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Does Aid for Education Attract Foreign Investors? An Empirical Analysis for Latin America

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Abstract:
We address the question of whether foreign aid helps attract foreign direct investment (FDI). This could be achieved if well targeted aid removed critical impediments to higher FDI inflows. In particular, test the hypothesis that aid for education is an effective means to increase FDI flows to host countries in Latin America where schooling and education appears to be inadequate from the viewpoint of foreign investors. We employ panel data techniques covering 21 Latin American countries over the period from 1984 to 2008. We find that aid for education has a statistically significant positive effect on FDI. This effect is robust to potential outliers, sample selection, alternative specifications and different estimation methods.

Keywords: foreign aid, foreign direct investment, aid effectiveness, human capital.

JEL classification: E24, F21, F35, O15, O19

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Introduction

While the effectiveness of foreign aid in promoting economic growth in the recipient countries is controversially debated,[1] there appears to be a broad consensus that foreign direct investment (FDI) inflows bring many benefits to host countries. According to the so-called Monterrey Consensus achieved at the UN summit on Financing for Development in 2002, "foreign direct investment … is especially important for its potential to transfer knowledge and technology, create jobs, boost overall productivity, enhance competitiveness and entrepreneurship, and ultimately eradicate poverty through economic growth and development. A central challenge, therefore, is to create the necessary domestic and international conditions to facilitate direct investment flows" (United Nations, 2003: 9, paragraph 20).

Consequently, policymakers around the world have liberalized regulations and offered incentives to attract FDI inflows.[2] Yet FDI continues to be highly concentrated in a few host countries, while various developing countries hardly participated in the FDI boom. The distribution of FDI is skewed even within relatively advanced regions such as Latin America. Some countries, notably Chile and Panama, hosted outstandingly high FDI stocks, relative to GDP, in the mid-1980s already and still belonged to the top group 25 years later (Figure 1). In sharp contrast, countries such as Cuba and Venezuela ranked at the bottom at both points in time. Other Latin American countries changed their position considerably during this period: While Guatemala suffered a steep decline, neighbouring Honduras and Nicaragua jumped from poor rankings in the mid-1980s to close the top in recent years.

This raises the question of whether the international community could support the diffusion of FDI-related benefits by using aid as a means to ease access to FDI. Theoretically, foreign aid has

[1] See Doucouliagos and Paldam (2009) for a survey on the "sad results of 40 years of research" on aid effectiveness. In a similar vein, Temple (2010: 4445) concludes that "the available evidence is generally too fragile to bear much weight, even though it has improved over time." The recent results of Nowak-Lehmann *et al* (2012) suggest that aid generally has an insignificant impact on economic growth. By contrast, McGillivray *et al* (2006) offer an optimistic account of previous research.

[2] For details, see UNCTAD (2010).

ambiguous effects on FDI (Harms and Lutz, 2006; Kimura and Todo, 2010). On the one hand, aid may increase the productivity of private capital by improving the supply of complementary factors of production (Selaya and Sunesen, 2012). On the other hand, aid could have adverse effects on FDI by giving rise to rent-seeking (e.g., Economides *et al*, 2008) and by crowding out foreign investment in the tradable goods sector (Beladi and Oladi, 2007).[3] Yet a widely cited OECD report called on donors to improve "the synergies between FDI flows and ODA" (OECD, 2002: 30). Beerfeltz (2011: 417), the under-secretary in the German Ministry for Economic Cooperation and Development, declared that German development aid shall "motivate companies to make more direct investments in our [development cooperation] partner countries."

This could be achieved if well targeted foreign aid removed critical impediments to higher FDI inflows, for instance by improving the endowment of host countries with sufficiently skilled labour on which foreign direct investors draw. Previous studies on the aid-FDI nexus have often employed aggregate aid data. This approach does not account for the heterogeneous nature of aid. Some recent studies disaggregate aid, as we do in the following. Nevertheless, an important gap remains that we attempt to fill. Apart from disaggregating aid, we consider the specific needs of host countries by identifying major bottlenecks to higher FDI inflows that foreign aid may help overcome. Our analysis addresses this issue by focusing on host countries in one particular region, Latin America, and aid in one particular category, education.

Our central hypothesis is that aid for education is an effective means to increase FDI flows to host countries where schooling and qualification can reasonably be considered inadequate from the viewpoint of foreign direct investors. This appears to be the case in large parts of Latin America, as we describe in more detail in the subsequent section. At the same time, the recent literature suggests that analysing disaggregated aid and its impact on narrowly defined outcome variables offers a more promising way to assess the effectiveness of aid, compared to earlier studies

[3] Beladi and Oladi (2007) show theoretically that aid could crowd out foreign private investment if the tradable goods sector is more capital intensive than non-traded public consumption goods that aid helps produce.

on the economic growth effects of aggregate aid. In particular, it has been found that aid for education improved educational outcome variables such as enrolment rates (Dreher *et al*, 2008) as well as completion rates, repetition rates, and gender parity (D'Aiglepierre and Wagner, 2010). This provides an important channel through which aid for education could have promoted FDI in Latin America.

We employ panel data techniques covering 21 Latin American countries over the period from 1984 to 2008. We find that aid for education has a statistically significant and positive effect on FDI. This effect is robust to potential outliers, the selection of Latin American sample countries, alternative specifications and different estimation methods. Before presenting our results in detail, we discuss the relevant literature in the next section.

Analytical Background and Related Empirical Evidence

Previous literature offers several building blocks on which our central hypothesis on the effects of aid for education on FDI flows to Latin American countries rests. First, we refer to North-South models of FDI suggesting that a sufficiently qualified workforce is an important pull factor as foreign direct investors rely on relatively skilled labour in developing host countries. Second, we draw on comparative evaluations and surveys revealing that education and schooling constitute relatively weak competitive spots that may erode Latin America's position in the worldwide competition for FDI. Third, we relate to recent contributions to the aid effectiveness literature which indicate that aid may help improve educational outcomes. Finally, we review the existing empirical literature on the link between aid and FDI.

Education as a determinant of FDI

Foreign firms in developing host countries are generally found to pay higher wages than local firms (Lipsey, 2002). At the same time, the FDI-related wage premium is typically higher for more skilled workers. In the Latin American context, Mexico has received particular attention in this regard

(e.g., Aitken *et al*, 1996; Feenstra and Hanson, 1997).[4] Hanson (2003) concludes from a survey of the earlier literature that FDI has increased the relative demand for skilled labour in Mexico. The observation that FDI draws on relatively skilled labour in developing host countries supports the theoretical predictions of North-South models of FDI. In particular, Feenstra and Hanson (1997) argue that FDI may increase the skill premia not only in the advanced source countries of FDI (by offshoring the relatively unskilled labour intensive lines of production), but also in the less advanced host countries. FDI-related activities tend to be relatively skilled labour intensive in the host country, even though they are relatively unskilled labour intensive by the standards of the source country.

According to Aghion and Howitt (1998: chapter 8), FDI-induced skill premia in the host countries could be a temporary phenomenon. By triggering a "transition to a new technological paradigm" (Aghion and Howitt, 1998: 262) FDI raises the demand for more skilled labour. In particular, the skill premium increases as long as domestic firms are struggling to absorb new technologies and the transition results in high demand for skills that are in short supply. The supply of the required skills is expected to improve over time to the extent that firms manage the transition to the new technological paradigm and workers acquire the necessary skills.

The theoretical reasoning of Feenstra and Hanson (1997) as well as Aghion and Howitt (1998) suggests that education and worker qualification in the host countries represent important pull factors of FDI and ensure smoother technological transitions. Indeed, empirical studies consider the endowment of host countries with human skills to be an important determinant of FDI (e.g., Noorbakhsh *et al*, 2001; Nunnenkamp and Spatz, 2002). Insufficient education and worker qualification could discourage FDI inflows and impair transition processes particularly in middle-income countries where local governance structures and essential physical infrastructure are no

[4] However, higher FDI-related wage premia for better skilled workers have also been observed in Asian host countries such as Indonesia (Lipsey and Sjöholm, 2004).

longer binding constraints. Comparative evaluations and surveys on schooling, education and qualification indicate that various Latin American host countries may fall into this category.

Education as a binding constraint in Latin America

The OECD's Programme for International Student Assessment (PISA) provides first indications on the poor quality of education in Latin America. Eight of our Latin American sample countries participated in the PISA round of 2009.[5] Their performance in terms of reading, science and math proficiency was considerably below the median, and most of the Latin American countries ended up in the lowest quartile in all three dimensions.[6] According to Hanushek and Woessmann (2009), the test scores of seven Latin American countries were only slightly better than the test scores of three Sub-Saharan African countries, even though the average GDP per capita of the former was more than twice as high as that of the latter. However, this comparison offers at best limited insights as comparable test scores are hardly available for particularly poor African countries.[7]

The World Bank's World Business Environment Survey (WBES) uses a uniform questionnaire to compare the severity of constraints by "listening to firms" (World Bank, 2003: 1). According to this survey, more than half of the firms rated education in Latin America to be "slightly bad," "bad," or "very bad" (World Bank, 2003: 64). Importantly, this share was higher than in any other region, including Africa. At the same time, the share of firms rating public services in Latin America to be bad was lower in most other fields (notably infrastructure and utilities) than in education. Taken together, the WBES suggests that poor education is a particularly serious bottleneck to private business development.

[5] Argentina, Brazil, Chile, Colombia, Mexico, Panama, Peru, and Uruguay. For detailed results, see "education" under: http://www.oecd.org/statistics (accessed: October 2012).
[6] Chile and Uruguay performed slightly better.
[7] We thank an anonymous reviewer for alerting us to this limitation. See Birchler and Michaelowa (2013) for sources of information on test scores for African as well as Latin American countries. The Latin American Laboratory for Assessment of the Quality of Education offers information on the quality of education in Latin America (http://portal.unesco.org/geography/en/ev.php-URL_ID=7919&URL_DO=DO_TOPIC&URL_SECTION=201.html).

More systematic evidence in this regard may be derived from the Global Competitiveness Report of the World Economic Forum (WEF). This report provides a more detailed ranking with respect to several educational indicators and covers a large set of countries across the whole spectrum of GDP per capita (Figure 2). As can be seen, our Latin American sample countries are hardly represented in the top tercile of all 144 countries included in this report. While various Latin American countries occupy the middle range in terms of school enrolment ratios, most of them cluster at the bottom with respect to quality aspects of education. Furthermore, as concerns the quality of education, the survey results support the view that poor education tends to be a particularly serious problem in Latin America. Figure 3 reveals that almost all Latin American sample countries fall below the 'normal pattern' when the quality of education is related to the countries' average GDP per capita. In other words, Latin American countries typically fall behind the quality of education to be expected at their level of economic development.

