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A NOTE ON SOCIAL CAPITAL, SPACE AND GROWTH IN EUROPE

by Luciano Lavecchia*

Abstract

This note replicates the analysis of Tabellini (2010) on the relationship between social capital and regional economic growth in Europe, extending that work and the underlying dataset by focusing on the spatial dimension of social capital and introducing a definition of contiguity among European regions. We find a sizable and robust contribution of social capital to regional growth. We also estimate a Spatial autoregressive model with autoregressive disturbances (SARAR) and a Spatial Durbin Error model (SDEM). The results confirm the positive role of social capital, highlighting the importance of spatial spillovers, which warrants further discussion.

JEL Classification: A13, O10, N13.
Keywords: social capital, space, growth, europe, sarar, sdem.

Contents

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1 Introduction[1]

Ever since Adam Smith, economics has explored the relationship between values, beliefs and economic performance. Literally thousands of papers have dealt with this issue, which has come to be known as the question of "social capital" but there remain some unresolved problems of definition (Solow, 1995), measurement (Fukuyama, 2000) and transmission mechanisms (Bisin and Verdier, 2001). This paper contributes by highlighting the spatial dimension of social capital, adopting the definition proposed by Guiso et al. (2011), namely *"those persistent values and shared beliefs, which allow a group to overcome the free rider problem in the pursuit of socially valuable activities."* In particular, we build on the study of the relationship between social capital and regional economic growth in Europe by Tabellini (2010).

At first we focus on the proposed identification, based on instrumental variables (IVs), testing the strength of the instruments; then we focus on the spatial dimension of social capital, seeking spatial spillovers between European regions.

As to identification, OLS and 2SLS estimates find a significant contribution of all measures of social capital to economic growth (see Table 12). However, the 2SLS results need to be useda with caution, s far as exogeneity and the strength of the instruments is concerned. We use a Limited information maximum likelihood (LIML) estimator, which is recognized as more robust with respect to the problem of weak IV; it confirms the positive role of social capital.

With regard to the spatial dimension of social capital, we follow LeSage (2014) on the search for (global or local) spatial spillovers. Social interactions are spatially sticky; to the extent that they are related to social capital, the latter is spatially bounded as well. Tests on the spatial autocorrelation of OLS residuals (rejecting the null of random spatial process), jointly with the likely omitted variable problem, support this approach (LeSage and Pace, 2009). We estimate a Spatial autoregressive model with autoregressive disturbances (SARAR) and a Spatial Durbin error model (SDEM).

The results from these models point to a positive and significant role of social capital in economic growth. Further, there is evidence of global spatial spillovers. Additional analysis is required to

[1]The opinions are those of the author and do not involve the Banca d'Italia. I would like to thank Giorgio Fazio, three anonymous referees and seminar participants at the XXXV AISRE Conference, ERSA 2013, Banca d'Italia, Universitá di Palermo for useful comments and discussions.

determine the source of this underlying spatial process.

2 Proximity, social capital and growth

To study the spatial "roots" of social capital one must recognize that agents' interactions and the distribution of values/norms occur in a given places and time. Indeed, insofar as the formation of cultural traits will depends on human interactions, the strength of these ties will depend on transaction costs, which typically increase with distance, so that social interactions are favored by urban agglomeration (Westlund, 1999). As a consequence, as social relations are spatially sticky, so are norms and values Tabellini (2008); Rutten et al. (2010). It is worthwhile giving a brief review of the literature on the spatial dimension of social capital.

Rutten and Gelissen (2010) model the effect of social capital on economic growth, considering also an indirect effect *via* innovation; the idea is that a higher levels of social capital fosters exchange of knowledge and spillovers. They find evidence that social capital contributes to growth, above all through the indirect channel they posit, for 120 European Union regions.

Similarly, de Dominicis et al. (2013), using a SARAR model, find that in a sample of European regions geographical proximity and social capital contribute to knowledge transmission.

The smaller the spatial context (say, a neighborhood), the denser the social network; this has important implications for peer monitoring, a mechanism illustrated in Pasini and Millo (2006), who observe the relationship between social capital, measured as the share of the population living in small towns, and the demand for insurance, *via* moral hazard, in the Italian provinces; the estimated contribution is substantial and significant; they too estimate a SARAR, finding greater social capital increases the demand for non-life insurance by reducing moral hazard.

