Understanding Persistence

Morgan Kelly

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Long Run Impact of History

- European mortality determines quality of institutions.
- Spanish *Mita* still affects Peruvian living standards.
- Common law countries have better judicial systems.
- Towns with pogroms after the Black Death gave more support to the Nazis.
- Genetic diversity determines modern income.
- Plough adoption determines women's rights.
- Potato determined city growth.
- Slave trade determines incomes and levels of mistrust in modern Africa.

Objections

Simplistic monocausal explanations of complex phenomena.
What is mechanism?
p hacking and publication bias.
Answers in search of questions.
Reversals.
All irrelevant because t statistics huge.
Examine 25 studies here. 14 report a t above 3.3 ($p = 10^{-3}$) and six above 5.1 ($p = 10^{-7}$).

Spatial Regressions.

However, maybe these results are just too good to be true.
Persistence regressions are spatial regressions.
Tobler's First Law of Geography. "Everything is related to everything else. But near things are more related than distant things."
Spatial data highly autocorrelated and, moreover, show strong spatial trends.

Dangers of spatial autocorrelation.

- Just like time series, it is easy to fit spurious trends.
- Because observations resemble not only immediate neighbours but distant ones as well, many observations contribute little to increasing the precision of coefficient estimates: standard errors can be much larger than you think.

25 papers.
American Economic Review (10), *Quarterly Journal of Economics* (8), and *Econometrica* (2), with one each taken from the *American Economic Journal: Macroeconomics, Journal of Political Economy, Journal of Politics*, *Review of Economics and Statistics*, and *Science*
Chosen to include IV, diff-in-diff, regression discontinuity, and non-linear regressions.
Mix "Attitudes and Institutions" with "Genetics and Geology".

What Paper is NOT About

- Not concerned with issues of data construction or estimation; plausibility of persistence story, alternative explanations, quality of historical scholarship (this is high in most cases).
- Not interested in individual papers except insofar as they illustrate the general contours of literature.
- Not concerned with potential statistical issues with original studies: follow their specification completely.
- Not out to "disprove" anyone's results or provide a two sentence critique.
- Not implying that because regression examined here may be problematic, others in paper are.

Robustness checks against trend fitting.

Persistence regressions start with single explanatory variable: misspecified.
Add extra control variables to proxy for omitted confounders: continent, latitude, distance from sea etc.
Propose three simple robustness checks here.

1. Add dummy for World Bank Regions for global studies.
2. Add longitude-latitude for studies on a smaller scale.
3. Remove regions, usually with extremely high or low values.

	Regression	**Robustness Check**[a]
Global		
Acemoglu, Colonial Origins.	Property rights on settler mortality.	WB Regions.
Acemoglu, Reversal.	Income on AD 1500 popn.	WB Regions. Malaria.
Alesina, Plough.	Female employment on plough adoption.	WB Regions.
Ashraf, Malthusian.	AD 1500 popn on neolithic transition.	WB Regions.
Ashraf, Out of Africa.	Income on genetic diversity.	WB Regions.
Comin, 1000 BC.	Income on technology in 1000 BC.	WB Regions.
Galor, Time Preference.	Patience on soil fertility.	WB Regions.
La Porta, Law Finance.	Judicial efficiency on Common Law.	Rich country dummy.
Nunn, Ruggedness.	Income on ruggedness $\times$ Africa.	Malaria.
Nunn, Potato.	Population on potato suitability.	Europe dummy.
Schulz, Kinship.	Individualism on kinship intensity.	WB Regions.
Spolaore, Diffusion.	Income on genetic distance from US.	WB Regions.

	Regression	Robustness Check
	Europe and the Americas	
Acharya, American Slavery	Republican support on 1861 slavery	Ex Texas.
Ambrus, Cholera.	Rent on cholera pump boundary.	Direction.
Becker, Anti-Semitism	Pogroms on Protestantism	Ex. Brandenburg.
Becker, Weber.	Literacy on percentage Protestant.	Direction.
Caicedo, Mission.	Literacy on mission distance.	.
Dell, Mita.	Consumption on Mita boundary.	Direction.
Voigtlaender, Persecution.	Nazi vote on pogroms.	Ex Bavaria.
	Africa and India	
Alsan, Tsetse.	Slavery on tsetse suitability.	.
Banerjee, Land Tenure.	Crop yield on British tax.	Ex North India.
Michalopoulos, Pre-Colonial.	Light density on political complexity.	Direction.
Michalopoulos, Scramble.	Civil conflict on border split.	Border Dummy.
Nunn, Mistrust.	Mistrust on slave exports.	Ex Bight of Benin.
Nunn, Slavery.	Income on slave exports.	Malaria.

