

Regions and Super-Regions in Economic Development: Global Demarcations in the Impact of Foreign Aid on Foreign Investment

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January 2013

Abstract

Global demarcations exist between development aid and foreign direct investment. Rigorous statistical analysis that contrasts the relative homogeneous and heterogeneous influences of time-series panel data allows regions in the developing world to define themselves endogenously. The results suggest that regions can be classified as either “aid-oriented” or “investment-oriented.” Evidence-based support for international development should appropriately account for these cross-region similarities when developing policies on the incentives for foreign investment and market-based economic growth.

Keywords: foreign aid, foreign direct investment, panel data, cointegration
JEL Classification: F35, C23, O24

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1. Introduction

Economic development is often categorized at aggregations to the country or regional level, with relevant policy and research conducted accordingly. In some core areas, however, certain cross-regional patterns are quite strong relative to trends in other regions. Rigorous statistical analysis that contrasts the relative influences of time-series panel data clusters “super-regions” with otherwise widely varying characteristics. Evidence-based support for international development, as well as appropriate U.S. foreign policy activities, may benefit greatly by accounting appropriately for these cross-regions similarities when developing policies on the incentives for foreign investment and market-based growth.

The basis of analysis for the present paper is foreign aid and foreign direct investment in the context of economic growth in developing countries. Foreign aid, referred to in this paper as official development aid (ODA), has been the subject of significant controversy in recent years in reference to the question of whether aid causes growth.¹ Tangential to this question is whether foreign aid causes foreign direct investment (FDI), with an answer common to both that “it depends.” In some cases the relationship depends on the form of foreign aid, such as the concepts of “digging holes” and “capital flows”, of which the former represents service provision and infrastructure development,² while the latter represents foreign aid intended to spur an enabling environment for growth. As stated explicitly when setting out the identification strategy below, this paper is agnostic as to whether “aid causes growth” or “FDI causes growth.” We are quite vigorous, however, in analyzing whether, how, and when aid might “cause” investment.

¹ Most relevant discussions begin with Easterly (2006), Sachs (2006), and Banerjee and Duflo (2011). See also Burnside and Dollar (2000) and Rajan and Subramanian (2008).

² See Moss (2007)

The results demonstrate that the relationship between ODA and FDI differs substantially among various regions. We conduct a series of granger causality tests that incorporate recent innovations in the analysis of heterogeneous panel data.³ The tests allow for regions and sub-groups to self-identify: that is, the data defines the regions. In this case, the data reveals global demarcations, which we label “aid-oriented” regions, including South Asia, Middle East/North Africa, and sub-Saharan Africa, as compared with “investment-oriented” regions, including East Asia/Pacific, Latin America/Caribbean, and Europe/Central Asia.⁴ Empirical analysis reveals that the impact of ODA on FDI in these different regions appears to exhibit statistical regularities.

The relationship between ODA and FDI identified in this paper has direct relevance to U.S. foreign policy, such that evidence-based support for international development can appropriately account for these cross-region similarities when developing policies on the incentives for foreign investment. The 2002 National Security Strategy, facing the altered foreign policy landscape of the early 2000’s, implicitly elevated development alongside defense and diplomacy as the “Three D’s” of U.S. foreign policy, and ensuing documentation has held economic growth as a key component of U.S. engagement with the developing world.⁵ The September 2010 Presidential Policy Directive on Global Development sets forth sustainable, broad-based economic growth as a key objective, defined as “growth that includes all major income groups, ethnic groups and women, and that significantly reduces poverty.” The First Quadrennial Diplomacy and Development Review (2010) refers specifically to broad-based growth, which “creates opportunities for people to lift

³ Hurlin and Venet (2001), Hurlin (2005), Hood, Kidd and Morris (2008), Fowowe (2011).

⁴ For purposes of exposition, the regions will often be referred to by their acronyms: East Asia/Pacific (EAP), Europe/Central Asia (ECA), Latin America/Caribbean (LAC), Middle East/North Africa (MENA), South Asia (SAS), and sub-Saharan Africa (SSA).

⁵ See the USAID (2004) White Paper, “U.S. Foreign Aid: Meeting the Challenges of the 21st Century.”

themselves, their families, and their societies out of poverty, away from violent extremism and instability, and toward a more prosperous future.”

The Initiative for Global Development (2010) presents the U.S. business case for aid reform in the context of FDI and the private sector’s interest in the developing world. They claim foreign aid is the United States’ primary investment in good governance, calling it a “catalytic” investment that encourages private sector flows. An implication would be that ODA helps stimulate the conditions that lead to increased FDI flows. One example in which aid, investment, and growth are manifested in U.S. foreign policy is the Presidential initiative “Partnership for Growth” in which economic growth becomes a top bilateral priority and the primary U.S. development objective of selected countries.⁶

For the purposes of the paper, we take ODA to be official development assistance defined by the OECD as the “flows of official financing administered with the promotion of the economic development and welfare of developing countries as the main objective, and which are concessional in character with a grant element of at least 25 percent (using a fixed 10 percent rate of discount).”⁷ We define FDI as net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.⁸ As our focus is on capital flows to the developing world, for expedition we refer herein specifically to FDI flows to lower and middle income countries as defined by the World Bank.

This paper is not directly concerned with “aid effectiveness”, nor does it address popular, controversial questions about whether “aid causes growth” or even if “FDI causes

⁶ <http://www.state.gov/r/pa/prs/ps/2011/11/177887.htm>

⁷ <http://stats.oecd.org/glossary/detail.asp?ID=6043>

⁸ It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. See: <http://devdata.worldbank.org/query/default.htm>

growth.” We ask the specific statistical question whether ODA “granger-causes” FDI, a concept defined in the empirical section below and based on techniques developed by Hurlin and Venet (2001).⁹ The literature review in Section 2 therefore places this question in a more general context of whether foreign aid and foreign direct investment are substitutes or complements, with a review both of the status of public and private capital flows into sub-Saharan Africa and relevant investigations using panel data techniques.

