

# Foreign direct investment and development: the role of research and development

## Supplementary Online Appendix

### A1. Using alternative specification: lags of independent variables

Here, as further robustness checks, we re-estimate our benchmark econometric models using lags of the independent variables. Perhaps, FDI and R&D may have some kind of gestation lag before they exert some impact on development. Moreover, using lags reduces the likelihood of any contemporaneous correlations and thus reduces any potential endogeneity concerns. The results, as shown in Tables A1 and A2, are substantially unchanged. The marginal plots in Figure A1 further confirm the earlier results that FDI and R&D are substitutes.

### A2. Using Stock of FDI

We also used stock of FDI as an alternative to the net FDI flows we use in our main findings. the results as shown in A3 and A4 are consistent with our main findings.

Table A1: Impact of FDI on growth, inequality and welfare (lag of independent variables), IV regression

Variable	GDP p.c.		Inequality (GINI)		HDI		iHDI	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI/GDP (t-1)	0.0079*** (0.0026)	0.0186*** (0.0061)	-0.1794*** (0.0561)	-0.5169*** (0.1175)	0.0014*** (0.0005)	0.0040*** (0.0009)	0.0079*** (0.0020)	0.0150*** (0.0030)
R&D (t-1)	0.4266*** (0.0336)	0.4940*** (0.0491)	-2.2329*** (0.5184)	-4.5367*** (0.9397)	0.0521*** (0.0036)	0.0660*** (0.0061)	0.1192*** (0.0148)	0.1469*** (0.0185)
FDI/GDP (t-1) × R&D (t-1)		-0.0192** (0.0078)		0.5982*** (0.1466)		-0.0045*** (0.0010)		-0.0143*** (0.0034)
ICT Infrastructure (t-1)	0.0123*** (0.0007)	0.0127*** (0.0007)	-0.0275*** (0.0092)	-0.0421*** (0.0118)	0.0015*** (0.0001)	0.0026*** (0.0001)	0.0021*** (0.0002)	0.0024*** (0.0002)
Secondary education (t-1)	0.0001 (0.0001)	0.0001 (0.0001)	-0.0038** (0.0016)	-0.0032* (0.0018)				
Tertiary education (t-1)	0.0091*** (0.0014)	0.0083*** (0.0015)	-0.1389*** (0.0157)	-0.1053*** (0.0214)				
Financial development (t-1)	0.0030*** (0.0008)	0.0032*** (0.0008)	0.0408*** (0.0145)	0.0383*** (0.0187)	-0.00001 (0.0001)	0.00002 (0.0001)	-0.0019*** (0.0005)	-0.0018*** (0.0005)
Inflation (t-1)	-0.0225*** (0.0057)	-0.0226*** (0.0058)	-0.1277*** (0.0453)	-0.1297*** (0.0524)	-0.0007* (0.0004)	-0.0008** (0.0004)	-0.0009 (0.0006)	-0.0019*** (0.0009)
Unemployment (t-1)	-0.0094*** (0.0034)	-0.0099*** (0.0035)	0.1171* (0.0646)	0.1391** (0.0711)	0.0011*** (0.0004)	0.0008** (0.0004)	0.0028*** (0.0009)	0.0025*** (0.0010)
Turning Point: FDI [R&D]	-	25.73 [0.97]	-	7.58 [0.86]	-	14.67 [0.89]	-	10.27 [1.05]
Obs.	1110	1110	767	767	1222	1222	741	741
<b>First Stage regression</b>								
BITs	13.3351*** (4.1640)	4.5954*** (1.0016)	14.5167*** (4.5390)	4.8440*** (1.1232)	12.9803*** (4.0646)	4.7055*** (1.0098)	4.6941*** (1.1284)	2.4561*** (0.5237)
Cragg-Donald F-Stats	195.62	75.54	146.42	52.55	205.21	83.37	29.35	21.09

Note: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

Table A2: Impact of FDI on poverty (lag of independent variables), IV regression

Variable	Headcount poverty \$1.90				Headcount poverty \$3.20				Headcount poverty \$5.50				Multidimensional poverty			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(5)	(6)	(7)	(8)	(5)	(6)	(7)	(8)
FDI/GDP (t-1)	-0.0306*** (0.0106)	-0.0753*** (0.0293)	-0.0825*** (0.0237)	-0.2045*** (0.0583)	-0.1685*** (0.0454)	-0.4024*** (0.1067)	-0.2183* (0.1140)	-0.3357** (0.1578)								
R&D (t-1)	0.4293* (0.2373)	0.1247 (0.3210)	-0.1567 (0.3653)	-0.9894* (0.5519)	-2.7794*** (0.5580)	-4.3766*** (0.9271)	-6.2052*** (1.7929)	-6.2212*** (1.6301)								
FDI/GDP (t-1) × R&D (t-1)	0.0791*** (0.0367)	0.2162*** (0.0738)	0.1647*** (0.0738)	-0.1594*** (0.0169)	-0.1647*** (0.0171)	-0.2403*** (0.0176)	-0.2504*** (0.0184)	-0.0262 (0.0215)	-0.0412* (0.0214)							
ICT Infrastructure (t-1)	-0.0863*** (0.0137)	-0.0883*** (0.0136)	-0.1594*** (0.0169)	-0.1647*** (0.0171)	-0.0004 (0.0039)	-0.0001 (0.0038)	0.0046 (0.0038)	0.0050 (0.0038)	-0.0180** (0.0050)	-0.0199*** (0.0050)						
Secondary education (t-1)	0.0008 (0.0033)	0.0009 (0.0033)	-0.0004 (0.0039)	-0.0001 (0.0038)	-0.2304*** (0.0249)	-0.2183*** (0.0253)	-0.3827*** (0.0301)	-0.3594*** (0.0314)	-0.1025*** (0.0314)	-0.0765*** (0.0314)						
Tertiary education (t-1)	-0.1140*** (0.0183)	-0.1096*** (0.0184)	-0.2304*** (0.0249)	-0.2183*** (0.0253)	0.0045 (0.0081)	0.0036 (0.0092)	-0.0128 (0.0144)	-0.0145 (0.0164)	-0.0145 (0.0164)	-0.0791 (0.0557)						
Financial development (t-1)	0.0036 (0.0042)	-0.0114 (0.0678)	0.0045 (0.0081)	0.0036 (0.0092)	-0.0100 (0.0107)	-0.0107 (0.0107)	0.0487 (0.1013)	0.0473 (0.1032)	0.7138** (0.2969)	0.8441*** (0.2685)						
Inflation (t-1)	-0.0112 (0.0679)	0.0679 (0.0520)	(0.0847) 0.1622** (0.0755)	(0.0849) 0.1701** (0.0763)	(0.0849) 0.1701** (0.0763)	(0.0849) 0.3863*** (0.0946)	(0.0849) 0.4015*** (0.0969)	(0.0849) 0.4066*** (0.1343)	0.7138** (0.1343)	0.8441*** (0.1228)						
Unemployment (t-1)	0.0650 (0.0518)	0.0679 (0.0520)														
Turning Point: FDI [R&D] Obs.	- 767	[0.95] 767	- 767	4.57[0.95] 767	- 767	10.55[0.97] 767	- 767	19.90[1.07] 349								
<b>First Stage regression</b>																
BITs	14.5167*** (4.5390)	4.8440*** (1.1232)	14.5167*** (4.5390)	4.8440*** (1.1232)	14.5167*** (4.5390)	4.8440*** (1.1232)	3.2797*** (1.3541)	2.1185*** (0.6930)								
Cragg-Donald F-Stats	146.42 52.55	146.42 52.55	146.42 52.55	146.42 52.55	146.42 52.55	146.42 52.55	7.30	8.24								