Figure 4 underscores the severity of educational bottlenecks in Latin America by comparing the rankings along two dimensions: the quality of math and science education and the quality of overall physical infrastructure. All of the 144 countries covered in the WEF report with rank positions up to 96 in both dimensions fall into quadrant IV; i.e., neither math and science education nor overall infrastructure appear to constitute major bottlenecks in these countries. By contrast, countries fall into quadrant II when they rank in the bottom third for both dimensions. Quadrants I and III comprise countries ranking in the bottom third for either math and science education (I) or overall infrastructure (III). As can be seen, the distribution of our Latin American sample countries in Figure 4 is concentrated heavily in the "north" (quadrants I and II), while the distribution of Sub-Saharan African countries is concentrated in the "east" (quadrants II and III). This suggests that educational bottlenecks in education tend to be more pronounced than infrastructural bottlenecks in

Latin America, while infrastructural bottlenecks appear to be relatively more serious in Sub-Sahara Africa.[8]

Aid and educational outcomes

According to data from UNESCO, public expenditure on education (in % of GDP) varies considerably within Latin America.[9] However, Michaelowa and Weber (2007) find no compelling evidence that higher domestic expenditure on education improves outcomes in terms of school enrolment and completion rates. They conclude that "this confirms parts of the educational development literature which suggests that inefficiencies in national education expenditure are so important that results are only loosely related to financial inputs" (Michaelowa and Weber, 2007: 381). Likewise, domestic expenditure on education has insignificant effects on educational outcome variables considered by Dreher *et al* (2008) as well as D'Aiglepierre and Wagner (2010).

In striking contrast to domestic expenditure, foreign aid for education appears to be effective in improving educational outcome variables. Michaelowa and Weber (2007) find that aid for education increases primary education, even though the impact of aid is rather small and conditional on local governance. Likewise, Dreher *et al* (2008) show that higher per-capita aid for education significantly increases primary school enrolment. This result proves to be robust to the method of estimation, the use of instruments to control for the endogeneity of aid, and the set of control variables included in the estimations. D'Aiglepierre and Wagner (2010) focus on aid for primary education and consider a broader spectrum of educational outcome variables, including completion and repetition rates as well as gender parity. Aid in this particular category proves to be strongly

[8] Less surprisingly, Asian countries are concentrated in the "southwest" (quadrat IV) where bottlenecks appear to be modest along both dimensions.

[9] It should be noted that Latin American countries do not generally underperform in terms of public expenditure on education, compared to selected countries in other regions with expenditure shares of about five per cent in recent years (e.g., Germany, Hungary, Rep. of Korea, and South Africa). Cuba reported outstandingly high expenditure shares of 12-14 per cent in 2007-2009. Argentina, Brazil, Costa Rica, and Mexico are close to the five per cent benchmark. On the other hand, countries with expenditure shares below three per cent include the Dominican Republic and Peru. For details, see: http://stats.uis.unesco.org/unesco/TableViewer/document.aspx?ReportId=143&IF_Language=eng (accessed: October 2012).

effective. Christensen *et al* (2011) compare aid for primary education from bilateral and multilateral donors. They find that bilateral donors condition their aid on better control for corruption in the recipient countries, which renders bilateral aid more effective in boosting school enrolment. As shown by Birchler and Michaelowa (2013), however, the quality of education may suffer when enrolment rates increase rapidly. Even though appropriate data on the quality of education in developing countries are scarce, it appears that "donors may have focused on quantity to the detriment of quality" (Birchler and Michaelowa, 2013: 16).[10]

Taken together, these strands of the literature invite the hypothesis that aid for education helps attract FDI inflows, notably to where schooling and education appear to be deficient as in large parts of Latin America. This is even though previous research offers little insights on whether the link between aid for education and educational outcomes would also hold in the specific Latin American context.[11] It cannot be taken for granted that this is the case.[12] However, we collect some stylized facts to render our hypothesis more plausible. Figure 5 portrays the development of completion rates at different levels of schooling for our sample of Latin American countries, drawing on the well-known Barro-Lee database.[13] As can be seen, the increase in aid for education since the mid-1980s for the Latin American sample is correlated positively with completion rates at the secondary and tertiary levels of schooling.

Furthermore, we draw on country-specific information on average years of schooling available for all 21 Latin American sample countries from the Barro-Lee database. More precisely, we calculate the change in average years of schooling, covering all levels of schooling, during the whole period of observation (2010 compared to 1985) and, alternatively, during five-year intervals

[10] Birchler and Michaelowa (2013) present a qualitative comparative analysis (QCA) of student achievement at the end of primary education for 15 African countries with sufficient data. The QCA does not support the view that the overall amount of aid for education has played an important role for improving the quality of education in the African sample (in contrast to the composition of aid for education).
[11] We thank an anonymous reviewer for stressing this limitation.
[12] Indeed, Birchler and Michaelowa (2013) show that primary enrolment rates (NER) are hardly correlated with rising aid for education in Latin America. However, this may "simply reflect that for most of the countries covered, the NER has been at or close to its maximum of 100 per cent" (Birchler and Michaelowa, 2013: 2).
[13] The database is available from: http://www.barrolee.com/.

since 1985. The changes in average years of schooling are then correlated with aid for education in the corresponding periods of time (i.e., average aid, relative to the recipient country's GDP, throughout the 1984-2008 period or, alternatively, during five-year sub-periods starting with 1984-1988). This simple exercise results in correlations that are positive, though not particularly strong, providing further indications that aid for education may have contributed to improved educational outcomes in Latin America. Specifically, the correlation coefficient is 0.26 when considering aid for education and changes in years of schooling for the cross section of the 21 sample countries over the whole period of observation.[14] Not surprisingly, the correlation coefficient is lower (0.13) when pooling the five sub-periods available for each country in our sample.

Obviously, these simple correlations do not necessarily imply that aid for education is causal for improved educational outcomes in Latin America. Providing a deeper and comprehensive analysis of the effects of aid for education on outcomes in Latin America would also require data on the quality of education, which is hardly available over time. The more modest objective of presenting Latin-American specific stylized facts is to indicate that the general link between aid for education and educational outcomes may also hold for this region.

Previous literature on aid and FDI

Our focus on aid with the explicit purpose of removing educational bottlenecks in the recipient countries deviates from previous studies on the links between aid and FDI. Almost all of these studies apply aggregate aid data, starting with Papanek (1973) who observed a statistically insignificant correlation between aid and FDI across countries in the 1950s and 1960s. While Papanek (1973: 123) rejected the view that "aid is biased in favour of the countries which are

[14] The correlation coefficient increases to 0.44 when Brazil and Mexico are excluded from the sample. Both countries reported considerable increases in average years of schooling, while aid/GDP ratios were relatively low as is typically the case for large and relatively advanced recipient countries.

hospitable to (and often exploited by) the private investors of aid donor countries", Berthélemy and Tichit (2004) find some evidence that donors grant more aid to host countries of FDI.[15]

Harms and Lutz (2006) is the most prominent study on whether aid stimulates private foreign investment. Using data for 92 developing host countries during the 1988-1999 period, Harms and Lutz find that aggregate aid per se has no significant impact on foreign investment flows.[16] Surprisingly, however, the effect of aid proves to be strictly positive "where firms have to cope with substantial restrictions on their activities" (Harms and Lutz, 2006: 780). Karakaplan *et al* (2005) concur that aid per se has no positive effect on FDI. In contrast to Harms and Lutz, however, Karakaplan *et al* show that aid is more likely to induce FDI in host countries with better governance and more developed financial markets. Asiedu *et al* (2009) find that aid per se is negatively associated with FDI in low-income host countries, but aid tends to mitigate the adverse effects of country risk on FDI. Unconditionally positive effects of aid from bilateral sources, though not from multilateral sources, are reported by Yasin (2005) whose panel analysis covering the 1990-2003 period is restricted to eleven sub-Saharan Africa countries.[17] Blaise (2005; 2009) considers Japanese aid to be a determinant of Japanese FDI in China and, respectively, in four south-east Asian countries. Employing conditional logit analyses based on firm-specific data, both case studies reveal that aggregate Japanese aid had a significantly positive impact on the location choices of Japanese direct investors.[18]

[15] Berthélemy and Tichit (2004) regard higher FDI inflows (in per cent of GDP) as an indicator of 'good' economic policies. The coefficient on FDI proves to be sensitive to the specification of the estimation equation and to the time period considered.

[16] Note that the dependent variable in Harms and Lutz (2006) includes FDI and portfolio equity investment. However, their results are essentially the same when considering only FDI in a robustness test. As concerns the aid variable, Harms and Lutz differentiate between loans and grants and also between aid from bilateral and multilateral sources in additional robustness tests. However, they do not consider sector-specific aid.

[17] In an earlier cross-section analysis for individual years (1976, 1979, or 1980), Schneider and Frey (1985) consider aid from three sources as possible determinants of FDI flows to developing countries: Western donor countries, communist donor countries, and multilateral institutions. While aid from communist countries enters significantly negative in their cross-country regression, the coefficients on aid from the other two sources are significantly positive.

[18] Blaise (2009) provides a detailed description of the sector-wise composition of Japanese aid to Indonesia, Malaysia, the Philippines, and Thailand. However, aggregate aid disbursements from the database of the OECD's Development Assistance Committee are used in the econometric estimation. Likewise, Kang *et al* (2011) use aggregate aid data to show that Korean aid resembles Japanese aid in promoting bilateral FDI.

All these studies ignore the sector-wise composition of aid. This may help explain the highly ambiguous results. As a first step toward disaggregating aid, Kimura and Todo (2010) distinguish between five major donors and separate 'aid for infrastructure' from other aid (mainly budget support, debt relief, and humanitarian aid). Both types of aid prove to be insignificant as determinants of FDI, except for FDI from Japan. Kimura and Todo focus on the so-called vanguard effect of Japanese aid promoting Japanese FDI, though not FDI from other sources, but they hardly consider truly sector-specific aid. Their definition of 'aid for infrastructure' is extremely broad and includes aid for projects related to social and economic infrastructure as well as aid for production activities and so-called multi-sector aid.

