THE COLONIAL ORIGINS OF DIVERGENCE IN THE AMERICAS
A LABOUR MARKET APPROACH[♣]

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The Colonial Origins of the Divergence in the Americas: A Labour Market Approach

ABSTRACT

Part of a long-run project to put together a systematic database of prices and wages for the American continents, this paper takes a first look at standards of living in a series of North American and Latin American cities. From secondary sources we collected price data that –with diverse degrees of quality– covers various years between colonization and independence and, following the methodology now familiar in the literature, we built estimations of price indexes for Boston, Philadelphia, and the Chesapeake Bay region in North America and Bogotá, Mexico, and Potosí in Latin America exploring alternative assumptions on the characteristics of the reference basket. We use these indexes to deflate the (relatively more scarce) figures on wages, and compare the results with each other, and with the now widely known series for various European and Asian cities. We find that real wages were higher in North America than in Latin America from the very early colonial period: four times the World Bank Poverty Line (WBPL) in North America while only two times the WBPL in Latin America. These wages place the North American colonies among the most advanced countries in the world alongside Northwestern European countries and the Latin American colonies among the least developed countries at a similar level to Southern European and Asian countries. These wage differences existed from the early colonial period because wages in the American colonies were determined by wages in the respective metropoles and by the Malthusian population dynamics of indigenous peoples. Settlers would not migrate unless they could maintain their standard of living, so wages in the colonies were set in the metropole. Political institutions, forced labour regimes, economic geography, disease environments and culture shaped the size of the economy of each colony but did not affect income levels.

Keywords: economic history, real wages, standard of living, labour market, population, Great Divergence, North America, Latin America.

JEL Classification: N11, N16, N31, N36, J2, J4, I32

Introduction

The Americas figures prominently in discussions about the divergence in the world economy. The United States and Canada are among the richest countries in the world, while Latin America is markedly poorer. North and South America were settled by people of various parts of Europe who brought with them different legal frameworks and political arrangements modelled on the countries they came from, along with different religions, languages and other cultural traits. The geographies of the continents differ in topography, disease environment, agricultural potential, and mineral resources. These variations raise the tantalizing possibility that economic success can be reduced to culture, institutions, or geography, and different analysts have championed one or another of these possibilities.

A long-standing cultural explanation, first formulated for Europe by Max Weber [1904-5], attributes the success of North America to the Protestantism of its settlers and the failure of the South to Catholicism. Another line of argument, which is common in colonial ideology, attributes the underdevelopment of Latin America to the supposed irrationality of pre-capitalist groups like natives or former slaves [McClelland, 1961; Rogers, 1962; Hagen, 1962]. Most of these cultural arguments, however, lack support. The Weber thesis has been discredited as an explanation of European history, and the irrationality of peasant cultivators has been consistently refuted by agricultural economists [Tawney, 1938; Trevor-Roper, 1967; Blaut, 1993; Lehmann and Roth, 1995; Schultz, 1964; Berry and Cline, 1979; Booth and Sundrum, 1985; Mellor and Mudahar, 1992].

More plausible are institutional arguments. The simplest is North, Summerhill and Weingast's contention that English institutions, which predominated in the North, were superior to Spanish and Portuguese institutions, and that the colonial experience strengthened these differences [North *et al.*, 2000]. Secure property rights and limited government allowed a market economy to flourish in the North, while communal ownership of native land, insecure property rights among the Spanish, and meddlesome interventions by the state shackled the market south of the Rio Grande [see also Coatsworth, 2006, 2008].

Other institutional arguments are ultimately geographical since they explain institutions by geography rather than colonial heritage. Thus, Engerman and Sokoloff [1997, 2002] have proposed an account that begins with geography and ends with institutions. The geography of the Caribbean and Brazil favoured sugar production, which was carried out on large plantations staffed with African slaves. The result was exceptionally unequal societies. They underpinned non-democratic governments that taxed and spent in ways that benefited the elite rather than the majority. This was true whether the colony was English, French, Spanish, or Portuguese. Likewise, the large native populations in Mexico and the Andes were ruled by comparatively small settler population with the same outcome. In contrast, New England and the middle Atlantic colonies had economies of family farms that sustained participatory government from an early date. These participatory governments acted with a wider range of interests and provided benefits for a larger proportion of society. There were many policy differences between the North and the South, and education was one that had implications for long run development. The democratic governments of North America established mass education at an early date, while universal education was not achieved in Latin America until the late twentieth century.

Acemoglu *et al.* [2001] have advanced an alternative formulation in which settler mortality was the key geographical variable. If many settlers died (say, the colony was malarial), an 'extractive' regime was established in which Europeans extorted income and labour from the natives. In contrast, where European settlers faced low mortality, they settled in great numbers and institutions were established to facilitate their land ownership and trading opportunities. The extractive colonies developed weak property rights and arbitrary governments that shackled economic development, while the settler colonies develop secure property rights and governments that promoted trade and growth.

While these arguments are clever and revealing, we find them to be ultimately unsatisfying. Our reservations are both empirical and theoretical. Empirically, the problem is that there are no satisfactory measures of economic performance for North America before the mid-eighteenth century and for Latin America before the late nineteenth century. Except for a few odd (in several senses) national income estimates, measures of GDP are lacking before these dates – a weakness that did not prevent Angus Maddison from concocting numbers to fill the void [Maddison, 1995]. Maddison's original figures, as well as their reworking by Coatsworth [2008: 547] depicted here in Figure 1, show North America slightly behind Latin America in the colonial period and both substantially behind the leading countries of Western Europe. Acemoglu *et al.* [2002] have put colonial Latin America much further ahead than North America, based on conjectured urbanization rates and a review of Bairoch's [1982] very weak estimates of industrial output. The authors conclude "that the reversal in relative incomes [when the North became richer than the South] took place during the late eighteenth and early nineteenth centuries and was linked to industrialization." [Acemoglu *et al.*, 2002: 1258]. The truth is that nobody knows when the Great Divergence occurred in the Americas, so explanations of that divergence drift across the centuries without any firm anchor. In this paper, we aim to fill the evidential gap using estimates of real wages in leading cities in North and South America between 1500 and 1800.

[Figure 1 about here]

We also find the explanations of divergent development in terms of geography, culture, or institutions to be unsatisfying on the theoretical plane because the discussion is carried on without reference to the markets involved. Most incomes were returns to labour, capital, or land, and reflected the prices of these resources and the quantities owned. The prices are critical, and we focus on the labour market because it determined the incomes of most members of society. Once we see how the markets worked, it is easier to see the role of geography, culture, and institutions in the development of the New World.

We begin by measuring real wages in North and South America between colonization and independence, and comparing them to Europe and Asia. We find that for much of the seventeenth and eighteenth centuries, North America was the most prosperous region of the world, offering living standards at least as high as those in the booming parts of North-Western Europe. Latin America, on the other hand, was much poorer and offered a standard of living like that in Spain and less prosperous parts of the world in general. Next, we analyse the market mechanisms that yielded these results including international migration, the demography of the American Indian populations, slavery, and the various systems that the Spanish used to manipulate Indian labour in the colonial period. We conclude that the long run income levels in the colonies reflected income levels in the corresponding colo-

nial powers and the Malthusian demography of the Indians. Colonial features like political arrangements, culture, and disease environment affected the size of the colony's economy but had little bearing on its income level.

The Price and Wage History of the Americas

The main empirical contribution of this paper is the measurement of real wages in leading parts of North and South America from the early colonial period to the beginning of the nineteenth century. There have been many studies on both prices and wages in the American continent (see the Appendix), but usually they focus on a country or region without a comparative perspective, which is the one we want to stress here. We concentrate on Boston, Philadelphia, and the Chesapeake Bay region of the future USA, and Mexico, Potosi, and Bogota in Latin America (with a sideways glance to Buenos Aires). For all of these places, we collected wage rates and the prices of consumer goods. The latter were combined into a consumer price index to gauge the standard of living that workers could purchase with their earnings. We calibrate our index, as explained later in the paper, so that living standards can be expressed as multiples of the World Bank Poverty Line (WBPL).

All studies of this sort confront a series of standard problems, which we have dealt with as follows:

- Sources: Our data were drawn from price histories conducted by historians of the places that we study. They have derived their data from the accounts of long lasting institutions (e.g. Pardo Pardo [1972]'s study of the records of the Convents of the Conception and of St. Francis in Bogota), the records of merchants and manufacturers [e.g. Wright, 1885], state administrative records [e.g. Borah and Cook, 1953], and market reports in newspapers (Bezanson et al. [1935, 1936, 1951, 1954]'s volumes on Philadelphia). Full details are given in the Appendix.

- Wholesale and Retail Prices: Often sources report wholesale prices or import valuations rather than retail prices, which are relevant to consumer purchasing power. We have been able to compare retail and wholesale prices for the same commodities using information in Wright [1885] as well as similar twentieth century data for Mexico in the ILO *Yearbook of Labour Statistics*. These comparisons indicate retail mark-ups of approximately 50% in both cases. There were differences between different classes of commodities. We have applied the appropriate mark-up to wholesale prices as necessary to estimate the retail prices needed for our cost of living indices.

- Exchange Rates: Wages and prices were recorded in units of account like Massachusetts shillings (old tenor and new), Spanish *marevidis*, and Mexican *reales*. All units of account have been converted to grams of silver since silver coins were the principal media of exchange or could be purchased with the paper currencies that sometimes circulated in British North America. For the conversions relating the *reales* used in the Spanish colonies, we followed the classic work of Burzio [1958].

- Weights and Measures: Prices were quoted in local weights and measures. These have been converted to metric equivalents. This issue was particularly difficult in Latin America where many capacity of units like the *fanega* or the *carga* varied from place to place. Here we used the conversions suggested in Doursther [1965 (1840)] and those appearing Allen and Murphy [2005: Tables IV to VI]. In the few cases where we needed to translate volumes into weight (or vice versa), we applied alternative exchange rules to different products as detailed in the Appendix.

- Type of Labour: We concentrate on unskilled workers – generally, building labourers, agricultural labourers, or miners.

- Slavery and Forced Labour: Labour exploitation was common in the Americas [see, e.g., Monteiro, 2006]. Slaves, however, are excluded from the present analysis. We do include the wages of native Indians employed under labour regimes like *repartimento* and *mita*. While these were not voluntary arrangements, earnings can still be meaningfully compared to prices to measure consumption possibilities. Later in the paper, we discuss how *repartimento* affected native earnings and whether slavery reduced the incomes of workers in general.

- Wage Quotations: Sometimes wages were paid exclusively in cash, and sometimes they included food, drink, or accommodation. We have tried to use only cash wages. Occasionally, the value of food has been added to cash wages where appropriate and where the value of the payment in kind could be established. Generally, we have used daily wage rates rather than monthly or annual wages since the later were much more likely to include unrecorded payments in kind [Allen et al. 2011].

Wages in the Americas

We have been able to assemble unskilled wages for three colonies in British North America–Massachusetts from its founding in 1630, Philadelphia from 1727, and Maryland from 1662. For Latin America we have rural and urban wages for Mexico from 1525, Bogotá from 1635, and Potosí from 1677. These have been converted to grams of silver per day based on the silver value of the currency in each year.

[Table 1 about here]

Table 1 summarizes average wages for the Americas at 50 year intervals and contrasts them with corresponding averages for cities in Europe and Asia. The patterns are striking. Between 1650 and 1700, Potosi had by far the highest wages in the world–almost double those of London, which was in second place. Potosi's lead was not a surprise since it was the world's biggest silver mine. Silver wages elsewhere in the Americas were not exceptional, however. By the early eighteenth century, Potosi's lead had slipped, and between 1750 and 1799, Philadelphia had leapt into first place with the highest wage level in the world. Boston, London, Amsterdam, and Mexico City were close behind. Throughout the early modern period, central and southern Europe had low wage levels as did Bogota and rural Mexico. These patterns are shown graphically in Figures 2 and 3 as, for the sake of

clarity, we plotted silver wages annually for North America in Figure 2 and for Latin America in Figure 3, in both cases contrasting with silver wages in London, Valencia and the Lower Yangzi Delta.

[Figure 2 and 3 about here]

Price of Subsistence

Wages, in themselves, do not indicate living standards. It is necessary to compare them to the prices of consumer goods to see how the purchasing power of wages varied between cities and changed over time. If wages at Potosi, for instance, were high because of the inflationary effects of the silver mined there, then prices might also have been high for the same reason. If that were true then the standard of living of miners would have been low even though their silver wage was high. To address this possibility, wages must be compared to a consumer price index.

Since even the poorest people consume a range of goods, the prices of many things must be taken into account to infer the standard of living from the wage rate. In measuring changes over time, the ideal procedure is to use the results of consumer expenditure surveys to determine the shares of spending on different items and then use those shares as weights in the consumer price index. However, our problem is more complicated because we want to measure differences across space as well as changes over time, and because diet differed profoundly in different parts of the world: workers in the Yangtze Delta, for instance, subsisted on rice, while their counterparts in Mexico ate maize.

Despite differences in the staple grain, however, there were strong similarities in the spending patterns of poor labourers around the world, and these similarities underlie the price indices we construct. Most poor people ate a quasi-vegetarian diet and derived most of their calories from the cheapest available grain. This was either boiled into gruel (e.g. oatmeal or rice) or ground to a coarse flour and fried into unleavened bread (*chipatis* or *tortillas*). Peas, beans, or other legumes formed the second important component of the diet and were especially rich sources of protein, although a considerable amount also came from the grain. Some fat (butter, ghee, olive oil) was also consumed. Meat was rare and consumed mainly on ceremonial occasions. Alcohol was seldom enjoyed. In addition to food, poor labourers also bought some cloth for clothing and used small quantities of fuel for heating or cooking and oil and candles for light. There was also a cost for housing, but it represented only a small fraction of income.