Section 3 outlines the identification strategy and clarifies the underlying identifying assumptions. The empirical analysis begins in Section 4 with a comparison of ODA and FDI trends across regions, with a conscious focus on Africa given the continued dominance of public investment by donor agencies on the continent. Moss (2007) describes in detail the types of capital flows into Africa, showing that it remains dominated by public investments such as official development assistance. He cites African FDI as rising modestly over time while also shrinking in global share with both a country and sector concentration. These first two trends are confirmed in our analysis below, with the latter investigated in companion papers.

The data analysis in Section 4 demonstrates, however, that Africa is not necessarily unique in its dependence on public capital flows. Basic statistical correlations suggest similar relationships in Middle East/North Africa and South Asia that may be more similar than different to those of sub-Saharan Africa. We therefore refer to these three regions as “aid-oriented.”

⁹ Economists/statisticians are unlikely to ever claim that one phenomenon *causes* another phenomenon; rather, we make *causal inferences*. Granger causality is a specific inference about causality: If past elements/lagged terms of y provide a sufficient amount of information that can explain (or predict) current levels of x , then we can say y “granger-causes” x .

Section 5 subjects these statistical indicators to rigorous econometric analysis. Arellano (2003) provides a comprehensive description of the value in exploring heterogeneity across different time-series panels, which for present purposes we aggregate to regions of countries. By implementing unit root and cointegration tests at the regional level, we find preliminary support for the hypothesis that MENA, SAS, and SSA exhibit distinct characteristics among the relationships of their ODA and FDI flows.

The analysis continues with a test of granger-causality in heterogeneous panel data using a three-step procedure described in detail below. We chose this procedure to examine the null hypothesis of aid-oriented regions because of the stated feature that the aggregate data sets can define themselves. That is, rather than testing an initial null hypothesis that MENA, SAS, and SSA are more similar than they are different, we test all six developing regions separately. As the data categorizes commonalities, the procedure allows for the classification of relevant “super-regions.”

Section 6 concludes with a review of the results, which support the initial statistical review that draws the global demarcation in the relationship of foreign aid and foreign direct investment between aid-oriented and investment-oriented regions. The concluding remarks also provide suggestions for future research and the more challenging question of why these patterns exist.

2. Literature Review

One prominent strand of the relevant literature suggests that foreign aid is most effective in “good policy environments.”¹⁰ Alesina and Dollar (2000) find that ODA responds to political variables, such as rule of law, while FDI responds to good economic

¹⁰ See, among others, Burnside and Dollar (2000), Hansen and Tarp (2001), Dalgaard and Hansen (2001), Collier and Dollar (2002), Easterly (2003), Easterly, Levine, and Roodman (2004), and Collier and Hoeffler (2004).

policy, but no statistical evidence that a mutual dependence between FDI and ODA exists. The strategic considerations accompanying aid allocations do not appear to impact FDI. Private capital flows go to relatively higher income countries, which Alesina and Dollar conclude is due to their market size. Presumably, therefore, even with good rule of law and sound economic policies, low-income countries cannot expect to receive FDI.

Asiedu and Villamil (2002) suggest that foreign direct investment could be a substitute for development aid, in that private capital flows could substitute completely for multilateral development assistance¹¹, while ODA can also be a complement to FDI by affecting incentives for investment. As we show below, in many parts of the world FDI has not just “substituted” for ODA, but has very dramatically overtaken it as a source of capital flows. Foreign direct investment and ODA themselves may not be complements, but ODA can have an indirect impact on FDI by improving factors that encourage FDI, such as contract enforcement infrastructure development and human capital. As Bruner and Oxoby (2009) state, “in order to determine if foreign aid can buy growth, it must first be established under what circumstances can foreign aid yield investment.”

¹¹ Citing Rodrik (1995).

Asiedu (2002) asks, “Is Africa Different?” and investigates whether drivers of FDI in the developing countries may not have similar force in sub-Saharan Africa. In an analysis of developing countries outside of Africa, she finds that higher returns on investment and better infrastructure positively impact FDI, but these variables have no statistically valid impact in sub-Saharan African countries.¹² Moreover, openness to trade, as defined by the ratio of total trade to GDP, promotes FDI in all developing countries, but has a significantly smaller marginal impact in sub-Saharan Africa. She concludes that, on this metric, Africa is different, and suggests that effective policies elsewhere may not be effective there.

Asiedu, Jin, and Nandwa (2009) demonstrate in an empirical analysis that ODA can mitigate the negative impact of country risk on inward FDI, but estimate that the amount of ODA would need to double (an “implausibly high” level) for ODA to completely offset risks based on contract modifications, restrictions on profit repatriation, and payment delays. The required level of ODA is equivalent, whether bilateral or multilateral.

Bruner and Oxoby (2009) analyze the role of property right institutions, finding that deficient institutions impair the ability for ODA to stimulate investment. They identify two constraints to the ODA/investment link: the return on investment may be too low, or an appropriation problem may exist.

