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MARKET POTENTIAL AND GLOBAL GROWTH OVER THE LONG TWENTIETH CENTURY

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Market Potential and Global Growth over the Long Twentieth Century
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ABSTRACT

We examine the evolution of market potential over the long twentieth century from 1900 to 2010. Theoretically, we exploit a structural gravity model to derive a closed-form solution for a widely-used measure of market potential. We are, thus, able to express market potential as a function of directly observable and easily estimable variables. This allows us to consistently compare our measure of market potential both in the cross-section and over time. Empirically, we collect a large data set on aggregate and bilateral trade flows as well as output for 51 countries. We find that market potential exhibits an upward trend across all regions of the world, in particular after World War II. The rise in market potential is also associated with a significant share of global income growth over that period.

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1. Introduction

Unlocking the sources of economic growth remains a critical research topic in the economics profession. And a question of long-abiding interest has been the role of globalization in helping or hindering the growth prospects of nations. In a recent contribution, Grossman and Helpman (2015) provide a valuable overview of the endogenous growth literature. They consider how the globalization of goods and ideas affects incentives for knowledge acquisition and the efficacy of technological innovation. In particular, they highlight international economic integration as a potential mechanism to create larger markets from which those who invent, improve, and distribute goods are afforded greater profit opportunities.

Drawing inspiration from this idea, we turn to the notion of market potential to probe the influence of globalization on growth. As in the preceding literature, we model market potential as a summary measure of both external and internal demand which explicitly takes into account the costs of transaction and transport associated with the exchange of goods. But in contrast to much of the preceding literature, we seek to exploit the wide variation in the evolution of the global economy over the long twentieth century—that is, from 1900 to 2010—to investigate the role of market potential in shaping global growth over this period.

Figure 1 plots aggregate exports for 51 countries representing roughly 90% of world GDP in 2010. As it illustrates, the variation in the growth of international trade over the twentieth century was substantial. From 1900 to 1910, trend growth in global exports was around 3.5% per year relative to trend growth in global GDP of around 2%. The sources of this trade boom are fairly easy to locate in the form of maritime and overland transport revolutions, the liberalization of commercial policy, and the development and improvement of transaction technologies, in particular, the classical gold standard.

The series also indicates that World War I was clearly a traumatic event for the global economy. Even following its conclusion, many of the previously prevailing trends confronted countervailing forces in the form of cartelization in the transport sector, the creation of new nation states and new borders, the resurrection of a hobbled gold standard, but, above all, a lingering sense of discord and distrust in international relations. Thus, a sharp recovery into 1929 was fully reversed with the descent into the Great Depression, setting a seesaw pattern in which trade volumes in 1950 were no greater than they were 40 years earlier.

The period from 1950 to 2000, however, witnessed a distinct resurgence in global trade. This was primarily a function of dramatic changes in commercial policy and openness along with the creation of institutions to facilitate international exchange and a distinct—albeit more limited—role for technological change in the transport sector. This process continued throughout the early 2000s, but at an accelerated pace not least due to the rise of China and its return to world markets. Finally, Figure 1 also depicts the projection of the prevailing trend for the period from 1900 to 1910. Thus, over the course of the long twentieth century, World War I introduced a long period of disruption in the pace of globalization which was only completely recovered in the 1970s and only consistently surpassed in the 2000s.

Our goal, then, comes in assessing the relationship between globalization and growth in the long run by: (1) developing a theoretically-derived measure of market potential appropriate for historical use rather than relying on "data-as-given" narratives as in Figure 1, allowing us to relate globalization and growth in a more disciplined way; (2) collecting a new data set on aggregate exports, bilateral trade, and GDP for 51 countries; (3) constructing our proposed measure of market potential, as well as charting and decomposing its evolution through time; and (4) tracing its contribution to the growth experience of countries over the long twentieth century.

Of course, we are far from the first to consider the theme of market potential and its role in the growth process. Harris (1954) was motivated by the question of why, with only 12% of the United States by area, the Northeast produced fully 50% of its manufacturing output and employed 70% of its industrial labor force in 1950. His informal model is one in which firms balance production versus trade costs in determining their location and in which the presence of deep input and output markets influence this decision. His paper also marks the first usage of the term market potential which Harris defines as "an abstract index of intensity of possible contact with markets." It is calculated as the sum of markets accessible to a given point over distance-to-markets from that point.

Krugman (1991, 1992) resurrected this notion of market potential, imparting a degree of economic respectability by grounding it in a spatial general equilibrium model. The basic structure of the Krugman model was then extended by Helpman (1998), enhancing its tractability in empirical work (e.g., Hanson, 2005). In addition, Fujita, Krugman, and Venables (1999) gave rise to the workhorse model of the new economic geography. Importantly, these modeling approaches rely on a common set of elements, typically in the form of CES consumption, simple production functions and monopolistically competitive firms. Symmetry in preferences and technology yield a structural link between market potential and standards of living.

For our purposes, one of the most important contributions to this literature comes from Redding and Venables (2004). Motivated by the wide dispersion in cross-country manufacturing wages and incomes, they concentrate on two mechanisms which may potentially explain such disparities: (1) the distance of countries to markets in which their output is sold; and (2) the distance of countries to markets from which capital and intermediate goods are purchased. Thus, the presence of trade costs means that more distant countries face a penalty on their sales as well as additional costs on imported inputs. As a consequence, firms in these countries can only afford to pay relatively low wages, translating into lower levels of GDP per capita. This result holds even if technologies are the same across countries.

Liu and Meissner (2015) recently considered the theme of historical market potential in the context of the Redding and Venables (2004) model. Using cross-sectional data for 27 countries in 1900 and 1910, they establish that market potential was a significant determinant of GDP per capita in the early twentieth century. They also raise the prospect that the United States did not necessarily benefit from a natural lead in market potential as its greater domestic market size was counterbalanced by its greater distance to other—in particular, European—markets. Finally, Head and Mayer (2011) consider panel evidence for the role of market potential in driving differences in GDP per capita for the period from 1965 to 2003. Thus, they are able to establish a broader consistency with the results of Redding and Venables (2004).

However, we argue that there are complications when it comes to using Redding and Venables' approach in a panel setting, which make its use in a historical context potentially problematic. First, one needs the full matrix of all bilateral trade flows for every year, imposing a large cost in terms of data collection. This is due to the fact that the construction of market potential in Redding and Venables (2004) and Head and Mayer (2011) relies on a set of exporter and imported fixed effects pertaining to all countries in the world, based on a standard gravity model of bilateral trade. Without the full matrix of global trade flows, estimates of these fixed effects can shift substantially.[1] More importantly, estimates of market potential will not be strictly comparable from year to year in their setup. This stems from the fact that, in order to estimate their gravity equation in the appropriate way, one fixed effect must be dropped in addition to the constant. Redding and Venables choose to drop the exporter fixed effect for the

[1] For instance, see Anderson and van Wincoop (2003) who obtain different estimates for a two-country model with US and Canadian data only and a multi-country model that includes observations for 20 additional countries.

United States, and that choice affects the value of the market potential measure. Of course, this normalization is perfectly acceptable in the cross-section, but it complicates interpretation if one would like to make comparisons over time. Our proposed solution, then, comes from exploiting a link between the model of Redding and Venables and structural gravity models that allows us to bypass exporter and importer fixed effects.

The rest of the paper proceeds as follows. Section 2 lays out the relationship between market potential and structural gravity. It does so first by revisiting the work of Redding and Venables (2004) on market potential and then by relating it to the work of Anderson and van Wincoop (2003). This results in a new solution for the measure of market potential that is less data-intensive and therefore particularly suitable for historical settings. Section 3 introduces the underlying data, presents our new evidence on market potential over the long twentieth century, and provides a comparison to existing formulations of market potential. Section 4 relates our new measure to global growth in the context of standard wage equations drawn from the existing literature. Section 5 concludes.

2. Market potential and structural gravity

We first outline the basic setup of the Redding and Venables (2004) new economic geography model. We then relate it to the structural gravity framework by Anderson and van Wincoop (2003). As a departure from the existing literature, this allows us to derive an analytical solution for the market potential measure mainly in terms of directly observable variables.

2.1 The new economic geography model

Redding and Venables (2004) propose a new economic geography model with multiple countries. Symmetric firms in the manufacturing sector operate under monopolistic competition, and each firm produces a differentiated variety that is used both in consumption and as an intermediate good. Preferences and production are described by a CES aggregator with a common elasticity of substitution ($\sigma > 1$),

$$(1)\quad U_j = \left(\sum_{i=1}^{N} n_i c_{ij}^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)},$$

where U_j is utility in country j, c_{ij} is consumption of a symmetric variety imported from country i, n_i denotes the number of varieties in country i, and N is the total number of countries. The standard price index P_j is given as the dual to the U_j quantity aggregator.

