aid network organized in a directed dyad-year format. If country A does not send development aid to country

B, the tie is coded with 0. However, if there are donations from A to B, then the dataset entry will depict the number of donations within that dyad. The dependent variable is thus the probability of donations in a specific *dyad*. In concordance with previous analyses concerning development aid (e.g., Shields and Menashy, 2019; Berthélemy and Ariane, 2004), we utilize a cross-classified mixed-effects regression and allow a random intercept for donors and recipients to account for the non-independence of observations. The model can be formalized as:

$$y_{ijt} = \beta_0 + \beta_x X_{1ijt} + \beta_2 X_{2jt} + \mu_i + \mu_j + \varepsilon_{ijt}$$

Where y_{ijt} denotes the number of development aid donations from donor i to recipient j in year t , β_0 denotes the overall intercept, X_{1ijt} denotes a dyadic independent variable X_1 explicating the relationship between donor i and recipient j at time t and its relationship to the dependent variable y , such as shared IO membership or colonial relations. X_{2jt} denote (in our case) recipient-specific independent variables, such as GDP per Capita or the ILSA participation of the recipient. The random effects μ_i and μ_j are grouped residuals while ε_{ijt} denotes the dyad-specific error term. This modeling procedure is standard for dyadic data and is further discussed in Kenny et al. (2006), Pinheiro and Bates (2000).

Due to the empirical distribution of development aid, the data is heavily zero-inflated: most observations (country - country -

inclusion did not substantially change the effects of either of the two main explaining variables, both in size and significance value.

TABLE 2 Logistic hazard regression results (coefficients depict hazard ratios).

	Donor level (1)	Donation level (2)
Time interval 1	0.22***	0.25***
Time interval 2	0.18***	0.21***
Time interval 3	0.08***	0.08***
Time interval 4	0.15***	0.13***
Time interval 5	0.09***	0.07***
Time interval 6	0.04***	0.01***
Exposure (indegree)	2.60***	2.49***
Indegree	0.97	1.50***
Proportion of donation on GDP	1.08	1.08
Enrollment rate (log)	1.10	1.09
Foreign trade quota (log)	0.79*	0.82
GDP per capita (log)	1.52**	1.54**
Democracy index	1.64***	1.69***
Education IGO membership (count)	1.37**	1.36*
Region: Europe	Ref.	Ref.
Region: East Asia and Pacific	0.41**	0.37**
Region: Latin America and Caribbean	0.29***	0.29***
Region: Middle East and North Africa	0.67	0.72
Region: North America	0.56	0.57
Region: South Asia	0.04***	0.03***
Region: Sub-Saharan Africa	0.62	0.62
McFadden's pseudo R	0.14	0.15
N countries	154	154
Observations	1,035	1,035
Log likelihood	-297.39	-295.40
Akaike Inf. Crit.	634.77	630.79

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

year) share no aid and are thus coded as 0. Only 10% of all possible country-country-year combinations include one or more donations. Therefore, the analysis needs to account for the inflation of zeros. We do this by first predicting whether a donation was made between countries. Secondly, we predict the number of donations between these dyadic pairs per year. Those range from 0 to 349 donations, and 90% of possible observations show that zero donations have been made. [Supplementary Figure 1](#) shows the distribution graphically.

The dependent variable, i.e., development aid donations between two countries, is a count variable that counts the number of possible and actual donations for each recipient. We estimate a *hurdle model*, which is a special case of zero-inflation models. Hurdle models are two-component models and combine a truncated count component for the positive counts (in our

case, the number of donations between an established donor-recipient pair) and a right-censored hurdle component which models zero vs. larger counts (in our case, the existence of a development aid relation in the first place). The model includes a zero-truncated negative binomial distribution with a log link function ([Brooks et al., 2017](#)). We chose this model based on theoretical considerations: The included independent variables only affect the probability of getting no donations. Due to the origin of zeros in the data, i.e., getting no donations, and the distinct variables contributing to each of the equations, other zero-inflation (i.e., Tobit) or a sample selection models (Heckman) would not be appropriate (for further explanations, see [Zeileis et al., 2008](#)).

The hurdle models' output is twofold: A count component predicts the aspects affecting the number of donations per donor-recipient pair and year under the condition that this pair had donations that year. The hurdle component models the excess zeros with a logit model, predicting the probability of receiving a donation in the first place. We do not control for the dollar amount of donation since we assume an effect on the probability of newly built relations rather than an increase in dollars donated.