[a] Blanks denote cases where the results were unaffected by the standard robustness checks applied to similar studies.

Global persistence variables as regional proxies

The long range correlation of many persistence variables makes them act as regional proxies. Their impact falls when explicit regional dummies are added.

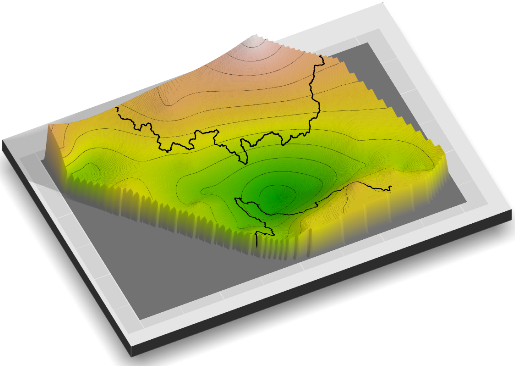
Acemoglu. Settler Mortality.

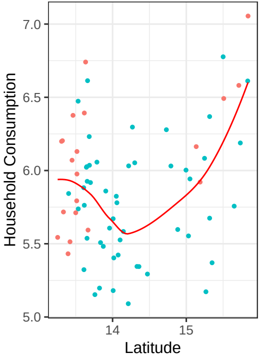
Nunn. Potato Suitability.

Spolaore. Genetic Distance.

Alesina. Female Employment.

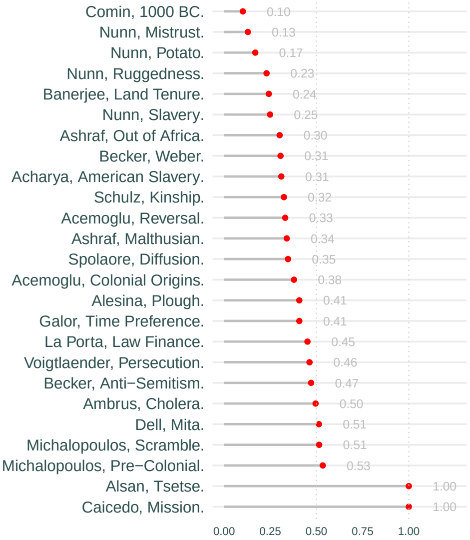
Fitting directional trend: Dell, Mita.





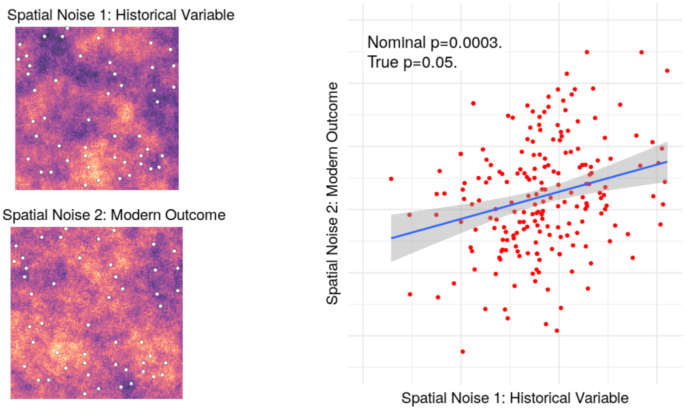
Change in effect sizes after robustness checks.

Coefficients after applying controls for WB Regions, directional trends or extreme areas, relative to original values.



Spatial noise regressions can appear highly significant

At each town (white dot) we take the value of two noise simulations where dark areas have low values. Call one the modern outcome and the other history, and regress one on the other. The impact of history on the present appears indisputable but is the result of failing to adjust standard errors for the fact that only a quarter of observations add to the precision of the estimate.