Selaya and Sunesen (2008) find that ODA in the form of physical capital can substitute for FDI by crowding out investment, while ODA in the form of complementary inputs, such as public infrastructure projects and human capital investment, can raise the marginal productivity of capital. In similar fashion, in an investigation of ODA and FDI specific to South Asia, Bhavan, Xu, and Zhong (2011) divide ODA into whether it is

¹² Note that Asiedu (2002)’s measures infrastructure by the number of telephones per 1,000 people, which may no longer be a reliable indicator. She points out that infrastructure might not be as relevant for resource-based FDI, which is common to sub-Saharan Africa.

assistance for production sectors (physical capital development) or economic infrastructure and humanitarian aid (human capital/infrastructure). Both types of ODA are shown to attract FDI.

Karakaplan, Neyapti, and Sayek (2005) investigate the hypothesis that countries receiving ODA create direct or indirect (signaling) effects in an economy that attracts FDI. Their results suggest that ODA and FDI flow together in the presence of good governance and financial market development. In a side point, Karakaplan, Neyapti, and Sayek provide a control for sub-Saharan Africa in their regressions, and find that relatively *higher* GDP per capita appears to be related to *less* FDI in Africa. We discuss the implications below with specific attention to whether Africa is, indeed, different.

Bezuidenhout (2009) uses panel estimates on Southern Africa to find a negative relationship between FDI and growth, but no statistical relationship between ODA and growth; he does not compare the relationship between ODA and FDI.

Kapfer, Nielson, and Nielson (2007) specifically address the role of ODA in developing infrastructure that attracts FDI to developing countries. They show that ODA appears to have no direct impact on FDI, but ODA allocated to specific sectors of infrastructure has a positive impact on infrastructure, which in turn has a positive impact on FDI. According to Kapfer, Nielson, and Nielson, infrastructure, such as better network for communication, transportation, and energy can be “special” due to its public good quality that mitigates misuse of development funds (rich and poor alike can benefit from infrastructure projects) as well as its easily observable outputs (compared to measuring the effects of education, health, or economic policy.) They use 51 developing countries in their data set, and while they do not disaggregate by region, the sample includes nine countries from sub-Saharan Africa. They also discuss “harmful surges of FDI” in the context

in sub-Saharan Africa, creating a possible catch-22: ODA develops infrastructure which encourages extractive FDI that has “serious negative effects on overall wealth”; a more optimistic picture considers the possibility that ODA focused on infrastructure raises general human development.

3. Identification

Implicit in the question “does ODA facilitate FDI?” is one-way causality: the question “does FDI encourage ODA?” may only have credibility in the scenario in which a multinational firm incentivizes a donor agency to increase its assistance to a particular country or region. Conditions on “good environments” related to ODA and FDI, however, require the consideration of particular identifying assumptions. Substantial volumes of ODA are transferred to countries with the worst economic conditions, so the data may interpret the correlation between bad economies and rising ODA to say that foreign aid *caused* the bad conditions. As Rodrik (2005) argues, the endogeneity of policy fundamentally affects policy/growth regressions, and consequently regressing “growth” on “policy” provides information about neither the effectiveness of policy nor the motives of government.¹³ Clemens, Radelet, Bhavnani, and Bazzi (2012) recognize the problem that aid often flows into countries specifically because of poor economic conditions or bad policy environments, such that aid classified as “emergency” and “humanitarian” may have an expected negative correlation with growth.

Foreign direct investment, however, has been shown to go to good economic environments. Alesina and Dollar (2000) identify political and economic determinants of

¹³ Rodrik (2005) points out that endogeneity discussions have focused on “outcome” variables, such as investment, which are jointly determined (or caused by) incomes.

ODA and FDI. They find that ODA responds more to political variables, such as democratization, while FDI responds to economic incentives, which include good policy environments, trade liberalization, and property right protection. Asiedu, Jin, and Nandwa (2009) discuss how FDI and ODA might be jointly determined by general conditions in the country. Foreign assistance might be provided by altruism or for strategic reasons, with the former including: lowering poverty; helping a country meet its debt obligations; or restoring internal balance in a country. They find that the multilateral and bilateral donors are both interested in helping reduce poverty or heavily indebted countries, but bilateral aid is not as well motivated on macroeconomic instability as on multilateral aid.

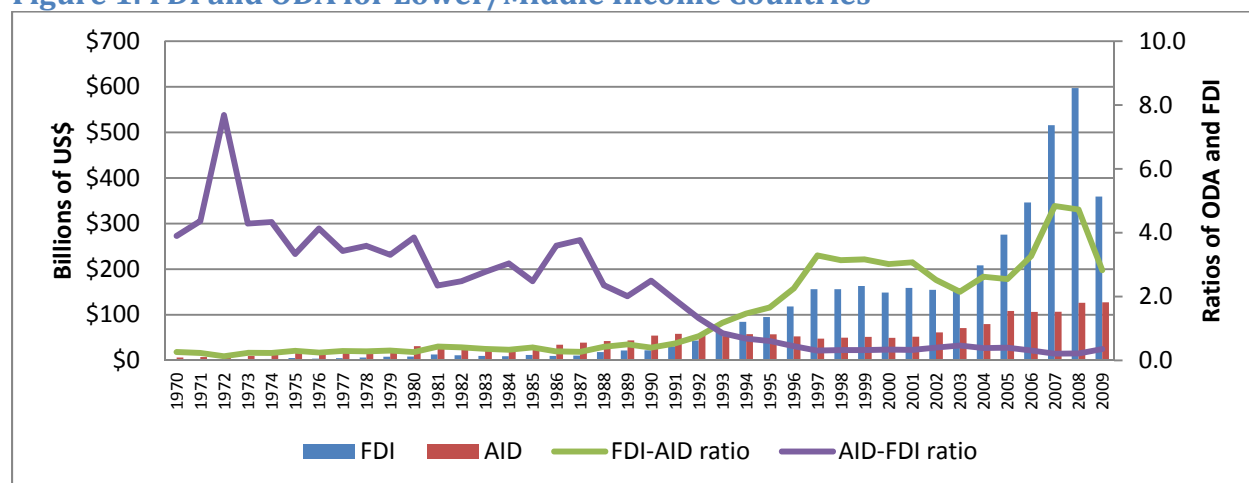
For a proper econometric specification, the key identifying assumption is that FDI may respond to policy environments but does not, itself, “create” a good policy environment. We further assume that FDI does not “cause” ODA, although remain open to the possibility of multinational firms affecting domestic political economy decisions. The analysis herein remains agnostic as to whether ODA or FDI can “cause” GDP growth.