Takagi et al. (2012), estimating a SDM, consider the inverse of the distance between individuals living in a Tokyo neighborhood: their survey finds that neighbors' social capital reduces victimization rates.

3 Description of the dataset

We use the same dataset as Tabellini (2010) with a few small improvements (see the Data Appendix for more information). We consider 8 countries and 63, either NUTS 1 or NUTS 2 regions[2] in order to ensure data representativeness at sub-national level (see Table 1).

We take two measures of economic development: *yp9500*, i.e. per capita GDP adjusted for purchasing power, expressed as a share of the EU-15 average, and variable *growth*, a variable defined as average GDP growth in the period 1977-2000. The urbanization rate in 1850 (variable *urb_rate1850*), defined as the fraction of the population living in cities with over 30.000 inhabitants is included as a measure of past economic development, in order to reduce any confounding factors in the 2SLS approach[3].

As controls, we take the gross primary and secondary school enrollment rate in 1960 (variable *school*) and country dummies (proxy for current political institutions). The GDP growth rate in 1977 (variable *initial_gdp*) has been included in the regressions with *growth* as dependent variable, in order to test for convergence.

As for the measures of social capital (Table 2), Tabellini (2010) extracts the principal components (PCs) of four "cultural" variables (generalized trust, respect for others, control over life and autonomy; see Data Appendix) from the 1990 and 1999 waves of the European Value Study; these variables could be considered, at least partially, as proxies for social capital. The first PC of the whole dataset is called *pc_culture*; the PC from the three positive values (general trust, respect and control) is *pc_culture_pos* and the first PC on values to be taught to children (respect and autonomy) is called *pc_children*.

Figure 1 shows the quartile distribution and clusters of the measures. All panels show the clear heterogeneity in endowment of social capital across European regions. Regions in West Germany and the Netherlands appear to be the most highly endowed, Southern Italy and parts of Portugal and France, the least. Overall, however, the geographical diversity in social capital is more complex than the usual North-South gradient.

Rather, the distribution also seems to vary considerably within countries and in some cases border regions in different countries have similar values. It also seems that the allocation is not

[2] *Nomenclature of Territorial Units for Statistics*, Eurostat's classification of European regions

[3] With respect to the original dataset, we were able to update the estimates of urbanization and literacy rates for the Netherlands and Portugal - see the Data Appendix

random but there is some underlying pattern. As noted, human relations are spatially sticky; by analogy, we can assume that individuals from contiguous regions are more likely to engage in social interactions[4]; the local indicators of spatial association (LISA) suggest a clustering of the values representing similar regions (see Figure 1); regions with high values of social capital surrounded by similar neighbors are denoted in black and belongs to so-called "high-high" clusters (HH); regions with low and similar levels of social capital are represented by a grid pattern (LL clusters).

There are also a few cases of regions with high capital surrounded by regions with low levels (HL regions), denoted by stripes. We can observe clusters of regions with high values in West Germany across all measures; LL clusters are found in Portugal, France and Southern Italy.

4 Estimation strategy and results

4.1 Social capital and economic growth

In what follows we estimate the following equation:

$$Y = \alpha + \delta SC + \beta Y_0 + \gamma X + \epsilon \tag{1}$$

where Y is either the average per capita GDP in 1995-2000 (variable *yp9500*) or the average growth rate in per capita GDP from 1977 to 2000 (variable *growth*); SC are our measures of social capital; Y_0 is a proxy of past economic development, and X are our control variables, namely school enrollment rate and country dummies (and *initial_gdp* for the regressions with *growth* as dependent variable).

The results from the OLS estimation (see Table 4) for *yp9500* are very similar to those in Tabellini (2010). All the measures of social capital are positive and statistically significant at 5 percent; the effects are large and robust to heteroskedasticity. As for the specifications with *growth* as dependent variable, there is evidence of convergence and of a positive role of social capital.