Eighteenth century descriptions show that Eurasia can be divided into two regions in so far as the consumption of labourers is concerned. Workers in Southern England and the Low Countries were a privileged minority who ate wheat bread, beef, and beer and also had the purchasing power to buy luxuries like sugar, tea and even pictures for their walls. In the *State of the Poor*, Sir Frederick Eden [1797, Vol. II: 433-435], for instance, described a London gardener whose family's daily consumption included 4-1/3 pounds of bread, half a pound of meat, and some cheese, beer, tea, and sugar. In addition, the family had new clothes and shoes each year and paid fees for the children to go to school. Elsewhere in Eurasia, living standards were much lower. This region includes Britain's Celtic fringe

where wheat bread was luxury. As Dr. Johnson put it: "oats" is "a grain which in England is generally given to horses but in Scotland supports the people." Most of Europe was more like Scotland than southern England. Delaunay Deslandes, the director of France's Saint-Gobain glass works, attributed his firm's competitive advantage to low wages. "Our Frenchmen eat soup with a little butter and vegetables. They scarcely ever eat meat. They sometimes drink a little cider but more commonly water. Your Englishmen eat meat, and a great deal of it, and they drink beer continually in such a fashion that an Englishman spends three times more than a Frenchman." [quoted by Harris, 1975: 67, n. 42]. Bread had been the staple of labourers' diets in medieval Tuscany, but by the eighteenth century they could no longer afford it. Tobias Smollett in his *Travels through France and Italy*, 1766, remarked "The nourishment of those poor creatures consists of the refuse of the garden, very coarse bread, a kind of meal called polenta, made of Indian corn, which is very nourishing and agreeable, and a little oil…" [Smollet, 2008 (1766): 176]. Meat was a rarity.

The quasi-vegetarian diet was the norm across Asia. Palsaert, who visited India in the early seventeenth century, called the Indian diet "monotonous." In the Delhi-Agra region, the people "have nothing but a little *kitchery* [kedgeree] made of green pulse mixed with rice... eaten with butter in the evening, in the day time they munch a little parched pulse or other grain." The workmen "know little of the taste of meat." Indeed, pigs, cattle, chickens, and eggs were all taboo. In western India, wheat was not eaten by the labouring population, whose main source of carbohydrates was millet. [Raychaudhuri and Habib 1982, I: 164]. Sir George Staunton [1798, II: 55, 213] in his account of the famous McCartney expedition to China observed that "the labouring poor" of Beijing "are reduced to the use of vegetable food, with a very rare and scanty relish of animal substance." Labouring people across most of Eurasia spent little on items other than food in the eighteenth century, and most of their food spending was directed towards the most economical grain.

Consumption patterns were similar in colonial Latin America. In Peru, for instance, working class Indians mostly ate 'small girdle-cakes of quinoa flour' and roasted maize [Descola, 1968: 130]. They also consumed small amounts of haricot beans and gourds. Fresh meat was rarely consumed outside of holidays, with some dried meat providing protein in between. Native Peruvians were also limited to crude cooking implements and ovens that filled their homes with soot. These Native Peruvian labourers lived at the same level as the poor in other parts of the world [cf. Gootenberg [1990] for Peru, Quiroz [2005] for Mexico, and Barba [1999] for Buenos Aires].

We use these descriptions to specify a basket of consumer goods representing subsistence consumption for one adult male per year, as shown in Table 2. The total daily in-take of calories is set to 1940–intentionally a modest value. Most calories come from maize and, indeed, it accounts for most of the cost of the basket. We can use this basket for most places in the Americas. For other parts of the world where other grains formed the staple, the diet is modified by replacing the maize with the quantity of oatmeal, millet, sorghum, etc., that brings the total calories in the diet to 1940. Other items remain the same.

[Table 2 about here]

Our cost of living index is the cost of the subsistence basket and its counterparts in other parts of the world [Allen, 2001; Allen et al., 2011]. To compute the index, we gathered prices for the goods in Table 2. These prices were converted into silver, and the cost of the subsistence baskets are shown in Table 3 and Figure 4. The cost of living index highlights the inflationary effect of the silver economy. Potosi had the highest price level by far. Spain and Mexico came next. Silver was the most important export of Mexico, so it is not surprising that its prices were elevated like Bolivia's. Most of the Potosi and Mexican silver was shipped, in the first instance, to Spain, and its prices were also inflated as a result [see, e.g. Flynn, 1978; Drelichman, 2005]. Prices were generally lower in London than in the Spanish Empire, although British prices were also high compared to central Europe and East Asia, the great sink for the world's silver. Prices were usually lower in British North America than in England. Cheaper commodities were the basis of the staple economies of the east coast of the future USA. This pattern was changing at the end of the eighteenth century as prices in England and the USA began to rise with respect to Spain.

[Table 3 and Figure 4 about here]

Subsistence Ratios

We could measure and compare 'real wages' by dividing the nominal wages in Table 1 by the price of subsistence in Table 3. However, we can calculate a more revealing real wage index by comparing the labourer's annual income to the cost of supporting his family at subsistence. First, full time, full year earnings are estimated by multiplying the daily wage by the number of days worked in a year. Of course, this varied. The maximum number of working days depended on the number of saint days and religious holidays, but was generally 250-275. For uniformity, we assume 250. Second, we increase the cost of the subsistence basket in Table 3 by 5% as an allowance for rent, which was about the share of rent in income in English and Low Countries' budgets for labourers during the Industrial Revolution, and not far from the scarce estimates available for the Americas. Some figures in fact indicate that in urban areas like Mexico or Buenos Aires rents in the eighteenth century were large [Calderón Fernández, 2009; Johnson, 1990], but most working class apparently lived in fringes of the cities paying relatively more modest prices. Gootemberg is one of the very few that actually attempted some estimates for urban Peru and he assigns a 7.8% of a family budget to rent in early XIX century urban Peru [Gootemberg, 1990: 17], more or less in line with our allowance. Third, we multiply the result by 3 to estimate the cost of supporting a family. That cost, of course, varied with family composition, but the assumption that a family's consumption was close to that of three men is justified by the norms for recommended daily calorie consumption. Typically, the calorie consumption of a woman is about four fifths that of a man, and children receive even less [Scientific Advisory Committee on Nutrition, 2009: 50, 52]. Consequently, the recommended calorie intake of one man, one woman, and two children is approximately equal to that of three men.

Thus, the welfare indicator studied in this paper –the 'subsistence ratio'– equals full time, full year earnings divided by the annual cost of maintaining a family at subsistence. If the ratio equalled one, a labourer working full time earned just enough to keep a family at the subsistence level specified in Table 2. Subsistence ratios greater than one indicate the chance to purchase either more items like those shown in Table 2 or to expand con-

sumption to more 'luxurious' items. Ratios less than one suggest that families faced serious economic difficulties. By design, there was little scope for reducing consumption, so if the man's income fell short of subsistence either he or his wife or children had to work more to maintain the minimum standard of living, or some other source of income had to be secured.

The cost of subsistence for a family has another useful interpretation. If we calculate the cost of the subsistence basket in Table 2 (and its counterparts using other carbohydrates) with United States prices in 2010, multiply the result by 3.15 to allow for rent and to convert it to a family basis, and finally divide by four people per family, the cost per day averages out to be $1.30. This is very close to the World Bank's poverty line of $1.25 per day; hence, the consumption pattern in Table 2 shows what the World Bank Poverty Line means in practice. A worker with a subsistence ratio of one, by our calculation, earned enough to keep his family at the WBPL. More generally, our subsistence ratio measures the standard of living as multiples of the World Bank Poverty Line. Table 4 shows subsistence ratios for American, European, and Asian cities from 1500 to 1800, and Figure 5 plots some representative series.

[Table 4 and Figure 5 about here]

Previous research has shown two patterns of real wages in early modern Eurasia [Allen, 2001; Allen et al., 2011]. The first pattern characterized the maritime cities of North-Western Europe like London and Amsterdam. They had the highest standard of living. Labourers in these cities earned about four times the WBPL from the fourteenth century to the 1870s when living standards began to rise rapidly. Workers in southern English towns like Oxford had a marginally lower standard of living. This wage pattern is especially surprising considering that North-Western Europe had rapidly rising populations, which could have led to a decline in real wages along Malthusian and Ricardian lines: fertility increases and diminishing returns from a rising land-labour ratio could have overcome any real wage increases. However, the economic growth caused by expanding international trade was enough to offset the rising population and maintain the wage at rough equality. The workers in North-Western Europe, it should be noted, did not eat four times as much oatmeal specified in the subsistence diet for that region but instead, upgraded their diet to beef, beer, and bread [see Hersh and Voth, 2009].

The second pattern characterized most of continental Europe as well as Asia. In European cities like Vienna and Florence, real wages were almost as high in the fifteenth century as they were in London or Amsterdam. The standard of living declined in the next centuries, however, under the impact of growing population and in the absence of a source of growth like the trade boom in North-Western Europe. India suffered a similar drop between the seventeenth and the nineteenth centuries. The standard of living in China was similarly low as well. All of these societies ended up with the wage of unskilled workers equal to 75% - 150% of the WBPL in the late eighteenth century. The history of living standards in Spain is perhaps surprising. Wages in Valencia and Madrid also dropped from four times subsistence in the mid fifteenth century to only 1.35 WBPL in the eighteenth century. Spain certainly had a colonial empire, but it may have suffered from one that was too valuable. As we have noted, silver was Spain's main colonial import, and the American bullion inflated the Spanish price level. This 'Dutch Disease' phenomenon de-

pressed Spanish agriculture and depopulated the medieval industrial centres [Drelichman, 2005], the reverse of the situation in England and the Netherlands where colonies stimulated manufacturing. The population of Spain almost doubled between 1500 and 1800; without a corresponding increase in the demand for labour, real wages collapsed.

How did the experience of the Americas compare to the European and Asian patterns? Several features stand out. First, Philadelphia had the highest standard of living for labourers in the eighteenth century, and Boston and the Chesapeake were not far behind. In 1630, living standards for labourers in Boston were below those in London and not dissimilar to those in provincial towns like Oxford. The standard of living rose in Boston in the seventeenth century, and, by the early eighteenth, it was above London and almost as high as Philadelphia's. Maryland labour incomes were exceptionally high during the tobacco boom of the 1660s and 1670s and then slid to the London level. North America pulled ahead of London after 1750 as wages advanced slowly in the new world and slumped in the old. Second, living standards were much lower in Latin America. Our longest wage series is for Mexico. It begins in 1527 with a wage equal to only one quarter of subsistence. This was not enough to support a family and barely enough to feed a man for a day. Such low wages undoubtedly contributed to the 90% drop in the Indian population in the century and a half following Cortés' conquest. Demography trumped exploitation, however, and decreasing population coincided with increasing wages in rural Mexico, which rose to about 1.75 times subsistence in the late eighteenth century. Wages in other parts of Spanish America were similar. Labourers in Potosi earned a bit less than twice subsistence in the seventeenth and eighteenth centuries (the very high wages paid in Potosi were indeed cancelled by very high prices), and their counterparts in Bogota earned just over twice subsistence. The highest earning workers in Latin America in our sample were labourers in Mexican cities who earned about 3 times subsistence in the eighteenth century. This, of course, was much less than workers earned in British North America or in North-Western Europe. Using real wages as the metric, the future USA was far ahead of Latin America throughout the seventeenth and eighteenth centuries.

Wage patterns and trans-Atlantic labour markets

Unskilled workers earned about four times the WBPL in British North America in the eighteenth century, but only twice WBPL in Latin America. Figures 4 and 5 suggest an explanation; namely, that colonial wages were determined by wages in the imperial power. This was, indeed, one of the likely mechanisms at work, although others including demography and coercion of the native population probably also played a role.

Regular streams of immigrants flowed from Britain to its colonies and from Spain to its Latin American possessions. The magnitudes are summarized in Table 5. These flows served to integrate the labour markets in Europe and America, since the colonies had to offer the settlers attractive enough terms to make the trans-Atlantic move worthwhile. While each empire had an integrated labour market spanning the Atlantic, these markets were distinct in the view of the cultural, linguistic, and religious differences between England and Spain and the state of war that frequently obtained between the two countries.

[Table 5 about here]

Figure 6 shows graphically how these distinct labour markets implanted the European wage structures into the Americas. A colony like Pennsylvania had to offer a wage four times WBPL to attract settlers from England, that were facing a considerable opportunity cost of earning a living in Britain, while Mexico only had to offer only twice WBPL, since in the Iberian peninsula wages were considerably smaller.

[Figure 6 about here]

Figure 6 makes a second important point about colonial development. Characteristics of the colonies like the efficiency of their technology, the effectiveness of their governments, the cost of their transport systems, or the way they treated Africans or native Americans could affect the size of the colonial population by shifting the demand for labour but not the wage rate earned by European settlers. That was set in the European metropolis where the colony competed for labour. Presumably, the capital market worked similarly with rates of return set in Europe since Europe and the Americas were linked via mercantile credit and bills of exchange [e.g. McCusker and Menard 1985: 135-7, 181-7], but we do not explore that issue here. The only factor return that was affected by colonial features was the rent of land or mining rights since land was not internationally mobile, and its price was bid up as the colony expanded. Most income was wages and profits, so colonial GDP per capita was mainly determined in Europe.

The Demand for labour in the colonies

Staples Theory and the Size of Colonial Economies

While colonial incomes were largely determined by labour supply factors, the size of the colonies depended on labour demand. How was that determined? In the case of the Caribbean and North American colonies, the staples theory [Innis, 1930; Galenson and Menard, 1980; Altman, 2003] provides a plausible account. The staples thesis posits a populous and economically developed core (Europe) and an unsettled periphery (America) that is rich in natural resources. The periphery is settled when the price of colonial produce in Europe rises high enough or the transport cost from America drops low enough to make it economically worthwhile for people to move to the colonies, to invest their capital there, and to buy slaves to work colonial plantations. The colony is competing to attract labour and capital, so wage and profit rates in the colony must follow those in Europe, while also providing a premium to cover the costs of migration and the risks of investing in the New World.

Pennsylvania is a good example of staples development. The colony was founded in 1681 and was suited to the cultivation of wheat, which became its export staple. The trade was profitable since the price of wheat was higher in England than in Philadelphia by an amount that equalled the cost of transport (although competition generally took place in the Bahamas, Caribbean, and Iberia). As a result, prices in Philadelphia and London moved up and down together. These features are apparent in Figure 7. The Seven Years War (1756-63) and the American Revolution (1776-83) are the exceptions that prove the rule, for trade was disrupted in these periods, and the correlation of prices broke down. In addition to

wheat and flour, Pennsylvania exported timber products, ships, iron, and potash, and earned foreign exchange from its merchant marine. Exports were important to the colony's economy and amounted to about 30% of total output in 1770. The foreign exchange earned on these sales paid for English consumer goods. As the economy grew, it attracted more labour from Europe, and the Philadelphia wage was generally above that of London, in accord with the theory.

