Supplementary Appendix to "Dimensions of Human Capital and Technological Diffusion"

Authors:

Zainab Asif (Queensland University of Technology)

Radhika Lahiri (Queensland University of Technology)

Part A

Measures of Technology and Human Capital

- *Usage Lags of Technology*

From a theoretical perspective technology usage lag x for a country c at time t explains the time in terms of number years before a leader last had the same level of usage of technology. This shows difference in time period in the usage and adoption of a technology between a country c and that of leader. Following Comin et al (2008), we denote $X_{j,t}$ as the technology usage intensity of a specific technology for country j at a time period t. We evaluate this usage level in country j with the past time series of the leader, which is the U.S. Then the time series of U.S is given as $\{X_{U.S,s}\}$ where the observations over time are indexed as s. We let S denote the set of observations available in the past data. In this time series S for U.S they further select two observations each indicating a technology usage intensity level. In the first case they select $\bar{s}$ which they define as:

$$\bar{s} = \frac{arg\ min}{s \in S}\{s | X_{U.S}s' \geq X_{j,t}\ for\ all\ s' \in S\ and\ s' \geq s\} \tag{1}$$

In equation (1) $\bar{s}$ is the set of observation that denotes the first time U.S passed the level of technology usage $X_{j,t}$ for country j. On the other hand, the second observation $\underline{s}$ denotes the last time U.S recorded a level of technology usage which was either equal or lower than $X_{j,t}$ which is given as:

$$\underline{s} = \frac{arg\ min}{s \in S}\{s | X_{U.S,s} \geq X_{j,t}\} \tag{2}$$

Given these two observations, we denote τ as the last time U.S had technology usage level $X_{j,t}$ which can be computed as follows:

$$\tau = \left(\frac{X_{j,t} - X_{U.S,\underline{s}}}{X_{US,\overline{s}} - X_{US,\underline{s}}}\right)\left(\overline{s} - \underline{s}\right) \tag{3}$$

Since it is known that $\overline{s}$ comes after observation $\underline{s}$ in the historical time series data for U.S,

Comin et al (2008) suggest that the technology usage lag between country j and U.S at time t can

be given as $t - \tau$.

- *Cognitive Skills*

Hanushek and Woessmann (2012) employ the test scores of US as benchmark to develop the

qualitative measures of education which we use in our analysis as representative of human capital.

Based on these test scores they develop a metric which scales the current level of each International

Student Achievement Test (ISAT) relative to the known previous comparable performance of a

student which is expressed as:

$$U_{a,s,t}^{US} = \left(NAEP_{a,s,t}^{US} - NAEP_{a,s,1999}^{US}\right)\frac{SD_s^{US,PISA}}{SD_{a,s}^{US,NAEP}} \tag{4}$$

In equation (4), U is the standardized performance difference of students from the

benchmark country US, a is the age of student and s denotes the subject (i.e. mathematics or

science) at relative time t or benchmark comparison date, which is in this case year 1999.

$SD_s^{US,PISA}$ is the subject specific standard deviation of U.S students on Programme for International

Student Assessment (PISA) test, while $SD_{a,s}^{US,NAEP}$ is the age and subject specific standard deviation

of U.S students on National Assessment of Educational Progress (NAEP) test.

Moreover in order to bring in variation in test scores over time that are comparable across

countries they select a group of OECD countries as a benchmark to develop a comparable scale

for the variation on different ISATs.[1] The framework transforms original test scores denoted as O

---

[1] This group of countries is called OECD standardized group (OSG) which includes countries: Austria, Belgium, Canada, Denmark, France, Germany, Iceland, Japan, Norway, Sweden, Switzerland, United Kingdom and United States.

of country i, for each age a and subject s at time t into a transformed test score X which is expressed as:

$$X_{a,s,t}^i = \left(O_{a,s,t}^i - \overline{O_{a,s,t}^{OSG}}\right) \frac{SD_{s,PISA}^{OSG}}{SD_{a,s,t}^{OSG}} \tag{5}$$

Given equation (5), the transformed test score X has mean zero among the OECD standardized group countries. The variation in the metric of rescaled test score termed as X in the above equation is comparable across tests. In order to generate the common metric for educational quality that is comparable across time, country and subject, they combine equation (4) and (5), where the standardized test score can be formally expressed as:

$$I_{a,s,t}^i = X_{a,s,t}^i - X_{a,s,t}^{US} + O_{s,PISA}^{US} + U_{a,s,t}^{US} \tag{6}$$

Equation (6) gives the standardized test score $I_{a,s,t}^i$. It determines the performance in ISAT for all participating countries on a common scale that can be compared across ISATs. After performing the standardization procedures this exercise provides cognitive skills measured as a simple average of all standardized science and mathematics test scores of the ISAT's for a participating country.

Part A (continued): Definitions and Descriptive Statistics:

Variable Name	Definition	Source
Mathematics Cognitive skills	Mathematics test scores for grade 8	National Center for Education Statistics (1992). Report on TIMSS and PIRLS byInternational Study Center, Lynch School of Education, Boston College & International Association for the Evaluation of the Educational Achievement. 2011.
Science Cognitive Skills	Science test scores for grade 8	National Center for Education Statistics (1992). Report on TIMSS and PIRLS byInternational Study Center, Lynch School of Education, Boston College & International Association for the Evaluation of the Educational Achievement. 2011.
Years of Schooling	Average years of total schooling	Barro and Lee 2010
Life Expectancy	Life expectancy at birth, total (years)	World Bank, World Development Indicators.(2015)
Foreign Direct Investment	Foreign direct investment, net inflows (% of GDP)	World Bank, World Development Indicators.(2015)
Real GDP per capita	Gross Domestic Product (GDP) measured in 1990 International Geary-Khamis dollar.	Maddison Data Set (2018)
Unemployment Rate	Unemployment, total (% of total labor force) (national estimate)	World Bank, World Development Indicators.(2015)
Harvester	Number of self-propelled machines that reap and thresh in one Operation	Comin and Hobijn (2009)
Milking machine	Number of installations consisting of several complete milking units	Comin and Hobijn (2009)
Tractor	Number of wheel and crawler tractors (excluding garden tractors) used in agriculture	Comin and Hobijn (2009)
Fertilizer	Metric tons of fertilizer consumed. Aggregate of 25 individual types listed in source	Comin and Hobijn (2009)

Bone marrow Transplant	Number of bone marrow transplants performed	Comin and Hobijn (2009)
Heart Transplant	Number of heart transplants performed	Comin and Hobijn (2009)
Kidney Transplant	Number of kidney transplants performed	Comin and Hobijn (2009)
Liver Transplant	Number of liver transplants performed	Comin and Hobijn (2009)
Lung Transplant	Number of lung transplants performed.	Comin and Hobijn (2009)
Cable TV	Number of households that subscribe to a multi-channel television service delivered by a fixed line connection	Comin and Hobijn (2009)
Cellphone	Number of users of portable cell phones	Comin and Hobijn (2009)
Mail	Number of items mailed/received, with internal items counted one and cross-border items counted once for each country. May or may not include newspapers sent by mail, registered mail, or parcel post	Comin and Hobijn (2009)
Newspaper	Number of newspaper copies circulated daily. Note that there is a tendency for news circulation to be under-reported, since data for weekly and biweekly publications are not included	Comin and Hobijn (2009)
Radio	Number of radios	Comin and Hobijn (2009)
Telephones	Number of mainline telephone lines connecting a customer's equipment to the public switched telephone network as of year end	Comin and Hobijn (2009)
Internet	Number of people with access to the worldwide network	Comin and Hobijn (2009)

