Market Potential and the Rise of US Productivity Leadership*

April 4, 2013

Dan Liu (Shanghai University of Finance and Economics)

Christopher M. Meissner (University of California, Davis and NBER)

Abstract: The US advantage in per capita output, apparent from the late 19th century, is frequently attributed to its relatively large domestic market. We construct market potential measures for the US and 26 other countries between 1880 and 1913 based on a general equilibrium model of production and trade. When compared to other leading economies in 1900, the year around which the US overtakes Britain in productivity leadership, the US does not have the overwhelming lead in market potential that it has in GDP per capita. Still, market potential is positively related to the cross-country distribution of income per capita, but the impact of market potential is likely to be very heterogeneous. We illustrate this in a quantitative calculation of the welfare gains from removing international borders in 1900. While there are gains from trade for all nations, the largest European countries do not close their per capita income gaps with the US after this hypothetical rise in market potential. On the other hand, many small countries could have done so.

* We are grateful to Steve Broadberry, George, Chouliarakis, Giovanni Federico, David Greasley, Michael Huberman, David Jacks, Ian Keay, Alex Klein, Aldo Musacchio, and Dennis Novy, who supplied advice on data, gave us the green light to use some of it, and warned us against potential mis-use of various data series. Special thanks to Pierre van der Eng who graciously provided access and advice on Indonesian trade and GDP data. Leslie Hannah, Lionel Fontagné, Peter Jensen, Thierry Mayer, Dennis Novy, Max Schulze, Paul Sharp, and Jose de Sousa gave us many helpful comments and suggestions. We also thank conference and seminar participants at the NBER Summer Institute, Berkeley, Madrid, Odense, Essex, Paris, Bologna, University of Barcelona, Kent, London School of Economics, and Carlos III for comments and suggestions. Remaining errors are the responsibility of the authors.

I. Introduction

A prominent view in the growth literature holds that the United States of America was uniquely blessed by its large domestic market. Paul Romer (1996) suggests that America's sizeable internal market and its natural resources allowed the US to assume productivity leadership over Great Britain by the late 19th century. Romer follows a large tradition in economic history that attributes US dominance in income per capita to its market size. Abramovitz and David (1996), Rosenberg (1963, 1981) and Sokoloff (1988), amongst many others, have argued that a large market incentivized inventive activity ostensibly leading to productivity advance. These scholars echo earlier observations by Marshall (1920) that market size mattered. Even earlier, the contemporary observations of Andrew Carnegie held that:

> "The American has constantly expanding home demand…justifying costly improvements and the adoption of new processes…a Continent under one government…it is free unrestricted trade in everything under the same conditions, same laws, same flag, and free markets everywhere. The European manufacturer finds obstacles to such varied expansion, in a continent divided into hostile and warring States, with different laws and exactions and tariffs at every boundary,"[1]

As Carnegie noted, the corollary to the "Great America" literature is that the internal market for 19th century European producers was small. International borders also imposed significant restrictions on demand, productivity and wages. If European incomes and wages were lower than in America, then it has often been maintained that international borders were a key factor.

But this view heavily discounts two features of the data which are not easily dismissed. One is the strong productivity growth and high standards of living in northwestern Europe in the late nineteenth century when compared to other parts of Europe and other areas of the world. The other is the relatively high density of northwestern Europe and the high level of intra-European market integration. Leslie Hannah (2008) describes the facility with which 19th century Europeans transacted with nearby neighbors despite the international borders they faced, and oppositely, how large distances in the United States provided natural barriers to trade. Hannah surveys

[1] Andrew Carnegie (1902) Rectorial Address at St. Andrews, 1902, pp. 31-32

evidence from plant size and suggests that scale economies were as prevalent in Europe as the US. We go further than Hannah, and the rest of the existing historical literature, by precisely measuring the 'size of the market' and also by asking whether market size mattered for relative economic performance.

After several decades, the economic history literature is still debating whether tariffs and trade influenced nineteenth century economic performance in an important period of industrialization.[2] Unfortunately, the results from this line of empirical enquiry have not provided a uniform conclusion on the relationship in question. Some authors find a positive relationship between openness to trade and incomes while others find that tariffs boosted growth and raised productivity. A notable recent finding by Lehmann and O'Rourke (2011) is consistent with the idea that industrial tariffs actually raised growth rates in domestic industry.

By contrast, the literature covering the experience of the past several decades shows a large amount of support for the idea that market size is important for raising incomes. Two highly influential empirical investigations making strong use of theoretical advances in new economic geography find that market potential is associated with higher incomes in the late twentieth century (Redding and Venables, 2004; Hanson, 2005). We build on the methodology of this contemporary literature but incorporate several recent and important methodological advances from the broader empirical trade literature. Most importantly, while the recent literature on market potential has largely focused on partial equilibrium correlations in a reduced form single equation regression setting, we examine the welfare impact of limited market potential due to international borders following Anderson and van Wincoop (2001).

Theoretical models in international trade and new economic geography predict several channels through which market potential can affect incomes. Higher market potential allows firms to sell more output at a given price which raises payments to the factors of production. Market potential also allows firms to decrease their production costs when a greater range of intermediates and inputs from foreign or local suppliers is available. Finally, market potential raises real income by expanding the range of goods

[2] Some prevalent examples include: Bairoch (1972); O'Rourke (2000); Irwin (2002); Irwin and Tervio (2002); Vamvakidis (2002); Clemens and Williamson (2004); Jacks (2006); Tena-Junguito (2010); Schularick and Solomou (2011).

available and lowering the consumer price level. Market size can also incentivize human capital accumulation and investment in new technologies as has also been highlighted in the broader growth literature. We focus on the first three forces in the context of a one-period general equilibrium model.

We proceed in two steps. First we measure interactions with foreign markets by providing a theoretically consistent measure of *market potential* for 27 countries for two benchmark years 1900 and 1910.[3] Market potential is a function of trade barriers including international borders, but also of real foreign purchasing power. This is a different approach from the rest of the economic history literature which uses tariffs, ad hoc openness ratios, or price differentials for a limited set of commodities to infer how integrated an economy is. To build our measure, we pair a theoretical model of international trade with new historical bilateral trade data. For theory we rely on Fujita, Krugman and Venables (1999) and Anderson and van Wincoop (2003). For data we have added here significantly to the trade data underlying Jacks, Meissner and Novy (2011), so that for the years 1900 and 1910 our dyadic data are the most complete currently available to researchers in digital format.

Next, we use our measure of market potential to help explain cross-country income differences in the first wave of globalization. We find that market potential is a robust and economically significant determinant of income per capita in the early 20th century. This is consistent with recent empirical research such as Redding and Venables (2004). Still, the regression-based, reduced form elasticities suggest that market size alone cannot account for the sizable gaps in output per person between the US, UK, Germany, and France.

We also provide a link between studies on the welfare consequences of border barriers (Anderson and van Wincoop, 2001) and the market potential literature. We

[3] We use the term countries even though the Australian colonies (Western Australia, South Australia, Queensland, New South Wales, Victoria, and Tasmania), New Zealand, India, Ceylon, and Canada were all British colonies. We also combine the Australian colonies into one unit called Australia which roughly conforms to modern boundaries and our data on national GDP. The set of countries we look at is Argentina, Austria-Hungary, Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Greece, India, Indonesia, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Philippines, Portugal, Spain, Sri Lanka, Sweden, Switzerland, UK, Uruguay, USA. For our income regressions, we drop Sri Lanka and the Philippines due to a lack of income data.

explore a counterfactual in a simple Armington model of trade in order to gauge the welfare consequences of international borders that limit market potential. If the notion that the domestic market matters has any force, it should be the case that removing international borders brings about large welfare gains for those unfortunate to have been trapped behind national frontiers in the world's smallest countries. Our findings here demonstrate that this is indeed the case. However, for the largest European countries (France, Germany, UK), the gains were significantly smaller than for small countries. Market potential (domestic and foreign) in large parts of Europe was already comparable to the US or even larger. The negative consequences of the ubiquitous border barriers in Europe appear to have been overstated. At the same time, it is true that for smaller nations like Belgium, Canada, Denmark, and Switzerland fewer borders could have eliminated their income gaps against the US. Oppositely, there is evidence that large internal distances in the American economy significantly offset the advantage of having a "large" internal market and that there must have been other forces promoting America's ascent besides market potential.

II. Cliometric Viewpoints

Market activity and exchange, whether across or behind the border, is the natural basis for the welfare gains from trade. It is obvious then why economic historians have long been interested in measuring the size of the gains from trade between nations. What is less obvious is why the economic history literature has so far come to no decisive conclusion as to the size or even the existence of such gains from trade.

One widely cited collection of results in quantitative economic history reports a positive relationship between tariffs and productivity growth. The seminal study in the comparative economic history literature, Bairoch (1972), studies the experience of several European countries finding that tariffs were not associated with slower growth. It might be argued that a univariate association on poorly measured data in a highly selected sample could give misleading results. Therefore, O'Rourke (2000) looks at a larger sample, includes more control variables, and uses better econometric techniques. He also finds a "tariff-growth paradox". Jacks (2006) presents parallel evidence from an even larger sample. Lehmann and O'Rourke (2011) and Tena-Junguito (2010) use disaggregated data finding evidence that industrial tariffs were associated with higher productivity growth in the industrial sector in the late nineteenth century especially in the most economically advanced countries. This literature argues that the historical evidence is consistent with learning-by-doing and other non-convexities. If this were true, then the overall gains from international trade may be limited or even negative in certain cases. On the other hand, standard theory suggests that if tariffs impede specialization they decrease productivity, raise prices, appreciate the real exchange rate, limit exports as well as imports and diminish the range of goods available for consumption and production. If this is true, then greater international trade should be associated with higher real incomes.

Clemens and Williamson (2004) argue for an interaction between tariffs and other national characteristics. A positive link between tariffs and growth is evident in the 1870-1913 data but typically only when a nation has a large domestic market and is ready for industrialization, accumulation, and human capital deepening. Without these, gains from trade are lost and there are unlikely to be positive tariff-induced dynamic effects on productivity. Domestic market potential is a partial substitute for access to foreign markets in this view.

Contrary to the above studies, Schularick and Solomou (2011) show there is no significant relationship between tariffs and income prior to 1913 using GMM techniques for dynamic panel models and aggregate data. Irwin (2002) also disputes the notion that higher tariffs caused higher growth. Canada and Argentina, both high tariff countries, relied on capital imports to create export-led commodity-based growth. Oppositely, Russia, Portugal, and Brazil implemented high tariffs which were insufficient to raise growth dramatically. In an interesting industrial-level case study, Head (1994) notes that there were strong learning effects in the heavily protected US steel rails industry, but that tariffs brought losses to the consumers of steel rails and that the overall welfare impact was small. Irwin (2000), in a careful case study of the American tinplate industry, denies the importance of tariffs for promoting industrial development.

Another strand of the literature focusses on the relationship between productivity and trade openness. Irwin and Terviö (2002) and Jacks (2006) find a positive and significant relationship between international trade and output per capita.

This is in contrast with earlier results from Vamvakidis (2002) which showed no strong positive link between trade and growth prior to 1970.

In contrast to these studies Donaldson (2010) provides strong support for the idea that market potential raised real incomes of regions in India in the 19th century. The relationship between greater integration and productivity in the older literature appears to be very sensitive to methodology, measurement, and sample.[4] Donaldson (2010) shows that there are important gains from using theoretically grounded estimating equations. Without the discipline of such a theoretical model, arbitrary regularity conditions can easily shroud the relationship between market activity and outcomes.

III. Trade costs in history

A limited number of measures of market potential and exposure to trade have been used in the economic history literature. The studies mentioned above rely largely on two. These are the average tariff rate and the ratio of foreign trade to total output. Tariffs, as proxied by the ratio of tariff revenue to total imports have their drawbacks as is well known. Prohibitive tariffs can give the appearance of low protection. The existence of non-tariff barriers can raise protection without raising this ratio. The ratio of total trade, the sum of exports plus imports, to total GDP is also problematic. Standard international trade theory suggests scaling not by GDP but either by total expenditure (e.g., when trade is unbalanced) or by gross production (e.g., when intermediates are used) and using either only exports or imports (see Arkolakis, Costinot and Rodríguez-Clare, 2012 or Feenstra, 2010). Moreover, trade intensity must be measured relative to some theoretically defined benchmark to be useful.

[4] Kim (1995) and Rosés (2003) use new economic geography and trade theory to motivate empirical models that explain the regional distribution of industrial activity in the US and Spain. Rosés argues that home market effects/market potential mattered in Spain while Kim finds mixed evidence for these forces. Klein and Crafts (2011), however, show that market potential was an important determinant of industrial location in the USA prior to 1913. Schulze (2007) studies the Habsburg Empire in the 19th century and finds little evidence that market potential mattered for regional income per capita. Crafts and Mulatu (2006) observe a minor role for market potential in the UK in pre-World War I Britain. Mitchener and McLean (2003) find that access to a waterway is positively related to state level per capita incomes in the 19th century.

More generally the outcome- the size of cross-border trade flows – is influenced by relative productivity, overall size, the degree of competition, and total trade costs. The latter encompass not just tariffs but many other frictions or barriers to international trade (Anderson and van Wincoop, 2004 and Jacks, Meissner, and Novy, 2010). These other frictions include transportation, financing charges, information acquisition, the fixed beachhead costs of establishing sales in a new market, property rights, long-distance contracting problems, and so forth. The "openness ratio" tells us little about how various trade policies and trade costs matter for economic outcomes. The relationship between these policies and trade flows is theoretically predicted to be highly heterogeneous at the country level and dependent upon many factors including general equilibrium forces (Anderson and van Wincoop, 2003).

One view in the history literature is that the USA forged a large internal market. High incomes in the US were due in part to low internal trade costs in America. This argument, in comparative perspective, has become very hard to maintain as Hannah (2008) recently demonstrated. Once one looks past national borders and thinks more broadly about market activity that includes cross-border trade and one thinks more carefully about trade costs it is not at all apparent that the US had any decisive advantages in market size. While European nations were on average smaller and international borders had to be crossed more frequently, distances between points of economic activity and demand were significantly smaller, transportation networks were denser and other frictions such as legal and informational problems within Europe were arguably decreasingly significant. According to our data, the population weighted average distance between the ten largest states in the US (898 km.) was three to four times that of the weighted distance between the top ten cities in Great Britain (222 km.), France (212 km.), and Germany (284 km.).[5] While it might be true that American railroads were highly efficient at long-hauls, the productivity gaps in the transportation sector would have to have been immense to make up for this difference. In 1909 average freight revenues per ton-mile in the US was 65 cents, $1.21 in France, $1.24 in Prussia and $2.30 in the UK (Bureau of Railway Statistics, 1911) suggesting significant

[5] Bilateral great circle distances between the ten most populous cities were calculated and corresponding population weights were used to calculate these average internal distances. We used the distance between the ten the largest cities in the ten most populous states in the case of the US. This is likely to understate domestic distance in the US. See the data appendix for more information.

advantages although less than the four-to-one ratio required to offset the average distance.[6]

It is certainly true that the US had no internal tariffs during the period of interest. But in northwestern Europe, Britain, Belgium, France and Germany maintained low average tariff rates of not more than 10 percent. The commitment to Free trade was strong and stable in the first two nations as well.[7] The distances to be overcome between were obviously much smaller than within North America as well. In terms of great circle distances, the north of England lies roughly 600 kilometers from northern France and 855 kilometers separate Liverpool from Hamburg. The former is roughly the distance from New York to Pittsburgh while the latter is the distance from Boston to Pittsburgh. American economic activity and market interactions expanded westward after the mid-nineteenth century encompassing Ohio, Indiana, and Illinois. The distance between Chicago and New York is nearly 1,200 kilometers.