Selaya and Sunesen (2012) refine major aid categories to address the theoretical ambiguity mentioned in our introduction above. Specifically, projects related to social and economic infrastructure are supposed to attract FDI by improving the supply of complementary factors of production. By contrast, aid is supposed to crowd out FDI when granted as "pure physical capital transfers" (Selaya and Sunesen, 2012: 2155). Indeed, the empirical analysis reveals the expected opposing effects of both types of aid on FDI, even though the categorization of aid is still fairly broad and not related to specific 'needs' or bottlenecks to FDI in the recipient countries.[19] Kapfer *et al* (2007) focus on aid for economic infrastructure (communication, transportation, energy), which they find to have a significant effect on FDI. Mayer's (2006: 34) analysis of dyadic aid and FDI patterns suggests, however, that the "very strong effect [of aid for infrastructure] seems entirely caused by the cross-sectional variation in the data" and largely disappears once country-pair fixed effects are included.

Mayer (2006) represents the only study that also considers aid for social infrastructure as a distinct determinant of FDI, with similarly sensitive results as in the case of aid for economic

[19] Note that aid for infrastructure covers (i) social infrastructure such as education, health, and water & sanitation and (ii) economic infrastructure such as energy, communication and transportation. Accordingly, aid for infrastructure accounted for about half of total aid in the sample used by Selaya and Sunesen (2012: 2158). Aid invested in physical capital includes aid projects in agriculture, manufacturing, trade, banking, and tourism.

infrastructure. We suspect that social infrastructure is still too broad a concept to capture specific bottlenecks to FDI that sector-specific aid may help overcome. The OECD's aid statistics subsume not only aid for education, health, and water & sanitation under 'social infrastructure' but also aid projects related to government administration and civil society. As a matter of fact, education accounted for just about 20 per cent of total aid commitments listed under 'social infrastructure' by all donors in recent years (2005-2010).[20]

Empirical Analysis

The analysis in this section examines the relationship between aid for education and FDI in Latin America. We first describe the empirical model and the data. Subsequently, we present fixed-effects estimates of the impact of aid for education on FDI. Finally, we test the robustness of our results.

Empirical model and data

Our model is of the general form:

$$FDI_{it} = \beta_1 Aid_{it} + \sum_{m=1}^{M} \gamma_m X_{mit} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (1)$$

where $i = 1, 2, ..., N$ is the country index; $t = 1, 2, ..., T$ is the time index; *FDI* represents net FDI inflows relative to GDP; and *Aid* stands for net aid flows relative to GDP.[21] In line with our reasoning above, we decompose *Aid* into aid for education, *Aidedu*, and all other (non-education) aid, *Aidother*. *X* is the usual vector of *m* time-varying control variables. Following Harms and Lutz (2006), we control for GDP per capita (GDP^{pc}), the trade-to-GDP ratio (*Trade*), governance (*Governance*), and investment risk (*Investment risk*). We include fixed effects, α_i, to control for any country-specific omitted factors that are stable over time. We also include period dummies, α_t, to account for common time effects such as shocks affecting all countries at the same time, as is standard in the literature.

[20] For details, see: http://stats.oecd.org/index.aspx?DataSetCode=CRS1 (accessed: October 2012).
[21] We follow previous studies in defining FDI and aid relative to GDP (e.g., Yasin, 2005; Karakaplan *et al*, 2005). The reason is that both net aid and net FDI flows are negative in some years. These observations would be lost when taking logs. GDP data are from the World Development Indicators (WDI) (http://data.worldbank.org).

The empirical analysis covers the period from 1984 to 2008.[22] As is common practice in panel studies, we use time-averaged data to eliminate business cycle effects. Specifically, we construct five-year averages as in Selaya and Sunesen (2012). This gives us five periods for our panel (1984-1988 until 2004-2008). We include all Latin American countries with available data, with the exception of countries with a population below one million.[23] This yields a sample of 21 Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

We now describe the data used in the empirical analysis. For our FDI variable, we use net FDI inflows from the United Nations Conference on Trade and Development (UNCTAD) FDI database.[24] As noted before, we distinguish two types of aid: aid for education, and aid for other purposes. Both categories of aid are based on aid commitments reported in the Creditor Reporting System (CRS) database of the Development Assistance Committee (DAC) of the OECD.[25] Aid for education includes aid for basic education, secondary education, postsecondary education, and unspecified levels of education according to CRS purpose code 110. *Aidother* comprises all other CRS purpose codes except code 110.

Principally, it would be more appropriate to use aid disbursements, instead of aid commitments, as the effects of aid should depend on actual flows rather than donor promises that are often not fully met. However, reliable data on sector-specific aid disbursements are not reported by donors for a sufficiently long period of observation.[26] Therefore, we follow previous studies and use aid data on a commitment basis (see, e.g., Dreher *et al*, 2008; Kimura and Todo, 2010). This is reasonable as commitments and disbursements are usually highly correlated (see also Clemens *et al*,

[22] Note that data on investment risk (described below) are not available before 1984.
[23] We follow Harms and Lutz (2006) in excluding extremely small countries.
[24] Available at http://unctadstat.unctad.org
[25] Available at http://www.oecd.org/dac/stats/idsonline
[26] For a detailed discussion of data issues with regard to sector-specific aid, see the Appendix.

2012). In addition, we perform estimations with estimated disbursements of aid for education (see the Appendix for details).

Our control variables are drawn from the previous empirical literature on the aid-FDI relationship. Data for GDP per capita (in 1000 US dollars) and trade (exports plus imports relative to GDP) are from the WDI online database. Following Harms and Lutz (2006) and Kapfer *et al* (2007), we lag both variables one period to alleviate potential endogeneity problems.

As far as the measure of governance is concerned, the often used World Governance Indicators from the World Bank are available only from 1997 onwards. Therefore, we follow Kapfer *et al* (2007) and include the democracy index from the POLITY IV database.[27] This index ranges from –10 (strongly autocratic) to +10 (strongly democratic). The choice of this variable is based on the following considerations: There is evidence to suggest that the level of democracy is both a determinant of aid (e.g., Alesina and Dollar, 2000) and a determinant of FDI (e.g., Jensen, 2003). Thus, one should control for democracy to avoid omitted variable bias. Moreover, the level of democracy appears to be a good proxy for the quality of governance. Li and Resnick (2003: 187), for example, point out that "democratic institutions […] collectively serve to secure private property rights and lower the risks of expropriation, contract repudiation, ineffective rule of law, and government corruption […]." Nevertheless, the relation between democracy and FDI is theoretically ambiguous. For instance, Li and Resnick (2003) argue that democratic governments are more likely to impose restrictions on multinational enterprises to prevent them from taking advantage of monopolistic positions. FDI could be discouraged by such restrictions. Therefore, we consider two alternative, more specific measures of governance in the robustness section: the Freedom House Civil Liberties index and the Freedom House Political Rights index.[28]

Finally, in line with Harms and Lutz (2006) and Selaya and Sunesen (2012), we include a measure of investment risk: the investment profile index from the International Country Risk Guide

[27] Available at http://www.systemicpeace.org/polity/polity4.htm
[28] Available at http://www.freedomhouse.org

(ICRG), published by the Political Risk Services Group.[29] This measure assesses several factors affecting the risk to investment, including contract viability and payment delays, and ranges from 0 (very high risk) to 12 (very low risk). Table 1 presents summary statistics on the variables included in Equation (1).

Baseline results

In column (1) of Table 2, we present the baseline results with our aid variables defined in terms of commitments as reported in the CRS. The effects of most of the control variables on FDI are in line with previous studies. The coefficients on the volume of trade and GDP per capita are positive, although only GDP per capita seems to have a statistically significant influence on FDI flows. As in previous studies (e.g., Harms and Lutz, 2006) we also find lower investment risk and FDI to be significantly and positively correlated (recall that higher values imply a less risky business environment). More surprisingly, the negative coefficient on our governance variable suggests that more democratic regimes attract *less* FDI. While Kapfer *et al* (2007) report the same finding, it is clearly at odds with the view that democratization induces more FDI through better governance in the broadest sense. It rather appears that FDI is discouraged by restrictions on the activities of multinational enterprises that democratic governments are more likely to impose (Li and Resnick, 2003).

Turning to the variables of major interest, we do not find any statistically significant influence of aid to other sectors (*Aidother*) on FDI inflows. This is in line with the ambiguous results of previous studies using aggregate aid data. By contrast, aid for education is positively associated with FDI in Latin American countries. The *t*-value of *Aidedu* is highly significant, and the point estimate implies that an increase of *Aidedu* by one standard deviation increases the FDI-to-GDP ratio by more than one percentage point – an economically large effect.

[29] See https://www.prsgroup.com/prsgroup_shoppingcart/pc-75-7-icrg-historical-data.aspx

As discussed in detail in the Appendix, sector-specific aid data are underreported in the CRS. The degree of underreporting becomes more serious the further one moves back in time. Therefore, we replicate the baseline estimation by excluding the first five-year interval (1984-1988) in column (2) of Table 2. Indeed, *Aidedu* loses its statistical significance when omitting the most distant past in this way.[30] The finding that aid for education is no longer effective in stimulating FDI could have different explanations. On the one hand, the poor quality of CRS data in the more distant past may bias our results and lead us to overstate the impact of aid for education in column (1), even though underreporting appears to be relatively modest for our Latin American sample (see Appendix). On the other hand, the variation over time is limited once the fixed-effects estimations are based on a reduced number of time intervals.[31]

A definite conclusion on the validity of these two explanations is almost impossible unless longer time series of fully reliable aid data become available. Yet, the following estimations suggest that the impact of aid for education is understated in column (2), rather than being overstated in column (1). In columns (3) and (4), we adjust the sector-specific CRS commitments in two steps to arrive at estimated disbursements.[32] In the first step, we multiply sector-specific CRS commitments with the ratio of overall aid disbursements over overall aid commitments from the DAC's aggregate aid statistics, in order to correct for a possible upward bias of sector-specific commitments. In the second step, we also account for possible underreporting in the CRS. The estimations with these two variants of estimated disbursements of aid for education closely resemble the baseline findings on the effect of *Aidedu* on FDI inflows.

Finally, we need to ensure that our results are not subject to spurious regression problems due to the potential non-stationarity of the data. As is well known from the growing literature on non-stationary panel data, even panel regressions may be spurious when the regression residuals are

[30] Most other findings are hardly affected when reducing the period of observation. However, the negative coefficient on our governance variable is no longer significant at conventional levels in column (2).
[31] Similarly, Birchler and Michaelowa (2013: 8) do not find any significant effects of aid for education on school enrolment any more when restricting the period of observation.
[32] See the Appendix for details.

non-stationary. Following Eberhardt *et al.* (2013), we therefore apply the ADF Fisher panel unit root suggested by Madalla and Wu (1999) to the residuals of our models. The corresponding *p*-values are reported in the bottom part of Table 2. As can be seen, the null hypothesis of non-stationarity is rejected at the one per cent level for the residuals from all models, suggesting our results are not spurious.

