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2022

Persistence in World Export Patterns and Productive Capabilities Across Two Globalizations

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PERSISTENCE IN WORLD EXPORT PATTERNS AND PRODUCTIVE CAPABILITIES ACROSS TWO GLOBALIZATIONS*

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Abstract

We construct a new global commodity-level export dataset to analyze the persistence of export patterns as proxies of productive capabilities across the first and the current waves of globalization. We find that productive capabilities are path-dependent and historical capabilities are powerful predictors of countries' incomes today. This is robust to controlling for persistence in geography, institutions, and colonial status, and confirmed by instrumenting past capabilities with asymmetric reductions in travel times following the switch from sailing to steamboats. We also show that the "great specialization" in primary goods and manufacturing goods exporters coincided with a great polarization in global diversification levels.

Keywords: persistence, globalization, productive capabilities, development, global export patterns

JEL codes: O33, O47, F02, F14, F6

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I Introduction

Why are some nations rich and others poor? This is one of the cardinal questions in economics. In recent years, a growing number of persistence studies locates the answer in the distant past (Voth, 2021). Most of the literature focuses on non-economic factors as drivers of long-term growth, such as culture, institutions, and geography. In this paper, we provide a more distinctly economic explanation of persistence: path-dependence in countries' productive capabilities. The development economics literature suggests that export data can be used to reveal countries' productive capabilities when global markets are integrated. This level of global market integration first coalesced in the period of globalization of the late 19th century. The aims of this study are (I) to analyze the persistence of relative productive capabilities across the first and the current waves of globalization, and (II) to investigate the extent to which productive capabilities in the previous globalization predict today's GDP per capita. To this end, we construct a new global commodity-level export dataset and document export patterns for the peak of the first globalization.

We use export-based measures of productive capabilities to examine the longstanding theoretical insight from economic development and growth theories that increasing returns and positive spillovers create path dependencies. We define productive capabilities in a broad sense as all knowledge, skills, technology, and organizational capacity required to produce products in an internationally competitive way. The more productive capabilities a country commands, the more different and complicated things it can produce. Productive capabilities are located on the level of individuals and of the firm, as well as on the aggregate level of countries due to spillover effects. Economists have long argued that productive capabilities matter for economic growth (Chandler, 1992; Dahlman, Ross-Larson and Westphal, 1987; Fagerberg and Srholec, 2008; Lall, 1992, 1987; Penrose, 1959; Richardson, 1972). Weitzman (1998), Hausmann and Hidalgo (2011), van Dam and Frenken (2020), and others have suggested that productive capabilities are path-dependent—that is, the more capabilities a country has, the more it can develop. Productive capabilities have also been found to be good predictors of future growth (Hidalgo, 2021). This makes productive capabilities a natural candidate for persistence.

For the present study, we have constructed a completely new dataset for commodity-level merchandise exports in the peak phase of the first globalization (1897–1906). To the best of our knowledge, ours is the first database to go far beyond Lamartine Yates’s (1959) census of world trade in terms of the granularity of export categories for this period.¹ We cover 99 countries and at least 80 percent of world exports, recording a total of 21,151 distinct commodity-country-year observations for the years 1897 to 1906 and covering 432 commodity types at the SITC-4 level. To make our historical data compatible with contemporary export data, we manually translated classifications in primary sources in five languages into the four-digit Standard International Trade Classification (SITC).

We use three export-based measures of countries’ productive capabilities: diversification, economic complexity, and sophistication. All three measures rely on the insight that in order to export a good on the world market, a country needs productive capabilities to produce competitively. Therefore, exports can reveal productive capabilities. Diversification counts the distinct commodity types (e.g., SITC codes) that each country exports competitively. Economic complexity, as defined in Hidalgo and Hausmann (2009), refers to an index that utilizes information about countries’ diversification and the ubiquity of exports across countries. Sophistication ranks countries according to the complexity of their exports weighted by a product’s share of total exports (Lectard and Rougier, 2018). Our classification of the historical data into SITC categories allows us to use the same measures for the first and the present globalization and, thus, to compare productive capabilities in a methodologically consistent way. Figure I illustrates our geographic coverage and the ranking of countries’ export diversification in the first and present globalizations. The map indicates that countries have tended to stay in the same decile across the span of a century.

[Figure I here.]

Our analysis delivers four key findings.

¹For want of more comprehensive data, Yates’s (1959) work is still used in exercises that decompose trade in the previous era of globalization to the sectoral level (Findlay & O’Rourke, 2007; Galor, 2005; O’Rourke, 2018). Yates records 57 commodity types for the year 1913.

First, cross-sectional regressions of today's capabilities (1998–2007) on historical capabilities (1897–1906) reveal path dependence. Countries that had a high position on the global capabilities ladder in the first globalization also tended to be ahead of others a century later. Conversely, countries that started on lower rungs tended to “trail behind”, not to catch up. For example, a country that was 10 percentage points closer to the most diversified country in 1897–1906 was also, on average, 7.3 percentage points closer to the top in 1998–2007, controlling for contemporary covariates.

Second, historical productive capabilities are also powerful predictors of today's levels of economic development. The effect is large for all three measures. At the three-digit SITC level and when using a revealed comparative advantage (RCA) cutoff of 0.5 to filter out negligible exports, a country that is 10 percentage points closer to the top-ranked country in terms of economic complexity in the historical period has a 39 percent higher GDP (purchasing power parity) per capita today on average.² This effect is even higher, 56 percent, if GDP is instead measured at market exchange rates. This and the first result are robust to calculating our measures at other levels of commodity disaggregation (SITC levels 2 and 4) and to varying the threshold above which a commodity is considered a competitive export (RCA of 0.1 and 1). The two findings also hold for the first principal component of the three measures, for subgroups of countries, when using the 1970s and 1980s as the outcome period, and after testing for various forms of spatial correlation.

Third, we find that the path dependence in productive capabilities is not simply a function of persistence in countries' geography and institutions or the long-run impact of colonialism. We control for climate, geographic location, and natural endowments, and account for institutions with the constraint on the executive in 1900, a measure of institutions protecting property rights. We also use measures of colonial status and heritage in 1900. The association between present and past capabilities in this specification hardly declines. The size of the effect of past capabilities on today's development levels roughly halves, which suggests that the persistence in productive capabilities

²Revealed comparative advantage in commodity x by country y is defined as the share of y 's exports of x in the value of y 's total exports divided by the share of the global exports of x in the value of total global exports (Balassa, 1965).

is a complementary explanation to geography, institutions, and colonialism of contemporary GDP per capita. We further rule out omitted variable bias by constructing an instrument variable. Drawing on Feyrer (2019) and Pascali (2017), we use asymmetric reductions in travel times following the switch from sailing ships to steamboats in the second half of the 19th century to identify the effect of past capabilities on current outcomes.

Finally, our novel dataset also sheds new light on export patterns in the first globalization. We find that countries that exported manufacturing goods also exported a diverse set of non-manufacturing goods. In contrast, countries limited to exporting primary goods only achieved low levels of diversification. Even though the absolute level of diversification has increased sharply for all countries across the two globalizations, the relative inequality in countries' diversification levels remains relatively stable.

This paper contributes to four strands of literature in economics.

We contribute to the debate over the deep roots of economic development in the historical persistence literature (Nunn, 2020, 2009; Spolaore and Wacziarg, 2013; Voth, 2021). This literature often relies on non-economic historical variables to explain today's economic outcomes. This can make findings subject to criticism of ad-hoc hypothesizing (Voth, 2021). Our approach is to measure one economic variable – productive capabilities – in an 'apples-to-apples' comparison. We use the same measures of productive capabilities based on comparable commodity-level export data from both periods. This allows us to hypothesize persistence building on concepts of learning by doing, increasing returns to scale and path dependence, grounded in long-standing theories in development and growth economics (e.g. Kaldor, 1966; Myrdal, 1973, 1944; Romer, 1986; Young, 1928). Path dependence in productive capabilities has been empirically demonstrated for shorter, more recent time periods (Coniglio et al., 2021; Hidalgo et al., 2007). Our analysis extends these findings to the very-long-run and thus builds a bridge with the persistence literature. Using Voth's (2021) terminology, we also provide an 'apples to oranges with theory' persistence study, which is consistent with the predictions of endogenous growth theory (Grossman and Helpman, 1990; Romer, 1990): persistence in productive capabilities is a key determinant of today's income levels.

Second, our results on the path dependence of productive capabilities are complementary to those of previous studies that focus on fundamental causes of long-run development, such as geography and the quality of institutions. The detrimental impact of extractive colonial institutions on today's development also operates through the effect of those institutions on productive capabilities. We find that a colonial past has a large negative effect on today's productive capabilities and confirm the finding of previous studies (Dell, 2010; Nunn, 2008) that the same holds for income levels. Our results also speak to persistence in technology advantages. Comin, Easterly and Gong (2010) studied the role of technology adoption over the course of millennia. Due to their very long-time horizon, their results have been critiqued for not taking the great divergence and industrial revolutions into account (Thompson and Sakuwa, 2013; Voth, 2021). We use the period of the Second Industrial Revolution when the great divergence was firmly established as our starting point (Pascali, 2017). Economic historians have long argued that technological advantages acquired in the late 19th century have persisted until today due to economies of scale and scope (Chandler, 1992, 1990). Rather than focusing on the adoption of specific technologies, our approach focuses on the advantages that given productive capabilities confer in acquiring further capabilities (Atkin, Costinot and Fukui, 2021; Hausmann and Hidalgo, 2011).

Third, our paper links findings on global export diversification for recent years to the first period of globalization. Going back to Dennis Robertson (1938), the literature has characterized world trade in this period as a "great specialization" between net exporters of primary and of manufactured goods with one caveat: industrialized countries (the UK and North-West Europe) were also major exporters of primary goods, while primary goods exporters were largely de- or non-industrialized countries (Findlay and O'Rourke, 2007, p. 411-4). Our novel data reveal that once we look beyond broad sector categories, this asymmetric degree of specialization amounts to a global hierarchy in export diversification, with industrialized countries occupying the top ranks. Our finding is consistent with the hump-shape hypothesis for the present globalization, which suggests that countries diversify up to a certain threshold of income levels, beyond which diversification levels decline (Imbs and Wacziarg, 2003; Strauss-Kahn and Cadot, 2011). All estimated

thresholds in the literature for the inflection point in diversification levels are above the highest income levels at the turn of the 20th century (Cadot et al., 2013). Based on this, one would expect a global hierarchy of diversification of the type we observe. In this context, global export patterns in the first globalization can be described as a “great polarization” in diversification.

Finally, we contribute to the literature on persistence in international trade patterns. This literature has focused on whether specializations are locked-in or whether there is specialization mobility referring to changes in export lines. Empirical evidence is mixed and theoretical research in this field suggests that there are good reasons for both persistent specializations and mobility (Proudman and Redding, 2000). These include endogeneity of technological change (e.g., Krugman, 1987; Grossman and Helpman, 1991; Redding, 1999) and economic geography and agglomeration economies (e.g. Krugman, 1991; Fujita, Krugman and Venables, 1999). For example, learning-by-doing speaks for persistent specialization, while spillover effects can boost new export lines. By focusing on relative degrees of diversification and the complexity of exports, our analysis is agnostic regarding whether countries continue exporting in the same sectors or move into new ones. We show that initial export patterns matter in terms of how many different goods a country can export and how complex these goods are.

The remainder of this paper is structured as follows. Section II develops our conceptual framework and provides the historical background. Section III describes our new world export database. Section IV introduces our measures of productive capabilities and describes global export patterns in the historical period. Section V contains the main results for persistence in capabilities and their effect on GDP. Section V examines alternative explanations for present-day outcomes. Section VI concludes.

II Conceptual framework and historical background

Our conceptual framework builds on the insight that productive capabilities exhibit increasing returns to scale, which suggests path dependency. Productive capabilities have also been found

to determine future levels of income. Therefore, we expect historical productive capabilities to be both persistent and predictive of today's relative wealth of nations. To study the persistence in productive capabilities, we use export data and compare the first period of globalization with the present one. The first globalization of the late 19th century is the starting point for our analysis since, for the first time, the whole world was integrated into global trade. Exports reveal countries' productive capabilities. By the turn of the 20th century, the great divergence originating in the 18th century had been firmly established and the Second Industrial Revolution saw the creation of powerful companies that dominated throughout the 20th century.

II.A Path dependence in productive capabilities

An old insight and robust stylized fact in development economics is that a country's productive capabilities matter for its prosperity.³ Productive capabilities refer to mastering a certain set of technologies (James and Romijn, 1997), where "technology is, most fundamentally, knowledge about how to do things" (Evenson and Westphal, 1995). This basic insight dates back to the beginning of growth theory. Adam Smith (1776) famously argued that an increase in the social division of labor is the greatest source of advancement for the wealth of nations. The development of new branches of specialized production in turn leads to an increasing variety of productive capabilities (Young, 1928).

Theoretically, there are good reasons to believe that capabilities are persistent. In particular, capabilities may exhibit increasing returns: the acquisition of new capabilities depends on the productive capabilities available in the first place. To provide a contemporary example, the capabilities required to produce batteries and internal combustion engine cars help in the development of electric vehicles. This process may have combinatorial features (Weitzman, 1998). If new products require a recombination of certain tasks, then having the capability to carry out these tasks improves the likelihood of developing new products or moving into new sectors. Moreover, for

³See, for example, Rosenstein-Rodan (1943), Prebisch (1950), Hirschmann (1958), Lall (1992), Lederman and Maloney (2003), Hausmann, Hwang and Rodrik (2007), Hidalgo et al. (2007), Hesse (2009), Hausmann and Hidalgo (2011), Lederman and Maloney (2012), Zhu and Li (2017).

persistence it may not only matter how many capabilities a country possesses, but also which specific combinations of capabilities it has. This is due to the network-like properties of the space of capabilities, where some capabilities unlock more additional capabilities than others (Hausmann and Hidalgo, 2011; van Dam and Frenken, 2020). These combinatorial and network features give reason to expect that productive capabilities tend to be path-dependent, which makes them a natural candidate for persistence. So far, however, the persistence of productive capabilities and its implications for income levels have not been explored for the long-run due to data limitations.

If we extrapolate this analysis into the long run, we expect that the hierarchy of productive capabilities established during the first globalization period and the Second Industrial Revolution is persistent over time. We can interpret the persistence in terms of the common image of a ladder of development where countries are ranked based on the kinds of goods they export (Krugman, 1985). By way of analogy, consider a ladder of productive capabilities, which all countries are higher on today than they were previously, but their relative positions have not changed greatly. The countries at the bottom of the hierarchy tend to *trail behind* rather than catch up with the countries on top of the ladder. If countries are predominantly trailing behind in terms of productive capabilities, they also lack opportunities to catch up on the ladder of development more generally. In other words, development is path-dependent. Consequently, we expect past productive capabilities to be powerful predictors of today's income levels. In particular, we hypothesize that the persistence in relative productive capabilities is a mechanism by which relative income per capita levels are transmitted over longer time periods.

Comin, Easterly, and Gong's (2010, pp. 67–8) study of technology as a driver of persistent differences in income levels comes closest to study long-run persistence in productive capabilities. They identify the following key drivers for path dependencies in technology from the literature on technological development: complementarities between existing technologies; recombination of old technologies into new ones; feedback and spillover of technology to science and vice versa as well as across different sectors; economies of scale and scope; and learning by doing. Comin, Easterly, and Gong measure technology directly as the adoption of certain production techniques

in the course of millennia. By contrast, we approach productive capabilities through outcomes in terms of export competitiveness, which allows for a more fine-grained analysis and a broader coverage albeit for a shorter time frame. However, the basic intuition is the same: the drivers that perpetuate technology advantages also apply to productive capabilities more broadly. As a general tendency, the more know-how, production experience, management skills etc. a country already has, the more it can acquire.

A growing body of literature studies productive capabilities in recent decades using export data (e.g. Atkin, Costinot and Fukui, 2021; Hidalgo and Hausmann, 2009; Sutton and Treffer, 2016). If a country is able to export a good, its producers must have accumulated the productive capabilities required to produce at international quality levels in a cost-competitive way. The more different goods a country exports, the more diverse its productive capabilities are. These scholars document path dependencies in productive capabilities for recent years (e.g. Boschma and Capone, 2015; Coniglio et al., 2021; Hidalgo et al., 2007; Minondo, 2011; Petralia, Balland and Morrison, 2017; Pinheiro et al., 2021).

This export-based analysis has also linked productive capabilities to a country's growth potential: a country that can competitively export a larger variety of goods can capture more markets and has more sectors in which it can increase its productivity; for example through learning by doing (Young, 1991). Recent studies have shown that higher levels of export diversification and complexity are, in fact, closely linked to higher levels of GDP per capita (Felipe et al., 2012; Hidalgo et al., 2007; Lall, 2000). Our new database allows us to examine, for the first time, the long-run persistence of productive capabilities across the first globalization and the present one and the implications for today's income levels.

II.B Two globalizations

To study the persistence of productive capabilities using export data, it is desirable to compare periods with a great degree of global market integration. If market integration is highly heterogenous, export data is less accurate in revealing relative capabilities across countries. Previous studies

have been limited to the post-1962 period covered by the UN COMTRADE database (Cadot et al., 2013; Hidalgo et al., 2007), which spans a phase of high levels of protectionism, followed by a phase with increasingly free markets. The First World War saw the previous globalization start to disintegrate. The post-World War II period was marked by decades of protectionism, the spread of state socialism, and state-led development. According to the Sachs-Warner index, the share of countries with open trade policies was as low as 15.6 percent in 1960, but increased from 26 percent in 1985 to 73 percent in 2000 (Wacziarg and Welch, 2003). Trade openness rapidly increased from the 1970s until 2007 (Federico and Tena-Junguito, 2017).

Our database covers the decade 1897–1906 to capture the previous globalization in its mature state, while also using a period without major global crises or structural breaks. Peak openness in the first globalization is commonly dated to 1913 (Federico and Tena-Junguito, 2017; Klasing and Milionis, 2014), but also varies across countries, with the United States and Canada peaking as early as 1900 and Japan as late as 1929 (Bairoch and Kozul-Wright, 1998). The end of the last era of globalization is usually defined as 1913 (Federico and Tena-Junguito, 2017; Glick and Taylor, 2010). No single decade will be perfectly free from political or economic instabilities. For example, our period includes the Russo-Japanese War, the Constitutional Revolution in Persia, and the colonization of several parts of the African continent by European powers. However, major economic crises were, for the most part, absent: the Long Depression in Europe and the United States had ended by the mid-1890s, as had the aftershocks of the Barings Crisis of 1890 and the Encilhamento in Brazil.

It is contested whether the ongoing wave of globalization is ebbing (O'Rourke, 2018), but the pre-2008 period can be considered part of its high point before what looks like a return of protectionism (Fajgelbaum, Goldberg, Kennedy, & Khandelwal, 2020). Trade openness, measured in terms of the share of global merchandise trade in world GDP, peaked in 2008 at 24.6 percent (UNCTAD, 2020). We use the decade before the Great Recession (1998–2007) and after the Asian financial crisis as a period that is comparable to the first era of globalization in terms of the relative absence of a major global crisis.

II.C Great divergence, first globalization and Second Industrial Revolution

In this section we introduce the great divergence, the first globalization, and the Second Industrial Revolution as historical background to the initial conditions of our analysis. By the late 19th century, the global division of labor brought about by the “great divergence” (Pomeranz, 2000) that began in the 18th century was firmly established. At the onset of the First Industrial Revolution in 1750, Asia, Africa, and Latin America combined still produced by far the largest share in world manufacturing output—estimated at 73 percent. By 1860 this share had halved, to 36.6 percent as Europe caught up and took over. Along with a flipped asymmetry in industrial production, living standards diverged drastically in the 19th century as the new industrial core countries pulled ahead (Findlay and O’Rourke, 2007; O’Rourke and Williamson, 1999; Pritchett, 1997; Williamson, 2011). Europe and the Western Offshoots continued their rapid rise since the take-off in the 18th century, while Africa and Asia fell behind in relative terms (Nunn, 2020). The Theil inequality coefficient of incomes globally almost quintupled in the course of the 19th century (Findlay and O’Rourke, 2007, 414–5). By 1904, Asia, Africa, and Latin America’s share of global manufacturing exports was merely 6.5 percent, according to our data.

The great divergence occurred in the context of rapidly increasing global trade. The first era of globalization (1870–1913) was the first time that nearly all territories and peoples of the world had been comprehensively integrated into a truly global market. The decline in trade costs was an important driver of this trade boom (Jacks, Meissner and Novy, 2010, 2008). It was also the Age of High Imperialism (Ferguson, 2002). Europe’s imperial powers opened up the rest of the world through colonization, as in the case of most of Africa, or through gunboat diplomacy towards nominally independent countries in parts of Asia (Bairoch and Kozul-Wright, 1998; Findlay and O’Rourke, 2007; Nayyar, 2013, 2006; Williamson, 2002). When globalization came to a close in 1914, European imperial powers politically controlled 84 percent of the world’s land surface, compared to 67 percent in 1878 (Headrick, 1981, p. 3). At the same time, European merchants and planters had shaped countries’ production structures, as a growing literature on commodity histories shows (e.g. Beckert, 2015; Curry-Machado, 2013; Mintz, 1986).

Long-distance trade had gained importance in earlier periods, but it was only in the late 19th century that the global division of labor fundamentally shaped the internal organization of economies around the world (O'Rourke and Williamson, 2002; Pascali, 2017; Williamson, 2011). World trade boomed from 1870 to 1913, accounting for more than 20 percent of world GDP for the first time (Estevadeordal, Frantz and Taylor, 2003).⁴ Measures such as global price convergence, savings-investment correlations, and current account imbalances demonstrate global market integration (Jones and Obstfeld, 1997; Obstfeld and Taylor, 2004; Schularick, 2006; Taylor et al., 2002). The trade boom was facilitated by a transport and communication revolution (steamships, railways and telegraphs), backed by the gold standard and internationalizing financial markets, and fueled by a “growth miracle” in the most advanced capitalist countries (Federico and Persson, 2007; Jacks, Meissner and Novy, 2010; Lewis, 1969; Pascali, 2017; Williamson, 2011, 1996).

Pascali (2017) recently demonstrated that the first globalization of the 19th century deepened the great divergence compared to the 18th century. He finds that “the majority of the economic divergence that is observed between the richest countries and the rest of the world in the second half of the nineteenth century can be attributed to the first wave of trade globalization” (Pascali, 2017, p. 2824). This argument is consistent with studies on earlier Periods, which find that trade leads to major alterations in prosperity (Nunn, 2020). Engerman and Sokoloff's (1997) path-breaking study suggests that different specializations between North and South America established during colonial rule explain their subsequent divergence in development trajectories. This insight has been confirmed in a number of recent contributions.⁵ Nunn (2020, p. 2) concludes a survey of the literature on the impact of the emergence of world trade as follows: “Some parts of the world, such as Western European countries and their offshoots, benefitted from the trade; other parts, such as European colonies, were harmed.”

⁴Estimates of the rate of growth of GDP and of trade in the period 1870–1913 vary, but trade certainly outpaced output (Pascali, 2017). Mitchie & Kitson (1995) suggest that output growth was 2.7 percent and trade growth was 3.5 percent, while Maddison (1989) estimates 2.5 percent and 3.9 percent, respectively.

⁵For example, in a study on Peru's mita system, Dell (2010) shows how a specialization in mineral extraction impacted subsequent economic prosperity. Nunn (2008) and Nunn and Wantchekon (2011) find that Africa's long-term development was severely harmed by the slave trade. Acemoglu, Johnson and Robinson (2005a) demonstrate that the rise of Europe was driven by the Atlantic trade.

In parallel to the first globalization and the deepening great divergence, the late 19th century also witnessed the Second Industrial Revolution. Technological innovations transformed old industries such as steel, copper, aluminum, food processing, and oil refining and created new industries such as man-made dyes, fibers and fertilizers, mass-produced machines, and devices powered by electricity. The new production methods were highly capital-intensive. As a result of high fixed costs, throughput became critical for firms' competitiveness. New firms succeeded if they effectively exploited both economies of scale and scope (Chandler, 1993). This required product diversification, which depended on learned capabilities including knowledge, skill, and experience. Companies that accumulated such capabilities in relation to manufacturing, marketing, and management quickly conquered international markets. Superior organizational capabilities allowed them to be the first to commercialize new products after World War II, for example in pharma, aerospace, and electronics. In the Second Industrial Revolution, many new companies emerged that had not existed in the First Industrial Revolution of the 18th century. In contrast, Chandler and Hikino (1997, p. 33) suggest that, with the exception of electronic data-processing the large-scale, global enterprises originating in the Second Industrial Revolution, mainly in the US and Europe, also dominated in the post-World War II Third Industrial Revolution and throughout the 20th century. This points to high levels of persistence in the learned capabilities of companies after initial conditions had been established in the late 19th century.

III New Database: World exports in the first globalization

We have constructed a new database of global merchandise exports for the first globalization. Digitizing primary sources on trade flows, we recorded export data for the years 1897–1906 for up to 99 countries on the level of individual commodities. To our knowledge, this is the first such global export commodity database and the first effort to go beyond Lamartine Yates's (1959) "census" of global trade in the first globalization. We have re-coded original commodity descriptions into the Standard International Trade Classification (SITC, revision 4, four-digit) and have re-classified

polities to align with present-day country borders to make the historical data consistent with UN COMTRADE data for the present globalization.