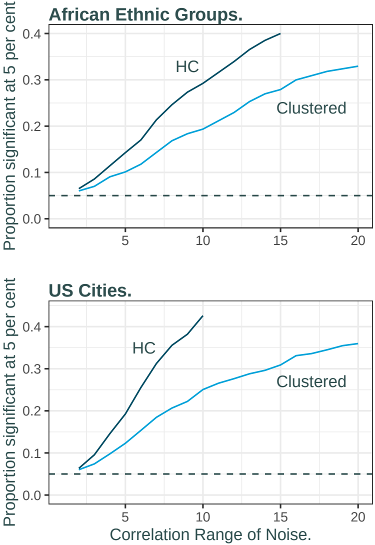


Spatially correlated standard errors.

Usual talisman against spatial autocorrelation of residuals is to cluster at some arbitrary geographical level.
Not a great idea.
Hard to decide on clustering (Abadie et al) and different assumptions can lead to very different standard errors.
In order for standard errors to be consistent, residuals cannot be correlated between clusters.
(Very large clusters consistent but give wildly varying standard error estimates in practice.)

Spatial noise regressions.

Spatial correlation can cause marked inflation of t statistics even with clustered standard errors.



HAC Standard Errors

$$\begin{aligned} \text{Var}\left(\hat{\beta}\right) &= \left(X'X\right)^{-1} X'\Omega X \left(X'X\right)^{-1} \\ &= \left(\tfrac{1}{N}X'X\right)^{-1} \Phi \left(\tfrac{1}{N}X'X\right)^{-1} \end{aligned} \tag{1}$$

Spectral approach, pioneered by Conley, is to estimate Φ as a weighted sum of cross products

$$\hat{\Phi} = \frac{1}{N}\sum_{s_i,s_j} K\left(s_i, s_j\right) x_{s_i}\hat{u}_{s_i}x'_{s_j}\hat{u}_{s_j} \tag{2}$$

where $K\left(s_i, s_j\right)$ is a weighting kernel that must be chosen.
Currently no automatic, data-driven procedure for choosing elements of K.
Conley: rectangular kernel. Widely differing standard errors as assumed cutoff varies.

Proposed Approach.

Decompose the kernel into a systematic spatial component and idiosyncratic noise

$$K\left(s_i, s_j\right) = \rho\, C\left(s_i, s_j\right) + (1-\rho)\, 1_{ij} \tag{3}$$

where the indicator $1_{ij} = 1$ when $i = j$ and 0 otherwise, and $0 \leq \rho \leq 1$.

The structure parameter ρ reflects the ratio of spatial signal to noise in the residuals.

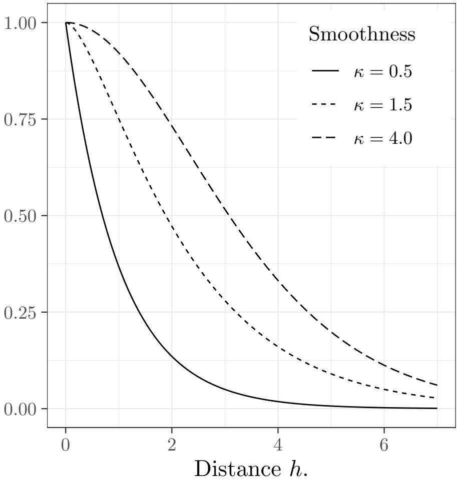
$\rho = 0$ gives standard heteroskedasticity consistent standard errors.

Need to choose kernel C. Workhorse of geostatistics is Matérn function.
Correlation between sites s_i, s_j at distance h apart is

$$M(h; \theta, \kappa) = \frac{2^{1-\kappa}}{\Gamma(\kappa)} \left(\frac{h}{\theta}\right)^{\kappa} B_{\kappa}\left(\frac{h}{\theta}\right) \quad (\kappa > 0, \theta > 0) \qquad (4)$$

θ is range parameter, κ is smoothness.
$\kappa = 0.5$, exponential falloff of correlation, $\kappa \to \infty$ Gaussian.

Matern Function $\theta = 1$.