4. Data

Data was collected on GDP, FDI, and ODA in both current and constant (2008) US dollars for developing countries in the six regions of: East Asia/Pacific (EAP), Europe/Central Asia (ECA), Latin America/Caribbean (LAC), Middle East/North Africa (MENA), South Asia (SAS), and sub-Saharan Africa (SSA). The regions are defined according to the World Bank’s data classification. Table A-1 in the Appendix provides a list of each region.

Figure 1 compares FDI to ODA for lower and middle income countries and shows that since 1990, FDI to developing countries has been increasing at a much faster rate than has ODA. Until 1992, these countries received more inflows of development aid than investment, but since then inward FDI has dominated ODA flows to the developing world. In 1990, about \$22 billion dollars in FDI flowed to lower and middle income countries, compared to about \$58 billion in official development assistance, and during that time ODA had been about two to four times the size of FDI flows since 1970. After 1990, however, the amount of FDI to developing countries grew over 26 times to \$597 billion in 2008, before dropping off to \$359 billion in 2009. At the same time, ODA simply doubled to \$126 billion in 2008, rising again to \$127 billion in 2009.¹⁴ The ratios have reversed, and now FDI to the developing world is two to four times the size of ODA flows. Such contrasting trends call into question whether the now-swamped ODA flows can “cause” such a massive FDI surge. An alternative hypothesis might argue that the ODA prior to 1990 “set up” the necessary conditions for subsequent FDI flows.

Figure 1: FDI and ODA for Lower/Middle Income Countries

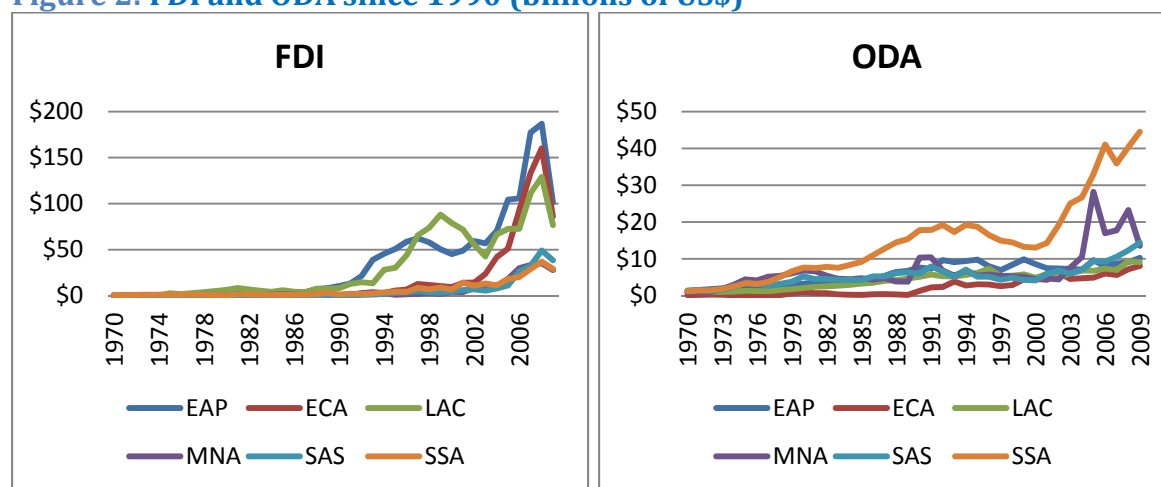


Source: World Development Indicators

¹⁴ These are in current US dollars. In constant (2008) US dollars, ODA rose from \$84 billion in 1990 to \$130 billion in 2009, less than doubling in size.

As shown in Figure 2, FDI flows to different regions appear to be more correlated than similar ODA flows. FDI tends to move in synch across regions to a greater extent than ODA in a manner that suggests FDI is determined more by market forces and ODA by relatively non-economic concerns. FDI is also more volatile than ODA, as the coefficients of variation¹⁵ in Figure 1 are 1.43 for FDI and 0.67 for ODA. Development assistance flows, unlike FDI, did not fall with the recession, and in fact rose in every region but Middle East/North Africa. Note also the substantial difference in scale: Sub-Saharan Africa and Middle East/North Africa receive far more ODA relative to FDI than the other regions. As Asiedu, Jin, and Nandwa (2009) point out, determinants of FDI in sub-Saharan Africa may be different than in other regions.