III.A Data sources

Export data are among the richest and most accurate and reliable of the colonial statistics. Censuses were only rarely undertaken by imperial administrations, and were often little more than guesstimates, especially in African colonies (Frankema and Jerven, 2014). Detailed data on the overall structures of colonial economies were rarely collected in any systematic fashion. In contrast, colonial governments relied on trade taxes for revenue and therefore kept careful records of the international flow of goods (Gardner, 2012). This was the case both for colonies and the colonial home countries of Europe, many of which experienced a protectionist backlash that ended the preceding period of openness. The self-governing white settler colonies and some Latin American countries also raised tariffs and, to that end, kept careful trade statistics (Bairoch and Burke, 1989; Findlay and O'Rourke, 2007, 2003; O'Rourke and Williamson, 1999, pp. 93–118; Williamson, 2011, 2006). The United Kingdom stands out as a major Exception, with its continued economic openness at home, but nonetheless collected detailed statistics on its own trade, and, as the ruler of the most expansive empire, ensured that statistical processes were implanted in the territories it ruled (Touchelay, 2019). After the First World War, the availability of French data compilations declined, and although the British statistical compendia were still published, export statistics generally became less detailed at the commodity level.

The largest source for our database is the *Statistical Abstract of Foreign Countries* (henceforth SAFC), published in 1909 by the US Bureau of Statistics. The “Statistics of foreign commerce” contained therein are available from 1896 to 1906. We have recorded the data for 1896 from the SAFC, but have not used the 1896 data in our analysis since the availability of other sources limits the scope of coverage for that year. It is a very large compendium of trade statistics taken from contemporary national statistical sources at the time, and presented in a uniform format. As such, it represents a natural basis upon which to build a global export database. While imperfect, the SAFC

evinces several advantages over compiling statistics from country-level sources. Firstly, values are presented in USD, converted at prevailing market exchange rates. Quantities are similarly presented, for the most part, using American metrology. Consequently, we have also adopted the use of the US dollar for all other countries not included in the SAFC. Secondly, the Bureau of Statistics reorganized much of the original source material into the prevailing American product nomenclature, which, while not immediately translatable into contemporary classification systems, simplified the task of assigning SITC codes in a consistent fashion.

However, the SAFC does not, by itself, allow for the compilation of a global database. In particular, the coverage of Asia, Africa, and Oceania is poor. We rely on SAFC as a source for 46 countries, and on a range of colonial statistics and country-level sources for the remaining 53 countries. The country-level sources are summarized in Table A.1 in the appendix, with notes on methods. After the SAFC, the most important sources for the database were various British imperial trade statistics followed by the French statistics. Economic historians have ranked British and French trade statistics as being of highest quality for the 19th century (Lampe, 2008, p. 7). We used the *Statistical Abstract of the British Empire* for all British colonies, except where the issue of data quality led us to turn to more detailed country-level sources. This was the case for Nyasaland/Malawi, as well as for British India and British Burma, for which we turn, respectively, to the *Colonial Annual Reports*, and *Annual Statement of Trade of British India* and the *Annual Statement of Trade of British Burma*.

The French annual compilation *Statistiques coloniales* provides detailed bilateral commodity-level trade data by colony. They are recorded in the Continental system, with “Denrées et marchandises du cru de la colonie” (special exports) distinguished from “denrées et marchandises provenant de l’importation”, or re-exports. We took special exports only, in order to record only exports produced within the colonies themselves. Our figures for exports of French colonies are more accurate than those given in Frankema, Williamson and Woulter (2018), since exports are valued using free on board (f.o.b.) prices – or the official price equivalent – from the African coast rather than French imports valued in terms of cost, insurance and freight (c.i.f.), and we include all exports to

all partners, rather than assuming all French colonial exports went to France.

The German colonial empire is not represented at all in the SAFC, and has been entirely reconstructed from the original data published in *Das Statistische Jahrbuch für das Deutsche Reich* (contained in the section “Die Schutzgebiete”). The Portuguese empire was challenging to reconstruct. For several of its smaller entities (Guinea Bissau, Timor Leste) we were unable to locate suitable data for the time period in question. We have relied on roughly contemporaneous secondary sources to reconstruct the commodity composition of trade for Angola and Mozambique, the two largest Portuguese colonies.

A number of other countries were reconstructed using port-level data collected by British diplomatic officials and summarized in the British Parliamentary Paper series *Consular Reports on Trade and Finance*. Finally, some individual countries were reconstructed from miscellaneous sources, such as the Belgian Congo from the official government gazette data. For Iran/Persia, we made use of H. W. Mclean’s report on Persian trade, *Report on the condition and prospects of British trade in Persia*, for the Commercial Intelligence Committee of the British Board of Trade. Mclean gave detailed data for two years, 1901–022 and 1902–03, relying on a draft version of the Persian imperial trade statistics, which he corrected with additional information. We have taken these estimates and located additional data from various secondary sources, such as the *Statesman’s Yearbook*, to extend the time series for certain products through 1905.

III.B Database construction

We constructed our database from these primary sources as follows. Historical records of trade statistics were scanned and converted to digital format using optical character recognition technology. The original source documents were compared with the digitized versions and mistakes were corrected manually by at least two checkers. We ensure the quality of our data by performing a number of robustness checks. This included checking for unusually large changes in exports between years and benchmarking total exports against existing datasets for aggregate trade data.

The goal of this project is to help explain comparative development across the two global-

izations, and to this end, we manually translated the historical commodity classifications into the contemporary SITC (rev.4) system at the four-digit level. Each product description was investigated and matched to the closest product description in the full SITC nomenclature by a coder. In case of doubt, the full team of three coders considered the description and assigned the most appropriate SITC code. We thus created a dictionary to translate original product descriptions to SITC codes. After assembling the dictionary, we then performed several manual checks, looking at items that had been assigned the same SITC code to ensure all of the product descriptions were appropriate. This translation exercise ensured that our data is directly comparable with UN COMTRADE, which records trade flows using the SITC nomenclature.

Country borders are not fixed over time. We aim to record exports from the geographical units that most closely approximate current nation states in order to be able to trace long-term development trajectories. To this end, we used subnational sources for some countries or colonies where these were available. For example, in reconstructing the trade of countries in the former Ottoman Empire, we drew on port-level records from British and French consuls to estimate exports from areas that are now independent countries, such as Turkey, Lebanon and Israel. Similarly, we deducted all exports at the commodity level from British Burma, for which independent statistics exist, from the aggregate figures for British India.

All export flows in local currencies were converted to US dollars at prevailing exchange rates, using the Federico and Tena-Junguito (2019) market exchange rate dataset. We compiled the data on the basis of *special exports*—that is, all domestic exports of goods produced wholly or partly within each country, excluding transit trade, re-exports, and purely monetary flows of bullion and specie. Therefore, we got as close as we could to a database listing only exports that were produced within the country that exported them. Most original source materials list transit trade, re-exports and bullion and specie separately at the commodity level. In two major cases—the Netherlands and Belgium—so-called “disguised transit” is a well-known problem whereby transit trade is incorrectly listed as special trade. We relied on existing studies of those countries’ exports to correct for this problem (Horlings, 2002; van Zanden and Lindblad, 1989). We also used international

prices from Federico & Tena-Junguito (2019) to correct for inaccurate “administrative” pricing in several countries, especially the Netherlands, Belgium, and Spain.

III.C Data overview

Our final database reports detailed exports of up to 419 distinct commodities per year and for 99 countries for the period 1897–1906. The map in Figure I illustrates our geographical coverage. Blank areas are missing from our data: these are mainly landlocked countries. See Table I for an overview of data coverage in terms of SITC 2- to four-digit. Our data set contains 23,944 unique observations indexed by country, year, and product. This represents 2186 unique product descriptions in our primary sources in their original languages. We cover, on average, 82 percent of global trade, as measured by Federico and Tena-Junguito (2019) (see Table I).

[Table I here.]

Our country-level aggregates that are built up from the commodity-level might be more accurate than those recorded in aggregate trade databases for some countries. We avoid some of the problems that beset aggregate data from that period: for example, our database explicitly excludes monetary bullion. This is in contrast to other databases, where bullion-inclusive aggregate export figures have been taken from primary sources with either little or incomplete correction (this is often the case, for example, in the trade aggregates presented in Mitchell’s *Historical Statistics* compilations). Because we worked from the commodity level, we were able to explicitly exclude such flows. For 80 percent of country-year exports, we remain within a 20 percent annual deviation from estimates by Federico and Tena-Junguito (2019). For countries where the estimates by Federico and Tena-Junguito exceed ours, this is largely due to the fact that we exclude monetary bullion flows where they include them. In other cases, they rely on extrapolations where we use auxiliary data, such as in the case of Nepal, where we rely on Indian import data since virtually all exports from Nepal flowed through India in our period.⁶

⁶Some adjustments also serve to approximate today’s political boundaries. For Malaysia, for instance, Federico

In order to stay true to our aim of compiling detailed commodity-level data, some countries had to be excluded that could enter the aggregate datasets, like Afghanistan or Mongolia. Due to difficulties in collecting data on trade that did not flow via ports, trade data tend to be sparse in our period for landlocked developing countries, such as those in central Asia or central Africa (in the latter case, statistics would become more detailed as colonial rule was entrenched). In one case—Nepal—we could reconstruct the commodity composition of exports by relying on Indian trade statistics, since this was overwhelmingly where Nepalese exports were directed. Nevertheless, the resulting dataset is close to other estimates of global total exports, as Table I shows.

To the best of our knowledge, ours is the first global database to record commodity-level exports for the previous globalization and the first study to go beyond Lamartine Yates’s (1959) “census” of global trade for 1913. Yates hand-coded exports from primary sources and did not publish the underlying data, or document his sources in detail. Furthermore, while his coding was extremely detailed for historical work in the 1950s, it was not highly disaggregated when compared to our approach. Yates presents total global exports of 57 distinct commodities without reporting the country shares. He also lists exports for eight product classes for 30 countries and 12 product classes for eight world regions. We cover more than three times as many countries and record much more distinct product categories at more disaggregated levels. Other more recent datasets only record aggregate trade flows (Federico and Tena-Junguito, 2019) or are limited to regional or country-level coverage (Frankema et al., 2018; Meissner and Tang, 2018).

Our data is most complete and reliable at the three-digit level for two reasons. First, the product descriptions in the primary sources were, in some cases, too vague to attribute the more specific four-digit category. Second, the SITC classification system is set up to record some kinds of detail and not others: for example, in classifying wood and timber, the SITC system pays close attention to the treatment and transformation of wood, without distinguishing the *kind* of wood (that is,

and Tena-Junguito treat Malaya and Straits Settlement (Singapore, Penang, and Malacca) effectively as two separate countries and then add them up into Malaysia so that trade between them is counted as international trade. Almost all exports from British Malaya to the outside world took place through the ports of the Straits Settlements, so if we had tried to gather port-by-port data for British Malaya (which is quite difficult given the sources because most of British Malaya was composed of semi-independent protectorates and did not keep adequate data), we would have overcounted Malaysian exports.

from what kind of trees). In primary sources from the early 20th century, by contrast, we often have reasonably good information about the kind of wood, but only sometimes have information regarding its treatment. Therefore, going down to the SITC-4 level can introduce a bias when we study countries' export diversification and economic complexity. It may appear that a country is exporting more distinct commodities simply because its trade statistics include the treatment of wood instead of its kind. For the broader three-digit classification this problem is not generally an issue in our data. Throughout the paper we use data at the SITC-3 level. This disaggregation level for diversification analysis is in line with other recent studies (Lall, Weiss and Zhang, 2006; Zhu and Fu, 2013) as well as in Michaely's (1984) pioneering work.

IV Initial export patterns and measures of productive capabilities

In this section, we first examine the export patterns in the first globalization to map the starting point of our persistence analysis. We find a *great polarization* between high levels of diversification on the part of industrialized countries and high levels of specialization on the part of countries limited to exporting primary goods. Second, we introduce our three measures of productive capabilities based on export data (diversification, economic complexity and a principal component of the first two plus a measure of sophistication).

IV.A The great polarization: Export patterns in the first globalization

The global division of labor that emerged in the first globalization and Second Industrial Revolution (see section II.C) has commonly been described as the "Great Specialization" (Findlay and O'Rourke, 2007; Nayyar, 2019, 2013; Vries, 2018), a term coined by Dennis Robertson (1938). The label Great Specialization captures that poor countries in Africa, Asia, and Latin America exported almost exclusively raw materials, while North-West Europe and the UK predominantly exported manufacturing goods. This was a result of their divergent paths of industrialization in

the UK and North-West Europe, and deindustrialization or a lack of industrialization in the rest of the world. Previous empirical accounts of export patterns in the first globalization use regional net exports of broad commodity categories; that is, primary versus manufactured goods (Findlay and O'Rourke, 2007, 412). Our novel data allow us to revisit the export patterns in the first globalization.

When we focus on the distribution of manufactured and crude material exports across regions, our analysis broadly confirms the pattern identified by the Great Specialization thesis. Manufacturing goods were a substantial part of global trade in the first globalization, with an annual average of 28.7 percent of global exports in 1897–1906. As Table II shows, European countries had by far the largest share of manufactured goods in their exports, with an average of 41.2 percent, and this share was even higher for European colonial powers (43.1 percent). In a distant second place on this list was North America (16.6 percent). Latin America had the lowest share of manufactured exports (2.0 percent) compared with 8.4 percent in Africa and 11.2 percent in Asia & Pacific. The picture for the export of crude materials (SITC section 2) is roughly the reverse: Africa ranks first (48.0 percent), followed by Latin America and the Caribbean (41.1 percent), Asia Pacific (37.0 percent), North America (32.3 percent), and finally Europe (12.6 percent). With some variations, this reverse pattern also holds for the other non-manufacturing SITC sections.

[Table II here.]

At the country level, some of these patterns become even more striking. Figure II shows 99 countries ranked by the share of manufactured goods in their average export baskets for 1897–1906.⁷ The manufacturing share in exports was very low for most countries (average 7.5 percent), but accounted for 68 percent in Great Britain, the top exporter of manufacturing goods at the time. The top seven manufacturing exporters were all Western European countries. Thirty-one countries, mostly in sub-Saharan Africa and Latin America, did not export any manufactured goods at all.⁸

⁷Average export baskets account for the unbalanced nature of the panel as follows: first we calculate average exports per commodity by dividing the sum of exports by the years in which the country reported non-zero exports. Then we sum across commodities to calculate shares. We also use these average export baskets for other summary statistics and the measures of capabilities.

⁸Five of these countries were in Asia and three in Europe.

On the other hand, even after more than a century of decline in manufacturing in Asia (Williamson, 2009), India (rank 11), Iran (rank 12), China (rank 15), and Thailand (rank 20) were still among the top 20 manufacturing exporters, while Japan ranked eighth, ahead of the US (14th). This lends support to Alice Amsden's (2001) argument that historical manufacturing experience mattered for Asia's ascent in the 20th century.

[Figure II here.]

A caveat to the Great Specialization formula that Findlay and O'Rourke (2007, 143–4) pointed to becomes more prevalent once we consider commodity-level export patterns: countries and regions of the world were by no means equally specialized in the first globalization. Instead, we observe a hierarchy in the degrees of diversification. Figure II plots countries' level of diversification, where diversification is measured in terms of the number of distinct SITC-3 codes in which a country has a revealed comparative advantage of 0.5 or greater. This measure of diversification captures the distinct product lines in which a country is competitive on the world market. We find a strong correlation of 0.73 between countries' manufacturing share and their level of diversification in the first globalization. The more manufactured goods a country was able to export, the wider the range of products it is competitively producing. Africa, Latin America, and several Asian countries were limited to exports of primary goods and had a very low level of diversification, while Western Europe and, to a lesser degree, some Asian countries like India, Japan, Iran, and China, were exporters of both manufacturing goods and a diverse set of non-manufactured goods. The Great Specialization pattern that divided the world into primary and manufactured goods producers coincided with a *great polarization* between export *diversification* on the part of the manufacturing exporters and export *specialization* or a lack of diversification on the part of the exporters of primary goods.⁹

Figure I shows a world map of countries' diversification ranks during the first globalization (1897–1906). It illustrates that the great polarization like the great specialization was primarily a

⁹This is consistent with Becuwe, Blancheton and Meissner's (2018) finding that France in 1836–1938 underwent a process of export diversification while industrializing.

North-South divide. But there was also a West-East divide for the Northern hemisphere: North America and Western Europe reached higher diversification levels than Asia. However, Asia was, for the most part, more diversified than Latin America and Africa with the exception of North Africa.¹⁰

IV.B Export patterns as measures of productive capabilities

Diversification is the most straightforward proxy for productive capabilities based on non-bilateral export data. This is a simple count of the number of distinct commodities a country exports competitively (Hausmann et al., 2014, pp. 24–25; Hidalgo and Hausmann, 2009). Export diversification has long been used as an indicator for levels of industrialization in the development literature (Felipe et al., 2012). The idea is that the more different kinds of commodities a country is exporting, the more diverse the productive capabilities it must have at its disposal. The positive correlation between the manufacturing share of exports and diversification we observe in the great polarization of the first globalization (Figure II) suggests that countries that exported manufacturing goods as the most technologically advanced goods in this period were also in command of a whole range of other productive capabilities in less technology-intensive sectors. By contrast, the countries that were confined to exporting less technology-intensive primary goods lacked the productive capabilities necessary to export manufactured goods. As such, we can infer from the great polarization in diversification in the first globalization a polarization in productive capabilities.

For our cross-section analysis, we are interested in countries' productive capabilities in relation to all other countries in the same period. Therefore, we normalize all diversification levels by dividing through the maximum export lines of the most diversified country in the respective period (Great Britain for the first globalization and France/Spain for the current globalization). This rescaled diversification measure allows us to examine the extent to which countries changed their rank on the productive capabilities ladder across the two globalizations.

Beyond diversification as a simple count of distinct export lines, complexity measures add

¹⁰And with the exceptions of Mozambique, Tanzania, and Guinea.

an important dimension in approximating countries' underlying productive capacities. Consider a country that exports 10 types of grain vis-à-vis a country that exports 10 goods spread across vehicles, machinery, and grains. The two countries' diversification scores would be the same, but we would expect that the latter country would command a wider range of productive capabilities than the former. Complexity measures try to capture this difference. To go beyond diversification, they also consider the ubiquity of export products. Ubiquity captures how common an export good is across countries. More formally, Hausmann and Hidalgo (2011) define ubiquity as the number of countries competitively exporting a certain product. This builds on the idea of a hierarchy of types of productive capabilities. More ubiquitous commodities are those that require less capabilities and can therefore be competitively produced by a large number of countries. Put differently, countries that produce less ubiquitous goods can also produce more ubiquitous goods, but not vice versa.

Hausmann and Hidalgo (2011) find a robust relationship between ubiquity and diversification: less diversified countries tend to export more ubiquitous goods, whereas the most diversified countries tend to export both ubiquitous and non-ubiquitous goods that are beyond the reach of countries further down in the diversification hierarchy. This relationship appears as a triangular adjacency matrix between countries and products (Hidalgo and Hausmann, 2009) (as illustrated in the appendix Figure A.1b for the years 1998–2007). We show that this same relationship between ubiquity and diversification also holds for the first globalization, as illustrated by the triangular structure in the matrix (Figure A.1a). Both then and now, less diversified countries with a limited stock of productive capabilities are constrained to a small range of goods exported by many competitors including highly diversified countries, while countries with high diversification levels also enjoy relatively exclusive competitiveness in the most productive capability-intensive types of exports. Sutton and Trefler (2016) call these goods “hard to make”.

The economic complexity index is a measure that uses this insight regarding ubiquity and diversification. It combines ubiquity and diversification in an iterative process, weighing countries' diversity with the ubiquity of its products and, in turn, the ubiquity of products by the diversity of the exporting countries (Hidalgo and Hausmann, 2009). The appendix contains a formal definition

using matrix notation for complexity and all other measures of capabilities we use. Thus, economic complexity approximates underlying productive capabilities by drawing on more information than the simple diversification measure. To go back to our example, if grains are more ubiquitous than vehicles or machinery, the country that is only exporting grains would have a lower complexity score than the country that only exports vehicles or machinery – even if their diversification scores are the same. Formally, the economic complexity index produces a scalar index of how similar countries’ export baskets are to each other (Mealy et al., 2019).

[Table III here.]

As well as countries, goods can also be ranked by considering the diversification and ubiquity of the exports of countries that produce a particular good for the world market. Table III lists the most and least complex goods in the first globalization, according to the product complexity index. The most complex goods are predominantly manufactured metal goods and chemical goods like fertilizers, while the least complex goods are mainly unprocessed agricultural goods. This corresponds to the traditional notion of manufacturing versus primary goods sectors. However, beyond this broad binary, the complexity measure allows us to rank all goods and all countries in relation to one another. Figure III maps countries’ economic complexity rankings by decile for 1897–1906. The overall picture is similar to that for the maps of the diversification ranking (Figure I).

[Figure III here.]

Due to its properties in accounting for a variety of exports and also for certain characteristics of these exports, economic complexity is a superior predictor of countries’ productive capabilities and future growth potential (Hidalgo, 2021). Yet, for a set of exceptional cases, diversity performs better as an indicator. This is the case for countries with low levels of diversification that export some non-ubiquitous goods that are unique to a few countries due to a scarce natural endowment. Consider the example of Guyana, which was reasonably undiversified in the first globalization, but

exported diamonds, a specialization shared by only two other countries in the historical period. Combining ubiquity and diversification in a measure of economic complexity ranks the productive capabilities of such a country more highly than when only diversification is considered. This “statistical illusion” is similar to the one found for more recent data in relation to developing countries (Lall, 2000; Lectard and Rougier, 2018). There the issue is that when countries with low levels of industrialization contribute labor-intensive steps in the global value chain for highly complex products, the export basket can make it appear as if the industrial structure was more advanced than it actually is. A higher complexity rank in cases like this may just be a reflection of the uniqueness of a country’s soil, climate or raw materials and not of its fungible productive capabilities.¹¹ This is a more common issue in the first globalization than in the second one since agriculture played a greater overall role in the second. For this reason, we use both diversification and complexity to approximate productive capabilities.

In order to use exports as a reliable indicator for countries’ underlying productive capabilities, we filter out accidental exports. A country might be exporting a certain good in small quantities due to a glut on its market, which might lead to the good being sold at an artificially low price. We would not want to infer from such an export that a country has the necessary productive capabilities to be competitive on the world market in producing this good on a sustained basis. Therefore, we follow the literature that uses export data to proxy for productive capabilities (Hausmann and Hidalgo, 2011; Sutton and Treffer, 2016) and adopt a revealed comparative advantage (RCA) as defined by Balassa (1965) of 0.5 to as a lower cut-off point below which product exports are not counted,¹² to prevent our results from being driven by very small export lines.¹³ French (2017) confirms the suitability of Balassa’s RCA for revealing capabilities or, as he calls it, “fundamental

¹¹Even in these exceptional cases, a complexity score that exceeds the diversification rank may be a good omen for the terms of trade, since a country that monopolizes the entire supply or large shares of the world exports of a particular good will have market power.

¹²This means we calculate each commodity’s share in total exports of a country and the world, and only include those export lines for which the share in a country’s exports is at least half their share in world trade.

¹³Sutton and Treffer (2016) use the “normalized world export share”, which is close to Balassa’s RCA except that it records a country’s share in world exports of a commodity divided by the country’s unweighted arithmetic average share of world exports, rather than the country’s actual share of world exports. Sutton and Treffer discount values that are very close to zero.

comparative advantage”. We assume that a country exports the goods with $RCA > 0.5$ competitively, but also subject this threshold to robustness tests. To accommodate missing data in some years for some countries in both periods, we calculate the RCAs from average export baskets (see Footnote 2 for a definition).¹⁴

For robustness, we also consider the principal component of economic complexity, diversification as well as sophistication. Sophistication (Lectard and Rougier, 2018) ranks countries by weighing each country’s export shares by the product complexity index introduced above. In addition to using an RCA threshold, this measure is sensitive to the relative importance of goods in a country’s exports in ways that economic complexity is not. This can make a marked difference. For example, for 1998–2007, both China and the United States reached the top decile in terms of sophistication. But the two countries rank in the second highest decile in terms of economic complexity. The manufacturing share of exports has long been used to approximate countries’ productive capabilities. It is a measure that is less sensitive to the statistical features of our data.

All three proxies for productive capabilities—diversity, economic complexity and the principal component—are comparable across the two waves of globalization thanks to our translation of the historical data into the SITC system. Table IV reports summary statistics for both periods. In Table V we analyze correlation patterns across our key variables and find that they are all positively and highly correlated. This indicates that all three measures proxy a common underlying feature: productive capabilities.

[Table IV here.]

[Table V here.]

¹⁴This treatment also applies to all control variables.

