Journal of Economics and Development Studies
June 2014, Vol. 2, No. 2, pp. 499-520
ISSN: 2334-2382 (Print), 2334-2390 (Online)

Published by American Research Institute for Policy Development

Geographic Statistical Analysis of the Relationship between Foreign Aid and Foreign Investment

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Abstract

Global demarcations exist between development aid and foreign direct investment. 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, classified as either "aid-oriented" or "investment-oriented" regions. As stated explicitly when setting out the identification strategy below, this paper is agnostic as to whether "aid causes growth" or "investment causes growth." We are quite vigorous, however, in analyzing whether and when aid might "cause" investment. A series of Granger causality tests that incorporate recent innovations in the analysis of heterogeneous panel data demonstrate that global demarcations exist between foreign aid and foreign investment that differ substantially among various regions. Evidence-based support for international development policy 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

1. Introduction

Regional demarcations exist between development aid and foreign direct investment. In some core areas, however, certain cross-regional patterns are quite strong relative to trends in other regions.

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Rigorous statistical analysis that contrasts the relative influences of time-series panel data clusters countries into "super-regions" with otherwise widely varying characteristics, classified as either *aid-oriented* or *investment-oriented* regions.

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.[2] Tangential to this question is whether foreign aid causes foreign direct investment (FDI), with an answer common to both that "it depends." 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 and when aid might "cause" investment.

A series of Granger causality tests that incorporate recent innovations in the analysis of heterogeneous panel data demonstrate that global demarcations exist between foreign aid and FDI that differ substantially among various regions.[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 regional geographies, 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.

This analysis incorporates the OECD definition of official development assistance 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)."[4] 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. 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.[5]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.

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[2] Most relevant discussions begin with Easterly (2006), Sachs (2006), and Banerjee and Duflo (2011). See also Burnside and Dollar (2000), Hansen and Tarp (2000, 2001).
[3]Hurlin and Venet (2001), Hurlin (2005), Hood, Kidd and Morris (2008), Fowowe (2011).
[4] http://stats.oecd.org/glossary/detail.asp?ID=6043
[5] See: http://devdata.worldbank.org/query/default.htm

This paper is not directly concerned with "aid effectiveness", nor does it address popular, controversial questions about whether "aid causes growth" or whether "FDI causes 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).Section 2 reviews literature that places this question in a more general context of whether foreign aid and foreign direct investment are substitutes or complements.

Section 3 outlines the identification strategy and clarifies the underlying identifying assumptions. The empirical ansalysis begins in Section 4 with a comparison of ODA and FDI trends across regions. 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*.

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 South Asia, Middle East/North Africa, and sub-Saharan Africa 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 the existence of aid-oriented regions because of the stated feature that the aggregate data sets can define themselves. That is, rather than testing an initial hypothesis that South Asia, Middle East/North Africa, and sub-Saharan Africa 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.

2. Literature Review

One prominent strand of the relevant literature suggests that foreign aid is most effective in "good policy environments."[6] Alesina and Dollar (2000) find that ODA responds to political variables, such as rule of law, while FDI responds to good economic 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 the authors 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.

Harms and Lutz (2006), nevertheless, find "stubbornly robust" indications that foreign aid has a positive, significant impact on foreign investment in countries with a substantial regulatory burden: under these circumstances, aid works in poor policy environments. In contrast, countries with average institutional characteristics yield a marginal effect of aid on investment close to zero. Kimura and Todo (2010) identify no statistical relationship between foreign aid and foreign investment at the aggregate level but do find a "vanguard effect" in the relationship between Japanese aid and Japanese foreign investment.

Asiedu and Villamil (2002) suggest that foreign direct investment could be a substitute for development aid, citing Rodrik (1995) in that private capital flows could substitute completely for multilateral development assistance, 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. Asiedu, Nandwa, and Jin (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.

[6] 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).

Bruner and Oxoby (2009) analyze the role of property right institutions, finding that deficient institutions impair the ability for ODA to stimulate investment.

Similarly, 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 foreign aid and foreign direct investment.

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, the authors 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.