Distance mattered insofar as it increased the resource costs of shipping goods to the consumers and producers that demanded them. Some indications are given in Hannah (2008), and they show that it is not at all clear that the average transaction incurred lower freight costs within the US than in Northwestern Europe. Europe relied more heavily on water-based transportation than the US because it made economic sense to do so not because it was an inefficient market outcome. Although raw railway freight rate comparisons make it appear that the US had a transport cost advantage, the European substitution of more efficient methods of transport made it so that the overall average freight rates per ton-kilometer were not that far apart (Hannah, 2008, p. 53). Hannah argues that the average consumer was further away from railway transport than the average European consumer or producer. In the UK, traffic along the rail

[6] The UK numbers are not strictly comparable according to the source since they include “high-class” freight services and other charges. The figures for the US refer to several mid-Atlantic states which are officially referred to as Group II (New York, Pennsylvania, New Jersey, Maryland, and Delaware).

[7] Wolf (2009) finds evidence that administrative borders *within* late 19th century Germany were significant barriers to trade. After controlling for language, distance and cultural variables, the international border barrier had a tariff equivalent of 37 percent while internal administrative borders yielded a tariff equivalent of 15.5 percent. No statistical test is provided, nor are standard errors reported, but it would appear hard to reject that the border barriers were economically significantly different when holding geography, language and religion constant. One interpretation is that many regions of Germany were quite well integrated with ‘foreign’ countries in this period.

network was more intensive than in the US with twice as many locomotives per 1,000 miles of line. Within the most populous mid-Atlantic states (Group II or New York, Pennsylvania, New Jersey, Delaware, and Maryland) the density of railways per square mile was the same as the UK, 1.83 times that of the France, and 1.33 that of Prussia-Hesse (Bureau of Railway Statistics, 1911). However, when compared to the UK, Group II had a freight car density only ¾ that of the UK. It is also true that railway gauges were standardized by treaty from 1886 in 13 principal continental countries, but that nations like Spain, Russia and Portugal refrained from doing so. Europe's railway network for inland transportation and its system of maritime connections rivaled the US distribution system in most sensible comparisons.

Hannah summarizes the course of other potential trade costs writing many of them off as serious barriers to trade within northwestern Europe. Linguistic diversity was cured by multi-lingual inhabitants and close proximity of other "languages". The gold standard and fixed exchange rates reigned in Europe, uniformity of coinage had been established by the 1880s and financial transactions through the capitals of London, Paris and Berlin were eased by cross-border international financial operations. In the US, cross-state branching restrictions and limitations on international financial activity were expressly forbidden making for a highly fragmented and unstable financial system when compared to the British, Belgian, Dutch, or German systems.

Of course, a proper treatment of this issue based on a careful historical accounting of the innumerable real trade costs is beyond the scope of this paper. The difficulties inherent in such a project are obvious since it is nearly impossible to enumerate completely the myriad trade costs faced by consumers and producers. Aggregation is also a problem. Relative price calculations have many pitfalls. An alternative, but more precise approach than previous attempts is to use theory along with the aggregate data at hand to reveal the extent of market potential. This approach, outlined in the next section, has a strong track record in both the trade and economic geography literature.

IV. Theory and Data

New trade theory provides one justification for the long-held intuition that "market potential" can explain the cross country income distribution. The model presented here, based on Redding and Venables (2004) and Fujita et al. (1999) assumes consumers love variety. A fixed cost to production underpins the outcome of monopolistic competition and gives rise to a range of goods being produced -- each one unique to a local firm. This approach allows for the interaction between trade costs and demand to influence the supply side. Market potential is one key determinant of factor incomes in this simple model.

A representative consumer in a particular destination d loves variety and so maximizes the following CES utility function defined over (all) goods x from all countries $s = 1, \ldots, S$. Direct utility is given by

$$U_d = \left[\sum_s n_s x_{sd}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \qquad \sigma > 1 \tag{1}$$

where σ is the (constant) elasticity of substitution between varieties and n_s is the number of varieties produced in country s. Maximization is subject to the standard budget constraint

$$\sum_s p_{sd} x_{sd} = Y_d$$

Demand in value is given by

$$\check{x}_{sd} = \left(\frac{P_d}{t_{sd} p_s}\right)^{\sigma-1} Y_d \tag{2}$$

where t is a trade cost factor such that importers incur a trade cost in tariff equivalent terms to import from country s equal to $\tau = t - 1$ of country s's goods. This implies $p_{sd} = t_{sd} p_s$. Also P is the CES consumer price index or the minimum expenditure necessary to purchase one unit of the consumption bundle or

$$P_d = \left[\sum_s n_s (t_{sd} p_s)^{1-\sigma} \right]^{1/1-\sigma}. \qquad (3)$$

The representative firm for each country s has profits given by

$$\pi_s = \sum_d p_s x_{sd} - w_s^{\lambda} m_s^{\phi} P_s^{\omega} \left[C + a_s x_s \right]. \qquad (4)$$

In this model firms use a composite input with price $w_s^{\lambda} m_s^{\phi} P_s^{\omega}$. Firms incur a fixed cost of production in terms of the composite input equal to *C,* and they have a marginal input requirement of a_s. Three types of inputs are used here, and they are aggregated in a Cobb-Douglas function. The first input is labor which we assume to be an internationally *immobile* factor of production. Despite the historically large volume of net migration for certain countries during the nineteenth century this assumption is valid so long as labor is not fully and instantaneously mobile across countries. An alternative assumption is that labor is perfectly mobile but that there is a constrained sector or a non-tradeable such as in Helpman (1998) and Hanson (2005). Since we will use total factor payments or GDP as a proxy for wages, all that is needed is that there be one immobile factor of production or a non-tradeable factor that relies on a fixed endowment so that total real incomes diverge. A mobile factor of production, is paid *m,* and these returns are equalized across countries in this model. This input could be construed to be capital. The final input is a composite index of final goods used as "intermediates".

The first order condition for the firm, together with the demand function given above, lead to price being a constant markup over marginal cost equal to $\frac{\sigma}{1-\sigma} a_s w_s^{\lambda} m_s^{\phi} P_s^{\omega}$. The zero profit condition implies that there is a level of output $\bar{x}$ at which firms break even such that their price satisfies

$$p_s^{\sigma} \bar{x} = \sum_d Y_d \left(\frac{P_d}{t_{sd}} \right)^{\sigma-1}. \qquad (5)$$

Since prices are a markup over marginal cost, we see immediately that

$$\left(\frac{\sigma}{1-\sigma} a_s w_s^{\lambda} m_s^{\phi} P_s^{\omega} \right)^{\sigma} \bar{x} = \sum_d Y_d \left(\frac{P_d}{t_{sd}} \right)^{\sigma-1}. \qquad (6)$$

Rearranging this equation we find

$$\left(w_s^{\lambda} m_s^{\phi}\right)^{\sigma} = \psi\left(a_s P_s^{\omega}\right)^{-\sigma} \left[\sum_d Y_d \left(\frac{P_d}{t_{sd}}\right)^{(\sigma-1)}\right], \psi = \left(\frac{1-\sigma}{\sigma \bar{x}^{1/\sigma}}\right)^{\sigma}. \tag{7}$$

This condition shows that, in equilibrium, nominal payments to the factors of production are a function of a term related to the source country's productivity parameter as well as a *real* trade cost-weighted sum of *all* destination countries' market sizes. This sum is what we refer to as market potential. It is worth emphasizing that this new economic geography model includes a third force in the market potential variable beyond the intuitive trade-cost weighted expenditures. This third force is represented by the destination country price index. When foreign markets are less competitive, and hence their price indexes are higher, it is easier to sell into such a market and consequently wages are higher. Finally with the addition of intermediates, proximity to foreign and domestic suppliers reduces costs and increases factor payments. [8]

The theoretical model gives us a justification for why incomes would then be larger in a country with greater market potential. The question now is empirical. Which countries had the largest markets in practice? How much did international borders reduce trade? How much of the variance in GDP per capita across countries is explained by these differences?

V. Estimation

To proceed, we follow a two-step approach similar to Redding and Venables (2004). First we use an equilibrium gravity equation for the value of exports which allows us to recover the market potential variable. Using the result due to Anderson and van Wincoop (2003) gravity in the model given above is given by the following system of equations

[8] As it turns out, foreign market potential and supplier access are strongly positively correlated so we focus only on foreign market potential in the empirical analysis.

$$\check{x}_{sd} = \frac{Y_s Y_d}{Y^W}\left(\frac{t_{sd}}{P_s P_d}\right)^{1-\sigma} \tag{8}$$

$$P_d^{1-\sigma} = \frac{1}{Y^W}\sum_s (Y_s)\left(\frac{P_s}{t_{sd}}\right)^{(\sigma-1)} \quad \forall\, d$$

The gravity equation illustrates that bilateral trade is a function of a dyad's incomes, bilateral trade barriers (i.e., trade costs), t, and the "multilateral" terms P_s and P_d. After a normalization, these terms can be solved for a unique solution for the price vector as a function of all bilateral trade costs, income shares and one parameter, the elasticity of substitution.

With the gravity equation, it becomes possible to obtain estimates of total foreign market potential--the sum of foreign market capacities--defined as

$$MP_s = \sum_d (Y_d)(t_{sd})^{1-\sigma} P_d^{\sigma-1}.$$

Although one can estimate and solve the entire system of equations defined in (8), one can also recover consistent estimates of the market potential terms by using a dummy variables approach with the gravity equation. Since we have dyadic data, we use exporter and importer intercepts which subsume the ratio of GDP and the unobservable scaled price indexes.

To build market potential, MP_s we need an estimate of trade costs. We assume, as is standard, that the trade cost function is given by

$$t_{sd} = (dist_{sd})^{\rho} b^{\gamma_{sd}^{B}} \lambda^{\gamma_{sd}^{L}} \eta^{\gamma_{sd}^{V}}.$$

Here, *dist,* is the harmonic mean of the population-weighted great circle distance in kilometers between each pair of the ten most populous cities in each nation.[9] For domestic distances we use the harmonic weighted average of distances between these top ten cities.[10]

[9] Head and Mayer (2010) suggest the harmonic mean. We use an exponent of -1. An arithmetic (weighted) mean may bias domestic distance upward which would bias the border coefficient upward.

[10] We use the populations of the ten most populous states for the US and the distance between the largest city in each state and other cities. We make the "internal distance" of a city equal to 5 kilometers. This implies a radius for a "disk-shaped" city of 7.5 kilometers when using the rule that average distance between a producer and a consumer, when production is concentrated at the center of a disk and consumers

We use data for international bilateral trade as well as "domestic" trade as proxied by gross production minus exports. An appendix explains our methodology and sources. An estimate of total expenditure on domestic goods allows us to estimate the penalty imposed by international borders. The indicator variable γ_{sd}^{B} is one when trade takes places between two separate countries (or a colony and the center country) and zero for intra-national trade. This yields an estimate, b, of the "border effect" which is equal to one plus the tariff equivalent of the transaction cost of moving goods across an international border. Likewise, γ_{od}^{L} is one when trade takes place between two countries which do not share a common language, so that λ provides an estimate of one plus the tariff equivalent of the trade cost when two nations do not share a common language. Finally, the indicator γ_{sd}^{V} is one when nations are neighbors (i.e., they share a land border). We discuss alternative approaches to proxying trade costs below.

We estimate our gravity equation using the Poisson pseudo-maximum likelihood model suggested by Santos Silva and Tenreryo (2006). This model provides predicted values at the extremes of the distribution that are much closer to actual values than the standard log-linear model. Since we are interested in measuring the importance of domestic trade, this methodology turns out to be crucial when barriers to international trade are significant. The Poisson model is estimated using the exponentiated log of the gravity relationship from (8) as follows:

$$\check{x}_{sd} = \exp[\kappa + \beta_s \ln(\mathrm{orig}_s) + \beta_d \ln(\mathrm{imp}_d) + \delta_1 \ln(dist_{sd}) + \delta_2 \gamma_{sd}^{B} + \ \delta_3 \gamma_{sd}^{L} + \delta_4 \gamma_{sd}^{V} + \varepsilon_{od}].$$

The constant, κ, turns out to be the product of supplier and market potential for one reference nation (we choose the US). For the remaining *N-1* countries, β_s is a country-exporter indicator and β_d is a country-importer indicator. The model estimates orig_s and imp_s the building blocks of the market potential terms. We also see that $\delta_1 = (1-\sigma)\rho$, $\delta_2 = (1-\sigma)ln(b)$, $\delta_3 = (1-\sigma)ln(\lambda)$, and $\delta_4 = (1-\sigma)ln(\eta)$, so that we are unable to identify the tariff equivalents of the trade costs and the elasticity of substitution separately. We recover estimates for total market potential for country s as the sum of domestic and foreign market potential as follows:

---

uniformly distributed around the disk, is 2/3 of the radius. See the data appendix for more on these calculations.

$$\widehat{MP}_s = \widehat{DMP}_s + \widehat{FMP}_s$$
$$= \left(\widehat{\mathrm{imp}}_s\right)^{\beta_s}(dist_{ss})^{\widehat{\delta_1}} + \sum_{d \neq s}\left(\widehat{\mathrm{imp}_d}\right)^{\beta_d}\left[(dist_{sd})^{\widehat{\delta_1}}\left(\widehat{\delta_2}\right)^{\gamma_{sd}^B}\left(\widehat{\delta_3}\right)^{\gamma_{sd}^L}\left(\widehat{\delta_4}\right)^{\gamma_{sd}^V}\right] .$$

The split into domestic market potential (*DMP*) and foreign market potential (*FMP*) depends upon a different trade cost vector for trade within countries than that which applies for international trade. To proxy for these trade costs, we use internal distance as described above. Although it is possible to retrieve an estimate of supplier potential, we do not rely on it for our baseline regressions as it is turns out to be very highly correlated with foreign market potential.

The second step is to estimate an income or wage equation. Our regressions are based on the following basic functional form

$$\ln\left(\frac{GDP}{Population}\right)_s = \eta + \mu \ln\left(\widehat{MA_s}\right) + Z_s'\delta + \nu_s \qquad (9)$$

Where we use nominal GDP per capita converted to US dollars using annual average exchange rates, η is a constant, *Z* is a vector of other included regressors, and ν_s is an error term. As equation (7) shows, factor productivity matters. As a consequence we include observables that are likely to be correlated with this variable in the vector *Z* while also allowing for an unobservable component to productivity in the error term. Throughout, we use robust standard errors or standard errors clustered on the country when we run models for panel data. The data sources we rely on are described in a data appendix below.

We have nominal GDP data for 25 of the 27 countries listed above for two benchmark years from 1900 and 1910. For our trade matrix, we make use of trade flows in both directions (including domestic trade) there are a total of 729 observations possible in each year. We use contemporary aggregators of data like the British Board of Trade statistics as well as every sample country's official published trade statistics. For a balanced panel of data for 1900 and 1910 we have 523 observations. There are 65 observations that, according to sources, had zero trade in 1900. There are 7 such observations in 1910. We also have 3 unused non-zero trade observations for 1900 and 63 for 1910 since these pairs are not available in both years. We surmise that for the observations where no data were reported there are a substantial number of zero trade values in the remaining observations (138 in 1900 and 136 in 1910). Because of indirect trade routes, or varying thresholds for reporting data, we leave these values as missing. Wherever possible, we have relied on statistics published by the importer rather than an exporter since imports were more often subject to customs house inspection for tariff reasons and therefore were likely to be more accurate. [11] We make no correction for source or destination bias.

We also ignore zero trade relationships in the rest of what follows. The reason is three-fold. First, no explicit wage equation is easily recovered from a framework like that of Helpman, Melitz and Rubinstein who model zero trade flows. Second, most zeros within the confines of our 27 x 27 trade matrix are for pairs of very small countries, and the welfare gains from adding in trade with such countries in a counterfactual world would likely be very small. Finally, serious challenges to identification of fixed costs of trade as opposed to ad valorem tariff equivalents exist. Moreover, it is impossible to identify the border impact in a limited dependent variable setting since all nations trade with themselves.