Figure 2: FDI and ODA since 1990 (billions of US\$)



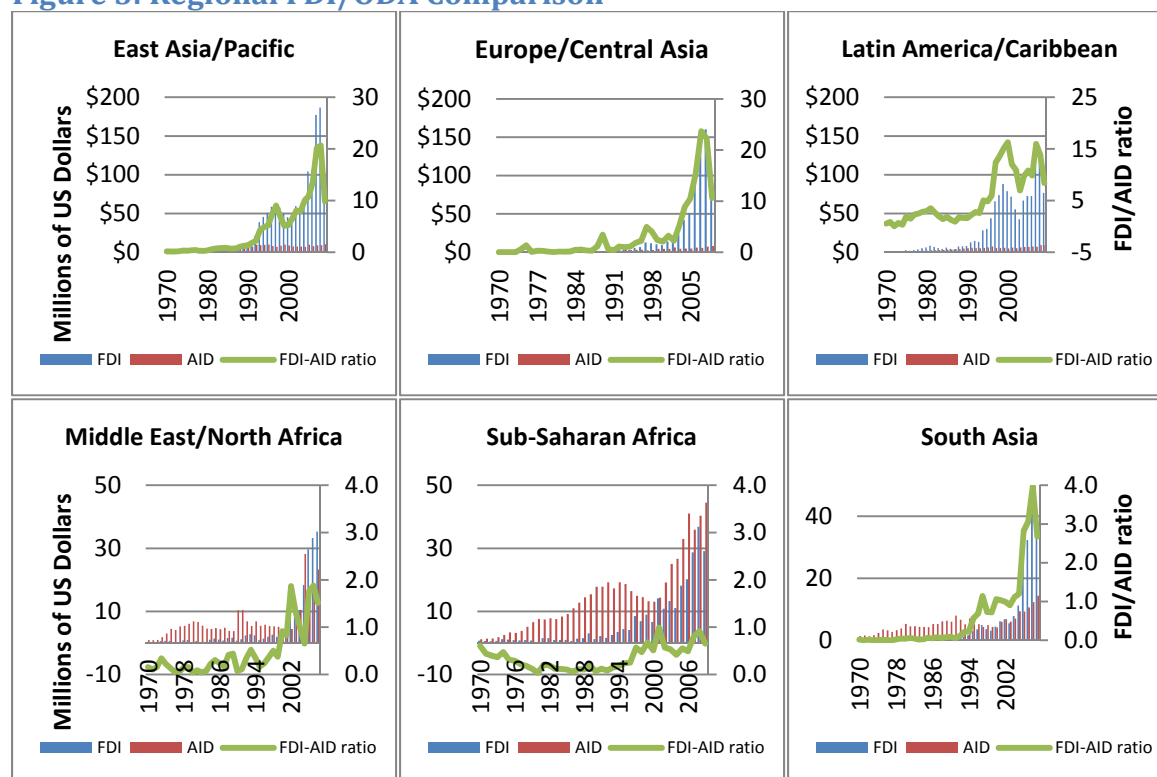
Source: World Development Indicators

Figure 3 disaggregates the data on FDI and ODA flows into specific regions. Note the dramatic difference in scales between the two rows of diagrams. For the top row, FDI flows approached \$200 million in the late 2000's, while the bottom row never topped \$50

¹⁵ The coefficient of variation is a normalized measure of probability distribution, the standard deviation divided by the mean.

million. Moreover, the FDI/ODA ratio for the first set of regions (investment-oriented) approaches 25, while the same ratio for the second set (aid-oriented) never tops 4.0.

Figure 3: Regional FDI/ODA Comparison



Source: World Development Indicators

One implication could be that FDI moves in synch for the investment-oriented regions, while ODA does so for aid-oriented regions. Table 1 provides some scattered support for these predictions, showing that correlations across regions are much stronger for FDI than for ODA but with no obviously discernible pattern.

Table 1: Correlations FDI_ODA by region

	FDI						ODA					
	EAP	ECA	LAC	MNA	SAS	SSA	EAP	ECA	LAC	MNA	SAS	SSA
EAP	1	0.93	0.92	0.91	0.89	0.95	1	0.79	0.92	0.54	0.73	0.79
ECA	0.93	1	0.79	0.98	0.97	0.95	0.79	1	0.87	0.65	0.79	0.88
LAC	0.92	0.79	1	0.77	0.78	0.88	0.92	0.87	1	0.67	0.86	0.92
MNA	0.91	0.98	0.77	1	0.96	0.95	0.54	0.65	0.67	1	0.80	0.82
SAS	0.89	0.97	0.78	0.96	1	0.96	0.73	0.79	0.86	0.80	1	0.94
SSA	0.95	0.95	0.88	0.95	0.96	1	0.79	0.88	0.92	0.82	0.94	1