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.He points out that endogeneity discussions have focused on "outcome" variables, such as investment, which are jointly determined (or caused by) incomes. Clemens, Radelet, Bhanani, 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 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,Nandwa, and Jin (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

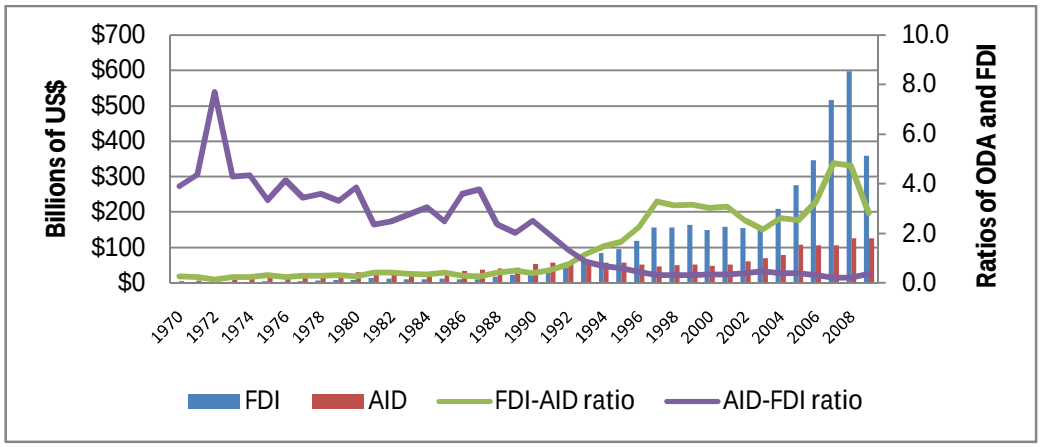
We collected GDP, FDI, and ODA data in both current and constant 2008 U.S. dollars for developing countries in six regions as classified by the World Bank: East Asia/Pacific (EAP), Europe/Central Asia (ECA), Latin America/Caribbean (LAC), Middle East/North Africa (MENA), South Asia (SAS), and sub-Saharan Africa (SSA). Table A-1 in the Appendix provides a list of countries in 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, in current U.S. dollars.

In constant U.S. dollars, foreign aid rose from $84 billion in 1990 to $130 billion in 2009, less than doubling in size. 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

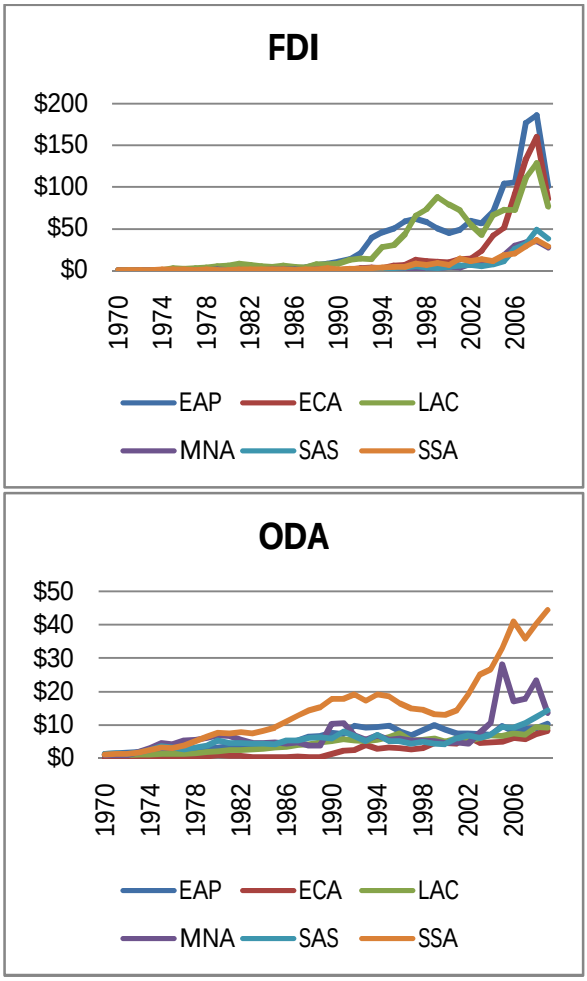


Source: World Development Indicators

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 variation, in Figure 1 are 1.43 for FDI and 0.67 for foreign aid. (Coefficients of variation are a normalized measure of probability distribution, the standard deviation divided by the mean.) Development assistance flows, unlike FDI, did not fall with the globalrecession, 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, Nandwa, and Jin (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$)