Delayed effects

The baseline estimations reported in Table 2 assess the effects of aid granted during a five-year interval on FDI inflows in the same five-year interval. This approach may capture delayed effects of aid granted at the beginning of the interval, while aid granted at the end of the interval could stimulate FDI inflows only if foreign investors anticipated its effectiveness in improving the host country's endowment of sufficiently qualified labour. This approach probably fails to capture delayed effects on FDI fully, in particular when using commitments of aid. It takes time until committed aid is disbursed, and still more time until disbursed aid eventually improves the education of the workforce.[33]

In the following, we modify the estimation approach to assess delayed effects more fully and, correspondingly, reduce the reliance on anticipation effects. More precisely, we estimate the effects of our aid variables in t – t+4 on FDI inflows in (i) t+1 – t+5, (ii) t+2 – t+6, and (iii) t+3 – t+7. The results are presented in columns (2) – (4) of Table 3, together with the benchmark estimation from column (1) of Table 2 for ease of comparison. The results are strikingly similar across the different lag structures. In particular, *Aidedu* enters significantly positive in all

[33] As noted by an anonymous reviewer, the effects may be further delayed if primary education and the related infrastructure and teacher training are priority targets of aid for education. For our sample of Latin American countries, education specifically targeted at primary education accounts for a relatively small share of overall aid for education (27% in 1995-2008, compared to 36% for Sub-Sahara Africa and almost 50% for South Asia). On the other hand, the share of aid targeted at post-secondary education is much higher in Latin America than in other regions (33%, compared to 23% in Sub-Sahara Africa and 15% in South Asia).

estimations shown in Table 3, even though the level of significance weakens to the five per cent level when delayed effects on FDI are taken into account.[34]

At least implicitly, the results in Table 3 suggest that foreign investors anticipate the effects of aid for education on the country's endowment of sufficiently qualified labour. To the best of our knowledge, the relevance of anticipation effects on FDI has rarely been addressed in the earlier aid literature. However, other strands of the literature on the determinants of FDI provide ample evidence on anticipation effects. In particular, several studies find that FDI inflows increase well in advance of the widening and deepening of regional integration. Egger and Paffermayr (2004) conclude that anticipation effects are common to various steps of EU integration. Indeed, these authors find that the effects on FDI are "mainly anticipatory" and "seem to be exhausted with the formal completion" (page 108). According to Alguacil *et al* (2008), new accession countries experienced a boom in FDI inflows prior to their actual adhesion to the EU.[35] In the Latin American context, it has been shown that Mexico attracted rising FDI flows prior to the ratification of the North American Free Trade Agreement (NAFTA). Kose *et al* (2004: 11) argue that "there was an anticipation effect after the member countries agreed to pursue negotiations for a free trade agreement in 1991," i.e., three years before NAFTA became operative (see also Salvatore, 2007).

The evidence that foreign direct investors anticipate changes in relevant FDI parameters is not restricted to the effects of regional integration. The model of Belderbos *et al* (2004) predicts FDI in anticipation of the imposition of anti-dumping duties. Azrak and Wynne (1995) support this proposition empirically for Japanese FDI in the United States. Graham and Wada (2001: 6) suspect that the rise of FDI approvals by Chinese authorities at the beginning of this century was "in anticipation of reforms that are likely to accompany Chinese entry into the World Trade

[34] The choice of lag structures hardly affects the results on our control variables; the only exception is that the governance variable is no longer significant in columns (3) and (4). More surprisingly, *Aidother* proves to be significantly negative at the five per cent level in column (4). While this result is not particularly plausible, one might suspect that, in the longer run, foreign investors regard a rising dependence on aid, other than aid addressing specific bottlenecks in the recipient country, as a substitute for FDI inflows.

[35] See also the literature on announcement effects given in Ismail *et al* (2009).

Organization." Linton and Corrado (2008) observe a steep increase in FDI flows to India's pharmaceutical industry when multinational enterprises expected major changes in the country's patent law. Kwok and Tadesse (2006: 776) even ponder the possibility that "the prediction of low corruption in the future attracts more FDI today." In the context of foreign aid, Mayer (2006: 45) argues that "commitments can have a large signaling role for foreign investors, who can be affected by them even if not all commitments actually end up in disbursements." Against this backdrop, it appears not far-fetched to attribute the positive correlation between aid commitments and concurrent FDI decisions at least partly to the expectation of foreign investors that aid for education may prove effective in improving educational outcomes in host developing countries where education traditionally constituted a major bottleneck to FDI.

Potential outliers

We perform several sensitivity tests in order to examine the robustness of the significantly positive effect of aid for education on FDI. Given the relatively small number of countries in our sample, we first need to ensure that the positive coefficient on *Aidedu* is not due to potential outliers. To this end, we re-estimate Equation (1), excluding one country at a time from the sample. The sequentially estimated coefficients and their *t*-statistics are presented in Figure 6. The horizontal axis lists the country omitted from the regression, beginning with Argentina (as the first omitted country) and ending with Venezuela. On the vertical axis we plot the respective coefficients and *t*-statistics of the aid variable in the remaining sample of twenty countries. As can be seen, the estimated coefficients are relatively stable and always significant at least at the five per cent level, suggesting that the positive effect of aid for education on FDI is not the result of an individual outlier.

Sample selection bias and non-Latin American samples

In this section, we address two issues of sample selection. First, the positive relationship between aid for education and FDI may be due to sample selection bias if, for example, a group of countries

in a particular part of Latin America has a significant effect on the results. To investigate this, Equation (1) is re-estimated excluding either countries from the Caribbean (Cuba, Dominican Republic, Haiti, and Jamaica) or those in Central America (Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama). In additional estimations, we exclude:

- the three countries with the highest per capita income (Argentina, Mexico, Uruguay) or those with the lowest per capita income (Bolivia, Nicaragua, Haiti),
- the three countries with the highest share of FDI in GDP (Chile, Jamaica, Bolivia) or those with the lowest share of FDI in GDP (Paraguay, Haiti, Cuba), and
- the three countries with the highest share of aid for education in GDP (Nicaragua, Haiti, Bolivia) or those with the lowest share of aid for education in GDP (Argentina, Brazil, Mexico).

The resulting coefficients on *Aidedu* are listed in Table 4. They are all significant at least at the five per cent level, suggesting that the positive effect of aid for education on FDI is not due to sample selection bias.

Second, we recall from the section 'Analytical background and related empirical evidence' that poor education tends to be a particularly serious problem in Latin America, compared to other regions. This could imply that aid for education is less effective in helping overcome critical bottlenecks to higher FDI flows to other regions. To test this proposition at least tentatively, we re-run the baseline estimation in column (1) of Table 2 for two non-Latin American samples: 32 countries located in Sub-Sahara Africa and 12 countries located in South, Southeast and East Asia.[36] As can be seen from the results reported at the bottom of Table 4, the robust and positive coefficient of *Aidedu* shown for Latin America does not carry over to other regions. *Aidedu* enters positive, but it fails to pass the five per cent level of significance for the small Asian sample. The evidence is even weaker for Sub-Sahara Africa. This tends to support our reasoning that aid for

[36] Note that we included all countries in these regions for which the data were available and where the population exceeded one million.

education is effective in stimulating FDI mainly where the education and qualification of the workforce can be regarded as the major bottleneck to higher FDI inflows.

Alternative measures of aid, FDI, and governance

Next, we examine whether our results are robust to using alternative measures of aid, FDI, and governance. In column (1) of Table 5, we replace FDI flows by FDI stocks (relative to GDP) as our dependent variable. The coefficient on *Aidedu* is still statistically significant and its impact continues to be quantitatively important. An increase of *Aidedu* by one standard deviation induces an increase in the FDI stocks-to-GDP ratio of four percentage points. In column (2), we follow Kapfer *et al* (2007), Kimura and Todo (2010), and Kang *et al* (2011) and use absolute FDI flows as the dependent variable and absolute aid flows as regressor. As can be seen, the coefficient on aid for education remains positive and statistically significant. Interestingly, the sign of our governance variable changes from negative to positive (although it is not significant).

In columns (3) and (4), we return to our standard definition of aid and FDI variables, relative to GDP. However, we replace the POLITY IV democracy index by two more specific measures of governance (see, e.g., Yasin, 2005; Michaelowa and Weber, 2007): the Freedom House Civil Liberties index and the Freedom House Political Rights index. Irrespective of whether we use the POLITY IV measure or the Freedom House measures, the coefficient on *Aidedu* is statistically significant and positive, as the results in columns (3) and (4) show. At the same time, the alternative governance measures prove to be insignificant at conventional levels in Table 5. Presumably, this is at least partly because the variation of governance measures across countries is removed by the inclusion of country fixed effects, while the variation of governance measures over time is typically limited.

In column (5) we add a measure of government ideology to our baseline specification from Table 2 to make sure that our results are not driven by a potential omitted variable bias.[37] To

[37] We owe this point to an anonymous reviewer.

measure the orientation of the largest government party we use a dummy variable that takes the value of 1 if the largest government party is left or right wing and 0 for parties that are defined as centrist in the Database of Political Institutions.[38] As can be seen in column (5), controlling for government orientation hardly affects our results. The new variable itself does not enter significantly our equation. More importantly, the coefficient on aid for education remains positive and statistically significant at the five per cent level.

Alternative estimation methods

Finally, we investigate whether the estimates are robust to using alternative estimation methods. Specifically, a potential problem with the above estimation procedure could be that it assumes aid for education to be exogenous. However, aid may be endogenous. For example, causation may run from FDI to aid if foreign investors lobby their governments to increase aid. In particular, foreign investors drawing on qualified local labour may lobby for aid for education to be granted to their preferred host countries. As a consequence, the above fixed effects estimations on the impact of aid on FDI may be biased upwards. On the other hand, the fixed effects estimations may be biased downwards if donors grant more aid to compensate for reduced FDI flows, for instance at times of economic and financial crises or in the aftermath of natural disasters.