V Persistence in productive capabilities and the ladder of development

In this section we describe our baseline results. As described in Section II, the first globalization shaped countries' position in the global division of labor and, as shown in Section IV, resulted in a great polarization between countries with high and low levels of productive capabilities. Our results suggest a high degree of persistence in productive capabilities across the two globalizations. Past productive capabilities are also highly predictive of countries' per capita GDP today.

V.A Descriptive analysis

Prior to running regressions, Figure IV illustrates our main finding: both relative diversification and economic complexity measures of productive capabilities point to strong persistence across the two eras of globalization. The left Panels (A, B) plot one of the two variables for the previous globalization (1897–1906) on the horizontal and the present globalization (1998–2007) on the vertical axis. We rely on UN COMTRADE data available at the Observatory of Economic Complexity for export data for 1998–2007.¹⁵ We observe a strong and positive correlation: the higher up a country was on the ladder of productive capabilities a century ago, the higher up it tends to be in the present globalization. Countries on the bottom of the hierarchy have been trailing behind rather than catching up to those at the top across the past century.

[Figure IV here.]

Countries' position in the global relative diversification hierarchy has remained remarkably persistent since the great polarization of the late 19th century, even though absolute levels of export diversification have greatly increased.¹⁶ Figure IVa suggests a one-for-one translation of past

¹⁵The data is available here: <https://legacy.oec.world/en/resources/data/>

¹⁶Then, the United Kingdom was by far the most diversified country, with 69 distinct export lines at the SITC 3 level according to our data (1897–1906), whereas the mean diversification level was only 16. In the present globalization (1998–2007), the most diversified countries—France and Spain—both had 201 distinct export lines, while the mean of all countries of 79 surpassed the United Kingdom's diversification in the last era of globalization.

capability advantages into current ones on average, with a best linear fitted slope of 1.03. Over a third of the countries in our data, mostly former European colonies in Africa, are stuck across the two periods, with less than 25 percent of the respective maximum relative diversification levels. In contrast, West European countries and the US dominated the hierarchy then and still do now.

Diversification across the two globalizations is further illustrated in the maps in Figure I. Broadly speaking, we observe a persistence of the pattern described for the great polarization of the late 19th century (see section IV.A). Some notable cases of falling behind compared to the first globalization are Russia and countries in the Middle East, as well as several African countries, while Brazil and Argentina are more hopeful cases of some degree of catching up.

One possible objection against our finding of a persistence in the great polarization in diversification may be that the degree in inequality in diversification could have been very different across the two periods. We calculate the Gini coefficient over countries' export lines for both globalizations to capture the distribution of diversification levels. The two Ginis are close to each other with 0.40 for 1897–1906 and 0.36 for 1998–2007. The relative inequality in export diversification in the present era of globalization is of a similar magnitude compared to the first globalization (see Lorenz curves in Figure V). Despite a small reduction in the Gini, there is a lack of Lorenz dominance (the two curves intersect). Inequality at the bottom of the distribution has even slightly increased, and the decline in the Gini is explained by more equality among the most diversified countries. The phenomenon of “catching up” among the top countries is also documented regarding GDP by Pritchett (1997). In 1897–1906 the United Kingdom was far ahead of all other countries in terms of its diversification. Its closest rivals, Netherlands and Germany, only reached 71 and 74 percent of the United Kingdom diversification level, respectively. In 1998–2007, eight countries—all European or the United States—scored above 80 percent of the maximum diversification level (Figure IVa).

[Figure V here.]

For the economic complexity index, the best linear fit comparing the first and the present globalization has a slope of 0.57 (Figure IVb). This indicates that despite the dominant pattern of

trailing behind, some degree of catching up has occurred in terms of economic complexity. The lower degree of persistence in complexity (Figure IVb) compared to diversification (Figure IVa) suggests that, to the extent that countries have upgraded their position in the global hierarchy of productive capabilities, they did so predominantly by exporting more complex goods rather than by primarily increasing the variety of goods exported (van Dam and Frenken, 2020). In terms of economic complexity Japan and South Korea have overtaken the European countries and the United States that continue to dominate in diversification. China and Mexico have caught up to the economic complexity ranks of countries that were in the top tier a century ago. Nevertheless, for the world as a whole, we find a persistent great polarization in economic complexity that is broadly similar to that for diversification as illustrated in the maps in Figure 1. Most African countries have either been stuck at the bottom of the ranking or have fallen even further behind compared to the historical period (1897–1906). For Latin America the picture is mixed, with Chile as the country that has fallen furthest behind compared to where it started at the turn of the 20th century and Brazil a notable exponent of catching up to upper-middle ranks.

Part of a country's diversification and complexity may be due to its size. Figures A.3 and A.4 in the appendix illustrate this point by plotting our productive capability measures against area and population. While the relationship with area is weak, we find a stronger correlation with population. Therefore, we control for population throughout all specifications of our regression analysis and account for geographic features including area in Table VII.

Panels C and D of Figure IV indicate that past productive capabilities are also highly predictive of today's GDP per capita measured in international dollars using World Bank data. But note that past economic complexity explains a lot more of the variation in the data, with an R^2 of 0.47, than relative diversification, which has an R^2 of 0.25. This difference confirms the theoretical prior that economic complexity is a more accurate measure of capabilities and a more powerful predictor of future income than a simple count of export lines recorded by diversification. Our subsequent regression analysis will detail the coefficient size discussion. Some notable outliers that achieved higher levels of income than that predicted by both past diversification and complexity are countries

that benefit from resource rents (such as Oman, Australia, and, to some extent, Norway) or from offshore financial services (such as Bahamas, Cyprus, Grenada, and Seychelles). However, for a number of countries, past complexity and diversity aligns much more with present income per capita. This is the case especially at high income levels, such as for Denmark, South Korea, and Sweden, but also for a few middle-income countries like Thailand, South Africa, or Indonesia.

V.B Persistence in productive capabilities

To estimate the persistence in productive capabilities, we use the following econometric specification

$$\mathbf{Y}_i^{\text{present}} = \alpha + \beta \mathbf{X}_i^{\text{past}} + \gamma \mathbf{Controls}_i + \varepsilon_i \quad (1)$$

where $\mathbf{Y}_i^{\text{present}}$ denotes a country observation of a measure of productive capabilities or the logarithm of GDP per capita in the current globalization (1998–2007), and \mathbf{X}_i the respective capability measure in the past globalization (1897–1906). $\mathbf{Controls}_i$ is a vector of control variables. In this section, the controls consist of variables from the current globalization that are standard in the export diversification literature and unlikely to be outcome variables of past capabilities themselves.¹⁷ We have only added variables that measure levels rather than rates of change since we are not interested in the changes within our contemporary reference period but the persistence across the two periods. First, to account for the degree of economic liberalization, we include trade openness as the trade/GDP ratio.¹⁸ Second, following the large literature on the resource curse, which finds that raw material abundance undermines the prospects for economic diversification, we control for the share of total natural resource rents in GDP (Frankel, 2010). Third, we control for present population since countries' population sizes are broadly speaking path-dependent and a country's size in this dimension could affect the scope for export diversification and innovation

¹⁷For studies on trade diversification that employ a subset of these controls see, for example, Agosin (2008), Agosin, Alvarez and Bravo-Ortega (2012), Cadot, Carrere and Strauss-Kahn (2013), Imbs and Wacziarg (2003), Lectard and Rougier (2018), Parteka and Tambari (2013).

¹⁸The question of whether economic liberalization aids or hinders diversification is a contested policy issue and studies have reached inconsistent conclusions (Carrere, Cadot and Strauss-Kahn, 2011; Chang and Andreoni, 2020; Dennis and Shepherd, 2011; Parteka and Tambari, 2013; Rodrik, 2016).

(Jones and Romer, 2010). We exclude other present period controls which are frequently used in the literature because they could be outcomes of past capabilities themselves: for example, human capital, the quality of institutions, and foreign direct investments. Nevertheless, we found that our results are not affected by their inclusion. We also analyze the role of historical institutions in an alternative model specification below. Note that geography and spatial trends can be a concern in persistence studies (Kelly, 2019). To ensure robustness of our results, we run a randomization inference procedure based on Kelly (2021) and in Section VI.A include a range of geographic factors in our model specification.

Table VI Panel A column (1) and (2) report the estimates of Equation (1) using present relative diversification and complexity as outcome variables. A past level of relative diversification that is 10 percentage points closer to the most diversified country in the first globalization increases the current relative diversification by an average of 7.3 percent. These results are also highly statistically significant. The small standard errors imply that the effect is still 5 percentage points after subtracting twice the largest standard errors (of the three reported) from the point estimate—in other words, it is statistically significant at the 5 percent level. As in the scatter plots, the effect size is slightly smaller for economic complexity. Ten percentage points of higher past complexity translates into 4.5 percentage points more complexity today, or 3.5 percentage points when lowering the coefficient by twice the largest standard error. These strong correlations persist in addition to those with resource rent and population, which also have statistically highly significant effects. The resource rent effect is particularly large: a 1 percentage point increase in resource rents in GDP lowers the capability measures by about 1 percentage point. The high R^2 shows that the model specification explains about two-thirds of the variation in the contemporary counterpart, up from about half in the scatter plots. These results suggest that past productive capabilities constitute an important correlate of today's productivity capabilities.

V.C Historical productive capabilities as predictors of income levels

Ultimately, we are interested in the extent to which persistence in productive capabilities determines economic outcomes today. Columns (4)–(5) of Table VI Panel A show that both measures of productive capabilities during the first globalization are highly predictive of current levels of GDP per capita. The economic importance is striking. For instance, if relative diversification is 10 percentage points higher in the historical period, the logarithm of per capita GDP in the current globalization increases by 0.43—that is, GDP per capita increases by 54 percent on average. The R^2 for diversification (0.42) is somewhat lower than for complexity and the standard error around the coefficient of past capabilities is larger. However, even when we move two standard deviations below the point estimate according to the largest, regionally clustered error, a 10 percentage point upward move in the historical diversification ranks corresponds to a 32 percent higher present GDP per capita. The complexity measure is slightly lower, but with smaller standard errors so that two standard deviations below the point estimate with the largest regionally clustered errors gives an only slightly lower predicted GDP per capita increase. To put these results in perspective, consider the World Bank’s classification of countries into low-, medium-, and high-income countries (using their current, 2020 data). A 32 percent increase in the GNI of all low-income countries would move eight of these 26 countries into the lower-medium category. It would also catapult 24 lower or upper middle-income countries into the next higher category, including such populous countries as China, Indonesia, the Philippines and Russia. The coefficients were estimated using purchasing power parities calculated by the World Bank, but as we show in Table A.3 in the appendix, our results carry over to market exchange-rate-calculated GDP and the PPP estimates reported in Penn World Table 10.0. The correlation of initial conditions in capabilities with today’s wealth of nations is high.

[Table VI here.]

V.D Basic robustness checks

To ensure the robustness of our regression results for diversification and the economic complexity index, we verify that our measures approximate underlying productive capabilities and are not driven by the structure of the SITC system. First, we perform a principal component analysis using our two measures as well as the sophistication measure. Sophistication adds additional information about the commodity shares of export baskets beyond the simple cut-off point that the RCA provides (see section IV.B). The appendix shows a scatter plot (Figure A.2) of the correlation of both sophistication and the first principal component with the outcome variables for more intuition on these measures. Columns (3) and (6) in Table VI use the first principal component of the three measures and confirm our previous result: productive capabilities are persistent and past rankings strongly correlate with those we observe today. Second, we use different levels of granularity (SITC-2 and SITC-4 instead of SITC-3) to classify exports. We also apply a low RCA of 0.1 and a high RCA of 1.0 as cutoff. Appendix Table A.4 shows that our results are robust to these different ways of classifying the data.

Another robustness check varies the time period of the outcome variable. Instead of the 1998–2007 period, we calculate capability and GDP measures for alternative subperiods (1962–1971 and 1979–1988). The results in appendix Table A.3 show that export patterns and GDP per capita, even in those less globalized periods, can be well predicted with the historical measures. The robustness of our results to varying dependent variable periods also confirms that productive capabilities are persistent rather than re-emergent (Voth, 2021). In other words, the global ladder of productive capabilities continued in the period of protectionism. Despite the developmentalist policy agenda of the post-war era, countries at the bottom of the hierarchy tended to trail behind rather than catch up.

Recently, persistence studies have been critiqued as displaying inflated t-statistics due to spatial correlation (Kelly, 2021). While our regression tables report Conley standard errors, we also apply Kelly’s recommended randomization procedure to measure the influence of spatial structure. We find spatial correlation in our data and simulations of spatial noise reduce the p-value of our

regressions (Table A.5). Reassuringly, our data generates a higher t-statistic than the spatial noise more than 90 percent of the time in most specifications, and always when we include a geographic trend. To further examine the effect of for spatial correlation we also add the World Bank regions to our regression, which reduces coefficient size but does not qualitatively affect our results A.6. We further examine the effect of spatial structure in our next section on alternative explanations for persistence by controlling for a number of geographic variables.

V.E Country clusters

Before examining the influence of other past covariates, we ask whether our results so far also show persistence within clusters of the data, or whether the best fit draws a slope through two or more country clouds within which convergence takes place. This “club convergence” (Baumol 1986) would not invalidate the persistence result, but it would suggest that it is possible to catch up within clusters of more similar countries. Baumol shows that there is a convergence club in terms of GDP per capita of industrialized countries and one of socialist countries, whereas there is no convergence among developing countries. In other words, developing countries are a non-convergence club. We Update his classification to the post-socialist era of globalization. We start by clustering countries into the IMF’s advanced and developing countries.

Our findings in Table VI Panel B for capability convergence in the long run broadly confirm those of Baumol for capability convergence in the long run. We find a long-run convergence club of today’s advanced economies. Among advanced economies, the persistence coefficient for complexity and principal component is small in absolute terms and relative to the standard error. The scatterplots in Figure IV help to interpret this result. The United Kingdom, an extreme outlier in the first globalization in terms of its vastly superior diversification, lost its dominant position, while France and Spain leaped from the interquartile range to the top. A similar picture emerges for the other measures of capability, with Japan and Korea catching up. For the 75 countries classified as developing countries, however, the persistence in relative capabilities holds very strongly. This suggests that, over the past century, developing countries have not caught up within their group

and are a long-run non-convergence club. The result is strongest for economic complexity and the principal component. This suggests some countries diversify without increasing their economic complexity to the same degree.

For GDP, grouping countries by income level lowers the size of coefficients in advanced economies, but does not alter the statistical significance of any of our results. Historical productive capabilities correlate with today's income levels. In contrast to the convergence in today's capabilities in advanced economies, countries that commanded the highest levels of capabilities in the past period but have since been overtaken are still on top of the current income hierarchy. This finding is broadly consistent with the hump-shape hypothesis. This hypothesis suggests that there is an inverse u-shaped relation between contemporaneous income levels and diversification: country diversification decreases beyond a certain income threshold (Imbs and Wacziarg, 2003; Strauss-Kahn and Cadot, 2011).

The main findings also hold when clustering based on countries' initial positions on the global capabilities ladder (see Table A.7).

VI Alternative explanations of persistence in productive capabilities

Our results so far show a high degree of persistence in productive capabilities and a high predictive power of past productive capabilities for today's income levels. In this section, we analyze persistence in the context of alternative drivers of long-run affluence. We ask whether persistence in productive capabilities is a result of geography or historical institutions and show that even after controlling for these previously omitted variables, persistence in productive capabilities remains a key determinant of current capabilities and GDP per capita. We confirm these results using an instrumental variable setup in which we exploit exogenous variation in the impact of the shift from sailing ships to steamboats on travel times. Our results suggest that initial conditions can create path dependencies that complement the explanations provided by geographical, institutional, and

other persistent factors.

VI.A Institutions, colonial legacy and geography

There has been a long-standing debate about whether institutions or geography drive growth in the long run (Rodrik, Subramanian and Trebbi, 2004; Sachs, 2003). We have to rule out the possibility that the persistence in productive capabilities we observe is simply an expression of the persistence of either institutions or geography. After all, climate, geography and ecology have long been considered essential to explaining differences in economic performance going back to, for example, Montesquieu (1750) and Marshall (1890). Diamond (1999) and Sachs (2001) have revived the hypothesis that geography drives affluence. It can constrain or enable economic development, more so in historic periods than today (Nunn, 2014). Recent persistence studies highlight the importance of geography for long-run outcomes (Spolaore and Wacziarg, 2013).

Institutions are an equally prominent explanation of differences in long-run economic performance (Acemoglu, Johnson and Robinson, 2005b). Historical institutions with origins in the distant past, especially those regarding property rights, have been shown to explain current economic outcomes (Acemoglu and Johnson, 2005). Pascali (2017) also demonstrates that institutions matter for the impact of trade openness on growth in the first globalization. Furthermore, commodity histories suggest that geography and institutions interact in shaping countries' export baskets.¹⁹ Moreover, a large and growing empirical literature confirms the long-term effects of colonization as a key institution (Dell, 2010; Nunn and Wantchekon, 2011) for growth performances. Therefore, we re-estimate Equation (1) with historical covariates accounting for geography and institutions (constraint on executive and colonial history), replacing the previous set of contemporary controls in the vector $Control_i$.

¹⁹For example, Beckert (2015) illustrates that the export boom in cotton in the Caribbean in the 19th century cannot be explained solely by its geographic advantages, since Anatolia, India, and the West Indies were equally suited for cotton planting, but did not experience a similar boom. He argues that this was due to the institutions of a slave-based plantation economy that were already in place for sugar in the Caribbean, but not in the other places. Liu (2020) asserts that while Assam's geography was suited for tea planting, it took the British decades of institutional redesign to create competitiveness in tea exports.

To capture countries' geography, we use standard geographic variables like area, latitude, island, and distance from a country's centroid to nearest coastline or sea-navigable river (see Table A.2 in the appendix for all data sources). All measures are on the country level in terms of today's territories. A climate variable allocates countries into four climate zones, ranked in terms of suitability for agriculture, using Olsson and Hibbs' (2005) data based on the Koppen-Geiger system. Missing observations were supplemented by consulting Olsson and Hibbs' source, Strahler and Strahler (1992). Terrain ruggedness is defined as small-scale terrain irregularities. It can impact productive capabilities through a number of channels. Steep slopes can negatively affect cultivation and increase building and transportation costs. But as Nunn and Puga (2012) show, ruggedness can also have beneficial effects as in the case of Africa, where it protected certain regions from exposure to slave trade. We use the terrain ruggedness index that Nunn and Puga have constructed building on Riley, DeGloria, and Elliot (1999). Resource and labor endowments, too, can affect countries' productive capabilities. We here use coal and population measured at the time of the first globalization as proxies for these endowments in the historical period.²⁰

We account for two major dimensions of countries' institutions. The "constraint on executive" variable from the Polity V database ranks checks and balances on the executive on a scale of 1 to 7. This has been widely used as a measure of the protection of property rights to proxy institutional quality. To account for colonial legacies and colonial institutions in 1900, we construct two measures based on Hadenius and Berg-Schlusser's (2007) data and the ICOW Colonial History Data Set (Hensel, 2018). The first measure is colonial heritage. It takes values of 1, 2, or 3 depending on whether a country *ever* was a colony, never was a colony but did not have colonies, or was a colonizer at some point in history. We construct an additional indicator of economic sovereignty in the year 1900, taking the values of 1, 2, or 3 depending on whether a country was a colony, an independent country or a colonial power at the time of the first globalization.

²⁰Coal-powered steam engines were a driver of industrialization in the 19th century, as first argued by Deane (1965), and proximity to coal fields boosted economic growth in Europe after 1750 (Fernihough and O'Rourke, 2021). The importance of the availability of coal for the First Industrial Revolution is a factor that has been widely considered by economic historians. See Fernihough and O'Rourke (2021) for an overview of some of the key contributions to this literature.

[Table VII here.]

Table VII reports our results in three panels, one for each historical institutional measure (constraint on executive, colonial heritage and economic sovereignty in 1900).²¹ Regardless of how we measure institutions, the economic complexity index and the principal component remain highly statistically significant predictors of both current capabilities and GDP per capita. The magnitude of the estimate declines modestly relative to the previous regressions in Table 6. It falls more with the controls for colonial institutions than for the constraint on executive. This points to the long-term negative impacts of colonialism on today's productive capabilities and income levels, consistent with other studies that have documented the long shadow of colonization (Arcand et al., 2021; Broms, 2017; Jones, 2013; Xu, 2019). When we control for colonial institutions, past diversification loses its statistical significance and the effect size decreases by a large margin. This result confirms that persistence in diversification is not as strong as in the other indicators. Again, it confirms the intuition that not all additional exports require additional capabilities.

The model specifications with institutional measures of colonial heritage or colonial status in Panels B and C explain today's outcomes in terms of productive capabilities and income levels better than Panel A, which controls for constraint on executive. In particular, the economic sovereignty measure is highly statistically significant in all specifications. The model for today's income levels regressed on complexity and economic sovereignty is also the specification that records the highest R^2 (0.721). Recalling from Figure IV that European overseas colonies were clustered at the lower end of the historical distribution of the relative capability measures, the results here imply that countries which were colonized at the turn of the 20th century both started out with a lower level of productive capabilities and found it harder to catch up in the century ahead as compared with countries which were independent in the first globalization.

The effects of colonial status in 1900 on capabilities and income levels today are both significant and large. The economic complexity index in Panel C shows that being a colonial power rather than a colonized country in 1900 predicts, on average, a 16 percentage points higher eco-

²¹Estimates for all control variables are reported in appendix Table A.8.

conomic complexity in the current globalization, all else equal. It also predicts a 236 percent higher GDP per capita today on average. This variation is in addition to the impact of initial capabilities, which remains large: Moving 10 percentage points up on the historical complexity index on average adds 19 percent to current GDP. Previous studies have argued that specialization in extractive industries in certain colonies led to poor development outcomes (Nunn, 2020). Our results add to this line of research by showing that, at the global level, countries that were colonies in 1900 found it particularly hard to diversify their exports and accumulate capabilities throughout the 20th century.

Our results are robust to variation in the measure of GDP, time period, RCA cutoff, and SITC granularity used (appendix Tables A.9–A.16). In sum, they demonstrate that initial conditions in productive capabilities are a useful complementary explanation for persistent differences in affluence to the widely examined factors of institutions and geography.

VI.B Instrumental variable analysis

Our results in the previous subsection control for a host of historical covariates. They could still be subject to omitted variable bias due to time-invariant unobserved heterogeneity. For example, differences in current outcomes have also been attributed to cultural traits (Caicedo, 2019; Enke, 2019; Giuliano and Nunn, 2021), which are difficult to measure on a global scale in the historical period. Another candidate for an omitted variable is past human capital differences (Glaeser et al., 2004). It might be that persistent cultural traits, human capital, and other factors that are difficult to measure on a global scale in the historical period determine both historical and contemporary productive capabilities.

To test the robustness of our results to omitted variables, we use an instrument inspired by Feyrer’s (2019) widely used time-varying geographic instrument (Donaldson, 2018; Kleinman, Liu and Redding, 2020). Feyrer exploits the disproportionate reduction in travel times as a result of air travel compared to travel by sea, which causes an uneven reduction in transportation costs, to difference out time-invariant heterogeneity. Our instrument for historical capabilities is based

on an analogous logic. Before the shift from sea to air travel, there was a shift from sailing to steamboats in the late 19th century. This created a similar disproportionate reduction in travel costs, since sailing times depend on wind patterns (Pascali, 2017). For instance, the steamboat reduced the travel time from Brazil to Portugal by 55 percent relative to a clipper, but it reduced the reverse journey time by only 40 percent. This is because the favorable wind pattern allowed direct journey westward on the Atlantic using only sail power, but the wind patterns on the return journey required a northern detour on the way back, hence the triangular trade pattern of the pre-steam Atlantic economy.

However, there is an important difference between the switch from shipping to air transportation and the shift from sailing to steamboat that is due to the different change in cost structures. Shipping still remains the more cost-effective choice for certain goods and routes despite the invention of air travel. Thus, the switch is a slow and incomplete process of replacing means of transportation. In contrast, the steamboat replaced almost all sailboats within the span of less than two decades. This switch in transportation occurred at the same time as the first globalization, when initial world export patterns were set.

In line with the gravity model, we expect a disproportionately large decline in shipping time resulting from the switch to the steamboat to positively impact the diversification and complexity of exports. Gravity is one of the most successful empirical models in economics. It shows that both foreign direct investment and trade gravitate towards closer economies (Anderson, 2011). The gravity model has also been applied to the first globalization (Lopez-Cordova and Meissner, 2003) and Pascali (2017) finds that the switch from sail to steamboats had large effects on trade volumes. Based on gravity, exporters that come disproportionately closer to major markets thanks to a higher reduction in travel time should benefit from a greater increase in foreign demand, investment inflows, and knowledge spillovers, which will enhance opportunities to develop productive capabilities. Together with the enhanced cost competitiveness thanks to the reduced transportation costs, this increases their export diversification and economic complexity.

