

SOUTH AMERICA

by the numbers

By Richard Van Noorden

The expanding economies of South America have led to a significant rise in scientific output over the past two decades, and research spending has increased in most countries. But given the region's share of the world's population and gross domestic product (GDP), publication rates still fall short of what would be expected. Research quality has not kept

pace with rising output, and the continent's research papers still struggle to attract citations from the rest of the world. There are huge inequalities across the region, too: Brazil dominates the publication record, for example, whereas Chile takes pole position in the patent landscape and Argentina scores highly in terms of the proportion of its population working in science.

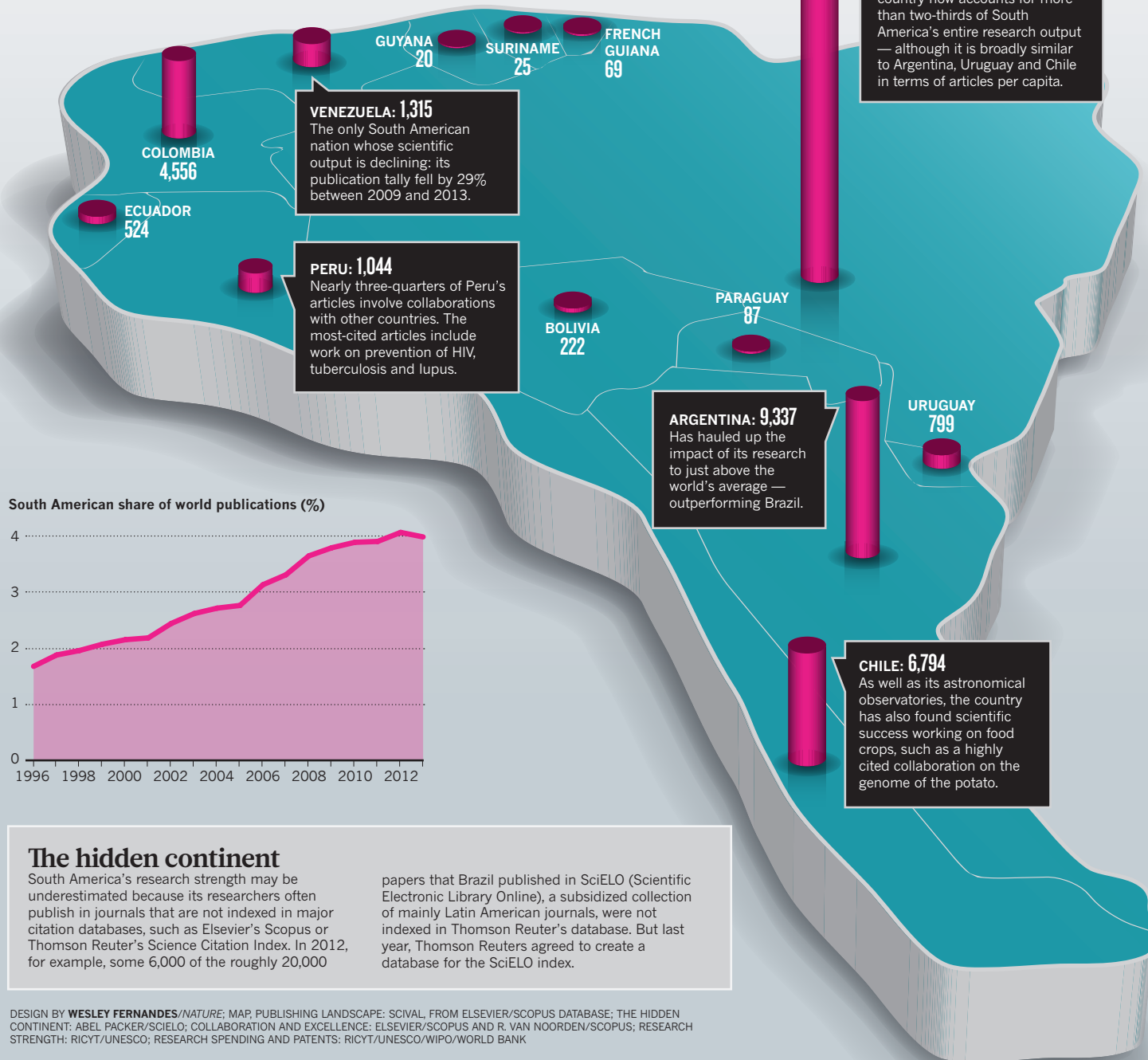
THE PUBLISHING LANDSCAPE

South America has boosted its share of the world's research articles — but at 4%, it still underperforms slightly relative to its 5–6% share of world population and GDP.

NUMBER OF ARTICLES PUBLISHED IN ELSEVIER'S CITATION DATABASE SCOPUS IN 2013
(see 'The hidden continent' below)

BRAZIL: 46,306

In the past 20 years, Brazil's scientific output has risen by more than a factor of five, as its economy has almost tripled in terms of purchasing power. The country now accounts for more than two-thirds of South America's entire research output — although it is broadly similar to Argentina, Uruguay and Chile in terms of articles per capita.