Computer	Number of self-contained computers designed for use by one person	Comin and Hobijn (2009)
Visitor beds	Number of visitor beds available in hotels and elsewhere visitor rooms	Comin and Hobijn (2009)
Visitor rooms	Number of visitor rooms available in hotels and elsewhere. years)	Comin and Hobijn (2009)
Aviationpkmp/air	Civil aviation passenger-KM traveled on scheduled services by companies registered in the country concerned. Not a measure of travel through a country's airports	Comin and Hobijn (2009)
Shipton Steam motor/sea	Tonnage of steam and motor ships (above a minimum weight) in use at midyear	Comin and Hobijn (2009)
Vehicle car/land	Number of passenger cars (excluding tractors and similar vehicles) in use. Numbers typically derived from registration and licensing records, meaning that vehicles out of use may occasionally be included.	Comin and Hobijn (2009)
Electricity production	Gross output of electric energy (inclusive of electricity consumed in power stations) in KwHr	Comin and Hobijn (2009)
Population	Population	Comin and Hobijn (2009)
Political Rights	Countries are ranked on the scale of 1-7 with countries and territories with a rating of 1 enjoy a wide range of political rights. These include free and fair elections. Candidates who are elected actually rule, political parties are competitive, the opposition plays an important role and enjoys real power, and the interests of minority groups are well represented in politics and government.	Freedom in the World Report (2016)
Civil Liberties	Countries are ranked on the scale of 1-7 with countries and territories with a rating of 1 enjoy a wide range of civil liberties. These include freedoms of expression, assembly, association, education, and religion. They have an established and generally fair legal system that ensures the rule of law (including an independent judiciary), allow free economic activity, and tend to strive for equality of	Freedom in the World Report (2016)

	opportunity for everyone, including women and minority groups.	
GDP per capita	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.	World Bank, World Development Indicators (2015)
Expenditure on R& D	Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development.	World Bank, World Development Indicators (2015)

Part B: Descriptive Statistics for Mathematics Cognitive Skills Panel for Usage Intensity as measure of Technology Adoption (1964-2003).

Variable	Observations	Mean	Std Dev	Min	Max
Mathematics Cognitive skills	480	424.064	111.452	122.4	609
Years of Schooling	1000	8.001	2.582	0.92	12.64
Life Expectancy	1038	71.68183	6.006965	44.92385	81.76
Foreign Direct Investment	672	2.015817	2.899249	-0.6519227	22.38404
Unemployment Rate	495	7.360606	4.875179	0.9	36.7
Harvester	856	2.217481	2.440021	0.0000996	10.21824
Milking machine	494	4.761195	5.033899	0.0067787	21.15954
Tractor	894	13.80816	12.18866	0.001072	58.20502
Fertilizer	893	46.68103	40.69915	0.599535	229.3602
Bone marrow Transplant	176	0.0214691	0.0183561	0.0001206	0.0746298
Heart Transplant	165	0.0049186	0.0033667	0	0.0147882
Kidney Transplant	398	0. 0210578	0.0128271	0.0000962	0.0507885
Liver Transplant	176	0.0064384	0.0046055	0	0.0184819
Lung Transplant	120	0.0017186	0.0012383	0	0.0046925
Cable TV	457	94.04078	109.0733	0	401.346
Cellphone	671	97.31201	205.5867	0	1026.304
Mail	554	0.1775561	0.1306173	0.0023467	0.6652465
Radio	845	0.5986825	0.4161835	0.0517568	2.147192
Telephone	678	284.8042	234.0749	2.089562	1013.462
Internet	310	105.475	150.6394	0	573.1446
Computer	368	159.2686	153.634	0.8779043	696.3917

Visitor beds	491	13.39978	9.011875	0.2283789	40.57656
Visitor rooms	577	6.565598	4.312404	0.2860303	17.09582
Aviation pkmp/air	600	0.9307605	1.56559	0.001707	13.57749
Shipton Steammotor/sea	389	0.2673012	0.5718443	0.0018271	3.300755
Vehicle car/land	798	216.9602	177.0675	0. 5360206	791.4692
Electricity production	909	5465321	5501502	35040.34	3.12e+07
Population	962	39562.11	63868.29	1017	291200
Political Rights	742	2.448787	1.926992	1	7
Civil Liberties	742	2.568733	1.797432	1	7
GDP per capita	903	9823.426	9927.19	105.1262	50111.66
Expenditure R&D	168	1.611943	0.9913625	0.10166	4.22244

Part B (continued): Descriptive Statistics for Science Cognitive Skills Panel for Usage Intensity as measure of Technology Adoption (1973-2003).

Variable	Observations	Mean	Std Dev	Min	Max
Science Cognitive skills	418	131.2	367.3213	151.1557	580
Years of Schooling	713	8.317363	2.450953	1.79	12.64
Life Expectancy	744	72.27863	5.067044	53.47881	81.76
Foreign Direct Investment	578	2.219367	2.994509	-0.6519227	22.38404
Unemployment Rate	432	7.180787	5.252941	0.9	36.7
Harvester	552	2.557819	2.6157	0.0007337	10.21824
Milking machine	271	4.700926	5.172172	0.0067787	21.15954
Tractor	610	14.06253	13.14737	0.0085992	58.20502
Fertilizer	609	47.60572	42.00031	0.599535	229.3602
Bone marrow Transplant	136	0.0179578	0.0167072	0.0001206	0.067665
Heart Transplant	117	0.0041423	0.0025224	0	0.0089563
Kidney Transplant	272	0.0227518	0.0129084	0.0006714	0.0507885
Liver Transplant	121	0.0063818	0.0046032	0	0.0184819
Lung Transplant	95	0.0018226	0.0013436	0	0.0046925
Cable TV	396	65.82861	82.7646	0	278.7279
Cellphone	615	89.85775	192.0515	0	939.4391
Mail	329	0.1697851	0.1492096	0.0036425	0.6652465
Radio	567	0.6420931	0.4513853	0.0857526	2.147192

Telephones	431	292.6813	251.6995	6.327229	1013.462
Internet	276	102.5083	149.4308	0	573.1446
Computer	332	147.8118	158.4431	0.8779043	696.3917
Visitor beds	410	12.78704	9.883768	0.2283789	40.57656
Visitor rooms	536	6.199816	4.514737	0.2860303	17.09582
Aviation kmp/air	357	1.196812	1.939648	0.0357245	13.57749
Shipton Steam motor/sea	253	0.3441496	0.6950479	0.0042609	3.300755
Vehicle car/land	519	225.8919	189.7235	2.190707	791.4692
Electricity production	612	6120185	6228404	181876.8	3.12e+07
Population	669	42246.37	67901.2	1674	291200
Political Rights	640	2.720312	1.965642	1	7
Civil Liberties	640	2.829687	1.853152	1	7
GDP per capita	633	10574.13	10243.84	269.8519	50111.66
Expenditure R&D	149	1.372285	0.9553502	0.10166	3.91382