[Figure 7 about here]

This close relationship between staples led growth and migration is evident across the North American colonies. Figure 5 shows considerable variation in North American labour earnings in the seventeenth century. Maryland wages, which are computed earnings per day in small scale tobacco cultivation, were very high in the 1660s and 1670s because tobacco prices were exceptionally high. Immigration in response to these high incomes led to greater tobacco production and lower prices, which drove daily earnings towards the London wage. Massachusetts wages, on the other hand, were low in the early seventeenth century. The settlers in the 1630s came mainly from rural areas of southern England. The Oxford wage, which we placed in Figure 8 for reference along with the London and the North American series, represents what they were giving up. They did, of course, have the alternative of relocating to London, which was growing fast by attracting migrants. The early settlers were willing to forego the London wage premium to live in a Puritan colony. By the late seventeenth century, English migrants to America, however, were not willing to pay that price, and wages in the colonies rose enough to match what London offered.

[Figure 8 about here]

Could colonial Latin America have replicated the North American model of staples development? The answer is most likely no because most of the continent was 'out of range' of Europe due to the high cost of shipping. North eastern Brazil was occasionally an exception. The Portuguese grew sugar there in the sixteenth and early seventeenth century, but the industry could not compete with Caribbean producers (who were closer to Europe) once production began there in the seventeenth century. Mexico was effectively too far from Europe to profitably produce and export most products because Veracruz was more distant from Europe than most British colonies and because of the extremely high cost of shipping goods from the Mexican plateau to the coasts. Peru was even more distant from Europe since its produce had to be shipped first by sea to Acapulco and then across Mexico to Veracruz. [See Márquez, 2006: 400-403]

The significance of these considerations is clear from the price history of wheat. Figure 7 showed that Pennsylvania was 'in range' of Europe, so staples development was possible and competition for English labour meant that wages had to be high. We can repeat the exercise for Mexico, Peru, and Argentina to see whether the production of wheat would have been profitable in the eighteenth century. We compared prices in Latin America to prices in Amsterdam, which was the great free trade port of Europe. Refined analysis is unnecessary in the case of Mexico, for Mexican wheat was at least four times as expensive as wheat in Amsterdam (or London or Philadelphia). Wheat prices were lower elsewhere in South America, and Figure 9 compares the prices of wheat in Buenos Aires and Lima to those in Amsterdam. In most years, prices were higher in South America than in Europe,

so exporting wheat would not have paid for Latin America in the eighteenth century. Of course, Argentina did develop enormously by exporting wheat after 1870, and it is instructive to compare prices in Buenos Aires and in Amsterdam in the late nineteenth century (Figure 10). After 1868, Argentine prices drop below Dutch prices and the two series move up and down together. The configuration of Argentine and European prices after 1870 was the same as the configuration of Philadelphia and London prices in the eighteenth century. In both cases, the periphery could profitable grow and export wheat to the core. The different configuration of prices in eighteenth century Latin American makes the point that Latin America could not emulate the economic development of the British North American colonies in the eighteenth century–whatever the political system or cultural disposition of the population.

[Figure 9 and Figure 10 about here]

There was only one important item that could be produced in Latin America and exported to Europe, and that was silver coins. Silver was inflationary, however, and high wages and prices limited the possibilities of exporting other commodities.

Consequently, Mexico and Peru were not staple economies on the North American model. In 1800, exports amounted to only 4% of Mexican GDP. The demand for labour was determined by internal factors–by coercion of the natives, by the balance of land and labour, and by the efficiency of the economy—rather than by the export sector.

Demography and Smithian Growth in Latin America

Since staples exports were not important in driving economic expansion and thus migration and population growth in colonial Latin America, other factors are required to explain the increasing wages before 1650 and the stagnant wages despite significant population increases after 1650. Our discussion will focus on Mexico, but it is relevant to Potosí and Bogotá as well. Before 1650, Mexico exhibited a pattern that is common in many preindustrial economies: population and wages were inversely related. When the Spanish arrived in the 1520s, the population was very high, and wages were low. Indeed, the power of the conquistadores to coerce the labour force pushed wages even lower than high population implied (see below). As the native population collapsed (see Figure 11), the real wage rose (despite attempts to coerce labour) and reached a value of about one in the mid-seventeenth century, as we saw in Figure 5. At this wage, a full time worker could support a family at the subsistence level.

[Figure 11 about here]

After 1650, the Mexican population grew from 1-1.5 million to 6 million in 1800. Over the same period–and this is of great importance–the inverse relationship between population and the wage broke down: the wage rose to twice subsistence and remained there even though the population was expanding. Labour supply and wage could both increase only if the demand for labour was growing faster than the supply, and it is likely to think the rise in labour demand reflected rising productivity across the economy. Agriculture was transformed by the integration of European crops and animals (wheat, sheep, cattle) with the in-

digenous crops (maize, beans, squash, tomatoes, chillies). Transportation was revolutionized with European draught animals (horses and mules). Manufacturing gained impetus through the fabrication of new products (woolen cloth) and the concentration of production in specialized regions that promoted the division of labour. These were the characteristics of English industry that made it more productive than American and precluded manufacturing in the colonies. In contrast, the isolation of Mexico and the Andes and the large size of their populations made manufacturing development feasible. The expansion of the Latin American economy, of course, took place under the sway of Spanish rule and shows that Spain's policies, however illiberal, were not sufficiently detrimental to prevent economic expansion.

In addition, the data suggest that the underlying Malthusian mechanism was still at work. An indication of this is the fact that we observe a slight decline in real wages after 1750, compatible with findings of decreasing stature among Mexican army recruits from 1740-1830 [Challú, 2010: 52-3], when population may have begun to outstrip the pace of Smithian economic growth leading to a decline in living standards. But the crude birth rate around 1800 was still exceptionally high at 59 per 1000. [Knight, 2002: 208]. Evidently, a wage between 1 and 2 WBPL was enough to cause sustained population growth among the native population. The supply price of Spanish labour was also similar, probably because Spain was also in a Malthusian equilibrium with a wage marginally above bare bones subsistence. Elastic supplies of Indian and Mexican labour stabilized the wage in Mexico at about 2 WBPL for about one century even as the economy developed rapidly and the population expanded.

Forced labour and wages

One of the key features of the colonial American economies was the prevalence of coerced labour in its various forms: slavery in North America and the Caribbean and forced labour regimes such as the *encomienda*, *mita*, and *repartimento* in Latin America. These labour systems, however, were less important in determining wage levels in the colonies than one might expect. White and slave labour were not close substitutes in North America, and forced labour regimes had lost most of their power by the early seventeenth century in Latin America.

Slavery and colonial wages in North America

Slavery was not a pan-American institution. While slavery was very important in the Caribbean, Brazil and the southern British colonies of the future USA, it was not important in Mexico, Columbia, the Andes, or the northern British colonies. Therefore we can assess the influence of the competition between slave and white labour on white real wages by comparing wages in the northern British colonies (Massachusetts and Philadelphia) with wages in the southern British colonies (Maryland). When comparing the wages, we do not observe large differences between the Maryland wages and the Philadelphia and Massachusetts wages: they all converge on the London wage during the seventeenth and eighteenth centuries. This convergence took place despite a significant increase in the slave population in Maryland during the period. These results are consistent with an integrated

labour market for white workers in British North America, but they also beg an explanation for how competition with slave labour affected the white labour market.

Our view is that white wage rates were not lowered by competition from slaves because white labour and slave labour were not close substitutes. Peri and co-authors recently made a similar point when discussing the impact of unskilled immigration on US wages [Peri and Sparber, 2009; Ottaviano and Peri, 2011]. Even more clearly than in their case, where the limited substitutability between low skilled immigrant and American workers plays a key role in understanding the positive impact of immigration on American workers, the substitutability of white and slave labour was probably close to zero. Most slaves were employed on plantations producing rice or tobacco. Part of the white economy was also tied to the slave economy through the provision of food and services to the plantations. To analyze the impact of slavery, we conceptually divide the white economy into that part (which serviced the plantations) and the other part, which was independent of them. The demand for labour in the two sectors ($L^{D}_{Plantation}$ and $L^{D}_{Non\text{-}Plantation}$) are shown in a standard labour allocation diagram (Figure 12).

[Figure 12 about here]

The demand for white labour related to the slave economy is measured rightwards from the axis at O_S and the other demands for white labour is measured leftward from O_F. A horizontal line at $W = 4\ WBPL$ shows the long run supply of labour from England. The diagram shows an economy that was, at the outset, in long run equilibrium with $O_S L_A$ white labour employed in the plantation-related sector and $L_A O_F$ elsewhere. Suppose next that the price of slaves in the international market fell. In that case, it would have been profitable for the plantation sector to expand into more remote or less fertile areas, and the demand for white labour in support activities would have risen (to $L^{D'}_{Plantation}$). The increase in demand would have raised the wage of white workers to W' in Figure 12 as the plantation sector bid for labour. In the long run, however, the white population of the colony would have grown as migrants came in response to the higher wage. This is shown geometrically by the rightward shift in vertical axis on the right side of the diagram. The population would have swollen until the wage in the colony dropped back to W. The increase in the slave economy due to the fall in the price of slaves would have induced an increase in the white population, a short run rise in its wage, but no permanent improvement in its standard of living, which was set in the British labour market.

From forced labour to haciendas in Latin America

Forced labour played a different and more limited role in influencing Latin American growth. Forced labour from the beginning of the conquest to the early seventeenth century depressed real wage rates but did not affect economic expansion in the way that slave prices did in North America. Again, we concentrate on the history of Mexico, but the trends in real wages were similar in Bogota and vicinity (Figure 13), as were the labour market institutions and the reasons for their evolution [Monteiro, 2006].

[Figure 13 about here]

Mexico's labour relations went through three main phases. The first phase lasted from Cortes' conquest in 1521 to the middle of the sixteenth century. At the outset, the Spanish regarded all of the natives as slaves by right of conquest. The sentiment was regularized through the system of *encomienda*. Leading conquistadores and political favourites were granted the right to extract labour and tribute from groups of natives. There were no limits on Spanish behaviour. Cortes was not alone in branding and selling his Indians. The major public and private buildings in Mexico at this time were erected by *encomienda* labour brutally forced to do the task. Wages were no more than food for the day (perhaps 25% of WBPL)–this is shown as W_e in panel (a) in Figure 14–or often zero. Both the quantity and compensation for the labour was dictated by the Spanish, so the natives were driven 'off their supply curve.'

[Figure 14 about here]

Encomienda largely disappeared in the generation after 1550 when it was replaced with less onerous systems of exploitation. Some historians attribute the change to the drop in the native population, but that explanation is hard to credit since labour become more valuable and, therefore, more worth exploiting as its supply decreased. The Spanish crown consistently opposed *encomienda* since it created an aristocracy in Mexico that was too powerful and independent. *Encomienda* were made non-inheritable (although some owners finagled a single bequest), so eventually they all reverted to the Crown. In addition, regulations were introduced to restrict the rights of the owners.

Encomienda was replaced with *repartimento*, which was a compulsory system for obtaining wage labourers. The crown had hoped that Indian workers could be mobilized by wages, and wages rose in quarter real steps from one quarter *real* per day in 1549 to one *real* per day in 1590 and ultimately two *reales* in 1629. Villages were issued quotas of workers to supply at these wages. The village leaders faced sanctions for not complying, and they could compel Indians to participate. This power was limited, however, as Indians drifted away from villages to become casual workers or the 'vagabonds' who alarmed colonial authorities. There were also competing *repartimentos* for drainage projects (the *desagüe*), building, mining, and agricultural labour, which was assigned to wheat farms around Mexico City and Puebla. As population declined in the last half of the sixteenth century, the proportional demands on the native villages increased. The system ultimately failed because villages ceased to supply the labourers demanded irrespective of sanctions. *Repartimento* was abolished in 1633 when wage labour became the principal employment system.

Repartimento was a complex system. While it contained coercive elements, they were ultimately ineffective in generating a work force. [Gibson 1964: 58-97, 220-56, Knight 2002: 102-27] We are, consequently, inclined to regard Indian labour as essentially voluntary and offered according to a supply curve. The function of the *repartimento* was to create an employers' cartel (a monopsony) that could offer lower wages by preventing competition amongst Spanish employers. The equilibrium of the monopsony [see, e.g., Boal and Ransom, 1997: 87-88] is shown in panel (b) of Figure 14 where the competitive equilibrium (L_c and W_c) is contrasted with the monopsonist's equilibrium (L_m and W_m). The monoposonist employs L_m workers determined by the intersection of the demand curve and marginal cost of labour from the native economy. The monopsonist pays W_m which is the wage that in-

duces the supply of L_m. This quantity of labour was shared out amongst the employers who comprised the cartel.

Yet thinking about the *repartimento* as a pure monopsonist is probably an overstatement. The bottom panels in Figure 14 describe a more realistic representation of the Mexican labour market, what is called "a monopsony with a competitive fringe". In this scenario, there is a dominant firm or cartel, in this case the firms getting *repartimento* workers, and a group of outsiders who hire labour in the normal manner. With this arrangement, the labour supply curve shown in the figure should be regarded as the residual supply curve of labour from the competitive fringe, i.e. the total supply to the market less the demand of the fringe for workers. The key element here is that the dominant employer (the *repartimento*) wants to maximise its profit, but has to adjust its hiring to the potential hiring of other agents in the economy, so it faces a limitation on how far it can depress the wage. In the middle of the sixteenth century, the fringe was small, as described in panel (c). The demand of labour from the *repartimento* (its marginal revenue product) made up most of the demand from the whole colonial economy (L^D), and the residual supply of labour was not too different from the total labour supply, so we have an equilibrium (L_{m1},W_{m1}) that was probably not far from (L_m,W_m) in panel (b). But the fringe grew substantially as Spaniards acquired native lands for agricultural purposes, making the supply of labour increasingly elastic, as shown in panel (d), collapsing the monopsonistic power of *repartimento*. By 1620, at least half of the agricultural land in the valley of Mexico had been taken from the Indians and given to colonists mainly in blocks of several hundred acres [Gibson, 1964: 277] The hacienda was born, and these employers made up much of the fringe.