Nominal demand in country j added over all individual varieties from country i follows as

$$(2)\quad x_{ij} = n_i p_{ij} c_{ij} = n_i p_{ij}^{1-\sigma} y_j P_j^{\sigma-1},$$

where y_j is the income of country j. Redding and Venables (2004) refer to the term $y_j P_j^{\sigma-1}$ as the *market capacity* of country j, $m_j \equiv y_j P_j^{\sigma-1}$, since it determines consumers' demand in that country for an individual variety with given a price p_{ij}. They employ the typical iceberg trade cost assumption so that the destination country price p_{ij} depends multiplicatively on the factory price p_i in origin country i and a bilateral trade cost factor $t_{ij} \geq 1$ with $p_{ij} = t_{ij} p_i$. Furthermore, they assume that trade costs are bilaterally symmetric, i.e., $t_{ij} = t_{ji}$.[2]

Apart from the demand-side aspect captured by market capacity, the right-hand side of equation (2) also contains supply-side variables in the form of $n_i p_i^{1-\sigma}$, net of bilateral trade costs t_{ij}. Redding and Venables (2004) refer to this term as the *supply capacity* of country i, $s_i \equiv n_i p_i^{1-\sigma}$. It consists of an extensive margin measure n_i for the number products originating in i as well as their price competitiveness embodied by p_i. Redding and Venables (2004) provide

[2] In Appendix I, we show that our main insights go through even if trade costs are bilaterally asymmetric. In that case, we can derive a closed-form expression for the geometric average of market and supplier access measures in equations (12) and (13) as a function of observable variables.

further details for the supply side of the model. For instance, they impose a Cobb-Douglas technology with an immobile factor (e.g., labor), an internationally mobile factor (e.g., capital), and a composite intermediate good with price P_i. They introduce increasing returns by way of a fixed input requirement.[3] It turns out, however, that the supply-side details are not essential for the aggregate gravity relationship that emerges from the model as the basis for the empirical analysis.[4]

Given the above structure of the economy and the expression for bilateral trade flows in equation (2), how can one summarize what Harris (1954) first described as "the intensity of possible contacts with markets"? Redding and Venables (2004) proceed to define *market access* of country *i* as the trade cost-weighted sum of the market capacities of all partner countries. The resulting measure MA_i captures the strength, or intensity, of demand faced by suppliers from country *i*:

$$(3)\quad MA_i = \sum_{j=1}^{N} t_{ij}^{1-\sigma} m_j .$$

Analogously, *supplier access* of country *j* is defined as the trade-cost weighted sum of the supply capacities of all partner countries. This measure SA_j captures the availability of supply faced by customers in country *j*:[5]

$$(4)\quad SA_j = \sum_{i=1}^{N} t_{ij}^{1-\sigma} s_i .$$

[3] The full model is explored in detail by Fujita et al. (1999, chapter 14).
[4] For instance, the supply side could be further simplified by removing the capital input or, in the extreme case, by setting up an endowment economy with an Armington structure. Also see Head and Mayer (2011, section 2.1) on the various supply-side structures consistent with the aggregate gravity relationship. It is well-known that similar aggregate relationships arise from the models of Eaton and Kortum (2002), Chaney (2008), and Melitz and Ottaviano (2008).
[5] Redding and Schott (2003) use the same definitions of market and supplier access.

2.2 Exploiting the link with structural gravity

Formally, we can frame the setup outlined above as part of the class of trade-separable general equilibrium models (see Anderson and van Wincoop, 2004 for details). Here, separability refers to the fact that the allocation of bilateral trade flows is determined independently of the output structure. In its simplest form, we can think of the model as a one-sector manufacturing economy in which expenditure equals the value of output and income. As a budget accounting identity, the spending by country j on imports x_{ij} is linked to all possible origin countries i (including the domestic market) such that it adds up to the income of country j, i.e., $\sum_i x_{ij} = y_j$. We also impose market-clearing such that the value of all production originating in country i equals the exports to the destination markets j, i.e., $\sum_j x_{ij} = y_i$. Given this structure and the assumption of balanced trade, we can apply the insights of Anderson and van Wincoop (2003) who solve for the structural gravity equation as

$$(5) \quad x_{ij} = \frac{y_i y_j}{y^W} \left(\frac{t_{ij}}{P_i P_j} \right)^{1-\sigma},$$

where y^W denotes global income given by the sum of the incomes of all countries.[6]

The price indices aggregate the import prices over all origin countries. P_j is also a key component of country j's market capacity m_j, but it is not directly observable in the data.[7] Following Novy (2013), we use the structural gravity equation (5) to solve for P_j. That is, we form the analogous gravity equation for domestic trade x_{jj} and then rearrange to obtain

[6] Note that due to bilateral trade cost symmetry the outward and inward multilateral resistance terms coincide. This assumption can be relaxed (see Appendix I).

[7] Even if appropriate price indices were available, they likely would not include non-pecuniary trade cost components such as informational barriers.

(6) $P_j^{\sigma-1} = \left(t_{jj}^{\sigma-1} \frac{x_{jj} y^W}{y_j y_j} \right)^{\frac{1}{2}}.$

It follows that we can express market capacity as

(7) $m_j = y_j P_j^{\sigma-1} = \left(t_{jj}^{\sigma-1} x_{jj} y^W \right)^{\frac{1}{2}}.$

We insert this expression for m_j back into gravity equation (5) to arrive at

$$x_{ij} = \frac{y_i}{y^W} \left(\frac{t_{ij}}{P_i} \right)^{1-\sigma} m_j,$$

also noting that exports from i to j from equation (2) can be rewritten as

(8) $x_{ij} = n_i \left(t_{ij} p_i \right)^{1-\sigma} y_j P_j^{\sigma-1} = s_i t_{ij}^{1-\sigma} m_j.$

By combining the last two expressions and rearranging we obtain

(9) $s_i = \frac{y_i P_i^{\sigma-1}}{y^W} = \frac{m_i}{y^W} = \left(\frac{t_{ii}^{\sigma-1} x_{ii}}{y^W} \right)^{\frac{1}{2}}.$

We can then use the expressions for m_j and s_i to simplify the market and supplier access terms in equations (3) and (4). Using $t_{ij}^{1-\sigma} m_j = x_{ij} / s_i$ from equation (8), inserting this into the expression for MA_i and using market-clearing, we obtain

(10) $MA_i = \sum_{j=1}^{N} t_{ij}^{1-\sigma} m_j = \frac{1}{s_i} \sum_{j=1}^{N} x_{ij} = \frac{y_i}{s_i}.$

Similarly, we use $t_{ij}^{1-\sigma} s_i = x_{ij} / m_j$ from equation (8), insert it into the expression for SA_j and use the accounting identity to obtain

(11) $SA_j = \sum_{i=1}^{N} t_{ij}^{1-\sigma} s_i = \frac{1}{m_j} \sum_{i=1}^{N} x_{ij} = \frac{y_j}{m_j}.$

We note that the expressions for MA_i and SA_j no longer involve summation over trading partners. Finally, we combine equations (7), (9) and (10)-(11) to summarize our derivation as

$$(12) \qquad MA_i = \frac{y_i y^W}{\left(t_{ii}^{\sigma-1} x_{ii} y^W\right)^{\frac{1}{2}}},$$

$$(13) \qquad SA_i = \frac{y_i}{\left(t_{ii}^{\sigma-1} x_{ii} y^W\right)^{\frac{1}{2}}}.$$

Thus, MA_i and SA_i are proportional since $MA_i = y^W SA_i$.[8]

All else being equal, MA_i increases in global income. Intuitively, if the global economy grows, demand for individual country i's output rises. In contrast, SA_i decreases since the growth of production in the world represents more competition and, thus, a decline in relative supply capacity. Not surprisingly, growing y_i increases both market and supplier access since it represents both rising availability of supply to customers elsewhere as well as rising demand for foreign products. Higher domestic trade costs t_{ii} work in the opposite direction since they hamper the domestic economy. We can think of t_{ii} as the cost of reaching domestic customers and sourcing domestic supply. The role of domestic trade flows x_{ii} is perhaps less obvious to understand. Holding output constant, due to market-clearing a rise in x_{ii} means less trade with foreign countries, which implies that bilateral trade costs t_{ij} must have risen. A rise in bilateral trade costs is associated with more isolation from global markets, which in turn hurts demand prospects as well the ability to obtain the supply of goods emerging from partner countries.

We draw two conclusions for our empirical analysis. First, since the market and supplier access measures are proportional, for a given cross-section they do not contain independent

[8] We can also express market access as a function of the price index. Use equation (7) to substitute $y_j P_j^{\sigma-1}$ for the denominator in equation (12). It follows $MA_i = y^W P_i^{1-\sigma}$. Despite its simplicity, the disadvantage of this expression is that the price index, or multilateral resistance variable, is not observable in the data.

information. Therefore, we proceed with a single measure corresponding to the expression for market access in (12). We simply call it market potential, MP_i, with $MP_i \equiv MA_i$. Note that since the similarity of market and supplier access was not clear at the time, Redding and Venables (2004) report both measures.

Second, in contrast to the previous literature, we do not require bilateral trade cost variables to compute our market potential expression (12). Instead, it is a simple function of domestic variables and a global constant.[9] Moreover, the variables in equation (12) are for the most part given by the data. That is, income y_i is directly observable, and domestic trade flows x_{ii} as well as global income y^W can be constructed from the data. Domestic trade costs scaled by the elasticity of substitution, $t_{ii}^{\sigma-1}$, can be constructed based on estimates from a standard gravity regression using domestic trade cost proxies such as internal distance. We provide details in the empirical section.

3. Data and empirics

3.1 The data set

We collected a large annual data set for 51 countries over the period from 1910 to 2010 which is comprised of aggregate exports, bilateral trade flows, and GDP. We choose to begin data collection in 1910, rather than 1900, in order to maximize the cross-section of countries at our disposal. This data includes newly collected trade observations, in particular, for the periods spanning the World Wars. We provide details on our sources in Appendix II while Figure 2 summarizes the sample graphically. Countries in black (n=33) are those for which the full

[9] In the empirical section, we compare our measure of market potential against those traditionally estimated and then constructed with bilateral trade data as, for instance, by Redding and Venables (2004). An advantage of our measure is parsimony. While we potentially introduce measurement error by relying on measures of t_{ii} and x_{ii}, we are more likely to avoid the inclusion of unrelated unobserved heterogeneity that can be associated with estimated exporter and importer fixed effects.

complement of output and trade data is available from 1910 while those in grey (n=18) are those for which consistent data is available only from 1950. The sample countries represent roughly 75% of world GDP in 1910, roughly 85% of world GDP in 1950, and roughly 90% of world GDP in 2010.