4.2 Addressing endogeneity

The OLS results suggest the importance of social capital in explaining differences in regional economic performance. But the results are likely to be biased by endogeneity so we need to adapt our

[4] Technically, we assume a first order queen contiguity spatial weighting matrix.

identification strategy. In particular, recalling that social capital is transmitted and accrued *via* direct socialization by parents and *via* indirect socialization by the community, we could estimate the current level of social capital by means of

$$SC = \alpha + SC_0\beta + Y_0\phi + X\zeta + u \tag{2}$$

where SC_0 is the (unobserved) historical level of social capital. Even if cultural attitudes are not observable, there is evidence that they are persistent (Giavazzi et al., 2014), so we might proxy SC_0 with X_0, the historical counterpart of X on the grounds that the historical level of social capital was determined by the historical socio-economic background. Tabellini (2010) suggests the following identification:

$$SC = \lambda_1 + \lambda_2 X_0 + \lambda_3 Y_0 + \lambda_4 X + v \tag{3}$$

where X_0, as noted, should capture the historical indirect socialization process. In particular, X_0 is composed of two variables: the literacy rate in 1880 (variable *literacy*) and political institutions in the past (*pc_institutions*).

The data for *literacy*, the ability to read or write, come from several sources, although the original dataset provided no regional detail for the Netherlands or Portugal. However, we were able to recover observations for the Dutch and Portuguese NUTS 2 regions (see the Data Appendix). The intuition is that general literacy should increase participation and civic engagement, helping to place constraints on politicians.

The variable *pc_institutions* summarizes the political institutions existing in different years (1600, 1700, 1750, 1800 and 1850) using Acemoglu et al. (2001) for the period 1600-1750 and the POLITY IV database for 1800 and 1850. In using these instruments we posit that exogeneity in past political institutions and literacy should not affect current economic development. This strong assumption is mitigated by the fact that we control for past economic development (urbanization rate), current political institutions and education.

Apart from *literacy* in the specification with *yp9500* as dependent variable, the evidence from the reduced form equations (see Tables 5 and 6) tells in favor of the exogeneity and strength of the instruments. Since the rule of thumb on the first-stage F statistic has been shown to be misleading (Staiger and Stock, 1997), we rely on a new test proposed by Stock and Yogo (2002), using the same statistic but with new critical values.

The results from the 2SLS regressions indicate that almost all the proposed specifications do not reject the null hypothesis of exogeneity of instruments (the *Sargan* test) at the 10 percent level (see Table 7). As for the strength of the instruments, the first-stage F statistic, compared with the appropriate critical value of 19.93 proposed by Stock and Yogo (2002), suggests the weakness of all specifications, except *pc_ culture_ pos* with *yp9500* as dependent variable, whose coefficient is nearly 50 percent higher than in the OLS specification.

When a more robust approach is taken (LIML), all the estimates increase, confirming the positive role of social capital.

4.3 A spatial approach

When the change in the r-th characteristic of region i has an effect on the outcome variable of region j, or $\frac{\partial y_j}{\partial X_i^r} \neq 0$, we talk of spatial spillover. If the effect of the change in region j is limited to region i, we talk of local spatial spillovers; if the effect is broader (a chain reaction) we call it a global spatial spillover.

To see whether this holds in our case, we could first test the OLS residuals. To do so, we denote spatial proximity formally by a matrix, W, whose ij-entry is equal to 1 if region i and region j are contiguous, 0 otherwise. In addition, by convention diagonal elements are equal to 0 and it is standard procedure to normalize row elements such that row sums are equal to 1. This idea of proximity is known as "first order queen contiguity" and W is our spatial weighting matrix. With 63 regions (no islands - see Data Appendix) we have 254 links: an average of 4 links per region,with a low of 1 and a high of 10.

We can now test for spatial autocorrelation in the residuals using the Global Moran's I statistic (Anselin, 1993). In particular, Table 9 reports on the null hypothesis of no spatial autocorrelation (in the first column) and on some additional tests suggesting the likely spatial specification, namely, the *LM_ error* and *LM_ lag* tests, and their robust version (in the other columns). The specifications with *"pc_ culture"* and *"pc_ children"* reject the null of complete spatial randomness while the other tests point to a Spatial error model (SEM). These findings are only indicative, however, and tests for identification have been criticized (Kelejian and Prucha, 1998). All in all, the results suggest that we should not discard the idea that the true data generating process (DGP) is a spatial model.

