Eric A. Hanushek, Lavinia Kinne, Pietro Sancassani and *Ludger Woessmann*

Patience and the North-South Divide in Student Achievement in Italy and the United States

KEY MESSAGES

- **Human capital theory recognizes that time preferences – patience – are important for skill investments**
- **We show how Facebook interests can be used to construct subnational measures of patience**
- **Differences in patience are closely related to regional student achievement in Italy and the United States**
- **They account for two-thirds of the achievement variation across Italian regions and one-third across US states**
- **The results lead to new perspectives on long-standing within-country disparities**

Students' academic achievement varies widely and persistently across regions in many countries. For example, in both Italy and the United States, eighth-grade math achievement differs between the top- and bottom-performing region/state by the equivalent of over two years of learning – roughly two-thirds of the achievement difference between top- and bottom-performing OECD countries. Such regional skill differences are very important for regional income differences (Hanushek et al. 2017).

Ever since the earliest human capital theory of Becker (1964), discount rates have been recognized as an important determinant of individual decisions to invest in skills (for evidence see Sutter et al. 2013; Golsteyn et al. 2014; Castillo et al. 2019; Angerer et al. 2023). But their role at the individual level is just part of the full impact of time preferences. Patience – the relative valuation of present versus future payoffs – appears in many closely-related decisions. At the individual level, students weigh current gratification such as play time with friends against study time that may lead to deferred rewards. At the group level, communities trade off present against future costs and benefits when deciding how much to invest in school quality, how strongly to motivate children to learn, and whether to design institutions to incentivize learning. Such effects of aggregate preferences, which are a component of cultural identities, are consistent with the influence of patience found for international achievement differences (Figlio et al. 2019; Hanushek et al. 2022), and for economic development (Galor and Özak 2016; Sunde et al. 2022).

In new research (Hanushek et al. 2023), we study whether differences in people's patience can account for the large and long-standing subnational differences in student achievement.[1]

USING FACEBOOK INTERESTS TO MEASURE PATIENCE AT THE REGIONAL LEVEL

Subnational investigation of patience has been stymied by a lack of representative region-specific measures of time preferences. The key methodological innovation of our research is combining the massive data available from social media – specifically Facebook interests – with machine-learning algorithms to derive new subnational measures of patience. Our derivation of regional patience measures builds on recent international analysis of culture in Obradovich et al. (2022) and contributes to the recent work using social-media data in analyzing culture and social networks (e.g., Chetty et al. 2022; Bailey et al. 2022).

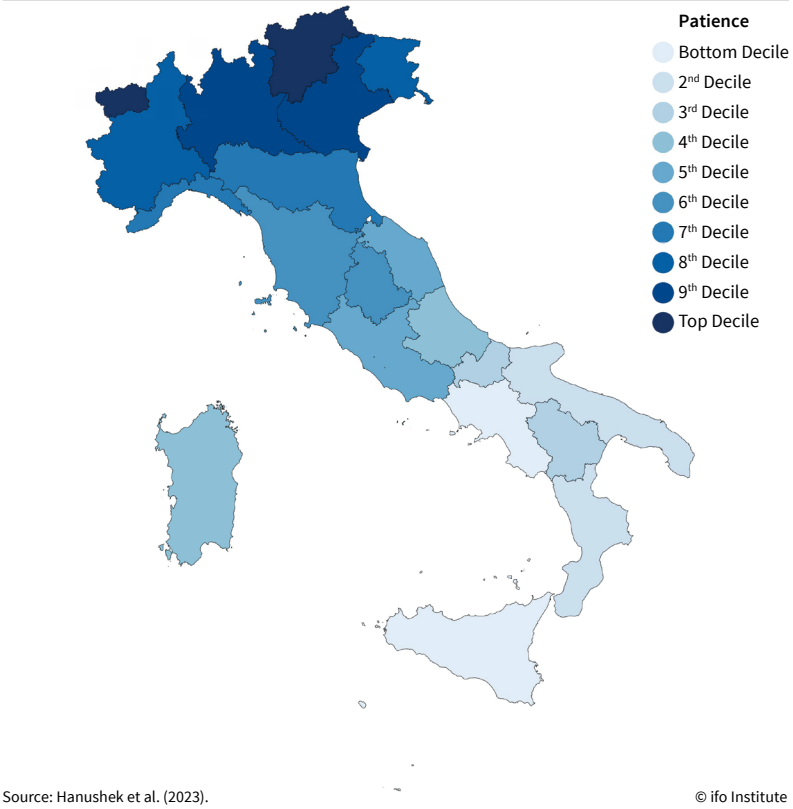
The underlying idea is that social-media data contains important information about people's underlying preferences. For marketing purposes, Facebook has developed an algorithm to classify the "interests" of over two billion people based on their self-reported interests, clicks and "likes" on Facebook, software downloads, clicks on Facebook's ads on other sites, and additional inferences from overall behavior and location. The hundreds of thousands of interests classified by Facebook are organized in categories such as business, entertainment, family, wellness, food, hobbies, fashion, sports, and technology. We scrape Facebook's marketing application programming interface to identify the 1,000 Facebook interests with the largest audiences worldwide.