Two other issues are worth noting. First, for domestic "exports," we use the value of total gross production minus exports. Our sources and methods for reconstructing gross production for each country are described in an appendix. Second, we construct market potential figures only for country-pairs that have positive trade. The same is true for our welfare calculations where we only allow partners with which there is non-zero trade to enter the price index.

Several threats to the identification of μ exist when estimating equation (9). First, if market potential is simultaneously determined with income per capita, our estimate of the coefficient on market potential will be biased, and the bias is likely to be upwards if richer countries also trade more. Also, market potential, itself a function of foreign

---

[11] Platt (1971) records several memorable observations on the reliability of trade statistics including: "you require to have a great deal of faith in order to feel that you are reasoning on a secure basis; and "comparison of trade statistics, for a historical analysis of economic relations between two countries, must be abandoned". Platt suggests that the largest problems are for smaller American Republics where official valuations were quite frequently non-reality based. By the early twentieth century many of the advanced nations had started to record imports according to the place of consignment rather than the port of shipment and likewise for exports.

incomes, might be correlated with the domestic income shock due to spatial correlations in the error terms. To deal with these issues, we have several strategies.

First we compare an instrumental variables estimator to standard OLS estimates. Our excluded instrument which predicts market potential is the bilateral estimated trade cost function multiplied by partner population. This function uses geographic and pre-determined cultural and demographic information to predict current year market potential but excludes the portion of the market potential variable related to GDP. There is no reason to believe this type of geographic positioning of a country is related to unobservables that determine income per capita in a given year. Second, we lag market potential by two years when we estimate the model, so that we have market potential and other control variables for 1900 and 1910 while information on GDP per capita is for 1902 and 1912. Finally, in some specifications, we control only for foreign rather than domestic plus foreign market potential. Finally we estimate a panel model over 34 years including country fixed effects, and country-specific time-trends to eliminate time-invariant unobservables at the country level and any remaining country-specific trends which are highly visible in the data.[12]

Correlation between variables we include in Z and the error term can also cause bias. On the other hand, there is an obvious benefit to controlling for other variables that influence income per capita via their impact on factor productivity. We include three key variables in Z. The first is a control for institutions and is a dummy equal to 1 when a nation is located in a tropical region. Next we include the logarithm of the ratio of population to total land area. Factor endowments will determine the marginal product of labor and land which can affect total factor payments via wages and land-rental rates. Finally, we also control for the skill level of the labor force with a measure of human capital. Specifically we rely on the data set underlying Morrisson and Murtin (2009) which measures educational attainment.

[12] Head and Mayer (2011) make the case for this strategy.

VI. Empirical Results

In Table 1 we present results from gravity regressions for 1900 and 1910. Distance is negatively correlated with exports in all years and the coefficient shows a slight tendency to decrease in absolute magnitude over time. At the average distance in the sample, and with an assumed elasticity of substitution of 7, the tariff equivalent of distance is estimated as 86 percent in 1900 and 66 percent in 1910.[13] The international border and language differences represent significant barriers to trade as well. In 1900 crossing a border is equivalent to imposing an ad valorem tariff of 56 percent while not sharing a language gives rise to lower trade as if a tariff of 15 percent had been imposed.[14] Figure 1 plots these values for 1900 and 1910.[15]

In Figures 2 through 4 we plot total, foreign, and domestic market potential for 27 countries for 1900 and 1910. The largest values of market potential are in the industrial leaders: the UK, France, USA, and Germany. What is interesting here is that in 1900 *total* market potential for the UK is much larger than that for the US and all other countries. The values are much more similar in the US, France, Germany, and Austria. By this measure, German total market potential was only six percent smaller than that of the US in 1900. This would seem to call into question the primacy of market size for the

[13] Anderson and van Wincoop (2004) show that the elasticity of trade with respect to distance equals the product of the ad valorem freight-rate, the elasticity of freight costs per ton mile with respect to distance and 1 minus the elasticity of substitution. We used information on product level freight rates in British pence per ton and commodity prices underlying Jacks and Pendakur (2010) to estimate the elasticity of freight costs with respect to distance. Specifically we run a regression of the log of the freight cost in 1910 in pence per ton on the logarithm of distance and a set of commodity dummies. The data are for Britain and a large set of its trade partners over 21 commodities. From the gravity model an estimate of the distance elasticity of trade is available. With these we solve for the elasticity of substitution. When freight on coal is included in the regressions we obtain an elasticity of 5.5. Coal was expensive to ship and it makes up over half of the observations which is certainly non-representative of global trade. We checked the distance elasticity of freight without coal and it is much higher at 0.67 (versus 0.49). Without coal, our estimate of the elasticity of substitution is 11. We think 7, an intermediate value, is a reasonable baseline. We note that O'Rourke and Williamson (1994) assume an elasticity 1 for manufactures and 0.3 for tradeable "food" products.

[14] Wolf (2009) reports a tariff equivalent of 37 percent for the international border. If he had used an elasticity of substitution of 7, as we do, this would have been 25.5 percent.

[15] We include services in domestic trade which are largely non-traded. When we eliminated services from domestic trade, the coefficients in the gravity regression are not statistically different from those when services are included.

US productivity advantage. It also highlights the higher density of the European economic space in the late nineteenth century.

For foreign market potential, small nations located near larger countries have the largest foreign market potential variables. These include Belgium, Switzerland, Canada, and the Netherlands. Larger countries such as France, Germany and the UK have high foreign market potential as well. The US is below the median level of foreign market potential. The lower end consists of nations far from Europe in our data like Japan, the Philippines and Indonesia.

The results for domestic market potential show two crucial aspects of the data. In 1900, the US is not at the top of the distribution but rather it is a close race for second with Germany and France. In 1910 the US leaps clearly ahead of France and Germany but is not all that far ahead of Britain. Despite the fact that the US total income level was 50% larger than that of the Britain, distances were on average four times higher in the US imposing considerable constraints on achieving high domestic market access. This contrasts with the largest European nations in our sample which have smaller GDPs but nearly as much market potential as the US.

As a robustness check that avoids using the trade cost estimates from the gravity model, we can look at domestic market access by using available figures on freight rates. By necessity, recorded freight rates are highly mis-measured since rates varied by commodity, specific route and season. Nevertheless, based on data from Jacks and Pendakur (2010) for sea freight rates and Bogart (2010) for railway freight weights, we can adjust domestic market access using an imprecise measure of freight rates. Instead of scaling by the gravity-adjusted domestic distance value, we divide the country-specific intercept from the gravity model by the product of distance and the freight rate per ton mile. Nations used a mix of rail, ship, and road. We ignore road-way traffic and use the coefficients on the mix of transportation services given in Table 1 of Hannah (2008). Bogart's data show a significant cost advantage for the US in railway freight rates compared to European countries: 0.41 pence per ton mile for the US versus 1.13 in the UK, 0.73 in Germany and 0.78 in France. However, average US internal distance is respectively 5.3, 3.12 and 4.2 times larger. Hannah reports that the US relied on the railway for 45% of its freight (in 1906) while the UK reported 3%, Germany 21% and

France 7%. With these input weights, the US cost advantage is not at all as large as it might seem. Two forces - higher distances and a higher reliance on railway over water transport - work to offset the unit cost advantage.[16] When calculating domestic market access as the gravity estimated GDP value divided by these freight rates, the US has the 7th highest domestic market access out of the 8 countries for which we have comparable data. Leading the US are in order: UK, Japan, Belgium, France, Italy, and Germany.

We also looked at the atheoretical measure of market potential first suggested by Harris (1954). We calculated this for our countries and found that, by this metric, the USA is only a middle-ranked country in market access. Nations in Europe located close to other rich European nations have decidedly more market access with the Harris measure. The Harris metric does not however take on board the trade-reducing impact of international borders. If borders are an important barrier to trade then the Harris measure may be heavily biased. Neither does the Harris measure take into account the price index term which can be important.

VII. Market potential and the International Distribution of Income

Before looking at the relationship between theoretically appropriate market access and relative incomes, we look at more standard measures in our sample. Table 2 relates income per capita to an export to GDP ratio and the Harris measure of market access. In column 1 we see that OLS estimates suggest that the ratio of exports to GDP is significantly related to income. This relationship disappears when using two-stage least squares in column 2. Here our instrument is the trade cost vector and its estimated coefficients from our gravity regression. There is considerable variation in income per capita while export/GDP ratios are much less variable even when the outliers of the Netherlands (very open, not so rich) and Argentina are included. After throwing out

[16] We divide the importer fixed effect given in the gravity model by the average total domestic freight rate. To obtain this freight rate, we multiply internal distance by the freight rate per ton mile. We use bilateral international ocean shipping values from Jacks and Pendakur's dataset for selected bilateral pairs and then average these across all destinations for each country to get an "average" ocean shipping freight rate per ton mile. We then use a geometric average of these values and Bogart's railway shipping rates with the weights given by the values in Table 1 of Hannah (2008). We have no systematic data on terminal charges nor for inland shipping rates.

Argentina and the Netherlands, the relationship in column 1 is even weaker which confirms the conjecture. There is a positive relationship between income and the Harris measure in our data but the coefficient is not statistically significant.

In Table 3 and in Figure 5, we explore the relationship between total market potential and GDP per capita. Here we find a positive and significant relationship. Figure 5 shows a scatter plot of the data and the OLS regression line that regresses GDP per capita on a constant and the log of market access. The elasticity of income with respect to total market potential is estimated at about 0.35 implying an elasticity of substitution of about 3 with a 95 percent confidence interval of [0.25, 5.07]. There is a 1/3 standard deviation rise in the log of income per capita (equal to 0.32) associated with a one standard deviation rise in the logarithm of market potential.

Our instrumental variables regressions provide little evidence of endogeneity problems. Our excluded instrument, the level of the summation of trade-cost weighted populations is strongly related to the log of market access as our F-tests show. In both 1900 and 1910, the coefficient on market potential falls somewhat in size and in statistical significance. However, we have tested the null hypothesis of exogeneity by including residuals from the first stage regressions in our second stage regressions and via a Hausman test. In neither case can we reject the null hypothesis of exogeneity. A final regression pools the data for 1900 and 1910 in column 5 of Table 3. Here we include country fixed effects and a year indicator for 1910. The coefficient on market access is slightly higher and it is also statistically significant suggesting that unobserved heterogeneity is not a major problem.

In Table 4 we present cross-sectional regressions that relate the logarithm of GDP per capita to the logarithm of foreign market access. This substitution may alleviate some of the access simultaneity bias inherent in total market potential. That variable includes the domestic market potential variable which is itself a function of domestic incomes. However, it does not totally alleviate this problem since foreign price indexes are a function of all countries' income shares including the domestic income share.

In any case, foreign market access is positively associated with income per capita in Table 4. Figure 6, shows an unconditional scatter of foreign market access and income per capita in 1900. There is a wide variety of outcomes. India has a foreign market access only

5% smaller than the US but an income per capita that is 16% of the US level. India is well below the regression line while the US is an outlier above it. Market access alone does not account for a significant fraction of the cross-country income distribution since the R-squared is only 0.1. Overall the evidence of a positive relationship between foreign market access and GDP per capita in this sample is weaker. OLS coefficients are positive but only significant at the 25 and 20 percent level. In our 2 stage least squares estimates, the coefficients on market potential grow in size somewhat and they are significant at the 6 percent and 11 percent level. Again we could not reject exogeneity of the market potential variable. With country fixed effects the coefficient on foreign market potential is 0.698 and it is significant at the 7 percent level. The OLS coefficient on foreign market access in 1900 suggests that a one standard deviation rise of the log of foreign market access would be associated with a rise of 0.20 standard deviation in the log of GDP per capita.

In Table 5 we present results using domestic market access. Domestic market access is positively associated with GDP per capita and it is statistically significant. Figure 7 provides an accompanying scatter plot like those above. Here our findings are more in line with those of Table 3 using total market potential. The relation between domestic market potential and GDP per capita is quite robust. In both instrumental variables specifications, and when including fixed effects, the point estimate hardly changes.

Table 6 investigates these same relationships in a panel data setting. In order to avoid compositional effects from pooling all available data we chose to use a balanced panel representing 13 countries between 1880 and 1913. We present only specifications that include country-fixed effects along with country specific time trends. We run pairs of these panel models for total, foreign and then domestic market access. The first regression in each pair does not use any excluded instrumental variables, while the second regression uses the sum of trade-cost weighted populations of trade partners.

All of the regressions in Table 6 report positive coefficients on the three market access variables. The point estimates are generally smaller than in the cross-section regressions. However, in column 2, we can see that a one standard deviation rise in the logarithm of total market access is again associated with a .2 standard deviation rise in the logarithm of GDP per capita. The instrumental variables coefficients imply an elasticity of substitution on the order of 5 (column 2 and column 6) or 10 (column 4).

Our results are also robust to excluding services and the labor force in the service sector. In unreported regressions, we calculated the share of total GDP in agriculture and industry (i.e., tradeable share) and also scaled population by the share of the labor force in each of those sectors. Additionally we also scaled GDP by the share of output in industry and the population by the share of the labor force in industry. We were unable to obtain reliable data on labor force shares for Brazil, Greece, Indonesia, and Uruguay. In both cases, the results are qualitatively similar to results when we use GDP per capita in the same sample. In fact, for agricultural and industrial output market, market potential is somewhat more statistically significant than it is when using GDP per capita. For estimated industrial output per estimated worker, the point estimates on market access are nearly identical to those when using GDP per capita but with much larger standard errors. Given the noisiness in the labor force and output share data, this is unsurprising.

VIII. Borders, Trade and Welfare: A Simulation

The econometric results show strong evidence that market potential was positively correlated with incomes prior to World War I. The drivers of market potential in our model are GDPs, trade costs, and the level of market competition (i.e., the price indexes). One branch of the literature such as Hanson (2005) has gone on to estimate the impact of a rise in one nation's or one region's GDP on all other GDPs. We follow a different path and instead ask what would have happened to consumer welfare had the trade costs arising from international borders been eliminated in a given year.

The experiment gives an indication of the benefit received by a large nation like the US from trading largely with itself. Put another way, we can now examine the impact of borders (e.g., on European nations) to see whether the observed gap in real incomes against the US could have been eliminated by abolishing international borders and granting the "same flag" to all trade partners. When borders fall, common languages, proximity, and distance are the only remaining barriers to trade in our model. All of these are obviously rough proxies for transport and information costs. At the same time, the international border is a proxy for many institutional and technical barriers to trade such as legal systems and contract enforcement, monetary regimes, health and safety requirements for products, labor standards etc. We are assuming these are all eliminated when the border disappears.

To gauge the impact on welfare of a removal of the borders, we follow Anderson and van Wincoop (2003) and Rose and van Wincoop (2001) who calculate the change in the consumer price index/multilateral resistance terms after a removal of international borders. In this model, real output is held constant. Real incomes and hence welfare change when trade costs change due terms of trade effects and changes in the price index or cost-of-living.[17]

The general equilibrium model outlined above allows one to find a solution to the change in price indexes once we solve for price changes after removal of the border barrier. We assume throughout that the elasticity of substitution is 7. Results in levels are sensitive to the assumed value of this elasticity. The magnitude of welfare gain is negatively related to this parameter. These levels however are not overly sensitive when moving from an elasticity of 5 up to 12. Still, as the elasticity of substitution rises, the welfare gain is intuitively smaller since local goods become better substitutes for foreign goods. It is obvious that imposing a unique and constant elasticity of substitution across all countries, all goods and all markets there may be a significant bias to our analysis. We therefore consider our results below as a preliminary benchmark. Finally we assume, as above that labor is immobile across borders. In the long-run any labor mobility would act to erase real income differentials. Indeed while some sigma convergence in GDP per capita and wages took place as documented by O'Rourke and Williamson (1994) and O'Rourke, Taylor and Williamson (1996) absolute convergence was not observed in this period.