However, I have elected not to estimate an SEM but to opt instead for an SARAR and a Spatial Durbin Error model (SDEM). In particular, we estimate an SARAR (1,1) or,

$$\begin{cases} y = \lambda W y + X\beta + u \\ u = \rho W u + \nu \end{cases} \tag{4}$$

where $u \sim N(0, \sigma_\nu^2 I_n)$, followed by an SDEM,

$$\begin{cases} y = X\beta + WX\theta + \alpha + u \\ u = \lambda W u + \epsilon \end{cases}$$

where $\epsilon \sim N(0, \sigma_\epsilon^2 I_n)$.

According to LeSage (2014), the choice among all the spatial models ultimately comes down to determining whether our spatial spillovers are global (captured by the Wy term in the SARAR model) or local (captured by WX in the SDEM), although the exact identification cannot be drawn from the point estimates of ρ or λ but requires specific Bayesian method which is beyond the scope of this paper. Moreover, SARAR should not be mistaken for a combination of a SEM and a Spatial autoregressive model (SAR), which has been proven to be a Spatial Durbin model (LeSage, 2014). The instruments for the measures of social capital are the same as in the 2SLS/LIML analysis.

The results given by the SARAR model (Table 10) suggest that all but one of the measures of social capital are significant at least at the 10 percent level, although caution is needed in interpreting the coefficients;as LeSage and Pace (2009) have shown there is a *n-by-n* matrix of partial derivatives or,

$$\frac{\partial y}{\partial X^r} = (I_n - W\rho)^{-1}(I_n \beta_1^r)$$

In particular, they suggest computing the average total direct impact (ATDI) and the average total impact (ATI) effects (Drukker and Prucha, 2013). In the bottom part of Table 10 we report these effects: the ATIs of the estimations with *yp9500* as dependent variable are comparable to those computed under the LIML estimator.

The estimation results from the SDEM (see Table 11) indicate that all the proxies for social capital make a positive and significant contribution both to per capita GDP (variable *yp9500*) and to GDP growth (variable *growth*), although in the latter case the contribution is modest and there is evidence of substantial economic convergence. On the other hand, the spatial lag of *pc_children* (for *yp9500* only), capturing the local spatial spillovers, is the only significant (but negative) result. Summing up, it appears that there is some unspecified global spillover effect, which certainly warrants further investigation.

5 Conclusions and avenues for further research

Although there is a very substantial body of literature on social capital, the spatial dimension has gone largely unexplored. Starting from Tabellini (2010), we have examined the role of social capital in economic growth in European regions. Our data indicate a positive and significant contribution (see Table 12 for a recapitulation). However there is still work to be done on this issue, We have found solid evidence of spatial spillovers but the underlying mechanism is not clear. Much work is still needed on both the theoretical and the empirical level. Another important question is the choice of the relevant geographical unit: is social capital a national phenomenon (which could suggest using NUTS 0 or NUTS 1 data) or it is more localized? We are certainly data constrained, but it is tempting, within a given country, to explore the role of social capital at various levels of aggregation (in Italy, for example, macro-regions, regions and provinces), or to test for what is known as the modifiable areal unit problem (MAUP).

Data Appendix

Brief recap on the original the dataset

Constraints on the Executive branch - Tabellini (2010) extracts the first principal component of the variable *constraints to the executive branch* taken at five different historical moments. He elected to stop at 1850, because that date corresponds roughly to the creation of today's national states, so that afterwards regional variation in political institutions should diminish drastically. Note that the same value is assigned to all regions within a country, with the exception of Italy, Germany and some Spanish regions where, for historical reasons, specific values are assigned to some regions. The general idea is that a more democratic regime favors the diffusion of generalized norms and civic spirit and behavior.

Proxies for social capital - Following Tabellini (2010) our dataset comprises four measures of social norms, values and beliefs from the European Value Study (EVS). These are *generalized trust, control, respect and autonomy.*

"Generalized trust" is measured by responses to the question

> "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?"