Note: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

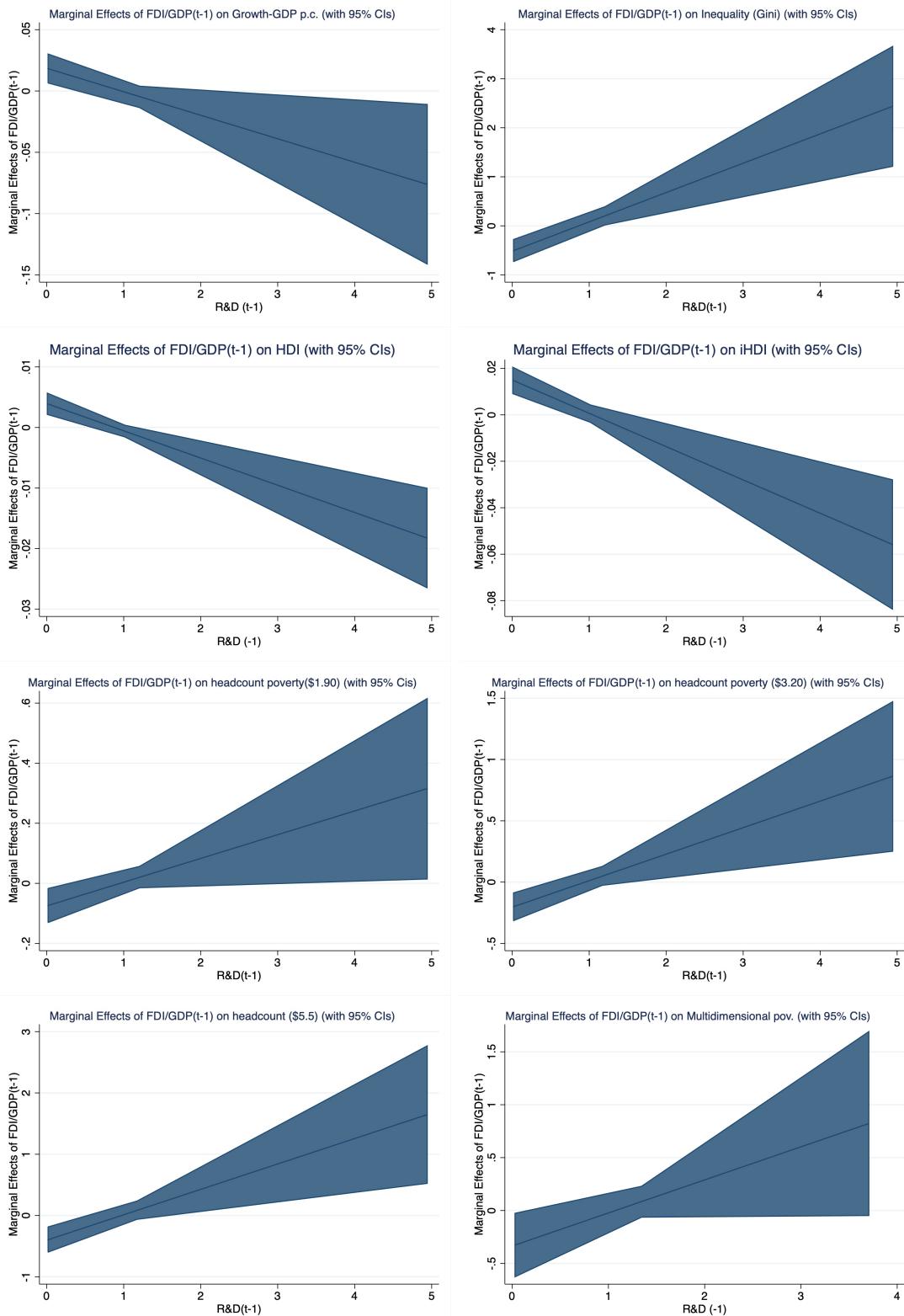


Figure A1: Marginal effects of lag of FDI on growth and development (with 95% CI), IV regression

Table A3: Impact of Stock of FDI on growth, inequality and welfare, IV regression

Variable	GDP p.c.	Income Inequality (Gini)	HDI	iHDI
FDIStock/GDP	0.0008*** (0.000)	-0.0163*** (0.002)	0.0001*** (0.000)	0.0002*** (0.000)
R & D	2.9035*** (0.068)	-9.7591*** (0.577)	-15.3141*** (0.719)	0.1107*** (0.008)
FDIStock/GDP x R & D	-0.0276*** (0.008)	0.0668* (0.037)	-0.0033*** (0.001)	-0.0034** (0.002)
ICT Infrastructure	0.0128*** (0.001)	-0.0268*** (0.012)	0.0012*** (0.017)	0.0024*** (0.000)
Secondary education	-0.0002 (0.000)	0.0027 (0.002)	0.0041 (0.003)	0.0000 (0.000)
Tertiary education	-0.0024 (0.002)	0.0287 (0.022)	0.0945** (0.046)	-0.0025*** (0.002)
Financial Development	-0.0126*** (0.001)	0.0688*** (0.010)	0.1073*** (0.026)	-0.0004*** (0.000)
Inflation	-0.0003 (0.007)	0.0042 (0.010)	-0.4153*** (0.092)	-0.4532*** (0.102)
Unemployment	0.0025 (0.004)	0.0028 (0.009)	-0.1863** (0.085)	-0.2610** (0.093)
Constant	6.6695*** (0.146)	5.9048*** (0.278)	48.2560*** (1.952)	49.7079*** (2.229)
Turning Point: FDI_Stock [R&D]	105.20 [0.67]	229.25 [0.90]	103.88 [0.70]	137.06 [0.74] 492
Obs.	871	637	871	492
<b>First Stage regression</b>				
BITs	180.1488*** (16.3849)	423.3752*** (115.3375)	195.6905*** (15.2746)	423.3752*** (115.3375)
ln(Researchers in R&D in mil.)	0.41174*** (0.0205)	0.3217*** (0.0199)	0.5223*** (0.0266)	0.4078*** (0.0282)
Cragg-Donald F-Stats	188.208	6.394	155.530	7.758
			188.208	6.394
				98.425
				2.370