3.2 Constructing market potential

We construct our preferred measure of market potential as given in equation (12). This approach does not require estimation of the entire term as we simply insert the data directly into the right-hand-side expression. Thus, the data on income y_i are readily available. We construct global income y^W as the sum of incomes of all countries in the sample, and domestic trade as the difference between income and total exports, $x_{ii} = y_i - x_i$, where x_i denotes total exports.[10]

The measure of domestic trade costs, t_{ii}, requires an assumption about the trade cost function. We follow the literature in imposing the common log-linear trade cost function that contains distance as a key trade cost element with an elasticity ρ. In addition, we allow for a contiguity indicator variable, $contig_{ij}$, that takes on the value of 1 if countries i and j share a land border.[11] This indicator variable also takes on the value of 1 for domestic trade (whenever $i = j$). We can summarize our trade cost function as:

(14) $$\ln(t_{ij}) = \rho \ln(dist_{ij}) + \xi\, contig_{ij}.$$

Since the market potential measure requires domestic trade costs scaled by the trade elasticity, we generate $t_{ii}^{\sigma-1} = dist_{ii}^{\rho(\sigma-1)} \exp\left(\xi(\sigma-1)\, contig_{ii}\right)$.

[10] Since income is measured as GDP and is cast in value-added terms, it is in principle not consistent with exports as a gross-value measure. However, for later years we are able to provide robustness checks by using total gross manufacturing production instead of GDP. This leaves our main results unaffected.

[11] Redding and Venables (2004), for instance, use the same trade cost function. We refer to the Appendix II for details on the distance variable.

We obtain time-varying distance and border coefficients by running annual gravity regressions by PPML (Fally, 2015; Santos Silva and Tenreyro, 2006). In particular, we use the specification

$$x_{ij} = \exp\left[(1-\sigma)\ln(t_{ij}) + \alpha_i + \alpha_j\right] + \varepsilon_{ij},$$

where we substitute our trade cost function (14) for t_{ij}. The variables α_i and α_j represent exporter and importer fixed effects that capture the income and price index terms in gravity equation (5), and ε_{ij} is an error term. We use a balanced sample of trade flows between the 33 countries indicated in black in Figure 2, including observations for domestic trade flows x_{ii}. The estimation results, not reported in detail here for every year, follow those typically obtained in the literature. The distance elasticity is close to unity standing around −1.2 on average across years, and the contiguity coefficient is around +1.4 on average.[12]

Figure 3 shows the average of the log values of market potential for all the countries in the sample. There is a clear upward trend driven by the growth of the world economy, with periods of global depression and recession in the early 1930s, the early 1980s, the early 1990s, and the late 2000s registering as troughs in the series. Underlying these global patterns is substantial heterogeneity with large and persistent differences in the levels of market potential across continents, e.g., Latin versus North America or Asia versus Europe.

At the same time, there is significant variation—particularly in relative terms—across individual countries. As an example, Figure 4 speaks to this issue by considering the trajectories of the log of market potentials for the United Kingdom and India over the long twentieth century. There, it is apparent that while much of the variation in the two series is shared in common—again, driven by the evolution of world GDP—there is still scope for differential rates of growth

[12] In comparison, Redding and Venables (2004, Table 1) yield broadly similar results. They obtain a distance elasticity of around -1.5 and a contiguity coefficient close to +1.0.

in market potential in the long run. This is seen most clearly in the ratio of the two series (UK:IND). It rises up to 1930 when the United Kingdom's lead attains its maximum and then consistently falls into the present day where Indian and UK market potential stand nearly at par.

3.3 A comparison to Redding and Venables (2004) and Harris (1954)

The previous literature constructs market and supplier access measures (3) and (4) by estimating equation (8) for x_{ij} where supply capacity s_i and market capacity m_j are taken as exporter and importer fixed effects, respectively. Redding and Venables (2004) follow this procedure for a single cross-section in 1994. Head and Mayer (2011) have panel data for the period from 1965 to 2003 but estimate the fixed effects year by year. The use of exporter and importer fixed effects implies a specific normalization due to the omitted exporter/importer category. For instance, Redding and Venables (2004) omit the exporter fixed effect for the US and also omit the constant in their specification such that no importer fixed effect has to be dropped. In contrast, our method of constructing—as opposed to purely estimating—market potential through equation (12) does not rely on exporter and importer fixed effect estimates and, thus, avoids the year-by-year normalization. We can, therefore, more consistently compare levels of market potential over time.

We follow Redding and Venables (2004) in proxying bilateral trade costs t_{ij} by bilateral distance and a contiguity dummy as in trade cost function (14). Based on equation (3) we then construct market access by adding up trade cost estimates for each bilateral trade relationship as

(15) $$\hat{MA}_i = \sum_{j=1}^{N} \exp(\alpha_j)^{\hat{\lambda}_j} \, dist_{ij}^{(1-\sigma)\hat{\rho}} \exp\left((1-\sigma)\hat{\xi}\, contig_{ij}\right),$$

where α_j's denote importer fixed effects and λ_j's their respective coefficients. The hats indicate coefficients that we estimate through annual OLS gravity regressions as in Redding and Venables (2004).

Figure 5 presents the average of the log values of the market access measure, MA_i, for the period from 1910 to 2010. As in Figure 3, there is a fairly consistent, upward trend throughout the second half of the twentieth century and the first decade of the 21st century. However, in Figure 5 we also observe two sharp increases in market access during the first half of the twentieth century to the extent that the average (log) values for market access in 1919 and 1946 exceed those for 2010. We would argue that this is clearly an implausible result given what we know about global macroeconomic history, in particular the role of the World Wars in disrupting global trade flows as seen in Figure 1.

The explanation for these counterintuitive results is that the usual pattern of gravity with a distance elasticity not too far from unity breaks down during war time.[13] Instead of being determined by the usual geographical factors, trade patterns appear driven by diversion of flows away from countries at war. Country-specific determinants of trade flows become more important, for instance a large increase of imports into the United States in exchange for war supplies. As a consequence, many of the λ_j fixed effect estimates jump up especially for the United States and, thereby, push the market access measure (15) in the same direction. Thus, while the approach of Redding and Venables (2004) is likely appropriate for a given cross-section of data in most periods, our results suggest caution for its use in repeated cross-sections, in particular during war years. For our purposes of understanding the trajectory of market potential over the long twentieth century, we therefore prefer the measures presented in Figure 3.

[13] In fact, the distance coefficient rises in absolute value in World War I and especially in World War II.

At the same time, in empirical applications, market potential is measured more often than not along the lines of Harris' (1954) formulation. For any particular country, this amounts to the summation across all possible trading partners of the ratio of their GDPs over their respective distances from the reference country, or:

$$MP_i = \sum_{j \neq i}^{N} \frac{GDP_j}{dist_{ij}}.$$

Figure 6 depicts this calculation for India and United Kingdom from 1910 to 2010. The resulting series are characterized by a very smooth long-run trend and consequently very little variability across countries and time. Thus, for our purposes of understanding the relationship between economic growth and market potential over the long twentieth century, we again prefer the measures presented in Figure 3.

3.4 Decomposing the growth of market potential over time

We believe it also may be instructive to understand the underlying drivers of the change in market potential over time. For that purpose, we take logarithms and differences of equation (12) to decompose the growth of market potential into four elements:

$$(16) \qquad \Delta \ln(MA_i) = \frac{1}{2}\left[\Delta \ln\left(\frac{y_i}{y^W}\right) - \Delta \ln\left(t_{ii}^{\sigma-1}\right) - \Delta \ln\left(\frac{x_{ii}}{y_i}\right)\right] + \Delta \ln\left(y^W\right).$$

The three elements in the square brackets are specific to country *i*. The first element represents the growth of this country's share of global income. The second represents the growth of this country's domestic trade costs, scaled by the elasticity of substitution, which is associated with a decline in market potential. The third element represents the growth of this country's domestic trade share. This can be seen as an inverse measure of openness. If bilateral trade costs with other countries go up, then the domestic trade share increases. It is also associated with a decline in market potential. Finally, the fourth element represents the overall growth in global income, which is common to all countries.

To understand the decomposition in equation (16), it is useful to consider the hypothetical benchmark of income growing by the same uniform rate across all countries. In that case, the income and domestic trade shares in the square brackets would not change, and market potential would be driven exclusively by overall global income growth through the last term. If one country grew faster than the otherwise uniform rate, its market potential would rise more quickly than elsewhere.

In Table 1, we present the results of decomposition (16), constructing the right-hand side variables as described in section 3.2. We use our sample of 33 countries that we group by five regions (Asia, Australia/New Zealand, Europe, Latin America, and North America). We present a decomposition for the full period from 1910 to 2010, as well as separate decompositions for the periods from 1910 to 1960 and from 1960 to 2010. Overall, market potential grew by 305% across countries on average over the full period. Perhaps not surprisingly, this growth is rather similar across regions as global income growth serves as a common factor in driving market potential.

However, countries experienced only very moderate growth in market potential prior to 1960. This was a period marked by war and protectionism and an associated rise in domestic trade costs as well as domestic trade shares (see Jacks, Meissner, and Novy, 2011). In contrast, the period after 1960 was characterized by positive contributions to market potential growth stemming from declining domestic trade costs and increasing openness. In particular, Asia experienced above-average growth in market potential due to its expanding share of global income while the opposite was the case for Europe.

4. Wage equation regressions

Here, we return to one of the motivating questions for this paper, namely what is the relationship between globalization and growth? In particular, is there any systematic link between our preferred measure of market potential and standard measures of economic development over the long twentieth century?

An appropriate starting point is provided by Redding and Venables (2004). In their work, they derive what is known as a *wage equation*, that is, an equation that structurally relates the price of the immobile factor of production (or wage) to a country's market access/market potential. Based on their model, the same wage equation would arise in our context.