Figure 8 displays our results for welfare changes in 1900 when we remove all international borders. The values on the left hand y-axis give the percentage rise in real income of the representative consumer in each country when borders are eliminated. These are compared to the ratio of Maddison's real GDP per capita figures for the US and each country. Finally, we plot the un-weighted average rise in exports for each country

[17] We refer the reader to the appendix for details.

after removal of border barriers. Since borders apparently imposed significant frictions to trade, the nations that trade most heavily with foreign countries and which are smallest are those most likely to see the largest gains in welfare. The un-weighted average rise in trade is on the order of 250%. This is much smaller than the point estimate from the gravity model which predicts an eleven-fold rise in bilateral trade. Consistent with Anderson and van Wincoop (2003), large countries see larger rises such that trade would have increased more than six-fold. Smaller countries are closer to the average or below it.

In terms of welfare gains, the smaller, centrally located economies in our sample achieve the largest gains in Figure 8. The percentage increase in welfare is just over 25 percent for countries like Belgium, Denmark and the Netherlands. The welfare gains reach 32 percent for Canada and 42 percent for Switzerland. The welfare gains are smaller for countries that are large and inwardly oriented. The US receives a rise of 4.8 percent in real income. The UK has an 8.5 percent gain. Germany sees a 7.9 percent improvement. France receives a boost to real incomes of 9.25 percent. This end of the distribution highlights that although nations like the UK, Germany, and France have welfare gains almost double that of the US, the impact of removing borders is relatively small.

In terms of income gaps against the US we find the following. About 1/7 of the real income differences between France and the US and less than 1/10 of the Germany-US gap are closed following the removal of borders. On the other hand, we see that the small nations reliant on international trade could have benefitted enormously from open access to larger markets. Belgium, the Netherlands, and Switzerland all overcome their income gaps with the US in this counterfactual. Canada and Denmark close more than 2/3 of their gaps. According to our calculations, Great Britain is still ahead of the USA in 1900. In terms of robustness, using a higher elasticity of substitution of 12 does not eliminate all of these findings. In general the welfare gains are smaller than those calculated in Figure 8 and yet Belgium, Australia, New Zealand, Switzerland and still close their real income gap. On the other hand the Netherlands fails to do so while the welfare gains are about 25 percent lower for Canada and Denmark.

The bottom line from this exercise is that market potential, while important for explaining the cross-country variation in income, does not seem to have been decisive for explaining differences in economic outcomes between the largest continental European countries and the US. When we compare income per capita between Germany or France and the US we see a gap of roughly 30 percent. But interestingly, the lack of a significant national market cannot account for this gap. In fact, these nations had a level of domestic market potential that was comparable to that of the US. Further integration, even a dramatic decline in international trade costs with the disappearance of international borders, could have raised real incomes but not enough to close these gaps. This suggests that the explanation for these gaps can be found in other forces. A list of potential explanations, which merit further study, might include differences in formal and informal institutions, financial forces, resource endowments, human capital, market structure and firm-level organization.

Our counterfactuals suggest that other forces besides market integration account for the income gap between the US and the continental leaders. At the very least, the static gains from trade, cannot account for such large gaps. There may also be limits to the gains from domestic market access perhaps due to congestion. In Britain, despite its density, income per capita was not commensurately higher than in the US where comparatively large distances had to be overcome. Marshall (1920) noted that space and congestion constraints were a problem in England near the turn of the 20th century whilst in the US company towns and inexpensive transportation allowed for greater dispersion with no negative impact on productivity.

On the other hand, a dramatic difference in results is available for small countries. For a nation like Canada, our data show a difference in per capita income against the USA (or the UK) of 37 percent. Our experiment shows that a significant proportion of this gap may have been due to the handicap its southern border imposed. In Europe, the Netherlands, Belgium and Switzerland also suffered in a similar way. In terms of where we started, it would appear correct to conclude that the European nations lay close together and they did in fact establish a dense and efficient system of transportation infrastructure. These forces may have allowed them to reap the advantages of scale production and proximity despite the ubiquitous borders. But this was not sufficient to overcome their income gap with the US. It must have been the case for the small open economies that borders mattered.

It is also enticing to run a further experiment that looks more closely at the limits of European integration. Here we imagine a world where borders fall--but only for the European countries in our sample. Essentially we impose the "single market" in 1900. Figure 9 shows the results. This figure reveals similar magnitudes of welfare gains as in Figure 8 for countries within Europe. When we aggregate across all European countries, the welfare gain is 16.35 percent compared to a gap in total real GDP per capita of 52 percent. Approximately one-third of the gap between "European" and American incomes could have been closed by integrating the continent.

Clearly, France and Germany are driving this result down towards zero. Had the gains for these two nations been larger, the counterfactual gap would be much smaller. It appears that the high level of pre-existing domestic integration in these two nations offset the large negative impact of international borders. Anderson and van Wincoop (2003) showed that a fall in the border between the US and Canada mattered little for US welfare in their counterfactual experiments. The bottom line has to be that France and Germany very likely failed to squeeze as much income out of their ostensibly significant domestic markets as the US did. The logic, however, does not translate directly to other smaller countries which still appear to have been stifled by international borders.

IX. Conclusion and Discussion

Our exploration of market size in the nineteenth century has made the following points. First, US total market access was not exceptional when compared to the largest European economies. The American internal market might have been free of Zollen and Douanes, and it might not have suffered from the bad case of Zersplitterung evident in Europe, but still, distance was not dead in the USA.

Second, market potential can play a significant role in explaining the cross-country distribution of income in the first period of globalization. The literature has provided very mixed evidence on whether tariffs and trade openness were important for explaining growth and income differences in the nineteenth century (as opposed to convergence). Indeed, Clemens and Williamson (2004) argue that GDP growth of a country's main trade partner was not a significant determinant of domestic growth. However, the market access literature gives at least two reasons why this might be a mis-leading experiment and other forces might influence this finding. If international trade costs (relative to domestic trade costs) rose as nations grew richer over time, this could easily offset the gains from foreign growth. Moreover, the higher the elasticity of substitution the smaller the rises in trade costs would have to be to offset such growth. Alternatively, if price indexes were falling (i.e., markets became more competitive) as trading partners grew, then exports to foreign countries and hence domestic incomes might not rise due to expanded foreign market access. The CES demand system highlights these pro-competitive effects. We propose a theoretically sound measure of market exposure and find it to be strongly positively correlated with income per capita both in the cross-section and in a panel data model.

Third, we find a strong relationship between domestic market size the level of GDP per capita. This might be interpreted as an argument for tariffs or other forms of protection, which should in theory raise demand for local output. Our model, our data, and the historical record give many reasons why this might not lead to overall welfare gains. First, protectionism drives up the price index and the cost of living for consumers. Tariffs also raise the cost of intermediates which shrinks demand for output and causes firms to pay lower wages. Our data show a negative relationship between domestic market potential and the nominal level of protection. Price indexes, which we have calculated separately, are positively related to the level of tariffs (tariff revenue divided by imports) suggesting that tariffs might have had negative welfare effects on the countries that chose to impose them.[18]

Finally, we provide an assessment of the cost of "small" markets at a crucial stage in economic development. By eliminating the iceberg trade costs, which represent pure deadweight loss due to the shipping of goods across space, nations could have gained significantly. In Europe, our simulated model suggests that the largest nations would have seen welfare gains of about 8 percent with the removal of their "troublesome" borders. On the other hand, smaller nations could have significantly closed their income gaps against the US had they been lucky enough to become part of larger "free-trade" federations like the US or even a European Union. Openness matters, but the impact depends strongly on the country in question.

[18] The positive relationship holds unconditionally but also when we control for population, land area, human capital and the tropical indicator. Any rise in tariff revenue would reduce welfare losses.

We note that the removal of the border is not the economic equivalent of simply lowering a uniform tariff of 40 to 50 percent to zero. Evidence from the 19th century suggests that tariffs of this magnitude imposed welfare losses on the order of 1-2%.[19] In general, tariffs generate producer surplus and tariff revenue. In a world of differentiated products, tariffs might even raise consumer surplus. Whatever the case, our estimated border effect, assuming unbiasedness and consistency, encompasses non-tariff barriers, institutional and cultural frictions, and myriad other unquantifiable trade costs suggested in the vast literature on these issues. In our model, these frictions, if taken literally, impede other, welfare-improving allocations of consumption. More elaborate models could derive gains from other margins of adjustment.

Finally, we conclude by considering a reality check. We have proposed a general equilibrium model and estimated one equilibrium structural relationship that this model provides. While scale economies are not necessary for our conclusions, complete specialization is. Other trade models could justify our findings. Admittedly, and closely related to this point, we have not tested against an alternative model.

Implicitly, our research assumes the production process was somewhat close to the abstractions of modern theories. Still, new economic geography, canonical Heckscher-Ohlin-Vanek models based on factor-endowment-driven trade, and Ricardian models of comparative advantage all predict welfare gains due to rising terms of trade which is where our evidence lies (Arkolakis, Costinot, and Rodriguez-Clare, 2012). To sort out the underlying driving forces for our results, one would need to look at the dynamics of location of economic activity and relative factor prices which we ignore at this stage. Still, the answer to these questions will provide new empirical evidence which dials into the still smoldering controversy on trade, tariffs, and growth in the 19th century.

One interesting avenue for research would be to consider the extensive margin-or opening up trade between countries that do not previously trade. In a world with fixed market entry costs, the welfare gains are different from those in our set-up. Many countries in our sample, especially the more remote and less developed countries, see smaller gains in our exercise because the number of trade partners is low and does not increase.

[19] Irwin (2010) and Federico and Vasta (2013)

We also try to deal with institutions and geography, but no interaction between the two is allowed.[20] Further work on assessing the precise channels by which market potential affected incentives in industry and how it mattered for consumers in the late nineteenth century is a remaining challenge. Ziebarth (2013) provides evidence from the 19th century United States that transportation improvements reduced 'misallocation'. Again, an interesting line of research shows that there are significant gains available from linking up with *new* trade partners and in extending the range and variety of goods. Work by Hersh and Voth (2010) on these issues shows this is likely to be important in the past. Furthermore, the gains from trade that we highlight are entirely static. Investment decisions, research and development, and total factor productivity growth are almost surely related to market size. More research certainly remains to be done when considering the interactions between the standard of living and international integration in the 19th century.

[20] Keller and Shiue (2013) present evidence from Germany in the late 19th century showing that institutions improved trade.

References:

Abramovitz, Moses and David, Paul A. 2006. "Convergence and Deferred Catch-up: Productivity Leadership and the Waning of American Exceptionalism," in Ralph Landau, Timothy Taylor, and Gavin Wright, eds., *The mosaic of economic growth.* Stanford, CA: Stanford University Press, 1996, pp. 21 -62.

Anderson, James E. & van Wincoop, E. 2001. "Borders, Trace, and Welfare." Charles Engel and Caroline Freund eds. *Brookings Trade Forum.* 207-243.

Arkolakis, C., Costinot, A. and Rodriguez-Clare, A. (2012) "New Trade Models Same Old Gains?" *American Economic Review*, 102 (1), 94-130.

Annuaire Statistique de la Suisse. 1891, 1900 and 1910.

Annual return of the foreign trade of the Empire of Japan, 1900, 1910. Tokyo

Anuario de la Dirección General de Estadística. Buenos Aires, various years. Dirección General de Estadística,

Annuario Estatistico do Brasil (various years).

Annuario Estatistico do Portugal. 1900 Lisbon.

Anuario Estatistico de España. (various years). Madrid.

Anuario estadístico de la República Oriental del Uruguay. (various years) Montevideo.

Arkolakis, C., Costinot, A., Rodríguez, Clare, A. 2012. "New Trade Models, Same Old Gains?" *American Economic Review* 102 (1) pp. 94-130.

Anderson, J.E., and van Wincoop, E 2003. Gravity with Gravitas: A solution to the Border Effect. *American Economic Review*, 93 (1), 70-192.

Anderson, J. E., & van Wincoop, E. 2004. Trade Costs. *Journal of Economic Literature, 42*, 691-751.

Der Auswärtige Handel Deutschlands. various years.

Barbieri, K. 2005. The Liberal Illusion: Does Trade Promote Peace? Ann Arbor: University of Michigan Press. (1996).

Bairoch, P. 1972. “Free trade and European economic development in the 19th century.” *European Economic Review*, vol. 3, (3), 211-45.

Bértola, Luis, Leonardo Calicchio, María Magdalena Camou, and Laura Rivero. 1998. El PBI uruguayo 1870-1936 y otras estimaciones. Facultad de Ciencias Sociales, Programa de Historia Económica y Social.

Bureau of Insular Affairs, War Department. 1911. *Quarterly Summary of Commerce of the Philippine Islands*. Government Printing Office, Washington.

Bogart, D. 2010. “A Global Perspective on Railway Inefficiency and the Rise of State Ownership, 1880-1912” *Explorations in Economic History* 47. 158-178.

Bohlin, Jan 2007. “Structural Change in the Swedish economy in the late nineteenth and early twentieth century– The role of import substitution and export demand” Goteborg Working papers in Economic History, no. 8.

Bulletin mensuel de statistique du commerce extérieur. Athens (various years).

Bureau of Railway Statistics. 1911. Comparative railway Statistics of the United States, The United Kingdom, France and Germany. Bulletin no. 24 Government Printing Office: Washington DC.

Carnegie, Andrew. 1902. A Rectorial Address Delivered to the Students in the University of St. Andrews Rectorial.

Carreras, A. 1989. Estadísticas Históricas de España Siglos XIX and XX. Fundacion Banco Exterior, Madrid.

Clemens, Michael A. and Williamson, J.G. 2004. “Wealth Bias in the First Global Capital Market Boom, 1870-1913,” *Economic Journal*, 114 (April), 304-337

Clemens, Michael A. and Williamson, J.G. 2004. “Why Did The Tariff-Growth Correlation Change After 1950?" *Journal of Economic Growth*, 9 (1), 5-46.

Contador, Claudio and Haddad, C. 1975. "Produto Real, Moeda e Preços: A Experiência Brasileira no Período 1861-1970." in *Revista Brasileira de Estatística* 36-143: 407-440.

Costinot, A. and Rodríguez-Clare, A. 2013. "Trade Theory with Numbers: Quantifying the Consequences of Globalization" NBER working paper 18896.

Klein, Alexander and Crafts, N.F.R. 2011. "Making Sense of the Manufacturing Belt: Determinants of U.S. Industrial Location, 1880-1920" Journal of Economic Geography. 12 775-807.

Crafts, N. and Mulatu, A. 2006 "How did the location of industry respond to falling transport costs in Britain before World War I?" Journal of Economic History 66. 575-607.

Donaldson, Dave. 2010 "Railroads of the Raj: Estimating the Impact of Transportation Infrastructure" NBER working paper 16487.

della Paolera, Taylor, A.M, Bózzoli, C.G. 2003. Historical Statistics in della, Paolera, G., Taylor A.M. (2003) editors, *A New Economic History of Argentina.* New York: Cambridge University Press.

Federico, G. 2004. "The growth of world agricultural production 1800-1938" *Research economic history.* 22 pp.125-181

Federico, G. 2012. "Le statistiche del commercio estero italiano, 1863-1939" Banca d'Italia.

Federico, G. and Vasta, M. 2013. "Italian Trade Policy: 1850-1938" Mimeo European University Institute.

Fenoaltea, S. 2005. The growth of the Italian economy, 1861-1913: Preliminary second-generation estimates. *European Review of Economic History* 9, pp. 273-312.

Feenstra, R.C. 2010. *Product Variety and the Gains from International Trade.* MIT Press, Cambridge.

Goldsmith, R. 1991. Brasil 1850-1984: Desenvolvimento Financeiro sob um Seculo de Inacão. Harper and Row, São Paulo.

Greasley, David, and Les Oxley. 2008. "Re-inventing New Zealand: Institutions Output and Patents 1870-1939." Mimeo University of Canterbury.

Grytten, O.H. 2004. The gross domestic product for Norway 1830-2003., Chapter 6 in Eitrheim, Ø., J.T. Klovland and J.F. Qvigstad (eds.),Historical Monetary Statistics for Norway 1819-2003, Norges Bank Occasional Papers no. 35, 241-288.