Two answers are possible: "Most people can be trusted" and "You can't be too careful". The measure *"generalized trust"* is the regional share of those who say "most people can be trusted".

The variable *"control of life"* is extrapolated from the question

> "Some people feel they have completely free choice and control over their lives, and other people feel that what they do has no real effect on what happens to them. Please use the scale to indicate how much freedom of choice and control you feel you have over the way your life turns out?"

The answer is coded from 1 to 10, where 1 means "no control" and 10 "a great deal". The variable *"control"* is constructed as a regional weighted average (multiplied by 10).

"Respect" and *"autonomy"* both refer to the following question

> "Here is a list of qualities which children can be encouraged to learn at home. Which, if any, do you consider to be especially important?"

The measures for these variable are the weighted regional average of people who mention *respect for others* or *obedience*. With reference to *"obedience"*, Tabellini (2010) suggests that this is a negative value, the basis of hierarchical societies, a coercive cultural environment stifling individual initiative and cooperation (so we should expect it to have a negative effect). Taking this into account, Tabellini rescaled it, creating the new variable *autonomy* such that

$$autonomy = 100 - obedience$$

that is the higher the value of *autonomy*, the lower the share of people who believe that *obedience* is a quality that should be inculcated in their children.

Changes with respect to the original dataset

Geography - To avoid problems with spatial estimation procedures we had to drop the islands that were included in the original dataset, a total of six observations: Madeira, the Azores, Sicily and Sardinia, the Balearics, the Canaries and Northern Ireland.

Urbanization rates - Tabellini (2010) defines the urbanization rate as the regional share of the population living in cities larger than 30.000 inhabitants. Unfortunately, the original database lacks regional detail for two of our eight countries, the Netherlands and Portugal; for them, in fact, the national rate was imputed to each region, obviously with a loss of accuracy. We were able to improve the dataset by recovering new regional data for both countries.

We found data on urban population at municipal level for the Netherlands at `http://www.populstat.info/Europe/netherlt.htm` and population for the Dutch provinces in Mitchell (2007) (available at `http://www.tacitus.nu/historical-atlas/population/benelux.htm`). For Portugal, we recovered population and urban population data for the *distritos do Continente* (i.e. provinces) from Veiga (2004); in 1864 only two Portuguese cities were above our population threshold of 30.000, Lisbon at 199.412 and Porto at 86.751.

Literacy - *Literacy* is defined as the share of people older than 7 who can read or write. The original dataset on literacy in the Netherlands and Portugal has the same problem of the urbanization rate. Again, we were able to find new data: Akcomak et al. (2013) provide data for the Netherlands and Ramos (1988) reports separate literacy rates for men and women for the Portuguese *distritos do Continente* in 1890. We take the simple average of male and female rates for each province and aggregate up to the correspondent NUTS 2 region.

Table 1: Sample countries and regions

Country	Number of regions	NUTS level
Belgium	3	NUTS 1
France	8	NUTS 1
West Germany	8	NUTS 1
Italy	13	NUTS 2
Netherlands	3	NUTS 1
Portugal	5	NUTS 2
Spain	13	NUTS 2
United Kingdom	10	NUTS 1
Total (8 countries)	63	NUTS 1/2

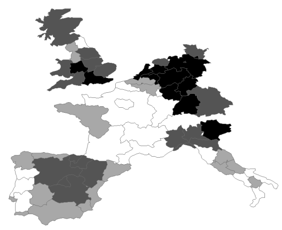
Table 2: Proxies for social capital

Proxy	Variables
pc_culture	g.trust, respect, control of life, autonomy
pc_culture_pos	g.trust, respect, control of life
pc_children	respect, autonomy

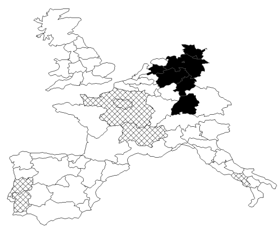
Table 3: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
		Dependent variables (Y)			
yp9500	63	97.33	30.46	50.17	215.33
growth	63	.02	.85	-1.83	2.01
		Covariates (X,Y_0)			
school	63	73.52	11.55	51.55	95.48
urb_rate1850	63	12.04	13.92	0	57.43
initial_gdp	63	4.52	.31	3.58	5.28
		Measures of social capital (C)			
pc_culture	63	-1.09	30.12	-56.69	57.22
pc_children	63	-0.49	23.90	-57.62	58.28
pc_culture_pos	63	-2.25	25.00	-49.99	39.47
		Instrumental variables (Z)			
pc_institutions	63	0.06	2.00	-2.09	3.58
literacy	63	55.90	25.69	14.6	96.5