Redding and Venables demonstrate a strong correlation between GDP per capita (their proxy for wages) and market access in the cross-section. This correlation remains strong after conditioning on a large number of covariates and controlling for potential endogeneity. Head and Mayer (2011) run an analogous set of panel regressions, finding results consistent with those of Redding and Venables. However, with our new proposed measure of market potential, it is an open question whether this empirical regularity remains intact.

Table 2 first tries to establish the simple association between the log of GDP per capita and the log of market potential. Standard errors are clustered on countries here—and in all regressions—to control for within-country serial correlation of arbitrary form. The coefficient reported in the first column is precisely estimated and comparable in magnitude to that reported by both Redding and Venables (2004) and Head and Mayer (2011). Of course, there are many other potential determinants of GDP per capita, and the specification in the second column, thus, controls for both common patterns over time and fixed, unobserved country-level characteristics. This estimation then relies upon variation within countries over time which is not determined by global shocks or trends. That the coefficient actually increases in magnitude is a reassuring sign of our measure's salience.

The final two columns repeat the regression for different samples. The full sample in columns (1) and (2) includes 33 countries with observations on market potential and GDP per capita from 1910 to 2010 and 18 countries with observations on market potential and GDP per capita from 1950 to 2010. A brief review of Figure 2 suggests the former are predominantly developed nations in North America and Western Europe while the latter are mainly developing nations in Africa and Asia. The third column, which is based on the balanced sample dating from 1910 only, shows a slightly weaker point estimate compared to column (2). Given the countries that join the sample in 1950 and that are part of the sample for column (2), this suggests that the link between market potential and GDP per capita may have become stronger over time or is stronger for developing nations. The fourth column excludes observations spanning the two World Wars. Those may be problematic if these years entailed a breakdown in normal economic relationships or suffered a deterioration in terms of data quality. The magnitude of the elasticity between GDP per capita and market potential is unaffected.

Tables 3 and 4 average our measures of market potential and GDP per capita over (non-overlapping) five- and ten-year periods. This approach of aggregating over time can be thought of as reducing the role of measurement error in particular years as well as diminishing the potential role of domestic and global business cycles in driving the results. Across all specifications in Tables 3 and 4, the values of the coefficients are stable and broadly similar to Table 2, again pointing to a tight relationship between levels of development and market potential throughout the past century.

Of course, there are good reasons why these results should be approached with extreme caution. Above all, there is clear endogeneity in any wage equation regression given the way our measure of market potential is constructed in equation (12) as a function of domestic output.[14] Redding and Venables (2004) as well as Head and Mayer (2011) instrument market potential with measures of geographic centrality, namely a country's distance from Belgium, Japan, and the United States. Naturally but unfortunately, such measures do not vary over time, a condition which underlies many other possible instruments for market potential.

Faced with this prospect, we choose instead to draw inspiration from a series of papers by Feyrer (2009a, 2009b). In Feyrer (2009b), the author begins with the observation that historically the vast majority of international trade by value has been conducted via sea routes, and that to this day the vast majority of international trade by physical volumes continues to be conducted in this manner. However, presently, a very large share—upwards of 40%—of international trade by value is conducted via air routes as improvements in aircraft technology and logistics have enhanced the industry's importance in this regard. Thus, over time, countries with shorter air routes to its trading partners relative to its sea routes (e.g., India) have benefited more from this exogenous technological change than those with relatively similar air and sea routes (e.g., Canada). As Feyrer notes, "this heterogeneity can be used to generate a geography based instrument for trade that varies over time."

In a similar vein, Feyrer (2009a) exploits the shock to the global economy embodied by the closure of the Suez Canal from 1967 to 1975. While many trade routes remained unaffected, many did not and found the distances separating markets increasing significantly. For instance, Feyrer reports that India nearly led the pack with a 30.6% increase in its trade-weighted distance to foreign markets while a country like Canada only experienced a 0.2% increase in the same. Using this exogenous variation in distance over time, Feyrer goes on to separately estimate the effect of distance on trade and the effect of trade on income.

[14] See Irwin and Terviö (2002) who highlight the simultaneity of trade and income throughout the twentieth century.

Here, we combine both approaches. In particular, we use the great circle distances from the CEPII GeoDist database (see Appendix II) to represent distances on air routes to Japan, the United Kingdom, and the United States, the critical nodes of the world economy through the long twentieth century. We also collected the corresponding distances for sea routes reported in Philip (1935). Conveniently, this source also delineates which sea routes utilized the various major canals of the world, e.g., the Kiel, the Panama, and the Suez. This information allows us to incorporate changes in the distances of sea routes introduced by the various closures and openings of these canals over the period from 1910 to 2010.[15] The final step is in constructing a series on the share of US imports by value which are transported by air over this period based on Hummels (2007) and various reports of the International Air Transport Association.

Thus, our three proposed instruments for market potential in the wage regression are the following, time-varying measures of effective distance to major world markets for country *i*:

$$\text{Effective distance}_{i,Japan,t} = \alpha_t * \text{Air distance}_{i,Japan} + (1-\alpha_t) * \text{Sea distance}_{i,Japan,t}$$
$$\text{Effective distance}_{i,UK,t} = \alpha_t * \text{Air distance}_{i,UK} + (1-\alpha_t) * \text{Sea distance}_{i,UK,t}$$
$$\text{Effective distance}_{i,US,t} = \alpha_t * \text{Air distance}_{i,US} + (1-\alpha_t) * \text{Sea distance}_{i,US,t}$$

where α is the share of US imports by value transported by air and where we exclude Japan, the United Kingdom, and the United States from our sample.

Table 5 reports the results of this exercise using 4,128 annual observations for GDP per capita and market potential (our original sample of 4,431 observations minus the 303 observations associated with Japan, the United Kingdom, and the United States). The top half of column (1) represents the first stage regression results. In order of magnitude, effective distances to the United States, then Japan, and finally the United Kingdom all register as statistically significant. Quantitatively, these three instruments explain a significant amount of the variation

[15] For our sample, the most significant events in this regard are the closure of the Kiel Canal during the World Wars, the opening of the Panama Canal in 1914, and the closure of the Suez canal from 1967 to 1975.

in our measure of market potential, with the R-squared of the regression registering a relatively healthy 0.25 and the regression passing standard tests of joint significance and under-identification. The bottom half of column (1) represents the second stage regression results. There, the elasticity between market potential and GDP per capita is estimated to be 0.41, or about half the size of the equivalent estimate reported in column (2) of Table 2. However, this elasticity is precisely estimated and, in combination with the fixed effects, captures a majority of the variation in GDP per capita across space and time.

Again, we replicate the same set of results as in previous tables by using full versus restricted samples (columns 1 versus 2 and 3) and by averaging dependent and independent variables over increasingly large periods of time (Tables 6 and 7). All of the coefficients are precisely estimated, fall within the range of 0.41 and 0.48, and are smaller than their OLS counterparts, suggesting some role for endogeneity in naturally driving our previous results. On the one hand, we are cautious in not pushing these results too hard in suggesting this is the definite causal effect of market potential on global growth. On the other hand, the results also likely leave little room for the possibility that secular changes in market potential were not an important factor in determining the economic fortunes of nations over the long twentieth century, whatever the precise parameter value may be.

5. Conclusion

We develop a new approach to the concept of market potential. Exploiting a structural gravity model of trade, we show that market potential can be expressed mostly as a function of directly observable variables such as domestic trade flows and output. We derive this expression by solving for multilateral resistance price indices across countries. These indices indirectly capture bilateral trade costs and therefore contain variation that is essential for computing market potential. Our approach has two key advantages. First, our measure is straightforward to compute. As we do not need to add up country fixed effect coefficients, it offers an alternative to the more onerous construction of traditional market potential measures. Second, our measure of market potential naturally lends itself to comparisons over time, not only in the cross-section.

On the empirical side, we construct market potential measures for 51 countries over the period from 1910 to 2010. We find a rising trend in market potential during the twentieth century overall, but with the exception of a distinct slump associated with the Great Depression. Market potential growth took off in a significant way only during the second half of the period.

We also show that our measure of market potential is closely linked to average incomes, both in the cross-section and over time. Our estimates suggest that every one-percent increase in market potential is associated with a change in GDP per capita by roughly 0.45%. A significant share of global growth over the long twentieth century could therefore be attributed to changes in market potential in the long run.

References

Anderson, James E. and Eric van Wincoop (2003), "Gravity with Gravitas: A Solution to the Border Puzzle." *American Economic Review* 93(1): 170-192.

Chaney, Thomas (2008), "Distorted Gravity." *American Economic Review* 98(4): 1707-1721.

Eaton, Jonathan and Samuel Kortum (2002), "Technology, Geography, and Trade." *Econometrica* 70(4): 1741-1780.

Fally, Thibault (2015), "Structural Gravity and Fixed Effects." *Journal of International Economics* 97(1): 76-85.

Feyrer, James (2009a), "Distance, Trade, and Income: The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment." *NBER Working Paper 15557*.

Feyrer, James (2009b), "Trade and Income: Exploiting Time Series in Geography." *NBER Working Paper 14910*.

Fujita, Masahisa, Paul Krugman, and Anthony J. Venables (1999), *The Spatial Economy: Cities, Regions, and International Trade.* Cambridge: MIT Press.

Grossman, Gene M. and Elhanan Helpman (2015), "Globalization and Growth." *American Economic Review: Papers and Proceedings* 105(5): 100-104.

Hanson, Gordon (2005), "Market Potential, Increasing Returns and Geographic Concentration." *Journal of International Economics* 67(1): 1-24.

Harris, Chauncy D. (1954), "The Market as a Factor in the Localization of Industry in the United States." *Annals of the Association of American Geographers* 44(4): 315-348.