Fujita, M., Krugman, P., Venables, A.J., 1999. *The Spatial Economy: Cities, Regions, and International Trade*. MIT Press, Cambridge, MA.

Handelsstatistiek Nederlandsch-Indië 1874-1937. 1939. Mededeelingen van het Centraal Kantoor voor de Statistiek No.161. Batavia: CKS.

Hannah, L. (2008) "Logistics, Market Size and Giant Plants in the Early Twentieth Century: A Global View" *Journal of Economic History*. 68 (1), 46-79.

Hanson, G., 2005. Market potential, increasing returns and geographic concentration. Journal of International Economics 67 (1) pp. 1-24.

Head, K. 1994. "Infant Industry Protection in the Steel Rail Industry." *Journal of International Economics*. Vol. 37. 141-165.

Head, K. and Mayer, T. 2004. Market Potential and the Location of Japanese Investment in the European Union Journal of International Economics. 86 (4), 959-972.

Head, K. and Mayer, T. 2010. "Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade," in Brakman, Steven and Peter van Bergeijk eds. *The Gravity Model in International Trade: Advances and Applications* , Cambridge University Press, 2010.

Head, K. and Mayer, T. 2011. "Gravity, market potential and economic development" Journal of Economic Geography. 11 (2), 281-294.

Helpman, E. 1998. "The Size of Regions." In D. Pines, E. Sadka, and I. Zilcha, eds., *Topics in PublicEconomics*. Cambridge: Cambridge University Press, 33-54.

Helpman, E. Melitz, M, Rubinstein, Y. 2008. Estimating Trade Flows: Trading Partners and Trading Volumes. *Quarterly Journal of Economics* 123 (2), 441-487.

Hersh, J. & Voth, H.J. 2009. Sweet diversity: colonial goods and the rise of European living standards after 1492. C.E.P.R. Discussion Paper 7386.

Horlings, E and Smits, J.P. 1997. A Comparison of the Pattern of Growth and Structural Change in the Netherlands and Belgium, 1800-1913. Jahrbuch für Wirtschaftsgeschichte 2 89-106.

Irwin. D.A. 2000. "Did Late Nineteenth Century Tariffs Promote Infant Industries? Evidence from the Tinplate Industry." *Journal of Economic History.* 60 (2). 335-360.

Irwin, D. A. 2002. "Interpreting the tariff-growth correlation of the late nineteenth century." *American Economic Review* 92 (2), 165-169.

Irwin, D. A., & Tervio, M. 2002. Does trade raise income?: Evidence from the twentieth century. *Journal of International Economics , 58* (1), 1-18.

Irwin, Douglas A. 2010. "Trade Restrictiveness and Deadweight Losses from US Tariffs." American Economic Journal: Economic Policy 2 (3). 111-133.

Jacks, D. 2006. "New Results on the Tariff-Growth Paradox." *European Review of Economic History* 10(2), 2006: 205-230.

Jacks, D. S., Meissner, C. M., & Novy, D. (2010) "Trade Costs in the First Wave of Globalization" *Explorations in Economic History* vol. 47 (2) pp. 127-141.

Jacks, D. S., Meissner, C. M., & Novy, D. (2011). "Trade Booms, Trade Busts and Trade Costs" *Journal of International Economics* vol. 83 (2), pp. 185-201.

Jacks, D.S. and Pendakur, K. (2010). Global Trade and the Maritime Transport Revolution. Review of Economics and Statistics 92 (4) 745-755.

Jaarcijfers voor het Koninkrijk der Nederlanden. (various years).

Johnston, L. and Williamson, S.H., "What Was the U.S. GDP Then?" Measuring Worth, 2011._ http://www.measuringworth.org/usgdp/.

Jones, M.T. Obstfeld, M. 2001. Saving, Investment, and Gold: A Reassessment of Historical Current Account Data. from Money, Capital Mobility, and Trade: Essays in Honor of Robert Mundell, edited by Guillermo A. Calvo, Rudi Dornbusch, and Maurice Obstfeld. Pp. 303- 363. Cambridge, MA: MIT Press.

Keller, W. and Shiue, C. 2013. "The Link Between Fundamentals and Proximate Factors in Development" NBER working paper 18808.

Kim, S. 2005. “Expansion of Markets and the Geographic Distribution of Economic Activities:The Trends in U.S. Regional Manufacturing Structure, 1860-1987.” 110 (4) *Quarterly Journal of Economics*. 881-908.

Kostelenos, G. C. 1995. Money and Output in Modern Greece: 1858-1938. Center of Planning and Economic Research, Athens.

Krantz, O. & Schön, L. 2007. Swedish Historical National Accounts 1800-2000. Lund: Lund Studies in Economic History.

Krugman, Paul (1980) “Scale Economics, Product Differentiation, and the Pattern of Trade” American Economic Review, 70, 950-959.

Komlos, J. 1987. Financial Innovation and the Demand for Money in Austria-Hungary, 1867-1913. *Journal of European Economic History*, 16(3), 587605.

Kostelenos, G. C. (1995): Money and Output in Modern Greece: 1858-1938. Center of Planning and Economic Research, Athens.

Lains, P. 2007. “Growth in a Protected Environment: Portugal, 1850-1950” research in Economic History, vol. 24, pp. 121-163.

Lehmann, S. and O’Rourke, K.H. 2011. “The Structure of Protection and Growth in the Late Nineteenth Century” *Review of Economics and Statistics.*

Maddison, A. 1991. *Dynamic Forces in Capitalist Development: A Long-Run Comparative View.* Oxford University Press, Oxford.

Maddison, Angus. 2003. *The World Economy: Historical Statistics.* Paris: Organization for Economic Cooperation and Development.

Malanima, P. 2002. *L’economia italiana delle crescita medievale alla crescita Contemporanea.* Mulino: Bologna.

Marshall, Alfred 1920. *Industry and Trade.* Macmillan and co.: London.

Meissner, C.M and López-Córdova, J.E. 2003. “Exchange Rate Regimes and International Trade: Evidence from the Classical Gold Standard Era, 1870-1913” *American Economic Review* vol. 93 (1) March, 344-353.

Mitchell, B.R. (2007a) International Historical Statistics, volume 1: Africa, Asia and Oceania 1750-2005, 5th ed. Palgrave Macmillan, London.

Mitchell, B.R. (2007b) International Historical Statistics, volume 2: Europe 1750-2005, 6th ed. Palgrave Macmillan, London.

Mitchell, B.R. (2007c) International Historical Statistics, volume 3: The Americas 1750-2005, 6th ed. Palgrave Macmillan, London.

Mitchener, K. J., McLean, I. W. 2003. "The productivity of US states since 1880" *Journal of Economic Growth*, 8 (1), 73-114.

Morrisson, C. and Murtin, F. 2009. "The Century of Education" *Journal of Human Capital*, 3(1) 1-42.

New Zealand Official Yearbook 1913. Wellington.

Ohkawa, K., Takamatsu, N., and Yamamoto, Y. 1974. National Income Vol. 1 in (eds). Ohkawa, K., Shinohara, M., and Umemura, M. *Estimates of Long-Term Economic Statistics of Japan Since 1868.* Tokyo: Toyo Keizai Shinposha.

O'Rourke, Kevin H., Alan M. Taylor, and Jeffrey G. Williamson. 1996. "Factor Price Convergence in the Late Nineteenth Century." *International Economic Review* 37 499-530.

O'Rourke, K.H. and Williamson, J.G. 1994. "Late Nineteenth-Century Anglo-American Factor-Price Convergence: Were Heckscher and Ohlin Right?". *Journal of Economic History*. 54 (4), 892-916.

O'Rourke, K. H. 2000. Tariffs and Growth in the Late 19th Century. *Economic Journal, 110*, 456-483.

Österreichisches statistisches Handbuch für die im Reichsrathe vertretenen Königreiche und Länder. Various years

Platt, DCM 1971. "Problems in the Interpretation of Foreign Trade Statistics before 1914" Journal of Latin American Statistics 3 (2), 119-130.

Prados de la Escosura, L. 2003. El Progreso Económico de España 1850-2000 Bilbao: Fundación BBVA.Rankin, K. 1992. New Zealand's Gross National Product, 1859-1939. *Review of Income and Wealth* vol. 1 series 38 pp. 49-69.

Romer, Paul 1996. “Why, Indeed, in America? Theory, History, and the Origins of Modern Economic Growth”*American Economic Review*, 86 (2) pp. 202-206

Rose, A. and van Wincoop, E 2001. National Money as a Barrier to International Trade: The Real Case for Currency Union. American Economic Review Papers and Proceedings 91 (2), 386-390.

Redding, S. and Venables, A. 2004. “Economic Geography and International Inequality” *Journal of International Economics*. 62, pp. 53-82.

Ritzmann-Blickenstorfer, H. 1996. *Historical Statistics of Switzerland*. Chronos Verlag: Zürich.

Rosenberg, Nathan. 1963. “Technological Change in the Machine Tool Industry, 1840-1910.” *Journal of Economic History,* December 23(4), pp. 414-43; reprinted in *Perspectives on technology.* Armonk, NY: Sharpe, 1976, pp. 9-31.

Rosenberg, N. 1981. "Why in America?" in Otto Mayr and Robert C. Post, eds., *Yankee enterprise, the rise of the American system of manufactures.* Washington, DC: Smithsonian Institution Press,

Rosés, Juan. 2003. “Why Isn’t the Whole of Spain Industrialized? New Economic Geography and Early Industrialization, 1797-1910.” Journal of Economic History. 63 (4) 995-1022.

Sammendrag af statistiske Oplysninger. Copenhagen. (various years).

Santos-Silva, JMC and Tenreyro, S. 2006. “The Log of Gravity” *Review of Economics and Statistics* 88 (4), 641-658.

Schularick, M. and Solomou, S. 2011. “Trade and Growth: Historical Evidence” *Journal of Economic Growth.* 16 (1), 33-70.

Schulze, M. 2000. “Patterns of growth and stagnation in the late nineteenth century Habsburg economy” *European Review of Economic History*. 4. 311-340.

Schulze, M 2007. “Regional Income Dispersion and Market Potential in the Late Nineteenth Century Hapsburg Empire” LSE WP 106/07.

Sivasubramonian, S. 2000. The National Income of India in the Twentieth Century. Oxford: Oxford University Press. 2000.

Smits, Jan-Pieter, Horlings, Edwin, and van Zanden, Jan Luiten 2000. "Dutch GNP and Its Components, 1800-1913" Gronigen Growth and Development Center Monograph series no. 5.

Smits, J.P., Woltjer, P.J. and Ma, D. 2009. "A Dataset on Comparative Historical National Accounts, ca. 1870-1950: A Time-Series Perspective" Groningen Growth and Development Centre Research Memorandum GD-107, Groningen: University of Groningen.

Summerhill, W. 1997. "Transport Improvements and Economic Growth in Brazil and Mexico" in Haber, S. Ed. *How Latin American Fell Behind: Essays on the economic histories of Brazil and Mexico*, 1800-1914 pp. 93-117 Palo Alto: Stanford University Press.

Statistical Abstract for the Several British, Colonies, Possessions, and Protectorates (various years).

Statistical Abstract for the United Kingdom. (various years). London.

Statistisk aarbog for Kongeriket Norge udgivet af det Statistiske centralbureau. (various years).

Sokoloff, Kenneth L. "Inventive Activity in Early Industrial America: Evidence from Patent Records." *Journal of Economic History* December 1988,48(4), pp. 813-50.

Sveriges Statistisk Tidskrift. (Various years) Stockholm.

Tableau annuel du commerce avec les pays étrangers. Ministère des Finances. (Bruxelles, various years).

Tena-Junguito A. 2010. "Bairoch revisited: tariff structure and growth in the late nineteenth century" European Review of Economic History 14, 111-143.

Thomas, Mark. 1984. "An Input-Output Approach to the British Economy, 1890-1914", D. Phil. Thesis, University of Oxford, Oxford, UK.

Toutain, J.C. 1987. Le produit interieur brut de la France de 1789 á 1982. Économies et Société Grenobles.

Urquhart, M.C. et. al. 1993. Gross National Product, Canada, 1870-1926, the Derivation of the Estimates. Kingston and Montreal, McGill-Queen's University Press.

Vamvakidis, A. 2002. How Robust is the Growth-Openness Connection? Historical Evidence. *Journal of Economic Growth , 7*, 57-80.

Van der Eng, P. 2010. The Sources of Long-Term Economic Growth in Indonesia, 1880-2008. Explorations in Economic History. 47. 249-309.

Whitney, W.G., 1968. "The Structure of the American Economy in the Late Nineteenth Century" PhD Dissertation. Harvard University, Cambridge, MA.

Wolf, N. 2009. "Was Germany Ever United? Evidence from Intra- and International Trade, 1885-1993" Journal of Economic History. 69 (3). 846-881.

Ziebarth, N. L. 2013. Are China and India backward? Evidence from the 19th century US census of manufactures. *Review of Economic Dynamics*. 16. 86-99.

Appendix I Welfare Calculation from a Structural Model of International Trade

Here we describe how we calculate the welfare gains from removing international borders in Figure 8 and Figure 9. We follow closely the approach taken in Anderson and van Wincoop (2003). Our results are consistent with the "exact hat algebra" approaches outlined in Costinot and Rodríguez-Clare (2013).

We first run our gravity regression to estimate the trade cost vector,

$$(\widehat{\mathrm{t}_{\mathrm{sd}}})^{1-\sigma} = (dist_{sd})^{\widehat{\delta_1}}\left(\widehat{\delta_2}\right)^{\gamma_{sd}^{B}}\left(\widehat{\delta_3}\right)^{\gamma_{sd}^{L}}\left(\widehat{\delta_4}\right)^{\gamma_{sd}^{V}}$$

Next, we solve for the equilibrium prices, $(p_s)^{1-\sigma}$, from the market clearing conditions, equation(8), in Anderson and van Wincoop(2003):

$$\theta_s = (p_s)^{1-\sigma}\sum_d (t_{sd}/P_d)^{1-\sigma}\theta_d$$

Where θ_s is the share of country i income in world (i.e., sample) income. From the normalization, $\Pi_s = P_s$, we have

$$\theta_s = (p_s)^{1-\sigma}{\Pi_s}^{1-\sigma} = (p_i)^{1-\sigma}{P_s}^{1-\sigma} = (p_s)^{1-\sigma}\sum_d (p_d t_{sd})^{1-\sigma}$$

where we plug in the definition

$${P_s}^{1-\sigma} = \sum_d (p_d t_{sd})^{1-\sigma}$$

Welfare (*Welf*) for country s is defined as

$$Welf_s = GDP_s/P_s$$

For our simulation, where borders are removed all over the world, we set γ_{sd}^{B}=0 so that the counterfactual trade cost vector is given by

$$(\widehat{t_{sd}}^{W})^{1-\sigma} = (dist_{sd})^{\widehat{\delta_1}}\left(\widehat{\delta_3}\right)^{\gamma_{sd}^{L}}\left(\widehat{\delta_4}\right)^{\gamma_{sd}^{V}}.$$

We then solve for the new equilibrium prices (and price indexes) assuming that physical output is constant. All of our calculations assume an elasticity of substitution of 7. The exact level of welfare changes is sensitive to this assumption although the qualitative results hold for reasonable changes in this parameter.

Appendix II: Data Appendix

Bilateral trade data: Data underlying Jacks Meissner and Novy (2011) were used initially and sources are reported there and in Jacks, Meissner and Novy (2010). To their 298 observations in 1900 and 1910 we added more than 300 observations in each of those years from the sources listed below.

We first relied on two data bases on bilateral nineteenth century trade: Barbieri (1996) and López-Córdova and Meissner (2003).