Variable: pc_culture

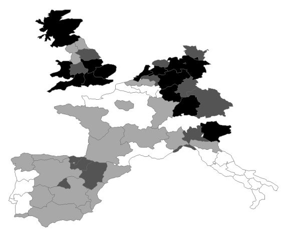


(a) Quartiles

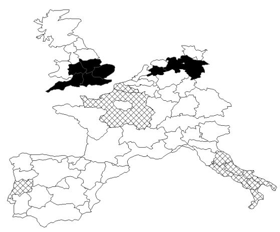


(b) Clusters

Variable: pc_culture_pos

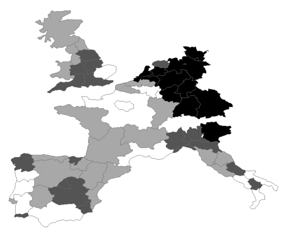


(c) Quartiles

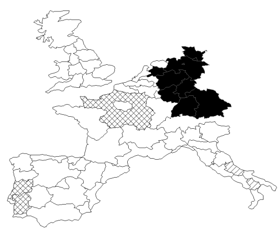


(d) Clusters

Variable: pc_children



(e) Quartiles



(f) Clusters

quartiles: darker regions indicates higher quartiles;

clusters: darker regions indicate HH clusters; regions with grid indicate LL clusters; striped regions are HL clusters

Figure 1: Quartiles and clusters of social capital

Table 4: OLS estimates [with robust s.e.]

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE		yp9500			growth	
school	0.51	0.77	0.60	-0.0048	-0.0002	-0.0043
	(0.53)	(0.52)	(0.54)	(0.010)	(0.010)	(0.011)
	[0.31]*	[0.30]**	[0.37]*	[0.0077]	[0.0074]	[0.0081]
urb_rate1850	0.62	0.68	0.61	0.0024	0.0037	0.0012
	(0.21)***	(0.20)***	(0.21)***	(0.0041)	(0.0042)	(0.0044)
	[0.17]***	[0.16]***	[0.16]***	[0.0034]	[0.0035]	[0.0040]
pc_culture	0.59			0.0091		
	(0.15)***			(0.0030)***		
	[0.13]***			[0.0033]***		
pc_culture_pos		0.72			0.011	
		(0.18)***			(0.0036)***	
		[0.16]***			[0.0045]**	
pc_children			0.61			0.0073
			(0.18)***			(0.0035)**
			[0.20]***			[0.0042]*
initial_gdp				-0.73	-0.78	-0.61
				(0.28)***	(0.28)***	(0.29)**
				[0.33]**	[0.32]**	[0.35]*
Observations	63	63	63	63	63	63
R^2	0.62	0.62	0.60	0.84	0.85	0.83
R-adj	0.54	0.55	0.52	0.80	0.81	0.79
Breusch-Pagan chi2	0.00	0.00	0.01	0.11	0.05	0.23
Jarque-Bera chi2	0.00	0.00	0.00	0.47	0.77	0.30

[Robust] Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

P-values for Breusch-Pagan and Jarque-Bera tests.

Table 5: Reduced-form and first-stage regression estimates (dep. var = *yp9500*)

	(1)	(2)	(3)	(4)	(5)	(6)
		Reduced-form			*First-stage*	
VARIABLE		yp9500		pc_culture	pc_culture_pos	pc_children
school	0.74	0.51	0.47	0.27	-0.17	0.21
	(0.56)	(0.53)	(0.52)	(0.39)	(0.31)	(0.38)
urb_rate1850	0.63***	0.51**	0.46**	0.04	-0.15	0.05
	(0.22)	(0.22)	(0.21)	(0.16)	(0.12)	(0.15)
pc_institutions	10.03**		7.01*	10.4***	10.5***	8.20***
	(3.99)		(3.79)	(2.86)	(2.22)	(2.72)
literacy		0.93***	0.82***	0.51**	0.44***	0.28
		(0.25)	(0.25)	(0.19)	(0.15)	(0.18)
Observations	63	63	63	63	63	63
R^2	0.56	0.61	0.63	0.79	0.81	0.69
F	6.6	8.1	8.0	17.1	20.2	10.4

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country dummies included.