NB: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

Table A4: Impact of Stock of FDI on Poverty, IV regression

Variable	Headcount poverty \$1.90			Headcount poverty \$3.20			Headcount poverty \$5.50			Multidimensional poverty		
	FDI_Stock/GDP	-0.0029*** (0.001)	-0.0926*** (0.034)	-0.0076*** (0.002)	-0.1746*** (0.052)	-0.0160*** (0.003)	-0.2469*** (0.064)	-0.0039* (0.002)	0.1669 (0.153)	R & D	-3.0973*** (0.704)	-14.4242*** (4.859)
FDI_Stock/GDP x R & D	0.1362*** (0.052)	0.1362*** (0.052)	0.1362*** (0.052)	0.2536*** (0.081)	0.2536*** (0.081)	0.2536*** (0.081)	0.2536*** (0.081)	0.2536*** (0.102)	0.2536*** (0.102)	0.1362*** (0.052)	0.1362*** (0.052)	0.1362*** (0.052)
ICT Infrastructure	-0.0635*** (0.016)	-0.0993*** (0.029)	-0.0993*** (0.020)	-0.1320*** (0.041)	-0.1986*** (0.023)	-0.2168*** (0.050)	-0.3087*** (0.050)	-0.3087*** (0.050)	-0.3087*** (0.050)	-0.0431*	-0.0431*	-0.0431*
Secondary education	0.0012	0.0041	0.00003	0.0055	0.0048	0.0123	-0.0030	-0.0030	-0.0030	0.0063	0.0063	0.0063
Tertiary education	-0.0083	0.1259** (0.005)	-0.0507*** (0.006)	0.1989** (0.005)	-0.1014*** (0.007)	0.2437*	-0.0277	-0.0277	-0.0277	0.0691	0.0691	0.0691
Financial Development	0.0200*** (0.006)	0.0986*** (0.035)	0.0396*** (0.010)	0.1859*** (0.054)	0.0599*** (0.014)	0.2620*** (0.066)	-0.0067	-0.0067	-0.0067	0.0676	0.0676	0.0676
Inflation	-0.0293	-0.1067 (0.100)	-0.0873 (0.123)	-0.2313 (0.150)	-0.1052 (0.219)	-0.3042 (0.250)	0.6292* (0.349)	0.6292* (0.349)	0.6292* (0.349)	0.9517*	0.9517*	0.9517*
Unemployment	-0.0447	-0.1971	-0.1199	-0.4036** (0.106)	-0.2985 (0.195)	-0.6005** (0.145)	0.4422*** (0.254)	0.4422*** (0.254)	0.4422*** (0.254)	1.0632*	1.0632*	1.0632*
Constant	14.6635*** (2.782)	17.6240*** (3.906)	34.2797*** (3.816)	39.7902*** (5.570)	63.6545*** (4.433)	71.2704*** (6.646)	37.6788*** (4.551)	37.6788*** (4.551)	37.6788*** (4.551)	0.567	0.567	0.567
Turning Point: FDI Stock [R&D]		105.90	109.00	120.72						-	-	-
Obs.	637	[0.70]	[0.69]	[0.70]	637	637	637	637	637	294	294	294

NB: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

<b>First Stage regression</b>	195.6905*** (15.2746)	964.8722*** (146.5812)	195.6905*** (15.2746)	964.8722*** (146.5812)	195.6905*** (15.2746)	964.8722*** (146.5812)	211.6721*** (15.2328)	211.6721*** (15.2328)	1662.659*** (212.2492)
BITs	0.5223*** (0.0266)	0.4078*** (0.0282)	0.5223*** (0.0266)	0.4078*** (0.0282)	0.5223*** (0.0266)	0.4078*** (0.0282)	0.5480*** (0.0467)	0.5480*** (0.0467)	0.4001*** (0.0477)
Cragg-Donald F-Stats	155.530	7.758	155.530	7.758	155.530	7.758	69.893	69.893	0.468

### A3. Differences across developed/developing countries

As further robustness checks, we examine how the development status of the countries influences the inter-relationships between FDI, development outcomes and R&D. We do this by using a dummy variable of whether a country is developed or developing (based on the United Nations' classification) with the amended specification being

$$\begin{aligned} DEV_{i,t} = & \alpha_0 + \alpha_1 FDI_{i,t} \times Developed_{it} + \alpha_2 FDI_{i,t} \times Developing_{it} + \alpha_3 R\&D_{i,t} \times Developed_{it} \\ & + \alpha_4 R\&D_{i,t} \times Developing_{it} + \alpha_5 (FDI_{i,t} \times R\&D_{i,t} \times Developed_{it}) \\ & + \alpha_6 (FDI_{i,t} \times R\&D_{i,t} \times Developing_{it}) + \gamma \mathbf{Controls}_{i,t} + \zeta_{i,t} \quad (\text{A1}) \end{aligned}$$

The results are reported in Tables A5 and A6. From these, we can see that the coefficient of BITs in the first stage is positive and statistically significant. Also, the Cragg and Donald (1993) *Wald F*-statistics test of weak identification is again rejected. From the tables, we can see that FDI inflows into developing countries have a significant impact on development outcomes: mainly Gini, HDI, iHDI, and on headcount poverty (\$1.90 and \$3.20) with significance at 1% level. Economically, we see that a one per cent increase in FDI leads to a 0.87%, 0.87%, and 1.10% decrease in the Gini index, headcount poverty at \$1.90 and \$3.20, respectively. Moreover, a one per cent increase in FDI leads to a 0.011 and 0.017 points increase in HDI and iHDI, respectively. However, for developed countries, we see that FDI inflows have a significant impact on development outcomes mainly on: Gini, HDI, iHDI, and on headcount poverty (\$1.90, \$3.20 and \$5.50) with a significance level of at least 5%. Meanwhile, for these countries, a one per cent increase in FDI leads to a 0.20%, 0.04%, 0.08% and 0.14% decrease in the Gini index, headcount poverty at \$1.90, \$3.20 and \$5.50, respectively. Again, a one per cent increase in FDI leads to a 0.001 and 0.009 percentage point increase in HDI and iHDI, respectively. We confirm the differential impact of FDI between developed and developing countries on these development outcomes with the Joint significance test of equality showing evidence of asymmetric impact.

Moving on to the impact of R&D, we find that the development impact of R&D is

more pronounced in developed countries than in developing countries. Here, R&D in developing countries only has a significant positive impact on HDI and iHDI, with a one per cent increase in R&D leading to a 0.020 and 0.080 points increase in HDI and iHDI, respectively. For developed countries, a one per cent increase in R&D leads to a 0.63% increase in GDP per capita, and a substantial increase of 0.074 and 0.141 points in HDI and iHDI, respectively. A one per cent increase in R&D, however, leads to a 3.04%, 0.44%, 1.09%, 2.14% and 5.39% decrease in the inequality (Gini), headcount poverty at \$1.90, \$3.20, \$5.50 and multidimensional poverty, respectively. These effects are quite substantial, especially for developed countries, showing the important role of R&D in these countries. Here also, we confirm the differential impact between developed and developing countries with the joint significance test of equality, showing an asymmetric impact between developed and developing countries.

These results generally show that the development impact of FDI is larger for developing countries than for developed countries. This may explain why these countries tend to be dependent on FDI. However, even though R&D only has a significant impact on HDI and iHDI for developing countries, the impact is more pronounced than that of the FDI. On the other hand, we find that R&D in developed countries plays a significant development role, showing a larger impact on growth, inequality, human development and poverty. This further validates the argument that countries tend to benefit more from R&D than they do from FDI and that countries, particularly developing, should focus more on expenditures in R&D.

#### **A4. Excluding top and bottom deciles of FDI and R&D**

Given that some countries have comparatively high net FDI inflows and R&D (as shares of GDP), we proceed to estimate the results by excluding the top and bottom deciles of FDI and R&D from our data sample following [Donaubauer et al. \(2016\)](#)<sup>1</sup>. The descriptive statistics shown in Table [A7](#) indicate relatively lower mean, minimum

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<sup>1</sup>We also winsorize the data at the top and bottom 1% as additional robustness checks. As discussed subsequently, our results remain consistent.