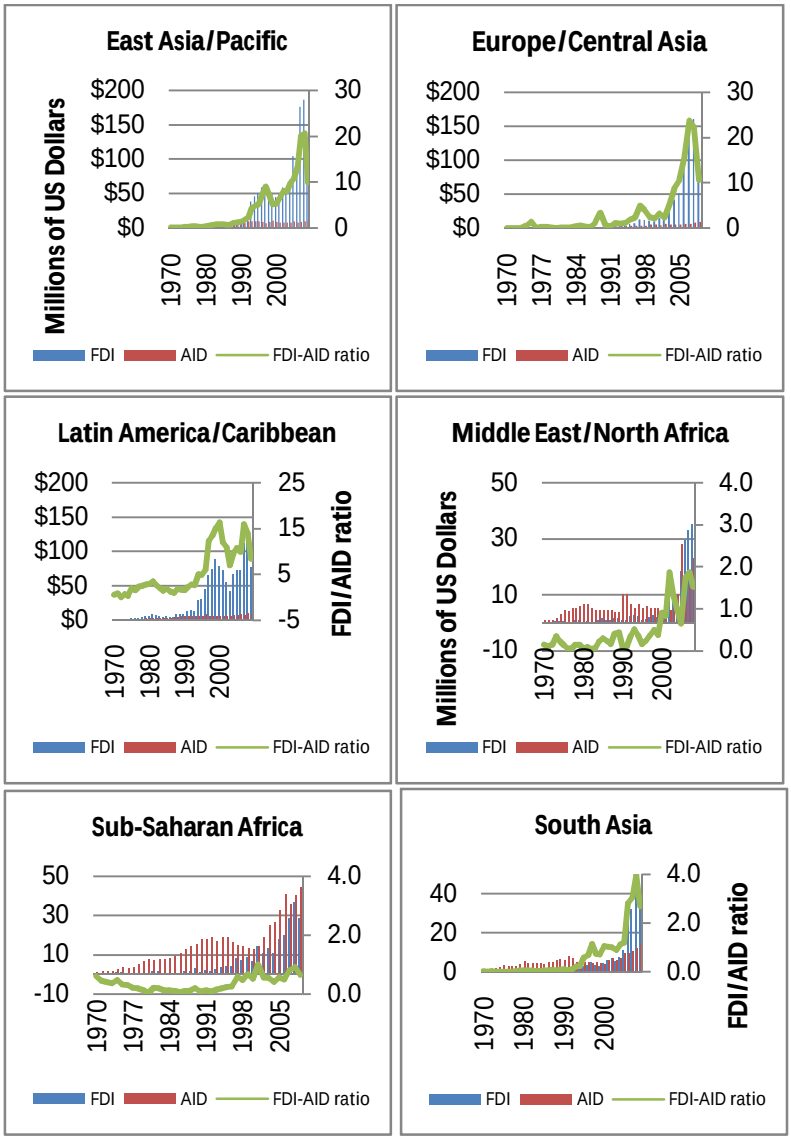


Source: World Development Indicators

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 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

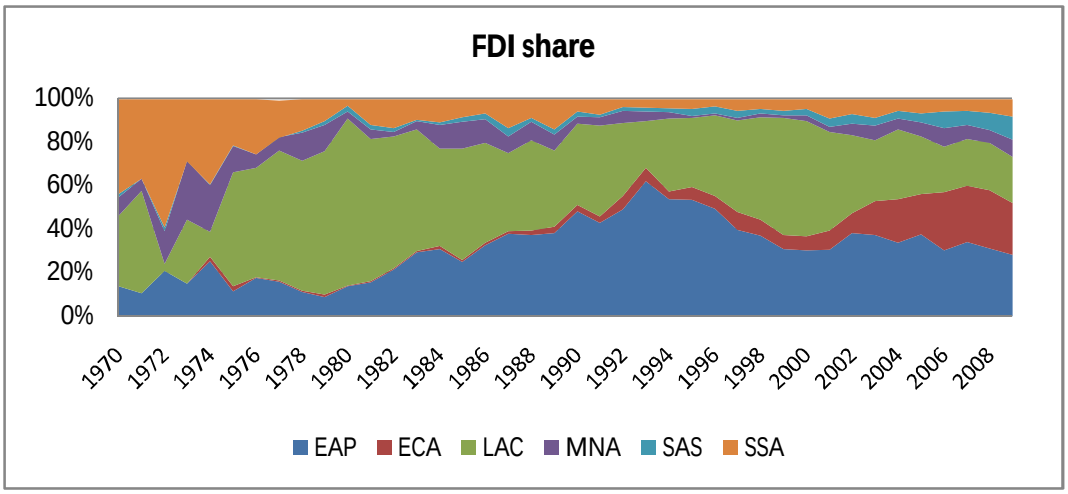
	FDI						ODA					
	EAP	**ECA**	**LAC**	**MNA**	**SAS**	**SSA**	**EAP**	**ECA**	**LAC**	**MNA**	**SAS**	**SSA**
EAP	1	0.93	0.92	0.91	0.89	0.95	1	0.79	0.92	0.54	0.73	0.79
ECA	0.93	1	0.79	0.98	0.97	0.95	0.79	1	0.87	0.65	0.79	0.88
LAC	0.92	0.79	1	0.77	0.78	0.88	0.92	0.87	1	0.67	0.86	0.92
MNA	0.91	0.98	0.77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