Table 6: Reduced-form and first-stage regression estimates (dep. var = *growth*)

	(1)	(2)	(3)	(4)	(5)	(6)
		Reduced-form			*First-stage*	
VARIABLE		growth		pc_culture	pc_culture_pos	pc_children
school	-0.0042	-0.0047	-0.0043	0.051	-0.36	-0.015
	(0.011)	(0.011)	(0.010)	(0.41)	(0.32)	(0.39)
urb_rate1850	0.0011	0.0011	0.00064	-0.14	-0.24*	-0.061
	(0.0044)	(0.0044)	(0.0043)	(0.17)	(0.13)	(0.16)
initial_gdp	-0.52*	-0.64**	-0.73**	19.7*	16.8*	20.4*
	(0.28)	(0.30)	(0.30)	(11.7)	(9.05)	(11.1)
pc_institutions	0.14*		0.12	9.59***	9.79***	7.33***
	(0.073)		(0.073)	(2.85)	(2.20)	(2.71)
literacy		0.010*	0.0091*	0.37*	0.32*	0.14
		(0.0053)	(0.0053)	(0.21)	(0.16)	(0.20)
Observations	63	63	63	63	63	63
R^2	0.83	0.83	0.84	0.80	0.83	0.71
F	22.0	22.2	21.2	16.5	19.7	10.3

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Country dummies included.

Table 7: Two-stage least square (2SLS) estimation

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE		yp9500			growth	
school	0.26	0.73	0.28	-0.0050	0.0014	-0.0039
	(0.53)	(0.48)	(0.59)	(0.0095)	(0.0094)	(0.011)
urb_rate1850	0.53**	0.66***	0.45*	0.0029	0.0045	0.0021
	(0.21)	(0.19)	(0.24)	(0.0039)	(0.0039)	(0.0045)
pc_culture	1.02***			0.015***		
	(0.25)			(0.0057)		
pc_culture_pos		1.05***			0.015***	
		(0.25)			(0.0056)	
pc_children			1.38***			0.021**
			(0.40)			(0.0095)
initial_gdp				-0.98***	-0.92***	-1.04***
				(0.32)	(0.30)	(0.40)
Observations	63	63	63	63	63	63
R^2	0.56	0.60	0.46	0.83	0.84	0.78
F	17.1	20.2	10.4	16.5	19.7	10.3
Sargan test (p-value)	0.17	0.09	0.10	0.44	0.34	0.24
Pagan-Hall (p-value)	0.06	0.00	0.79	0.59	0.31	0.99
First-stage F	13.4	20.3	7.35	8.35	13.6	4.31

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Limited information Maximum likelihood (LIML)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	yp9500	yp9500	yp9500	growth	growth	growth
school	0.23	0.73	0.21	-0.0050	0.0014	-0.0038
	(0.54)	(0.49)	(0.63)	(0.0095)	(0.0094)	(0.011)
urb_rate1850_bis	0.52**	0.65***	0.41	0.0030	0.0045	0.0022
	(0.21)	(0.19)	(0.26)	(0.0040)	(0.0039)	(0.0046)
pc_culture	1.06***			0.016***		
	(0.26)			(0.0058)		
pc_culture_pos		1.08***			0.016***	
		(0.26)			(0.0057)	
pc_children			1.55***			0.023**
			(0.46)			(0.010)
initial_gdp				-0.99***	-0.93***	-1.11**
				(0.33)	(0.30)	(0.43)
Observations	63	63	63	63	63	63
R^2	0.547	0.595	0.384	0.828	0.840	0.762
Sargan test (p-value)	0.17	0.096	0.11	0.44	0.34	0.25
First-stage F	13.4	20.3	7.35	8.35	13.6	4.31

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Spatial tests for OLS residuals (p-values)

Variable	Moran's Index	LM_Error	Robust LM Error	LM Lag	Robust LM Lag
pc_culture	0.06	0.23	0.12	0.87	0.31
pc_culture_pos	0.53	0.92	0.73	0.83	0.69
pc_children	0.05	0.19	0.04	0.89	0.12

Note: First-order queen contiguity, row standardized. The null for LM test is OLS specification.