Part B (continued): Descriptive Statistics for Mathematics Cognitive Skills Panel for Technology Usage Lags as measures of Technology Diffusion (1973-2003)

Variable	Observations	Mean	Std Dev	Min	Max
Mathematics Cognitive skills	440	428.1243	110.2615	122.4	609
Years of Schooling	960	7.866635	2.518101	0.92	11.76
Life Expectancy	998	71.5944	6.093759	44.92385	81.76
Foreign Direct Investment	638	2.082505	2.956014	-0.6519227	22.38404
Real GDP lag per capita	975	29.08615	18.07572	4	73
Unemployment Rate	471	7.415711	4.980973	0.9	36.7
Harvester	706	22.52295	11.17289	1.803589	40.99407
Tractor	744	21.43499	11.06449	-2.269452	40.99862
Fertilizer	701	20.55985	11.52588	-2.603976	43.00351
Bone marrow Transplant	116	1.486409	3.937542	-6.049613	12.04657
Heart Transplant	102	7.153791	4.400163	2.974864	14.98844
Kidney Transplant	329	5.504315	7.862458	16.97348	27.2596
Liver Transplant	148	5.309744	4.722574	2.164151	21.02741
Lung Transplant	76	3.244937	4.922544	7.649384	14.53378
Cable TV	235	13.71066	8.345276	-18.62067	27.51526
Cellphone	333	2.391144	4.276329	-7.869115	12.14841
Mail	526	60.61741	25.1219	7.968489	107.4928

Radio	787	32.74951	10.11304	13.13484	60.64052
Telephone	613	42.08814	26.05534	-0.1616383	87.49915
Internet	277	2.755459	2.542218	-1.744918	9.251847
Computer	344	7.733123	4.754848	-0.7463593	19.51483
Visitor beds	365	9.568224	7.048247	-3.591774	23.91281
Visitor rooms	498	10.2466	8.419268	-24.9582	25.92233
Aviation pkmp/air	535	16.37194	10.78567	-17.4344	45.87047
Electricity production	753	31.76108	17.77717	-18	67.01201
Political Rights	710	2.514085	1.944708	1	7
Civil Liberties	710	2.639437	1.805686	1	7
GDP per capita	863	9446.723	9693.34	105.1262	50111.66
Expenditure on R& D	160	1.565586	0.9932934	0.10166	4.22244

Part B (continued): Descriptive Statistics for Science Cognitive Skills Panel for Technology Usage Lags as measures of Technology Diffusion (1964-2003)

Variable	Observations	Mean	Std Dev	Min	Max
Mathematics Cognitive skills	387	372.5238	149.0293	131.2	580
Years of Schooling	682	8.147155	2.366785	1.79	11.76
Life Expectancy	713	72.16753	5.138295	53.47881	81.76
Foreign Direct Investment	547	2.298172	3.054491	-0.6519227	22.38404
Real GDP lag per capita	681	33.68674	19.32983	4	73
Unemployment Rate	408	7.233824	5.389327	0.9	36.7
Harvester	438	27.26247	8.415413	11.3886	40.99407
Tractor	498	26.09841	8.535559	6.340208	40.99862
Fertilizer	494	24.48208	9.807492	-1.955834	40.96936
Bone marrow Transplant	89	1.729173	4.164594	-7.323859	12.04657
Heart Transplant	93	23.71823	47.77922	-6.02362	216.5907
Kidney Transplant	224	6.097456	9.264138	-27.43828	34.35971
Liver Transplant	102	5.430726	4.998367	-2.164151	21.02741
Lung Transplant	69	2.885949	5.33661	-7.649384	14.53378
Cable TV	201	15.65594	7.227921	-12.21838	43.27872
Cellphone	317	2.550117	4.362253	-7.869115	12.14841
Mail	307	67.58051	27.22576	7.968489	107.4928

Radio	518	36.40362	9.782321	13.13484	60.64052
Telephone	386	49.21271	27.22868	-0.1616383	87.66544
Internet	244	3.099174	2.666004	-1.744918	9.251847
Computer	309	8.416949	5.145492	-0.7463593	19.51483
Visitor beds	282	9.689905	7.206189	-2.562439	23.91281
Visitor rooms	445	25.69847	66.30322	-24.9582	327.4338
Aviation pkmp/air	309	19.55163	11.03387	-17.4344	45.87047
Electricity production	483	35.49276	17.83551	-18	67.01201
Political Rights	609	2.807882	1.975392	1	7
Civil Liberties	609	2.922824	1.851996	1	7
GDP per capita	602	9996.65	9918.367	269.8519	50111.66
Expenditure on R& D	141	1.306084	0.939365	0.10166	3.91382

Part B Continued: Systems GMM for Usage intensity and Usage Lags of Technologies.

Table 1 : Systems GMM for Usage Intensity of Technologies Mathematics Test scores

Robust Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively. For systems GMM regression, we use lag 2 of the dependant variables lags of independent variables as instrumented variables to prevent potential endogeneity of our dependent and

Variables	Shipton Steam motor/ sea	Cable TV	Mail	Computers	Internet users	Telephone	Cell phones	Fertilizers
Lagged dependent variable	0.9174***	1.0005***	1.0241***	1.0821***	1.0056***	1.0168***	1.0830***	1.0114***
	(0.0333)	(0.0163)	(0.0053)	(0.0158)	(0.0534)	(0.0079)	(0.0288)	(0.0170)
Cognitive Skills	-0.0001	0.0296	0.000004	0.1163*	0.1034	0.0127	0.0460	-0.0078
	(0.0001)	(0.0265)	(0.00001)	(0.0623)	(0.0874)	(0.0306)	(0.0487)	(0.0085)
Years of Schooling	-0.0026*	-0.3348	-0.0006	-0.4336	0.7630	-1.8659**	0.8103	-0.0718
	(0.0012)	(0.8679)	(0.0005)	(0.8832)	(1.7279)	(0.7942)	(1.3374)	(0.1784)
Life Expectancy	0.0041*	0.0892	0.0009**	0.5218	3.9916***	0.4653	1.6330	0.1355
	(0.0019)	(0.4729)	(0.0004)	(0.5450)	(1.0142)	(0.6432)	(1.2214)	(0.1530)
FDI	0.0014	-0.1369	0.0005	0.2209	0.4961	3.3730**	1.2674	-0.0610
	(0.0010)	(0.4106)	(0.0007)	(0.5678)	(0.8652)	(1.1530)	(1.2131)	(0.0651)
Observations	199	233	175	198	170	210	281	316
AB test AR (1) (p-val)	-1.68(0.094)	-2.27(0.023)	-2.09 (0.036)	-2.38(0.017)	-2.37(0.018)	-1.96(0.05)	-1.21(0.02)	-2.14(0.032)
AB test AR (2)(p-val)	1.17(0.241)	-1.21(0.225)	1.11(0.265)	-1.05 (0.292)	-1.46(0.145)	0.37 (0.711)	-0.61 (0.544)	-0.77(0.439)
Hansen test (p-val)	0.00(1.000)	5.69(1.000)	0.00(1.000)	1.14(1.000)	4.43(1.000)	0.00(1.000)	2.75(1.000)	1.54(1.000)

independent variables with the residuals. Two standard diagnostic tests for system GMM dynamic model estimations are reported. The first is the Arellano–Bond tests for auto-covariance in residuals of order 1 as shown in the AB test AR(1) and of order 2 as shown in the AB test AR(2) with H_0: no auto-correlation. The second is the Hansen test to check for over-identifying restrictions; p-values are mentioned.in brackets.