To account for the potential endogeneity of aid, we re-estimate Equation (1) by two-stage least squares (2SLS) using as instruments lagged values of aid for education, the log of population, the lagged log of population, and the log of the infant mortality rate (from the WDI online database). Such instruments are widely used in the aid-growth literature (see, e.g., Boone, 1996; Burnside and Dollar, 2000; Hansen and Tarp, 2000). The 2SLS results are presented in column (1) of Table 6. As far as the quality of our instruments is concerned, the F-statistic reported at the bottom of Table 6 suggests a strong explanatory power of the first stage regression, and the Hansen J-test of over-identification restrictions shows that the instruments are uncorrelated with the error

[38] Available at http://go.worldbank.org/2EAGGLRZ40

term in the second stage equation. Thus, our instruments are relevant and exogenous. The coefficient on *Aidedu* is again statistically significant, corroborating the positive effect of aid for education in the baseline estimation. Surprisingly, the effect is quite large (6.577) compared to its counterpart in Table 2 (3.926). In other words, our fixed effects estimate appears to be biased downwards due to endogeneity. However, a Durbin-Wu-Hausman (DWH) test rejects the null hypothesis that aid for education is exogenous only at the ten per cent level (*p*-value = 0.075). This implies that we should be cautious in concluding that the two-stage instrumental variables estimation is clearly superior to the fixed effects estimation.

Indeed, we do not find compelling evidence for a downward bias of aid effects on FDI when employing a Generalized Methods of Moments (GMM) IV estimator to account for possible endogeneity of aid. The most commonly used GMM estimators are the Arellano and Bond (1991) difference GMM estimator and the Blundell and Bond (1998) system GMM estimator. Both estimators are based on a dynamic panel data model with the lagged dependent variable as a regressor. This variable captures the impact of the self-reinforcing effect of past values of the dependent variable (and its determinants) and thus determines the long-run response of the dependent variable to changes in the explanatory variables.

The Arellano and Bond (1991) estimator involves first removing the fixed effects from the regression by first-differencing and then instrumenting the differenced right-hand-side variables using lagged values of the original regressors. However, Alonso-Borrego and Arellano (1999) have shown that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences. Instrument weakness influences the asymptotic and small-sample performance of the difference estimator toward inefficient and biased coefficient estimates, respectively. Therefore, we use the Blundell and Bond (1998) system GMM estimator. This estimator reduces the weak instrument bias by using lagged differences as instruments in the levels equation. More specifically, it combines the regression equation in

differences and the regression equation in levels into one system. For the equation in differences, the instruments are lagged levels of the explanatory variables. For the equation in levels, the instruments are lagged differences of the independent variables.

The system GMM results (SYS-GMM) are presented in column (2) of Table 6. Column (2) also reports the Hansen J-test and a serial correlation test (AR2) where the null hypothesis is that the errors in the differenced equation exhibit no second-order serial correlation (by construction, the differenced error term is probably first-order serially correlated even if the original error term is not). As can be seen, the tests suggest that the instruments are valid and that the errors in the first-difference regression exhibit no second-order serial correlation.

Many authors do not place much emphasis on the significance of the lagged dependent variable (e.g., Forbes, 2000). Yet, it is worth mentioning that the lagged FDI variable it is not significant in Table 6. We accounted for the possibility that the coefficient on the lagged dependent variable becomes insignificant when the number of instruments is too large. Roodman (2009a) argues that as the time dimension increases, the number of instruments can be too large compared to the sample size, so that some asymptotic GMM results and specification tests are not valid. Too many instruments can overfit instrumented variables and fail to expunge their endogenous components, resulting in biased coefficients. Unfortunately, there is little guidance in the literature to determine how many instruments are "too many" (Roodman 2009a). As a "minimally arbitrary rule of thumb", Roodman (2009b: 99) suggests that the number of instruments should not exceed the number of countries in the regression. Because our sample includes only 21 countries, we reduced the number of instruments from a maximum of 31 unrestricted instruments to 19 restricted instruments by using only two-period lags of aid for education (and the lagged dependent variable) as instruments. Nevertheless, the behaviour of FDI and its determinants in previous periods does not appear to matter for current FDI.

This implies that aid for education would have only short-run effects on FDI according to the GMM results shown in column (2) of Table 6. Importantly, the coefficient on *Aidedu* is positive and highly significant once again. Moreover, the short-run effect is of similar magnitude as in the baseline estimation in Table 2. All in all, we tend to prefer the estimates in Table 2 over those in Table 6. This is also because both the Arellano-Bond estimator and the Blundell-Bond estimator are designed for large *N* (and small *T*) and thus may be biased in small country samples (as here).

Conclusion

Well targeted sector-specific foreign aid could possibly remove critical impediments to higher FDI inflows and, thereby, help diffuse FDI-related benefits across a wider spectrum of developing host countries. Specifically, we raise the hypothesis that aid for education is an effective means to increase FDI flows to host countries where schooling and qualification appear to be inadequate from the viewpoint of foreign direct investors. This is the case in large parts of Latin America.

Our results provide strong empirical evidence that aid for education is indeed associated with higher net FDI inflows to developing countries in Latin America. Employing data for 21 countries over the period from 1984 to 2008, we find no statistically significant effect of other (non-education) aid. By contrast, aid for education proves not only statistically significant but also has a quantitatively important positive impact on FDI flows to Latin American economies. In our baseline estimation, an increase in the ratio of aid for education over GDP by one standard deviation raises the FDI-to-GDP ratio by more than one percentage point. This finding is robust to potential outliers, sample selection within Latin America, and different variable definitions. The impact might even be stronger when using different estimation techniques to correct for potential endogeneity issues.

Our findings suggest that aid can be effective even though the relation between aggregate aid and economic growth appears to be elusive. This underscores the need to disaggregate aid and assess its effects on more specific outcome variables. To further explore possible synergies between aid and FDI flows (OECD, 2002), the case of aid for education in Latin America invites future

research into the alignment of sector-specific aid with FDI-related needs in particular host countries or regions. For instance, aid targeted at fighting HIV/AIDS could improve access to FDI for countries with particularly high infection rates. Likewise, aid may help upgrade physical infrastructure and, thereby, remove critical impediments to higher FDI flows to where physical infrastructure is particularly deficient. At the same time, deeper insights into the relationship between aid and FDI could be gained if inward FDI was differentiated by sectors and industries. It clearly deserves more attention whether sector-specific aid such as aid for education attracts FDI to certain sectors and particular types of FDI, though not necessarily other types.

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Table 1: Summary statistics and bivariate correlations

	Observations	Mean	Min.	Max.	Std. Dev.
FDI	82	0.0282	0.0000	0.0927	0.0212
Aidedu	82	0.0016	0.0000	0.0127	0.0027
Aidother	82	0.0349	0.0002	0.3976	0.0651
Trade	82	0.5834	0.1521	1.7905	0.3234
GDP^{pc}	82	2.325	0.332	7.814	1.570
Governance	82	6.6732	-7.0000	10.0000	3.7675
Investment risk	82	6.9498	3.0167	11.5000	1.9328

Correlation coefficients

	FDI	*Aidedu*	*Aidother*	*Trade*	GDP^{pc}	*Governance*	*Investment risk*
FDI	1.00	-	-	-	-	-	-
Aidedu	0.16	1.00	-	-	-	-	-
Aidother	0.04	0.78	1.00	-	-	-	-
Trade	0.43	0.06	0.03	1.00	-	-	-
GDP^{pc}	0.20	-0.52	-0.49	-0.11	1.00	-	-
Governance	0.44	0.01	0.01	0.22	0.16	1.00	-
Investment risk	0.59	-0.16	-0.28	0.26	0.36	0.46	1.00

Table 2: Baseline results for aid commitments and estimated disbursements

	(1) Baseline results, commitments	(2) First period (1984-88) removed, commitments	(3) Estimated aid disbursements in % of GDP	(4) Estimated aid disbursements in % of GDP (adj. for underreporting)
Aidedu	3.926** (3.02)	2.458 (0.93)	4.354** (3.21)	3.316** (3.94)
Aidother	0.019 (0.47)	0.049 (0.91)	0.033 (1.00)	-0.004 (-0.10)
Trade	0.014 (0.86)	0.002 (0.11)	0.015 (0.90)	0.016 (0.95)
GDP^{pc}	0.004** (5.89)	0.004** (3.22)	0.004** (6.41)	0.003** (7.14)
Governance	-0.002* (-2.64)	-0.001 (-1.38)	-0.002** (-2.72)	-0.002** (-3.43)
Investment risk	0.006** (3.56)	0.007** (4.77)	0.006** (3.65)	0.006** (3.61)
MW panel unit root test	0.000	0.000	0.000	0.000
Number of observations	82	62	82	82
Number of countries	21	21	21	21
Adj. R^2	0.66	0.57	0.66	0.66

t-statistics (calculated with White-corrected standard errors) are in parenthesis. **, (*) indicate significance at the one- (five-) per cent level. Coefficients for country and time fixed effects are not reported. MW denotes the ADF Fisher panel unit root suggested by Madalla and Wu (1999); the corresponding p-values are reported here.

Table 3: Delayed effects

	(1) Baseline results	(2) FDI inflows in t+1 – t+5	(3) FDI inflows in t+2 – t+6	(4) FDI inflows in t+3 – t+7
Aidedu	3.926**	3.951*	3.651*	3.848*
	(3.02)	(2.34)	(2.25)	(2.25)
Aidother	0.019	0.041	0.007	-0.055*
	(0.47)	(1.11)	(0.22)	(-2.39)
Trade	0.014	0.015	0.012	0.018
	(0.86)	(0.96)	(0.70)	(1.70)
GDP^{pc}	0.004**	0.004*	0.004**	0.005**
	(5.89)	(2.42)	(3.33)	(5.93)
Governance	-0.002*	-0.002*	-0.001	-0.001
	(-2.64)	(-2.19)	(-1.00)	(-0.74)
Investment risk	0.006**	0.006**	0.005**	0.004**
	(3.56)	(3.68)	(2.98)	(3.41)
Number of observations	82	82	82	82
Number of countries	21	21	21	21
Adj. R^2	0.66	0.66	0.65	0.68

t-statistics (calculated with White-corrected standard errors) are in parenthesis. **, (*) indicate significance at the one- (five-) per cent level. Coefficients for country and time fixed effects are not reported.

Table 4: Estimates of the effect of aid for education on FDI using different samples

	Coefficient on *Aidedu*	Number of countries in the sample	Number of observations
Excluding the Caribbean	3.948**	17	68
	(2.77)		
Excluding Central America	4.294*	14	54
	(2.53)		
Excluding the three countries with the highest GDP per capita	4.477**	18	70
	(3.77)		
Excluding the three countries with the lowest GDP per capita	3.378**	18	71
	(3.18)		
Excluding the three countries with the highest share of FDI in GDP	2.974*	18	71
	(2.37)		
Excluding the three countries with the lowest share of FDI in GDP	4.211**	18	71
	(3.08)		
Excluding the three countries with the highest share of aid in GDP	3.378**	18	71
	(3.18)		
Excluding the three countries with the lowest share of aid in GDP	3.883*	18	70
	(2.69)		
Non-Latin American samples:			
South, Southeast and East Asia	2.805	12	48
	(1.82)		
Sub-Sahara Africa	0.263	32	123
	(0.64)		

t-statistics (calculated with White-corrected standard errors) are in parenthesis. **, (*) indicate significance at the one- (five-) per cent level. Coefficients for country and time fixed effects are not reported.