Table A5: Impact of FDI on growth and development (developing and developed countries), IV regression

Variable	GDP p.c.	Gini	HDI	iHDI	Headcount poverty \$1.90	Headcount poverty \$3.20	Headcount poverty \$5.50	Multidimensional poverty
FDI/GDP × Developing	0.0278 (0.029)	-0.8691*** (0.306)	0.0107*** (0.003)	0.0172*** (0.006)	-0.8695*** (0.395)	-1.1034*** (0.400)	0.4508 (0.714)	-0.3388 (0.1453)
FDI/GDP × Developed	0.0039 (0.003)	-0.2031*** (0.072)	0.0014*** (0.001)	0.0090*** (0.003)	-0.0384** (0.015)	-0.0846*** (0.029)	-0.1435*** (0.045)	-0.1453 (0.102)
R&D × Developing	0.0165 (0.036)	-0.2348 (0.884)	0.0201*** (0.007)	0.0843*** (0.021)	-0.6618 (0.711)	-0.4907 (0.964)	0.2253 (1.053)	2.7677 (7.268)
R&D × Developed	0.4916*** (0.072)	-3.0430*** (0.627)	0.0738*** (0.008)	0.1413*** (0.022)	-0.4421* (0.253)	-1.0938** (0.444)	-2.1394*** (0.621)	-5.3944*** (1.574)
ICT Infrastructure	0.0124*** (0.001)	-0.0219*** (0.011)	0.0013*** (0.000)	0.0019*** (0.000)	-0.0858*** (0.014)	-0.1723*** (0.017)	-0.2443*** (0.019)	-0.0273 (0.030)
Secondary education	0.0001 (0.000)	-0.0013 (0.003)	- (0.002)	- (0.020)	-0.0001 (0.000)	-0.0024 (0.001)	-0.0048 (0.005)	-0.0044 (0.005)
Tertiary education	0.0087** (0.002)	-0.1458*** (0.018)	- (0.000)	- (0.020)	-0.0020*** (0.000)	-0.1089*** (0.021)	-0.2320*** (0.028)	-0.3646*** (0.031)
Financial Development	0.0043*** (0.001)	0.0351** (0.018)	- (0.001)	-0.0001 (0.000)	-0.0024 (0.001)	-0.0048 (0.005)	-0.0153 (0.013)	-0.0153 (0.045)
Inflation	-0.0130* (0.007)	-0.0766 (0.068)	-0.0011* (0.001)	-0.0004 (0.001)	0.1547* (0.093)	0.2014* (0.114)	0.0341 (0.131)	0.2086 (0.297)
Unemployment	-0.0083*** (0.003)	0.1146 (0.070)	0.0014*** (0.000)	0.0033*** (0.001)	0.0700 (0.051)	0.1455* (0.079)	0.3614*** (0.098)	0.3884*** (0.140)
Obs.	1111	776	1,223	664	776	776	776	314
Joint Test of FDI/GDP × Developing = FDI/GDP × Developed. $\chi^2$	-	5,099*	15,522***	2,73*	9,53***	7,09***	-	-
Joint Test of R&D × Developing = R&D × Developed. $\chi^2$	-	21,733***	41,393***	27,904***	-	-	-	-
<b>First Stage regression</b>								
BITs × Developing	3.070*** (0.6846)	4.1349*** (0.9183)	3.5893*** (0.6779)	3.813*** (1.0996)	4.1349*** (0.9183)	4.1349*** (0.9183)	4.1349*** (0.9183)	4.2624*** (0.7309)
BITs × Developed	-0.9939*** (0.1679)	-0.3566*** (0.0594)	-0.9387*** (0.1708)	0-6909*** (0.1708)	-0.3566*** (0.0594)	-0.3566*** (0.0594)	-0.3566*** (0.0594)	-0.2518*** (0.0509)
<b>Dependent Variable: FDI × Developed</b>								
BITs × Developed	15,6017*** (4.6349)	12,9318*** (4.5129)	15,2742*** (4.5214)	4,4722*** (1.1099)	12,9318*** (4.5129)	12,9318*** (4.5129)	12,9318*** (4.5129)	3,6341*** (1.4341)
BITs × Developing	0.2941 (1.1916)	0.7459 (1.6001)	0.0577 (1.1391)	-1.0986 (1.0340)	0.7459 (1.6001)	0.7459 (1.6001)	0.7459 (1.6001)	-0.9204 (2.8127)
Cragg-Donald F-Stats	16.50	31.95	25.10	7.70	31.95	31.95	31.95	3.76

Note: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

Table A6: Impact of FDI on growth and development with three-way interaction terms (developing and developed countries), IV regression

Variable	GDP p.c.	Gini	HDI	iHDI	Headcount poverty \$1.90	Headcount poverty \$3.20	Headcount poverty \$5.50	Multidimensional poverty
FDI/GDP × Developing	0.0617 (0.051)	-2.9330*** (1.492)	0.0218*** (0.008)	0.0179*** (0.007)	-2.3294* (1.256)	-2.6580* (1.596)	2.4139 (1.723)	0.7515 (1.235)
FDI/GDP × Developed	0.0031 (0.005)	-0.5618*** (0.148)	0.0045*** (0.001)	0.0139*** (0.003)	-0.1257* (0.066)	-0.2251** (0.095)	-0.2315** (0.103)	-0.1365 (0.141)
R&D × Developing	0.1943 (0.123)	-13.6511* (7.611)	0.0815*** (0.025)	0.0900*** (0.020)	-10.0715 (6.646)	-10.7259 (8.180)	12.7789 (8.985)	11.9104 (7.398)
R&D × Developed	0.4628*** (0.073)	-5.8170*** (1.330)	0.0961*** (0.017)	0.1490*** (0.020)	-1.3732* (0.775)	-2.3873** (1.103)	-2.1619* (1.245)	-4.4820*** (1.449)
FDI/GDP × R&D × Developing	-0.0982 (0.063)	8.2275* (4.579)	-0.0172** (0.007)	-0.0161 (0.010)	5.7654 (3.865)	6.2726 (4.787)	-7.6853 (5.374)	-3.2119 (2.318)
FDI/GDP × R&D × Developed	-0.0007 (0.007)	0.6141*** (0.161)	-0.0050*** (0.002)	-0.0127*** (0.003)	0.1263* (0.106)	0.2216** (0.116)	0.2109** (0.120)	0.1213 (0.120)
ICT Infrastructure	0.0136*** (0.001)	-0.0333*** (0.015)	0.0023*** (0.000)	-0.0808*** (0.000)	-0.1763*** (0.015)	-0.2487*** (0.020)	-0.2487*** (0.018)	-0.0290 (0.027)
Secondary education	-0.0001 (0.000)	-0.0013 (0.004)	-	-	0.0061 (0.005)	0.0028 (0.005)	-0.0054 (0.005)	-0.0119** (0.005)
Tertiary education	0.0081*** (0.001)	-0.1156*** (0.030)	-	-	-0.1084*** (0.035)	-0.2257*** (0.033)	-0.3396*** (0.034)	0.0002 (0.042)
Financial Development	0.0050*** (0.001)	0.0285 (0.023)	-0.0001 (0.000)	-0.0016*** (0.000)	-0.0050 (0.007)	-0.0082 (0.011)	-0.0143 (0.012)	0.0086 (0.037)
Inflation	-0.0123* (0.007)	-0.2286*** (0.085)	-0.0019** (0.001)	-0.0007 (0.001)	0.0650 (0.087)	0.0991 (0.102)	0.1327 (0.129)	0.0875 (0.327)
Unemployment	-0.0094*** (0.003)	0.0338 (0.086)	0.0008* (0.000)	0.0027*** (0.025)	-0.0003 (0.001)	0.0728 (4.472)	0.4722*** (5.574)	0.4114*** (0.136)
Obs.	1111	776	1223	664	776	776	776	314
Turning Point: FDI [R&D] -Developing	-	1.66[0.37]	4.74[1.27]	-	-	-	-	-
Turning Point: FDI [R&D] -Developed	-	9.47[0.91]	19.22[0.90]	11.73[1.41]	10.87[1.78]	10.77[1.02]	10.25[1.10]	-
<b>First Stage regression</b>								
BITs × Developing	1.7895*** (0.4551)	1.2849** (0.5955)	1.7139*** (0.5230)	2.7487*** (0.8494)	1.2849** (0.5955)	1.2849** (0.5955)	1.2849** (0.5955)	1.9454*** (0.3021)
BITs × Developed	-0.3560*** (0.0927)	-0.2221*** (0.0474)	-0.6141*** (0.0859)	-0.3901*** (0.1171)	-0.2221*** (0.0474)	-0.2221*** (0.0474)	-0.2221*** (0.0474)	-0.2023*** (0.0347)
<b>Dependent Variable: FDI × Developed</b>								
BITs × Developed	5.5412*** (1.1824)	5.0816*** (1.2827)	5.4933*** (1.1465)	2.5003*** (.5494)	5.0816*** (1.2827)	5.0816*** (1.2827)	5.0816*** (1.2827)	2.4594*** (0.7520)
BITs × Developing	0.1623 (0.5668)	0.5270 (0.9493)	0.3119 (0.5618)	0.6843 (0.6536)	0.5270 (0.9493)	0.5270 (0.9493)	0.5270 (0.9493)	3.0561 (1.8426)
Cragg-Donald F-Stats	14.92	8.87	10.87	9.03	8.87	8.87	8.87	5.42