We use Pascali's (2017) recent data for 1875 to 1890 to estimate the reduction in travel time

from the switch to steam ships. This interval captures a time window at the beginning of which steam vessels had become a mature technology and by the end of which they had replaced steam ships in all but marginal trade routes (Pascali, 2017). Hence, the change in means of transportation was completed just before our historical reference period for measures of productive capabilities (1897–1906). This time window also avoids confounding effects of the opening of the Suez Canal that had occurred in 1869. In the first globalization, the leading European nations were the capital exporters and “bankers of the world” and London was the global center of finance (Feis, 1965; Schularick, 2006). Trade was highly concentrated among the most advanced economies of the time and Europe accounted for approximately 60 percent of world exports during this period (Federico and Tena-Junguito, 2017). To account for this structural feature of the first globalization, we use the change in travel time that resulted from the switch from sailing to steam boats in relation to the United Kingdom due to its unique position (see Figure II); and to the world’s top 5 importers in 1900 (United Kingdom, Germany, France, United States, and Netherlands) as our instrument.

To construct our instrument, we calculate the reduction in travel time, R , of voyage, V , from country i to trade partner j weighted by the share, s , of exports as

$$R_i = \frac{1}{|T|} \sum_{t \in T} \sum_j s_{ijt} (V_{ijt}^{\text{steam}} - V_{ijt}^{\text{clipper}}) \quad (2)$$

where t are the available observations in the interval 1875 to 1890, which vary from country to country due to data availability. We take the average reduction over time of the number of members of the set T . The shares s sum to one in every year, and we calculate the travel reduction time both to the United Kingdom alone ($s = 1$) and to the top five importers. We only include countries with nonzero exports in the respective specifications.

This identification strategy rests on the assumption that the change in travel time does not explain current outcomes, except through its effect on productive capabilities in the first globalization. In particular, the exclusion restriction would be invalid if today’s trade patterns were directly impacted by the switch to steam ships in the 1870s and 1880s. This seems unlikely, for two main reasons: First, shipping times changed again when, just after our historical reference

period (1897–1906), the Panama Canal opened in 1914 and in 1911 the Northern Sea Route was expanded (Armstrong, 1992).²² Thus, the main impact on export patterns and productive capabilities from the shift from sail to steamboats not only coincides with our reference period of the first globalization (1897–1906), but was overridden shortly after. Second, a more recent shift in travel times and costs occurred with the improvements in aircraft technology (Feyrer, 2019), which has once more overruled the disproportionate effects caused by the shift from sail to steamboats.

Based on this exclusion restriction, we estimate a two-stage least squares specification with the travel time change from Equation (2) as the first stage instrument on which we regress historical capabilities. We do not control for our institutional variable because of the possibility that both past capabilities and unobservables influence institutions in 1900. European powers sought colonies that could provide raw materials for their industry. Therefore, specialization in a few raw materials could increase the likelihood of becoming a colony. Furthermore, more advanced manufacturing may have allowed countries to better defend themselves against attempts to turn them into a colony. Controlling for institutions would then introduce an association between our instrument and unobservables and prevent us from identifying a causal effect (Deuchert and Huber, 2017).

The first-stage results are reported in the eponymous sections in Table VIII. There is a clear negative relationship between reduction in travel time (recorded with a negative sign) and our measures of capabilities. In other words, the greater the reduction in travel time resulting from the switch from sailing to steam boat, the greater the level of productive capabilities. The second stage confirms our earlier results that past capabilities are persistent and impact today's GDP. The instrumental variable analysis suggests that the OLS estimate suffers from an attenuation bias. The effect size roughly doubles for persistence in capabilities and even triples for GDP. This is irrespective of whether the United Kingdom or the top five importers (Panels A and B) are used to create the instrument. In other words, 10 percentage points higher past complexity leads to 8.0 and 6.2 percentage points higher complexity today in Panels A and B, compared with only

²²The effect of canals on trade is demonstrated based on the closing of the Suez Canal in Feyrer (2021).

3.5 or 3.7 percentage points in the OLS estimate for the same sample size. These 10 percentage points lead to about a doubling of GDP per capita according to the two-stage estimation. The standard errors become larger relative to the effect size in the instrumental analysis, but still convey statistical significance. In particular, the relationship between past capabilities as measured by the complexity index and the principal component and current GDP is significant at the 1 percent level. Therefore, these results, which are robust to the same set of variations as in the previous subsection (see appendix Tables A.17–A.23), underpin the importance of capability persistence.

[Table VIII here.]

VII Conclusion

To what extent do countries' productive capabilities in the first globalization determine where they land on the global development ladder today? This paper addresses this question using novel global commodity-level export data. We find that (i) productive capabilities are path-dependent across the past century; (ii) productive capabilities at the peak of the first globalization are a powerful predictor of countries' GDP per capita today; (iii) findings (i) and (ii) are not driven by geography or institutions, and while colonialism matters greatly for initial productive capabilities, path dependency is not only a long shadow of colonialism; and (iv) the export patterns that underpin the global hierarchy in productive capabilities reveal that both globalizations were periods of a polarization in levels of diversification.

This study is the first to connect insights on the importance of productive capabilities for growth and development to the study of global income levels in the long-run. This presents a new link between long-standing theories of growth and development and the rapidly growing persistence literature. Moreover, researchers will be able to study global export patterns on a new level of granularity across the two globalizations. This contributes to the study of the long-run evolution of international trade.

Our findings on path dependence are relevant for policy makers. On the one hand, we show

the constraints to development that result from a country's position in the global economy. The flipside to our finding of path dependence is the outlier or path-defiant countries. Our analysis confirms the exceptional catch-up success of countries such as South Korea and Japan. The East Asian development models have been subject to a large amount of research. The present study validates the importance of these contributions for development policy that alters a country's set of capabilities. Future research could study the drivers of path defiance from a global perspective, building on the framework developed in this paper.

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Tables

TABLE I
ANNUAL DATA COVERAGE, GLOBAL EXPORTS 1897–1906

Year	Total value (Billion USD)	Percentage of Federico-Tena exports	Reporting countries	Commodities (SITC-2)	Commodities (SITC-3)	Commodities (SITC-4)
1897	5.535	66.7	53	59	182	370
1898	6.677	79.1	53	60	184	374
1899	7.243	78.3	55	60	185	374
1900	7.765	78.9	62	60	186	381
1901	8.430	86.6	93	60	191	407
1902	8.619	85.1	97	60	192	410
1903	9.193	86.1	98	60	192	413
1904	9.761	87.6	99	60	192	416
1905	10.420	86.1	98	60	191	419
1906	11.158	83.8	72	60	186	387

Notes. The column “Percentage of Federico-Tena exports” reports the percentage of total export values as estimated in Federico and Tena-Junguito (2019) that is included in our database. The “Commodities” columns respectively report the number of distinct commodities at 2-digit, 3-digit, and 4-digit SITC levels, with no RCA cutoff applied.

TABLE II
COMPOSITION OF WORLD EXPORTS BY SECTOR, REGION, AND COLONIAL STATUS, 1897-1906

SITC section	Global %	Africa %	Asia & Pacific %	Europe %	Latin America & Caribbean %	North America %	European overseas colonies %	European colonial powers %
0	25.7	16.1	35.5	17.8	46.5	37.2	39.6	14.7
1	2.8	5.4	2.3	2.6	4.7	2.5	4.4	2.7
2	22.7	48.0	37.0	12.6	41.1	32.3	38.6	12.9
3	4.5	0.2	3.2	5.0	0.1	7.1	1.5	5.3
4	1.1	3.0	1.3	0.9	0.9	1.2	1.2	0.8
5	2.9	1.6	1.0	4.4	0.6	0.4	0.9	4.6
6	26.4	8.1	12.8	37.6	3.3	13.6	6.7	39.1
7	2.6	0.0	0.1	3.8	0.0	2.1	0.0	4.0
8	3.7	0.3	1.3	5.7	0.1	1.1	0.3	6.0
Non-monetary gold	0.7	15.8	0.0	0.0	1.2	0.0	3.6	0.0
Miscellaneous	6.9	1.5	5.7	9.6	1.5	2.6	3.1	9.9
Total (Billion USD)	100 (9.0)	100 (0.3)	100 (1.2)	100 (5.2)	100 (0.8)	100 (1.5)	100 (1.7)	100 (4.9)
Manufacturing	28.7	8.4	11.2	41.2	2.0	16.6	6.1	43.1

Notes. SITC section numbers in the first column correspond to the following sectors: 0: Food and live animals; 1: Beverages and tobacco; 2: Crude materials, inedible, except fuels; 3: Mineral fuels, lubricants and related materials; 4: Animal and vegetable oils, fats and waxes; 5: Chemicals and related products, n.e.s.; 6: Manufactured goods classified chiefly by material; 7: Machinery and transport equipment; 8: Miscellaneous manufactured articles; Non-monetary gold: SITC code 9710, the only subcategory present in the historical database under Section 9; Miscellaneous: Goods that cannot be attributed to a category in the SITC. Regions are defined based on World Bank regions.

TABLE III
MOST AND LEAST COMPLEX COMMODITIES, 1897–1906

Ranking	SITC	Description	PCI	Exports, million USD (permille)	Top 5 exporters (number of exporting countries)
1	526	Abraum salts	1.00	26.98 (0.32)	Germany (1)
1	674	Flat-rolled products of iron or non-alloy steel, clad, plated or coated	1.00	76.01 (0.90)	Germany (1)
1	728	Other machinery and specialized industrial equipment or parts	1.00	41.54 (0.49)	Germany (1)
1	760	Telegraph and telephone apparatus	1.00	13.47 (0.16)	Germany (1)
1	770	Electrical machinery	1.00	70.21 (0.83)	Germany (1)
6	562	Chemical fertilizers	0.99	150.34 (1.77)	United Kingdom, Germany (2)
6	711	Steam boilers and parts of steam boilers	0.99	161.15 (1.90)	United Kingdom, Germany (2)
6	791	Railway vehicles and equipment	0.99	142.12 (1.68)	United Kingdom, Germany (2)
9	620	Manufactures of rubber, miscellaneous	0.99	307.60 (3.63)	Germany, United Kingdom, United States, France, Italy (6)
9	678	Wire of iron or steel	0.99	142.48 (1.68)	Germany, United Kingdom, Sweden (3)
11	660	Stone manufactures	0.99	27.78 (0.33)	Sweden (1)
12	673	Flat-rolled products of iron or non-alloy steel, not clad, plated or coated	0.99	209.54 (2.47)	United Kingdom, Sweden (2)

Notes. “PCI” stands for product complexity index which records the complexity of specific export goods as opposed to the economic complexity index which captures the complexity of an economy. “Exports” refers to the value of global exports of a product. The number in the parentheses indicates the share in the value of all global exports. Total number of exporters is enclosed in parentheses in the “Top 5 exporters” column. Commodity descriptions in historical sources were coded to the closest match in SITC. Occasionally vague wording in primary sources did not allow for an SITC at the 3-digit level, and for these categories trailing zeros were added to form “catch-all” categories. In this analysis we have excluded all commodities that could not be assigned at least to a two-digit level.

TABLE III
MOST AND LEAST COMPLEX COMMODITIES, 1897–1906 (CONTINUED)

Ranking	SITC	Description	PCI	Exports (Million USD, per mille)	Top 5 exporters (number of exporting countries)
181	667	Pearls and precious or semiprecious stones, unworked or worked	0.18	258.43 (3.05)	South Africa, Indonesia, Iran, Brazil, Myanmar (Burma) (15)
182	223	Oil-seeds and oleaginous fruits, of a kind used for making other vegetable oils	0.16	609.10 (7.18)	Argentina, India, Malaysia, Russia, Indonesia (37)
183	971	Gold, non-monetary (excluding gold concentrates)	0.12	599.06 (7.06)	South Africa, Mexico, Trinidad & Tobago, Senegal, Bolivia (8)
184	230	Unspecified rubber products	0.12	17.78 (0.21)	Indonesia (1)
184	599	Residual products of the chemical industries	0.12	1.25 (0.01)	Indonesia (1)
186	071	Coffee and coffee substitutes	0.12	960.14 (11.32)	Brazil, Indonesia, Mexico, Guatemala, Venezuela (33)
187	422	Fixed vegetable fats and oils, crude, refined or fractionated	0.12	114.68 (1.35)	Nigeria, Sri Lanka, Netherlands, India, Ghana (19)
188	430	Wax	0.11	8.30 (0.10)	Angola, Cuba, Madagascar, India, Turkey (14)
189	231	Natural rubber, balata, gutta-percha	0.10	707.74 (8.35)	Brazil, France, Congo - Kinshasa, Malaysia, Indonesia (39)
190	111	Other non-alcoholic beverages	0.08	0.24 (0.00)	Mexico, Guatemala, Ecuador, Ethiopia, Senegal (7)
191	072	Cocoa	0.08	165.61 (1.95)	Ecuador, Trinidad & Tobago, Brazil, Grenada, Venezuela (27)
192	662	Clay construction materials	0.00	0.00 (0.00)	Guinea (1)

Notes. “PCI” stands for product complexity index which records the complexity of specific export goods as opposed to the economic complexity index which captures the complexity of an economy. “Exports” refers to the value of global exports of a product. The number in the parentheses indicates the share in the value of all global exports. Total number of exporters is enclosed in parentheses in the “Top 5 exporters” column. Commodity descriptions in historical sources were coded to the closest match in SITC. Occasionally vague wording in primary sources did not allow for an SITC at the 3-digit level, and for these categories trailing zeros were added to form “catch-all” categories. In this analysis we have excluded all commodities that could not be assigned at least to a two-digit level.

TABLE IV
SUMMARY STATISTICS FOR MEASURES AND CORRELATES OF PRODUCTIVE
CAPABILITIES

Variable	Unit	Max	Mean	Min	Sd
Diversification (1998–2007)	Index	1.00	0.40	0.02	0.26
Diversification (1897–1906)	Index	1.00	0.23	0.03	0.18
Complexity (1998–2007)	Index	1.00	0.51	0.00	0.21
Complexity (1897–1906)	Index	1.00	0.44	0.00	0.25
First principal component (1998–2007)	Index	1.00	0.49	0.00	0.23
First principal component (1897–1906)	Index	1.00	0.43	0.00	0.25
Real GDP per capita (1998–2007)	Thousand	58.23	15.90	0.74	15.58
Trade openness (1998–2007)	Ratio	2.32	0.74	0.01	0.39
Resource rent (1998–2007)	Ratio	0.61	0.07	0.00	0.11
Population (1998–2007)	Million	1282.67	56.53	0.05	174.65

Notes. First principal component is calculated based on normalized scores of diversification, complexity, and sophistication.

TABLE V
CORRELATION OF MEASURES OF PRODUCTIVE CAPABILITIES

	Diversification	Complexity	First Principal Component
Diversification	1	0.72	0.72
Complexity	0.80	1	0.99
First Principal Component	0.81	0.98	1

Notes. Off-diagonal entries represent the Pearson correlation coefficients between two different measures of capabilities. The lower left three entries represent correlations in 1998–2007 period and the upper right three entries represent correlations in the 1897–1906 period.

TABLE VI
PERSISTENCE IN PRODUCTIVE CAPABILITY CONTROLLING FOR CONTEMPORARY COVARIATES

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Full Sample						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.734 (0.110) [0.091] {0.059}	0.419 (0.050) [0.067] {0.064}	0.423 (0.056) [0.080] {0.066}	4.298 (0.650) [0.769] {0.516}	3.282 (0.297) [0.442] {0.334}	3.307 (0.308) [0.515] {0.384}
Trade openness	0.044 {0.029}	0.064 {0.040}	0.090 {0.040}	0.378 {0.244}	0.157 {0.222}	0.103 {0.208}
Resource rent	-1.061 {0.126}	-0.833 {0.119}	-1.064 {0.142}	-1.856 {0.844}	-0.891 {0.669}	-0.877 {0.727}
Population (log)	0.037 {0.004}	0.028 {0.009}	0.030 {0.008}	-0.184 {0.050}	-0.112 {0.034}	-0.119 {0.036}
Constant	0.689 {0.067}	0.669 {0.120}	0.662 {0.106}	-1.064 {0.766}	-0.587 {0.662}	-0.629 {0.709}
R-squared	0.708	0.650	0.689	0.415	0.528	0.530
Observations	98	98	98	95	95	95
Panel B						
IMF Advanced Countries						
Productive capability	0.488 {0.208}	0.172 {0.143}	0.219 {0.127}	0.621 {0.157}	0.968 {0.166}	0.939 {0.178}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23	23	23	23	23	23
Panel C						
IMF Developing Countries						
Productive capability (1897–1906)	0.385 {0.165}	0.337 {0.081}	0.321 {0.088}	4.294 {0.681}	2.056 {0.417}	2.085 {0.418}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	75	75	75	72	72	72

Notes. Each column represents an OLS regression, where the dependent variable is listed in the first row. White, clustered (by World Bank regions), and spatially robust (Conley, 1999) standard errors are reported and respectively enclosed in parentheses, brackets, and braces. Panel A is a regression of productive capabilities (diversification, complexity and first principal component) and log real GDP per capita in the present globalization (1998-2007) on the same measures of productive capabilities in the first globalization (1897-1906) controlling for standard variables in the literature measured in 1998-2007. The first principal component is calculated based on normalized scores of diversification, complexity, and sophistication. Panel B and C are the same regressions but only for IMF advanced and developing countries respectively.

TABLE VII
PERSISTENCE IN PRODUCTIVE CAPABILITY CONTROLLING FOR PAST COVARIATES, 1998–2007

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.660 (0.282) [0.334] {0.242}	0.307 (0.116) [0.040] {0.065}	0.344 (0.135) [0.059] {0.066}	1.338 (1.745) [2.137] {1.444}	2.041 (0.720) [0.554] {0.507}	2.028 (0.758) [0.406] {0.476}
Constraint on executive	0.029 (0.014)	0.022 (0.010)	0.023 (0.011)	0.156 (0.071)	0.138 (0.074)	0.146 (0.073)
Geo. controls	Yes	Yes	Yes	Yes	Yes	Yes
Coal	Yes	Yes	Yes	Yes	Yes	Yes
Population	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.510	0.482	0.495	0.481	0.541	0.539
Observations	64	64	64	61	61	61
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.312 (0.197) [0.238] {0.202}	0.290 (0.091) [0.038] {0.061}	0.332 (0.105) [0.078] {0.071}	0.772 (0.702) [0.800] {0.644}	1.804 (0.444) [0.269] {0.342}	1.750 (0.457) [0.224] {0.318}
Colonial heritage	0.137 (0.043)	0.051 (0.031)	0.070 (0.037)	0.789 (0.191)	0.518 (0.176)	0.546 (0.178)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.669	0.625	0.649	0.642	0.686	0.684
Observations	85	85	85	82	82	82
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.210 (0.178) [0.172] {0.148}	0.261 (0.075) [0.060] {0.056}	0.323 (0.089) [0.067] {0.058}	0.437 (0.757) [0.457] {0.391}	1.739 (0.421) [0.542] {0.385}	1.704 (0.409) [0.507] {0.393}
Economic sovereignty	0.158 (0.038)	0.082 (0.028)	0.087 (0.030)	0.781 (0.134)	0.606 (0.129)	0.621 (0.127)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.712	0.653	0.671	0.670	0.721	0.718
Observations	85	85	85	82	82	82

Notes. Each column represents an OLS regression, where the dependent variable is listed in the first row. White, clustered (by World Bank regions), and spatially robust (Conley, 1999) standard errors are reported and respectively enclosed in parentheses, brackets, and braces. Panel A is a regression of productive capabilities (diversification, complexity and first principal component) and log real GDP per capita in the present globalization (1998–2007) on the same measures of productive capabilities in the first globalization (1897–1906) controlling for constraint on executive, geography, coal resources and population in the historical period. The first principal component is calculated based on normalized scores of diversification, complexity, and sophistication. “Geo. controls” refer to area (log), latitude, climate, ruggedness, distance to coast and river, and island. Panel B and C are the same regressions as Panel A but controlling for other institutional settings, namely colonial heritage and economic sovereignty. Colonial heritage is measured in 1900 and takes on values 1, 2 or 3 depending on whether a country ever was a colony, never was a colony but did not have colonies, or was a colonizer at some point in history. Economic sovereignty takes the values of 1, 2 or 3 depending on whether a country was a colony, an independent country or a colonial power in 1900.

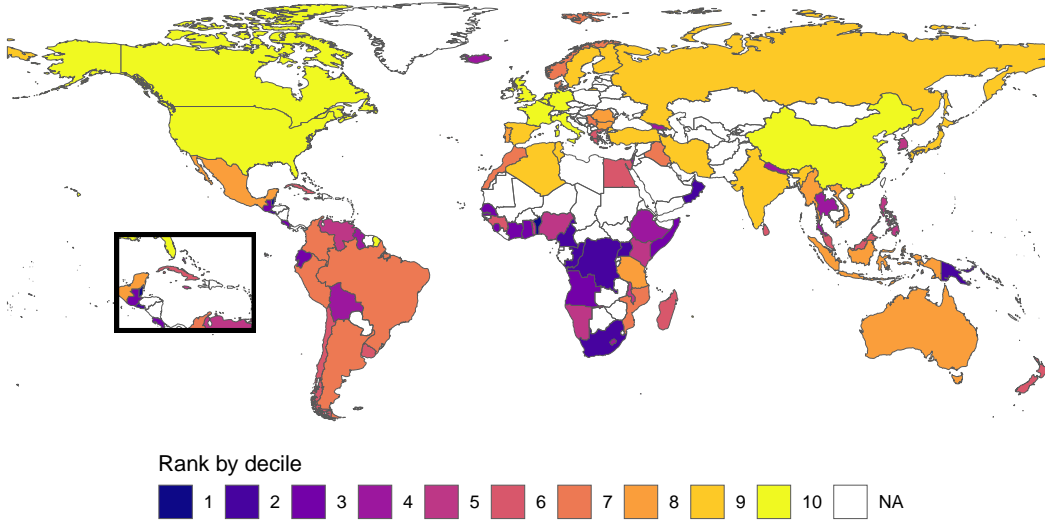
TABLE VIII
PERSISTENCE IN PRODUCTIVE CAPABILITY WITH INSTRUMENTAL VARIABLE, 1998–2007

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.48 (1.10)	0.79 (0.43)	1.03 (0.63)	11.21 (6.07)	7.28 (1.58)	8.36 (2.25)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
OLS						
Productive capability (1897–1906)	0.95 (0.17)	0.35 (0.12)	0.44 (0.12)	2.30 (0.90)	2.81 (1.12)	2.67 (0.95)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	–0.14 (0.07)	–0.21 (0.10)	–0.18 (0.09)	–0.16 (0.07)	–0.24 (0.10)	–0.21 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.43 (0.62)	0.62 (0.35)	0.81 (0.49)	8.88 (3.80)	7.09 (1.87)	7.74 (2.29)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
OLS						
Productive capability (1897–1906)	0.74 (0.24)	0.37 (0.11)	0.43 (0.11)	1.92 (0.87)	2.50 (1.04)	2.37 (0.90)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	–0.18 (0.07)	–0.22 (0.11)	–0.20 (0.10)	–0.20 (0.07)	–0.25 (0.11)	–0.23 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66

Notes. Each column represents a 2SLS or OLS regression, where the dependent variable is listed in the first row. Panel A uses as an instrument the changes in travel time to the top 5 importers in 1900 (United Kingdom, Germany, France, United States, and Netherlands) according to equation 2. Panel B uses changes in travel time only the United Kingdom. “Controls” refer to area (log), latitude, climate, island, and distance to coast and river. White standard errors are reported in parentheses.

Figures

Panel A: Export diversification, 1897–1906



Panel B: Export diversification, 1998–2007

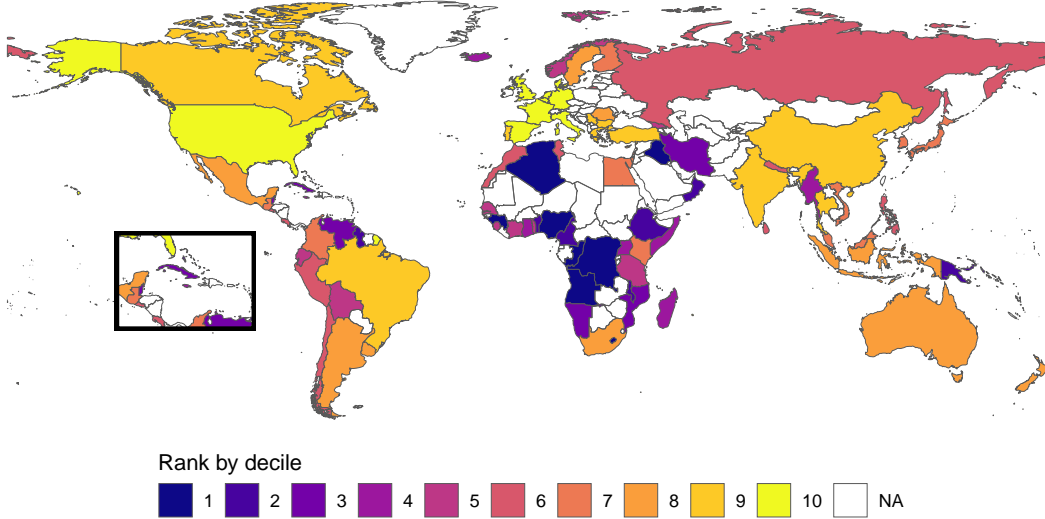


FIGURE I
World Map of Export Diversification in 1897–1906 and 1998–2007

Panel A shows a map of countries' average export diversification in 1897–1906 at SITC-3 level and using an RCA cutoff of 0.5. Each color represents a diversification rank by decile. Only countries covered by our dataset are colored. Panel B shows the same as Panel A but for 1998–2007.