Table 2: Systems GMM for Usage Intensity of Technologies Science Test scores

Variables	Aviation pkm air	Shipton Steam motor/ sea	Cable TV	Computes	Internet users	Telephone	Cell phones
Lagged dependent variable	1.0570***	1.0168***	1.005***	1.0792***	1.0157***	0.9988***	1.0728***
	(0.0221)	(0.0098)	(0.0149)	(0.0141)	(0.0462)	(0.0101)	(0.0284)
Cognitive Skills	0.0002	0.00001	-0.0026	0.1221*	0.0908	0.0175	0.0232
	(0.0002)	(0.00002)	(0.0228)	(0.0612)	(0.0814)	(0.0332)	(0.0362)
Years of Schooling	-0.0040	-0.0001	0.0379	-1.1772	0.8839	0.0975	0.4482
	(0.0058)	(0.0005)	(0.7822)	(1.0716)	(1.4465)	(1.5310)	(1.3857)
Life Expectancy	-0.0029	-0.0019	-0.0321	0.7536*	3.5791***	0.1168	2.3551**
	(0.0030)	(0.0002)	(0.447)	(0.3507)	(0.7151)	(0.6437)	(1.1011)
FDI	-0.0025	-0.0002	-0.208	0.1152	0.5282	0.7902	1.0899
	(0.0204)	(0.0003)	(0.335)	(0.5286)	(0.7376)	(1.1307)	(1.0406)
Observations	174	96	276	237	199	184	327
AB test AR(1)(p-val)	-1.82(0.068)	-1.24 (0.214)	-2.28 (0.023)	-2.62 (0.009)	-2.58(0.01)	-1.68 (0.093)	-1.08(0.02)
AB test AR(2) (p-val)	-0.13(0.895)	1.31(0.191)	-1.28 (0.200)	-0.72 (0.471)	-1.81(0.07)	-0.25 (0.79)	-0.73 (0.46)
Hansen test (p-val)	0.00(1.000)	0.00(1.000)	11.25 (1.000)	6.63(1.000)	5.96(1.000)	0.00(1.000)	8.48(1.000)

Robust Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively. For systems GMM regression, we use lag 2 of the dependant variables lags of independent variables as instrumented variables to prevent potential endogeneity of our dependent and independent variables with the residuals. Two standard diagnostic tests for system GMM dynamic model estimations are reported. The first is the Arellano–Bond tests for auto-covariance in residuals of order 1 as shown in the AB test AR(1) and of order 2 as shown in the AB test AR(2) with H_0: no auto-correlation. The second is the Hansen test to check for over-identifying restrictions; p-values are mentioned.in brackets.

Table 3: Systems GMM for Usage Lags of Technologies Mathematics Test Scores

Variables	Computers	Telephone	Cell phones	Visitor rooms
Lagged dependent variable	0.9905***	1.0013***	0.9543***	0.9588***
	(0.0359)	(0.0276)	(0.0455)	(0.0417)
Cognitive Skills	-0.0038	-0.0037	-0.0005	0.0012
	(0.0030)	(0.0032)	(0.0021)	(0.0012)
Years of Schooling	0.0120	0.1438	-0.1099***	0.0255
	(0.0437)	(0.1467)	(0.0325)	(0.1016)
Life Expectancy	-0.0593	0.0531	0.0079	0.0369
	(0.0514)	(0.1771)	(0.0340)	(0.0635)
FDI	0.0078	-0.1647*	-0.0402	0.0011
	(0.0285)	(0.0897)	(0.0450)	(0.0413)
GDP/income lag	0.0058	-0.0037	0.0079	0.0260*
	(0.0134)	(0.0591)	(0.0110)	(0.0125)
Observations	176	171	160	206
AB test AR(1) p-val	-2.44(0.015)	-2.86(0.004)	-2.41(0.016)	-1.39 (0.164)
AB test AR (2) p-val	-1.03 (0.305)	1.68 (0.10)	-1.78(0.075)	0.76(0.040)
Hansen test (p-val)	2.26(1.000)	0.00(1.000)	0.00(1.000)	0.01(1.000)

Robust Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively. For systems GMM regression, we use lag 2 of the dependant variables lags of independent variables as instrumented variables to prevent potential endogeneity of our dependent and independent variables with the residuals. Two standard diagnostic tests for system GMM dynamic model estimations are reported. The first is the Arellano–Bond tests for auto-covariance in residuals of order 1 as shown in the AB test AR(1) and of order 2 as shown in the AB test AR(2) with H_0: no auto-correlation. The second is the Hansen test to check for over-identifying restrictions; p-values are mentioned.in brackets.

Table 4: Systems GMM for Usage Lags of Technologies Science Test Scores

Variables	Cable TV	Cell phones	Transplant Heart
Lagged dependent variable	0.9493***	0.9577***	0.8759***
	(0.0531)	(0.0302)	(0.0175)
Cognitive Skills	-0.0086	0.0016	0.0833
	(0.0053)	(0.0021)	(0.1074)
Years of Schooling	0.0604**	-0.1144	0.2523
	(0.1319)	(0.0484)	(1.2370)
Life Expectancy	-0.0069	-0.0054	-2.8093
	(0.1553)	(0.0258)	(3.2441)
FDI	0.0144	-0.0442	-1.0176
	(0.0231)	(0.0296)	(1.1208)
GDP/income lag	0.0012	0.0034	-0.5750
	(0.0247)	(0.0089)	(0.6601)
Observations	155	221	79
AB test AR(1)(p-val)	-2.79(0.007)	-2.79 (0.005)	-1.41(0.159)
AB test AR(2)(p-val)	-1.60 (1.69)	-1.60(0.11)	0.94 (0.347)
Hansen test (p-val)	0.00(1.000)	0.00(1.000)	0.00(1.000)

Robust Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively. For systems GMM regression, we use lag 2 of the dependant variables lags of independent variables as instrumented variables to prevent potential endogeneity of our dependent and independent variables with the residuals. Two standard diagnostic tests for system GMM dynamic model estimations are reported. The first is the Arellano–Bond tests for auto-covariance in residuals of order 1 as shown in the AB test AR(1) and of order 2 as shown in the AB test AR(2) with H_0: no auto-correlation. The second is the Hansen test to check for over-identifying restrictions; p-values are mentioned.in brackets.