VENEZUELA: 1,315
The only South American nation whose scientific output is declining: its publication tally fell by 29% between 2009 and 2013.

PERU: 1,044
Nearly three-quarters of Peru's articles involve collaborations with other countries. The most-cited articles include work on prevention of HIV, tuberculosis and lupus.

ARGENTINA: 9,337
Has hauled up the impact of its research to just above the world's average — outperforming Brazil.

CHILE: 6,794
As well as its astronomical observatories, the country has also found scientific success working on food crops, such as a highly cited collaboration on the genome of the potato.

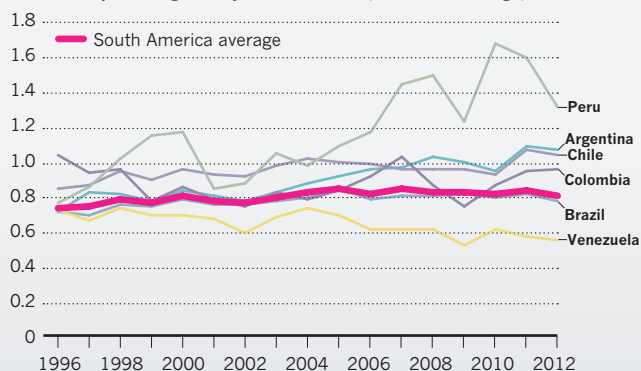
The hidden continent
South America's research strength may be underestimated because its researchers often publish in journals that are not indexed in major citation databases, such as Elsevier's Scopus or Thomson Reuter's Science Citation Index. In 2012, for example, some 6,000 of the roughly 20,000 papers that Brazil published in SciELO (Scientific Electronic Library Online), a subsidized collection of mainly Latin American journals, were not indexed in Thomson Reuter's database. But last year, Thomson Reuters agreed to create a database for the SciELO index.

DESIGN BY WESLEY FERNANDES/NATURE; MAP, PUBLISHING LANDSCAPE: SCIVAL, FROM ELSEVIER/SCOPUS DATABASE; THE HIDDEN CONTINENT: ABEL PACKER/SCIELO; COLLABORATION AND EXCELLENCE: ELSEVIER/SCOPUS AND R. VAN NOORDEN/SCOPUS; RESEARCH STRENGTH: RICYT/UNESCO; RESEARCH SPENDING AND PATENTS: RICYT/UNESCO/WIPO/WORLD BANK

COLLABORATION AND EXCELLENCE

South America's scholarly impact remains relatively low — its citation rate last year was around 80% of the world's average (below). Peru's articles do best, largely because most are co-authored with scientists outside the continent. Indeed, the region's less-developed countries are generally more likely to collaborate beyond South America. In Brazil, less than one-quarter of its articles in 2008–12 involved such partnerships (right).

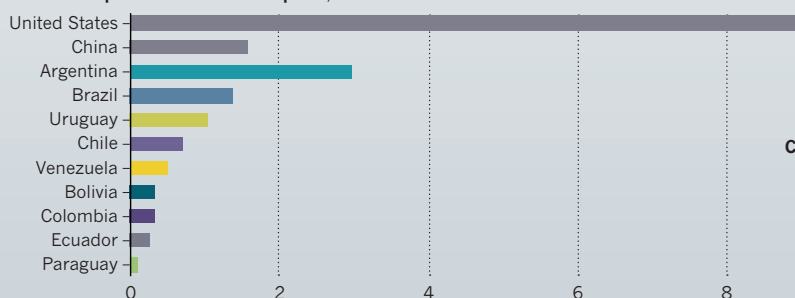
Citation impact weighted by research field (1 = world average)



RESEARCH STRENGTH

Brazil has more than 100,000 full-time researchers, single-handedly providing nearly two-thirds of South America's science personnel. But Argentina has the greatest proportion of researchers, with almost 3 scientists for every 1,000 workers.

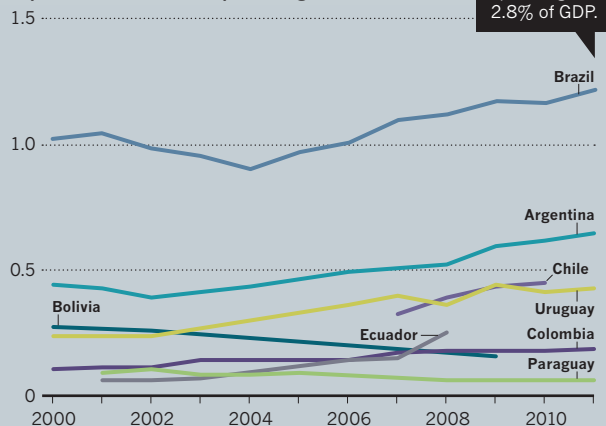
Full-time equivalent researchers per 1,000 labour force