Further data are from specific country sources as follows:

ARGENTINA	Anuario de la Dirección General de Estadística
AUSTRIA-HUNGARY	Österreichisches statistisches Handbuch für die im Reichsrathe vertretenen Königreiche und Länder:
AUSTRALIA	Statistical Abstract for the Several British, Colonies, Possessions, and Protectorates
BELGIUM	Ministère des Finances, Tableau annuel du commerce avec les pays étrangers (Bruxelles, various years).
BRAZIL	Annuario Estatistico do Brasil
CANADA	Statistical Abstract for the Several British, Colonies, Possessions, and Protectorates; Canada Year Book (various issues)
DENMARK	Sammendrag af statistiske Oplysninger
GERMANY	Der Auswärtige Handel Deutschlands
GREECE	Mēniaion deltion statistikēs exōterikou emporiou. Bulletin mensuel de statistique du commerce extérieur.
INDIA	Statistical Abstract for the Several British, Colonies, Possessions, and Protectorates
INDONESIA	CKS 161 (1939) Handelsstatistiek Nederlandsch-Indië 1874-1937. Mededeelingen van het Centraal Kantoor voor de Statistiek No.161. Batavia: CKS.
ITALY	Federico, Giovanni "Le statistiche del commercio estero italiano, 1863-1939" Banca d'Italia
JAPAN	Annual return of the foreign trade of the Empire of Japan, 1900, 1910
NETHERLANDS	Jaarcijfers voor het Koninkrijk der Nederlanden Annuaire statistique des Pays-Bas
NEW ZEALAND	Statistical Abstract for the Several British, Colonies, Possessions, and Protectorates

NORWAY	Statistisk aarbog for Kongeriket Norge udgivet af det Statistiske centralbureau
PHILIPPINES	Census of the Philippines 1903. US government printing office. Washington, DC. and Quarterly Summary of Commerce of the Philippine Islands 1911.
PORTUGAL	Annuario Estatistico 1900
SPAIN	Anuario Estatistico
SRI LANKA	Statistical Abstract for the Several British, Colonies, Possessions, and Protectorates
SWEDEN	Sveriges Statistisk Tidskrift
SWITZERLAND	Annuarie Statistique: 1891 (used for data for 1890), 1900 and 1910
UK	Statistical Abstract for the United Kingdom
URUGUAY	Anuario estadístico de la República Oriental del Uruguay

GDP and Population Data: For the figures presenting our welfare calculations we rely on Maddison (2003). For Austria-Hungary we use GDP and population data for Austria, Hungary, and Czechoslovakia. Population figures are from Clemens and Williamson (2004) unless noted below. In our regressions from Tables 2-6 we rely on nominal GDP per capita converted to US dollars at the annual average exchange rate. Sources for GDP and population are as follows:

ARGENTINA	GDP: Della Paolera, Taylor, Bózzoli (2003)
AUSTRIA-HUNGARY	GDP: Schulze (2000); price deflator from Maddison (1991)
AUSTRALIA	GDP: Jones and Obstfeld (2001)
BELGIUM	GDP: Maddison (1991)
BRAZIL	GDP: Contador and Haddad; POP: Contador and Haddad Data kindly shared by Aldo Musacchio.
CANADA	GDP & POP: Jones and Obstfeld (2001)
DENMARK	GDP: Obstfeld Jones (2001)
FRANCE	GDP: Toutain (1987) posted online by Smits, Woltjer and Ma (2009)
GERMANY	GDP: Jones and Obstfeld
GREECE	GDP: Kostelenos (1995)
INDIA	GDP: Sivasubramonian (2000); posted online by Smits, Woltjer, and Ma (2009)
INDONESIA	GDP and POP: Data underlying Van der Eng (2010)
ITALY	GDP: Fenoaltea (2005) Prices used to deflate are from: Malinima “Prices and Wages in

	Italy, 1270-1913
JAPAN	GDP: Ohkawa, Takamatsu, and Yamamoto (1974);
MEXICO	GDP: Summerhill (1997)
NETHERLANDS	GDP: Smits, Horlings, and van Zanden 2000. Posted online by Smits, Woltjer, and Ma (2009); POP: Maddison (2005)
NEW ZEALAND	GDP: Rankin (1992)
NORWAY	GDP & POP: Grytten (2004) Norges Bank: http://www.norges-bank.no/pages/77409/p1_c6_table_5.htm
PORTUGAL	GDP: Lains (2007)
SPAIN	GDP: Posted online by Smits, Woltjer, and Ma (2009). Original data are from Prados de la Escosura (2003).
SWEDEN	GDP: Krantz and Schön (2007); posted online by Smits, Woltjer, and Ma (2009)
SWITZERLAND	GDP: Ritzmann-Blickenstorfer (1996) (Net national product).
UK	GDP: Jones and Obstfeld (2001)
URUGUAY	GDP: Maddison (2003) deflated to current USD with US CPI
USA	GDP: Johnston and Williamson (2011)

Gross Production Data:

We have attempted to find the ratio of gross value of production to value added for 1910 or for years as close as possible to 1910 if data for 1910 were not available. With this ratio we are able to "re-flate" aggregate GDP figures, a value-added concept, to obtain the theoretically more appropriate value of total expenditure instead of aggregate value added expenditure.

Federico (2004) reports gross value to value added (GV/VA) ratios for agriculture. We used his benchmark figures for 1913 for all years for which we run a gravity model. We rely on these wherever possible and unless otherwise noted. We then use these figures with the appropriately re-scaled shares in GDP of agriculture and non-agricultural output to obtain a weighted average of the ratio of gross output to value added. Shares of agriculture in GDP are largely from Mitchell (2007a, 2007b, 2007c) unless otherwise noted below.

The ratio of gross output to value-added in the non-agricultural sector is not available for all of our countries. However, detailed input-output tables for the US in 1899 (Whitney, 1968), UK in 1907 (Thomas, 1984) and Sweden 1913 (Bohlin, 2007) suggest that the weighted average ratio of gross output to value added is roughly 2 across all three countries. The weights correspond to industry weights in gross output. For the US, the exact value is 2.06; for the UK the value is 2.31, and for Sweden it is 2.08.

Data on industrial output and the value of intermediates is available for New Zealand from an industrial census in 1911. Schulze (2000) reports value-added ratios for various industries, and we rely on these for Austria taking an un-weighted average of the reported figures. Canada also has good estimates of gross production due to Urquhart (1993). When country specialists reported gross/value added ratios, we used these as detailed below. In the absence of the preceding types of data for industrial and service output we assumed a ratio of 2.

Sources for output shares, gross production and value added are as follows:

ARGENTINA	GV/VA 1910 is the weighted average of the ratio in industry and non-industry. We use a ratio of 2 for industry. The sectoral weights are from Mitchell (2007c).
AUSTRIA-HUNGARY	Data are from Schulze (2000). We used his value-added ratios for several sectors (mining, tobacco, iron and steel-smelting, iron and steel-refining, transport engineering,
AUSTRALIA	GV/VA for agriculture from Federico. Share of agriculture output from Mitchell (2007a). We use a ratio of 2 for industry.
BELGIUM	Gross output to value added in agriculture is from Federico. We use a ratio of 2 for industry. We use a ratio of 1.1 for services. Shares for industry, agriculture and services are from Horlings and Smits (1997).
BRAZIL	Data on GV/VA for agriculture are from Federico for the year 1963. We also use a share of value added for industry of 49.6% taken from Goldsmith (1991).
CANADA	All data from Urquhart (1993) who reported gross values of output and GDP/Value added by industry and sector.
DENMARK	GV/VA from Federico for agriculture. We use a ratio of 2 for industry. Output shares from Mitchell (2007b).
FRANCE	GV/VA from Federico for agriculture. We use a ratio of 2 for industry. Output shares from Mitchell (2007b).
GERMANY	GV/VA from Federico. We use a ratio of 2 for industry. Output shares from Mitchell (2007).
GREECE	Share of agriculture in GDP as of 1910 is from Kostelenos (1995). We rely on Federico for the GV/VA ratio.
INDIA	GV/VA from Federico. Output shares from Mitchell (2007).
INDONESIA	GV/VA from Federico. We use a ratio of 2 for industry. Agriculture's share of GDP is from Van der Eng (1992).

ITALY	Federico reports a ratio for agriculture for 1910. We use a ratio of 2 for industry. The share of industry in value added is 44% in 1910 (Mitchell, 2007b).
JAPAN	Federico reports a ratio for agriculture for 1913. Share of agriculture from Mitchell (2007b).
MEXICO	No data in Federico. We use a ratio of 1.1 for GV/VA for agriculture. Share of agriculture from Mitchell (2007). We use a ratio of two for industry.
NETHERLANDS	Ratio of gross value to value added from Federico. Data on share of agriculture in value added from Smits, Horling, and van Zanden (2000).
NEW ZEALAND	Ratio of 1.1 is used for agriculture. A gross output ratio of 6.06 is used for industry. Data are from the Official Yearbook of New Zealand of 1913 and are based on a census of manufactures from 1911. The share of agriculture in value added is given in Greasley and Oxley (2008).
NORWAY	Ratio of 1.1 is used for agriculture. Share of agriculture is from Mitchell (2007b).
PORTUGAL	GV/VA in agriculture from Federico. We used a ratio of 2 for industry.
SPAIN	GV/VA from Federico. Agricultural share of GDP from Carreras (1989). We use a ratio of 2 for the non-agricultural portion of gross production.
SRI LANKA	No data were available for GV/VA. We use a share of 1.1 as in India. The share of agriculture in GDP is estimated at 60% as in India.
SWEDEN	Data are from Bohlin (2007) who presents an input-output table for 1913.
SWITZERLAND	We use a value of 2 in the absence of detailed reconstructions of national accounts in secondary sources.
UK	Data are based on an input output table by Thomas (1984) for 1907.
URUGUAY	GV/VA from Federico. Share of agriculture in GDP is from Bertola et. al. (1998).The agricultural sector does not include the pastoral sector which undertook significant processing.
USA	All figures are based on the input-output table of Whitney (1968).

Intra-national and international distances:

We calculate the population weighted distance between two countries as the weighted sum of the bilateral distances of the ten most populous cities in each country. Data on population by city are not available for all years. We used instead data from years that fell within the two decades 1895-1904 and 1905-1914. If there were multiple observations on a city within a decade, we averaged these values over the decade. It should be noted that at times observations from different years are available for cities within a country. We constructed the maximal amount of city observations possible for each country within the decade in this case. We then have one observation per city per decade and then one weighted distance per country pair per decade for domestic distance. For the USA we use the ten most populous states and the distances between the principal cities of those states. City populations were taken from the Statesman's yearbook and the following comprehensive website: http://www.populstat.info/

Great circle distances were calculated with the vincenty utility in Stata as the great circle distance using latitude and longitude data.

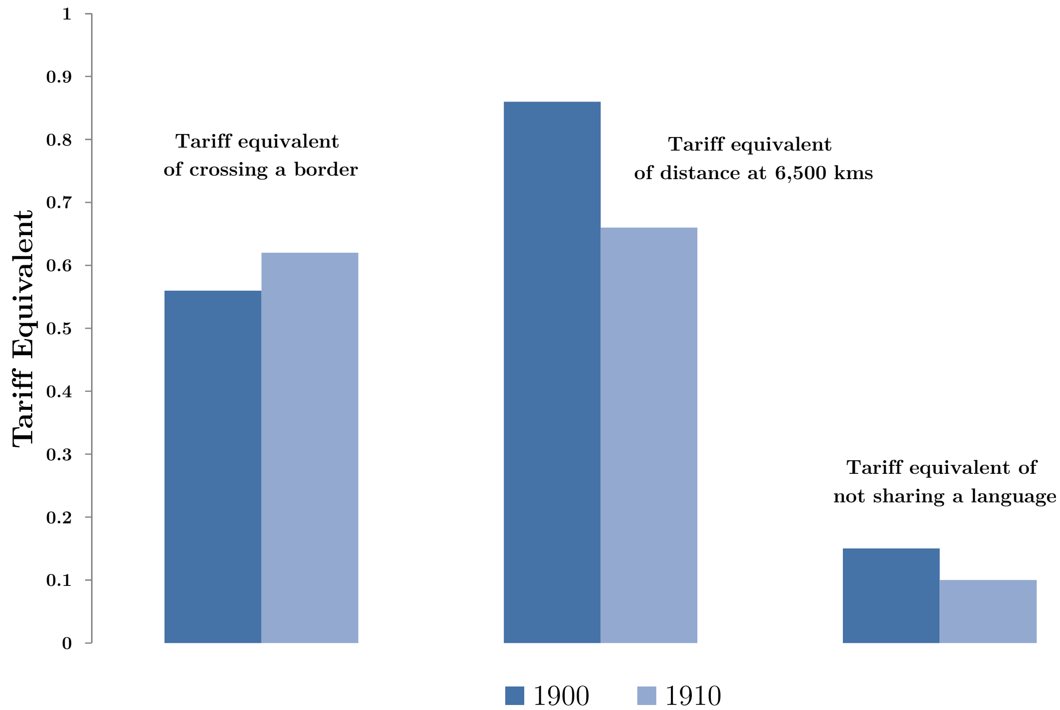
Latitude and Longitude are available from two websites:

http://www.worldatlas.com/aatlas/latitude_and_longitude_finder.htm and

http://www.maxmind.com/app/worldcities

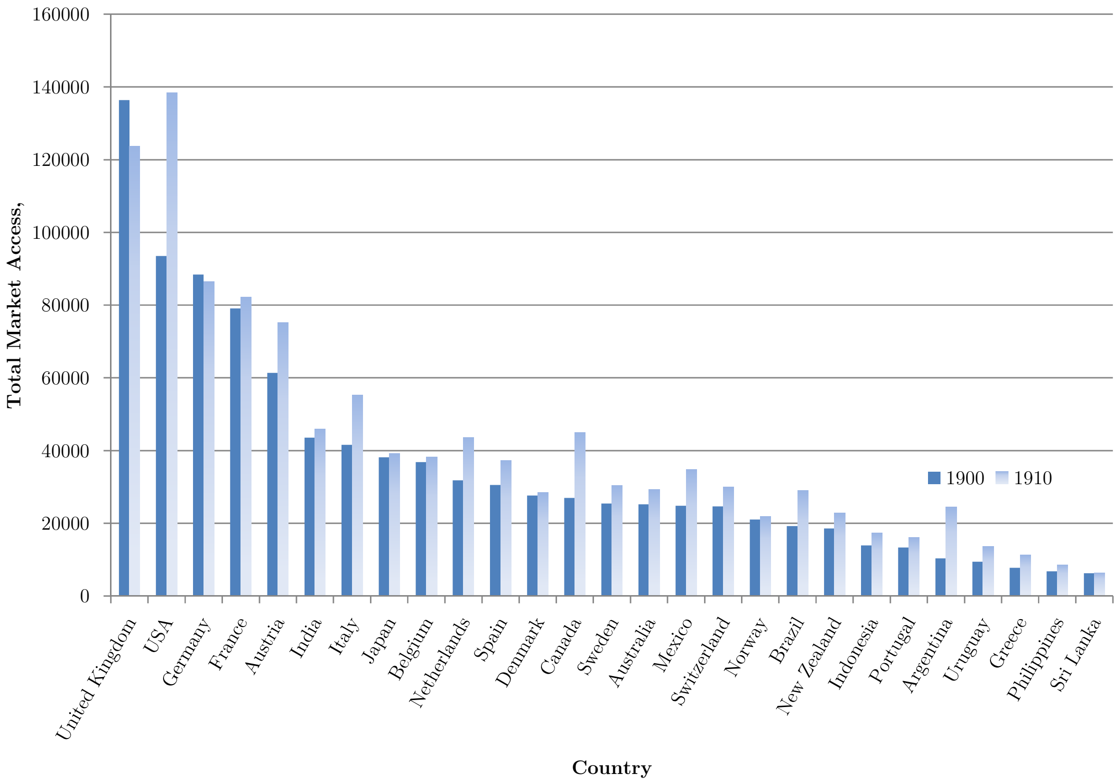
The weights are equal to population shares in the respective country. For each city internal distance is calculated as 5 kms. As explained in the text. The full data set for city populations by decade that we used is available upon request.