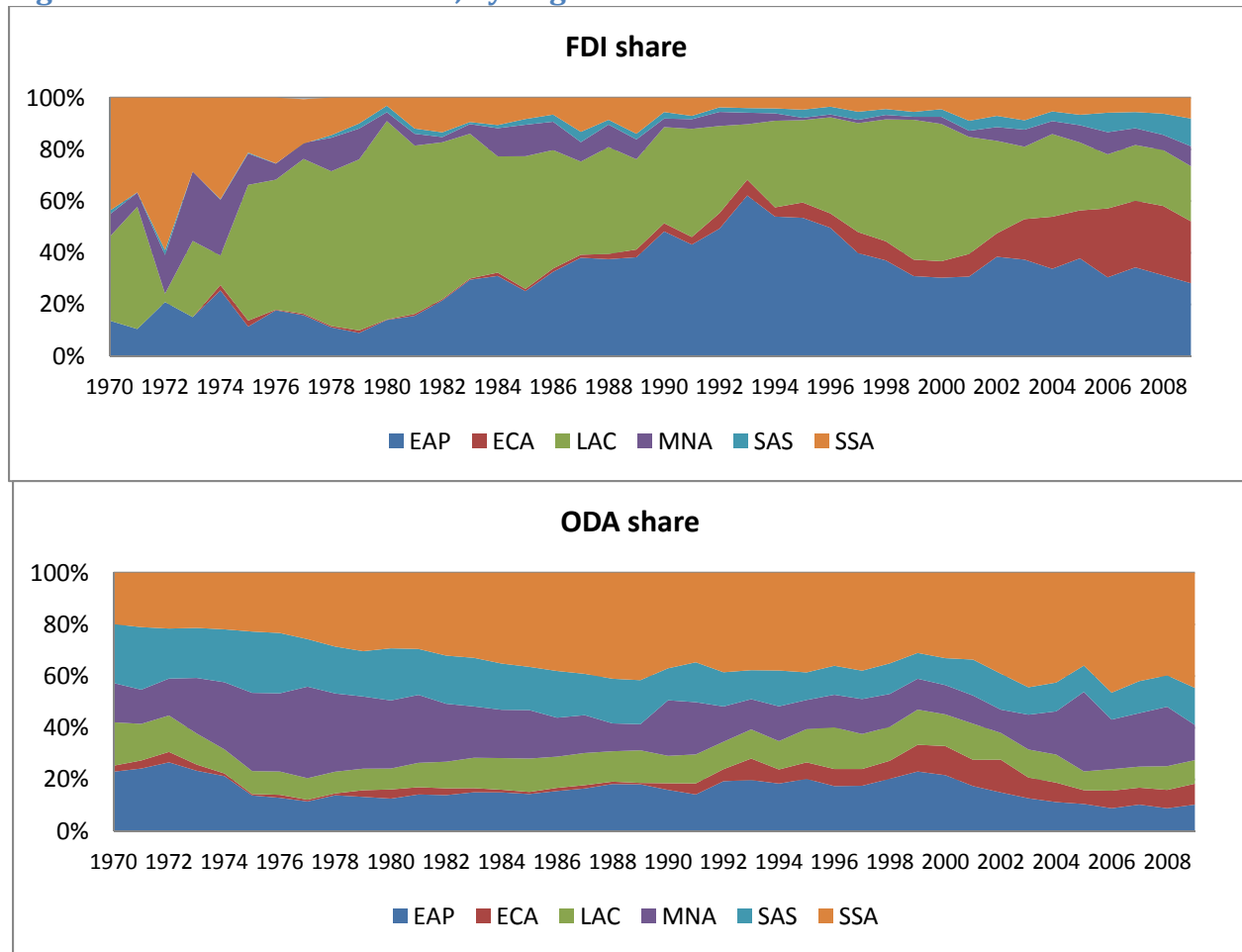
Source: Author's Calculations

By this reckoning, a global demarcation be drawn among regions in the developing world. As shown in Figure 2 above, over the past 40 years, and into 2009, sub-Saharan Africa received the lowest amount of inward FDI while receiving the highest amount of total official development assistance. The FDI flows are driven by multiple factors, including market size, natural resources and political uncertainty.¹⁶

Figure 4 displays the share of FDI and ODA by region from 1970 to 2009. The three investment-oriented regions show an increasing share of FDI, from a total of 46.2% in 1970 to 73.5% in 2009. Conversely, the share of ODA for the aid-oriented regions increased from 57.9% in 1970 to 72.5% in 2009. Note that in 1970, sub-Saharan Africa had a relatively large share of FDI (43.7%) that disappeared to single digits by 1980, but with a share of ODA that has increased consistently over the past four decades.

¹⁶ UNCTAD (2011) shows that eight of the ten largest greenfield FDI projects in least-developed countries were in “coal, oil, and natural gas” and another was in “metals.” Five of the ten largest acquisitions in LDCs were in “crude petroleum and natural gas” with another in “ferroalloy ores, except vanadium.”

Figure 4: Share of FDI and ODA, by Region



Source: World Development Indicators

Table 2 displays the correlations of FDI and ODA share for these six regions, along with 2009 GDP shares, and 2009 GDP per capita. The three investment-oriented regions have the lowest correlations between FDI share and ODA share, the lowest shares of GDP, as well as – by slim margins – the highest GDP per capita. We conclude that this first glance at the data suggests a simple, but non-trivial pattern: foreign direct investment follows wealth, while foreign aid does not.

Table 2: FDI and ODA Share Correlations

	FDI/ODA share correlation	2009 GDP shares	2009 GDP per capita
East Asia/Pacific	0.690	38.1%	\$ 3,269
Europe/Central Asia	0.743	15.5%	\$ 6,412
Latin America/Caribbean	0.802	24.1%	\$ 7,019
Middle East/ North Africa	0.822	6.4%	\$ 3,211
South Asia	0.822	5.7%	\$ 1,085
Sub-Saharan Africa	0.872	10.2%	\$ 1,127

Source: World Development Indicators

5. Panel cointegration and causality tests

Recent innovations in the statistical analysis of longitudinal panel data allow for tests of regional variations in the impact of development on foreign direct investment. The nature of country or regional data over time allows for differing relationships among the different units, but empirical analysis may reveal patterns of commonalities. For example, although Canada and the United States are separate political entities, information about one country can often help predict information about the other. Sometimes, Australia may prove a better predictor of information about Canada than the United States, while there may be situations in which nothing can predict Canadian responses except information about Canada itself. The tests employed in this section help identify the extent that different regions may provide information with regard to the relationship between ODA and FDI.

The analysis includes recurring references to “homogeneous” and “heterogeneous” behavior in the panel data. If a result indicates homogeneous behavior, then all members of a given panel are shown to respond in the same fashion. For example, Canada, Australia, and the United States are likely to respond in a homogeneous fashion to higher oil prices.

Heterogeneous responses help identify how groups respond in conjunction. Canada may exhibit similar responses to the United States for severe weather patterns (or hockey playoff results) independent of activities in Australia, but prove more similar to Australia than the United States following, say, shocks to the British pound.