Note: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

and maximum values for the variables.

This is to help consider the relevant thresholds of FDI and to check whether our major results are dependent on the selected sample. The results are reported in Tables [A8](#) and [A9](#). Here, once more, the coefficient of BITs in the first stage is positive and statistically significant. Again, except for the results for iHDI and multidimensional poverty in Table [A8](#), the [Cragg and Donald \(1993\)](#) *Wald F*-statistics test of weak identification is rejected for all estimations as the values are greater than the relevant critical values, indicating that the models are identified, and the instrument is relevant.

While we see that the size of the coefficients of FDI and R&D differ from our main results, the results are qualitatively similar to our earlier findings with FDI having a significant positive impact on growth and HDI and a significant negative impact on inequality and all poverty headcount measures. While we observe a much greater impact of FDI on the development outcomes compared to the results of the full sample, we still see that R&D has a more pronounced impact on the development outcomes than FDIs. We therefore confirm the earlier results that FDIs and R&D are substitutes, with the interaction being negative. The marginal effect plots in Figure [A2](#) further confirm that FDI and R&D are substitutes. Here, we see that increasing R&D expenditure along with FDI leads to a negative (positive) marginal effect of FDI on growth and welfare (poverty and inequality). From Table [A9](#), we confirm the non-linear impact of FDI on the development outcomes. We, however, find that the thresholds are significantly lower, averaging around 6%, showing that countries that fall between the bottom and top deciles even experience the non-linear effect of FDIs at much lower FDI shares of GDP. This suggests the even more important role of absorptive capacity of these countries through higher R&D investments to mitigate the negative threshold effect of FDI on development. Again, we find the interaction of FDI and R&D is negative, indicating that the two are substitutes. This is further confirmed by the marginal effects plots in Figure [A2](#). From the figures, we again see that increasing R&D along with FDI eventually leads to a negative (positive) marginal effect of FDI on growth and welfare (poverty and inequality). As noted, we also winsorized the data at the bottom and top 1%, leading to conclusions essentially unchanged.

Table A7: Descriptive Statistics - Winsorized data and sample excluding top and Bottom decile of FDI and R&D

Variable	Sample Excluding Top and Bottom Deciles of FDI and R&D					Winsorized Data				
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max		
GDP per capita -natural log (GDP p.c.)	8.906	1.256	5.090	11.528	8.505	1.490	5.651	11.340		
Gini Index (Gini)	36.345	8.041	23.200	64.800	36.780	8.052	24.600	57.100		
Human Development Index (HDI)	0.761	0.115	0.332	0.954	0.691	0.158	0.354	0.943		
Inequality-adjusted HDI (iHDI)	0.660	0.138	0.219	0.895	0.572	0.192	0.230	0.884		
Headcount poverty ratio at \$1.90 (Headcount Poverty \$1.90)	3.157	8.629	0	94.300	6.371	13.712	0	71.700		
Headcount poverty ratio at \$3.20 (Headcount Poverty \$3.20)	8.080	14.419	0	98.500	13.428	21.638	0	89.600		
Headcount poverty ratio at \$5.50 (Headcount Poverty \$5.50)	18.408	22.616	0	99.700	24.482	29.249	0	96.900		
Mutidimensional Headcount Poverty (Mutidimensional Poverty)	28.904	10.758	2.370	65.700	26.978	11.137	8.200	63.800		
Net FDI inflows as a share of GDP % (FDI/GDP)	3.801	2.666	0.403	12.179	5.440	8.129	-5.670	53.056		
Research and Development Expenditure as a share of GDP % (R&D)	0.756	0.602	0.100	2.523	0.974	0.972	0.022	4.078		
No. of Bilateral Treaties (BITs)	39.325	26.716	0	141	24.311	26.111	0	120		
Mobile and Telephone subscriptions per 100 people (ICT Infrastructure)	124.328	48.348	1.337	364.872	105.551	55.200	2.589	229.054		
Secondary Enrolment Ratio (Secondary Education)	167.938	215.108	14.299	788.926	187.422	251.905	15.714	786.353		
Tertiary Enrolment Ratio (Tertiary Education)	48.714	23.050	1.510	142.852	38.642	23.420	1.510	95.864		
Domestic credit to the private sector as a share of GDP % (Financial Development)	58.081	39.440	0.186	194.647	49.136	38.708	2.722	187.241		
Consumer Price Index % (Inflation)	4.962	5.487	-1.736	59.220	5.122	5.885	-2.078	36.522		
Unemployment rate % (Unemployment)	8.746	6.076	0.170	37.250	7.668	5.743	0.548	27.789		

Table A8: Impact of FDI on growth and development (excluding top and bottom deciles of FDI and R&D), IV regression