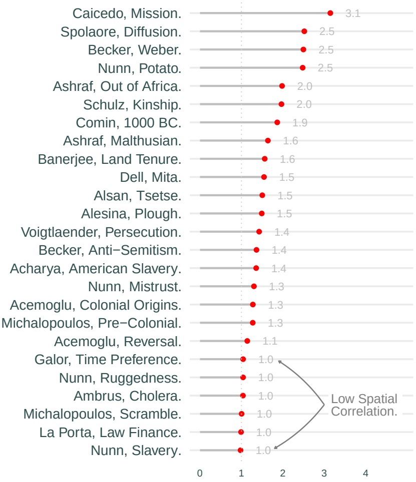
We have then a weighting kernel giving the correlation between the residuals at every location

$$K(s_i, s_j) = \rho\, M(h; \theta, \kappa) + (1 - \rho)\, 1_{ij} \tag{5}$$

whose three parameters θ, ρ and κ can be estimated by maximum likelihood from the estimated residuals.
K is then substituted into (2) to estimate Φ.
Potential problems.
1) Residuals do not obey a Matern function.
2) Economic locations, which is what matters, and not the same as geographical ones, which is what we get to observe.
Simulations in Appendix show limited downward bias in both situations.

Change in standard errors after HAC adjustment.

SEs estimated with exponential kernel relative to original values.
Before spatial robustness checks.

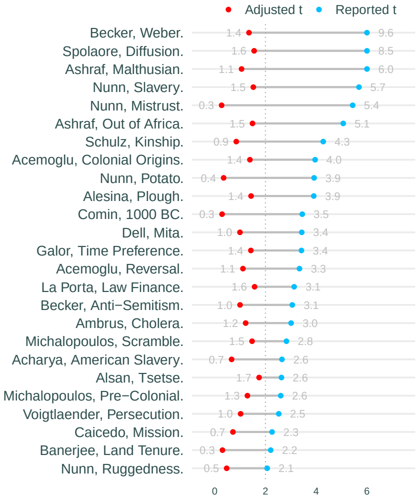


t Statistics

Coefficients lower and standard errors higher than suspected.
Increasing scepticism of “significance” although this seems in large measure to drive this literature.
A result that is interesting only because it is “significant” is not an interesting result to begin with.

Change in t statistics after robustness checks and standard error adjustments.

Values have been truncated at 6.



Detecting problems: Placebo test.

If your regression can explain everything, perhaps there is a problem.
Generate artificial dependent variables with same spatial trend and correlation structure as original variable.

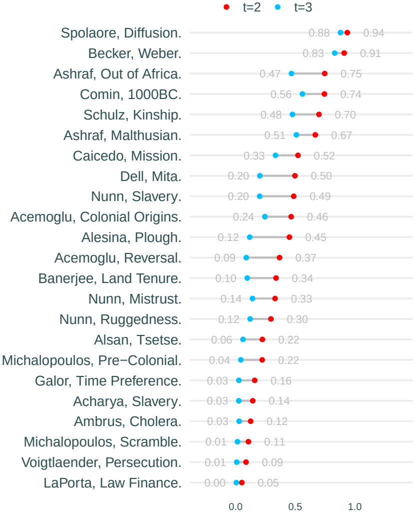
$$\hat{y} = f\,(\mathrm{Lon}, \mathrm{Lat}) + \hat{e}$$

Simulate noise variables $\tilde{e}$ with same spatial correlation structure as $\hat{e}$.
Run regressions with synthetic dependent variables

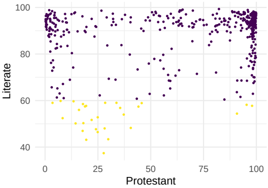
$$\tilde{y} = \hat{y} + \tilde{e}$$

Ability of Persistence Variables to Explain Spatial Noise.

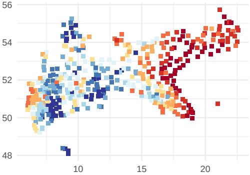
Proportion of synthetic regressions returning t statistics of 2 or 3.



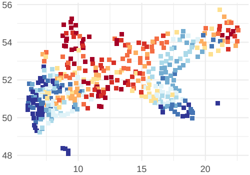
Protestantism and Literacy



Literacy by location.



Protestantism by location.



Conclusions

Strong claims require strong evidence and, for persistence regressions, large t values do not constitute strong evidence.

Numerators of t statistics inflated by fitting spatial trends.

Denominators underestimated by failing to account for spatial correlation in residuals.

Ultimately, strong evidence comes down to historical scholarship.