For the final model interpretation, the model below ([Table 3](#)) shows the untransformed coefficients of the mixed model and thus represents the log odds of the outcome. Donor exports to the recipient, donor imports from the recipient, recipient enrollment, recipient GDP per Capita, and the proportion of donations on recipient GDP have been scaled. The coefficients in the conditional model represent the change in the log odds of receiving one more donation within an established dyad. The coefficients in the zero-inflation model represent the change in the log odds of receiving any aid from the observed donor.

A first look at the two components of the model indicates a fair amount of difference in the effect of the considered factors on either the existence or the number of donations in a dyad. The existence of a colonial relationship results in a significant and positive effect in the conditional (count) model and a negative effect in the zero-inflation model. That means that, in our model, former colonies have, on average, smaller log odds of receiving donations from their former colonizers. However, if they do receive any aid to education from former colonizers, they tend to receive more donations than non-colonies. Thus, while in previous research, colonies tend to receive more aid donations, the odds of building an aid relationship in our model are smaller. Perhaps only countries gaining independence quite recently receive donations from former colonizers.

Enrollment rate and GDP per Capita show a very small effect which corroborates the findings of [Shields and Menashy \(2019\)](#). Furthermore, it supports the idea of targeted aid distribution: donors do not always target those countries most in need or most influential to implement donation funds but choose strategically out of other interests. Our estimation supports this with the positive and significant coefficient of donor import from the recipient in the zero-inflation model: donors are more likely to donate to countries from where they import large amounts of goods. However, the number of donations declines with rising donor imports. We can surmise that additional projects are less likely to be implemented once an aid to education relationship has been established. As we have not included the dollar amount in our analysis, this aspect should be included in further research. If the overall sum of the donations of one specific donor makes out a larger proportion of

TABLE 3 Hurdle model regression results.

		Conditional (count) model		Zero-inflation model			
Fixed effects							
(Intercept)		-2.7869***		9.752***			
Donor exports (log)		-0.4794		-6.4255*			
Donor imports (log)		-23.995***		7.9152**			
Colony		1.3442***		-1.3905***			
Enrollment		0.0075***		-0.0031			
GDP per Capita (log)		0.0000		0.0001***			
Proportion of donation on recipients GDP (log)		0.2442***					
Regime		0.0015		0.0293*			
Time		0.0266*		-0.1414***			
Time^2		0.0021***					
Shared IOs		0.2542***		-0.5259***			
ILSA participation		0.136***		-0.0434			
ILSA participation lag 1		0.0325		0.0323			
ILSA participation lag 2		0.0778		0.0142			
ILSA participation lag 3		-0.0257		-0.0546			
Random effects							
Groups	Estimate	Variance	Std. dev.	Groups	Estimate	Variance	Std. dev.
Recipient	Intercept	0.463	0.681	Recipient	Intercept	1.41	1.19
Donor	Intercept	0.909	0.949	Donor	Intercept	20.47	4.52
N. obs.		123,364		Recipients	141	Donors	46
Cox and Snells Pseudo R^2		0.32		-	-	-	-
Dispersion param.		0.6115		-	-	-	-
Akaike Inf. Crit		99,569		-	-	-	-
Bayesian Inf. Crit		99,889		-			

*p < 0.1; **p < 0.05; ***p < 0.01.

the recipient’s GDP, the odds of an additional donation are also greater. While shared membership in education IOs is associated with an increase in the odds of additional donations, they are associated with a decrease in the odds of donations from additional donors in the first place, as can be seen in the zero-inflation part of the model. This indicates that once a connection between donor and recipient is made, shared IO membership seems to positively impact the number of donations a recipient receives from the respective donor.

International Large-Scale Assessments participation only shows significant and positive coefficients in the conditional model for the year of participation. This indicates that ILSA participants have higher log odds of attracting additional donations for the year of participation (H2b) than countries that do not participate in ILSAs. In contrast, participation does not alter the odds of attracting additional donors. This finding also holds for times after participation. The results contradict our hypothesis H2a. The recipient’s participation in an ILSA only increases the odds of donations in already established donor-recipient pairs for the year of participation. Overall, this model shows that the hurdle of establishing an aid relationship between donor and recipient

seems to be greater than increasing the number of donations, as can be seen in the number of negative coefficients in the zero-inflation part of the model and the number of positive coefficients in the conditional model (shared IO membership, colonial ties, donor export).