Head, Keith and Thierry Mayer (2011), "Gravity, Market Potential and Economic Development." *Journal of Economic Geography* 11(2): 281-294.

Helpman, Elhanan (1998), "The Size of Regions." In Pines *et al*. (Eds.), *Topics in Public Economics*. Cambridge: Cambridge University Press, 33-54.

Hummels, David (2007), "Transportation Costs and International Trade in the Second Era of Globalization." *Journal of Economic Perspectives* 21(3): 131-154.

Irwin, Douglas A. and Marko Terviö (2002), "Does Trade Raise Income? Evidence from the Twentieth Century." *Journal of International Economics* 58(1): 1-18.

Jacks, David S., Christopher M. Meissner, and Dennis Novy (2011), "Trade Booms, Trade Busts, and Trade Costs." *Journal of International Economics* 83(2): 185-201.

Krugman, Paul (1991), "Increasing Returns and Economic Geography." *Journal of Political Economy* 99(3): 483-499.

Krugman, Paul (1992), "A Dynamic Spatial Model." *NBER Working Paper 4219*.

Liu, Dan and Christopher M. Meissner (2015), "Market Potential and the Rise of US Productivity Leadership." *Journal of International Economics* 96(1): 72-87.

Melitz, Marc and Gianmarco Ottaviano (2008), "Market Size, Trade, and Productivity." *Review of Economic Studies* 75(1): 295-316.

Novy, Dennis (2013), "Gravity Redux: Measuring International Trade Costs with Panel Data." *Economic Inquiry* 51(1): 101-121.

Philip, George (1935), *Philip's Centenary Mercantile Marine Atlas*. London: G. Philip & Son.

Redding, Stephen and Peter K. Schott (2003), "Distance, Skill Deepening and Development" *Journal of Development Economics* 72(2): 515-541.

Redding, Stephen and Anthony J. Venables (2004), "Economic Geography and International Inequality." *Journal of International Economics* 62(1): 53-82.

Santos Silva, J.M.C. and Silvana Tenreyro (2006), "The Log of Gravity." *Review of Economics and Statistics* 88(4): 641-658.

Appendix I: Asymmetric trade costs

Suppose we relax the assumption of bilaterally symmetric trade costs in section 2 and allow for bilateral asymmetries. In that case we would yield the more general structural gravity equation

$$x_{ij} = \frac{y_i y_j}{y^W}\left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma},$$

where Π_i and P_j denote the outward and inward multilateral resistance terms according to Anderson and van Wincoop (2003).

Equation (8) continues to hold, and the preceding expression becomes

$$x_{ij} = \frac{y_i}{y^W}\left(\frac{t_{ij}}{\Pi_i}\right)^{1-\sigma} m_j.$$

Combining these two expressions yields

$$s_i = \frac{y_i \Pi_i^{\sigma-1}}{y^W}.$$

However, unlike in equation (9) we cannot express s_i as a function of domestic trade costs t_{ii}, domestic trade x_{ii} and global income y^W. Neither is this possible for m_i as in equation (7). Instead, using equation (8) we can only express their product as

$$s_i m_i = t_{ii}^{\sigma-1} x_{ii}.$$

The expressions for market and supplier access in equations (10) and (11) continue to hold. We can therefore write their geometric average as

$$(MA_i\, SA_i)^{\frac{1}{2}} = \frac{y_i}{(s_i m_i)^{\frac{1}{2}}} = \frac{y_i}{\left(t_{ii}^{\sigma-1} x_{ii}\right)^{\frac{1}{2}}},$$

where the last expression uses the previous equation. Note that precisely the same expression for the geometric average would hold in the case of symmetric trade costs by combining equations (12) and (13). However, with asymmetric trade costs we are no longer able to solve for MA_i and SA_i separately.

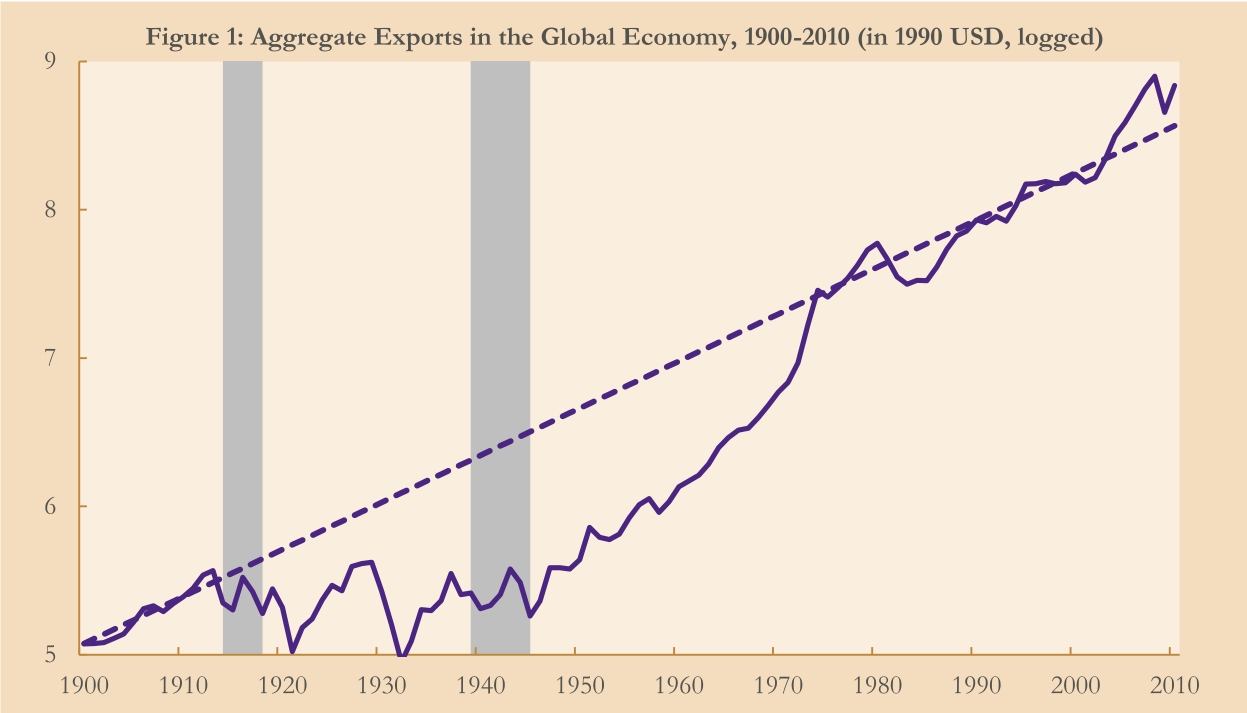
Appendix II: Data sources

Aggregate exports and bilateral trade: Trade figures were converted into real 1990 US dollars using the US CPI deflator in Officer, Lawrence H. 2015, "The Annual Consumer Price Index for the United States, 1774-2014" and the following sources:

Annuaire Statistique de la Belgique. Brussels: Ministère de l'intérieur.
Annuaire Statistique de la Belgique et du Congo belge. Brussels: Ministère de l'intérieur.
Annual Abstract of Statistics. London: Her Majesty's Stationery Office.
Barbieri, Katherine. 2002. *The Liberal Illusion: Does Trade Promote Peace?* Ann Arbor: University of Michigan Press.
Bloomfield, Gerald T. 1984. *New Zealand, A Handbook of Historical Statistics*. Boston: G.K. Hall.
Canada Yearbook. Ottawa: Census and Statistics Office.
Confederación Española de Cajas de Ahorros. 1975. *Estadísticas Básicas de España 1900-1970*. Madrid: Maribel.
Direction of Trade Statistics. Washington: International Monetary Fund.
Historisk Statistik för Sverige. 1969. Stockholm: Allmänna förl.
Johansen, Hans Christian. 1985. *Dansk Historisk Statistik 1814-1980*. Copenhagen: Gylendal.
Ludwig, Armin K. 1985. *Brazil: A Handbook of Historical Statistics*. Boston: G.K. Hall.
Mitchell, Brian R. 2003a. *International Historical Statistics: Africa, Asia, and Oceania 1750-2000*. New York: Palgrave Macmillan.
Mitchell, Brian R. 2003b. *International Historical Statistics: Europe 1750-2000*. New York: Palgrave Macmillan.
Mitchell, Brian R. 2003c. *International Historical Statistics: The Americas 1750-2000*. New York: Palgrave Macmillan.
National Bureau of Economic Research-United Nations World Trade Data.
Statistical Abstract for British India. Calcutta: Superintendent Government Printing.
Statistical Abstract for the British Empire. London: Her Majesty's Stationery Office.
Statistical Abstract for the Colonies. London: Her Majesty's Stationery Office.
Statistical Abstract for the Principal and Other Foreign Countries. London: Her Majesty's Stationery Office.
Statistical Abstract for the Several Colonial and Other Possessions of the United Kingdom. London: Her Majesty's Stationery Office.
Statistical Abstract for the United Kingdom. London: Her Majesty's Stationery Office.
Statistical Abstract of the United States. Washington: Government Printing Office.
Statistical Abstract Relating to British India. London: Eyre and Spottiswoode.
Statistical Yearbook of Canada. Ottawa: Department of Agriculture.
Statistics Bureau Management and Coordination Agency. 1987. *Historical Statistics of Japan, vol. 3*. Tokyo: Japan Statistical Association.
Statistisches Reichsamt. 1936. *Statistisches Handbuch der Weltwirtschaft*. Berlin.
Statistisk Sentralbyrå. 1978. *Historisk statistikk.* Oslo.
Tableau général du commerce de la France. Paris: Imprimeur royale.
Tableau général du commerce et de la navigation. Paris: Imprimeur nationale.
Tableau général du commerce extérieur. Paris: Imprimeur nationale.
Year Book and Almanac of British North America. Montreal: John Lowe.
Year Book and Almanac of Canada. Montreal: John Lowe.