Variable	GDP p.c.	Gini	HDI	iHDI	Headcount poverty \$1.90	Headcount poverty \$3.20	Headcount poverty \$5.50	Multidimensional poverty
FDI/GDP	0.1882** (0.074)	-6.1750*** (1.971)	0.0451*** (0.011)	0.3324 (0.310)	-2.9383*** (0.817)	-5.9192*** (1.230)	-8.2880*** (42.306)	14.9509 (42.822)
R&D	1.2621*** (0.271)	-16.2257*** (5.621)	0.1450*** (0.036)	0.8849 (0.813)	-9.9542*** (3.167)	-20.5205*** (5.399)	-33.0556*** (7.364)	24.2372 (74.042)
FDI/GDP × R&D	-0.1582** (0.065)	2.1985* (1.216)	-0.0174** (0.009)	-0.1590 (0.168)	2.4160*** (0.758)	4.5972*** (1.254)	6.1216*** (1.664)	-7.6293 (18.570)
ICT Infrastructure	0.0140*** (0.001)	-0.0090 (0.025)	0.0016*** (0.000)	-0.0019 (0.004)	-0.0723*** (0.016)	-0.1579*** (0.025)	-0.2411*** (0.033)	-0.2390 (0.585)
Secondary education	-0.0003* (0.000)	-0.0004 (0.004)	-	-0.0004 (0.004)	-0.0004 (0.004)	-0.0004 (0.005)	0.0079 (0.006)	-0.0139 (0.014)
Tertiary education	0.0050*** (0.002)	-0.1266*** (0.038)	-	-	-0.1074*** (0.026)	-0.2374*** (0.040)	-0.3960*** (0.052)	-0.0575 (0.275)
Financial development	0.0042*** (0.001)	0.0668*** (0.019)	0.0000 (0.000)	-0.0007 (0.001)	0.0047 (0.009)	0.0065 (0.016)	-0.0079 (0.023)	-0.0007 (0.215)
Inflation	-0.0119* (0.007)	0.0143 (0.125)	-0.0008 (0.001)	0.0028 (0.006)	0.0362 (0.074)	0.0930 (0.123)	0.1659 (0.197)	-0.5554 (4.179)
Unemployment	-0.0051 (0.004)	0.0927 (0.122)	0.0009 (0.001)	0.0068 (0.008)	0.1003* (0.059)	0.2155* (0.113)	0.4864*** (0.166)	0.6444 (0.559)
Turning Point: FDI [R&D]	7.98 [1.19] 725	7.38 [2.81] 512	8.33 [2.39] 775	-	4.12 [1.22] 436	4.46 [1.29] 512	5.40 [1.35] 512	- 196
Obs.								
<b>First Stage regression</b>								
BITs	0.8533*** (0.360)	0.7481* (0.406)	0.9482*** (0.364)	-0.0028 (0.322)	0.7481* (0.406)	0.7481* (0.406)	0.7481* (0.406)	-0.2411 (0.336)
Cragg-Donald F-Stats	10.38	8.46	12.84	0.48	8.45	8.46	8.46	0.06

Note: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

Table A9: Non-linear impact of FDI on growth and development (excluding top and bottom deciles of FDI and R&D), IV regression

Variable	GDP p.c.	Gini	HDI	iHDI	Headcount poverty \$1.90	Headcount poverty \$3.20	Headcount poverty \$5.50	Multidimensional poverty
FDI/GDP	0.2558 (0.211)	-19.7259*** (6.925)	0.1005*** (0.037)	0.1853*** (0.066)	-2.3843 (1.467)	-6.6204** (3.204)	-12.3261** (5.779)	-0.4500 (2.662)
FDI/GDP <sup>2</sup>	-0.0221 (0.018)	1.6806*** (0.597)	-0.0084*** (0.003)	-0.0156*** (0.006)	0.1847 (0.125)	0.5403** (0.273)	1.0533** (0.496)	0.0113 (0.247)
R&D	0.6147*** (0.050)	-6.343*** (1.671)	0.0488*** (0.008)	0.0955*** (0.019)	-0.1974 (0.443)	-1.8292** (0.865)	-7.9450*** (1.418)	-5.5497*** (1.240)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Turning Point: FDI	-	5.87	5.98	5.94	-	6.13	5.85	-
Obs.	725	512	725	400	512	512	512	196
<b>First Stage regression</b>								
BITs	0.1567*** (0.053)	0.1589*** (0.057)	0.1567*** (0.053)	0.1750*** (0.065)	0.1589*** (0.057)	0.1589*** (0.057)	0.1589*** (0.057)	0.1497** (0.066)
Cragg-Donald F-Stats	10.23	9.28	10.23	9.25	9.28	9.28	9.29	6.01

Note: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis

## A5. Winsorizing the Data

We provide further robustness by winsorizing our data at the top and bottom 1%. This provides additional robustness for the thresholds and turning points without losing data compared to the exclusion of the top and bottom deciles as done earlier. We do this with and without instrumenting for R&D. The results are presented in Tables A10 and A11. Again, our results are robust and similar to the main findings and we further confirm from Figures A3 and A4 that FDI and R&D are substitutes in the development process with the varying thresholds.

Table A10: Impact of FDI on growth and development -(Winsorizing the data), IV regression

Variable	GDP p.c.	Gini	HDI	iHDI	Headcount poverty \$1.90	Headcount poverty \$3.20	Headcount poverty \$5.50	Multidimensional poverty
FDI/GDP	0.0367*** (0.014)	-1.2267*** (0.220)	0.0099*** (0.002)	0.0244*** (0.006)	-0.1430* (0.059)	-0.3816*** (0.112)	-0.7347*** (0.176)	-0.3470** (0.165)
R & D	0.4891*** (0.059)	-5.8067*** (0.859)	0.0770*** (0.008)	0.1447*** (0.018)	0.1388 (0.338)	-0.7553 (0.532)	-3.9190*** (0.790)	-5.0549*** (1.052)
FDI/GDP x R & D	-0.0174* (0.010)	0.7274*** (0.138)	-0.0060*** (0.001)	-0.0149*** (0.004)	0.0740*** (0.038)	0.1940*** (0.072)	0.3504*** (0.113)	0.1847* (0.106)
ICT Infrastructure	0.0133*** (0.001)	-0.0131 (0.011)	0.0015*** (0.000)	0.0019*** (0.000)	-0.0751*** (0.012)	-0.1571*** (0.015)	-0.2385*** (0.017)	-0.0376* (0.021)
Secondary education	-0.0000 (0.000)	0.0015 (0.003)	0.0000 (0.003)	0.0007 (0.003)	0.0021 (0.003)	-0.0007 (0.004)	0.0023 (0.004)	-0.0089*** (0.004)
Tertiary education	0.0082*** (0.001)	-0.1245*** (0.020)	0.0001 (0.000)	-0.0010*** (0.000)	-0.1065*** (0.018)	-0.2367*** (0.025)	-0.3961*** (0.029)	-0.0703* (0.036)
Financial Development	0.0039*** (0.001)	0.0434*** (0.012)	-0.0001 (0.000)	-0.0010*** (0.000)	0.0018 (0.004)	-0.0010 (0.008)	-0.0292*** (0.012)	0.0036 (0.019)
Inflation	-0.0189*** (0.006)	-0.1091 (0.067)	-0.0013*** (0.001)	-0.0011 (0.001)	0.0469 (0.081)	0.0986 (0.102)	0.2243 (0.146)	0.5124 (0.325)
Unemployment	-0.0092** (0.004)	0.0412 (0.067)	0.0009** (0.000)	0.0032*** (0.001)	0.0526 (0.048)	0.1112 (0.074)	0.3174*** (0.100)	0.4540*** (0.128)
Turning Point: FDI [R&D] Obs.	28.11[2.11] 1111	7.98[1.69] 776	12.83[1.65] 1,223	9.71[1.64] 664	[1.93] 776	[1.97] 776	11.20[2.10] 776	27.37[1.88] 314
<b>First Stage regression</b>								
BITs	2.4559*** (0.4557)	2.8196*** (0.4773)	2.4146*** (0.4459)	2.0650*** (0.4261)	2.8196*** (0.4773)	2.8196*** (0.4773)	2.8196 (0.4773)	2.4650*** (0.4833)
Cragg-Donald F-Stats	86.225	82.268	89.505	46.046	82.268	82.268	82.268	40.942

NB: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis. All variables are winsorized at the top and bottom 1%