5 Conclusion

In this paper, we tested the effects of development aid to education on the first participation in an International Large-Scale Assessment (ILSA) and the effects of participation on the distribution of aid to education. We hypothesized that the more donors a country has, the higher the risk of participating in ILSAs (H1a). In addition, we expected an exposure effect: If donors already participated in ILSAs, the pressure on receiving countries also to participate increased (H1b). This also included a positive effect on the total number of donations with the risk of ILSA participation (H1c).

To sum up the first set of our analyses, we showed that the specific composition of the aid network to education is significantly

associated with the risk of countries participating in ILSAs for the first time. Increased *exposure* to donors who themselves have participated in an ILSA raises the risk of taking part in an ILSA for the first time (H1b). Additionally, the more *donations* a country receives, the higher the risk of participation in ILSAs (H1c). Even though the effects are moderately small, we find consistent, compelling statistical evidence. Interestingly, the world region of the recipient plays a significant mediating role in this scenario – the number of donors and ILSA-participating donors have different effects on countries in different world regions. This result indicates that participation in ILSAs is partly linked to strategic decision-making.

The second set of analyses yielded mixed results regarding our hypotheses: Participation in ILSAs is not associated with the odds of attracting additional donors (H2a); however, ILSA participation is positively associated with the odds of an increase in the number of donations (H2b), i.e., ILSA participants seem to get more projects funded than non-participants. Despite their small effect size, the results indicate that the distribution of development aid might not be uniquely dependent on the dyads' relationship but also on the recipients' qualities, such as willingness to participate in ILSAs. These results further confirm what previous research (Kijima, 2010; Addey et al., 2017; Liu and Steiner-Khamsi, 2022; Lopo et al., 2024) has already suggested: participation in ILSAs not only serves as an evaluation tool for national education systems or a justification for domestic education reforms but is also closely linked to the distribution of aid. This relationship persists even when accounting for historical path dependencies such as colonial ties or trade relations, further reinforcing the politicization of ILSAs.

Moreover, these findings highlight the conditions and dependencies shaping aid to education recipients. If countries must participate in ILSAs and inadvertently align their educational standards and structures with those of donor countries to improve scores and secure further funding, does this aid genuinely enhance local education, or does it primarily serve to align systems with donor priorities? Viewing ILSA adoption through the lens of aid dependency, we can see that studies that assume ILSA adoption to be driven by voluntary learning and/or emulation overlook the crucial dynamic of global power asymmetries and economic inequalities. We show that the isomorphism of education systems becomes even more pronounced, reinforcing not only by the labor market orientation of education but also by the acceleration of policymaking and the growing emphasis on evidence-based policy. At the same time, the global spread of ILSAs would not have been possible if education systems were not already highly standardized. ILSAs may simply represent the final step in the long process toward a globally uniform education system. To conclude our analysis, it seems that the pattern of development aid distribution influences participation in ILSAs. We show that a global trend toward monitoring and benchmarking tools in education systems is fostered and, perhaps, accelerated through monetary dependency structures. On average, countries that implement standardized and comparable student testing raise more funds through development aid if they are primarily receiving countries. In contrast, a lack of increased funds penalizes those who have not yet implemented ILSAs.

Future research should advance in different directions: On a methodological avenue, it should be tested whether the number of donors, as well as the exposure, can be modeled more precisely to see if the effects are stronger in a more decentral rather than a central network – in other words, providing information on a threshold for the coercion of countries to join collective actions such as participation in ILSAs. Furthermore, quantitative research on the role of multilateral donations from IOs and other transnational organizations is needed. On a critical political economy avenue, qualitative studies, in particular, should zoom in on detailed relationships between donors and recipients of aid and analyze the sometimes-hidden requirements for recipients and the interests of donating nation states, Transnational Corporations, IOs, etc., in the global standardization of a neoliberal education ideal.

Data availability statement

The datasets presented in this study can be found in online repositories. The data can be accessed at: <https://wesis.org>.

Author contributions

FB-T: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Validation, Writing – original draft, Writing – review and editing. HS: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Validation, Writing – original draft, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer CB declared a past co-authorship with the author HS to the handling editor.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1429107/full#supplementary-material>

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