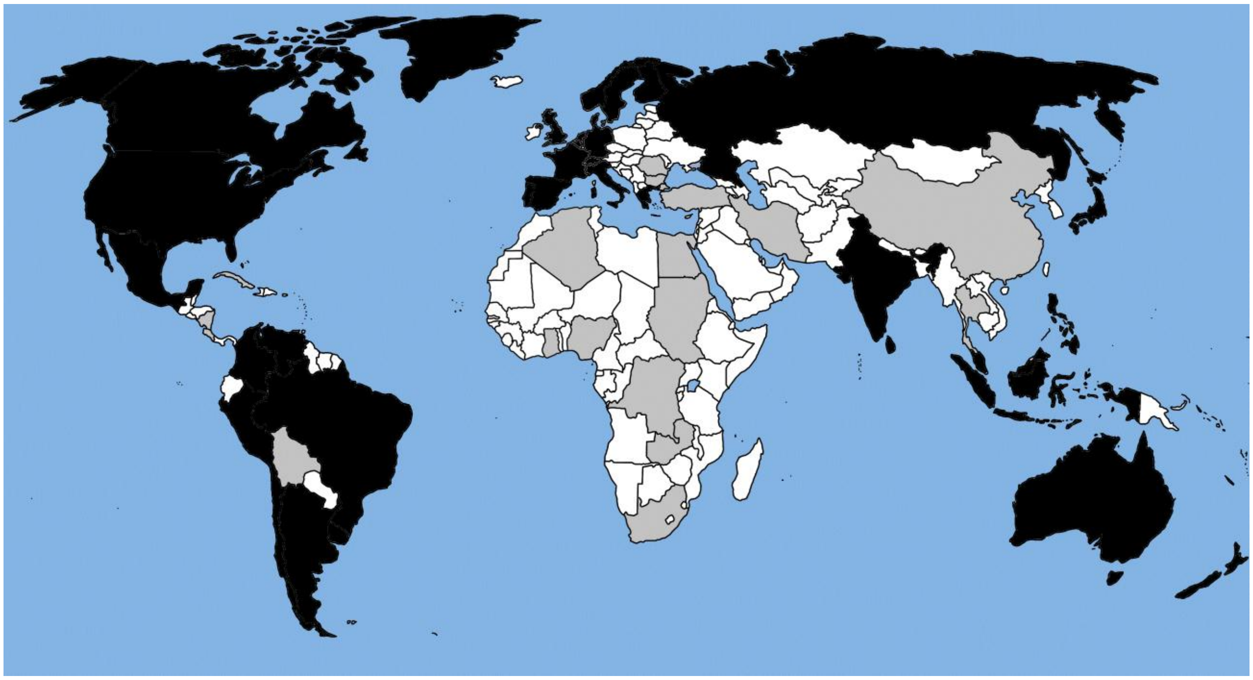
Distance: Taken from the CEPII GeoDist database available at www.cepii.fr. Bilateral distance is measured as the distance between the most populous cities/agglomerations in each country using the great circle formula. Domestic distance is measured based on a country's surface area with the formula $0.67^{*}(\text{area}/\pi)^{0.5}$ where area is measured in square kilometers. Details are provided in Mayer, T. and S. Zignago (2011), "Notes on CEPII's Distances Measures: The GeoDist Database." *CEPII Working Paper no. 2011-25.*

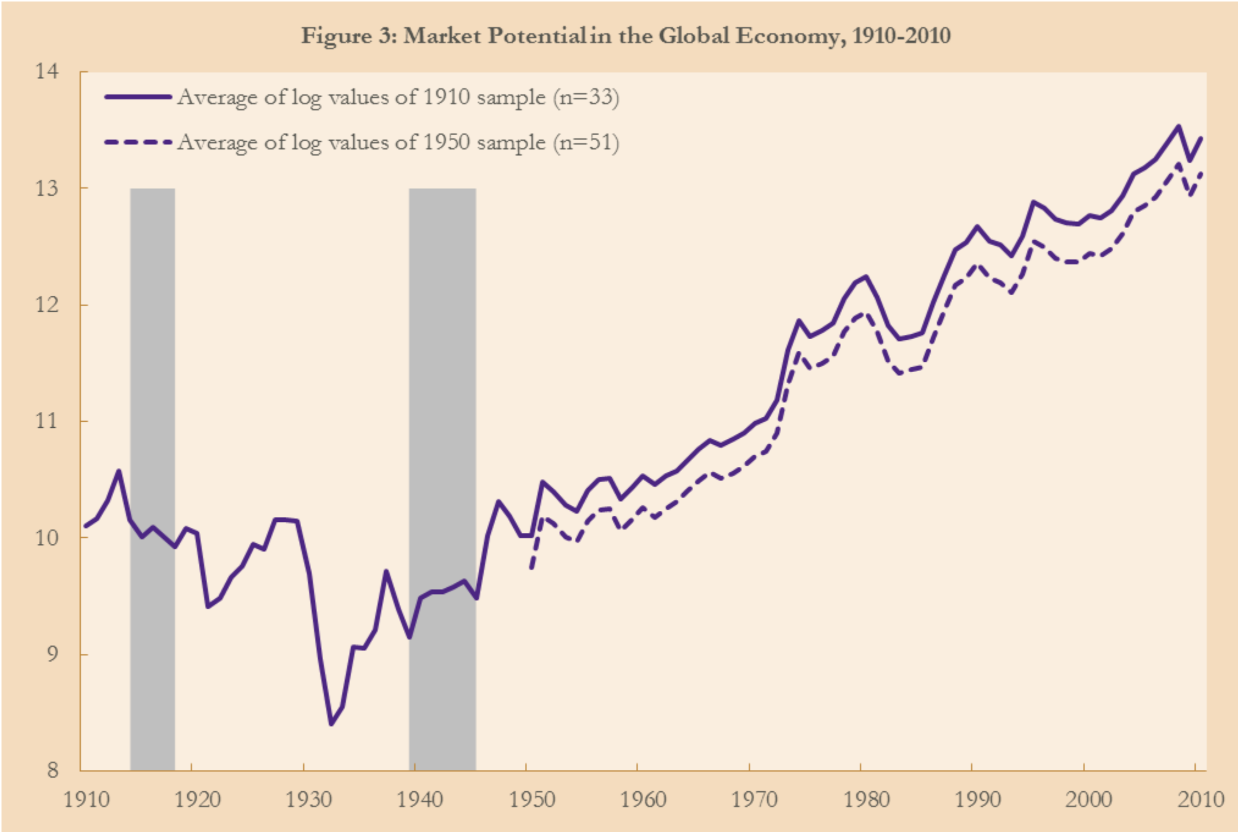
GDP: Maddison, Angus. 2009. *Historical Statistics of the World Economy: 1 – 2008 AD*. Updates drawn from Bolt, J. and J. L. van Zanden. 2014. "The Maddison Project: Collaborative Research on Historical National Accounts." *Economic History Review* 67(3): 627–651.



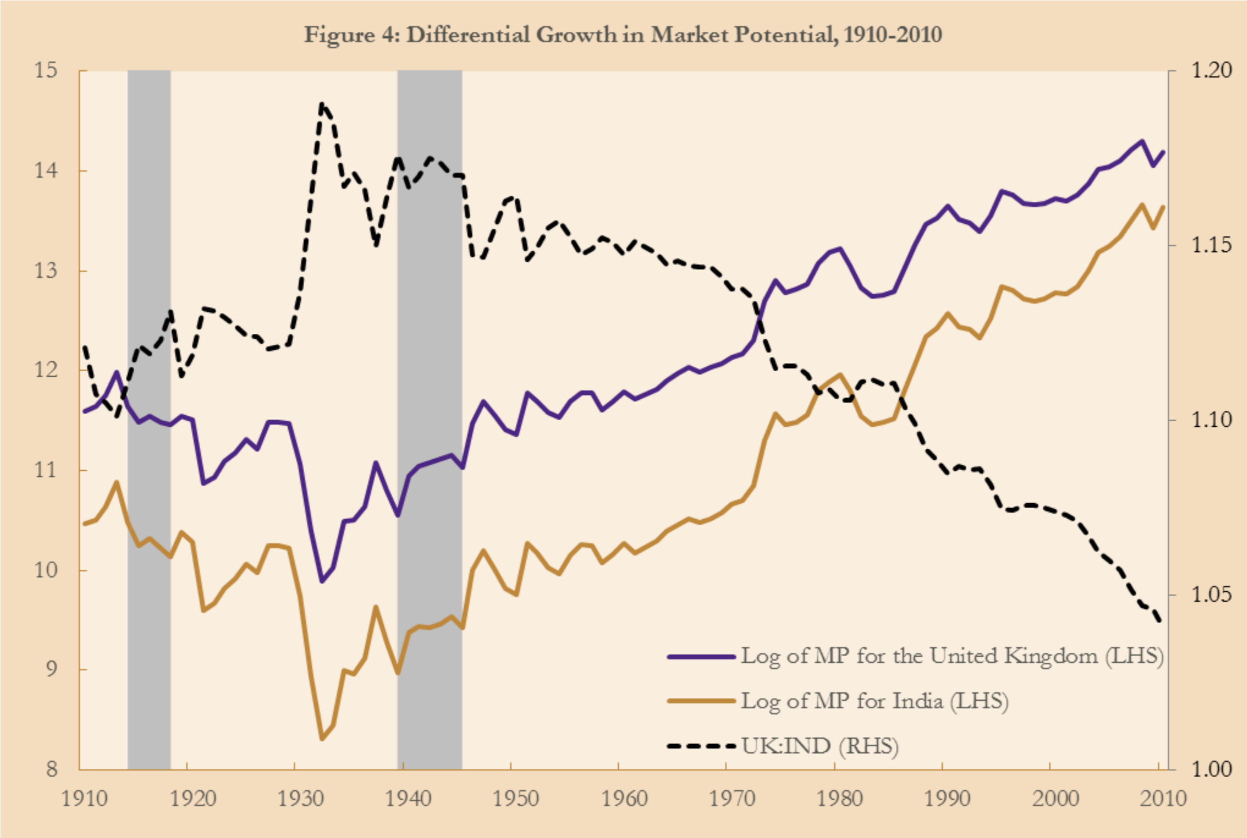
The solid line plots the sum of aggregate exports over the period from 1900 to 2010 for 51 countries representing roughly 90% of world GDP in 2010. The series is in real 1990 US dollars using the US CPI deflator, expressed in logarithms. The dashed line projects the trend in exports from 1900 to 1910 over the entire period up to 2010. The shaded areas indicate the World Wars. See Appendix II for data sources.