Table 5: Estimates using different measures of aid, FDI, and governance

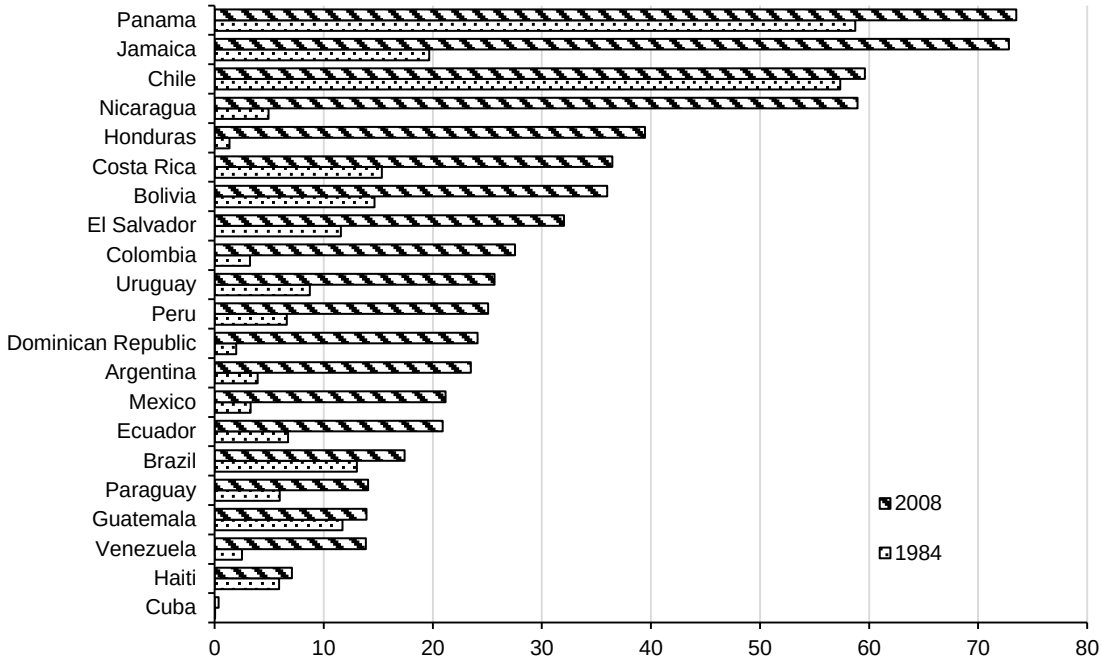
	Alternative measures of FDI		Alternative measures of governance		Additional variable: government ideology
	(1)	(2)	(3)	(4)	(5)
Dependent variable	FDI stocks in % of GDP	FDI (absolute)	FDI in % of GDP	FDI in % of GDP	FDI in % of GDP
Aid variable	Aid in % of GDP	Aid (absolute)	Aid in % of GDP	Aid in % of GDP	Aid in % of GDP
Governance variable	POLITY	POLITY	Civil liberties	Political rights	POLITY
Aidedu	15.144* (2.27)	140.467** (3.80)	3.453* (2.50)	3.430* (2.46)	3.736* (2.41)
Aidother	-0.389 (-1.13)	-3.945 (-1.64)	-0.006 (-0.16)	-0.008 (-0.21)	-0.003 (-0.08)
Trade	0.087 (1.59)	136.256 (0.10)	0.007 (0.51)	0.006 (0.49)	0.013 (0.80)
GDP^{pc}	0.013 (1.59)	1943.061* (2.41)	0.003** (6.75)	0.003** (6.09)	0.005** (3.93)
Governance	-0.003 (-0.58)	162.265 (0.79)	-0.001 (-0.24)	-0.001 (-0.49)	-0.002* (-2.17)
Investment risk	0.004 (0.57)	149.225 (0.30)	0.005** (2.84)	0.005** (2.96)	0.006** (3.77)
Government ideology					-0.004 (-0.52)
No. of observations	81	82	82	82	75
Number of countries	21	21	21	21	20
Adj. R^2	0.82	0.76	0.64	0.65	0.64

t-statistics (calculated with White-corrected standard errors) are in parenthesis. **, (*) indicate significance at the one- (five-) per cent level. Coefficients for country and time fixed effects are not reported.

Table 6: Alternative estimation methods

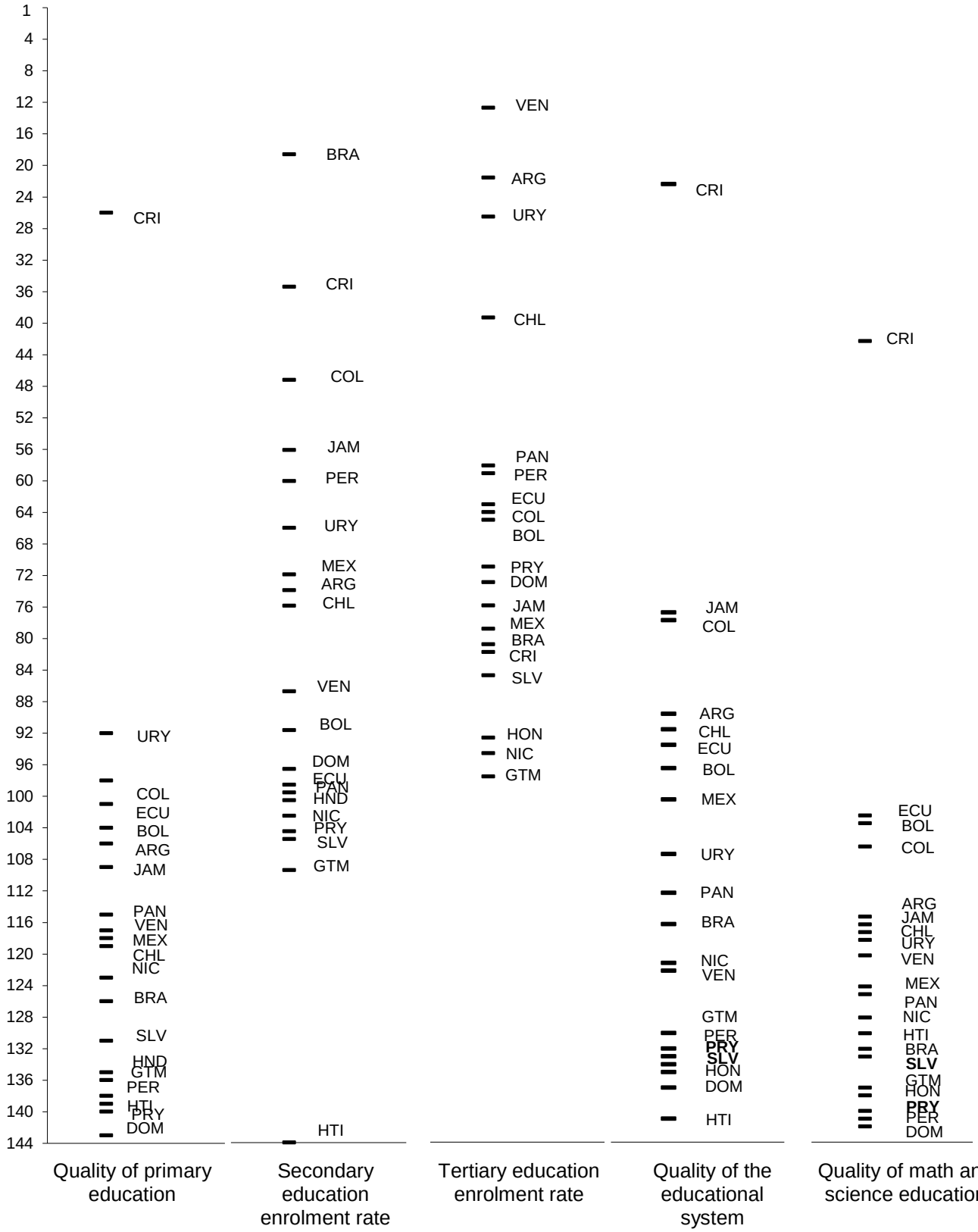
	(1) 2SLS	(2) SYS-GMM
Aidedu	6.577**	3.283**
	(2.79)	(4.35)
Aidother	0.044	-0.029
	(1.60)	(-1.20)
Trade	0.016	0.016*
	(1.26)	(2.04)
GDP^{pc}	0.005**	0.004**
	(14.75)	(2.75)
Governance	-0.002**	0.001
	(-3.46)	(1.36)
Investment risk	0.007**	0.002
	(4.50)	(1.33)
FDI (lagged)		0.326
		(1.25)
Number of observations	81	82
Number of countries	21	21
Adj. R^2	0.640	-
Number of instruments	4	19
1st stage F-statistic (p-value)	0.00	-
Hansen J-statistic (p-value)	0.971	0.632
AR2-test (p-value)	-	0.687

t-statistics (calculated with White-corrected standard errors) are in parenthesis. **, (*) indicate significance at the one- (five-) per cent level. Coefficients for country and time fixed effects are not reported. GMM results are reported for two-step GMM estimator using the finite sample correction proposed by Windmeijer (2005).