Part C: Additional Robustness Checks

In what follows we carry out three additional robustness checks for separate panels based on generic and specific cognitive skills for adoption and diffusion of technology respectively. Firstly, we control for the quality of institutions using measures of political rights and civil liberties. This is motivated by the recent emphasis on the role of institutions in the process of economic growth as poor quality institutions adversely affect economic performance of a country (Acemoglu et al 2005). On the other hand, good quality institutions ensure efficient allocation of resources, protect and safeguard political rights and civil liberties, reduce uncertainties, enable investment in high return projects and facilitate coordination among economic agents (North, 1990; Aghion et al, 2008; Meyer and Sinani, 2009; Rodrik et al, 2004; Glaeser et al, 2004; Flachaire et al, 2014; Jude and Levieuge, 2015.

Furthermore, improvements in technology through investment in human capital lead to economic growth. Developed economies experience higher growth because they are technologically more advanced than developing economies and are able to invest to a greater degree in the development of human capital and research and development aimed at technological adaptation (Romer, 1990; Aghion and Howitt, 1992). We therefore use GDP per capita to examine the influence of economic development on the adoption and diffusion of technology. We also use expenditure on research and development (R&D) as percentage of GDP and evaluate its impact on technology adoption and diffusion.

The robustness results are reported in Appendix C. Tables 1-2 of this appendix summarize results for adoption of technologies for generic and specific skills respectively. In addition, tables 3-4 contain results for diffusion of technologies for both generic and specific skills. Each panel in these tables represents a specific technology. The first column in each panel reports results regarding the impact of institutional quality on adoption and diffusion of selected technologies, while second and third columns respectively present the coefficients of GDP per capita and R&D expenditures for the technology in question.

Adoption and diffusion responses of majority of technologies are similar as in baseline regressions with the inclusion of institutional quality in both generic and specific panel estimations. In relation to the role of institutions, we obtain variable coefficients for the proxies of institutional quality. The "civil liberties" variable seems to be positive and significant in the

context of a larger set of technologies relative to others; however in most cases institutional variables are less important in comparison with measures of human capital.

Regarding the control variable for economic development, namely GDP per capita, the results for robustness checks for both generic and specific human capital reinforce earlier findings of baseline regressions. Again, in common with other control variables, macro-level variables of this type are rarely significant in the regressions. However, there are some exceptions. The usage intensity of some technologies, such as liver and lung transplant procedures, vehicle and cable TV respond positively to GDP per capita in both mathematics and science panels. In addition, we see that increase in GDP leads to a significant reduction in usage lags of fertilizer and visitor bed technologies. However, the results in the context of human capital remain qualitatively similar to the baseline regressions.

Controlling for R&D our results again show that outcomes in relation to human capital remain similar to baseline regressions. Expenditures on R&D, as with the case of other control variables are significant for a small set of technologies

Table1: Robustness Checks for Mathematics Skills Panel (Usage Intensity of Technologies).

Variables	(1) Transplant Liver			(2) Transplant Lung			(3) Visitor beds		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	0.000013 (0.000006)	0.0000065 (0.000006)	0.000073 (0.000068)	0.00002*** (0.000006)	0.000020*** (0.000007)	-.0000179 (0.0000633)	0.01187*** (0.0034)	0.007998* (0.00438)	-0.023136 (0.02688)
Years of Schooling	0.0007603 (0.00052)	0.00007416 (0.000522)	0.0015205 (0.00132)	-0.000898 ** (0.00036)	-0.001069*** (0.000369)	-0.000356 (0.00118)	-0.019472 (0.21529)	-0.079915 (0.21935)	0.10662 (0.56180)
Life Expectancy	-0.000268 (0.00027)	-0.000217 (0.000275)	-0.0014993 (0.00077)*	0.000416** (0.000163)	0.0004319*** (0.00016)	-0.0000532 (0.00075)	0.05572 (0.14597)	0.075843 (0.14708)	-0.060272 (0.21628)
FDI	-0.000012 (0.00004)	-0.000008 (0.00004)	-0.0000985 (0.00011)	-0.000001 (0.00002)	-0.0000015 (0.000025)	(0.00010) (0.00010)	-0.07433** (0.03480)	-0.07094** (0.03503)	-0.10202 (0.10031)
Political Rights	-0.00067 (0.00077)	-0.00022 (0.00081)					-0.29977 (0.26496)	-0.248431 (0.26874)	-0.06508 (0.47271)
Civil Liberties	0.000173 (0.00074)	-0.000006 (0.00074)		-0.000222 (0.00058)	-0.00043 (0.00058)		-0.03345 (0.33508)	-0.027362 (0.336527)	-0.327765 (0.56605)
GDP Per capita		0.00000006 (0.0000003)*	0.00000007 (0.00000007)		0.00000005** (0.00000002)	0.00000004 0.00000007		0 .000043 (0.00003)	-0.0000686 (0.000142)
Research & Development			0.0094451 (0.00438)**			0.0028803 (0.00413)			0.0026051 (1.2998)
Lagged dependent variable	0.7909*** (0.07891)	0.751695*** (0.08180)	0.2716344 (0.22203)	0.2529*** (0.11872)	0.268187** (0.117072)	-0.10466 (0.81608)	0.7162*** (0.05667)	0.7228*** (0.0565)	0.6902*** (0.1841)
Observations	83	83	16	68	68	16	157	157	32

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 1 continued: Robustness Checks for Mathematics Skills Panel (Usage Intensity of Technologies)

Variables	(4) Vehicle car/land			(5) Cable TV			(6) Computer		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	0.018992 (0.03530)	-0.040395 (0.03768)	0.543810 (0.95384)	0.1142*** (0.0353)	0.06643* (0.03926)	-0.239419 (0.82716)	0.20109*** (0.05913)	0.21552*** (0.07104)	0.873177 (0.67931)
Years of Schooling	-1.4853 (2.7145)	-1.436219 (2.6172)	-3.651587 (10.026)	1.550353 (2.6539)	1.315192 (2.6218)	1.799311 (9.2926)	7.683769** (3.59070)	7.852866** (3.62043)	15.3934 (10.954)
Life Expectancy	1.240549 (1.8851)	1.710958 (1.8221)	4.333874 (5.7518)	-.608835 (1.50703)	-.9733144 (1.49295)	4.953014 (4.70411)	2.635373 (2.2624)	2.581063 (2.2829)	4.982002 (5.9151)
FDI	0.09599 (0.50518)	0.072433 (0.48711)	-2.778173 (2.4257)	-1.045*** (0.31227)	-0.92542*** (0.31161)	-0.168778 (0.88461)	0.20785 (0.40405)	0.18115 (0.40856)	-1.86743* (1.1231)
Political Rights	-0.72536 (2.6632)	0.358174 (2.5846)	6.11402 (7.3948)	-8.769*** (2.7068)	-8.513206*** (2.6737)	-6.928899 (8.1358)	-0.0467878 (2.5885)	-0.09809 (2.6046)	13.3344 (10.406)
Civil Liberties	4.943798* (2.9863)	1.892107 (2.9968)	1.896459 (7.81754)	5.316003** (2.4019)	3.424606 (2.4759)	-0.9417895 (7.71469)	-2.68915 (3.3899)	-2.64764 (3.4598)	-9.09771 (9.5067)
GDP Per capita		0.0011*** (0.00030)	-0.0000721 (0.00124)		0.000583*** (0.00021)	-0.0011603 (0.00110)		-0.000115 (0.000353)	.0011837 (0.001381)
Research & Development			67.29925* (35.716)			9.355411 (16.2555)			-41.75186 (26.099)
Lagged dependent variable	0.9425*** (0.02786)	0.8667*** (0.03387)	0.5731*** (0.1569)	0.8569*** (0.03136)	0.8442*** (0.03133)	0.5337*** (0.1466)	1.0147*** (0.0154)	1.015*** (0.0157)	1.011*** (0.0548)
Observations	227	227	26	212	212	54	178	178	63