Figure 2: Sample Countries (from 1910 in black and from 1950 in grey)



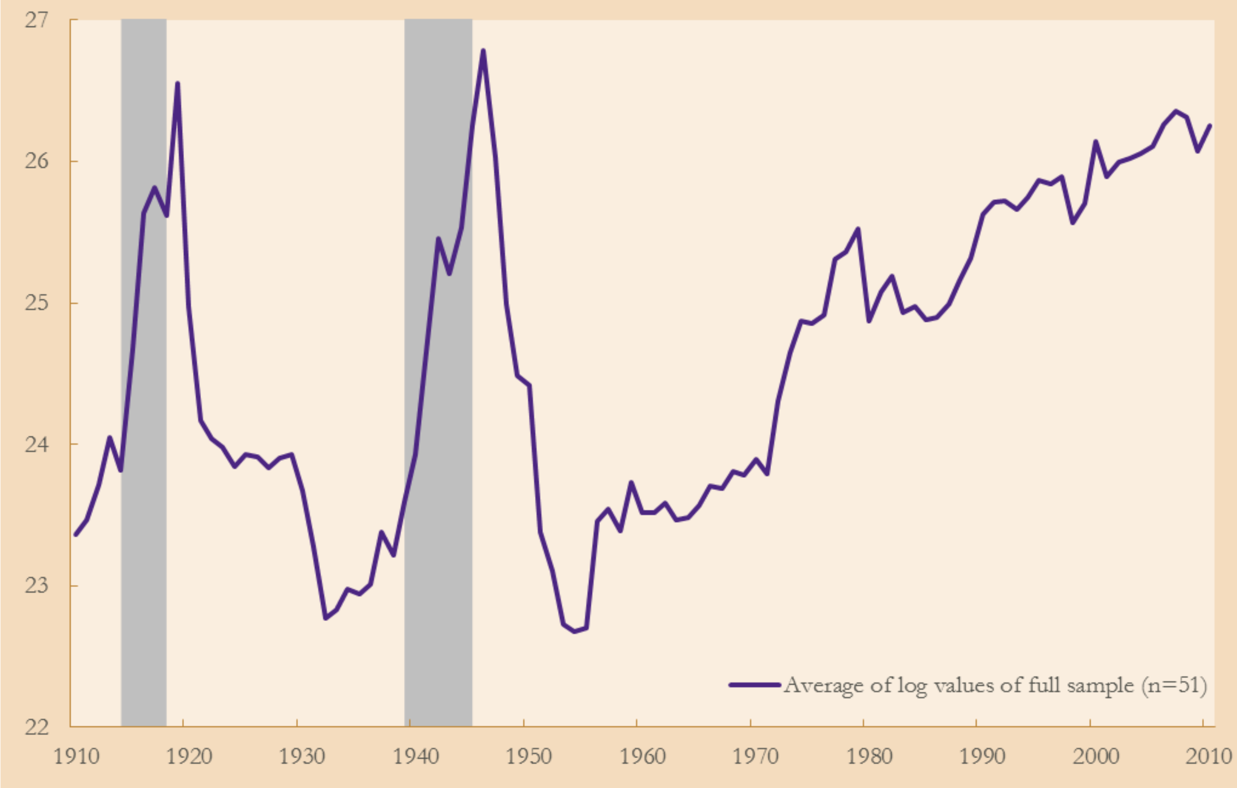


This figure plots the averages of the logarithmic values of the market potential measures of countries in two samples. The first sample (solid line) comprises the 33 countries for which the full set of output and trade data are available from 1910. The second sample (dashed line) comprises the 51 countries for which the full data set is available from 1950, thus adding 18 countries. See Figure 2 for an overview of the countries and Appendix II for a description of the data sources. The market potential measures are constructed based on equation (12). See section 3.2 for details. The shaded areas indicate the World Wars.

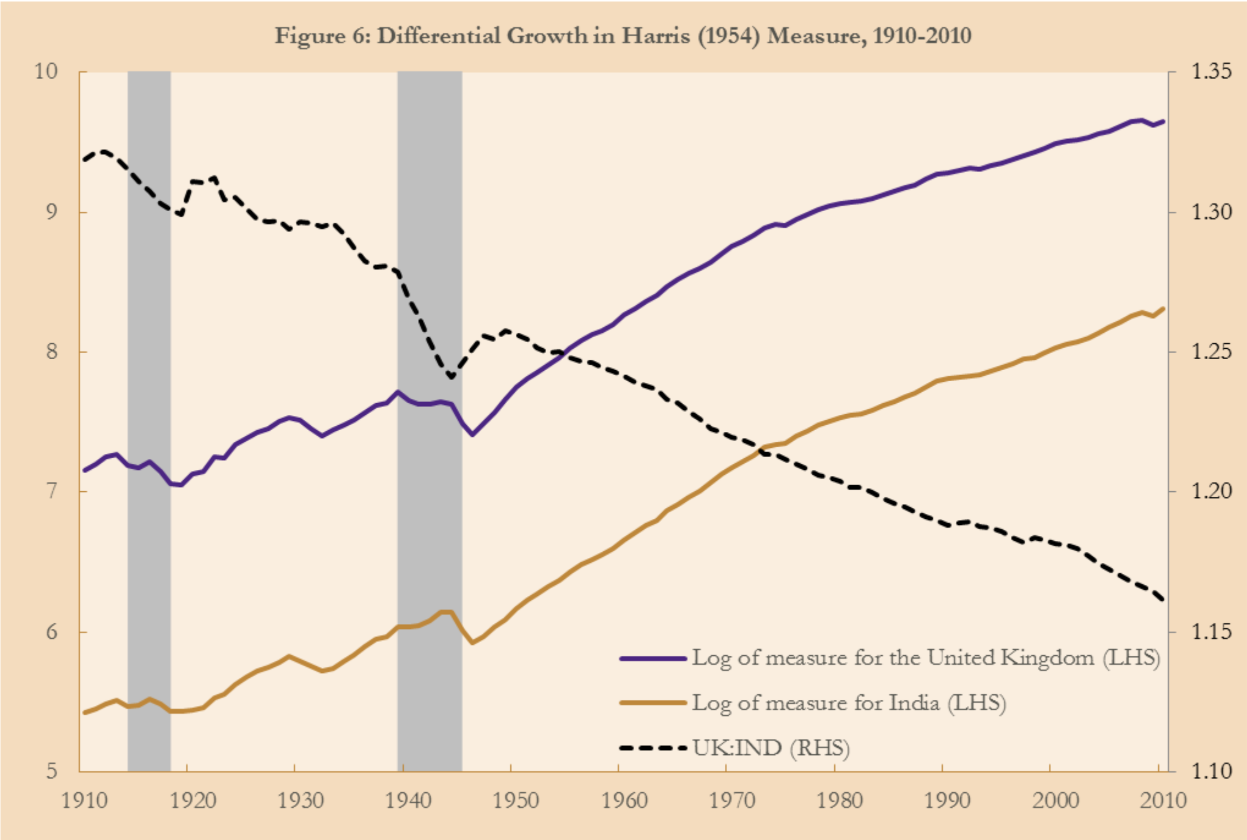


The solid lines plot the logarithmic values of the market potential measures for the United Kingdom and India, respectively, over the period from 1910 to 2010 (left-hand scale). The market potential measures are constructed based on equation (12). See section 3.2 for details. The dashed line depicts the ratio of the measure for the United Kingdom over the measure for India (right-hand scale). The shaded areas indicate the World Wars.

Figure 5: Redding and Venables Market Access Measure, 1910-2010



This figure plots the average of the logarithmic values of the market access measures for the individual 51 countries in the full sample over the period from 1910 to 2010, constructed based on the method devised by Redding and Venables (2004). The market access measures are constructed based on equation (15). See section 3.3 for details. See Figure 2 for an overview of the countries and Appendix II for a description of the data sources. The shaded areas indicate the World Wars.



The solid lines plot the logarithmic values of the market potential measures for the United Kingdom and India, respectively, constructed based on Harris (1954) over the period from 1910 to 2010. See section 3.3 for details. See Figure 2 for an overview of the countries and Appendix II for a description of the data sources. The dashed line depicts the ratio of the measure for the United Kingdom over the measure for India (right-hand scale). The shaded areas indicate the World Wars.

