Appendix NOT FOR PUBLICATION

Geographic dominance in coding technologies

In a few cases, we have not been able to document directly the absence of some specific technology in a given country 'X'. In these cases, however, we have direct evidence of the absence of the technology is some neighboring country 'Y' that has been proven to dominate technologically country 'X' at the time. This allows us to infer the absence of the technology in country 'X'.

An example of this is in our coding of communications in South America. We have little information about the diffusion of these technologies in 1500 AD in Brazil, Uruguay, Paraguay, and Colombia. Since the Incas were the most advanced civilization in South America during that time, any technologies absent from Inca civilization were assumed to be absent in the countries listed above. The Incas relied on Quipus (lengths of string knotted at intervals) for communications and had no written records (Scarre 1988:222; Encyclopedia Britannica 2006). This implies that the Incas did not have books or movable type printing. Using this geographic dominance argument, we infer that Brazil, Uruguay, Paraguay, and Colombia did not have these technologies either.

This geographic dominance argument might, however, have consequences on the computation of the standard errors in our regressions. Despite the few occasions where we have used the geographic dominance argument, we avoid this issue by clustering the errors around the areas of technological influence used to code the data. Further, we have checked that our results are robust to clustering the errors by continents.

More on advanced civilizations

In Table 5 we document the progression of advanced civilizations (Western Europe, China, India, and the Arab Empire) from 1000 BC to 1500 AD. Initially Western Europe lagged behind other civilizations but assumed technological leadership by 1500 AD. Western Europe initially started as the least technological sophisticated of the major advanced civilizations in 1000 B.C. It's lowly position was due to its slower adoption of communications, transportation, and military technology. Western Europe, with the exception of Italy, had not yet adopted written records for communication, vehicles for transportation, and iron weapons. Other advanced civilizations at the time, such as China and the Arab Empire already were using these technologies. However, by 0 A.D. Western Europe had adopted these technologies, and by 1500 A.D. it was the most technologically advanced civilization. Western Europe's ascendancy is primarily due to advances in transportation and military technology. During the 16th century, Western Europe alone had expeditions across all major oceans (The famous Chinese explorer Cheng Ho had voyaged across the Indian Ocean as far as East Africa in 1405-1431, but these voyages turned out to be an aberration as the voyages were stopped and ships destroyed by a subsequent emperor) . These journeys required adopting a number of shipbuilding and navigational technologies. Western Europe also was at the forefront in naval weapons. The navies of Western Europe deployed large warships (in excess of 1500 ton deadweight) with armaments of over 180 guns by the 16th century. Even advanced civilizations such as China and the Arab Empire had not yet adopted these advanced weapons.

Old technology differences and old income differences

Cross-country differences in per capita income in the pre-industrial world were significantly smaller than today. For example, according to Madison (2000), per capita income in the UK in 1500 AD was sixty-eight percent higher than in Mexico. In 2000, it was almost three times larger.

This observation has motivated two conclusions. First, that pre-industrial country conditions, such as the technology adoption level, did not vary much across countries. But this conclusion is not necessarily true as follows from the work of Kremer (1993), Galor and Weil (2000) and Jones (2001, 2005) and Hansen and Prescott (2002). All these papers have Malthusian models where fertility or population increases with technology. In this context, countries may have significant differences in technology but very small differences in per capita income.

Relationship of our paper to genetic diffusion stories

Spolaore and Wacziarg (2008) have a fascinating exploration of the effect of genetic distance on log-income distance. They take genetic distance as a difference between all characteristics vertically transmitted from parents to children (not only genetic, but even more importantly cultural), and suggest that differences in these characteristics act as a barrier to technology/development diffusion . They find that countries populated by more genetically distant cultures also have more different per capita incomes. This finding is complementary to ours because genetic distance is very persistent and was determined in a distant past. It differs, however, in at least two respects. First, we explore the effects of technology adoption history on current development. Our left hand side variable has a direct effect on development, while genetic distance surely does not have a direct effect on development. It is a proxy for costs of transferring technology. Second, by exploring a relationship in levels we are able to preserve the transitivity of our measures. This is not the case when looking at distances. Ashraf and Galor (2008) have another interesting genetic story, stressing the differences in genetic diversity across regions of the world as a determinant of comparative economic development ,through the beneficial impact of diversity on technological creativity.