Two changes governed the evolution of *repartimento*–the growth of the hacienda economy in the late sixteenth and early seventeenth centuries, and the decline in the Indian population. The first increased the demand for labour among the fringe, and the second reduced total labour supply. Together they reduced the excess supply of labour in Figure 14. The profit maximizing response of the employer's cartel was to raise the wage in the manner that we have seen occurring. In addition, the growth of the hacienda reduced the share of *repartimento* employment, and that directly reduced the power of the employers' cartel to push the wage below the competitive equilibrium. By the 1620s, this power was negligible, *repartimento* no longer had a purpose, and it was abolished. Mexican Indians earned the WBPL.

In conclusion, forced labour regimes in Mexico and other parts of Latin America likely depressed wages for around a century after conquest, but these institutions only accounted for part of the gap between North American and Latin American wages. Even after these regimes lost their influence, wages in North America were four times as high as wages in Mexico. Slavery in North America, on the other hand, did not affect white wage rates because slave and white labour were not close substitutes: slaves produced tobacco and rice while whites provisioned plantations. Expansion in the plantation economy driven by decreasing slave prices would increase the demand for white labour, but any increases in white wages were quickly reversed by increased migration from Britain. While forced labour regimes played an important role in determining the size of colonial economies, they did not affect the long-run equilibrium real wage levels in the colonies because of trans-Atlantic labour market integration.

Colonial origins of the Great Divergence

Colonial economic development had various causes depending on which aspect is considered. In the long run, the growth of per capita income was determined by wages and (we suspect) profit rates in Britain and Spain where the colonies competed for labour and capital, and by the demography of the native population, which expanded in Latin America at similar wage levels to those which induced migration from Spain. Since London offered unskilled workers a wage that was four times WBPL, while Madrid paid only twice WBPL, labour incomes in North America were twice those in Latin America for most of the seventeenth and eighteenth centuries. The relative prosperity of North America arose early in the colonial period.

In contrast, the growth of total GDP and population was determined by different factors that were specific to the colonies. These included the efficiency of production, the effectiveness of political institutions, cultural propensities, the healthfulness of the environment, the prices of exported goods, and so forth. Improvements in these regards led to increases in the demand for labour and induced European migration and population growth among the natives. While some historians have argued that North America was advantaged in one or another of these regards, the most striking feature of colonial development is that after the sixteenth century the populations of both North and South America grew rapidly without any prolonged depression of wages. Indeed, they were often rising. It would be hard to argue on the basis of the population histories that bad institutions, bad culture, or bad geography held Latin America back. Or that North America benefitted from good 'fundamentals.'

Having said this, there are mechanisms where the size of the economy in the colonial period could have influenced later development. Countries with larger populations and economies might have fared better under import substitution industrialization than countries with smaller economies because larger countries would have had a larger domestic market for their products. Likewise, there might have been more scope to realize economies of scale. Finally, although 'good' political institutions limited monopolistic behaviour and promoted competitive labour markets, even reputedly 'bad' Spanish colonial governments abandoned the *encomienda* system. These effects were non-negligible in contributing to growth, but in the long run, they had a secondary impact on wages and living standards compared to the trans-continental labour markets described above.

The implications of colonial history for later development depend on which features of society one thinks were most important. The growth in the size of colonial populations argues against the importance of American specific factors as causes of development. On the other hand, the wide spread commercial activity of the North American staples colonies increased the value of reading and writing for many people, while high wages provided most people with the resources to educate their children – a notable difference from Latin America). In addition, high wages increased the incentive to invent and adopt labour saving machinery. The invention of labour saving machinery increased the productivity of labour and wages leading to further invention and wage increases. The result was an ascending spiral of progress in North America but not in Latin America.

This conjecture has something in common with Habakkuk [1962]'s explanation of American industrial pre-eminence, but there are important differences. The common feature is the contention that high wages led to labour augmenting technical change. The difference lies in the explanation of the high wages. We attribute them to European wage differences and the demography of Indians in Latin America. Habakkuk attributed them to free land on the frontier. Since there was lots of 'free land' in Latin America as well as in the USA, it is hard to see how free land explains North America's development trajectory; indeed, Temin [1966] has shown that this link is not consistent with simple general equilibrium models. Moreover, free land was a colony specific factor, which, we have argued, affected the size of the new world population, but not the wage.

Our view of colonial labour markets has more in common with Arthur Lewis' [1978] characterization of the late nineteenth century world economy. International migration was important then, too, and Lewis distinguished between two different streams of migration that flowed at two different wages. Europeans moved abroad when foreign wages exceeded European wages, while Indians and Chinese moved if wages exceeded those in their home countries. Volumes of migration reflected demand growth in the receiving areas, but wage levels reflected those in the sending areas. We see the seventeenth and eighteenth centuries in similar terms with two streams of migrations–one emanating from North-Western Europe at high wages and the other from Iberia at lower wages. The result was an early difference in income levels in North and South America. These differences gave rise to differences in human capital accumulation and differences in the incentives to mechanize production. Those differences led to the Great Divergence in the Americas.

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Appendix

Price and wage data sources

Tables A.1 to A.6 below describe in detail the sources used in this study to construct the real wage indexes.

[Tables A.1 to A.6 about here]

Volumes to weight

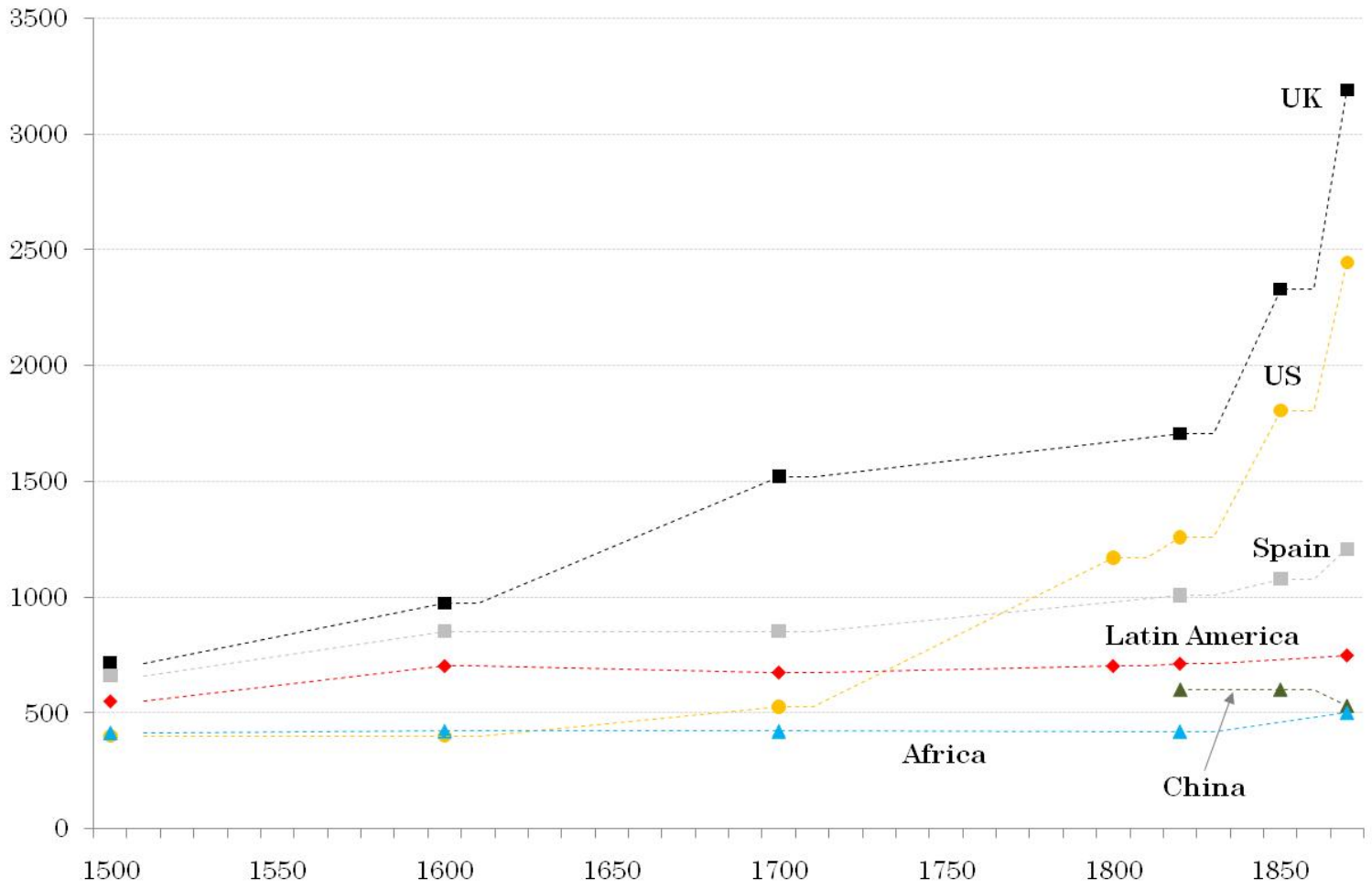
In some cases we needed to convert volume measures (like *fanegas*) into weight measures (like a kilo) to make them usable. We applied the following conversions (suggested in http://www.convert-me.com/en/convert/weight2volume):

1 litre of wheat = 0.769 kg.
1 litre of corn = 0.673 kg.
1 litre of rice = 0.689 kg.
1 litre of wheat flour = 0.593 kg.

For beans, that were generally unspecified, we follow the simple rule of counting a litre as 0.720 kg., which lies somewhere between the weight of the large castor beans (0.577 kg.) and the smaller navy beans (0.801 kg.), and close to that of soy beans (0.721 kg.)

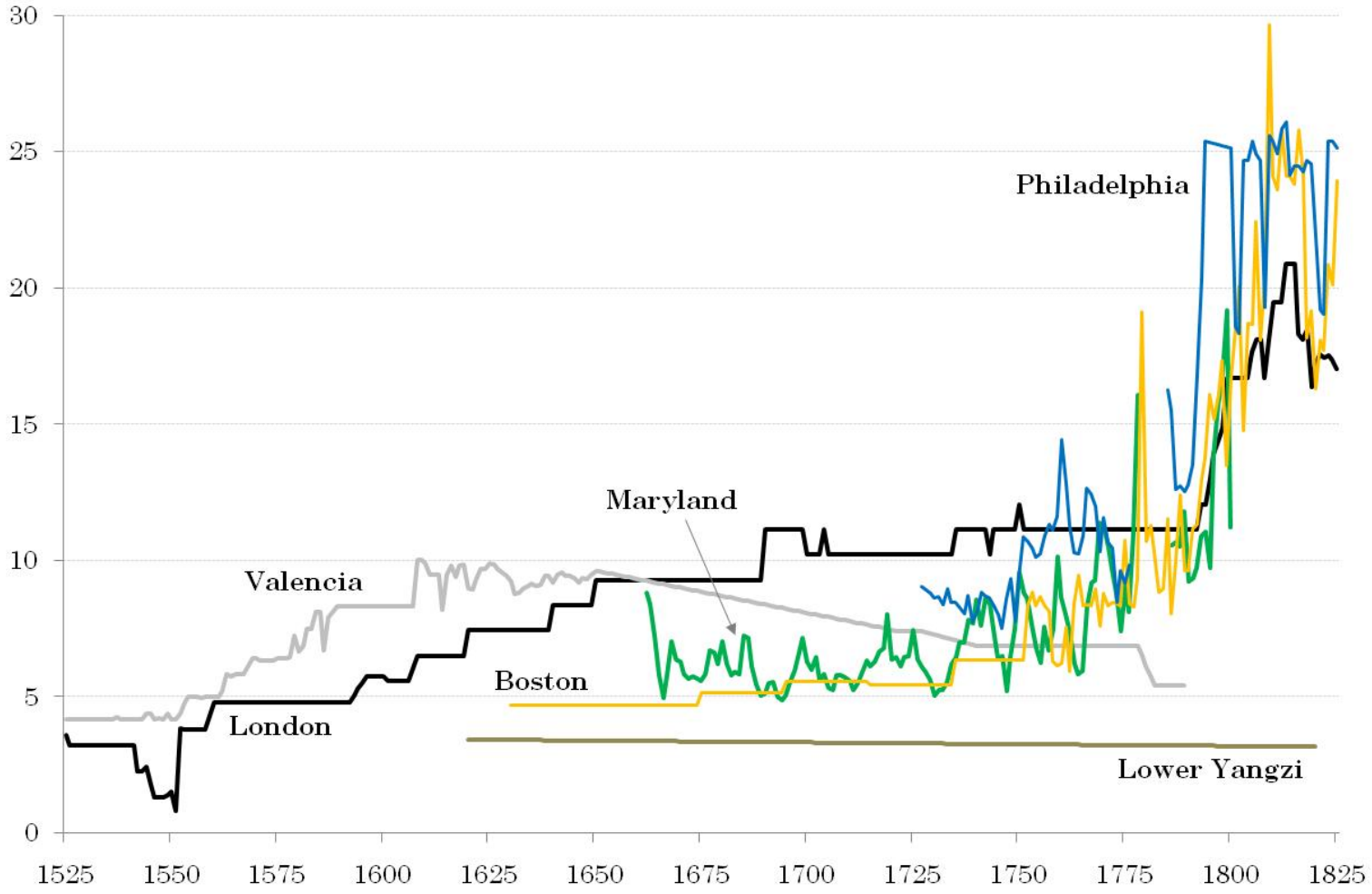
1 litre of butter = 0.865 kg.
1 litre of olive oil = 0.860 kg.
1 litre of sunflower oil = 0.920 kg.
1 litre of granulated sugar = 0.849 kg.