Table 10: SARAR(1,1) with IV

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE		**yp9500**			**growth**	
school	0.42	0.64*	0.49	-0.0054	0.00	-0.0059
	(0.36)	(0.35)	(0.38)	(0.0091)	(0.0093)	(0.0093)
urb_rate1850	0.77***	0.82***	0.74***	0.0038	0.0052	0.0037
	(0.18)	(0.17)	(0.19)	(0.0035)	(0.0035)	(0.0036)
pc_culture	0.40**			0.01**		
	(0.18)			(0.0039)		
pc_culture_pos		0.55**			0.013***	
		(0.22)			(0.0042)	
pc_children			0.51**			0.0081
			(0.25)			(0.005)
λ	0.62***	0.55**	0.64***	0.022	0.046	-0.0093
	(0.23)	(0.24)	(0.23)	(0.16)	(0.16)	(0.18)
ρ	-0.82***	-0.87***	-0.74***	0.41	0.38	0.29
	(0.27)	(0.24)	(0.28)	(0.36)	(0.38)	(0.29)
ATI	1.07	1.21	1.4	-0.0025	-0.0034	-0.0023
ATDI	0.46	0.61	0.58	-0.014	-0.0025	0.0155

Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1

Table 11: Spatial Durbin Error Model (SDEM)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE		yp9500			growth	
school	0.34	0.56	0.41	0.00	0.00	0.00
	(0.45)	(0.44)	(0.46)	(0.01)	(0.01)	(0.01)
urb_rate1850	0.47***	0.65***	0.48***	0.00	0.01**	0.00
	(0.17)	(0.17)	(0.17)	(0.00)	(0.00)	(0.00)
pc_culture	0.65***			0.01***		
	(0.13)			(0.00)		
pc_culture_pos		0.65***			0.01***	
		(0.15)			(0.00)	
pc_children			0.75***			0.01*
			(0.15)			(0.00)
initial_gdp				-0.80***	-0.82***	-0.72**
				(0.30)	(0.27)	(0.32)
W.school	-0.33	-0.57	-0.15	-0.02	-0.01	-0.02
	(0.81)	(0.72)	(0.82)	(0.02)	(0.02)	(0.02)
W.urb_rate1850	0.40*	0.47**	0.47*	0.01	0.02***	0.00
	(0.24)	(0.24)	(0.26)	(0.01)	(0.01)	(0.01)
W.pc_culture	-0.32			0.00		
	(0.26)			(0.01)		
W.pc_culture_pos		0.33***			0.02***	
		(0.32)			(0.01)	
W.pc_children			-0.75***			0.00
			(0.28)			(0.01)
W.initial_gdp				0.08	-0.39	0.22
				(0.45)	(0.42)	(0.49)
λ	0.04	-0.24	0.19	-0.03	-0.40	0.18

Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1

Table 12: Summary of the main results

Dep. variable	OLS	2SLS	LIML	SARAR			SDEM
				(coef)	(ATDI)	(ATI)	
			dep. var=yp9500				
pc_culture	0.59***	1.02***	1.06***	0.40**	0.46	1.07	0.65***
pc_culture_pos	0.72***	1.05***	1.08***	0.55**	0.61	1.21	0.65***
pc_children	0.61***	1.38***	1.55***	0.51**	0.58	1.4	0.75***
			dep. var=growth				
pc_culture	0.0091***	0.015***	0.016***	0.01**	-0.0014	-0.0025	0.01***
pc_culture_pos	0.011***	0.015***	0.016***	0.013***	-0.0025	-0.0034	0.01***
pc_children	0.0073***	0.021**	0.023**	0.01	0.0155	-0.0023	0.01*

*** p<0.01. ** p<0.05. * p<0.1. P-values for ATDI/ATI effects are not available

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