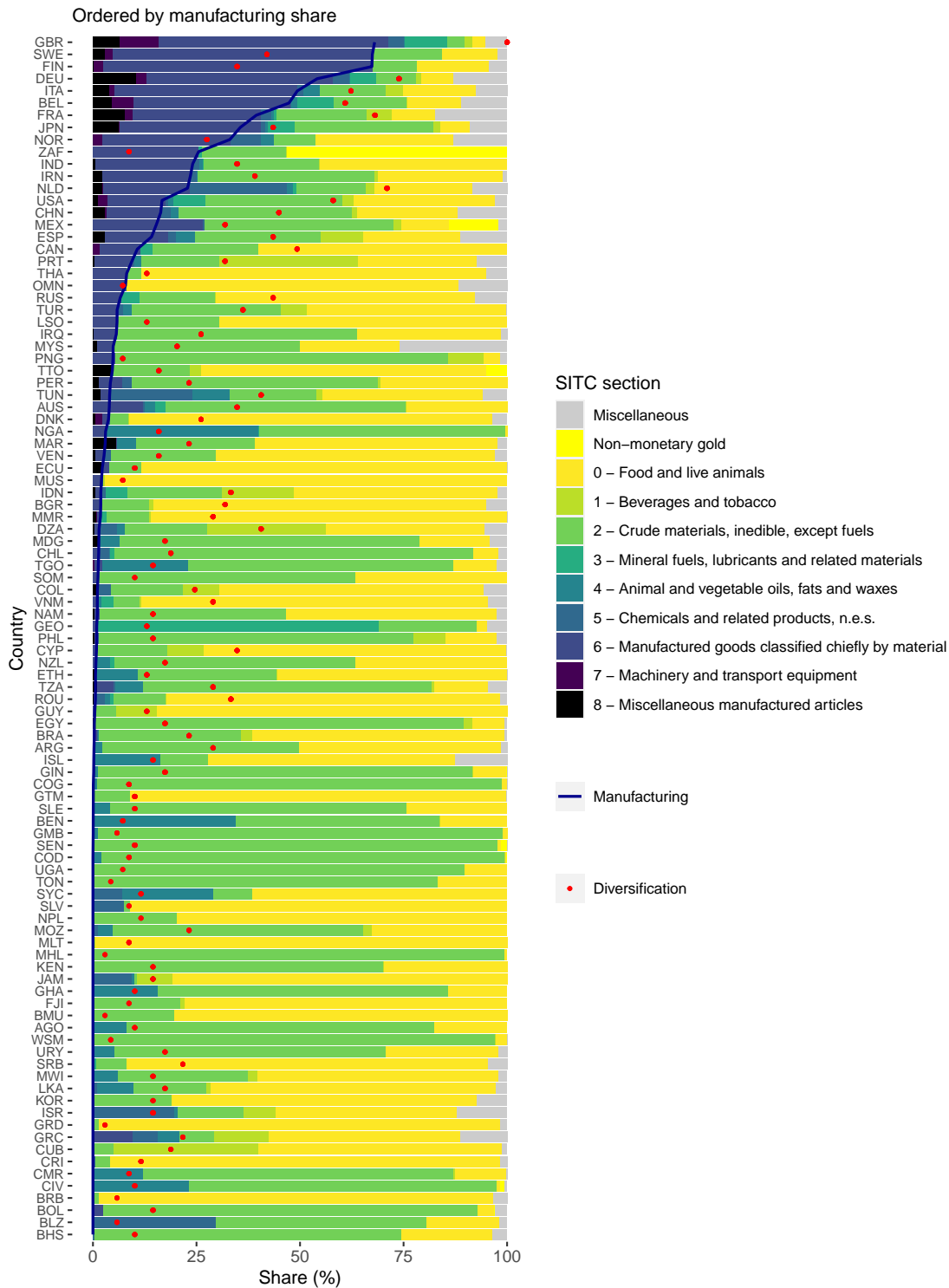
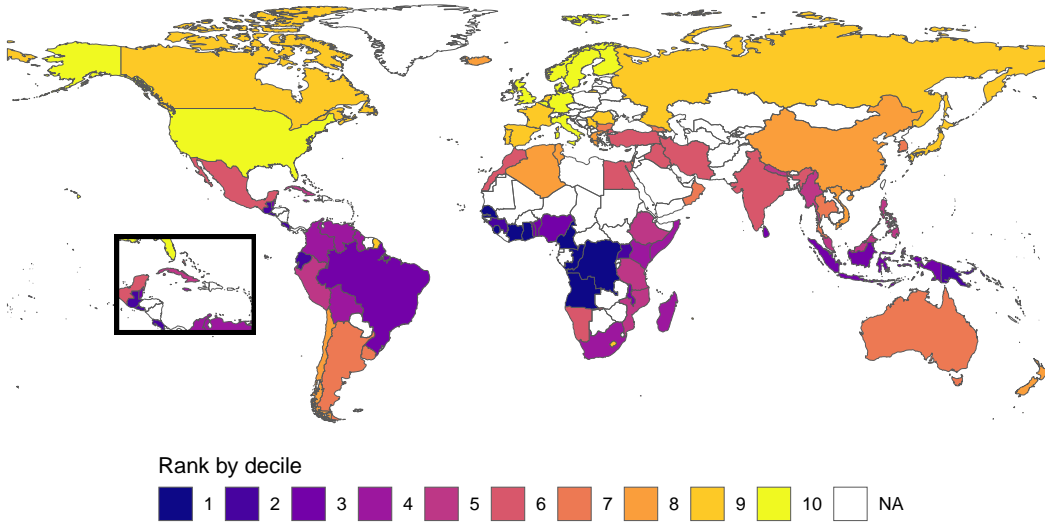


FIGURE II
Commodity Composition of Countries' Exports, 1897–1906

Countries ranked by their average manufacturing share in total exports in 1897–1906. The manufacturing share is depicted by the dark blue line. Manufacturing includes all commodities of Sections 6, 7, and 8, except Division 68: Non-ferrous metals. The red dots indicate countries' diversification levels. Diversification at the SITC-3 level is relative to that of the most diversified country (Great Britain, 73 distinct export lines), applying an RCA cutoff of 0.5. The bars show the distribution of exports over SITC sections (see legend for correspondence between colors and sections).

Panel A: Economic complexity, 1897–1906



Panel B: Economic complexity, 1998–2007

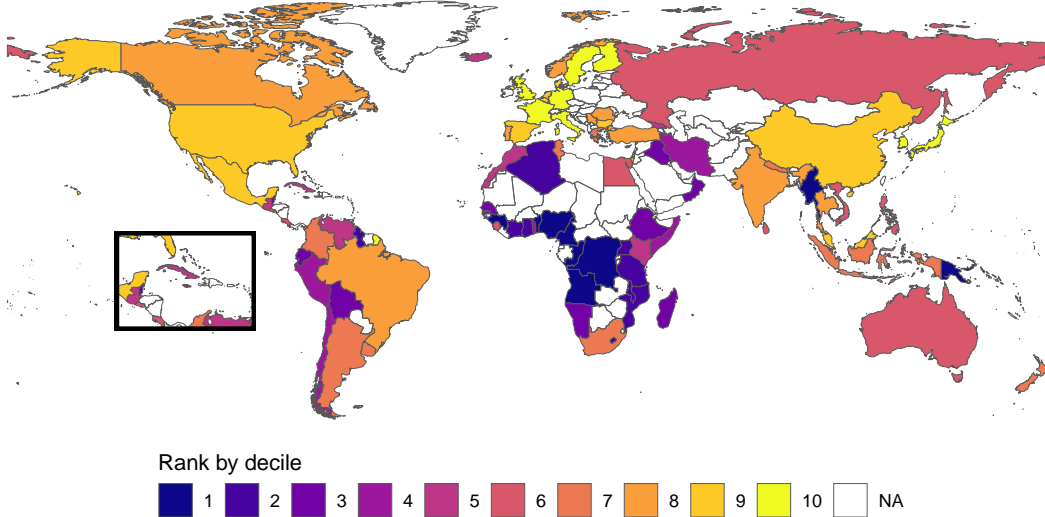


FIGURE III
World Map of Economic Complexity in 1897–1906 and 1998–2007

Panel A shows a map of countries' average economic complexity in 1897-1906 at the SITC-3 level and using an RCA cutoff of 0.5. Each color represents a diversification rank by decile. Only countries covered by our dataset are colored. Panel B shows the same as Panel A but for 1998–2007.

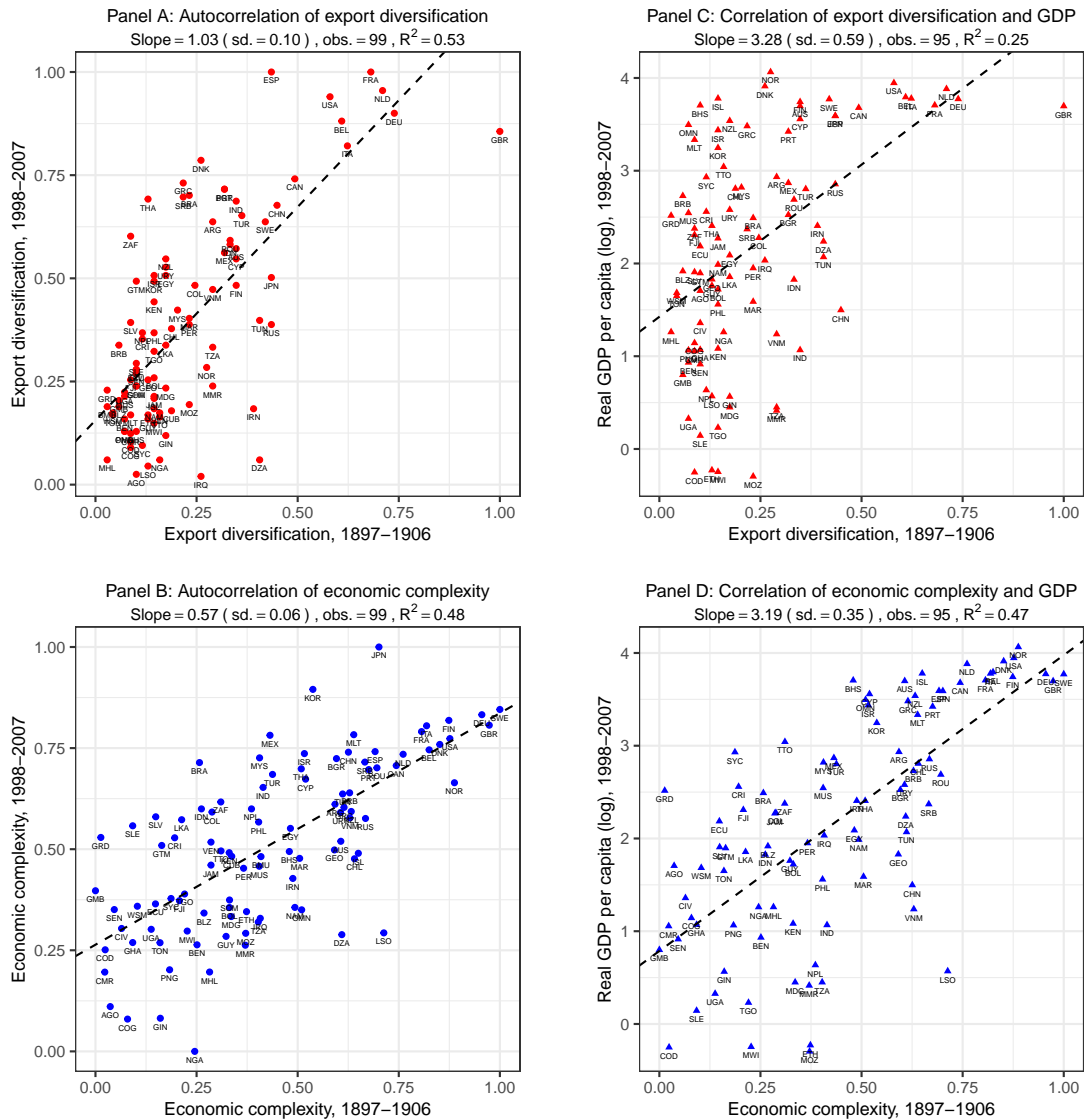


FIGURE IV
Correlations of Productive Capabilities and GDP Across Two Eras of Globalization, 1897–1906 vs. 1998–2007

Each dot or triangle in the scatterplots depicts a country. All data is at SITC-3 level and using an RCA cutoff of 0.5. The dashed lines indicate the best linear fit. Panel A shows the autocorrelation of export diversification of 99 countries in 1897–1906 (x-axis) and 1998–2007 (y-axis). Panel B plots the autocorrelation of economic complexity of 99 countries in 1897–1906 (x-axis) and 1998–2007 (y-axis). Panel C shows the correlation of export diversification in 1897–1906 (x-axis) and log real GDP per capita in 1998–2007 (y-axis) of 95 countries. Panel D plots the correlation of economic complexity in 1897–1906 (x-axis) and log real GDP per capita in 1998–2007 (y-axis) of 95 countries.

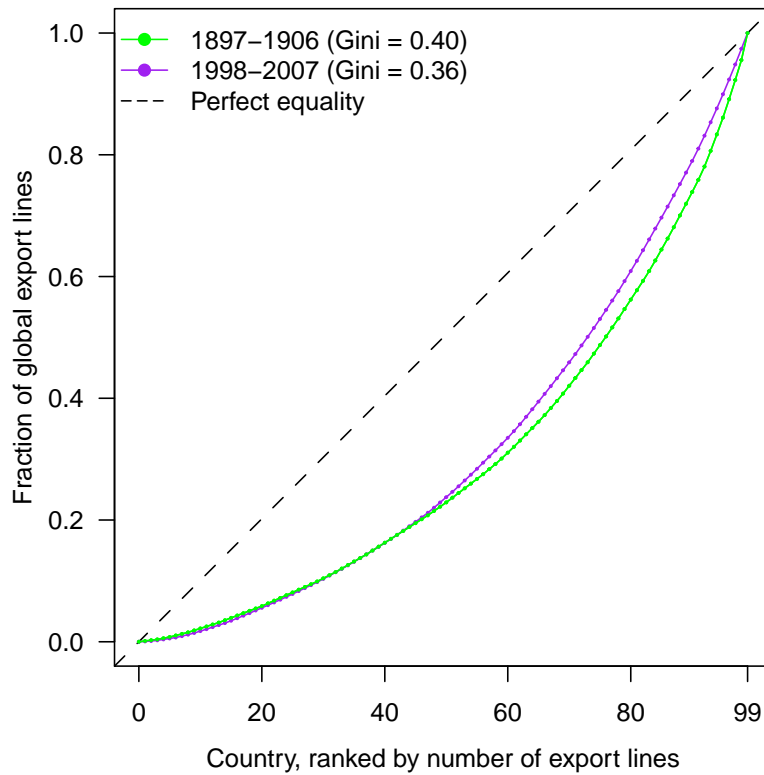


FIGURE V

Lorenz Curve of Inequality in Export Diversification 1897–1906 and 1998–2007

Lorenz curves of quantiles of countries on the horizontal axis ranked according to their number of distinct export lines at the SITC-3 level (RCA 0.5 cutoff) and the cumulative share of global export lines on the vertical axis for 1897–1906 and 1998–2007. The 45 degree line depicts a situation where every country would be equally diversified. In both periods, the bottom half of least diversified countries accounted for about 20 percent of global export lines, and the top half for 80 percent. Comparing the two distributions, the Gini coefficient has fallen in the later period due to more equality among the most diversified exporters, but neither of the two is more equal than the other across the distribution since the two lines cross (no Lorenz dominance).

Appendices

A Measuring productive capabilities

The measures of productive capabilities are based on Hausmann et al. (2014, 24-5). Let there be m varieties of commodities at a certain SITC digit level and n countries in a certain period. Let E be the $m \times n$ matrix in which each column records a country's export values by commodity. Use superscripts to denote the elements of matrices or vectors. Based on E , we first calculate the revealed comparative advantage (RCA) of a country's exports by commodity. The RCA of country i 's product j is defined as

$$\text{RCA}^{ji} \equiv \frac{E^{ji}}{\sum_j E^{ji}} / \frac{\sum_i E^{ji}}{\sum_j \sum_i E^{ji}} \quad (3)$$

Let M be an $m \times n$ matrix whose elements take on the value 1 or 0 depending on whether the RCA of the corresponding element of E is above or below a chosen threshold. Let e_c be an $n \times 1$ vector and e_p a $1 \times m$ vector; all elements of both vector are set to 1. The column and row sums of M are respectively $k_{c,0} = e_p M$ and $k_{p,0} = M e_c$. Diversification of the i th country is calculated as

$$\text{diversification}^i \equiv \frac{k_{c,0}^i}{\mathbf{max}(k_{c,0})} \quad (4)$$

where the operator $\mathbf{max}(\cdot)$ takes the maximum of a vector's elements. Let $\mathbf{diag}(\cdot)$ be a diagonal matrix whose diagonal elements take the elements of a given vector in the same order; $\mathbf{diag}^{-1}(\cdot)$ is its inverse matrix. Use T to denote transposition; then the iterative re-weighting algorithms are given as: $k_{c,N} = k_{p,N-1}^T M \mathbf{diag}^{-1}(k_{c,0})$, and $k_{p,N} = \mathbf{diag}^{-1}(k_{p,0}) M k_{c,N-1}^T$ where N is the step of the iteration. By substitution, we have

$$k_{c,N} = k_{p,N-1}^T M \mathbf{diag}^{-1}(k_{c,0}) = k_{c,N-2} M^T \mathbf{diag}^{-1}(k_{p,0}) M \mathbf{diag}^{-1}(k_{c,0}) \quad (5)$$

$$k_{p,N} = \mathbf{diag}^{-1}(k_{p,0}) M k_{c,N-1}^T = \mathbf{diag}^{-1}(k_{p,0}) M \mathbf{diag}^{-1}(k_{c,0}) M^T k_{p,N-2} \quad (6)$$

At convergence, $k_c \equiv k_{c,N}$ is the eigenvector of the matrix

$$\tilde{M}_{cc} \equiv M^T \mathbf{diag}^{-1}(k_{p,0}) M \mathbf{diag}^{-1}(k_{c,0}) \quad (7)$$

and $k_p \equiv k_{p,N}$ is the eigenvector of the matrix

$$\tilde{M}_{pp} \equiv \mathbf{diag}^{-1}(k_{p,0}) M \mathbf{diag}^{-1}(k_{c,0}) M^T \quad (8)$$

Following Hausmann et al. (2014, 24), we use the eigenvector that is associated with the second largest eigenvalue of \tilde{M}_{cc} and \tilde{M}_{pp} as k_c and k_p , respectively. Economic complexity of country i is calculated as:

$$\text{complexity}^i \equiv \frac{k_c^i - \mathbf{mean}(k_c)}{\mathbf{sd}(k_c)} \quad (9)$$

where the operators $\mathbf{mean}(\cdot)$ and $\mathbf{sd}(\cdot)$ respectively take the arithmetic average and standard deviation of the elements of a given vector. The product complexity index (PCI) of product j is defined as

$$\text{PCI}^j \equiv \frac{k_p^j - \mathbf{mean}(k_p)}{\mathbf{sd}(k_p)} \quad (10)$$

and sophistication of country i is calculated as

$$\text{sophistication}^i \equiv \Sigma_j \left(\frac{E^{ji}}{\Sigma_j E^{ji}} \text{PCI}^j \right) \quad (11)$$

B Extra figures and tables

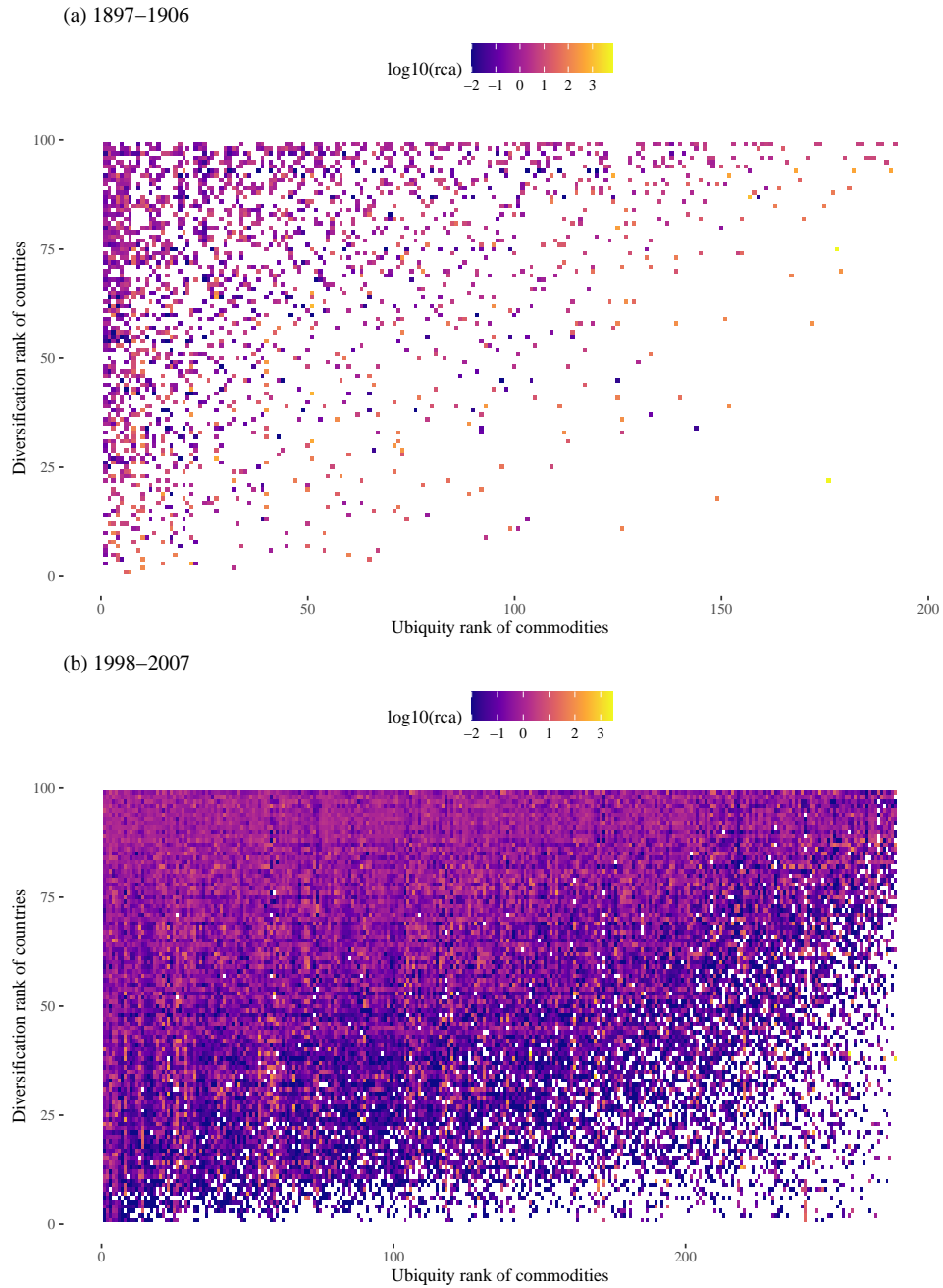


FIGURE A.1

Matrices of Ubiquity and Diversification in 1897–1906 and 1998–2007

Hausmann and Hidalgo (2011) find a robust relationship between ubiquity and diversification: less diversified countries tend to export more ubiquitous goods, whereas the most diversified countries tend to export both ubiquitous and non-ubiquitous goods that are out of reach for the countries further down in the diversification hierarchy. This relationship appears as a triangular adjacency matrix between countries and products (Hidalgo and Hausmann, 2009). Figure A.1 shows that this relationship between ubiquity (x-axis) and diversification (y-axis) also holds for the first globalization.