Figure 1. Maddison [1995] estimates of GDP per capita, in Geary-Khamis International Dollars of 1990



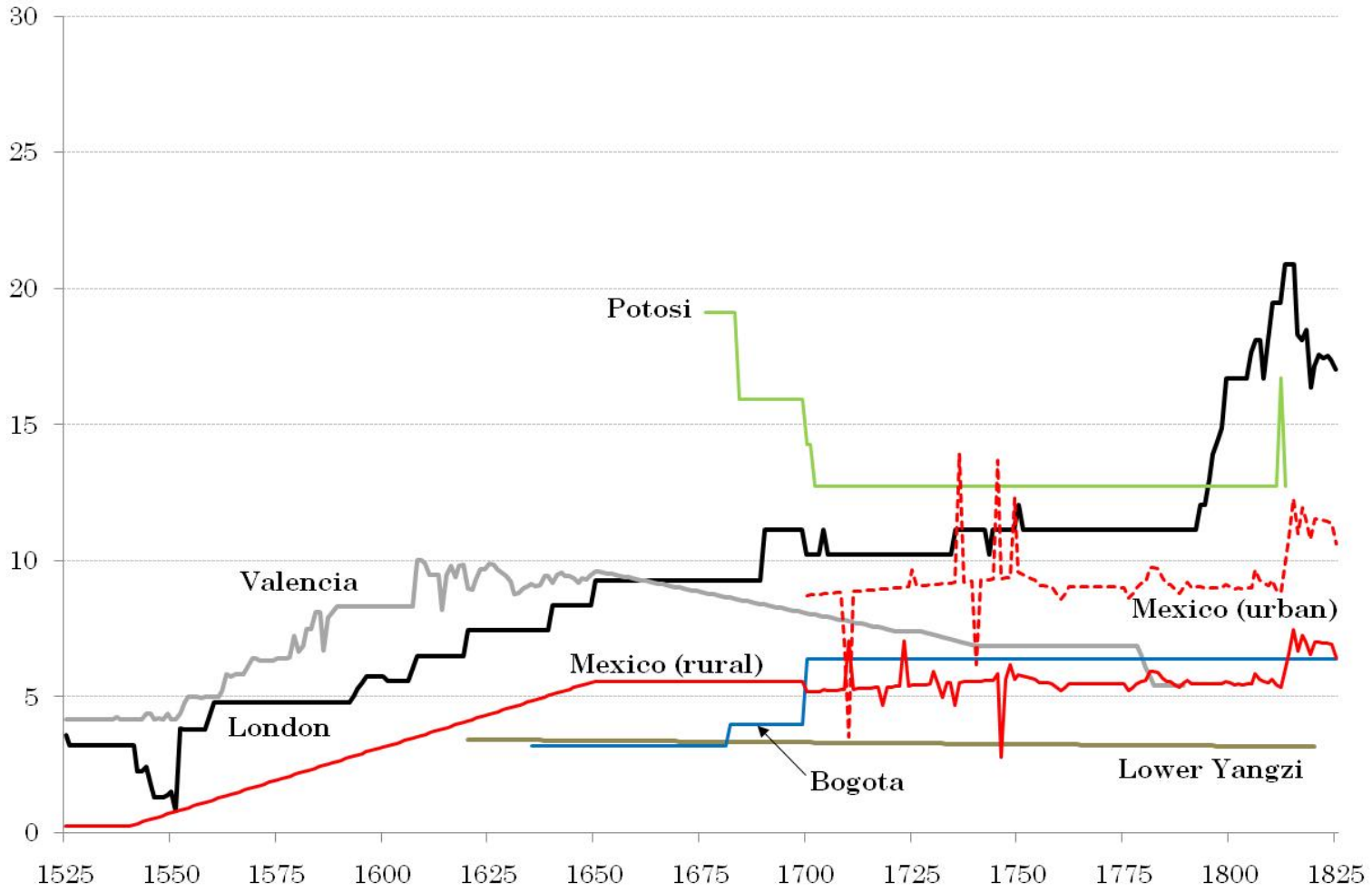
Sources: Coastworth [2008: 547].

Figure 2. Nominal wages (in grams of silver per day) in North American cities and around the world



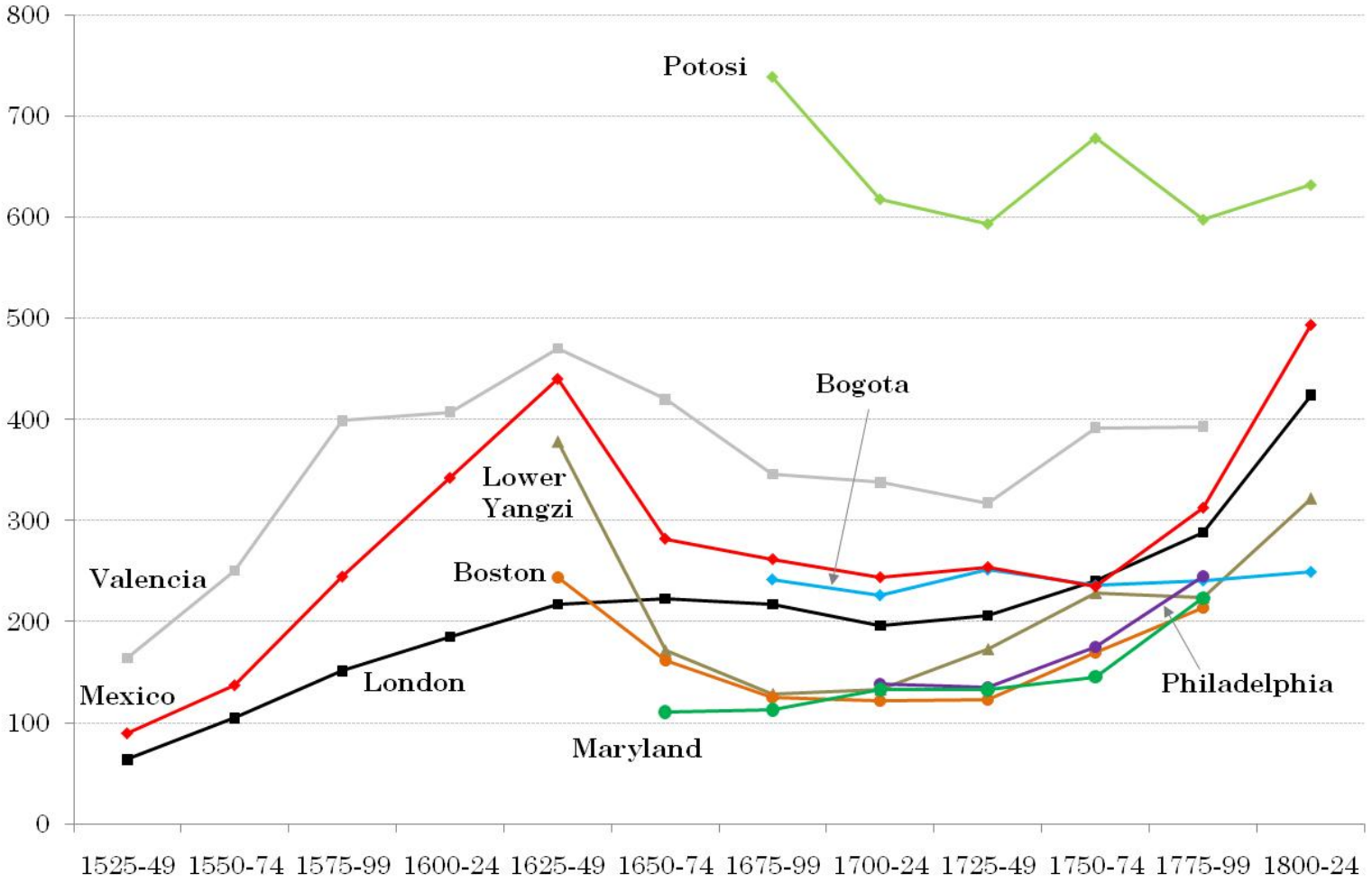
Sources: See text.

Figure 3. Nominal wages (in grams of silver per day) in Latin American cities and around the world



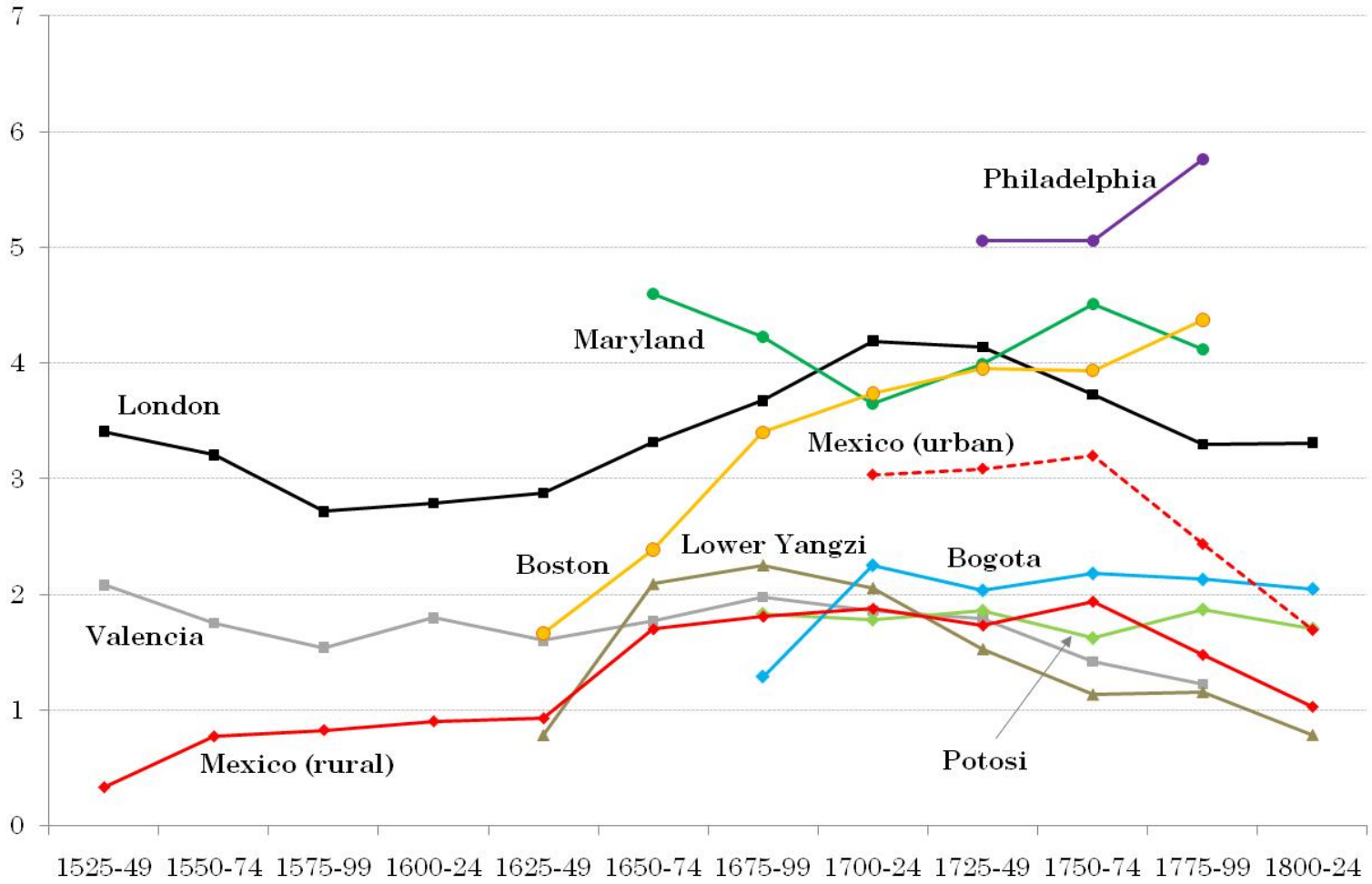
Sources: See text.

Figure 4. Cost of subsistence (barebones basket, grams of silver per adult male per year) around the world, 25 years averages



Sources: See text.

Figure 5. Welfare ratios around the world, 25 years averages



Sources: See text.