From these globally relevant interests, we derive measures for national and subnational levels of patience. We extract data on the prevalence of Facebook interests in each country and region and reduce their dimensionality by principal component analyses. Employing machine-learning techniques, we train an international model to predict the scientifically validated patience measure of the Global Preference

[1] The underlying research paper is "Can Patience Account for Subnational Differences in Student Achievement? Regional Analysis with Facebook Interests." This summary was first published on VoxEU.org on October 11, 2023.

Figure 1

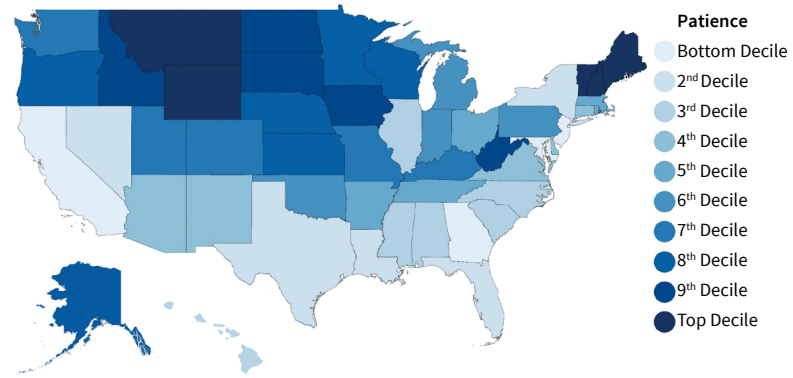
Facebook-derived Measure of Patience for Italian Regions



Source: Hanushek et al. (2023). © ifo Institute

Figure 2

Facebook-derived Measure of Patience for US States



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Survey (GPS) (Falk et al. 2018) from the principal components of the Facebook interests.

We validate the newly derived measure of patience through an international analysis that mimics prior investigations of preferences and cross-country achievement differences (Figlio et al. 2019; Hanushek et al. 2022). Our Facebook-derived measure performs as well as the original GPS measure in predicting PISA student achievement across the 48 GPS countries. Out-of-sample predictions allow us to expand the analysis beyond GPS countries to a total of 80 countries, and the patience measure provides very consistent predictions of PISA achievement for the expanded sample and the 32 added countries.

We use the parameters estimated from international Facebook interests to construct subnational patience measures across 20 regions for Italy and across 50 states for the United States based on observed regional Facebook interests. In Italy, the regions with the lowest patience measure are Sicily and Campania in the south and the highest is Trentino-Alto-Adige in the northeast (Figure 1). In the United States, the states with the highest level of patience are Vermont and Maine in the northeast (Figure 2). Both countries show substantial north-south variation in the Facebook-derived measure of patience that coincide with the long-standing geographical disparities in the two countries (for Italy, see, e.g., Putnam 1993; Guiso et al. 2004; Bigoni et al. 2018).

Non-representative regional preference measures from the GPS provide another way of validating the Facebook-derived patience measures. We can use the regional identifiers contained in the GPS data to construct regional GPS measures of patience (Sunde et al. 2022). These are obviously very noisy due to the small regional GPS sample sizes, averaging 50 individuals per Italian region and 20 per US state. Nonetheless, these are significantly positively correlated with our measure at 0.49 across Italian regions and 0.23 across US states.

PATIENCE AND STUDENT ACHIEVEMENT ACROSS ITALIAN REGIONS AND US STATES

We employ the newly derived regional measures of patience in analyses of subnational student achievement in Italy (using INVALSI test data) and the United States (using NAEP data).

The Facebook-derived measure of patience is strongly associated with regional student achievement in both countries. In Italy, a one-standard-deviation increase in regional patience is related to a 1.2–1.5-standard-deviation increase in eighth-grade math achievement (Figure 3). This is only slightly smaller than the estimate in the abovementioned cross-country analysis. In the United States, the equivalent estimate is statistically significant, albeit only about one-quarter in magnitude (Figure 4).

Eric A. Hanushek

is the Paul and Jean Hanna Senior Fellow at the Hoover Institution of Stanford University.

Lavinia Kinne

is a Postdoctoral Researcher at the DIW Berlin. She completed her PhD at the ifo Center for the Economics of Education and at Ludwig-Maximilians University in Munich.

Regional differences in patience account for over two-thirds of the test-score variation across Italian regions and for over one-third across US states. The smaller role in the United States may reflect that the substantial cross-state mobility of the US population lessens the preference heterogeneity and alters the intergenerational transmission of cultural traits.

While the regional analysis is descriptive, two aspects speak against major bias. First, our cross-country analysis indicates limited bias when we assign migrant students the patience measure of their origin country. This allows conditioning on fixed effects for residence countries to shield against simple reverse causation and unobserved features of students' residence countries. Second, the within-country estimation is less prone to confounding from unobserved national traits such as languages, constitutions, and institutional factors that has hampered prior cross-country analyses.

Consistent with skill development as a cumulative process, the association between patience and student achievement is stronger the higher the grade level. In Italy, estimates grow steadily across the four INVALSI testing occasions from second to tenth grade. Similarly, estimates for the US NAEP grow from fourth to eighth grade.