TABLE A1

Table A1

Dependent Variable	Log per capita GDP 2002				Current Technology			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Migration-adjusted technology level in 1000BC		1.493***				0.196***		
		(2.93)				(2.95)		
Migration-adjusted technology level in 0			2.270**				0.420**	
			(2.23)				(2.58)	
Migration-adjusted technology level in 1500AD				3.523***				0.561***
				(7.81)				(7.83)
Log arable land area	0.0487	0.0397	0.00242	-0.123**	0.00578	0.00797	-0.00225	-0.0207
	(0.87)	(0.76)	(0.06)	(-2.46)	(0.40)	(0.52)	(-0.21)	(-1.59)
Constant	7.994***	7.336***	6.594***	7.633***	-0.609***	-0.736***	-0.874***	-0.678***
	(12.92)	(13.14)	(7.62)	(13.55)	(-4.10)	(-4.79)	(-5.02)	(-5.39)
Observations	122	101	120	109	130	106	127	113
R-squared	0.01	0.11	0.10	0.53	0.00	0.07	0.12	0.43

Note: t-statistics in parenthesis computed using clustered standard errors.

Table A2: Technology Indices

wbcode	Country name	Place-based technology indices			Technology indices adjusted for post-1500 migration		
		1000 BC	0 AD	1500 AD	1000 BC	0 AD	1500 AD
AFG	Afghanistan	1.000	1.000	0.617	0.940	1.000	0.603
AGO	Angola	0.300	0.600	0.167	0.306	0.608	0.183
ALB	Albania		0.700			0.708	
ARE	United Arab Emirates		1.000			1.000	
ARG	Argentina	0.000	0.000	0.025	0.746	0.942	0.872
AUS	Australia	0.100	0.100	0.000	0.626	0.965	0.929
AUT	Austria	0.600	1.000	0.900	0.614	0.995	0.897
BEL	Belgium	0.600	1.000	0.900	0.611	1.000	0.895
BEN	Benin	0.300	0.600	0.167	0.300	0.623	0.193
BFA	Burkina Faso	0.300	0.600	0.508	0.300	0.600	0.508
BGD	Bangladesh	0.300	1.000	0.625	0.308	0.994	0.628
BGR	Bulgaria	0.500	0.700		0.512	0.704	
BIH	Bosnia and Herzegovina	1.000	0.700	0.825	1.000	0.700	0.825
BLR	Belarus	0.600	0.700	0.850	0.600	0.735	0.844
BLZ	Belize	0.300	0.600	0.233	0.449	0.777	0.588
BOL	Bolivia	0.000	0.500	0.158	0.180	0.650	0.408
BRA	Brazil	0.100	0.300	0.133	0.558	0.887	0.778
BTN	Bhutan	0.300	1.000		0.316	0.952	
BWA	Botswana	0.000	0.600	0.100	0.009	0.606	0.157
CAF	Central African Republic		1.000	0.233		0.838	0.270
CAN	Canada	0.100	0.100	0.133	0.619	0.938	0.891
CHE	Switzerland	0.600	1.000	0.825	0.630	0.994	0.836
CHL	Chile	0.400	0.400	0.158	0.538	0.802	0.713
CHN	China	0.900	1.000	0.883	0.900	1.000	0.883
CIV	Cote D'Ivoire	0.300	0.600	0.167	0.300	0.603	0.259
CMR	Cameroon	0.300	0.600	0.167	0.310	0.636	0.191
COG	Republic of the Congo	0.300	0.600	0.233	0.300	0.600	0.233
COI	Cook Islands			0.133			0.000
COL	Colombia	0.300	0.300	0.133	0.469	0.731	0.637
CRI	Costa Rica	0.300	0.300	0.133	0.566	0.922	0.895
CUB	Cuba	0.300	0.300	0.133	0.505	0.870	0.752
CZE	Czechoslovakia	0.600	1.000	0.825	0.600	0.993	0.826
DEU	Germany	0.600	1.000	0.900	0.618	0.998	0.898
DNK	Denmark	0.600	1.000	0.900	0.605	0.999	0.899
DOM	Dominican Republic		0.300			0.825	
DZA	Algeria	0.900	1.000	0.783	0.900	1.000	0.783
ECU	Ecuador	0.300	0.400	0.158	0.414	0.636	0.483
EGY	Egypt	0.900	1.000	0.783	0.906	1.000	0.761
ESP	Spain	0.600	1.000	1.000	0.604	0.996	0.995
EST	Estonia	0.600	0.700	0.850	0.600	0.781	0.835
ETH	Ethiopia	0.300	1.000	0.533	0.300	1.000	0.533
FIN	Finland	0.600	1.000	0.692	0.600	1.000	0.692
FJI	Fiji			0.133			0.438
FRA	France	0.600	1.000	0.933	0.621	0.997	0.922