Figure 6. Trans-Atlantic labour market

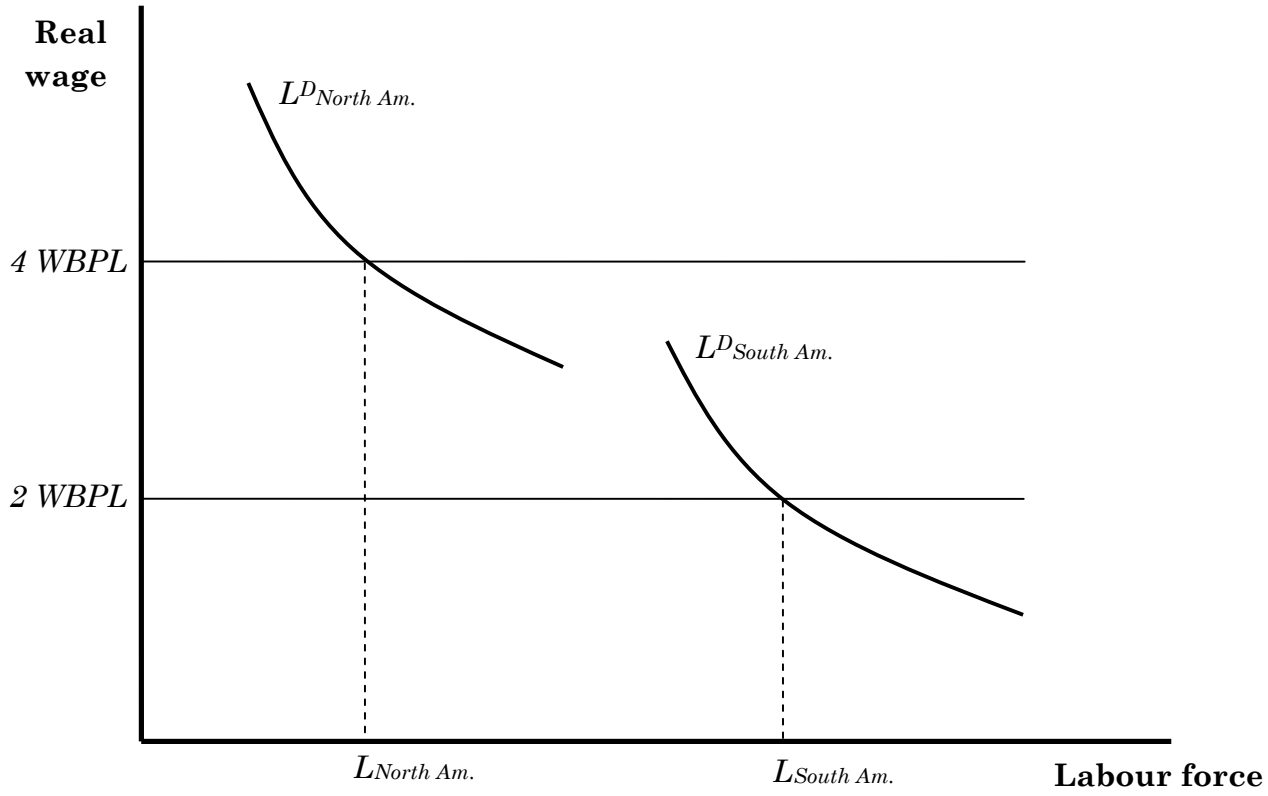
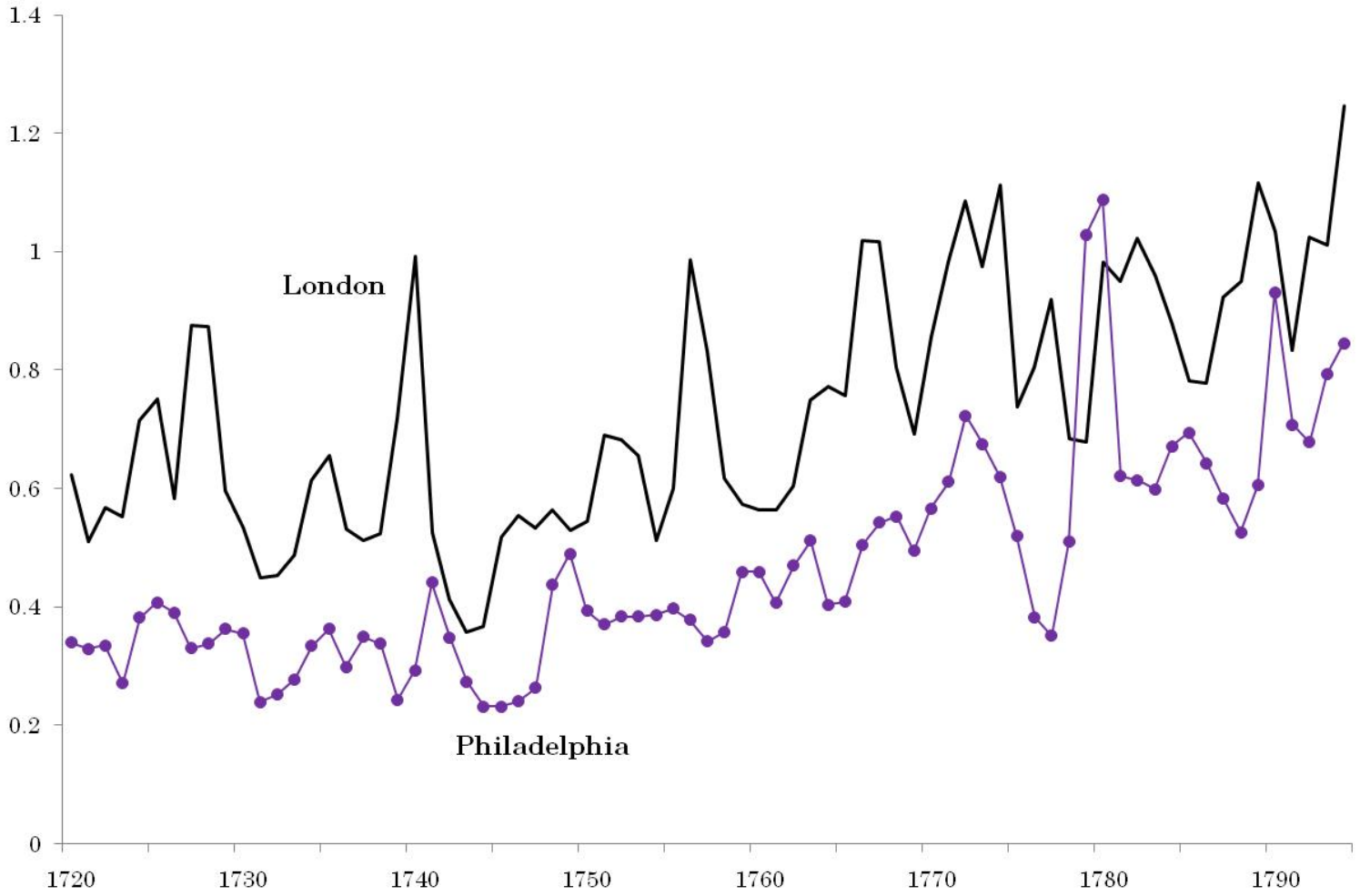
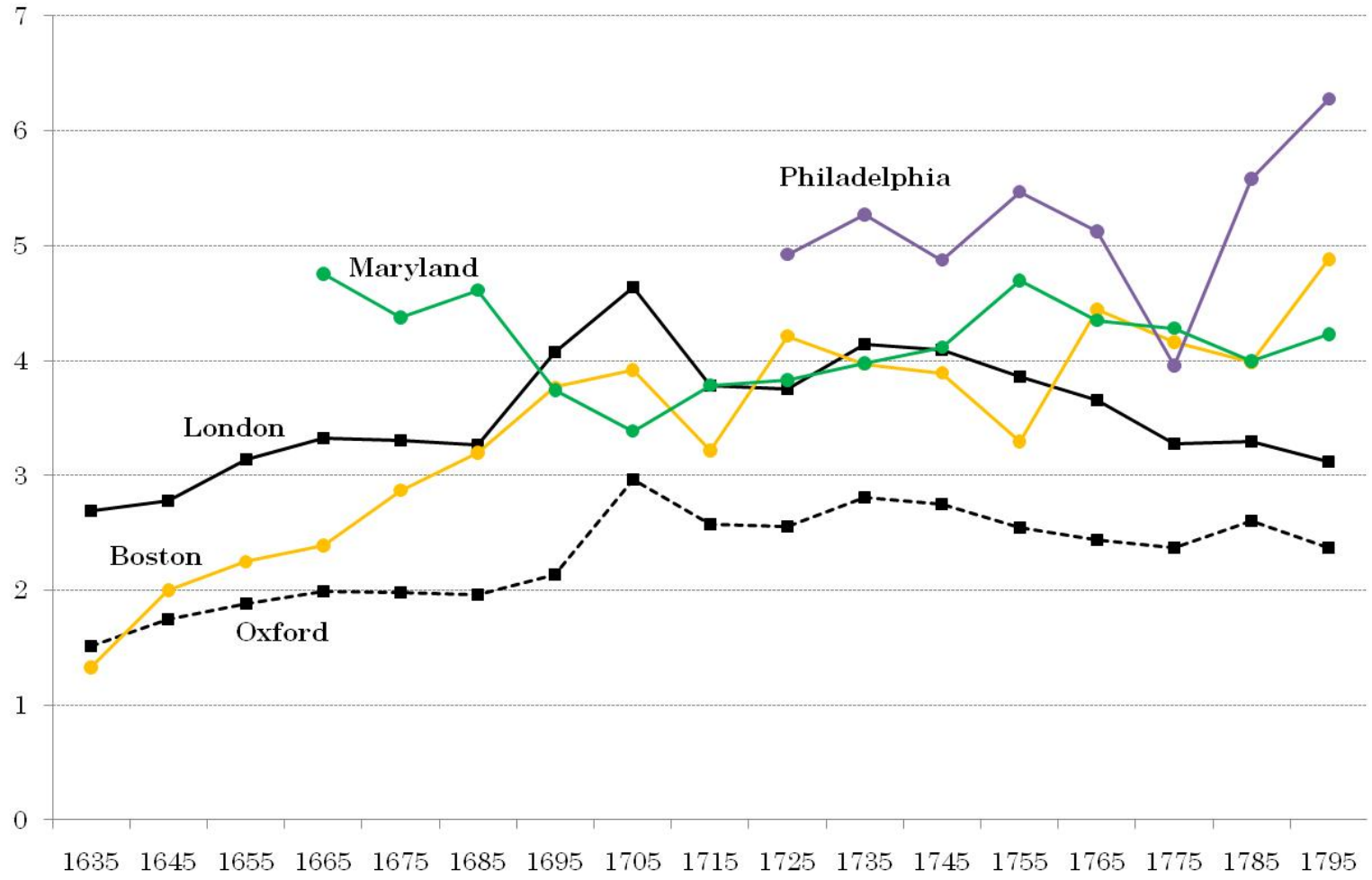


Figure 7. Price of wheat in Philadelphia and London (grams of silver per litre)



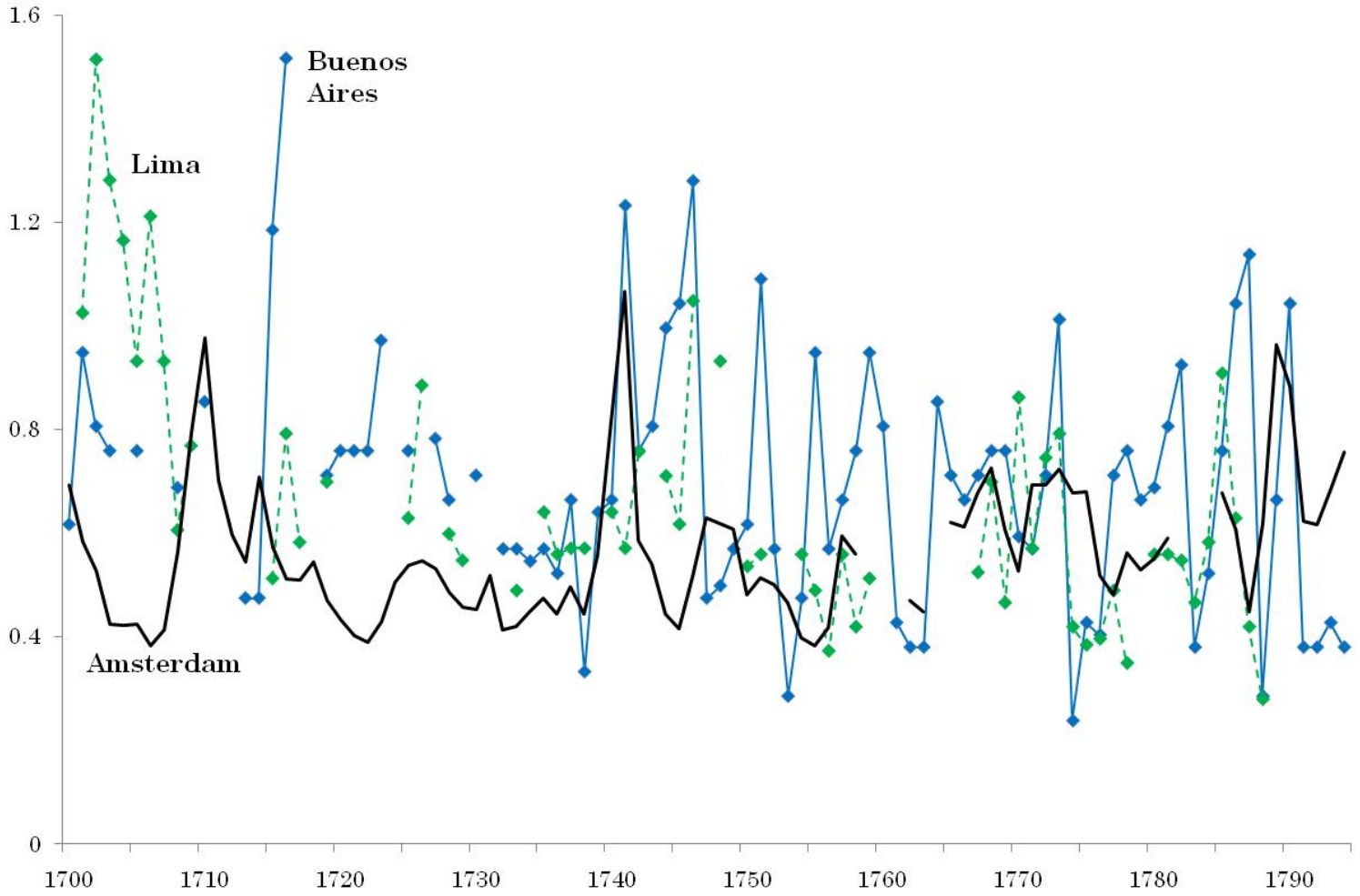
Sources: Our estimations based upon data from Allen [2001] for London, and Bezanson *et al.* [1935, 1936] for Philadelphia.

Figure 8. Welfare ratios in Britain and its colonies, 10 year averages centred on the dates shown



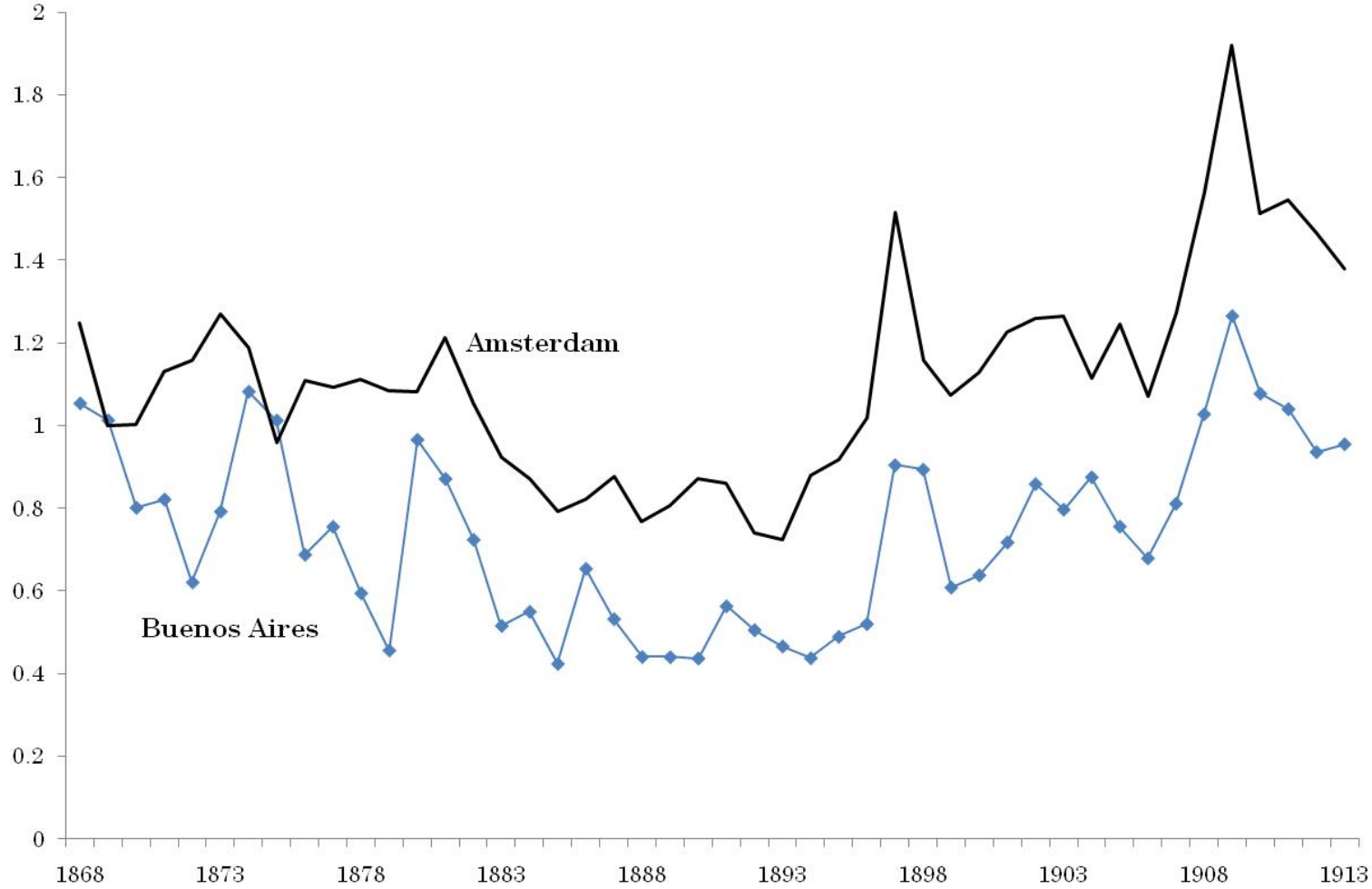
Sources: See text.