All results account for regional variation in risk-taking, another preference entering intertemporal decisions. The machine-learning model predicting risk-taking from Facebook interests does not, however, perform very well at the regional level. The poor measurement of risk-taking implies that the estimates of patience are lower bounds, because patience and risk-taking are positively associated and prior work suggests a negative association of risk-taking with student achievement (Hanushek et al. 2022).

Results do not differ significantly by gender. They are also robust in the available separate assessment waves. We find similar results for reading achievement in both countries, albeit with slightly smaller point estimates.

Moreover, results are consistent for six additional countries where regional achievement data covers fewer grades or regions. The positive association between regional student achievement and Facebook-derived patience holds in a pooled sample of 190 regions in eight countries. The association is separately significant in all additional countries – Brazil, Canada, Germany, Kazakhstan, and Mexico – except Spain.

Figure 3

Patience and Student Achievement across Italian Regions

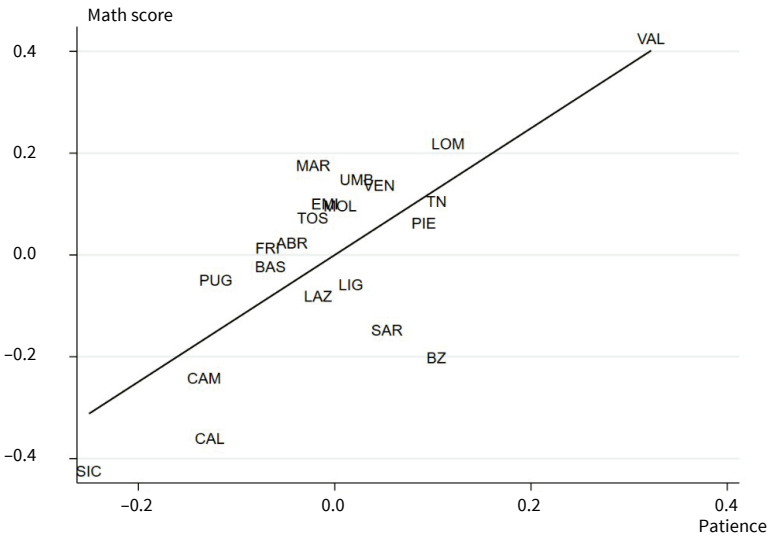

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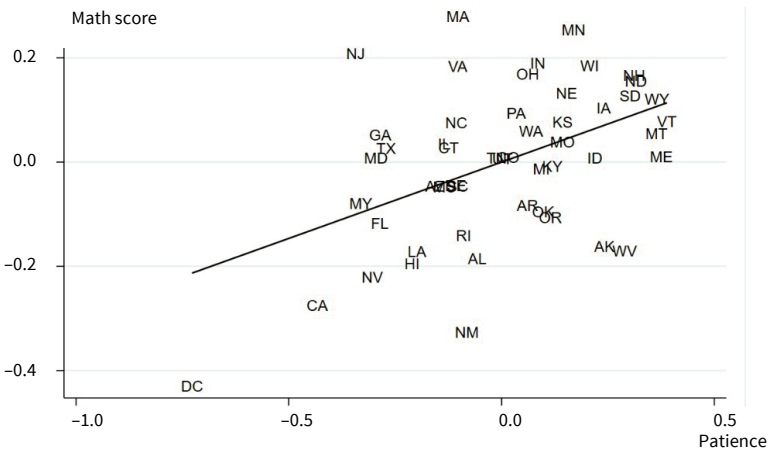
Figure 4

Patience and Student Achievement across US States



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book-derived measures of patience provide a powerful explanation of variation in student outcomes across Italian regions and US states. This new perspective on student performance helps to explain why, for example, north-south differences in student outcomes in both countries have been very stable over time even in the face of national efforts to equalize performance.

POLICY CONCLUSION: THE IMPORTANCE OF PATIENCE FOR LONG-STANDING SUB-NATIONAL DISPARITIES

Regional differences in student achievement are historically large and persistent but poorly understood and understudied. Our analysis shows that subnational differences in Face-

Pietro Sancassani

recently completed his PhD at the ifo Center for the Economics of Education and at Ludwig-Maximilians University in Munich.

Ludger Woessmann

is Director of the ifo Center for the Economics of Education and Professor of Economics at the University of Munich.

When concerned about within-country differences in student achievement, policymakers might look beyond proximate factors such as school spending or even family educational background to take possible differences in patience into account. Institutional features of schooling such as reliance on parental choice or test-based accountability are less tied to aggregate preferences (Hanushek et al. 2022). Thus, institutional reforms of school systems appear a viable policy mechanism for improvement that does not necessarily depend on changing preferences (Woessmann 2016). Moreover, while cultural traits are considered hard to change (e. g., Guiso et al. 2006; Bisin and Verdier 2011), recent evidence shows that traits such as patience are malleable, especially at a young age, and can be improved through specific interventions (e. g., Bird 2001; Alan and Ertac 2018; Jung et al. 2021). Hence, policies aimed at increasing patience may be an avenue for addressing educational investments and regional deficits in student outcomes.

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