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 1 continued: Robustness Checks for Mathematics Skills Panel (Usage Intensity of Technologies)

Variables	(7) Tractor			(8) Fertilizer		
	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	-0.00303*	-0.000582	0.029655	-0.0442351***	-0.00104908	-0.1352981
	(0.00162)	(0.00198)	(0.06046)	(0.01492)	(0.01703)	(0.12974)
Years of Schooling	0.029415	0.034499	0.464117	-3.601329***	-3.52864**	0.4274924
	(0.13385)	(0.13383)	(0.72843)	(1.1844)	(1.171003)	(1.58566)
Life Expectancy	0.0058313	0.018735	0.033375	3.437704***	3.9067***	-1.824247**
	(0.06975)	(0.07005)	(0.35982)	(0.70235)	(0.70433)	(0.80098)
FDI	0.0048781	0.0027866	-0.0097704	-0.1256564	-0.1922653	-0.1750385
	(0.02503)	(0.02487)	(0.0986123)	(0.221213)	(0.2193273)	(0.2115905)
Political Rights	0.1729604	0.1287412	-0.0546575	0.2797649	-0.61966	-1.11979
	(0.14262)	(0.14399)	(0.67600)	(1.24716)	(1.2536)	(1.4850)
Civil Liberties	0.2545829*	0.364131**	0.073563	2.09251	4.102527***	0.591595
	(0.15025)	(0.15872)	(0.844675)	(1.36454)	(1.44108)	(1.8202)
GDP Per capita		-0.0000308**	-0.0000616		-0.0005***	-0.0005043**
		(0.000014)	(0.000101)		(0.00012)	(0.00023)
Research & Development			-0.5875405			-4.359462
			(1.47783)			(3.1697)
Lagged dependent variable	0.8800***	0.88801***	0.7385***	0.8244***	0.7930***	0.134858
	(0.0198)	(0.0201)	(0.0895)	(0.0346)	(0.03514)	(0.14849)
Observations	279	279	50	279	279	50

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 2: Robustness Checks for Science Skills Panel (Usage Intensity of Technologies).

	(1) Transplant Liver	(2) Transplant Lung	(3) Visitor beds

Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	0.000006** (0.000002)	0.000005** (0.000002)	(0.00002)** (0.000009)	0.000004*** (0.000001)	0.000004** (0.000001)	-0.00001 0.0000007	0.00157 (0.00129)	-0.00013 (0.0014)	0.00712 (0.006)
Years of Schooling	0.000312 (0.00043)	0.00028 (0.00043)	-0.000350 (0.00127)	-0.0012427*** (0.00037)	-0.0013*** (0.0003)	-0.00026 (0.0009)	-0.07229 (0.1886)	-0.16391 (0.1895)	0.371475 (0.4379)
Life Expectancy	-0.00041 (0.00026)	-0.000381 (0.00026)	0.000532 (0.0006)	0.00023 (0.00017)	0.00028* (0.0001)	0.00008 (0.0004)	0.16711 (0.1131)	0.15817 (0.1123)	-0.067138 (0.1762)
FDI	0.000035 (0.00004)	0.000036 (0.00004)	0.00025*** (0.00008)	-0.0000016 (0.00002)	-0.000003 (0.00002)	0.000013 (0.00006)	-0.05184* (0.0312)	-0.04324 (0.0312)	-0.002219 (0.0506)
Political Rights	-0.00073 (0.00058)	-0.000373 (0.00062)					-0.23799 (0.2235)	-0.195155 (0.2222)	-0.19829 (0.4002)
Civil Liberties	.0001867 (0.00038)	0.000162 (0.00038)		-0.000446 (0.0006)	-0.000594 (0.0005)		-0.09759 (0.216)	-0.053984 (0.2155)	0.03184 (0.4145)
GDP Per capita		0.000000005 (0.00000003)	0.0000001* (0.00000008)		0.00000005** (0.00000002)	0.000000056 (0.00000005)		0.0000651** (0.00002)	-0.000005 (0.0001)
Research & Development			-0.0053*** (0.00173)			0.00036 (0.00167)			-0.52165 (0.9345)
Lagged dependent variable	0.6807*** (0.0867)	0.65282*** (0.08798)	0.498817 (0.20351)	0.4123*** (0.10644)	0.4101*** (0.1038)	0.14207 (0.5139)	0.79578*** (0.0445)	0.7813*** (0.0445)	0.7563*** (0.1548)
Observations	90	90	22	72	72	21	190	190	44

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 2 continued: Robustness Checks for Science Skills Panel (Usage Intensity of Technologies).

Variables	(4) Vehicle car/land			(5) Cable TV			(6) Computer		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	0.01653 (0.01064)	0.002474 (0.01166)	-0.06959 (0.11351)	0.0189* (0.01065)	-0.0086 (0.0124)	0.03256 (0.158)	0.023054* (0.0133)	0.01626 (0.0168)	0.041007 (0.1515)
Years of Schooling	-1.035602 (2.4878)	-2.363515 (2.4916)	-1.92958 (9.6117)	-0.8155 (2.242)	-0.477803 (2.202)	2.9533 (8.248)	6.446825** (3.125)	6.466533** (3.1075)	12.5284 (9.481)
Life Expectancy	1.319532 (1.5129)	0.88258 (1.4846)	0.17474 (4.794)	0.344787 (1.387)	-0.03924 (1.367)	4.67587 (3.999)	4.7476** (1.966)	5.060857** (2.020)	3.783758 (5.208)
FDI	0.1464266 (0.41812)	0.23612 (0.41285)	0.5974 (0.97135)	-0.8591*** (0.2698)	-0.68453** (0.2689)	-0.1067703 (0.7349)	0.3075012 (0.370)	0.32611 (0.3704)	-1.244442 (0.9531)
Political Rights	-0.553753 (2.2263)	-0.7617381 (2.1790)	0.16289 (6.5259)	-7.934*** (2.439)	-8.12762*** (2.398)	-6.833525 (7.417)	-0.354014 (2.625)	-0.3511 (2.6207)	11.24717 (9.7400)
Civil Liberties	1.579393 (2.2949)	0.4503156 (2.2914)	(-0.42590) (7.7340)	4.426275** (2.029)	2.908508 (2.029)	-0.84805 (7.086)	-5.355732** (2.723)	-5.523123** (2.731)	-10.03891 (8.862)
GDP Per capita		0.0007*** (0.0002)	0.000908 (0.00093)		0.0008*** (0.0002)	-0.00131 (0.0009)		0.0002313 (0.0003)	0.00134 (0.0012)
Research & Development			24.47498 (20.646)			8.946207 (13.985)			-50.38995** (21.225)
Lagged dependent variable	0.930445*** (0.0257)	0.8994*** (0.02788)	0.8647*** (0.11925)	0.8854*** (0.0262)	0.8680*** (0.0261)	0.5317*** (0.136)	1.013*** (0.0133)	1.011*** (0.013)	1.033*** (0.047)
Observations	250	250	36	253	253	62	215	215	75

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 2 continued: Robustness Checks for Science Skills Panel (Usage Intensity of Technologies).