Figure 9. Price of wheat in Buenos Aires, Lima, and Amsterdam (grams of silver per litre)



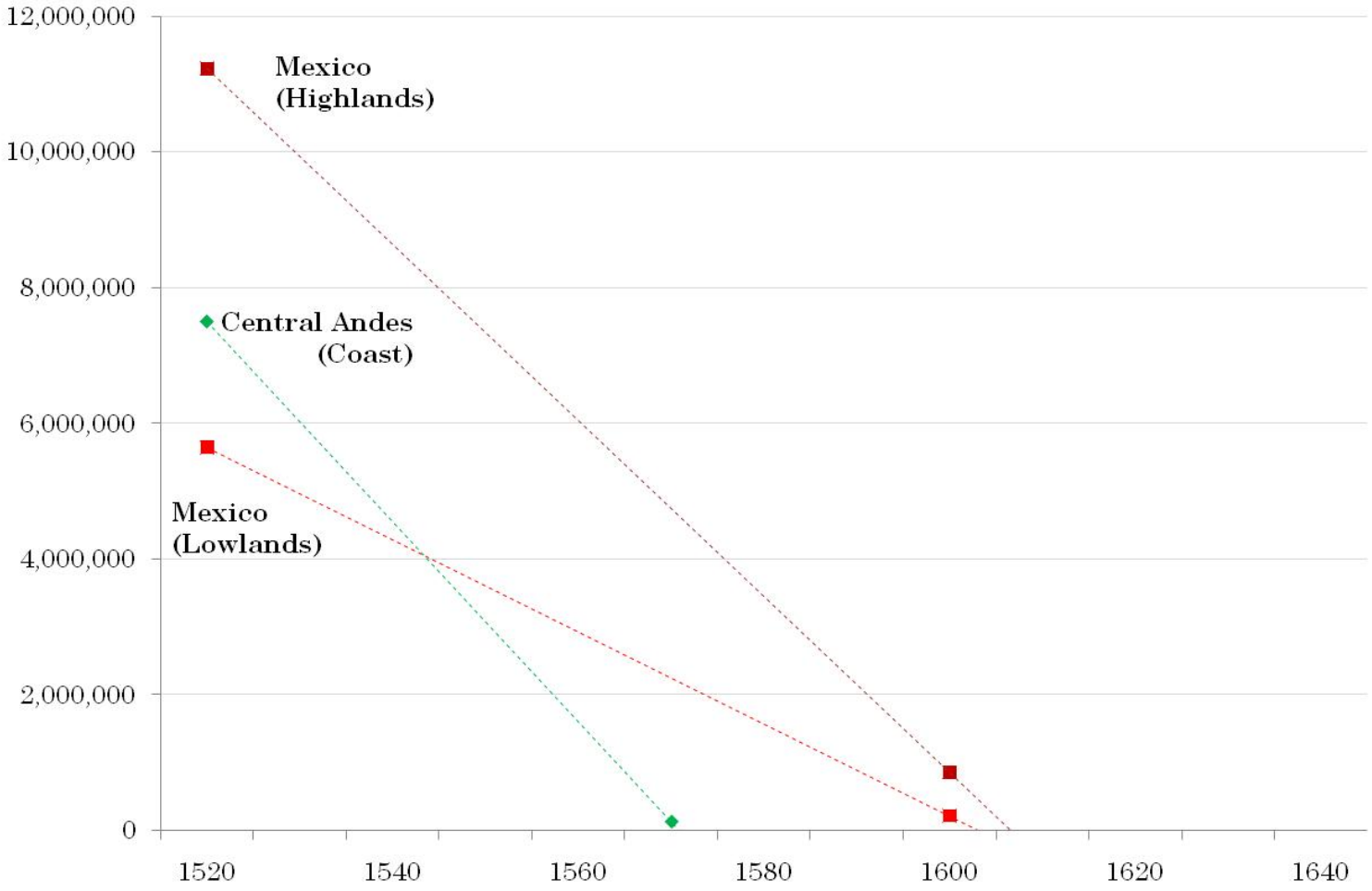
Sources: Our estimations based upon data from Cuesta and Conti [2007: 34-36] for Buenos Aires, Macera [1992:46] for Lima, and Allen [2001] for Amsterdam.

Figure 10. Price of wheat in Buenos Aires and Amsterdam (grams of silver per litre)



Sources: Our estimations based upon data from Alvarez [1929: 219-221] for Buenos Aires, and Allen [2001] for Amsterdam.

Figure 11. Depopulation: Initial population to nadir for selected regions



Notes and Sources: There is controversy about the size of the native population in colonial Mexico, but midrange values indicate that it dropped from perhaps 21 million in 1500 to a nadir of about 1.5 million in 1650. Thereafter, it began to grow. [Thornton, 1987: 15-41; Knight, 2002: 20-2, 110-1]. The figures here refer only to area around Mexico city, and to the region on the coast of the Andes, now Peru [Newson, 2006: 166].

Figure 12. Slavery and the White Labour Market

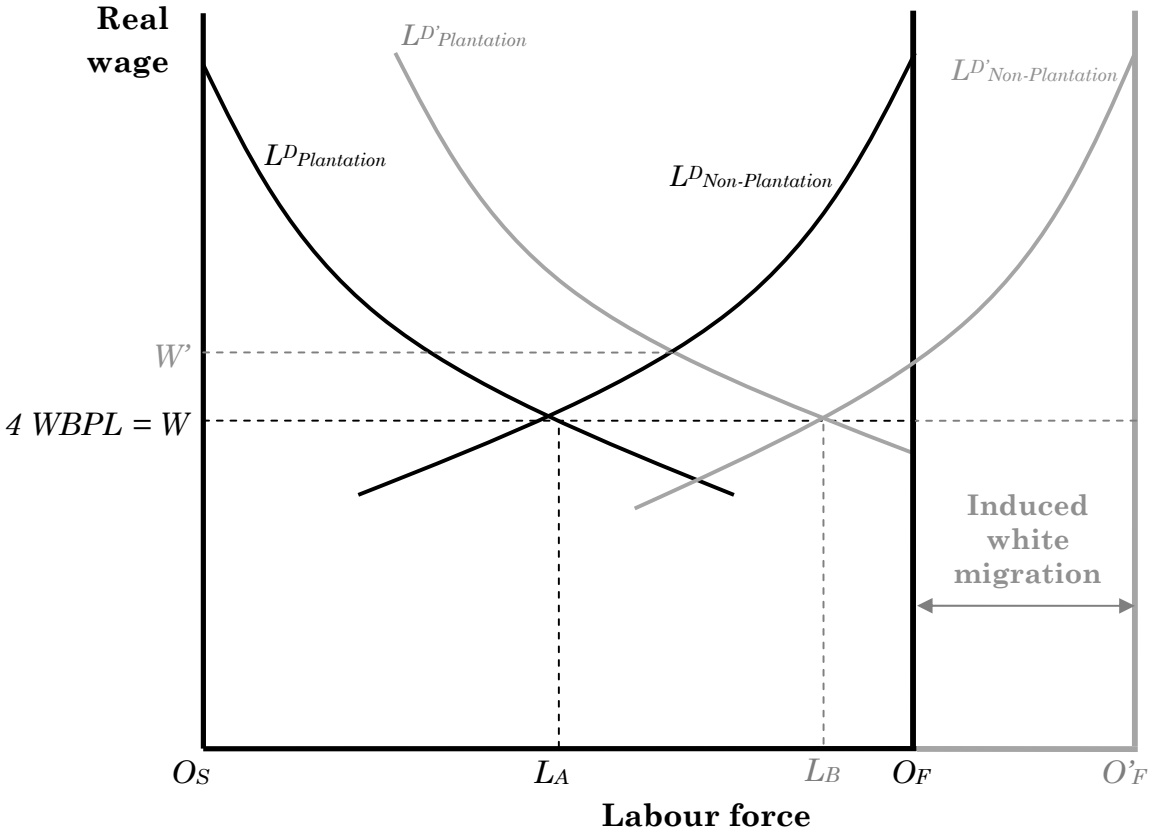
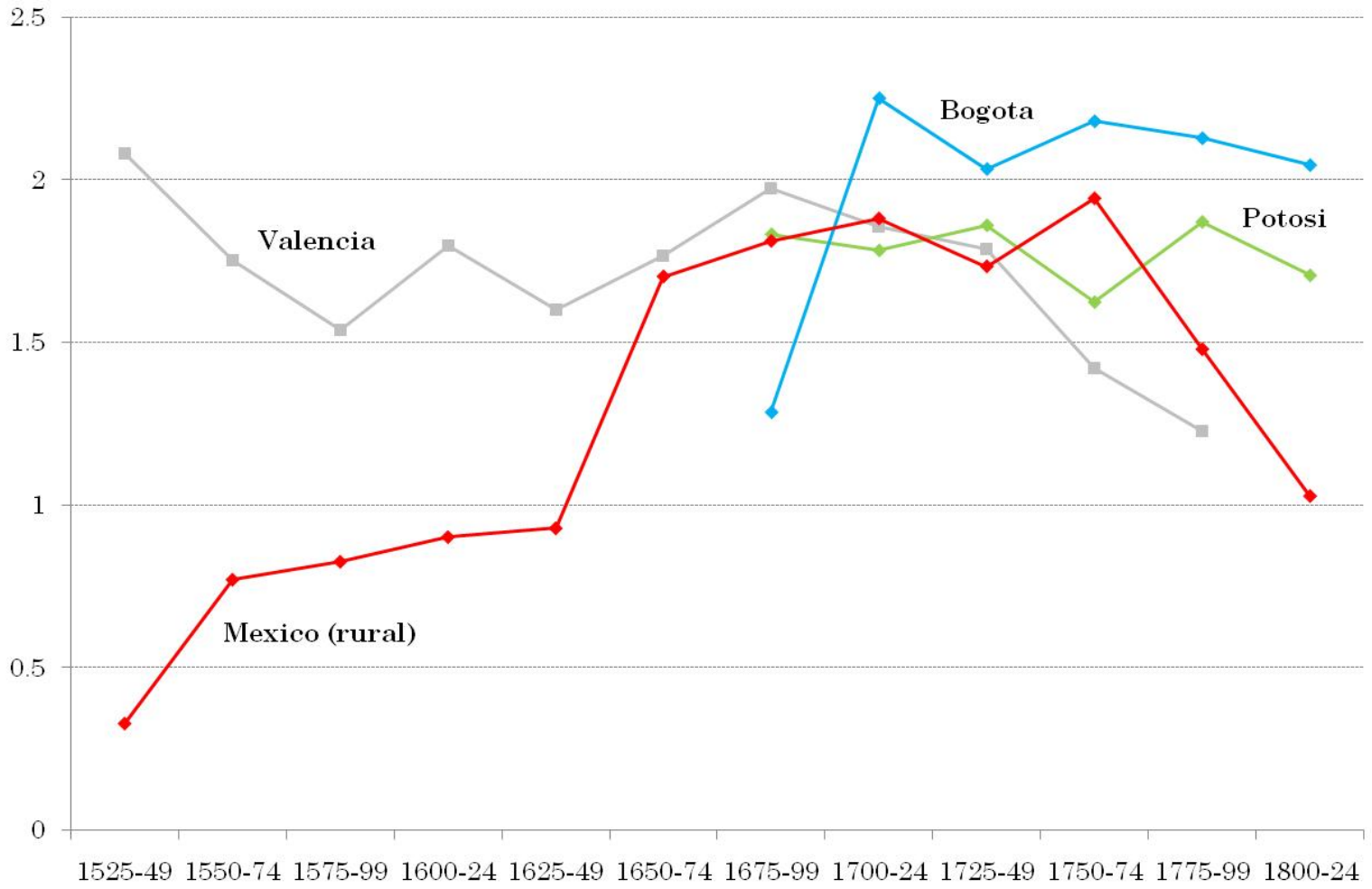


Figure 13. Welfare ratios in Spain and its colonies, 25 years averages



Sources: See text.