GAB	Gabon	0.300	0.600	0.167	0.303	0.605	0.177
GBR	England	0.600	1.000	1.000	0.601	0.988	0.978
GHA	Ghana	0.300	0.600	0.383	0.300	0.601	0.385
GIN	Guinea	0.300		0.400	0.570		0.288
GMB	The Gambia	0.300	0.600		0.302	0.602	
GNB	Guinea-Bissau		0.600	0.267		1.000	0.419
GNQ	Equatorial Guinea	0.300		0.167	0.316		0.216
GRC	Greece	1.000	1.000	0.933	1.000	1.000	0.933
GTM	Guatemala	0.300	0.600	0.233	0.379	0.705	0.434
GUY	Guyana	0.300	0.300	0.133	0.522	0.663	0.538
HKG	Hong Kong	0.900	1.000	0.883	0.897	0.991	0.875
HND	Honduras	0.300	0.300	0.233	0.438	0.628	0.587
HRV	Croatia	1.000	0.700	0.825	0.992	0.703	0.826
HUN	Hungary	0.600	0.700	0.900	0.604	0.709	0.895
IDN	Indonesia	0.500	0.700	0.658	0.508	0.706	0.663
IND	India	0.700	0.700	0.758	0.699	0.706	0.757
IRL	Ireland		1.000	0.800		0.999	0.803
IRN	Iran	1.000	1.000	0.808	1.000	1.000	0.804
IRQ	Iraq		1.000	0.783		1.000	0.774
ISR	Israel		1.000			0.989	
ITA	Italy	1.000	1.000	0.900	0.988	0.997	0.899
JOR	Jordan		1.000			1.000	
JPN	Japan	0.100	0.700	0.825	0.100	0.700	0.825
KAZ	Kazakhstan	0.500	1.000		0.548	0.981	
KEN	Kenya	0.300	1.000	0.233	0.393	1.000	0.256
KHM	Cambodia	0.500	0.700	0.750	0.504	0.703	0.754
KOR	Korea	0.600	1.000	0.850	0.600	1.000	0.850
LAO	Laos	0.500	0.700	0.750	0.536	0.727	0.763
LBN	Lebanon		1.000			1.000	
LBR	Liberia		0.600	0.167		0.601	0.171
LBY	Libya		1.000	0.783		1.000	0.769
LSO	Lesotho	0.000	0.600	0.167	0.000	0.600	0.167
LTU	Lithuania	0.600	0.700	0.850	0.600	0.741	0.847
LVA	Latvia	0.600	0.700	0.850	0.600	0.798	0.835
MAR	Morocco	1.000	1.000	0.408	0.966	1.000	0.457
MDA	Moldova	0.500		0.800	0.526		0.807
MDG	Madagascar		1.000	0.333		1.000	0.337
MEX	Mexico	0.300	0.600	0.258	0.388	0.719	0.476
MKD	Macedonia		1.000			0.979	
MLI	Mali	0.300	1.000	0.508	0.320	1.000	0.501
MLT	Malta			0.900			0.903
MMR	Myanmar	0.500	0.700	0.750	0.516	0.709	0.752
MNG	Mongolia	0.600	0.600	0.408	0.604	0.613	0.420
MOZ	Mozambique	0.000	0.600		0.000	0.600	
MRT	Mauritania	1.000	1.000	0.167	1.000	1.000	0.167
MWI	Malawi		0.600			0.600	
MYS	Malaysia	0.500	0.700	0.717	0.622	0.778	0.757
NAM	Namibia	0.000	0.600	0.100	0.197	0.643	0.231
NER	Niger		1.000	0.442		1.000	0.464
NGA	Nigeria	0.300	0.600	0.467	0.300	0.646	0.464