Variables	(7) Tractor			(8) Fertilizer		
	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	-0.0016292**	-0.000848	0.003432	-0.0096503*	0.00383	0.03638
		(0.00077)	(0.00950)	(0.00525)	(0.00579)	(0.02373)
	(0.00068)					
Years of Schooling	0.032197	0.062953	0.2297	-3.077685***	-2.402649**	-0.224506
		(0.140382)	(0.57673)	(0.98504)	(0.97232)	(1.4558)
	(0.14000)					
Life Expectancy	0.027081	0.06487	0.10401)	2.628***	3.3597***	-0.9713
		(0.06216)	(0.29298)	(0.47795)	(0.48842)	(0.7097)
	(0.05957)					
FDI	0.000843	-0.00264	-0.003406	-.1793301	-0.30106	-0.16421
		(0.02465)	(0.07303)	(0.1886)	(0.18593)	(0.1819)
	(0.02464)					
Political Rights	0.164230	0.145708	-0.00545	0.89101	0.49752	-0.2900002
		(0.13867)	(0.60253)	(1.058)	(1.0384)	(1.520)
	(0.13841)					
Civil Liberties	0.203979	0.248134*		2.365319**	3.359013	1.61003
		(0.14002)		(1.1027)	(1.0956)	(1.8532)
	(0.138376)					
GDP Per capita		-0.000029**			-0.0005***	-0.000307
		(0.00001)			(0.0001)	(0.00021)
Research & Development			-0.51270			-3.010473
			(1.1698)			(2.9443)
Lagged dependent variable	0.9100***	0.91481***	0.7356***	0.7905***	0.7590***	0.4419***
		(0.01912)	(0.07871)	(0.02794)	(0.0280)	(0.11920)
	(0.01899)					
Observations	305	305	61	305	305	61

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

27

Part C Continued: Robustness Checks for Mathematics and Science Skills (Technology Usage Lags).

Table 3: Mathematics Skills and Technology Diffusion.

Variables	(1) Cable TV			(2) Computers			(3) Transplant Bone marrow		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	-0.100 (0.006)	-0.0107 (0.009)	-0.129 (0.139)	-0.016*** (0.005)	-0.014** (0.005)	-0.030 (0.031)	-0.009 (0.006)	-0.006 (0.008)	0.074 (0.270)
Years of Schooling	0.761 (0.446)*	0.791 (0.452)*	0.388 (1.223)	-0.305 (0.231)	-0.293 (0.23)	-0.605 (0.514)	-0.3003 (0.411)	-0.313 (0.424)	2.274 (1.719)
Life Expectancy	0.374 (0.263)	0.342 (0.263)	0.367 (0.584)	0.189 (0.122)	0.202 (0.124)	-0.043 (0.234)	0.675*** (0.197)	0.628*** (0.207)	0.106 (1.279)
FDI	0.043 (0.052)	0.045 (0.053)	-0.068 (0.127)	0.023 (0.029)	0.019 (0.029)	-0.046 (0.064)	0.029 (0.030)	0.029 (0.0306)	-0.181 (0.315)
Political Rights	0.520 (0.441)	0.609 (0.443)	2.057* (1.156)	0.0508 (0.165)	0.051 (0.165)	0.205 (0.478)	-0.667 (0.738)	-0.661 (0.762)	
Civil Liberties	-0.227 (0.389)	-0.248 (0.416)	-0.289 (1.011)	0.1073 (0.223)	0.139 (0.228)	-0.589 (0.543)			
GDP Per capita		0.000009 (0.00005)	0.00002 (0.0002)	-0.003 (0.027)	-0.00002 (0.00002)	-0.000005 (0.00008)		-0.0001 (0.00004)	-0.00002 (0.0001)
Research & Development			-1.884 (2.621)			3.129*** (1.078)			9.106 (14.99)
GDP/income lag	0.0009 (0.053)	0.003 (0.060	-0.071 (0.231)		-0.012 (0.030)	0.054 (0.0905)	-0.012 (0.035)	-0.0364 (0.035)	-0.143 (0.305)
Lagged dependent variable	0.568*** (0.077)	0.569*** (0.079)	0.436*** (0.168)	0.880*** (0.046)	0.892*** (0.047)	0.857*** (0.073)	0.763*** (0.077)	0.779*** (0.077)	0.4206 (0.657)
Observations	123	123	43	157	157	56	59	59	12

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 3 continued: Mathematics Skills and Technology Diffusion.

Variables	(4) Lung Transplant			(5) Fertilizers			(6) Tractor		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	-0.099*	-0.108*	-0.0511	0.019***	0.016**	-0.006	0.0014*	0.001	-0.004*
	(0.058)	(0.059)		(0.006)	(0.007)	(0.074)	(0.0008)	(0.0009)	(0.002)
Years of Schooling	12.726***	11.993***		1.337**	1.303**	0.842	-0.015	-0.0241	-0.012
	(3.686)	(3.793)		(0.519)	(0.521)	(0.939)	(0.052)	(0.053)	(0.03)
Life Expectancy	-0.028	0.5903	-3.691	0.443	0.415	0.515	-0.015	0.077*	0.037*
	(1.153)	(1.36)		(0.271)	(0.273)	(0.495)	(0.052)	(0.045)	(0.019)
FDI	0.009	-0.003	2.611	0.0204	0.028	-0.247	0.002	0.003	-0.0005
	(0.157)	(0.159)		(0.076)	(0.076)	(0.120)	(0.009)	(0.009)	(0.003)
Political Rights				-0.021	0.025	0.819	-0.021	-0.015	0.025
				(0.412)	(0.415)	(0.851)	(0.053)	(0.054)	(0.03)
Civil Liberties				0.358	0.208	-0.452	0.0403	0.024	0.008
				(0.482)	(0.513)	(0.993)	(0.066)	(0.069)	(0.033)
GDP Per capita		0.0002	-0.0005		0.00004	-0.0002*			0.000002
		(0.0003)			(0.00005)	(0.0001)			(0.000005)
Research & Development						-0.861			
						(1.779)			
GDP/income lag	0.253	0.311	-0.319	0.026	0.044	0.005	0.00002	0.003	0.0046
	(0.35)	(0.357)		(0.066)	(0.069)	(0.149)	(0.0106)	(0.011)	(0.006)
Lagged dependent variable	-0.0054	-0.075	1.003	0.6009***	0.595***	0.621***	0.968***	0.968***	0.98***
	(0.215)	(0.231)		(0.064)	(0.064)	(0.169)	(0.015)	(0.01)	(0.009)
Observations	33	33	6	177	177	40	204	204	38

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 3 continued: Mathematics Skills and Technology Diffusion.