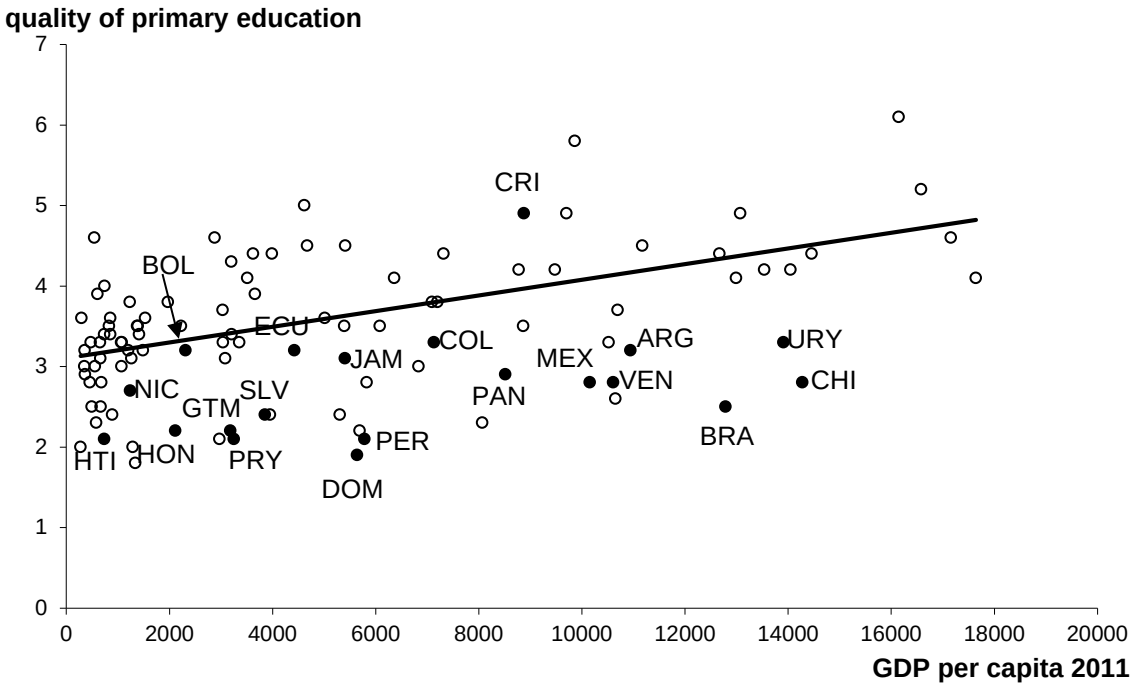
Source: UNCTAD online database

Figure 1: FDI stocks in per cent of GDP, 21 Latin American sample countries, 1984 and 2008



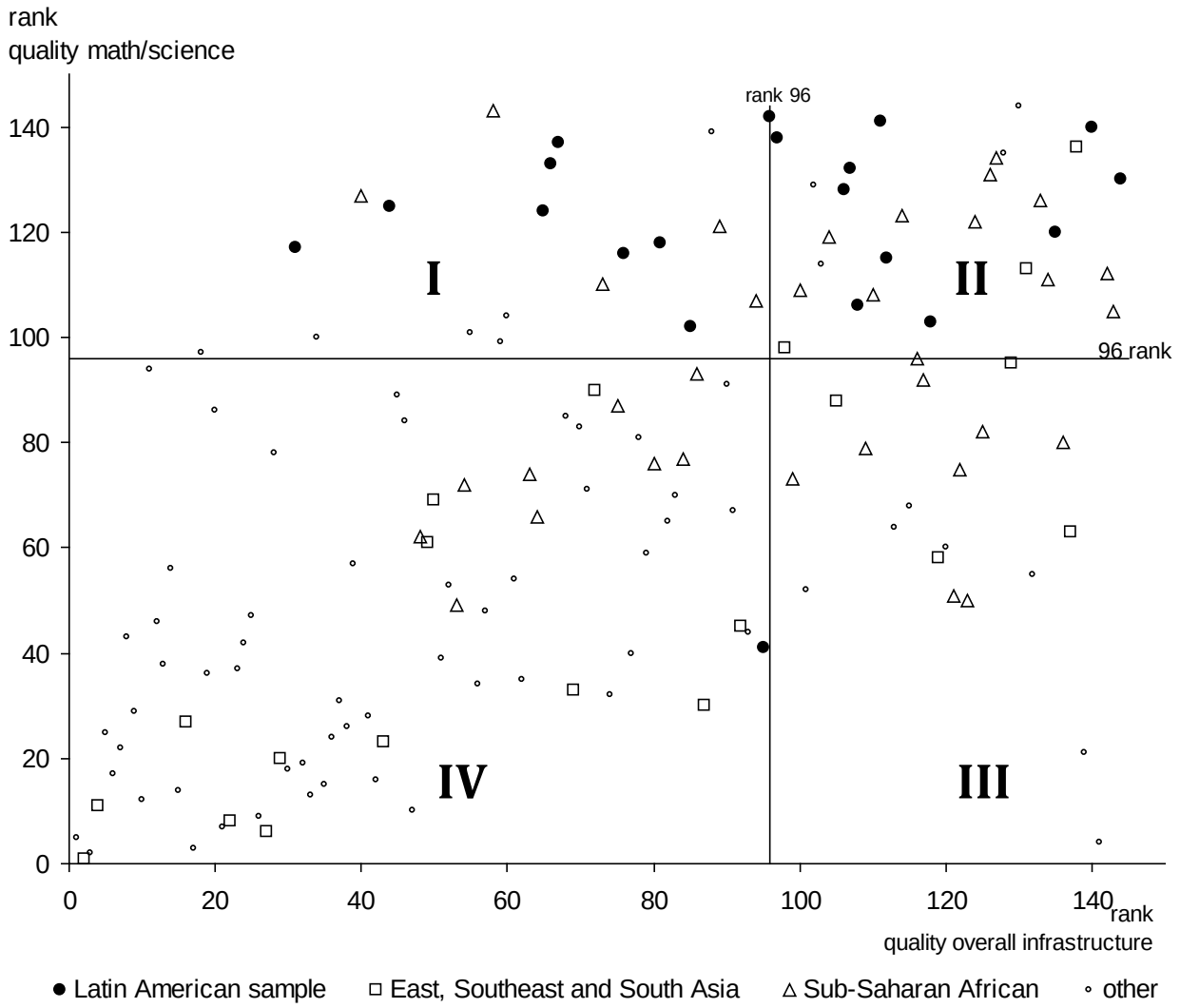
Cuba is missing in the source; Haiti is missing with respect to tertiary enrolment rate.
Source: World Economic Forum (2012)

Figure 2: Ranking of Latin American sample countries with respect to education



Excluding developed countries with GDP per capita higher than 20000$. Cuba excluded due to missing data.
Source: WEF (2012)

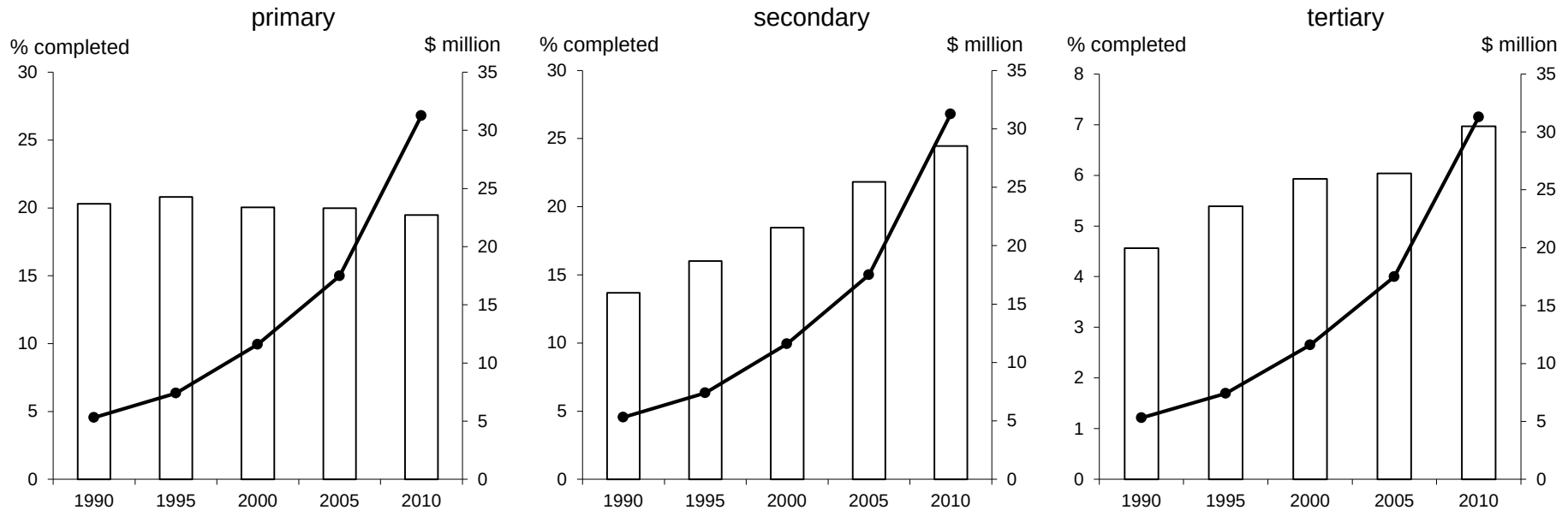
Figure 3: Quality of education and GDP per capita across countries: Position of Latin American sample countries in the 'normal pattern'



Cuba excluded due to missing data.

Source: WEF (2012)

Figure 4: Country rankings with respect to quality of math and science education and the quality of overall physical infrastructure: Position of Latin American sample countries compared to Asia and Sub-Sahara Africa



Solid line gives five-year averages of aid for education, starting with 1984 - 1988 (see text for details); right-hand scale.

Figure 5: Aid for education and highest schooling level attained (% of population age 15 and more that completed schooling levels): Average of 21 Latin American sample countries, 1985 – 2010