NIC	Nicaragua	0.300	0.300	0.133	0.454	0.685	0.588
NLD	Netherlands	0.600	1.000	0.900	0.605	0.994	0.890
NOR	Norway	0.600	1.000	0.900	0.600	1.000	0.900
NPL	Nepal	0.400	0.700	0.300	0.400	0.700	0.300
NZL	New Zealand		0.100	0.133		0.908	0.860
OMN	Oman		1.000			0.971	
PAK	Pakistan	1.000	1.000	0.725	0.976	0.976	0.727
PAN	Panama	0.300	0.300	0.133	0.465	0.689	0.578
PER	Peru	0.400	0.500	0.158	0.468	0.676	0.455
PHL	Philippines		0.700	0.583		0.700	0.583
PNG	Papua New Guinea	0.300	0.300	0.133	0.300	0.300	0.133
POL	Poland	0.600	1.000	0.850	0.600	0.999	0.851
PRT	Portugal	0.600	1.000	0.967	0.602	0.996	0.960
PRY	Paraguay	0.100	0.100	0.000	0.369	0.581	0.527
ROM	Romania	0.500	0.700	0.700	0.506	0.704	0.703
RUS	Russia	0.600	1.000	0.800	0.600	0.991	0.802
SAU	Saudi Arabia		1.000	0.483		0.991	0.492
SDN	Sudan	1.000	1.000	0.375	0.950	0.978	0.386
SEN	Senegal	0.300	1.000	0.325	0.304	1.000	0.333
SGP	Singapore		0.700	0.717		0.937	0.843
SLE	Sierra Leone		0.600	0.167		0.603	0.176
SLV	El Salvador	0.300	0.600	0.233	0.450	0.800	0.617
SOM	Somalia	0.300	1.000		0.300	1.000	
SVK	Slovakia		0.700	0.825		0.704	0.832
SWE	Sweden	0.600	1.000	0.900	0.604	0.997	0.893
SWZ	Swaziland	0.000	0.600		0.022	0.612	
SYR	Syria		1.000	0.700		1.000	0.699
TCD	Chad	1.000	1.000	0.400	0.983	0.996	0.401
THA	Thailand	0.500	0.700	0.750	0.556	0.742	0.769
TJK	Tajikistan	0.400	1.000		0.408	0.996	
TKM	Turkmenistan	0.500	1.000		0.506	0.995	
TON	Tonga			0.133			0.000
TUN	Tunisia			0.783			0.783
TUR	Turkey	1.000	1.000	0.833	0.957	0.972	0.834
TZA	Tanzania	0.300	1.000	0.233	0.300	1.000	0.233
UGA	Uganda	0.300	1.000	0.258	0.300	1.000	0.258
UKR	Ukraine	0.600	0.700	0.850	0.600	0.755	0.841
URY	Uruguay	0.000	0.000	0.000	0.712	0.945	0.890
USA	United States	0.200	0.300	0.133	0.566	0.901	0.773
UZB	Uzbekistan	0.500	1.000	0.450	0.509	0.994	0.481
VEN	Venezuela	0.300	0.300	0.133	0.467	0.709	0.613
VNM	Vietnam	0.500	0.700	0.800	0.510	0.708	0.802
YEM	Yemen		1.000			0.997	
YUG	Serbia & Montenegro	1.000	0.700	0.825	0.972	0.707	0.827
ZAF	South Africa	0.000	0.600	0.167	0.131	0.675	0.326
ZAR	Democratic Republic of the Congo	0.300	0.600	0.233	0.324	0.619	0.243
ZMB	Zambia	0.300	0.600	0.192	0.288	0.604	0.213
ZWE	Zimbabwe	0.000	0.600	0.167	0.006	0.604	0.175