Figure 1 The Tariff Equivalent of International Borders, Distance and not Sharing a Border.



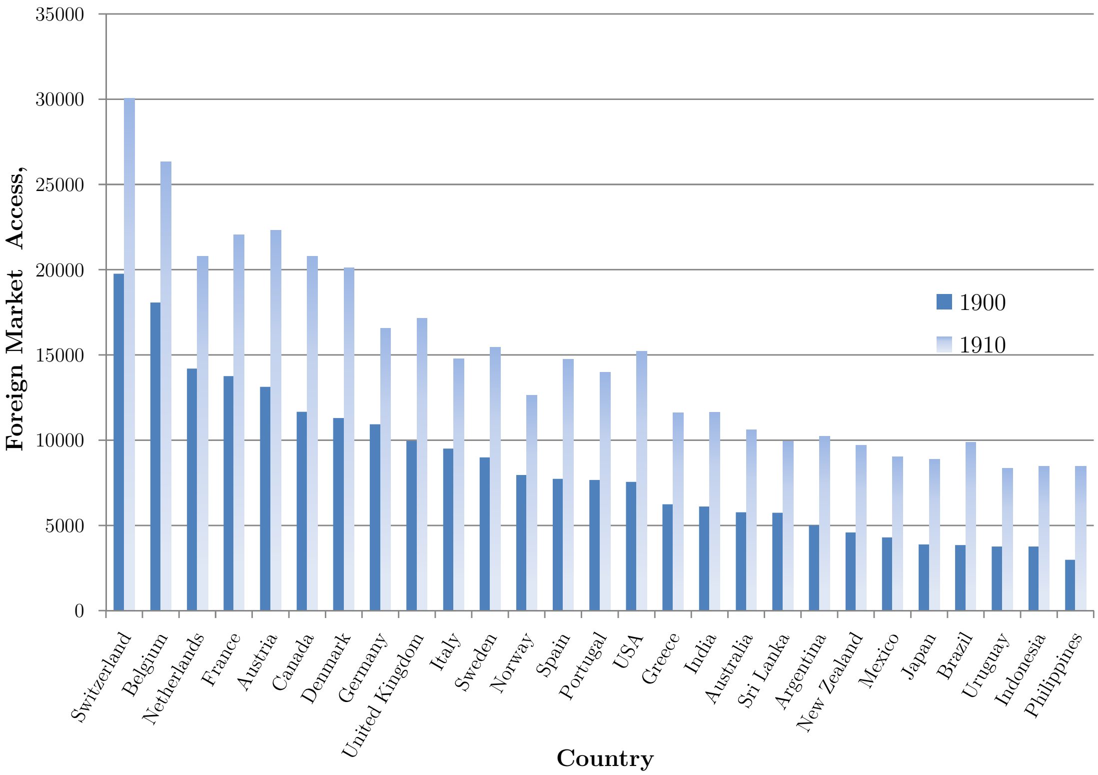
Notes: Bars represent the tariff equivalent of the respective "trade cost" indicated with an elasticity of substitution between all goods of 7. The tariff equivalent of distance is computed at the average weighted distance within the sample of 6,500 kms. Coefficients are from the gravity models in Table 1.

Figure 2 Total Market Potential, 1900 and 1910 for 27 Countries



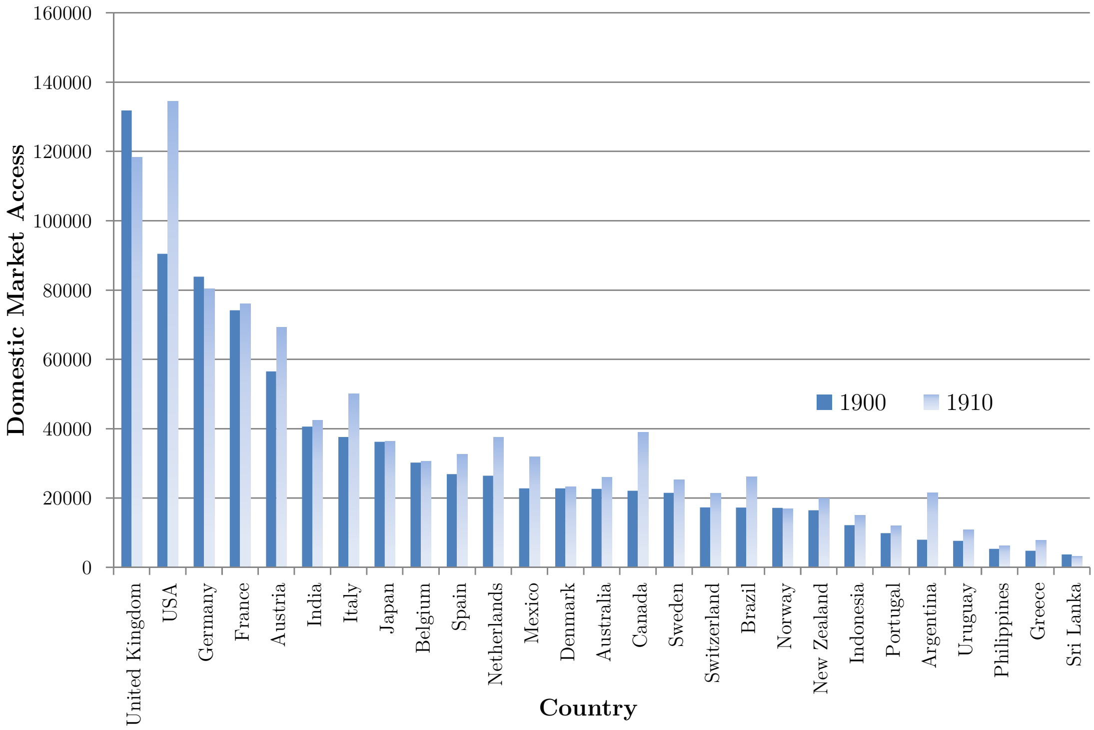
Notes: Total market potential is calculated from the sum of domestic and foreign market potential as described in the text.

Figure 3 Foreign Market Potential, 1900 and 1910 for 27 Countries



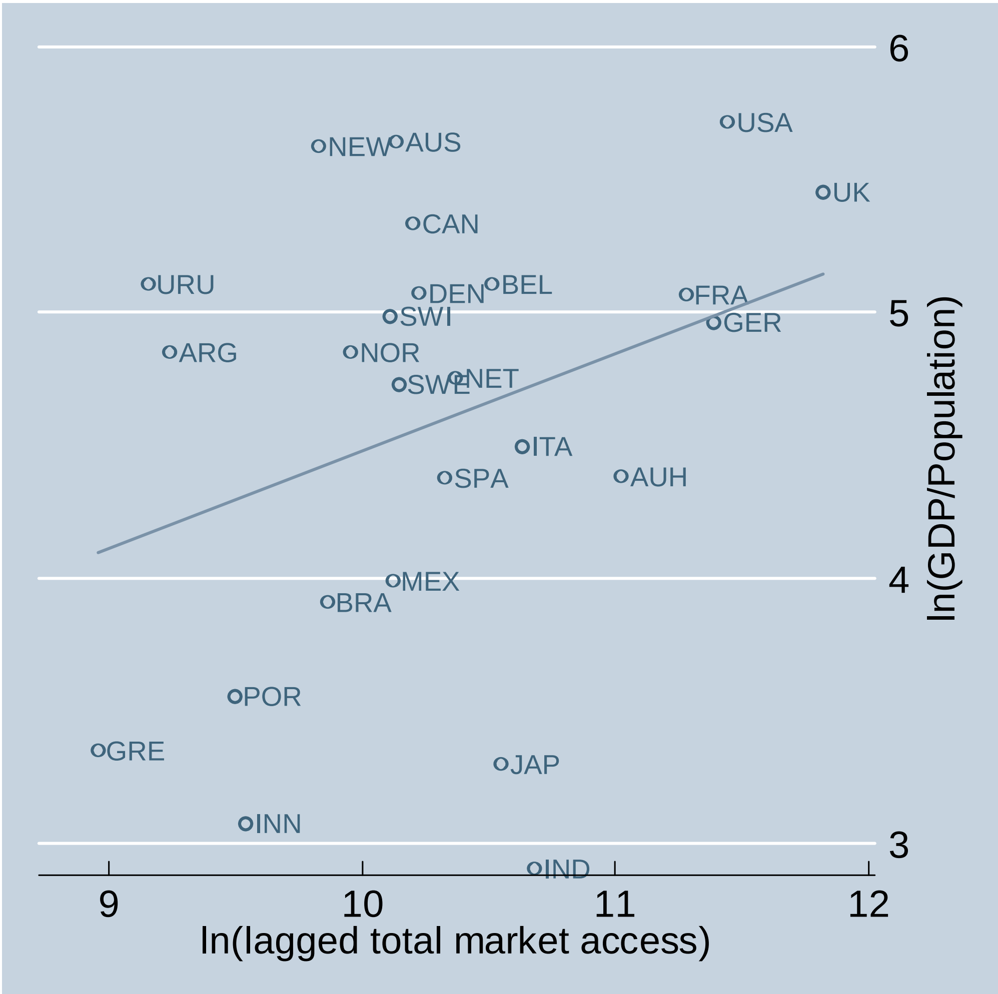
Notes: Foreign market potential is calculated as described in the text.

Figure 4 Domestic Market Potential, 1900 and 1910, 27 Countries



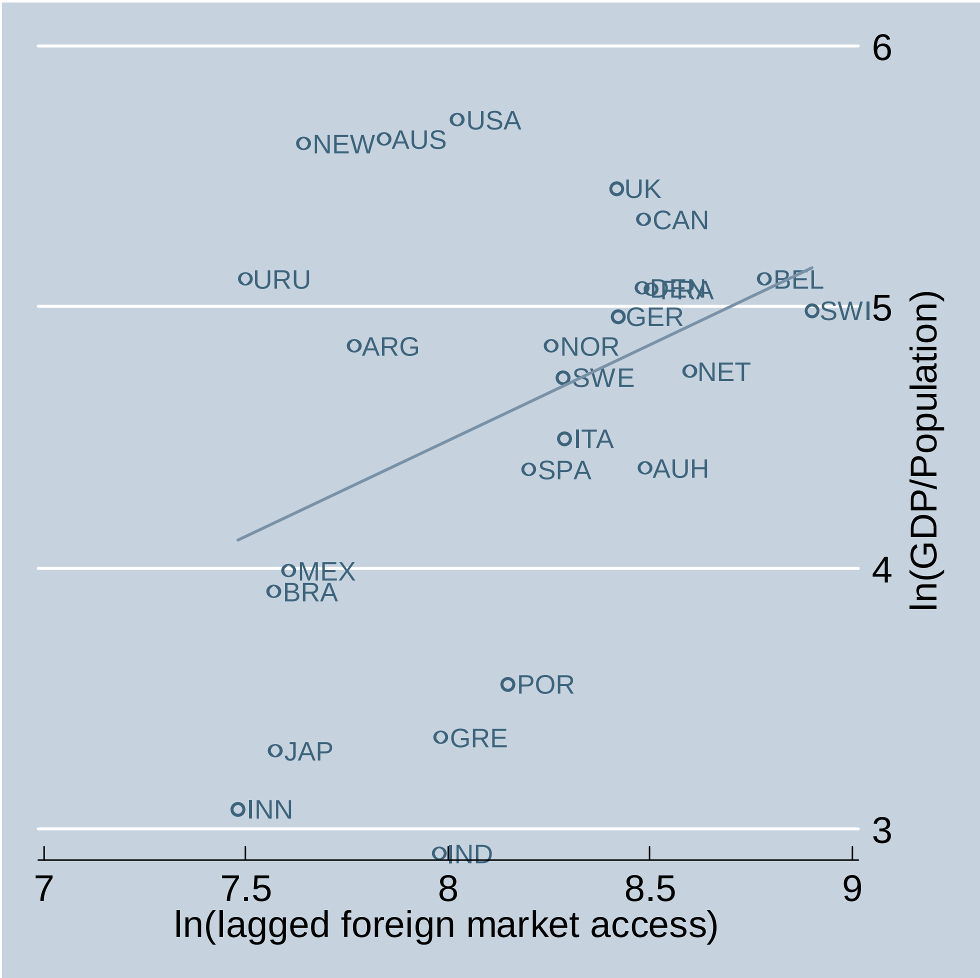
Notes: Domestic market potential is calculated as described in the text.

Figure 5 Total Market Potential and GDP per Capita in 1900 for 25 Countries



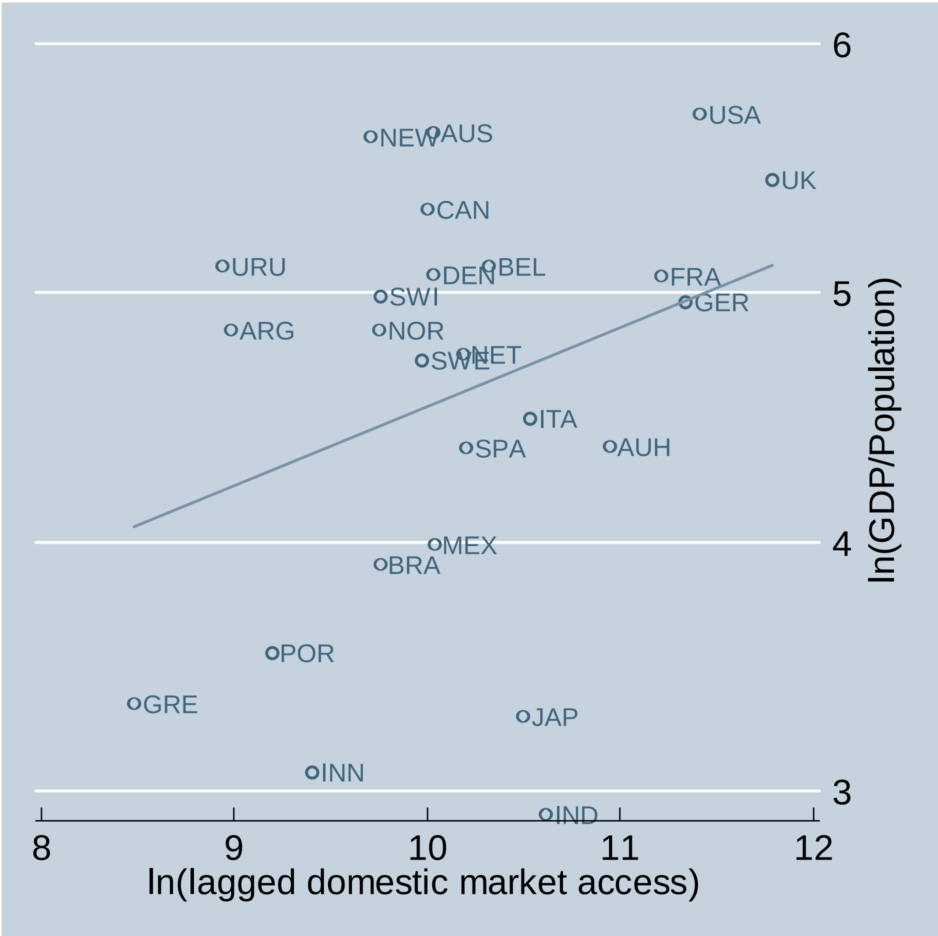
Notes: Figure represents the relationship between the logarithm of nominal GDP per capita in US dollars in 1902 and the logartihm of total market potential in 1900. The regression line is based on a regression of the logartihm of nominal GDP per capita in 1902 and the logarithm of total market potential in 1900 and a constant.