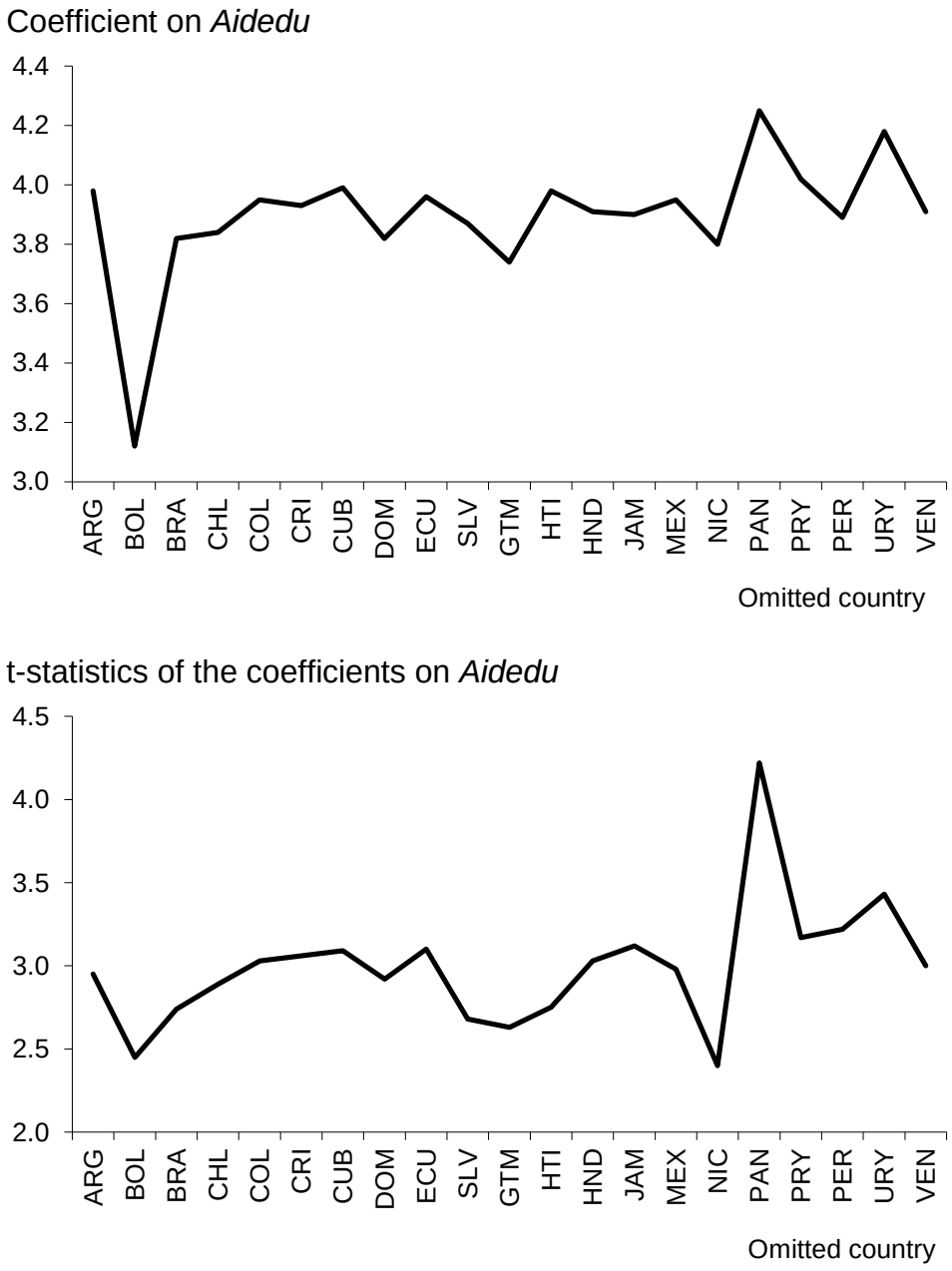


Figure 6: Estimation with single country excluded from the sample

Appendix: Aid data issues

Our empirical analysis is based on sector-specific aid data available from the project-based Creditor Reporting System (CRS) of the OECD's Development Assistance Committee (DAC). Sector-specific aid suffers from underreporting of donors, in particular in the more distant past. Underreporting is most serious with respect to actually disbursed amounts of sector-specific aid. Coverage of disbursements is almost complete only since 2002, whereas it tends to be a small fraction of actual aid disbursements throughout the 1980s and 1990s. Coverage of commitments is generally better than for disbursements, and widely perceived to be satisfactory since the mid-1990s.

In the baseline estimation we use data on aid commitments as reported in the CRS for the 1984-2008 period. This decision can be justified by a careful inspection of the data. In some contrast to the general pattern, underreporting of sector-specific commitments appears to be less serious for our sample of 21 Latin American countries. Figure A1 compares the development of total commitments by all donors to all 21 recipients as reported in the CRS (i.e., the sum of commitments to aid projects in all sectors) with the development of total commitments by all donors to all 21 recipients as given in the aggregate DAC statistics (where underreporting is no major issue). As can be seen, CRS commitments amount to 72 per cent of DAC commitments already in 1984-1989; annual coverage varied in the 1990s, while the average CRS/DAC ratio was again slightly above 70 per cent.

Underreporting in the CRS is commonly assumed to affect all sectors, including education, to essentially the same extent. This implies that underreporting of committed aid for education appears to be less serious for our Latin American sample. A possible explanation is that Japan plays a minor role as a donor in our Latin American sample so that Japanese underreporting is less relevant for the sample underlying our analysis.[39] On the other hand, large Western donors have

[39] For instance, Japan has reported aid in the form of technical cooperation only since 2003 (http://www.aiddata.org/content/index/user-guide/Sources-and-Coverage).

long-standing trade and investment relations with Latin America, which may have the effect that these donors have traditionally reported aid to Latin America more completely to show that aid may also help domestic business.[40]

In contrast to sector-specific commitments, the evidence for our sample corroborates serious underreporting of disbursed aid for education until recently. Strong indications to this effect result from a comparison of the share of disbursements of aid for education (as reported in the CRS) in total aid disbursements in the aggregate DAC statistics with the share of commitments of aid for education (again as reported in the CRS) in total aid commitments in the aggregate DAC statistics. There was a wide gap between these two shares throughout the 1980s and 1990s, pointing to substantial underreporting of sector-specific disbursements. Specifically, disbursed aid for education accounted for an average of just 0.7 per cent of total disbursements in 1984-1999, while committed aid for education accounted for 3.2 per cent of total commitments.[41]

Against this backdrop we pay heed to the warnings of various experts on the risk of using sector-specific disbursements from the CRS for the 1980s and 1990s. In earlier versions of the CRS User's Guide, the OECD's DAC stated explicitly that "most analyses have to be undertaken on a commitment basis" (as quoted in Kimura and Todo, 2010: 494). When assessing "long-term developments and the impact of structural variables, the only alternative is to use the data on aid commitments" (Michaelowa and Weber, 2007: 359). D'Aiglepierre and Wagner (2010: 17) consider it "risky" to "use aid to education data other than commitments." According to Christensen *et al* (2011: 2047), "the poor coverage of disbursement data precludes their use." Mayer (2006: 45) argues along similar lines and even sees an advantage of using commitments which "can have a large signalling role for foreign investors."

[40] It is interesting to note in this context that a relatively large share of aid for education is targeted at post-secondary education in Latin America. Birchler and Michaelowa (2013: 10) argue that tertiary education "may be of direct interest to the donors."

[41] By contrast, the share of disbursed aid for education was even somewhat higher than the share of committed aid for education in the most recent past (8.8% and 7.5%, respectively, in 2000-2008).

Most of the earlier literature on aid for education uses commitment data, including Mayer (2006), Dreher *et al* (2008), Kimura and Todo (2010), D'Aiglepierre and Wagner (2010), and Christensen et al. (2011).[42] We follow this literature in our baseline estimation. At the same time, we use refined measures of aid for education by estimating disbursements along the lines suggested in some previous studies, notably Michaelowa and Weber (2007) and Selaya and Sunesen (2012). While we also experimented with sector-specific disbursements from the CRS (results are available on request), we prefer estimated disbursements adjusted for underreporting in the CRS.

Following Michaelowa and Weber (2007), we combine the CRS data on sector-specific commitments with the aggregate DAC statistics on disbursements as well as commitments to arrive at estimated sector-specific disbursements. Specifically, we draw on the CRS for commitments of aid for education by all donors to recipient *i* in year *t*, $Aidedu_{it}^{com\ CRS}$. These data on commitments are adjusted to mitigate two potential biases: (i) a potential upward bias as commitments tend to exceed actual disbursements to the extent that donors renege on earlier pledges; (ii) a potential downward bias due to underreporting of project-based aid in the CRS.

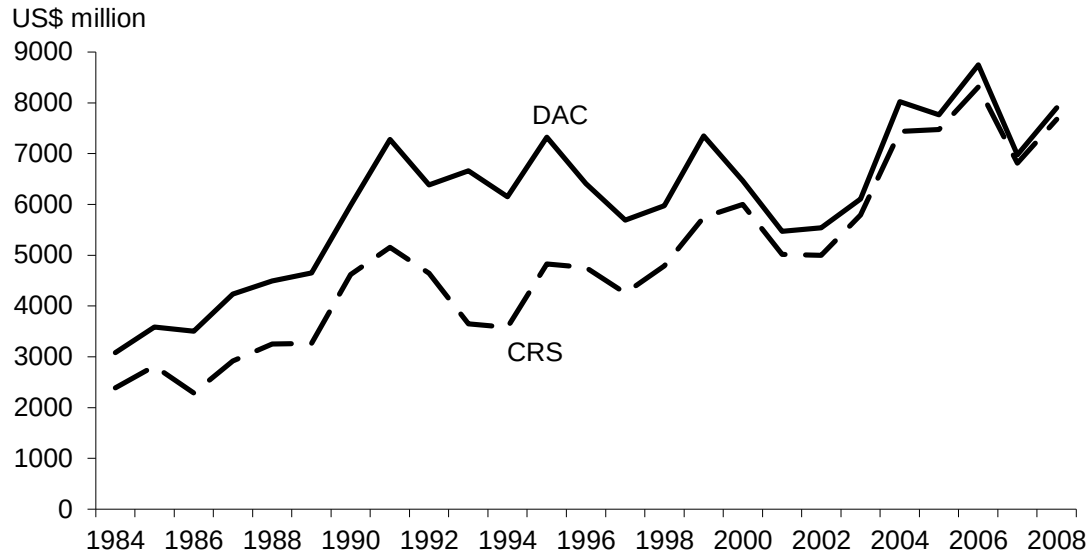
We account for the first bias by multiplying $Aidedu_{it}^{com\ CRS}$

$$Aidedu_{it} = Aidedu_{it}^{com\ CRS} \frac{Aidtot_{it}^{disb\ DAC}}{\Sigma_s\ Aid_{it}^{com\ CRS}}$$

As noted above, Mayer (2006) argues that commitments may better reflect the signaling effects of aid for foreign investors. However, the reporting of project-related commitments in year *t* may bias estimation results when disbursements are subsequently spread over several years *t+1*, *t+2*, etc.[43] It is in several ways that we attempt to mitigate the risk of distorted results. First, we average aid commitments over a relatively long period of five years so that annual peaks of commitments are smoothed over time and are more in line with disbursement patterns.[44] Second, we perform additional estimations by using (estimated) disbursements of aid, instead of committed aid (see above). Third, we assessed the practical relevance of the possible mismatch of commitments and disbursements for our specific case of aid for education in the Latin American sample. Specifically, we compare the volatility of commitments and disbursements of aid for education during the 2001-2008 period (when almost complete reporting of both commitments and disbursements allowed for such a comparison). We would expect commitments to be much more volatile than disbursements if the above noted reporting of commitments was pervasive. Using annual data for these eight years and the 21 sample countries, it turns out that the coefficient of variation (the ratio of the standard deviation to the mean) is just slightly higher for commitments than for disbursements (0.92 versus 0.83). This difference is further reduced if the comparison is based on two-year averages of commitments and disbursements (0.84 versus 0.81).

[43] We owe this point to an anonymous reviewer.

[44] Similarly, Christensen *et al* (2011) account for the delay between commitments and effects on the ground by averaging committed aid over a period of five years.



Source: OECD

Figure A1: Total aid commitments: CRS versus DAC data for the Latin American sample