Variables	(7) Visitor Beds		
	(1)	(2)	(3)
Cognitive Skills	0.0096	-0.003	0.185***
	(0.08)	(0.011)	(0.185)
Years of Schooling	1.119**	0.892*	1.651
	(0.508)	(0.519)	(1.147)
Life Expectancy	0.581	0.729*	0.106
	(0.368)	(0.372)	(0.704)
FDI	0.008	0.017	0.055
	(0.063)	(0.062)	(0.193)
Political Rights	0.335	0.468	0.646
	(0.411)	(0.412)	(1.178)
Civil Liberties	-0.268	-0.123	0.120
	(0.581)	(0.578)	(1.22)
GDP Per capita		0.0001	0.00005
		(0.00007)	(0.0005)
Research & Development			-4.998
			(4.26)
GDP/income lag	-0.005	0.036	0.00005
	(0.095)	(0.098)	(0.005)
Lagged dependent variable	0.516***	0.497***	0.968***
	(0.121)	(0.12)	(0.23)
Observations	100	100	28

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 4: Science Skills and Technology Diffusion.

Variables	(1) Cable TV			(2) Computer			(3) Transplant Bone marrow		
	(1)	(2)	(3)	(1)	(2	(3)	(1)	(2)	(3)
Cognitive Skills	-0.0016	-0.001	0.001	-0.003**	-0.002	-0.008	-0.003*	-0.002	0.001
	(0.001)	(0.002)	(0.024)	(0.0012)	(0.0014)	(0.006)	(0.002)	(0.002)	(0.007)
Years of Schooling	0.823*	0.887**	0.505	-0.009	0.008	-0.543	0.12	0.316	2.421**
	(0.37)	(0.371)	(1.063)	(0.205)	(0.2054)	(0.424)	(0.542)	(0.543)	(1.105)
Life Expectancy	0.338	0.286	0.176	0.073	0.058	-0.021	0.849***	0.805***	0.949*
	(0.215)	(0.215)	(0.459)	(0.112)	(0.113)	(0.188)	(0.264)	(0.26)	(0.533)
FDI	0.046	0.044	-0.044	0.003	0.001	-0.044	0.045	0.044	-0.037
	(0.041)	(0.042)	(0.099)**	(0.028)	(0.028)	(0.049)	(0.042)	(0.041)	(0.067)
Political Rights	0.422	0.500	2.221	0.088	0.089	0.258	-0.617	-0.274	
	(0.369)	(0.37)	(0.988)	(0.177)	(0.176)	(0.423)	(1.049)	(1.047)	
Civil Liberties	-0.241	-0.222	-0.062	0.375	0.405**	-0.571			
	(0.317)	(0.328)	(0.866)	(0.195)	(0.197)	(0.468)			
GDP Per capita		-0.0001	0.0001		-0.00003	-0.00001		-0.00009*	-0.00005
		(0.00004)	(0.001)		(0.00002)	(0.00006)		(0.00005)	(0.00006)
Research & Development			-0.066			3.152***			3.874***
			(2.011)			(0.851)			(1.441)
GDP/income lag	0.001		0.036	0.014	0.008	0.047	-0.029	-0.046	0.012
	(0.036)		(0.088)	(0.023)	(0.238)	(0.039)	(0.035)	(0.035)	(0.03)
Lagged dependent variable	0.600***	0.608***	0.400***	0.847***	0.851***	0.886***	0.687***	0.656***	0.201
	(0.060)	(0.06)	(0.117)	(0.044)	(0.044)	(0.059)	(0.089)	(0.089)	(0.142)
Observations	134	134	50	194	194	68	67	67	17

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 4 continued: Science Skills and Technology Diffusion.

Variables	(4) Transplant Lung			(5) Fertilizer			(6) Tractor		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Cognitive Skills	-0.001	-0.002	0.028	0.0012	0.00008	-0.0012***	0.00052	0.0006	-0.161
	(0.0084)	(0.0088)	(0.041)	(0.001)	(0.001)	(0.003)	(0.0005)	(0.00056)	(0.017)
Years of Schooling	5.772***	5.588**	2.273	0.726***	0.674**	-0.139	0.117	0.123	0.210
	(2.162)	(2.371)	(5.674)	(0.268)	(0.263)	(0.22)	(0.081)	(0.082)	(0.404)
Life Expectancy	0.194	0.313	0.689	0.458***	0.424***	0.105	-0.028	-0.025	0.714
	(1.019)	(1.191)	(2.025)	(0.141)	(0.138)	(0.165)	(0.065)	(0.065)	(0.244)
FDI	0.067	0.066	0.118	0.033	0.056	-0.013	-0.007	-0.008	-0.098
	(0.133)	(0.134)	(0.268)	(0.037)	(0.0372)	(0.026)	(0.014)	(0.014)	(0.052)
Political Rights				-0.04	0.005	-0.072	-0.028	-0.035	0.210
				(0.205)	(0.201)	(0.255)	(0.079)	(0.079)	(0.434)
Civil Liberties	2.821	2.787		0.196	0.226	0.556	0.060	0.076	-0.297
	(2.973)	(3.008)		(0.213)	(0.214)	(0.262)	(0.084)	(0.087)	(0.486)
GDP Per capita		0.00004	-0.0001		0.00008***	0.00006		-0.000006	-0.000005
		(0.0002)	(0.0009)		(0.0002)	(0.0003)		(0.00001)	(0.0007)
Research & Development						0.300			0.353
						(0.465)			(0.889)
GDP/income lag	-0.025	-0.021	0.03	0.025	0.047*	0.08***	-0.002	-0.004	0.026
	(0.112)	(0.114)	(0.124)	(0.026)	(0.026)	(0.019)	(0.079)	(0.012)	(0.088)
Lagged dependent variable	0.211	0.201	-0.310	0.785***	0.74***	1.024***	0.977***	0.980***	0.912***
	(0.167)	(0.176)	(0.731)	(0.039)	(0.041)	(0.064)	(0.018)	(0.019)	(0.113)
Observations	48	48	11	215	215	51	210	210	42

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.

Table 4 continued: Science Skills and Technology Diffusion.

Variables	(7) Visitor Beds		
	(1)	(2)	(3)
Cognitive Skills	0.0041	-0.001	0.035
	(0.004)	(0.005)	(0.031)
Years of Schooling	0.514	0.735	0.710
	(0.446)	(0.452)	(1.053)
Life Expectancy	0.735**	0.819**	0.650
	(0.315)	(0.309)	(0.572)
FDI	0.233	0.035	-0.076
	(0.600)	(0.058)	(0.134)
Political Rights	0.309	0.377	1.447
	(0.385)	(0.375)	(1.060)
Civil Liberties	0.062	0.066	-0.165
	(0.525)	(0.508)	(0.981)
GDP Per capita		0.0001	-0.00007
		(0.0006)	(0.0004)
Research & Development			-8.153**
			(3.696)
GDP/income lag	-0.028	-0.012	-0.813**
	(0.087)	(0.085)	(0.315)
Lagged dependent variable	0.603***	0.531***	0.898***
	(0.097)	(0.103)	(0.216)
Observations	101	101	34

Standard errors in parenthesis; *,**,*** imply 10%, 5%, and 1% significance levels respectively.