Figure 6 Foreign Market Potential and GDP per Capita for 25 Countries in 1900



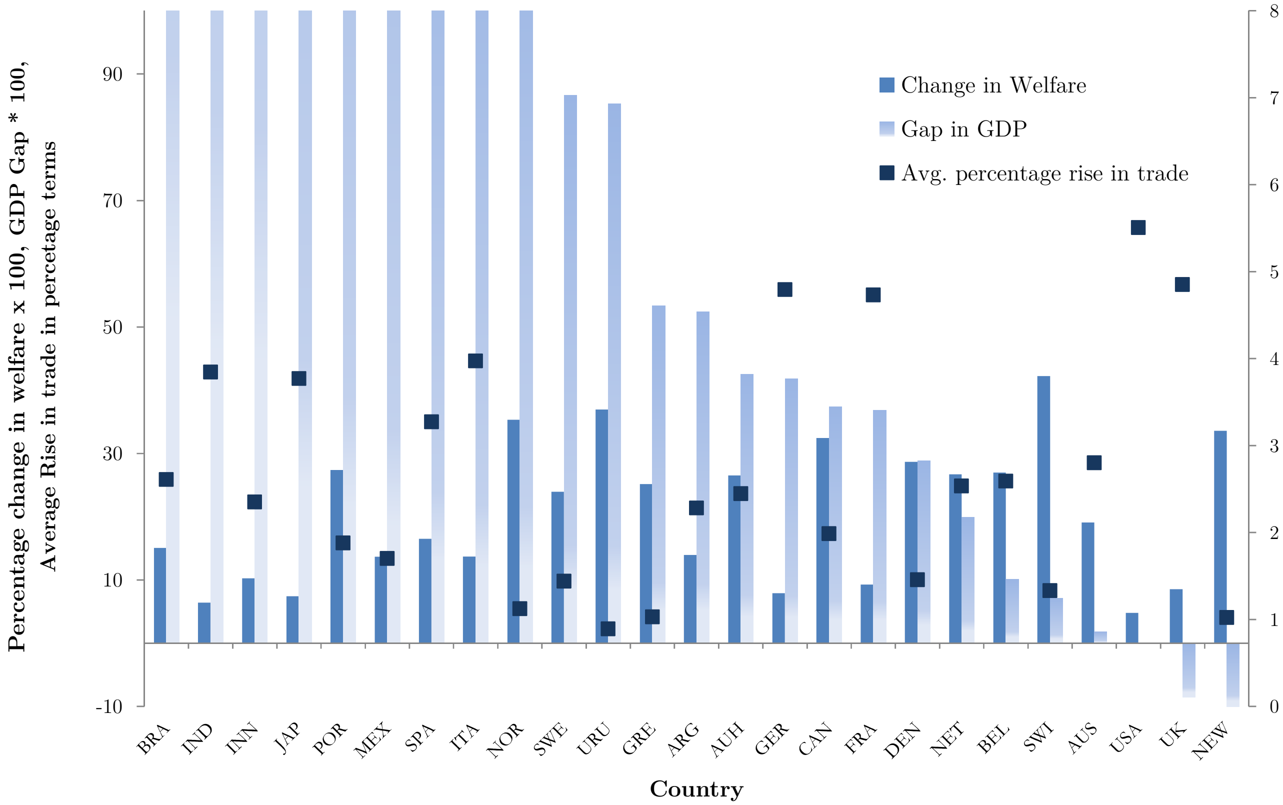
Notes: Figure represents the relationship between the logarithm of nominal GDP per capita in US dollars in 1902 and the logartihm of foreign market potential in 1900. The regression line is based on a regression of the logartihm of nominal GDP per capita in 1902 and the logarithm of foreign market potential in 1900 and a constant.

Figure 7 Domestic Market Potential and GDP per Capita for 25 Countries in 1900



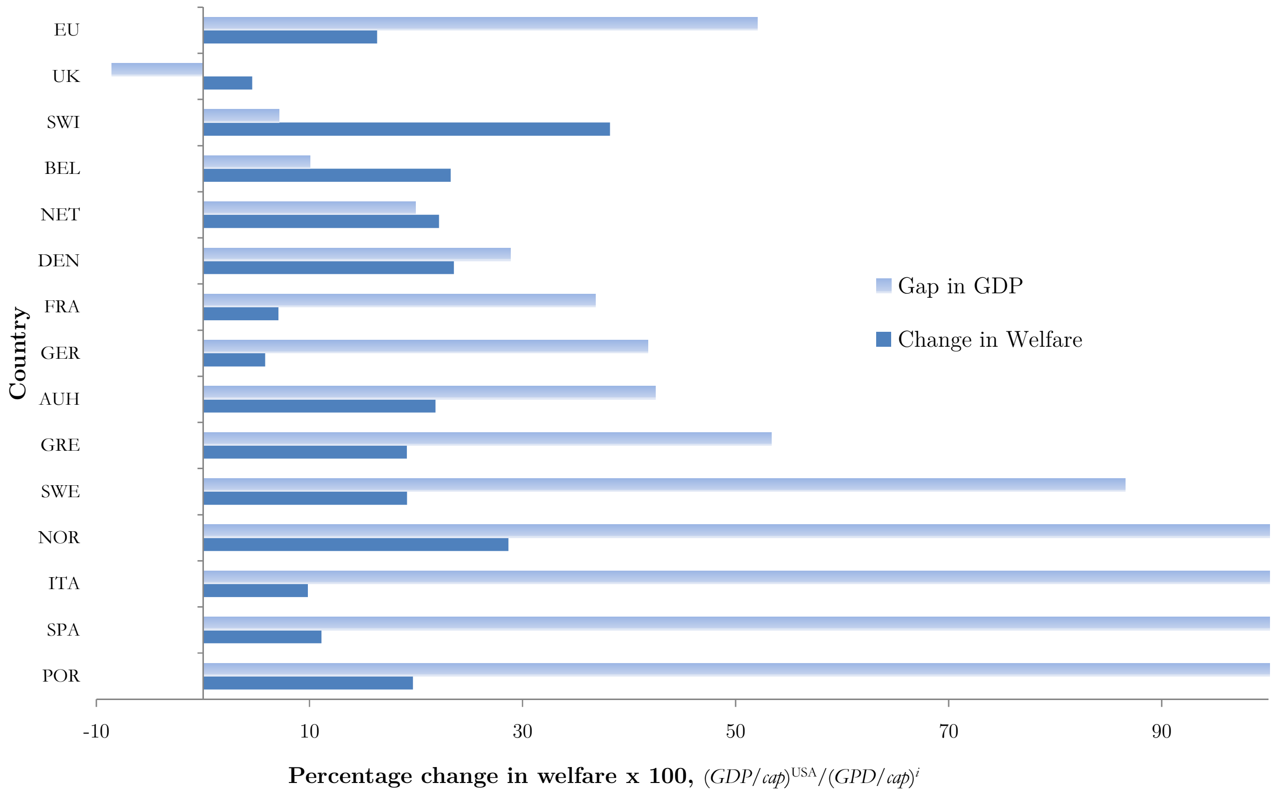
Notes: Figure represents the relationship between the logarithm of nominal GDP per capita in US dollars in 1902 and the logartihm of domestic market potential in 1900. The regression line is based on a regression of the logartihm of nominal GDP per capita in 1902 and the logarithm of domestic market potential in 1900 and a constant.

Figure 8 Welfare Changes from a Uniform Removal of All International Borders Compared to Gaps in GDP/Capita, 1900



Notes: This figure compares the difference between Maddison's real, PPP adjusted GDP/capita for the USA and each country to the welfare changes from a counterfactual world with "no international borders". A world with no borders implies that the tariff equivalent trade cost of an international border is equal to 1. Welfare changes are equivalent to the percentage rise (x 100) in the ratio of nominal output divided by the rise in the consumer price index. The consumer price index is calculated according the model discussed in the text and assumes that the elasticity of substitution between all goods—domestic and local--is 7. The average percentage rise in trade is an un-weighted average across all partners. A value of 1 is a 100 percent rise in trade.

Figure 9 Welfare Changes from a Removal of All European Borders Compared to Gaps in GDP/Capita, 1900



Notes: This figure compares the difference between Maddison's real, PPP adjusted GDP/capita for the USA and each country to the welfare changes from a counterfactual world with "no European borders". A world with no European borders implies that the tariff equivalent trade cost of an international border is equal to 1 for all intra-European country pairs. Welfare changes are equivalent to the percentage rise in the ratio of nominal output divided by the rise in the consumer price index. The consumer price index is calculated according the model discussed in the text and assumes that the elasticity of substitution between all goods—domestic and local--is 7.

Table 1 Gravity Models for 1900 and 1910

	1900	1910
ln ($dist_{ij}$)	-0.426***	-0.349***
	[0.084]	[0.087]
No shared language indicator	-0.858***	-0.611***
	[0.152]	[0.165]
No Shared Border	0.102	-0.212
	[0.195]	[0.218]
International trade indicator "Border effect"	-2.680***	-2.905***
	[0.282]	[0.308]
Number of Observations	523	523
Importer and Exporter Fixed Effects	yes	yes

Notes: Dependent variable is the level of bilateral exports in 1990 US dollars. Both models are estimated using the Poisson PML specification. For domestic pairs, exports equal GDP-Exports. See text for an explanation. Importer and exporter fixed effects are included in all columns. Robust standard errors clustered on dyads appear in brackets. *** p-value<0.01, ** p-value < 0.05, * p-value < 0.1

Table 2 Alternative Measures of Market Potential and GDP per Capita, OLS for 1900

	1	2	3
Exports/GDP	0.018*	---	---
	[0.010]		
Exports/GDP (IV)	---	0.025	---
		[0.026]	
Harris Market Potential	---	---	0.289
			[0.212]
Number of Observations	25	25	25
R-squared	0.093	0.078	0.087

Notes: Dependent variable is the logarithm of nominal GDP per capita two-years ahead. Column 2 is an instrumental variables regression using the trade costs vector from Table 1 as the excluded instrument. See text for an explanation. Robust standard errors appear in brackets. *** p-value<0.01, ** p-value < 0.05, * p-value < 0.1

Table 3 Total Market Potential and GDP per Capita, OLS and Instrumental Variables Results for 1900 and 1910

	1900	1900	1910	1910	1900 & 1910
ln (Total Market Potential)	0.376**	0.358**	0.340**	0.317*	0.471**
	[0.162]	[0.154]	[0.159]	[0.165]	[0.209]
ln (Pop./Land Area)	-0.197**	-0.193***	-0.202***	-0.199***	-0.339
	[0.073]	[0.064]	[0.065]	[0.057]	[0.444]
ln (Years of Schooling)	0.387***	0.392***	0.377***	0.382***	0.553
	[0.120]	[0.111]	[0.103]	[0.094]	[0.613]
Tropics	-0.328	-0.319	-0.209	-0.203	---
	[0.323]	[0.289]	[0.287]	[0.255]	
Number of Observations	25	25	25	25	50
R-squared	0.699	0.698	0.718	0.717	0.919
F-test first stage	---	78.212 ***	---	112.169 ***	---
H_0 = Market potential exogenous p-value	---	0.745	---	0.728	---
Method of estimation	OLS	2SLS	OLS	2SLS	OLS Fixed Effects

Notes: Dependent variable is the logarithm of nominal GDP per capita two-years ahead. See text for an explanation. Robust standard errors appear in brackets. In column 5 country fixed effects are included as is a year indicator for 1910. Excluded instrument is population-weighted trade-costs as described in the text.
*** p-value<0.01, ** p-value < 0.05, * p-value < 0.1

Table 4 Foreign Market Potential and GDP per Capita, OLS and Instrumental Variables Results for 1900 and 1910

	1900	1900	1910	1910	1900 & 1910
ln (Foreign Market Potential)	0.505	0.828*	0.531	0.606	0.698*
	[0.424]	[0.455]	[0.397]	[0.388]	[0.365]
ln (Pop./Land Area)	-0.174**	-0.207**	-0.207***	-0.213***	0.293
	[0.077]	[0.081]	[0.069]	[0.064]	[0.359]
ln (Years of Schooling)	0.420***	0.369***	0.380***	0.370***	0.585
	[0.143]	[0.109]	[0.119]	[0.098]	[0.454]
Tropics	-0.067	-0.024	-0.039	-0.029	---
	[0.352]	[0.331]	[0.329]	[0.305]	
Number of Observations	25	25	25	25	50
R-squared	0.651	0.637	0.682	0.681	0.912
F-test first stage	---	28.37 ***	---	66.931 ***	---
H_0 = Market potential exogenous p-value	---	0.228	---	0.688	---
Method of estimation	OLS	2SLS	OLS	2SLS	OLS Fixed Effects

Notes: Dependent variable is the logarithm of nominal GDP per capita two-years ahead. See text for an explanation. Robust standard errors appear in brackets. A constant is included in each regression but not reported. In column 5 country fixed effects and a year dummy for 1910 are included. Excluded instrument is population weighted trade costs as described in the text. *** p-value<0.01, ** p-value < 0.05, * p-value < 0.1

Table 5 Domestic Market Potential and GDP per Capita, OLS and Instrumental Variables Results for 1900 and 1910

	1900	1900	1910	1910	1900 & 1910
ln (Domestic Market Potential)	0.328**	0.315**	0.297**	0.281*	0.383**
	[0.142]	[0.137]	[0.140]	[0.147]	[0.168]
ln (Pop./Land Area)	-0.191**	-0.188***	-0.197***	-0.195***	-0.269
	[0.071]	[0.063]	[0.064]	[0.056]	[0.410]
ln (Years of Schooling)	0.393***	0.397***	0.383***	0.387***	0.526
	[0.123]	[0.114]	[0.105]	[0.096]	[0.612]
Tropics	-0.345	-0.337	-0.221	-0.215	---
	[0.327]	[0.292]	[0.285]	[0.254]	
Number of Observations	25	25	25	25	50
R-squared	0.697	0.698	0.716	0.717	0.917
F-test first stage	---	92.415***	---	73.17 ***	---
H_0 = Market potential exogenous p-value	---	0.837	---	0.83	---
Method of estimation	OLS	2SLS	OLS	2SLS	OLS Fixed Effects

Notes: Dependent variable is the logarithm of nominal GDP per capita two-years ahead. See text for an explanation. Robust standard errors appear in brackets. A constant is included in each regression but not reported. In column 5 country fixed effects and a year dummy for 1910 are included. The excluded instrument is population weighted trade costs as described in the text. *** p-value<0.01, ** p-value < 0.05, * p-value < 0.1

Table 6 Total Market potential and GDP per Capita, Panel Models for 1880-1913

	TMP	TMP	FMP	FMP	DMP	DMP
ln (Total Market Access)	0.515***	0.258***	---	---	---	---
	[0.090]	[0.118]				
ln (Foreign Market Access)	---	---	0.113*	0.135***	---	---
			[0.062]	[0.045]		
ln (Domestic Market Access)	---	---	---	---	0.531***	0.230***
					[0.089]	[0.14]
ln (Years of Schooling)	0.094	0.116	0.207	0.222	0.073	0.109
	[0.349]	[0.485]	[0.647]	[0.598]	[0.337]	[0.495]
ln (Pop./Land Area)	-0.258	-0.047	0.153	0.151	-0.324	-0.048
	[1.397]	[1.557]	[1.821]	[1.702]	[1.394]	[1.580]
Number of Observations	442	442	442	442	442	442
Number of countries	13	13	13	13	13	13
R-squared	0.767	0.232	0.676	0.04	0.773	0.225
Kleibergen Paap F-test first stage	---	24.565	---	28.786	---	22.619
Method of estimation	OLS	2SLS	OLS	2SLS	OLS	2SLS

Notes: Dependent variable is the logarithm of nominal GDP per capita. See text for an explanation. Robust standard errors appear in brackets. Country fixed effects and country-specific time-trends are included in all regressions. Excluded instrument is population weighted trade costs. See text for an explanation. For 2SLS results, preliminary regressions of the dependent variable, market potential, and the excluded instrument on the included exogenous variables are run. This allows calculation of robust standard errors clustered at the country level. R-squared's in column 2, 4, and 6 refer to the final "univariate" 2sls regression.*** p-value<0.01, ** p-value < 0.05, * p-value < 0.1