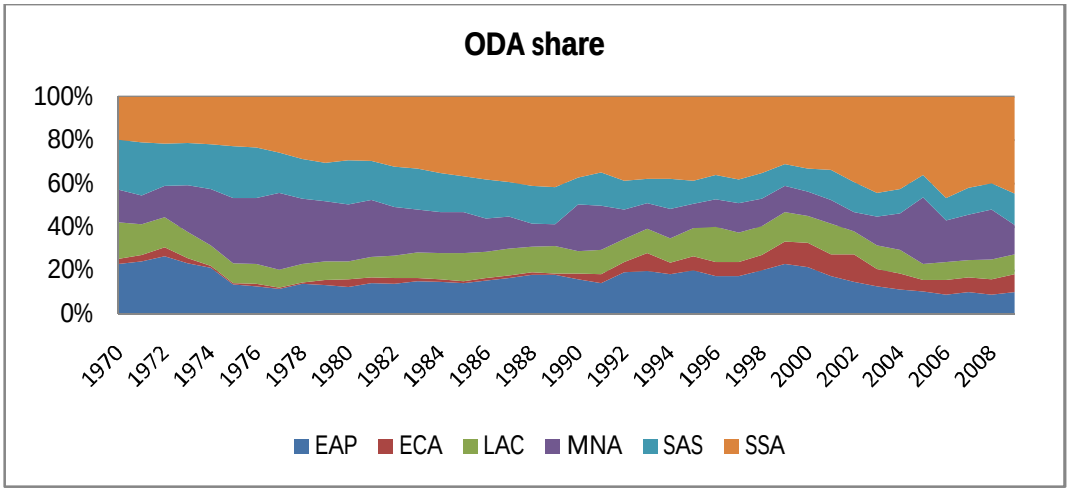
Source: Author's Calculations

By this reckoning, a global demarcation can be drawn within the geo-economies of developing countries. 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. 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 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 percent in 1970 to 73.5 percent in 2009. Conversely, the share of ODA for the aid-oriented regions increased from 57.9 percent in 1970 to 72.5 percent in 2009. Note that in 1970, sub-Saharan Africa had a relatively large share of FDI (43.7 percent) that disappeared to single digits by 1980, but with a share of ODA that has increased consistently over the past four decades.

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 $y_{it} = \alpha_{it} + \beta_{it}X_{it} + \varrho_i y_{i,t-1} + \varepsilon_{it}$, the parameter $|\varrho_i| = 1$. Something that affects last year's resultant will also affect this year's resultant and, by extension, next year's resultant. If $|\varrho_i| < 1$, then the shock will dissipate. As discussed in Banerjee, Dolado, Galbraith, and Hendry (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.All analysis in this section was conducted in Stata 11. 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-stationaritycan be rejected for neither FDI nor 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 (ϱ=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. 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. 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 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 Tests[7]

		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%		

[7] 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.

The basic process involves three specific tests.Test I: Homogeneous Non-Causality (F_I)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. Test II: Homogeneous Causality (F_{II})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. Test III: Heterogeneous Non-Causality (F_{III})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, Kidd, and Morris investigated the direction of "Granger-causality" in the post-Reconstruction American South between black mobilization and Republican Party development. The data demonstrated clear patterns, with a super-region defined as "the Deep South plus North Carolina" demonstrating a different causality relationship between the research subjects 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 foreign aid and foreign direct investment. 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 percent for East Asia/Pacific and Europe/Central Asia and 90 percent for Latin America/Carribean, suggesting that for these regions, ODA Granger-causes FDI.