The results suggest that aid-oriented regions exhibit clear differences in comparison to investment-oriented regions; with regard to the statistical relationship between ODA and FDI, these regions are more similar than they are different.

5.1 Regional unit root and cointegration tests

We begin by considering the stationarity of the ODA and FDI time series, and whether they may prove co-integrated. A non-stationary time series is one that contains a “unit root”, in the sense that external shocks have persistent effects – that is, in the equation $y_{it} = \alpha_{it} + \beta_{it}X_{it} + \rho_i y_{i,t-1} + \varepsilon_{it}$, the parameter $|\rho_i|=1$. Something that affects last year’s resultant will also affect this year’s resultant and, by extension, next year’s resultant. If $|\rho_i|<1$, then the shock will dissipate. As discussed in Banerjee, et al. (1993), the short run impacts of the disturbance have no tendency to grow systematically over time.

We incorporate unit root tests for heterogeneous panel models as introduced by Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003). The key insight allows for the consideration whether any of the specific series within the panel are stationary, while also analyzing if the homogeneous series is itself stationary. Table 3 shows the results of the Levin, Lin, and Chu (“LLC”) unit root tests, including a comparison for the inclusion of a trend.¹⁷ FDI and ODA refer to the variables in levels, while delta-FDI and delta-ODA are first-differences. Without including a trend, the null of non-stationarity cannot be rejected

¹⁷ All analysis in this section was conducted in Stata 11.

for either FDI and ODA, nor for delta-FDI. The null hypothesis can be rejected for delta-ODA. These results suggest that ODA is integrated of order one, $I(1)$, while FDI is $I(2)$ or higher. With a trend, however, we can reject the null hypothesis of non-stationarity for FDI: it appears that, according to LLC, the non-stationarity of FDI can be removed by de-trending the data. ODA, however, continues to appear $I(1)$ even with de-trending.

Table 3: Unit Root Analysis for Regional Data

	Ho: Variables are non-stationary ($\rho=1$) (6 regions by 36 years)					
	LLC			LLC w/trend		
	test statistic	p-value	Decision	test statistic	p-value	Decision
FDI	1.224	0.890	Do not reject	-2.005	0.023	Reject
deltaFDI	1.177	0.880	Do not reject	5.418	1.000	Do not reject
ODA	3.794	1.000	Do not reject	2.805	0.998	Do not reject
deltaODA	-5.368	0.000	Reject	-4.562	0.000	Reject

If both series are non-stationary, then we consider the possibility of cointegration and the introduction of an error-correction mechanism in the analysis. If two series are co-integrated, then the shocks to one series will persist in the other, and the partial difference would be stable around a fixed mean. In this case the series are drifting together (“correcting”) at roughly the same rate; the error correction mechanism preserves information about both forms of covariation.¹⁸ We use the panel cointegration tests of Pedroni (1999) and Westerlund (2007), which account for a potential integrated relationship for cross-sectional panels. Persyn and Westerlund (2008) offer the Stata code “xtwest” for the latter, which we thus incorporate below.

Table 4 shows the results, in which the null hypothesis of no cointegration can be rejected for the panel statistics. The group statistics estimate whether the panel is

¹⁸ Murray (1994) has famously illustrated this concept through the story of “the drunk and her dog”, in which a drunkard stumbles out of a bar into a statistical random walk. Her dog would normally follow a random walk as well, but instead is drawn by the error-correction mechanism of its master’s voice, and the drunkard is in turn drawn to the barking of the dog. The two series are then statistically co-integrated.

integrated as a whole, while the panel statistics estimate whether at least one element is cointegrated. As the p-value approaches 0.000, the more likely we are able to reject the hypothesis that the series are not cointegrated. By this estimate, then, the panel is not integrated as a whole, but individual elements may be. It would appear that the regional series might be cointegrated indicating that a long run relationship between ODA and FDI exists for *some* regions, but not in the aggregate.

Table 4: Regional Cointegration Tests¹⁹

		Results for Ho: No Cointegration					
		xtwest w/trend			xtwest w/out trend		
Statistics		Coeff.	p-value	Decision	Coeff.	p-value	Decision
Group Statistics	Gt	-1.291	0.999	Do not reject	0.083	1.000	Do not reject
	Ga	-7.289	0.955	Do not reject	0.619	1.000	Do not reject
Panel Statistics	Pt	-10.277	0.000	Reject	-2.659	0.827	Do not reject
	Pa	-40.145	0.000	Reject	-6.31	0.148	Reject

Table 5 provides results from a cointegration test for individual regions. The three regions that reject the null of no cointegration are Europe/Central Asia, Middle East/North Africa, and sub-Saharan Africa, which also happen to be the proposed aid-oriented regions.

Table 5: Individual Region Cointegration tests

H ₀ : FDI and ODA are not cointegrated		
Region	Test Statistic	Decision
East Asia/Pacific	11.02	No not reject
Europe/Central Asia	30.14**	Reject
Latin America/Caribbean	6.35	Do not reject
Middle East/North Africa	24.52**	Reject
South Asia	8.50	Do not reject
Sub-Saharan Africa	18.59**	Reject
**significant at 95%		

¹⁹ The test statistic incorporates three lags.

5.2 Regional causality tests

A useful test of granger-causality for panel data has been introduced by Hurlin and Venet (2001) and Hurlin (2005). Hood, Kidd, and Morris (2008) used the test to investigate political party developments in the American South and by Fowowe (2011) on the relationship between financial development and economic growth in sub-Saharan Africa. The basic concept involves a four-step procedure to identify the presence of “homogeneous” causality, in which the independent variables on whole may granger-cause the dependent variables, or “heterogeneous” causality, in which individual elements are assessed regarding the presence of granger-causality. The Hurlin and Venet methodology incorporates information from the entire panel for the assessment of individual patterns and develops F test statistics based on specific restrictions (see Appendix for details.)