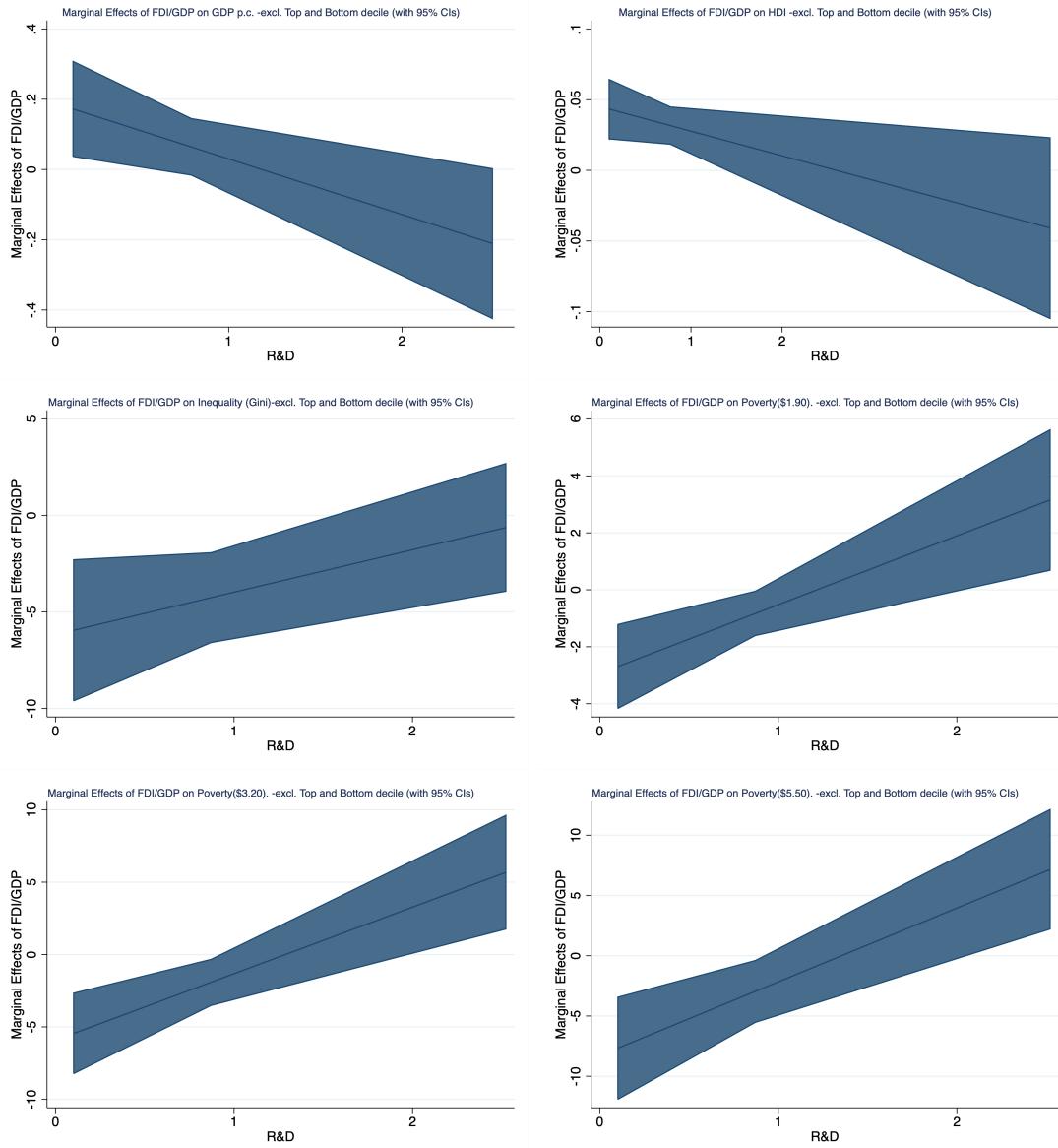


Figure A2: Marginal effects of FDI on development outcomes excluding top and bottom decile of FDI and R&D (with 95% CI), IV regression

Table A11: Impact of FDI on growth and development - (Winsorizing the data and instrumenting for both FDI and R&D), IV regression

Variable	GDP p.c.	Gini	HDI	iHDI	Headcount poverty \$1.90	Headcount poverty \$3.20	Headcount poverty \$5.50	Multidimensional poverty
FDI/GDP	0.0599*** (0.019)	-1.4590*** (0.287)	0.0115*** (0.003)	0.0279*** (0.007)	-0.2507*** (0.087)	-0.6362*** (0.169)	-1.2574*** (0.286)	-0.3120 (0.223)
R & D	1.0791*** (0.109)	-14.8094*** (1.619)	0.1396*** (0.012)	0.2668*** (0.031)	-4.0190*** (0.941)	-8.6647*** (1.437)	-16.9584*** (2.031)	-5.8296*** (2.435)
FDI/GDP x R & D	-0.0327*** (0.013)	0.8873*** (0.181)	-0.0069*** (0.002)	-0.0163*** (0.004)	0.1608*** (0.056)	0.3893*** (0.109)	0.7335*** (0.184)	0.1470 (0.136)
ICT Infrastructure	0.0129*** (0.001)	-0.0198 (0.015)	0.0012*** (0.000)	0.0012*** (0.000)	-0.0628*** (0.016)	-0.1296*** (0.021)	-0.2110*** (0.025)	-0.0390* (0.022)
Secondary education	-0.0001 (0.000)	0.0029 (0.002)			0.0007 (0.004)	-0.0003 (0.005)	0.0044 (0.005)	-0.0006 (0.009)
Tertiary education	-0.0014 (0.002)	0.0534* (0.032)			-0.0039 (0.024)	-0.0482** (0.043)	-0.1016** (0.024)	-0.0572 (0.036)
Financial Development	-0.0014 (0.001)	0.1059*** (0.018)	-0.0007*** (0.000)	-0.0025*** (0.001)	0.0282*** (0.009)	0.0570*** (0.014)	0.0896*** (0.022)	0.0041 (0.032)
Inflation	-0.0028 (0.008)	-0.3444*** (0.102)	0.0004 (0.001)	0.0015 (0.001)	-0.0143 (0.101)	-0.0465 (0.152)	-0.0167 (0.254)	0.5767 (0.361)
Unemployment	0.0005 (0.005)	-0.2548*** (0.093)	0.0017*** (0.001)	0.0071*** (0.001)	-0.0569 (0.068)	-0.1458 (0.109)	-0.2513* (0.152)	0.4333*** (0.182)
Turning Point: FDI [R&D]	33[1.83] 873	16.69[1.64] 638	20.23[1.67] 954	16.24[1.71] 536	25.00[1.56] 638	22.26[1.63] 638	23.12[1.71] 638	- 294
<i>First Stage regression</i>								
BITs	3.0256*** (0.5387)	3.4922*** (0.5417)	3.1243*** (0.5473)	2.8528*** (0.5445)	3.4922*** (0.5417)	3.4922*** (0.5417)	3.4922*** (0.5417)	3.5811*** (0.5790)
<b>R&amp;D</b>	0.4093*** 34.027	0.5146*** 32.499	0.5004*** 36.906	0.4706*** 17.477	0.5146*** 0.0233	0.5146*** 0.0274	0.5146*** 0.0274	0.5412*** 32.499
ln(Researchers in R&D in mil.)	(0.0201)	(0.0274)	(0.0194)					0.5412*** (0.0472)
Cragg-Donald F-Stats								11.025

NB: All variables are as defined earlier. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parenthesis. All variables are winsorized at the top and bottom 1%