Table 7: Heterogeneous Non-Causality

H_o: 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):			
90%	95%	99%	
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: Supra-Regions

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

6. Conclusions

Regional 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 that tends to trace the Indian Ocean: 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?" could be properly restated 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. For example, 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. 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.

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.

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Table A-1: Regional Classifications (World Bank, developing only)

East Asia / Pacific (EAP)	Europe / Central Asia (ECA)	Latin America	Middle East / North Africa (MENA)	Sub-Saharan Africa (SSA)	
American Samoa	Albania	Antigua and Bar	Algeria	Angola	Malawi
Cambodia	Armenia	Argentina	Djibouti	Benin	Mali
China	Azerbaijan	Belize	Egypt	Botswana	Mauritania
Fiji	Belarus	Bolivia	Iran	Burkina Faso	Mauritius
Indonesia	Bosnia and Herze	Brazil	Iraq	Burundi	Mayotte
Kiribati	Bulgaria	Chile	Jordan	Cameroon	Mozambique
Korea, DR	Georgia	Colombia	Lebanon	Cape Verde	Namibia
Lao PDR	Kazakhstan	Costa Rica	Libya	CAR	Niger
Malaysia	Kosovo	Cuba	Morocco	Chad	Nigeria
Marshall Is.	Kyrgyz Rep.	Dominica	Syria	Comoros	Rwanda
Micronesia	Lithuania	Dominican Rep.	Tunisia	Congo, DR	São Tomé and Principe
Mongolia	Macedonia, FYR	Ecuador	West Bank/Gaza	Congo, Rep	Senegal
Myanmar	Moldova	El Salvador	Yemen, Rep.	Côte d'Ivoire	Seychelles
Palau	Montenegro	Grenada		Eritrea	Sierra Leone
Papua New Guinea	Romania	Guatemala		Ethiopia	Somalia
Philippines	Russia	Guyana	**South Asia (SAS)**	Gabon	South Africa
Samoa	Serbia	Haiti	Afghanistan	Gambia, The	Sudan
Solomon Is.	Tajikistan	Honduras	Bangladesh	Ghana	Swaziland
Thailand	Turkey	Jamaica	Bhutan	Guinea	Tanzania
Timor-Leste	Turkmenistan	Mexico	India	Guinea-Bissau	Togo
Tuvalu	Ukraine	Nicaragua	Maldives	Kenya	Uganda
Tonga	Uzbekistan	Panama	Nepal	Lesotho	Zambia
Vanuatu		Paraguay	Pakistan	Liberia	Zimbabwe
Vietnam		Peru	Sri Lanka	Madagascar	Zimbabwe
		St. Kitts & Nevi			
		St. Lucia			
		St. Vincent & G			
		Suriname			
		Uruguay			
		Venezuela			

Table A-2 Construction of the F statistics

Test	Statistic	Null hypothesis
Test I (F_I) Homogenous Non-Causality	$$F_I = \frac{(RSS_2 - RSS_1)/Np}{RSS_1/[NT - N(1+p) - p]}$$	ODA does not granger-cause FDI for any of the panel members
Test II (F_{II}) Homogenous Causality	$$F_{II} = \frac{(RSS_3 - RSS_1)/[p(N-1)]}{RSS_1/[NT - N(1+p) - p]}$$	ODA granger-causes FDI for all panel members
Test III (F_{III}) Heterogeneous Non-Causality	$$F_{III} = \frac{(RSS_{2,i} - RSS_1)/p}{RSS_1/[NT - N(1+2p) + p]}$$	ODA does not granger-cause FDI for specific panel members

Statistics based on Hood, Kidd, and Morris (2008)

RSS_1: Sum of squared residuals from unrestricted model
RSS_2: Sum of squared residuals with restriction that all slope terms are set to zero
RSS_3: Sum of squared residuals with restriction that all slope terms are set equal to each other
$RSS_{2,i}$: Sum of squared residuals with restriction that slope terms for element i are equal to zero
N = number of groups (6)
T = number of years (36)
p = number of lags