RESEARCH SPENDING

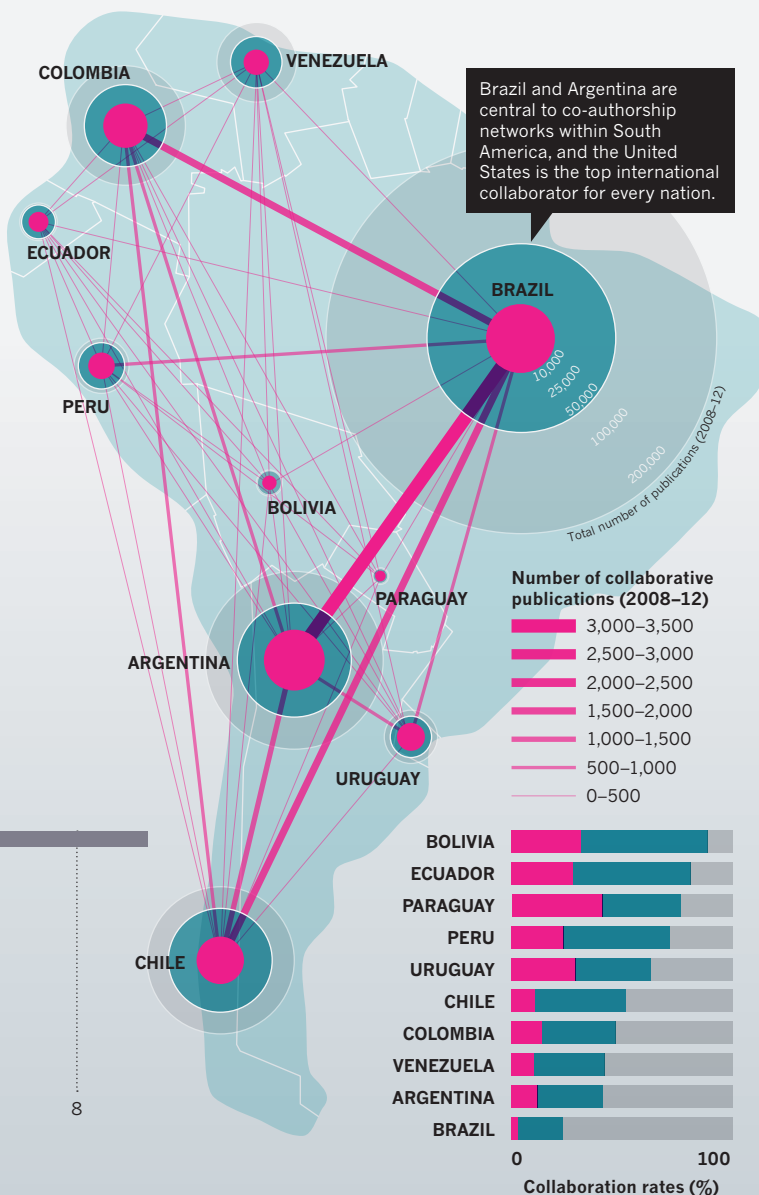
Argentina and Brazil's spending on research and development (R&D) has shot up even faster than their economies have grown. Brazil remains the region's only country to devote more than 1% of its economy to R&D*.

Expenditure on R&D as a percentage of GDP



*No verified figures for Venezuela, no up-to-date data for Peru. Data are incomplete for Ecuador and Chile.

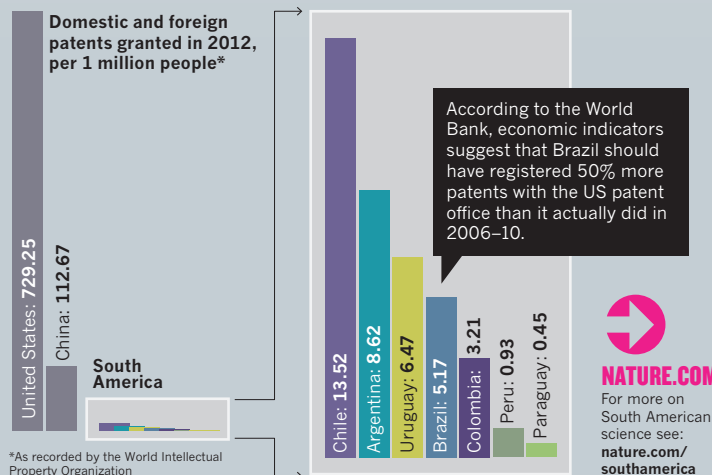
Collaborations involving other South American nations | Other international collaborations | No international collaboration



Brazil and Argentina are central to co-authorship networks within South America, and the United States is the top international collaborator for every nation.

PATENTS GRANTED

In Brazil, nearly half of research funding comes from the business sector; in other South American nations, the share from businesses is generally much lower, a stark contrast with many industrialized countries. Poor private investment results in a small number of patents granted per capita, where South American countries look particularly weak.



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