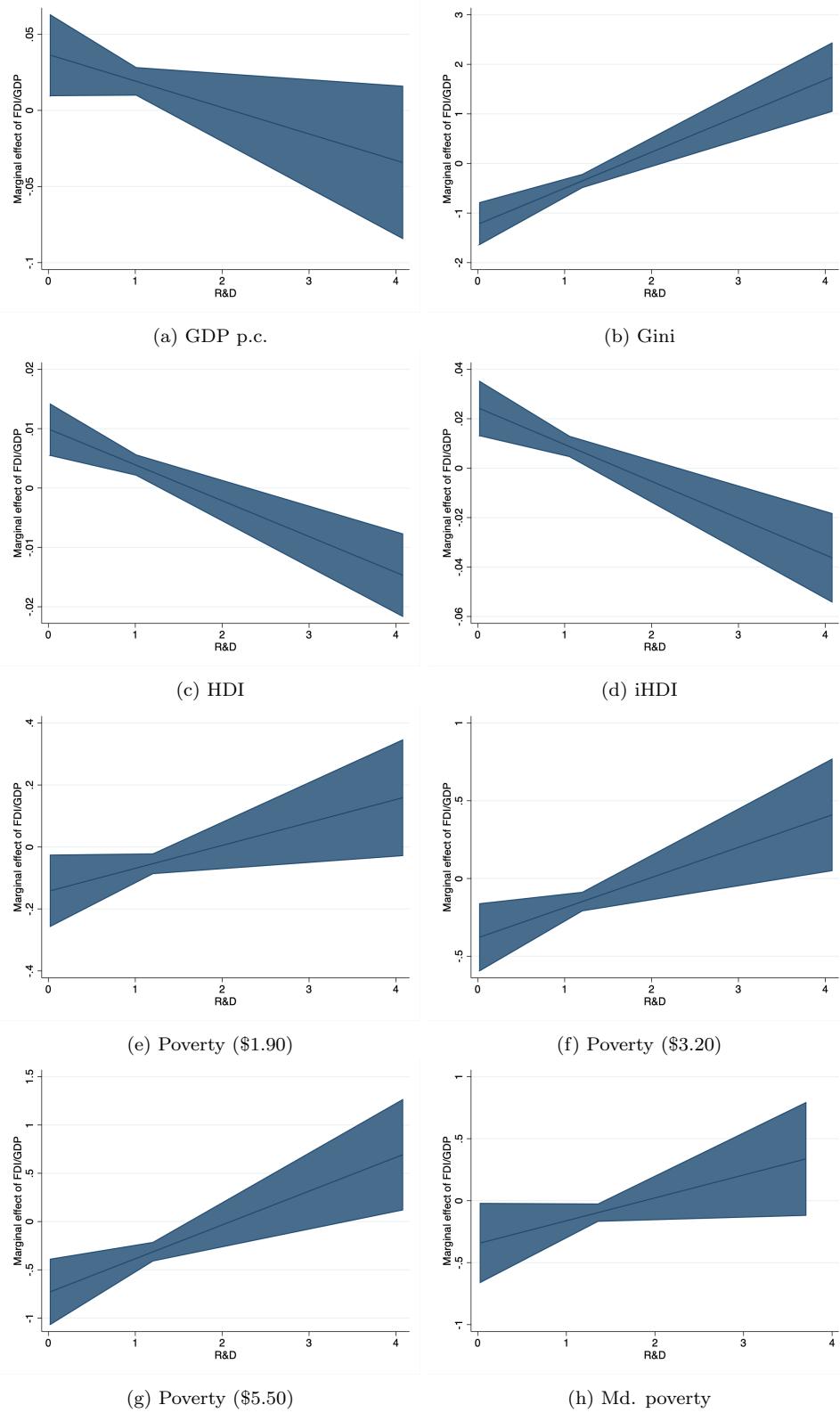


Figure A3: Marginal effects of FDI on growth and development (with 95% CI), IV regression-Winsorizing data

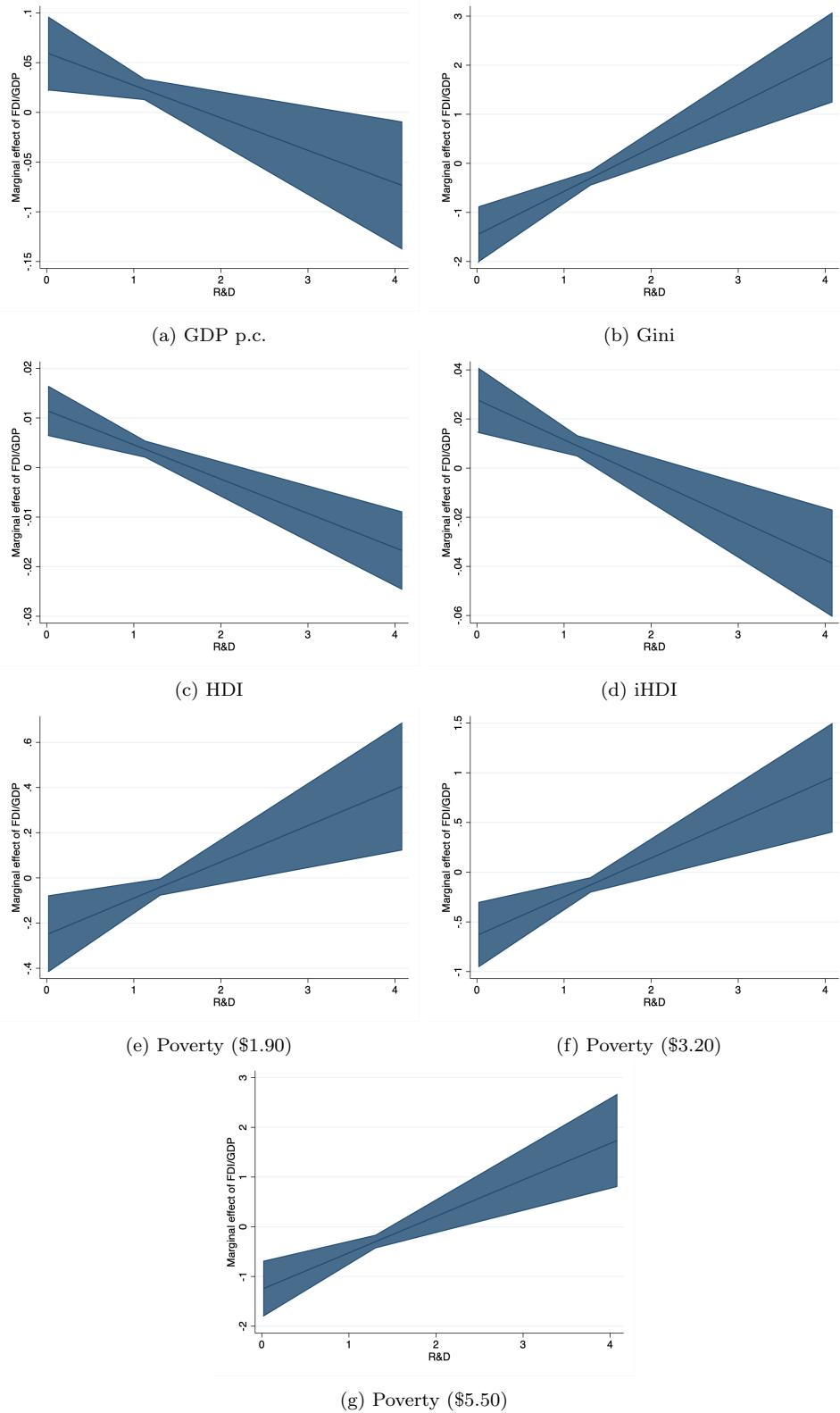


Figure A4: Marginal effects of FDI on growth and development (with 95% CI), IV regression-Winsorizing data and instrumenting for FDI and R&D

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