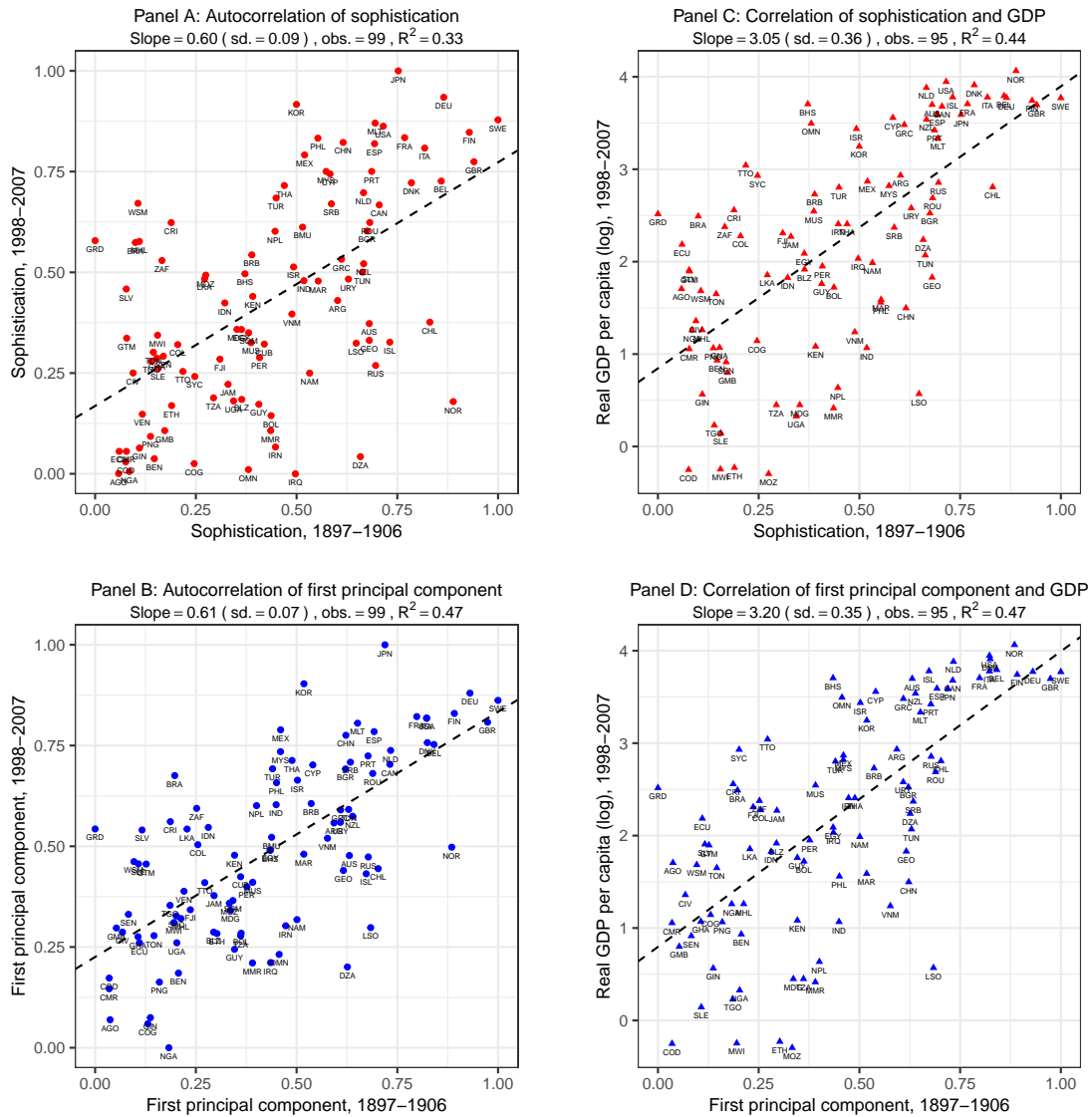


FIGURE A.2
 Correlation of Productive Capabilities Across Two Eras of Globalization, 1897–1906 vs. 1998–2007

Each dot or triangle in the scatterplots in Figure IV depicts a country. All data is at SITC-3 level and using an RCA cutoff of 0.5. The dashed lines indicate the best linear fit. First principal component is calculated based on normalized scores of diversification, complexity, and sophistication. Panel A shows the autocorrelation of export sophistication in 1897–1906 (x-axis) and 1998–2007 (y-axis) for 99 countries. Panel B plots the autocorrelation of the first principal component in 1897–1906 (x-axis) and 1998–2007 (y-axis) for 99 countries. Panel C shows the correlation of export sophistication in 1897–1906 (x-axis) and log real GDP per capita in 1998–2007 (y-axis) for 95 countries. Panel D plots the correlation of the first principal component in 1897–1906 (x-axis) and real GDP per capita in 1998–2007 (y-axis) for 95 countries.

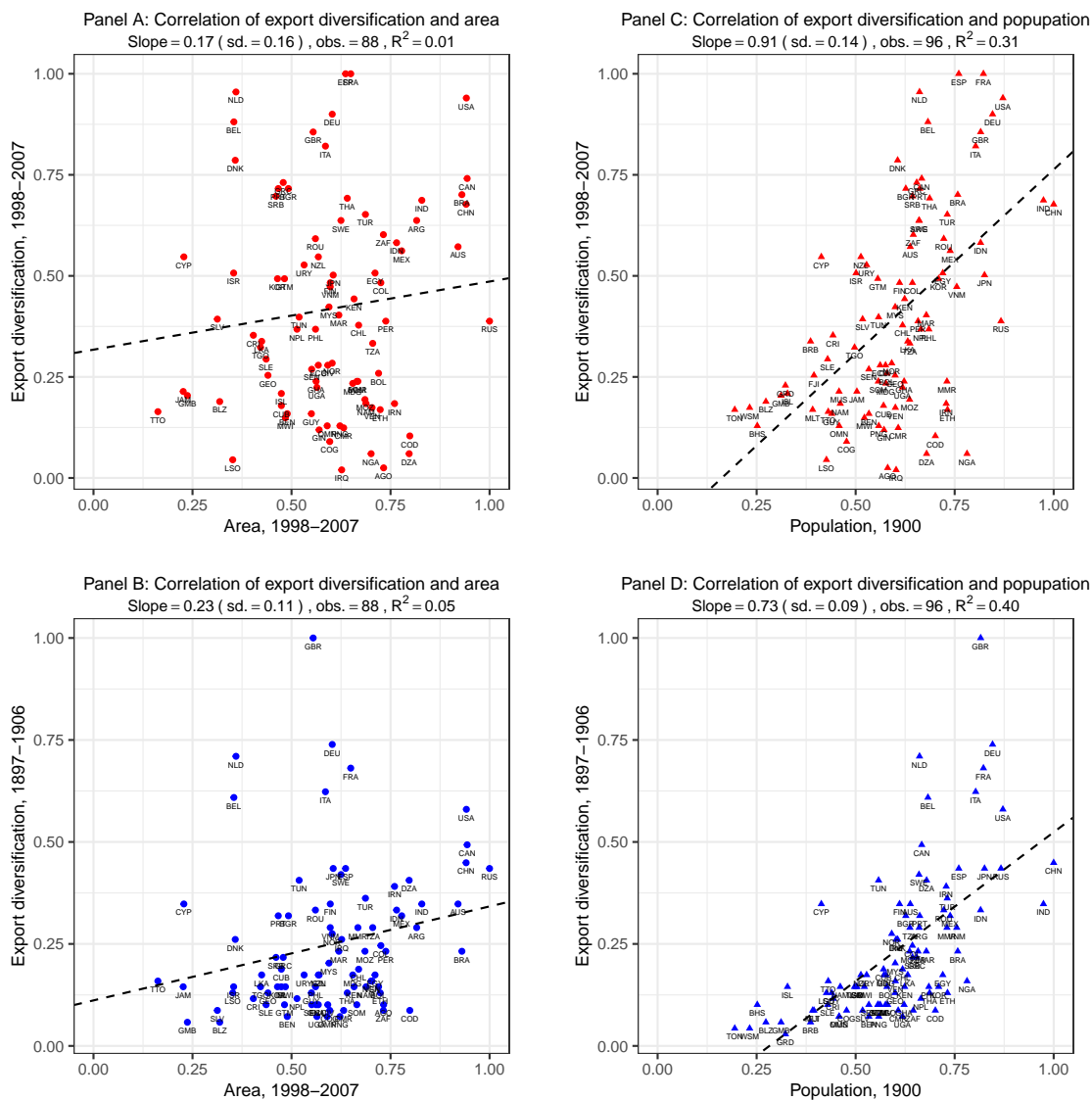


FIGURE A.3

Correlation of export diversification with area and population

Each dot or triangle in the scatterplots in Figure IV depicts a country. All data is at SITC-3 level and using an RCA cutoff of 0.5. The dashed lines indicate the best linear fit. The unit of the horizontal axis is normalized log thousands of square kilometers (A, B) or log thousands of persons (C, D). Panel A shows the correlation of export diversification in 1998—2007 (x-axis) and Area in 1998—2007 (y-axis) for 88 countries. Panel B plots the correlation of export diversification in 1897—1906 (x-axis) and area in 1998—2007 (y-axis) for 88 countries. Panel C shows the correlation of export diversification in 1998—2007 (x-axis) and population in 1900 (y-axis) for 96 countries. Panel D plots the correlation of export diversification in 1897—1906 (x-axis) and population in 1900 (y-axis) for 96 countries.

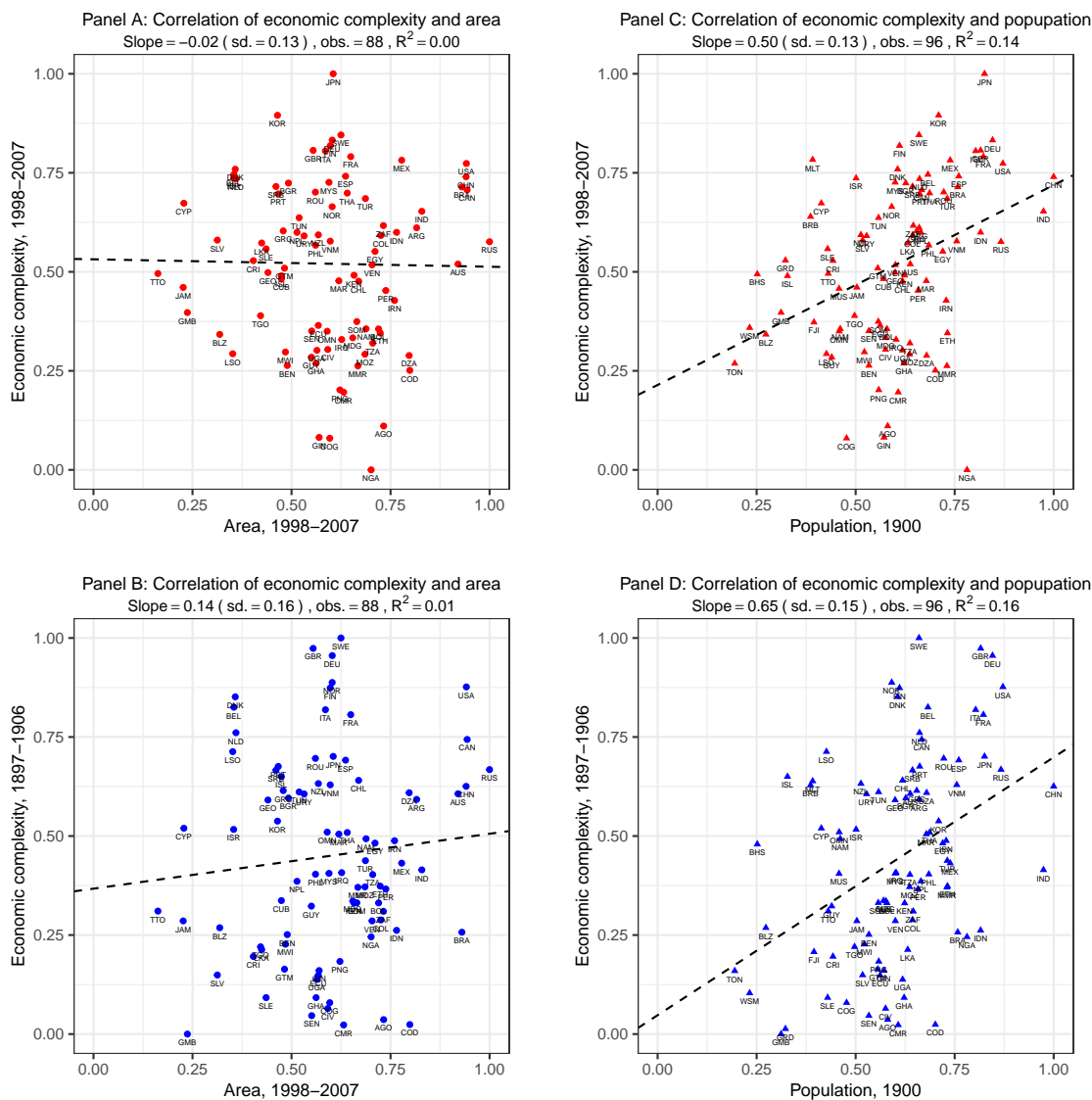


FIGURE A.4
Correlation of economic complexity with area and population

Each dot or triangle in the scatterplots in Figure IV depicts a country. All data is at SITC-3 level and using an RCA cutoff of 0.5. The dashed lines indicate the best linear fit. The unit of the horizontal axis is normalized log thousands of square kilometers (A, B) or log thousands of persons (C, D). Panel A shows the correlation of economic complexity in 1998—2007 (x-axis) and Area in 1998—2007 (y-axis) for 88 countries. Panel B plots the correlation of economic complexity in 1897—1906 (x-axis) and area in 1998—2007 (y-axis) of 88 countries. Panel C shows the correlation of economic complexity in 1998—2007 (x-axis) and population in 1900 (y-axis) for 96 countries. Panel D plots the correlation of economic complexity in 1897—1906 (x-axis) and population in 1900 (y-axis) for 96 countries.

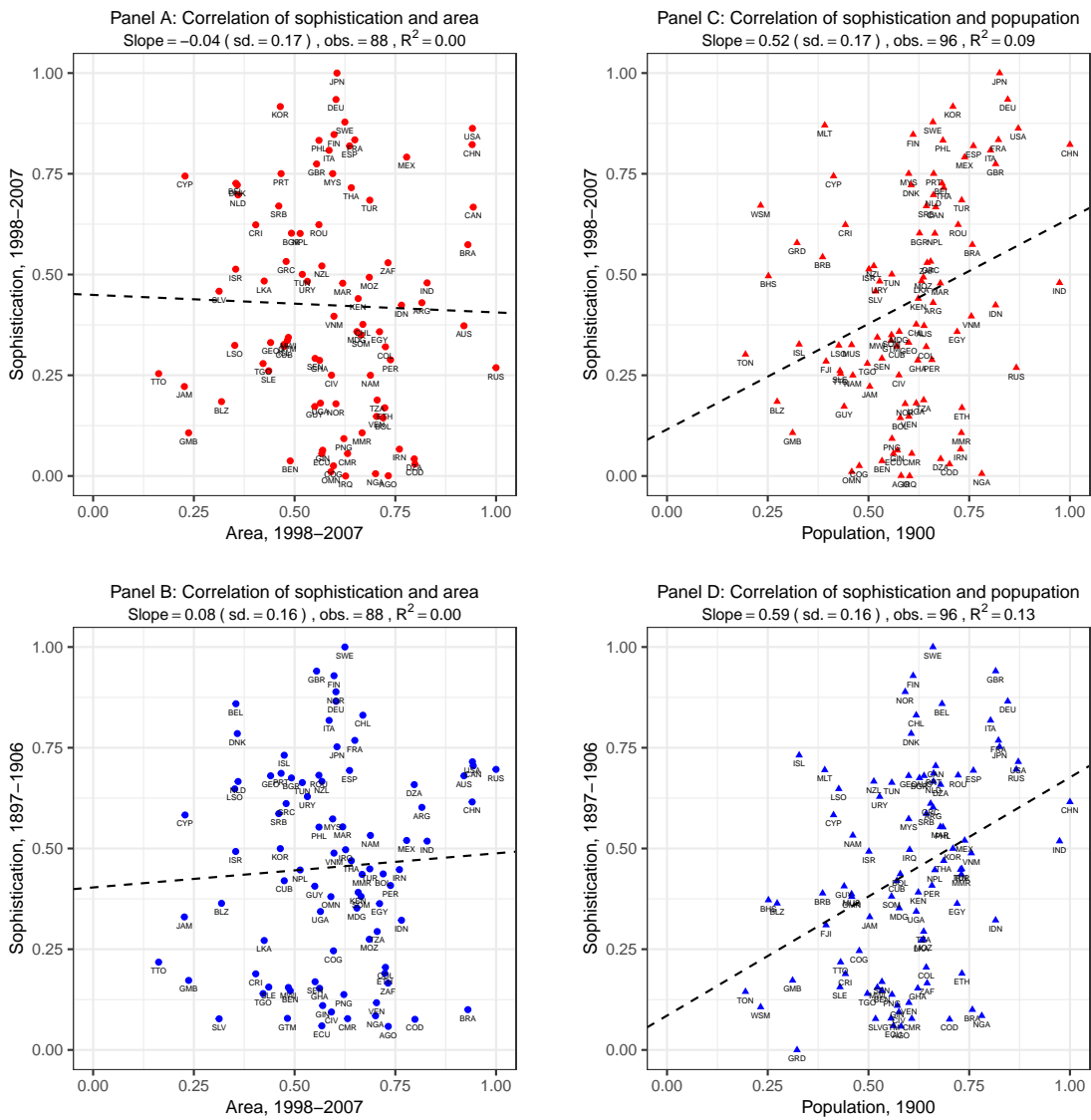


FIGURE A.5
Correlation of sophistication with area and population

Each dot or triangle in the scatterplots in Figure IV depicts a country. All data is at SITC-3 level and using an RCA cutoff of 0.5. The dashed lines indicate the best linear fit. The unit of the horizontal axis is normalized log thousands of square kilometers (A, B) or log thousands of persons (C, D). Panel A shows the correlation of sophistication in 1998—2007 (x-axis) and Area in 1998—2007 (y-axis) for 88 countries. Panel B plots the correlation of sophistication in 1897—1906 (x-axis) and area in 1998—2007 (y-axis) for 88 countries. Panel C shows the correlation of sophistication in 1998—2007 (x-axis) and population in 1900 (y-axis) for 96 countries. Panel D plots the correlation of sophistication in 1897—1906 (x-axis) and population in 1900 (y-axis) for 96 countries.

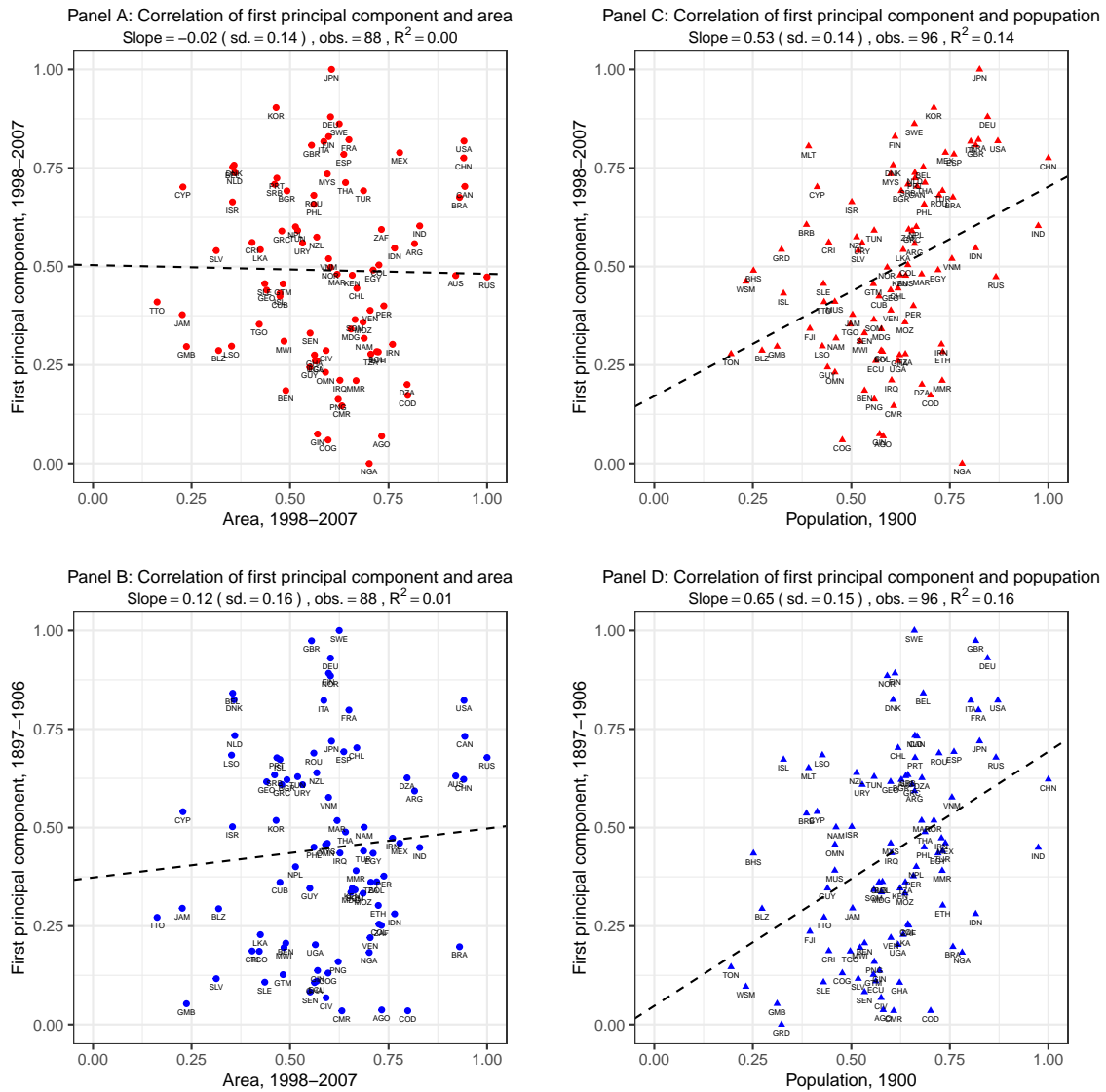


FIGURE A.6
Correlation of first principal component with area and population

Each dot or triangle in the scatterplots in Figure IV depicts a country. All data is at SITC-3 level and using an RCA cutoff of 0.5. The dashed lines indicate the best linear fit. The unit of the horizontal axis is normalized log thousands of square kilometers (A, B) or log thousands of persons (C, D). Panel A shows the correlation of the first principal component in 1998—2007 (x-axis) and Area in 1998—2007 (y-axis) for 88 countries. Panel B plots the correlation of the first principal component in 1897—1906 (x-axis) and area in 1998—2007 (y-axis) for 88 countries. Panel C shows the correlation of the first principal component in 1998—2007 (x-axis) and population in 1900 (y-axis) for 96 countries. Panel D plots the correlation of the first principal component in 1897—1906 (x-axis) and population in 1900 (y-axis) for 96 countries.

TABLE A.1
Country-level Sources

Code	Name	Source	Notes
AGO	Angola	Mesquita, João, Dados estatísticos para o estudo das pautas de Angola, Luanda: Imprensa Nacional, 1918.	
ARG	Argentina	Statistical abstract of foreign countries	
AUS	Australia	Statistical abstract of foreign countries	
BEL	Belgium	Statistical abstract of foreign countries	Disguised transit was removed using the method of Lindbland and van Zanden; see main text for details.
BEN	Benin/Dahomey	Statistiques coloniales	
BGR	Bulgaria	Statistical abstract of foreign countries	
BHS	The Bahamas	Statistical abstract of foreign countries	
BLZ	Belize/British Honduras	Statistical abstract of foreign countries	
BMU	Bermuda	Statistical abstract of foreign countries	
BOL	Bolivia	Consular Reports on Trade and Finance	
BRA	Brazil	Statistical abstract of foreign countries	
BRB	Barbados	Statistical abstract of foreign countries	
CAN	Canada	Statistical abstract of foreign countries	
CHL	Chile	Statistical abstract of foreign countries	
CHN	China	Statistical abstract of foreign countries	
CIV	Côte d'Ivoire	Statistiques coloniales	
CMR	Cameroon/Kamerun	Statistisches Jahrbuch für das Deutsche Reich	The German colony of Kamerun also included parts of what are now Nigeria (the former British North Cameroons; the South Cameroons and the French protectorate of Cameroun became what is now Cameroon).

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
COD	D.R. Congo/Belgian Congo	Bulletin officiel du Congo	
COL	Colombia	Commercial America	
CRI	Costa Rica	Statistical abstract of foreign countries	
CUB	Cuba	Statistical abstract of foreign countries	
CYP	Cyprus	Annual Report on Cyprus, various issues.	
DEU	Germany	Statistical abstract of foreign countries	
DNK	Denmark	Statistical abstract of foreign countries	
DZA	Algeria	Statistical abstract of foreign countries	
ECU	Ecuador	Compañía Guía del Ecuador, El Ecuador: guía comercial, agrícola, e industrial de la República, E. Rodenas, 1909.	
EGY	Egypt	Statistical abstract of foreign countries	
ESP	Spain	Statistical abstract of foreign countries	
ETH	Ethiopia	Statistiques coloniales	The French compilation gives exports for Djibouti (i.e. the French colony of Côte des Somalis). However Djibouti was largely a transit port for Ethiopian exports, and produced little. We have therefore assumed that exports from Djibouti were a reasonably proxy for Ethiopian exports.
FIN	Finland	Statistical abstract of foreign countries	
FJI	Fiji	Statistical Abstract of the British Empire	
FRA	France	Statistical abstract of foreign countries	

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
GBR	Great Britain	Statistical abstract of foreign countries	
GEO	Georgia	Consular Reports on Trade and Finance	Compiled from port-level data.
GHA	Ghana	Statistical Abstract of the British Empire	
GIN	Guinea/Guinée française	Statistiques coloniales	
GMB	Gambia	Statistical Abstract of the British Empire	
GRC	Greece	Statistical abstract of foreign countries	
GRD	Grenada	Statistical abstract of foreign countries	
GTM	Guatemala	Consular Reports on Trade and Finance	
GUY	Guyana	Statistical abstract of foreign countries	
IDN	Indonesia/Dutch East Indies	Statistical abstract of foreign countries	
IND	India	Annual Statement of the Trade of British India	The original data includes British Burma. We take our data for Burma and subtract it from British India., British India does include what are now Bangladesh and Pakistan
IRN	Iran	McLean, Report on the condition and prospects of British trade in Persia', Statesman's Yearbook, authors' projections	See text for detailed method.
IRQ	Iraq	Consular Reports on Trade and Finance	Assembled from port/city level data records.
ISL	Iceland	Consular Reports on Trade and Finance	
ISR	Israel	Consular Reports on Trade and Finance	Assembled from port/city level data records.