The basic process involves three specific tests.

Test I: Homogeneous Non-Causality (F_I). This procedure tests against the null hypothesis that ODA does not cause FDI in any manner within the panel. If this hypothesis cannot be rejected then the analysis of the two time series can be safely concluded on this point. If F_I suggests evidence to reject the null, then Test II provides further investigation into the nature of potential statistical causality in the panel data.

Test II: Homogeneous Causality (F_{II}). This test is built around the hypothesis that ODA causes FDI in a homogeneous fashion throughout the panel. If this hypothesis cannot be rejected, then we can safely conclude that ODA “granger-causes” FDI in a homogenous fashion across countries. Evidence to reject the null for F_{II} suggests heterogeneity in the statistical relationship among members of the panel.

Test III: Heterogeneous Non-Causality (F_{III}). This test analyzes the causality of individual panel members, based on information from the full panel of data. As F_I indicates the existence of some kind of granger causality, and F_{II} indicates that the statistical causality is heterogeneous, then F_{III} tests against the null hypothesis that ODA does not “cause” FDI for specific members of the panel.

Hood, Kidd, and Morris (2008) demonstrate that individual panel members can then be aggregated into an analysis to see if a particular subset might represent granger-causality, which we use to analyze the question of investment vs. aid-oriented regions. A real virtue of this test is that it allows for regions and sub-groups to self-identify: that is, the data defines the regions. For example, Hood et al. investigated whether the direction of “granger-causality” in the post-Reconstruction American South between black mobilization and Republican Party development. The data demonstrated clear patterns, with the “Deep South” plus North Carolina emerging with a different relationship than other southern states.

For the present model, Table 6 opens with the first two tests of the Hurlin approach: homogeneous non-causality and homogeneous causality. For Test I, the null hypothesis that ODA does not granger-cause FDI can be rejected for up to two lags in the data. These results suggest that, on the whole, there is no homogeneous non-causality between ODA and FDI. Therefore, there exists causality for at least one member of the panel. Test II investigates whether this relationship holds for the panel as a whole; specifically does a homogeneous causality flow from ODA to FDI? The results suggest that it does not, with homogeneous causality rejected for, again, two lags.

Table 6: Regional Homogeneous Causality and Non-Causality

Test I: Homogeneous Non-Causality			Test II: Homogeneous Causality		
Ho: ODA does not granger-cause FDI			Ho: ODA granger-causes FDI		
Lags	F_I	Decision	Lags	F_{II}	Decision
1	1.6463	Reject	1	1.1943	Reject
2	1.4129	Reject	2	1.0738	Reject
3	0.9878	Do Not Reject	3	0.8049	Do Not Reject

Test III then tests for heterogeneous non-causality, which investigates each individual panel member while incorporating information from the panel as a whole. The results of this analysis are displayed in Table 7. As can be seen, the null hypothesis can be rejected at 95% for East Asia/Pacific and Europe/Central Asia and 90% for Latin America/Caribbean, suggesting that for these regions, ODA granger-causes FDI.

Table 7: Heterogeneous non-causality

H ₀ : ODA does not granger-causes FDI in those regions			
Region		F_{III}	Decision
East Asia/Pacific		4.3664**	Reject
Europe/Central Asia		5.0310**	Reject
Latin America/ Caribbean		3.0372*	Reject
Middle East/ North Africa		1.0434	Do not reject
South Asia		0.3788	Do not reject
Sub-Saharan Africa		1.0434	Do not reject
Critical Values for F(6,36):			
<u>90%</u>	<u>95%</u>	<u>99%</u>	
2.75	3.84	6.63	

To further confirm the relationship of our proposed aid-oriented regions, we aggregate individual panel members into supra-regions in order to identify the elements of causation. The results are shown in Table 8 and support the implications of the chart analysis above: ODA interacts differently with FDI in the investment-oriented regions. We conclude that if Africa is different, then western and southern Asia are also different.

Table 8: Super-regions

If Reject, ODA granger-causes FDI in those regions				
<u>Country</u>		<u>F_{III}</u>		<u>Decision</u>
FDI-oriented		2.7287		Reject
ODA-oriented		0.7750		Do not reject
Critical Values for F(2, 36):				
<u>90%</u>	<u>95%</u>	<u>99%</u>		
2.13	2.60	3.78		

6. Conclusions

Global demarcations exist between development aid and foreign direct investment. The answer to whether development aid creates incentives for foreign direct investment appears to depend on where the activities occur. We employ innovative techniques for panel cointegration tests and heterogeneous panel causality, and the data shows that the relationship between the capital flows demarcates a clearly defined geo-political marker: from sub-Saharan Africa, through North Africa and the Middle East, and into South Asia. Rigorous statistical analysis supports the classification of an aid-oriented region in the sense that for this part of the developing world, foreign aid facilitates foreign direct investment.

One fundamental question not addressed is *why* this line exists. The question “why doesn’t capital flow to poor countries?” can be properly reframed as “why doesn’t capital flow to these specific poor countries?” Development issues are often framed either globally or regionally, with very studies focused on broader cross-regional trends. However, the very differences between Africa and the other aid-oriented regions, or even between sub-Saharan Africa and Northern Africa, can help illustrate why they also exhibit similar trends in their aid and investment data that distinguish them from trends in Latin America or East Asia.

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