Table 1: Decomposition of Changes in Market Potential

			Average growth in market potential		Contribution of growth in y_i/y^W		Contribution of decline in t_{ii}		Contribution of growth in x_{ii}/y^W		Contribution of growth in y^W
1910-2010	**Full sample**	**(n = 33)**	**305%**	**=**	**-5%**	**+**	**26%**	**+**	**6%**	**+**	**282%**
	Asia	(n = 6)	328	=	19	+	27	+	1	+	282
	Australia/NZ	(n = 2)	335	=	13	+	29	+	11	+	282
	Europe	(n = 15)	280	=	-27	+	24	+	11	+	282
	Latin America	(n = 8)	336	=	34	+	27	+	-8	+	282
	North America	(n = 2)	325	=	11	+	31	+	2	+	282
1910-1960	**Full sample**	**(n = 33)**	**22%**	**=**	**-5%**	**+**	**-97%**	**+**	**-3%**	**+**	**127%**
	Asia	(n = 6)	4	=	-24	+	-98	+	-1	+	127
	Australia/NZ	(n = 2)	26	=	6	+	-106	+	-2	+	127
	Europe	(n = 15)	26	=	-11	+	-87	+	-3	+	127
	Latin America	(n = 8)	36	=	22	+	-100	+	-12	+	127
	North America	(n = 2)	25	=	12	+	-113	+	-1	+	127
1960-2010	**Full sample**	**(n = 33)**	**286%**	**=**	**-1%**	**+**	**126%**	**+**	**8%**	**+**	**155%**
	Asia	(n = 6)	313	=	37	+	118	+	4	+	155
	Australia/NZ	(n = 2)	309	=	7	+	134	+	13	+	155
	Europe	(n = 15)	261	=	-16	+	121	+	16	+	155
	Latin America	(n = 8)	300	=	12	+	129	+	4	+	155
	North America	(n = 2)	301	=	0	+	144	+	2	+	155

Notes: All numbers are in percent, rounded off to integers and weighted by income shares in the initial year of the period (for the full sample or within regions, respectively).

Table 2: Wage Equation Regressions – OLS Estimates, Annual Observations

	(1)	(2)	(3)	(4)
	Dependent variable: Log of GDP per capita			
Log of market potential	**0.4094**	**0.7703**	**0.5763**	**0.5778**
standard error	**0.0344**	**0.1222**	**0.1345**	**0.1350**
t-statistic	**11.92**	**6.30**	**4.29**	**4.28**
p-value	**0.00**	**0.00**	**0.00**	**0.00**
Country and time FEs?	NO	YES	YES	YES
Balanced sample?	NO	NO	YES	YES
World Wars excluded?	NO	NO	NO	YES
Observations	**4431**	**4431**	**3333**	**2772**
R-squared	**0.38**	**0.94**	**0.95**	**0.95**

Notes: Standard errors are clustered on countries in all specifications.

Table 3: Wage Equation Regressions – OLS Estimates, Five Year Averages

	(1)	(2)	(3)	(4)
	Dependent variable: Log of GDP per capita			
Log of market potential	**0.4176**	**0.7988**	**0.6025**	**0.6490**
standard error	**0.0356**	**0.1265**	**0.1426**	**0.1437**
t-statistic	**11.73**	**6.31**	**4.22**	**4.52**
p-value	**0.00**	**0.00**	**0.00**	**0.00**
Averaged over five years?	YES	YES	YES	YES
Country and time FEs?	NO	YES	YES	YES
Balanced sample?	NO	NO	YES	YES
World Wars excluded?	NO	NO	NO	YES
Observations	**876**	**876**	**660**	**495**
R-squared	**0.38**	**0.95**	**0.95**	**0.96**

Notes: Standard errors are clustered on countries in all specifications.

Table 4: Wage Equation Regressions – OLS Estimates, Ten Year Averages

	(1)	(2)	(3)	(4)
	Dependent variable: Log of GDP per capita			
Log of market potential	**0.4188**	**0.7976**	**0.5882**	**0.6944**
standard error	**0.0360**	**0.1304**	**0.1463**	**0.1567**
t-statistic	**11.63**	**6.11**	**4.02**	**4.43**
p-value	**0.00**	**0.00**	**0.00**	**0.00**
Averaged over ten years?	YES	YES	YES	YES
Country and time FEs?	NO	YES	YES	YES
Balanced sample?	NO	NO	YES	YES
World Wars excluded?	NO	NO	NO	YES
Observations	**438**	**438**	**330**	**231**
R-squared	**0.38**	**0.95**	**0.95**	**0.96**

Notes: Standard errors are clustered on countries in all specifications.

Table 5: Wage Equation Regressions – IV Estimates, Annual Observations

	(1)	(2)	(3)
FIRST STAGE	Dependent variable: Log of market potential		
Log of distance to Japan	**-2.7141**	**-3.4613**	**-3.2995**
standard error	**0.5153**	**0.6925**	**0.6306**
t-statistic	**-5.27**	**-5.00**	**-5.23**
p-value	**0.00**	**0.00**	**0.00**
Log of distance to United Kingdom	**-2.5495**	-1.9161	**-1.8298**
standard error	**0.9570**	1.1829	**1.0890**
t-statistic	**-2.66**	-1.62	**-1.68**
p-value	**0.01**	0.12	**0.10**
Log of distance to United States	**-7.8370**	**-9.9547**	**-9.0322**
standard error	**3.7579**	**4.0672**	**3.9770**
t-statistic	**-2.09**	**-2.45**	**-2.27**
p-value	**0.04**	**0.02**	**0.03**
First-stage uncentered R-squared	0.25	0.25	0.25
Angrist-Pischke F test (p-value)	49.35 (0.00)	55.59 (0.00)	55.10 (0.00)
Angrist-Pischke underid. test (p-value)	151.26 (0.00)	172.63 (0.00)	171.14 (0.00)
	(1)	(2)	(3)
SECOND STAGE	Dependent variable: Log of GDP per capita		
Log of market potential (instrumented)	**0.4116**	**0.4664**	**0.4502**
standard error	**0.0275**	**0.0197**	**0.0186**
t-statistic	**14.99**	**23.72**	**24.18**
p-value	**0.00**	**0.00**	**0.00**
Country and time FEs?	YES	YES	YES
Balanced sample?	NO	YES	YES
World Wars excluded?	NO	NO	YES
Observations	4128	3030	2520
R-squared	0.73	0.78	0.80

Notes: Standard errors are clustered on countries in all specifications.

Table 6: Wage Equation Regressions – IV Estimates, Five Year Averages

	(1)	(2)	(3)
FIRST STAGE	Dependent variable: Log of market potential		
Log of distance to Japan	**-2.8843**	**-3.6280**	**-3.5632**
standard error	**0.5733**	**0.7631**	**0.7486**
t-statistic	**-5.03**	**-4.75**	**-4.76**
p-value	**0.00**	**0.00**	**0.00**
Log of distance to United Kingdom	**-2.7136**	-2.1143	-1.8644
standard error	**1.0087**	1.2725	1.2035
t-statistic	**-2.69**	-1.66	-1.55
p-value	**0.01**	0.11	0.13
Log of distance to United States	**-8.6668**	**-10.8462**	**-9.3225**
standard error	**3.7546**	**4.0331**	**3.7788**
t-statistic	**-2.31**	**-2.69**	**-2.47**
p-value	**0.03**	**0.01**	**0.02**
First-stage uncentered R-squared	0.27	0.27	0.27
Angrist-Pischke F test (p-value)	50.09 (0.00)	52.84 (0.00)	43.28 (0.00)
Angrist-Pischke underid. test (p-value)	153.83 (0.00)	164.54 (0.00)	134.93 (0.00)
	(1)	(2)	(3)
SECOND STAGE	Dependent variable: Log of GDP per capita		
Log of market potential (instrumented)	**0.4155**	**0.4727**	**0.4225**
standard error	**0.0281**	**0.0202**	**0.0211**
t-statistic	**14.80**	**23.43**	**19.99**
p-value	**0.00**	**0.00**	**0.00**
Averaged over five years?	YES	YES	YES
Country and time FEs?	YES	YES	YES
Balanced sample?	NO	YES	YES
World Wars excluded?	NO	NO	YES
Observations	816	600	450
R-squared	0.75	0.75	0.85

Notes: Standard errors are clustered on countries in all specifications.

Table 7: Wage Equation Regressions – IV Estimates, Ten Year Averages

	(1)	(2)	(3)
FIRST STAGE	Dependent variable: Log of market potential		
Log of distance to Japan	**-3.3921**	**-4.3348**	**-3.8117**
standard error	**0.7532**	**0.9838**	**0.8054**
t-statistic	**-4.50**	**-4.41**	**-4.73**
p-value	**0.00**	**0.00**	**0.00**
Log of distance to United Kingdom	**-3.1707**	**-2.6994**	**-2.3047**
standard error	**1.1796**	**1.5260**	**1.2174**
t-statistic	**-2.69**	**-1.77**	**-1.89**
p-value	**0.01**	**0.09**	**0.07**
Log of distance to United States	**-9.8713**	**-12.0048**	**-9.4340**
standard error	**3.6352**	**3.8195**	**3.2743**
t-statistic	**-2.72**	**-3.14**	**-2.88**
p-value	**0.01**	**0.00**	**0.01**
First-stage uncentered R-squared	0.31	0.32	0.34
Angrist-Pischke F test (p-value)	47.80 (0.00)	49.48 (0.00)	41.83 (0.00)
Angrist-Pischke underid. test (p-value)	147.18 (0.00)	154.58 (0.00)	131.08 (0.00)
	(1)	(2)	(3)
SECOND STAGE	Dependent variable: Log of GDP per capita		
Log of market potential (instrumented)	**0.4229**	**0.4811**	**0.4386**
standard error	**0.0281**	**0.0206**	**0.0230**
t-statistic	**15.04**	**23.31**	**19.03**
p-value	**0.00**	**0.00**	**0.00**
Averaged over ten years?	YES	YES	YES
Country and time FEs?	YES	YES	YES
Balanced sample?	NO	YES	YES
World Wars excluded?	NO	NO	YES
Observations	408	300	210
R-squared	0.75	0.80	0.85

Notes: Standard errors are clustered on countries in all specifications.