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
ITA	Italy	Statistical abstract of foreign countries	
JPN	Japan	Statistical abstract of foreign countries	
KEN	Kenya	Statistical Abstract of the British Empire	
KOR	Republic of Korea/Korea	Statistical abstract of foreign countries	
LKA	Sri Lanka/Ceylon	Statistical Abstract of the British Empire	
LSO	Besutoland/Lesotho	Statistical Abstract of the British Empire	
MAR	Morocco	Consular Reports on Trade and Finance	
MDG	Madagascar	Statistical abstract of foreign countries	
MEX	Mexico	Statistical abstract of foreign countries	
MHL	Marshall Islands	Statistisches Jahrbuch für das Deutsche Reich	
MLT	Malta	Papers relating to HM colonial possessions, Malta (Report on Blue Book), various	
MMR	Myanmar/Burma	Annual Statement of the Trade of British Burma	
MOZ	Mozambique	Alfredo Augusto Freira de Andreda Relatorios sobre Moçambique, 1908.	
MUS	Mauritius	Statistical Abstract of the British Empire	
MWI	Malawi	Annual Report on Nyasaland	

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
MYS	Malaysia	Statistical Abstract of the British Empire	The estimates for Malaysia are from the export statistics of the Straits Settlements colony: that is, principally, the ports of Singapore, Penang, Malacca. Though some produce from the other Malay states was exported directly to foreign countries, most flowed through these ports.
NAM	Namibia	Statistisches Jahrbuch für das Deutsche Reich	
NGA	Nigeria	Statistical Abstract of the British Empire	
NLD	The Netherlands	Statistical abstract of foreign countries	Disguised transit was removed using the method of Lindbland and van Zanden; see main text for details. Official prices corrected for most goods using market prices. 'All other goods' value was reduced by half to correct for misvaluation of official prices/transit.
NOR	Norway	Statistical abstract of foreign countries	
NPL	Nepal	Review of the Trade of British India	We use import trade from India to estimate Nepal's exports. Nepal is a landlocked country and most of its international trade. While some of its exports may have subsequently been re-exported by India, particularly textiles, we assume that this was captured in the import statistics.

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
NZL	New Zealand	Statistical abstract of foreign countries	
OMN	Oman	Consular Reports on Trade and Finance	The series was partly recorded in rupees and partly in dollars; market exchange rates were used to make individual years comparable
PER	Peru	Statistical abstract of foreign countries	
PHL	The Philippines	Statistical abstract of foreign countries	
PNG	Papua New Guinea/Deutsche Neu Guinea	Statistisches Jahrbuch für das Deutsche Reich	
PRT	Portugal	Statistical abstract of foreign countries	
ROU	Romania	Statistical abstract of foreign countries	
RUS	Russia	Statistical abstract of foreign countries	
SEN	Senegal	Statistiques coloniales	May contain some produce from what are now Mauritania and Mali. See text for details
SLE	Sierra Leone	Statistical Abstract of the British Empire	
SLV	El Salvador	Consular Reports on Trade and Finance	
SOM	Somalia	Statistical Abstract of the British Empire	Exports are from British Somaliland only
SRB	Serbia	Statistical abstract of foreign countries	Corresponds to the historical borders of Serbia in this period
SWE	Sweden	Statistical abstract of foreign countries	
SYC	Seychelles	Statistical Abstract of the British Empire	

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
TGO	Togo	Statistisches Jahrbuch für das Deutsche Reich	German Togoland also incorporated parts of what are now Ghana, after the colony was divided between France and Britain following World War I.
THA	Thailand	Statistical abstract of foreign countries	
TON	Tonga	Annual report on Tonga	
TTO	Trinidad and Tobago	Statistical Abstract of the British Empire	
TUN	Tunisia	Statistical abstract of foreign countries	
TUR	Turkey	Consular Reports on Trade and Finance	Reconstructed from port/city level data from
TZA	Tanzania	Statistisches Jahrbuch für das Deutsche Reich	The colony of Deutsche-Ostafrika also incorporated what are now Rwanda and Burundi, which became Belgian colonies following World War I. Given their distance from the ocean, we assign all exports from DOA to Tanzania.
UGA	Uganda	Statistical Abstract of the British Empire	
URY	Uruguay	Statistical abstract of foreign countries	
USA	United States of America	Statistical abstract of foreign countries	
VEN	Venezuela	Commercial America	Because we were unable to find a comprehensive source for Venezuelan exports, we reconstructed the commodity composition of exports from statistics relating to major First World export partners.

TABLE A.1
Country-level Sources (Continued)

Code	Name	Source	Notes
VNM	Vietnam	Statistical abstract of foreign countries	We were unable to procure port-level data to separate out the trade statistics of the five colonies of French Indochina—Annam, Cochinchine, Tonkin, Laos and Cambodia—the first three of which now form Vietnam. We therefore assign all exports from French Indochina to Vietnam. Because Cambodia and Laos were fairly marginal to the overall Indochinese economy, this is a fairly benign simplification.
WSM	Western Samoa	Statistisches Jahrbuch für das Deutsche Reich	
ZAF	South Africa	Statistical Abstract of the British Empire	

TABLE A.2
Variables and Data Sources

Variable	Source	Measure
Real GDP per capita		Constant 2017 international thousand dollar
Trade openness	World Bank	Trade/GDP
Resource rent		Resources rents/ GDP
Population (1998–2007)		Million
Area		km ²
Latitude	Geography datasets (Gallup, Mellinger and Sachs, 2010)	Degree
Distance to coast and river		km
Coal (1900)	Acemoglu et al. (2002)	Indicator
Island		Indicator
Ruggedness	Nunn and Puga (2012)	Index
Climate	Olsson and Hibbs (2005); Strahler and Strahler (1992)	Index
Population (1900)	HYDE 3.2 (Goldewijk et al., 2017)	Person
Maritime travel times	Pascali (2017)	Hour
Constraint on executive (1900)	POLITY V (Center for System Peace)	Index
Colonial heritage (1900)	Bernhard et al. (2004) and authors' calculations	Index
Economic sovereignty (1900)	Authors' calculations based on Hensel (2018)	Index

Notes. For Cuba, GDP data are from World Bank (NY.GDP.MKTP.CD). For Trinidad and Tobago, trade openness = merchandise trade/GDP + trade in services/GDP (World Bank, TG.VAL.TOTL.GD.ZS, BG.GSR.NFSV.GD.ZS).

TABLE A.3

Persistence in Productive Capability Controlling for Contemporary Covariates, Different Measures of GDP and Different Periods

Panel A: 1998–2007				World Bank Market Exchange Rate GDP		
	(1)	(2)	(3)	(4)	(5)	(6)
Productive capability (1897–1906)	Diversification 0.734 (0.110) [0.091] {0.059}	Complexity 0.419 (0.050) [0.067] {0.064}	First principal 0.423 (0.056) [0.080] {0.066}	Diversification 5.899 (0.848) [0.962] {0.606}	Complexity 4.438 (0.365) [0.567] {0.365}	First principal 4.437 (0.387) [0.693] {0.442}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.708	0.650	0.689	0.421	0.536	0.534
Observations	98	98	98	98	98	98
Panel B: 1998–2007				(Penn World Table PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Productive capability (1897–1906)	Diversification 0.734 (0.110) [0.091] {0.059}	Complexity 0.419 (0.050) [0.067] {0.064}	First principal 0.423 (0.056) [0.080] {0.066}	Diversification 0.506 (0.080) [0.112] {0.069}	Complexity 0.379 (0.033) [0.046] {0.030}	First principal 0.380 (0.034) [0.059] {0.039}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.708	0.650	0.689	0.446	0.543	0.543
Observations	98	98	98	93	93	93
Panel C: 1979–1988				(Penn World Table PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Productive capability (1897–1906)	Diversification 0.826 (0.103) [0.104] {0.062}	Complexity 0.560 (0.053) [0.100] {0.070}	First principal 0.597 (0.055) [0.079] {0.062}	Diversification 0.478 (0.081) [0.087] {0.065}	Complexity 0.358 (0.031) [0.035] {0.028}	First principal 0.354 (0.033) [0.046] {0.035}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.754	0.699	0.773	0.442	0.557	0.547
Observations	84	84	84	81	81	81
Panel D: 1962–1971				(Penn World Table PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Productive capability (1897–1906)	Diversification 0.957 (0.113) [0.067] {0.061}	Complexity 0.828 (0.065) [0.095] {0.084}	First principal 0.792 (0.063) [0.092] {0.070}	Diversification 0.505 (0.080) [0.058] {0.066}	Complexity 0.341 (0.032) [0.041] {0.032}	First principal 0.321 (0.033) [0.048] {0.035}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.733	0.746	0.754	0.450	0.533	0.509
Observations	72	72	72	70	70	70

Notes. Each column represents an OLS regression like in Table VI, but with varying GDP measures (Panels A and B) and replacing the 1998–2007 observations of the outcome variables and controls with earlier periods (Panels C and D).

TABLE A.4
Persistence in Productive Capability Controlling for Contemporary Covariates, Different RCA
Cutoffs and Different Digits

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Digit = 3, RCA \geq 0.1						
Productive capability (1897–1906)	Diversification	Complexity	First principal	Diversification	Complexity	First principal
	0.614	0.473	0.373	3.942	3.542	3.399
	(0.106)	(0.062)	(0.054)	(0.567)	(0.355)	(0.332)
	[0.092]	[0.081]	[0.077]	[0.632]	[0.502]	[0.538]
	{0.062}	{0.076}	{0.064}	{0.393}	{0.366}	{0.404}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.660	0.676	0.762	0.381	0.508	0.516
Observations	98	98	98	95	95	95
Panel B						
Digit = 3, RCA \geq 1						
Productive capability (1897–1906)	Diversification	Complexity	First principal	Diversification	Complexity	First principal
	0.638	0.416	0.426	4.449	3.787	3.732
	(0.144)	(0.045)	(0.055)	(0.717)	(0.371)	(0.365)
	[0.106]	[0.045]	[0.054]	[0.817]	[0.581]	[0.630]
	{0.075}	{0.035}	{0.039}	{0.579}	{0.381}	{0.418}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.669	0.655	0.674	0.423	0.529	0.535
Observations	98	98	98	95	95	95
Panel C						
Digit = 2, RCA \geq 0.5						
Productive capability (1897–1906)	Diversification	Complexity	First principal	Diversification	Complexity	First principal
	0.512	0.183	0.178	3.671	3.902	3.927
	(0.091)	(0.049)	(0.063)	(0.470)	(0.354)	(0.360)
	[0.118]	[0.045]	[0.050]	[0.515]	[0.638]	[0.666]
	{0.051}	{0.038}	{0.044}	{0.392}	{0.418}	{0.432}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.602	0.641	0.633	0.397	0.552	0.560
Observations	98	98	98	95	95	95
Panel D						
Digit = 4, RCA \geq 0.5						
Productive capability (1897–1906)	Diversification	Complexity	First principal	Diversification	Complexity	First principal
	0.811	0.712	0.709	4.181	4.612	4.360
	(0.103)	(0.073)	(0.071)	(0.655)	(0.329)	(0.318)
	[0.087]	[0.079]	[0.089]	[0.667]	[0.359]	[0.370]
	{0.071}	{0.067}	{0.063}	{0.438}	{0.253}	{0.288}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.743	0.665	0.717	0.386	0.575	0.590
Observations	98	98	98	95	95	95

Notes. Each column represents an OLS regression like in Table VI, but with varying RCA cutoffs (Panels A and B) and for different granularity of SITC classification (Panels C and D).

TABLE A.5
Test for the effect of spatial correlation

Model (Table VI)	No geographic trend			With geographic trend		
	Asymptotic	Randomized ($X_{\perp Z}$)	Randomized ($Y_{\perp Z}$)	Asymptotic	Randomized ($X_{\perp Z}$)	Randomized ($Y_{\perp Z}$)
	(1)	(2)	(3)	(4)	(5)	(6)
Model 1						
P-value	< 0.001	0.010	0.066	< 0.001	0.003	0.006
Range		1,600	3,240		1,930	3,440
Structure		0.955	0.852		0.958	0.846
Model 2						
P-value	< 0.001	0.013	0.053	< 0.001	0.024	0.047
Range		5,230	6,640		7,780	6,540
Structure		0.344	0.527		0.541	0.525
Model 3						
P-value	< 0.001	0.025	0.131	< 0.001	0.032	0.062
Range		4,840	2,940		8,940	3,040
Structure		0.320	0.672		0.549	0.649
Model 4						
P-value	< 0.001	0.220	0.176	< 0.001	0.051	0.084
Range		1,570	6,240		1,940	7,540
Structure		0.955	0.934		0.958	0.917
Model 5						
P-value	< 0.001	0.011	0.020	< 0.001	0.019	0.064
Range		4,930	6,240		7,640	7,570
Structure		0.316	0.934		0.534	0.916
Model 6						
P-value	< 0.001	0.024	0.038	< 0.001	0.014	0.060
Range		4,630	6,240		8,740	7,540
Structure		0.279	0.934		0.534	0.917

Notes. The table reports p-values after substituting spatial noise for our main explanatory variable ($X_{\perp Z}$) or dependent variable ($Y_{\perp Z}$) and simulating a set of observations, following Kelly (2021). Each p-value row reports our p-value from Table VI in column 1 and those obtained from Kelly’s randomization procedure in columns 2 and 3. Columns 4-6 do the same after adding longitude and latitude controls to the regression. P-values in columns 2, 3, 5, and 6 report the share of simulations where the spatial noise reports a higher t-statistic than our data does. Results are based on 2,000 simulations with $\kappa = 0.5$. Range specifies a distance in kilometers up to which the simulation takes spatial correlation into account; the interval over which this range was tried is a parameter in the simulation algorithm that required variation to find a result in most cases. Structure is the spatial signal-to-noise ratio. Not shown is Moran’s I which rejects the null of no spatial correlation in all models. Further details in Kelly (2021); the code used to generate the simulated results is at https://github.com/morganwkelly/Spatial_Randomization.

TABLE A.6
Persistence in Productive Capability Controlling for Contemporary Covariates including Region Dummies

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.311 (0.130)	0.214 (0.077)	0.202 (0.084)	1.376 (0.670)	1.531 (0.529)	1.585 (0.510)
Trade openness	0.067 (0.036)	0.082 (0.040)	0.111 (0.041)	0.396 (0.245)	0.310 (0.256)	0.284 (0.256)
Resource rent	-0.915 (0.157)	-0.820 (0.129)	-1.034 (0.144)	-1.371 (0.865)	-0.831 (0.837)	-0.832 (0.834)
Population (log)	0.056 (0.009)	0.035 (0.006)	0.037 (0.007)	-0.062 (0.058)	-0.050 (0.045)	-0.054 (0.045)
Sub-Saharan Africa	-0.272 (0.063)	-0.205 (0.050)	-0.210 (0.053)	-1.942 (0.333)	-1.612 (0.389)	-1.575 (0.376)
Latin America & the Caribbean	-0.160 (0.059)	-0.046 (0.039)	-0.075 (0.045)	-0.595 (0.274)	-0.362 (0.274)	-0.326 (0.273)
East Asia&Pacific	-0.174 (0.059)	-0.078 (0.052)	-0.060 (0.056)	-0.944 (0.371)	-0.764 (0.356)	-0.745 (0.349)
North America	0.014 (0.049)	-0.002 (0.032)	0.048 (0.041)	0.501 (0.212)	0.502 (0.175)	0.552 (0.190)
Middle East &North Africa	-0.209 (0.071)	-0.034 (0.049)	-0.062 (0.050)	-0.455 (0.347)	-0.458 (0.305)	-0.433 (0.312)
South Asia	-0.232 (0.068)	-0.065 (0.040)	-0.088 (0.048)	-1.715 (0.376)	-1.428 (0.448)	-1.438 (0.440)
Constant	1.132 (0.150)	0.897 (0.095)	0.898 (0.100)	1.832 (0.837)	1.473 (0.711)	1.410 (0.700)
R-squared	0.787	0.732	0.756	0.663	0.685	0.686
Observations	98	98	98	95	95	95

Notes. Each column represents an OLS regression like in Table VI, but including regional dummies according to the World Bank. "Europe and Central Asia" is left out as the benchmark group. White standard errors are reported in parentheses.

TABLE A.7
Persistence in Productive Capability Controlling for Contemporary Covariates, Ranked
by Historical Capability

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Top 1/3 Countries by Historical Capability						
Productive capability (1897–1906)	0.534 {0.115}	0.373 {0.063}	0.488 {0.081}	3.091 {0.966}	3.670 {0.575}	4.249 {0.695}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33	33	33	33	33	33
Middle 1/3 Countries by Historical Capability						
Productive capability (1897–1906)	1.776 {0.491}	0.739 {0.206}	1.335 {0.244}	6.215 {3.045}	6.274 {1.631}	9.239 {2.505}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33	32	32	31	30	30
Bottom 1/3 Countries by Historical Capability						
Productive capability (1897–1906)	0.106 {0.659}	0.154 {0.145}	0.420 {0.160}	14.231 {8.764}	1.362 {0.963}	2.194 {1.038}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32	33	33	31	32	32

Notes. Each column represents an OLS regression like in Table VI, but partitioning countries into three groups, according to their historical capability ranking. The low statistical significance for columns 1 and 4 for the bottom 1/3 of countries stems from a lack of variation in historical diversification, the explanatory variable, in the historical period.

TABLE A.8
Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Full
Table of Panel A in Table VII of the Main Paper

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Productive capability (1897–1906)						
	0.660 (0.282) [0.334] {0.242}	0.307 (0.116) [0.040] {0.065}	0.344 (0.135) [0.059] {0.066}	1.338 (1.745) [2.137] {1.444}	2.041 (0.720) [0.554] {0.507}	2.028 (0.758) [0.406] {0.476}
Area (log)	-0.007 (0.021) [0.015] {0.010}	-0.021 (0.027) [0.025] {0.018}	-0.029 (0.027) [0.029] {0.019}	0.278 (0.191) [0.165] {0.138}	0.218 (0.158) [0.128] {0.110}	0.213 (0.160) [0.119] {0.110}
Latitude	0.000 (0.001) [0.001] {0.001}	0.002 (0.001) [0.001] {0.001}	0.002 (0.001) [0.001] {0.001}	0.016 (0.009) [0.008] {0.009}	0.015 (0.006) [0.002] {0.005}	0.015 (0.006) [0.002] {0.005}
Climate	0.038 (0.032) [0.040] {0.025}	0.022 (0.026) [0.032] {0.024}	0.014 (0.030) [0.032] {0.026}	0.380 (0.147) [0.213] {0.118}	0.264 (0.160) [0.288] {0.148}	0.252 (0.165) [0.277] {0.143}
Island	-0.064 (0.047) [0.052] {0.037}	-0.007 (0.048) [0.039] {0.028}	-0.032 (0.049) [0.043] {0.028}	0.570 (0.467) [0.163] {0.301}	0.541 (0.401) [0.099] {0.233}	0.514 (0.403) [0.118] {0.244}
Coal	0.012 (0.068) [0.043] {0.040}	0.063 (0.060) [0.040] {0.045}	0.080 (0.063) [0.041] {0.045}	0.215 (0.399) [0.366] {0.333}	0.087 (0.374) [0.211] {0.237}	0.076 (0.369) [0.193] {0.224}
Ruggedness	-0.006 (0.015) [0.007] {0.009}	-0.009 (0.021) [0.018] {0.013}	-0.004 (0.022) [0.018] {0.012}	0.019 (0.105) [0.153] {0.104}	-0.140 (0.112) [0.134] {0.100}	-0.141 (0.113) [0.128] {0.099}
Distance to coast/river	-0.219 (0.140) [0.117] {0.103}	-0.259 (0.120) [0.104] {0.091}	-0.250 (0.128) [0.109] {0.098}	-1.431 (0.519) [0.318] {0.374}	-1.391 (0.472) [0.299] {0.294}	-1.411 (0.466) [0.306] {0.311}
Population (log)	0.038 (0.023) [0.025] {0.015}	0.026 (0.023) [0.026] {0.017}	0.034 (0.023) [0.026] {0.015}	-0.309 (0.148) [0.103] {0.128}	-0.252 (0.134) [0.074] {0.112}	-0.239 (0.134) [0.075] {0.116}
Constraint on executive (1900)	0.029 (0.014) [0.018] {0.010}	0.022 (0.010) [0.008] {0.007}	0.023 (0.011) [0.012] {0.008}	0.156 (0.071) [0.046] {0.039}	0.138 (0.074) [0.052] {0.048}	0.146 (0.073) [0.056] {0.050}
Constant	-0.303 (0.215) [0.173] {0.140}	0.201 (0.189) [0.235] {0.127}	0.131 (0.192) [0.236] {0.136}	1.783 (1.445) [2.025] {1.379}	1.671 (1.288) [1.840] {1.267}	1.564 (1.299) [1.823] {1.286}
R-squared	0.510	0.482	0.495	0.481	0.541	0.539
Observations	64	64	64	61	61	61

Notes. Each column represents an OLS regression like in Table VII Panel A, but showing all three types of standard errors for every covariate. White, clustered (by World Bank regions), and spatial robust (Conley 1999) standard errors are reported and respectively enclosed in parentheses, brackets, and braces.

TABLE A.9
Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Market Exchange Rate GDP

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank Market Exchange Rate GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.660 (0.282) [0.334] {0.242}	0.307 (0.116) [0.040] {0.065}	0.344 (0.135) [0.059] {0.066}	1.458 (2.124) [2.442] {1.658}	2.335 (0.900) [0.587] {0.583}	2.212 (0.925) [0.424] {0.511}
Constraint on executive	0.029 (0.014) [0.018] {0.010}	0.022 (0.010) [0.008] {0.007}	0.023 (0.011) [0.012] {0.008}	0.208 (0.091) [0.069] {0.049}	0.189 (0.092) [0.066] {0.055}	0.198 (0.091) [0.070] {0.057}
Geo. controls	Yes	Yes	Yes	Yes	Yes	Yes
Coal	Yes	Yes	Yes	Yes	Yes	Yes
Population	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.510	0.482	0.495	0.490	0.542	0.536
Observations	64	64	64	63	63	63
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.312 (0.197) [0.238] {0.202}	0.290 (0.091) [0.038] {0.061}	0.332 (0.105) [0.078] {0.071}	1.358 (0.934) [0.923] {0.797}	2.406 (0.581) [0.369] {0.386}	2.278 (0.597) [0.417] {0.403}
Colonial heritage	0.137 (0.043) [0.039] {0.039}	0.051 (0.031) [0.017] {0.023}	0.070 (0.037) [0.024] {0.026}	1.128 (0.230) [0.374] {0.183}	0.809 (0.238) [0.373] {0.156}	0.858 (0.233) [0.368] {0.145}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.669	0.625	0.649	0.653	0.698	0.694
Observations	85	85	85	84	84	84
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.210 (0.178) [0.172] {0.148}	0.261 (0.075) [0.060] {0.056}	0.323 (0.089) [0.067] {0.058}	1.121 (1.003) [0.595] {0.550}	2.466 (0.505) [0.622] {0.427}	2.375 (0.497) [0.620] {0.459}
Economic sovereignty	0.158 (0.038) [0.033] {0.020}	0.082 (0.028) [0.037] {0.030}	0.087 (0.030) [0.027] {0.024}	1.021 (0.169) [0.120] {0.107}	0.830 (0.169) [0.207] {0.164}	0.860 (0.165) [0.222] {0.176}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.712	0.653	0.671	0.672	0.730	0.726
Observations	85	85	85	84	84	84

Notes. Each column represents an OLS regression like in Table VII, but using GDP at market exchange rates.

TABLE A.10
Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Penn World Table
PPP GDP

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (Penn World Table PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.660 (0.282) [0.334] {0.242}	0.307 (0.116) [0.040] {0.065}	0.344 (0.135) [0.059] {0.066}	0.236 (0.190) [0.224] {0.153}	0.246 (0.079) [0.062] {0.052}	0.252 (0.083) [0.048] {0.050}
Constraint on executive	0.029 (0.014) [0.018] {0.010}	0.022 (0.010) [0.008] {0.007}	0.023 (0.011) [0.012] {0.008}	0.014 (0.008) [0.005] {0.004}	0.013 (0.009) [0.005] {0.005}	0.014 (0.009) [0.006] {0.005}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.510	0.482	0.495	0.520	0.575	0.577
Observations	64	64	64	61	61	61
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.312 (0.197) [0.238] {0.202}	0.290 (0.091) [0.038] {0.061}	0.332 (0.105) [0.078] {0.071}	0.136 (0.087) [0.102] {0.074}	0.208 (0.049) [0.034] {0.032}	0.207 (0.051) [0.036] {0.033}
Colonial heritage	0.137 (0.043) [0.039] {0.039}	0.051 (0.031) [0.017] {0.023}	0.070 (0.037) [0.024] {0.026}	0.078 (0.022) [0.034] {0.018}	0.052 (0.020) [0.031] {0.014}	0.054 (0.020) [0.031] {0.014}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.669	0.625	0.649	0.650	0.690	0.690
Observations	85	85	85	82	82	82
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.210 (0.178) [0.172] {0.148}	0.261 (0.075) [0.060] {0.056}	0.323 (0.089) [0.067] {0.058}	0.111 (0.088) [0.062] {0.049}	0.204 (0.046) [0.057] {0.037}	0.205 (0.045) [0.055] {0.040}
Economic Sovereignty	0.158 (0.038) [0.033] {0.020}	0.082 (0.028) [0.037] {0.030}	0.087 (0.030) [0.027] {0.024}	0.075 (0.015) [0.011] {0.011}	0.061 (0.014) [0.019] {0.016}	0.062 (0.014) [0.020] {0.017}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.712	0.653	0.671	0.669	0.718	0.719
Observations	85	85	85	82	82	82

Notes. Each column represents an OLS regression like in Table VII, but using PPP GDP from the Penn World Table 10.0.

TABLE A.11
Persistence in Productive Capability for Earlier Period 1979–1988 Controlling for Past Covariates,
Penn World Table PPP GDP

Productive capability (1979–1988)	Diversification	Complexity	First principal component	Real GDP per capita (log) (Penn World Table PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.639 (0.276) [0.365] {0.268}	0.395 (0.129) [0.038] {0.071}	0.401 (0.136) [0.029] {0.062}	0.088 (0.213) [0.272] {0.203}	0.122 (0.103) [0.120] {0.079}	0.110 (0.107) [0.104] {0.072}
Constraint on executive	0.029 (0.011) [0.021] {0.010}	0.022 (0.009) [0.008] {0.007}	0.021 (0.009) [0.013] {0.007}	0.016 (0.008) [0.006] {0.004}	0.014 (0.008) [0.004] {0.004}	0.015 (0.008) [0.004] {0.004}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.536	0.551	0.589	0.515	0.529	0.526
Observations	61	61	61	58	58	58
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.473 (0.180) [0.206] {0.181}	0.449 (0.106) [0.071] {0.061}	0.461 (0.116) [0.092] {0.082}	0.121 (0.090) [0.127] {0.105}	0.139 (0.061) [0.066] {0.052}	0.127 (0.061) [0.051] {0.041}
Colonial heritage	0.150 (0.035) [0.042] {0.027}	0.051 (0.026) [0.021] {0.018}	0.079 (0.030) [0.020] {0.022}	0.069 (0.022) [0.038] {0.020}	0.057 (0.026) [0.034] {0.019}	0.060 (0.025) [0.033] {0.016}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.749	0.722	0.764	0.645	0.657	0.654
Observations	81	81	81	78	78	78
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.378 (0.172) [0.135] {0.134}	0.401 (0.092) [0.109] {0.083}	0.449 (0.101) [0.099] {0.083}	0.056 (0.096) [0.126] {0.079}	0.126 (0.059) [0.099] {0.049}	0.119 (0.058) [0.094] {0.051}
Economic Sovereignty	0.142 (0.034) [0.044] {0.021}	0.085 (0.028) [0.042] {0.036}	0.090 (0.027) [0.031] {0.025}	0.074 (0.020) [0.016] {0.012}	0.064 (0.020) [0.016] {0.014}	0.066 (0.019) [0.017] {0.015}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.765	0.751	0.783	0.671	0.687	0.686
Observations	81	81	81	78	78	78

Notes. Each column represents an OLS regression like in Table VII, but using 1979–1988 observations of the outcome variables, and using PPP GDP from the Penn World Table 10.0 as the World Bank only reports this measure from 1990 onwards.

TABLE A.12
Persistence in Productive Capability for Earlier Period 1962–1971 Controlling for Past Covariates,
Penn World Table PPP GDP

Productive capability (1962–1971)	Diversification	Complexity	First principal component	Real GDP per capita (log) (Penn World Table PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.490 (0.260) [0.312] {0.294}	0.317 (0.132) [0.076] {0.091}	0.309 (0.123) [0.104] {0.093}	0.065 (0.217) [0.237] {0.194}	0.115 (0.105) [0.133] {0.088}	0.101 (0.105) [0.120] {0.082}
Constraint on executive	0.017 (0.011) [0.018] {0.010}	0.031 (0.013) [0.015] {0.010}	0.027 (0.012) [0.017] {0.009}	0.016 (0.009) [0.007] {0.005}	0.014 (0.008) [0.006] {0.004}	0.015 (0.008) [0.006] {0.004}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.482	0.560	0.565	0.456	0.470	0.468
Observations	61	61	61	58	58	58
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.547 (0.170) [0.189] {0.162}	0.582 (0.104) [0.125] {0.081}	0.535 (0.100) [0.131] {0.093}	0.166 (0.103) [0.125] {0.114}	0.143 (0.063) [0.073] {0.058}	0.126 (0.061) [0.056] {0.048}
Colonial heritage	0.098 (0.028) [0.026] {0.024}	0.040 (0.041) [0.021] {0.030}	0.061 (0.039) [0.018] {0.028}	0.066 (0.029) [0.047] {0.024}	0.057 (0.032) [0.047] {0.026}	0.060 (0.031) [0.045] {0.023}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.751	0.776	0.795	0.587	0.594	0.591
Observations	81	81	81	78	78	78
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.420 (0.142) [0.129] {0.109}	0.492 (0.110) [0.159] {0.108}	0.483 (0.091) [0.142] {0.094}	0.090 (0.096) [0.103] {0.067}	0.122 (0.058) [0.096] {0.046}	0.111 (0.055) [0.088] {0.046}
Economic Sovereignty	0.119 (0.028) [0.037] {0.026}	0.105 (0.032) [0.042] {0.038}	0.104 (0.028) [0.035] {0.029}	0.076 (0.022) [0.017] {0.010}	0.070 (0.022) [0.016] {0.012}	0.072 (0.021) [0.017] {0.012}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.780	0.807	0.823	0.625	0.640	0.638
Observations	81	81	81	78	78	78

Notes. Each column represents an OLS regression like in Table VII, but using 1962–1971 observations of the outcome variables, and using PPP GDP from the Penn World Table 10.0 as the World Bank only reports this measure from 1990 onwards.

TABLE A.13

Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Digit = 3, RCA \geq 0.1

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.380 (0.316) [0.262] {0.222}	0.490 (0.159) [0.045] {0.106}	0.437 (0.153) [0.073] {0.089}	0.064 (1.439) [1.744] {1.107}	1.729 (0.853) [0.753] {0.575}	1.755 (0.773) [0.474] {0.462}
Constraint on executive	0.037 (0.017) [0.020] {0.011}	0.033 (0.012) [0.010] {0.008}	0.033 (0.013) [0.013] {0.009}	0.163 (0.074) [0.049] {0.041}	0.147 (0.075) [0.053] {0.049}	0.152 (0.075) [0.057] {0.050}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.435	0.451	0.452	0.474	0.513	0.519
Observations	64	64	64	61	61	61
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.164 (0.195) [0.176] {0.164}	0.432 (0.140) [0.062] {0.111}	0.411 (0.133) [0.114] {0.112}	0.293 (0.619) [0.720] {0.561}	1.624 (0.512) [0.326] {0.360}	1.570 (0.486) [0.228] {0.333}
Colonial heritage	0.141 (0.050) [0.039] {0.042}	0.038 (0.040) [0.029] {0.038}	0.054 (0.041) [0.034] {0.036}	0.845 (0.178) [0.277] {0.149}	0.587 (0.177) [0.291] {0.127}	0.598 (0.178) [0.291] {0.123}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.544	0.497	0.522	0.638	0.670	0.672
Observations	85	85	85	82	82	82
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.080 (0.193) [0.122] {0.127}	0.359 (0.103) [0.060] {0.077}	0.370 (0.105) [0.071] {0.075}	0.099 (0.751) [0.677] {0.487}	1.632 (0.460) [0.593] {0.378}	1.597 (0.410) [0.496] {0.365}
Economic sovereignty	0.170 (0.047) [0.044] {0.021}	0.107 (0.038) [0.040] {0.034}	0.105 (0.037) [0.028] {0.024}	0.814 (0.121) [0.123] {0.108}	0.650 (0.123) [0.189] {0.158}	0.658 (0.122) [0.195] {0.163}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.594	0.542	0.565	0.669	0.707	0.709
Observations	85	85	85	82	82	82

Notes. Each column represents an OLS regression like in Table VII, but using an RCA cutoff of 0.1.

TABLE A.14

Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Digit = 3, RCA \geq 1

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.872 (0.294) [0.288] {0.243}	0.291 (0.125) [0.038] {0.062}	0.344 (0.141) [0.059] {0.065}	1.962 (1.685) [2.346] {1.588}	2.966 (0.983) [0.403] {0.577}	2.900 (1.005) [0.482] {0.626}
Constraint on executive	0.033 (0.014) [0.017] {0.010}	0.018 (0.007) [0.009] {0.005}	0.019 (0.009) [0.012] {0.007}	0.155 (0.070) [0.047] {0.040}	0.127 (0.074) [0.054] {0.051}	0.132 (0.073) [0.056] {0.052}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.533	0.456	0.461	0.488	0.556	0.555
Observations	64	64	64	61	61	61
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.248 (0.264) [0.321] {0.245}	0.300 (0.090) [0.070] {0.054}	0.329 (0.098) [0.091] {0.066}	0.856 (0.718) [0.872] {0.709}	1.970 (0.527) [0.459] {0.360}	1.929 (0.509) [0.435] {0.335}
Colonial heritage	0.120 (0.049) [0.039] {0.044}	0.060 (0.027) [0.022] {0.021}	0.073 (0.031) [0.028] {0.023}	0.781 (0.190) [0.297] {0.166}	0.511 (0.182) [0.293] {0.139}	0.525 (0.180) [0.289] {0.132}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.612	0.658	0.663	0.642	0.684	0.684
Observations	85	85	85	82	82	82
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.055 (0.215) [0.236] {0.187}	0.286 (0.071) [0.050] {0.042}	0.331 (0.082) [0.057] {0.047}	0.391 (0.707) [0.462] {0.399}	1.875 (0.469) [0.583] {0.382}	1.842 (0.446) [0.580] {0.392}
Economic sovereignty	0.176 (0.039) [0.037] {0.023}	0.075 (0.025) [0.021] {0.018}	0.076 (0.027) [0.018] {0.016}	0.783 (0.135) [0.118] {0.117}	0.600 (0.131) [0.198] {0.168}	0.606 (0.129) [0.203] {0.173}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.684	0.683	0.679	0.670	0.717	0.717
Observations	85	85	85	82	82	82

Notes. Each column represents an OLS regression like in Table VII, but using an RCA cutoff of 1.

TABLE A.15

Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Digit = 2, RCA \geq 0.5

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.550 (0.295) [0.192] {0.179}	0.124 (0.174) [0.059] {0.093}	0.182 (0.186) [0.085] {0.100}	1.007 (1.337) [1.350] {1.077}	4.015 (0.918) [0.526] {0.670}	4.063 (0.962) [0.576] {0.727}
Constraint on executive	0.038 (0.016) [0.019] {0.011}	0.028 (0.010) [0.011] {0.007}	0.028 (0.011) [0.013] {0.008}	0.159 (0.072) [0.043] {0.039}	0.122 (0.060) [0.042] {0.039}	0.126 (0.061) [0.045] {0.040}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.392	0.321	0.328	0.481	0.614	0.612
Observations	64	64	64	61	61	61
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.236 (0.199) [0.210] {0.188}	0.181 (0.110) [0.088] {0.064}	0.187 (0.122) [0.114] {0.079}	0.617 (0.682) [0.609] {0.625}	2.353 (0.484) [0.694] {0.394}	2.332 (0.491) [0.675] {0.380}
Colonial heritage	0.125 (0.052) [0.038] {0.050}	0.064 (0.039) [0.040] {0.026}	0.084 (0.045) [0.049] {0.028}	0.803 (0.187) [0.278] {0.156}	0.477 (0.169) [0.286] {0.156}	0.483 (0.171) [0.287] {0.152}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.521	0.445	0.469	0.641	0.704	0.703
Observations	85	85	85	82	82	82
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.078 (0.157) [0.167] {0.132}	0.148 (0.100) [0.050] {0.054}	0.180 (0.112) [0.056] {0.060}	0.233 (0.661) [0.334] {0.405}	2.222 (0.478) [0.667] {0.377}	2.198 (0.476) [0.676] {0.384}
Economic sovereignty	0.181 (0.042) [0.048] {0.026}	0.089 (0.034) [0.023] {0.021}	0.090 (0.037) [0.015] {0.019}	0.797 (0.139) [0.121] {0.123}	0.571 (0.130) [0.197] {0.165}	0.572 (0.130) [0.199] {0.167}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.602	0.482	0.490	0.669	0.734	0.732
Observations	85	85	85	82	82	82

Notes. Each column represents an OLS regression like in Table VII, but classifying exports at SITC-2 level.

TABLE A.16

Persistence in Productive Capability Controlling for Past Covariates, 1998–2007, Digit = 4, $RCA \geq 0.5$

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Institution Measured as Constraint on Executive (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.298 (0.283) [0.285] {0.193}	0.728 (0.167) [0.071] {0.091}	0.739 (0.180) [0.083] {0.085}	0.201 (1.574) [2.186] {1.433}	3.095 (1.069) [1.058] {0.865}	3.114 (0.979) [0.807] {0.736}
Constraint on executive	0.026 (0.015) [0.020] {0.011}	0.024 (0.010) [0.008] {0.006}	0.023 (0.012) [0.013] {0.008}	0.162 (0.073) [0.048] {0.040}	0.136 (0.073) [0.046] {0.043}	0.140 (0.072) [0.052] {0.045}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.505	0.573	0.606	0.474	0.547	0.562
Observations	64	64	64	61	61	61
Panel B						
Institution Measured as Colonial Heritage (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.221 (0.149) [0.153] {0.132}	0.610 (0.135) [0.074] {0.086}	0.640 (0.143) [0.103] {0.094}	0.095 (0.651) [0.783] {0.599}	2.638 (0.583) [0.489] {0.553}	2.578 (0.541) [0.359] {0.463}
Colonial heritage	0.159 (0.037) [0.032] {0.029}	0.053 (0.032) [0.024] {0.024}	0.064 (0.038) [0.031] {0.029}	0.865 (0.177) [0.274] {0.145}	0.489 (0.174) [0.274] {0.153}	0.474 (0.175) [0.283] {0.150}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.739	0.683	0.713	0.638	0.691	0.698
Observations	85	85	85	82	82	82
Panel C						
Institution Measured as Economic Sovereignty (1900)						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	0.218 (0.156) [0.139] {0.112}	0.551 (0.115) [0.082] {0.078}	0.602 (0.123) [0.080] {0.078}	-0.007 (0.774) [0.680] {0.454}	2.422 (0.645) [0.782] {0.513}	2.385 (0.581) [0.694] {0.486}
Economic sovereignty	0.143 (0.035) [0.037] {0.019}	0.081 (0.030) [0.032] {0.029}	0.085 (0.032) [0.025] {0.024}	0.822 (0.121) [0.113] {0.102}	0.568 (0.138) [0.174] {0.149}	0.560 (0.135) [0.181] {0.154}
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.754	0.704	0.730	0.669	0.718	0.725
Observations	85	85	85	82	82	82

Notes. Each column represents an OLS regression like in Table VII, but classifying exports at SITC-4 level.

TABLE A.17

Persistence in Productive Capability with Instrumental Variable, 1998–2007, Penn World Table GDP

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (Penn World Table PPP GDP)		
				(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.48 (1.10)	0.79 (0.43)	1.03 (0.63)	1.34 (0.78)	0.89 (0.23)	1.08 (0.37)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
OLS						
Productive capability (1897–1906)	0.95 (0.17)	0.35 (0.12)	0.44 (0.12)	0.25 (0.10)	0.30 (0.12)	0.29 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.14 (0.07)	−0.21 (0.10)	−0.18 (0.09)	−0.14 (0.07)	−0.21 (0.10)	−0.17 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.43 (0.62)	0.62 (0.35)	0.81 (0.49)	1.08 (0.48)	0.86 (0.26)	0.98 (0.34)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
OLS						
Productive capability (1897–1905)	0.74 (0.24)	0.37 (0.11)	0.43 (0.11)	0.22 (0.10)	0.28 (0.11)	0.27 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.18 (0.07)	−0.22 (0.11)	−0.20 (0.10)	−0.19 (0.07)	−0.23 (0.11)	−0.20 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but using PPP GDP from the Penn World Table 10.0.

TABLE A.18
Persistence in Productive Capability with Instrumental Variable, 1979–1988

Productive capability (1979–1988)	Diversification	Complexity	First principal component	Real GDP per capita (log) (Penn World Table PPP GDP)		
				(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.91 (1.20)	1.13 (0.35)	1.54 (0.56)	1.54 (0.80)	1.00 (0.28)	1.20 (0.42)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	54	54	54
OLS						
Productive capability (1897–1906)	1.03 (0.19)	0.65 (0.12)	0.69 (0.16)	0.27 (0.14)	0.39 (0.08)	0.34 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	54	54	54
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.14 (0.07)	−0.22 (0.12)	−0.19 (0.11)	−0.15 (0.08)	−0.23 (0.12)	−0.19 (0.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	54	54	54
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.00 (0.67)	1.06 (0.37)	1.30 (0.50)	1.29 (0.52)	1.08 (0.34)	1.23 (0.44)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	63	63	63
OLS						
Productive capability (1897–1906)	0.85 (0.23)	0.58 (0.11)	0.61 (0.14)	0.22 (0.12)	0.36 (0.07)	0.33 (0.07)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	63	63	63
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.18 (0.07)	−0.21 (0.11)	−0.19 (0.10)	−0.19 (0.07)	−0.23 (0.11)	−0.20 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	63	63	63

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but using 1979–1988 observations of the outcome variables, and using PPP GDP from the Penn World Table 10.0 as the World Bank only reports this measure from 1990 onwards.

TABLE A.19
Persistence in Productive Capability with Instrumental Variable, 1962–1971

Productive capability (1962–1971)	Diversification	Complexity	First principal component	Real GDP per capita (log) (Penn World Table PPP GDP)		
				(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.84 (1.08)	1.71 (0.59)	1.98 (0.74)	1.60 (0.83)	1.04 (0.28)	1.21 (0.41)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	54	54	54
OLS						
Productive capability (1897–1906)	0.95 (0.17)	0.79 (0.14)	0.73 (0.14)	0.26 (0.14)	0.42 (0.08)	0.35 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	54	54	54
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.14 (0.07)	−0.22 (0.12)	−0.19 (0.11)	−0.15 (0.08)	−0.23 (0.12)	−0.19 (0.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	54	54	54
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.82 (0.61)	1.50 (0.61)	1.64 (0.66)	1.25 (0.50)	1.05 (0.33)	1.16 (0.41)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	63	63	63
OLS						
Productive capability (1897–1906)	0.80 (0.19)	0.67 (0.14)	0.64 (0.13)	0.22 (0.12)	0.37 (0.08)	0.33 (0.08)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	63	63	63
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.18 (0.07)	−0.21 (0.11)	−0.20 (0.11)	−0.19 (0.07)	−0.23 (0.11)	−0.21 (0.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	65	65	65	63	63	63

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but using 1962–1971 observations of the outcome variables, and using PPP GDP from the Penn World Table 10.0 as the World Bank only reports this measure from 1990 onwards.

TABLE A.20
Persistence in Productive Capability with Instrumental Variable, 1998–2007, Digit = 3, RCA ≥ 0.1

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.32 (1.23)	1.18 (0.63)	1.34 (0.86)	10.38 (6.43)	9.01 (2.56)	9.64 (3.07)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
OLS						
Productive capability (1897–1906)	0.72 (0.18)	0.51 (0.18)	0.55 (0.15)	1.66 (1.04)	2.87 (1.29)	2.64 (1.07)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.15 (0.09)	−0.17 (0.08)	−0.15 (0.08)	−0.17 (0.09)	−0.20 (0.08)	−0.18 (0.08)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.39 (0.70)	0.77 (0.50)	0.88 (0.64)	8.99 (4.36)	8.42 (2.64)	8.59 (2.87)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
OLS						
Productive capability (1897–1906)	0.60 (0.19)	0.52 (0.15)	0.51 (0.13)	1.55 (0.86)	2.44 (1.11)	2.26 (0.95)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.17 (0.08)	−0.19 (0.09)	−0.18 (0.09)	−0.20 (0.08)	−0.21 (0.09)	−0.21 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but using an RCA cutoff of 0.1.

TABLE A.21
Persistence in Productive Capability with Instrumental Variable, 1998–2007, Digit = 3, RCA ≥ 1

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.61 (1.22)	0.94 (0.52)	1.02 (0.60)	11.46 (6.09)	8.69 (2.14)	8.70 (2.38)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
OLS						
Productive capability (1897–1906)	0.96 (0.21)	0.44 (0.11)	0.51 (0.12)	2.50 (0.85)	3.02 (0.89)	2.91 (0.81)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.13 (0.07)	−0.17 (0.09)	−0.17 (0.09)	−0.15 (0.07)	−0.20 (0.09)	−0.20 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.27 (0.69)	0.85 (0.43)	0.92 (0.48)	8.99 (3.80)	7.90 (2.26)	7.77 (2.29)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
OLS						
Productive capability (1897–1906)	0.65 (0.33)	0.43 (0.10)	0.48 (0.10)	2.02 (0.92)	2.69 (0.81)	2.59 (0.75)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.17 (0.07)	−0.19 (0.10)	−0.19 (0.09)	−0.20 (0.07)	−0.23 (0.10)	−0.23 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but using an RCA cutoff of 1.

TABLE A.22

Persistence in Productive Capability with Instrumental Variable, 1998–2007, Digit = 2, RCA \geq 0.5

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.85 (1.65)	0.80 (0.68)	0.69 (0.72)	9.99 (6.11)	7.65 (1.75)	7.71 (1.79)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
OLS						
Productive capability (1897–1906)	0.62 (0.18)	0.30 (0.15)	0.34 (0.17)	1.56 (0.72)	3.32 (0.64)	3.33 (0.65)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.15 (0.10)	−0.20 (0.10)	−0.20 (0.09)	−0.18 (0.11)	−0.23 (0.10)	−0.23 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.66 (0.79)	0.68 (0.53)	0.63 (0.56)	8.56 (3.88)	6.84 (1.68)	6.87 (1.73)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
OLS						
Productive capability (1897–1906)	0.56 (0.17)	0.29 (0.13)	0.32 (0.14)	1.50 (0.65)	2.99 (0.58)	2.96 (0.59)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.17 (0.09)	−0.23 (0.10)	−0.23 (0.10)	−0.21 (0.09)	−0.26 (0.10)	−0.26 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but classifying exports at SITC-2 level.

TABLE A.23
Persistence in Productive Capability with Instrumental Variable, 1998–2007, Digit = 4, RCA ≥ 0.5

Productive capability (1998–2007)	Diversification	Complexity	First principal component	Real GDP per capita (log) (World Bank PPP GDP)		
				(4)	(5)	(6)
Panel A						
Change in (log) Traveling Time to United Kingdom as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	2.54 (1.46)	1.13 (0.44)	1.37 (0.65)	14.52 (9.71)	8.86 (2.07)	9.49 (2.44)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
OLS						
Productive capability (1897–1906)	0.97 (0.17)	0.74 (0.18)	0.78 (0.17)	2.18 (1.05)	4.31 (0.95)	3.85 (0.92)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.11 (0.07)	−0.18 (0.08)	−0.17 (0.09)	−0.12 (0.08)	−0.20 (0.09)	−0.19 (0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59	59	59	57	57	57
Panel B						
Change in (log) Traveling Time to Top 5 Importers in 1900 as Instrument						
Second Stage						
Productive capability (1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
	1.58 (0.80)	0.93 (0.40)	1.12 (0.56)	11.27 (5.83)	9.07 (2.63)	9.41 (3.01)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
OLS						
Productive capability (1897–1906)	0.77 (0.21)	0.72 (0.14)	0.75 (0.14)	1.72 (0.92)	3.51 (0.87)	3.24 (0.86)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66
First Stage						
(1897–1906)	Diversification	Complexity	First principal component	Diversification	Complexity	First principal component
Change in traveling time	−0.14 (0.07)	−0.18 (0.09)	−0.17 (0.09)	−0.16 (0.07)	−0.20 (0.09)	−0.19 (0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	68	68	68	66	66	66

Notes. Each column represents 2SLS and OLS regressions like in Table VIII, but classifying exports at SITC-4 level.