Figure 14. *Encomienda*, *Repartimento*, and imperfect labour markets

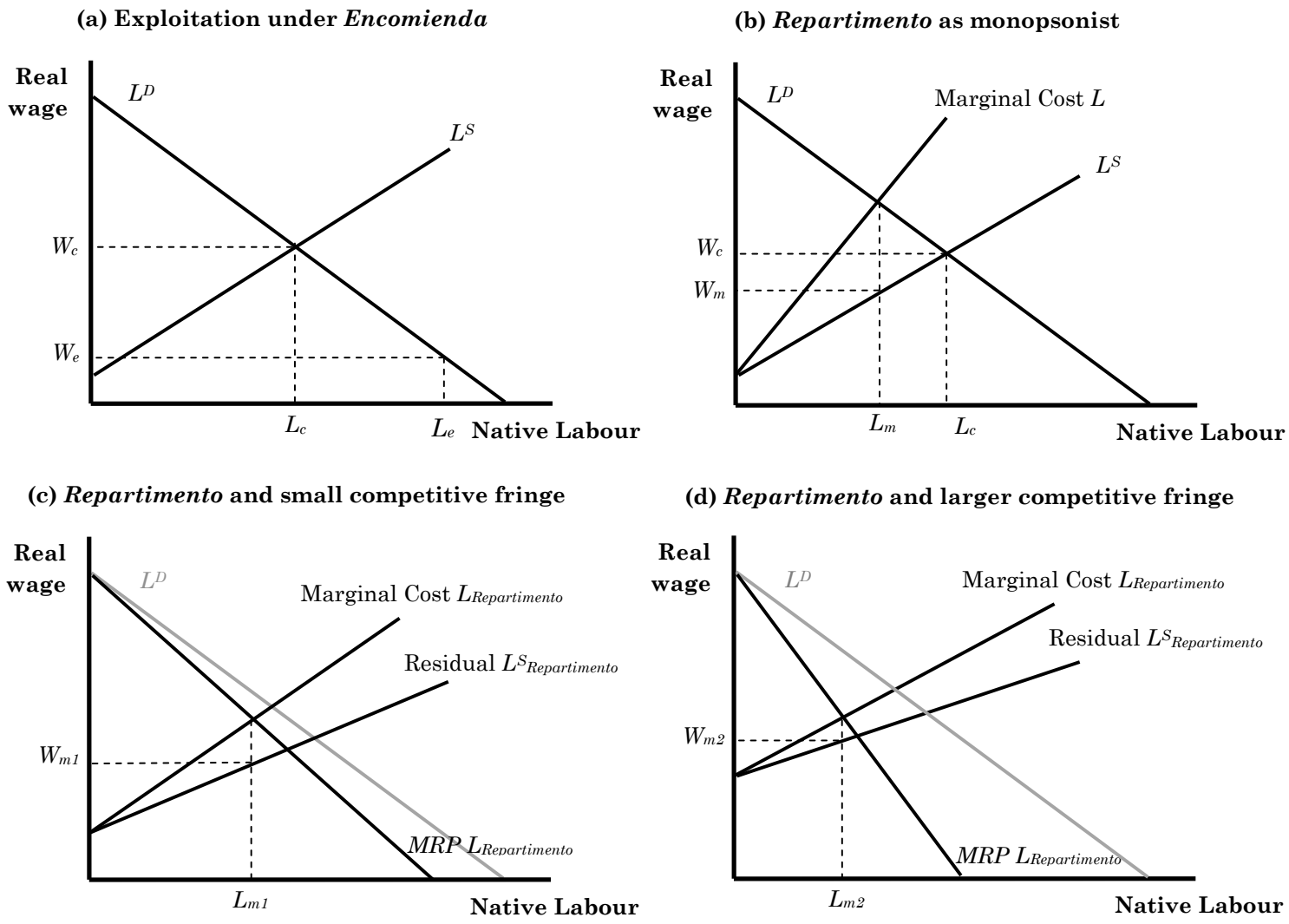


Table 1. Nominal Wages: Labourers (grams of silver per day)

	1500-49	1550-99	1600-49	1650-99	1700-49	1750-99	1800-49
North America							
Boston			4.7	5.0	5.7	9.8	20.9
Philadelphia					8.5	13.8	24.5
Maryland				6.2	6.4	9.9	
Latin America							
Potosi				17.0	12.8	12.8	13.0
Bogota			3.2	3.5	6.4	6.4	6.9
Mexico-urban					9.1	9.1	10.1
Mexico-rural	0.3	1.9	4.3	5.6	5.4	5.5	6.1
Northwestern Europe							
London	3.2	4.6	7.1	9.7	10.5	11.5	17.7
S Eng towns	2.5	3.4	4.1	5.6	7.0	8.3	14.6
Antwerp	3.0	5.9	7.6	7.1	6.9	6.9	7.7
Amsterdam	3.1	4.7	7.2	8.5	8.9	9.2	9.2
Southern and Central Europe							
Valencia	4.2	6.6	8.8	6.9	5.7	5.1	
Madrid		6.3	8.0		5.1	5.3	8.0
Florence	2.9	3.8	4.7				
Milan			5.9	4.1	3.2	2.9	3.1
Naples	3.3	3.5	5.3	4.8	4.8	3.8	3.8
Leipzig		1.9	3.5	3.9	3.7	3.1	4.4
Vienna	2.7	2.6	4.4	3.5	3.2	3.0	2.1
Asia							
Beijing					3.5	3.4	2.8
Lower Yangtze			3.4	3.4	3.3	3.2	3.2
Delhi		0.8	1.3	1.6			2.1
Bengal					0.7	0.9	0.8

Sources: See text.

Table 2. Bare bones subsistence basket of goods

	Quantity per person per year		Nutrients/day	
			Calories	Proteins
Food				
Maize	165	Kg.	1655	43
Beans/peas	20	Kg.	187	14
Meat	5	Kg.	34	3
Butter	3	Kg.	60	0
TOTAL			1963	60
Non-food				
Soap	1.3	Kg.		
Linen/cotton	3	meters		
Candles	1.3	Kg.		
Lamp oil	1.3	litres		
Fuel	2.0	Million BTU		

Notes: The table is based on quantities and nutritional values for the maize diet of the Americas. For other parts of the word, the diet uses the cheapest available grain, and the exact quantities consequently vary.

Table 3. Consumer price index (Cost of subsistence basket as in Table 2 and equivalents, Grams of silver per year)

	1500-49	1550-99	1600-49	1650-99	1700-49	1750-99	1800-49
North America							
Boston			244	143	122	192	
Philadelphia					135	205	
Maryland				111	133	184	
Latin America							
Potosi				701	566	594	612
Bogota				242	239	238	249
Mexico	109	198	391	270	249	274	353
Northwestern Europe							
London	67	128	201	220	201	264	383
S Eng towns	67	128	201	220	201	264	383
Antwerp	83	170	214	231	205	226	276
Amsterdam	66	104	152	158	172	202	266
Southern and Central Europe							
Valencia/Madrid	144	324	439	383	328	392	
Florence	99	156	177	129	177	240	352
Leipzig		119	227	134	154	163	201
Vienna	59	96	180	127	130	165	233
Asia							
Beijing					169	200	226
Lower Yangtze			378	150	153	226	319
Delhi		38	48	66	102	107	115
Bengal				50	77	146	130

Sources: See text.

Table 4. Subsistence Ratios: Labourers

	1500-49	1550-99	1600-49	1650-99	1700-49	1750-99	1800-49
North America							
Boston			1.66	2.89	3.84	4.15	
Philadelphia					5.06	5.34	
Maryland				4.41	3.82	4.32	
Latin America							
Potosi				1.83	1.82	1.75	1.71
Bogota				1.28	2.14	2.15	2.05
Mexico-urban					2.54	2.37	1.53
Mexico-rural	0.18	0.61	0.91	1.27	1.5	1.44	0.93
Northwestern Europe							
London	3.73	2.96	2.83	3.49	4.16	3.51	3.77
S Eng towns	2.89	2.21	1.65	2.03	2.79	2.52	3.15
Antwerp	2.88	2.87	2.98	2.48	2.75	2.48	2.32
Amsterdam	3.80	3.64	3.84	4.33	4.20	3.77	2.89
Southern and Central Europe							
Valencia	2.46	1.65	1.7	1.87	1.82	1.35	
Madrid	1.99	1.77	1.71	1.65	1.39	0.99	0.73
Florence		1.29	1.52	2.35	1.92	1.64	1.82
Milan	3.28	2.07	1.82	1.99	1.77	1.35	
Naples	2.46	1.65	1.70	1.87	1.82	1.35	
Leipzig	1.99	1.77	1.71	1.65	1.39	0.99	0.73
Vienna		1.29	1.52	2.35	1.92	1.64	1.82
Asia							
Beijing					1.25	1.04	0.79
Lower Yangtze			0.78	2.17	1.79	1.15	0.78
Delhi			2.96	2.99			1.30
Bengal					1.39	0.83	0.84

Sources: See text.

Table 5. Migration from Britain and Spain to their colonies, thousands of people migrating in each time period

	1500-1580	1580-1640	1640-1700	1700-1760
Britain	0	293	248	372
Spain	139	188	158	193

Notes: The table shows the number of Europeans migrating from Britain or Spain to its colonies in each time period. The figures come from Engerman and Sokoloff [2002: Table 1]

Table A.1. Sources for prices in Bogota

Food	
Maize	1707-1804: Pardo Pardo [1972: 237-240]
Chickpeas	1708-1810: Pardo Pardo [1972: 237-240] Both maize and chickpea prices were predicted for the period 1680-97 using the regression line for either price over the rest of the XVIII century; from 1698-1810, series were interpolated using a 21-year moving average.
Beef	1635-1812: Pardo Pardo [1972: 237-240] From 1680-1812, prices were interpolated using a 21-year moving average.
Butter	1682-1810: Pardo Pardo [1972: 237-240] Butter prices were interpolated using a 21-year moving average.
Non-food	
Candle	(Held equal to soap prices)
Lamp oil	(Held equal to butter prices)
Soap	1635-1803: Pardo Pardo [1972: 237-240] From 1680-1738 and from 1790-1810 a 21-year moving average was used to interpolate soap prices. From 1739-1789 the soap price was predicted from the butter price using the average butter to soap price ratio from 1680-1738.
Cotton cloth	1659-1818: Macera [1992: 110] (for Lima) Tocuyo prices, a 'plain home-spun cotton stuff', from Lima were substituted directly for cloth prices in Bogotá. These prices were interpolated using a 21-year moving average.
Firewood	1666-1812: Pardo Pardo [1972: 237-240] From 1680-1706 firewood prices were held constant at 2 reales/carga, the rate for the majority of the eighteenth century, and from 1707-1812 prices were interpolated using a 21-year moving average.
Wages	
Unskilled	1635-1812: Pardo Pardo [1972: 231-234] No interpolation was necessary. Wages were very stable rising from 1 real/day and to 1.25 reales/day by 1682 and to 2 reales/day by 1700.

Table A.2. Sources for prices and wages in Mexico

Food	
Maize	1525-1810: Garner [1985: 285; 1993: Appendix] Maize prices were interpolated using a 21-year moving average.
Beans	1665-1798: Espinosa [1995: 140-149]; 1741-83: Garner [1985: 313] Bean prices from 1525-1664 were predicted from maize prices using the maize to bean price ratio in later periods. From 1665-1819 Espinosa and Garner's bean price series were averaged and missing data were interpolated using the same maize to bean price ratio.
Meat	1527-99: Borah and Cook [1958: 79]; 1612-1814: Brading [1978: 195-6]; 1697-1807: Quiroz [2005: 101-103] Turkey prices were used for the sixteenth century because turkey was the most common domesticated meat. Missing data were interpolated using a regression line. Beef prices from Brading and Quiroz were averaged and interpolated using two separate regression lines: one on the beef prices from 1600-1780 and the second on the beef prices from 1780 onwards. These two regressions reflected stagnant beef prices from 1600-1780 and increasing beef prices thereafter.
Butter	1756-1803: Quiroz [2005: 108] Butter prices from 1525-1750 were predicted from tallow prices using the average tallow to butter price ratio from 1750-1820. Missing butter prices from 1750-1820 were interpolated using a regression line on the Quiroz data.
Non-food	
Tallow	1528-57: Borah and Cook [1958: 84]; 1643-1808: Brading [1978: 195-6] Tallow prices were held constant in the sixteenth century at the average tallow price from Borah and Cook. From 1600-1750 and from 1750-1820, regression lines were used to interpolate missing data. Two regressions were used to reflect changing trends in the price.
Lamp Oil	(Held equal to tallow prices)
Soap	1754-1808: Brading [1978, 195-6]; 1756-1803: Quiroz [2005: 108] Soap prices were predicted from the tallow price before 1750 based on the average soap to tallow price ratio from 1750-1820. From 1750-1820 a regression line was fit to the average of Brading and Quiroz's soap prices to interpolate the data.
Manta cloth	1526-73: Borah and Cook [1958: 62-75];1777-1867: Thomson [1989: 271]; 1780-1804: Miño Grijalva [1998: 231, 234]; 1835-45: Potash [1983: 163]; 1835-1877: Herrera Canales [1977: 38]; 1857-1877: Karemitsis [1973: 71] Early manta prices from 1525-75 were interpolated using a regression line. Missing manta prices were predicted using a regression line over the period 1575-1760. A regression line was fit to the average manta cost from 1777-1877 and was used to interpolate missing prices in the late eighteenth and early nineteenth century.
Firewood	Pardo Pardo [1972, 237-240] Very little firewood data existed for Mexico; therefore, the average price of firewood from Bogotá was used in the basket.

Table A.2. (cont') Sources for prices and wages in Mexico

Wages	
Unskilled	1524-91: Borah and Cook [1958: 86-89]; 1600-1700: Gibson [1964: 251]; 1704-1815: Garner [1993]; 1750-1856: Dobado Gonzalez, Gomez Galvarriato, and Williamson [2008, 803-805] Unskilled wages from 1525-1600 were interpolated using a regression line. A general increase in wages to a constant 1.75 reales/day was created drawing upon Gibson's wage estimates. Garner's rural and urban wages were converted from monthly wages, assuming that workers worked 21.7 days per month. From 1700-49 regressions were used to interpolate the rural and urban wages separately. From 1750-1856 Gonzalez *et al.*'s wage index was used to interpolate missing values in Garner's series.

Table A.3. Sources for prices and wages in Potosi

Food	
Maize	1683-1812: Tandeter and Wachtel [1990: 237-240]; 1734-1813: Tandeter and Wachtel [1990: 237-240] A weighted average of the Indian and White maize was used. This weighted price series was interpolated using an 11-year moving average from 1683-1690 and from 1709-1813. A regression was used to predict prices from 1891-1708.
Beans	Predicted from the Potosi maize prices using the average bean to maize price ratio in Lima.
Meat	1695-1813: Tandeter and Wachtel [1990: 259-262]; An 11-year moving average was used to interpolate the beef series.
Cooking Oil	1676-1804: Tandeter and Wachtel [1990: 222-225]; The cooking oil series was interpolated using
Non-food	
Tallow	(Held equal to soap prices)
Lamp Oil	(Held equal to cooking oil prices)
Soap	1676-1804: Tandeter and Wachtel [1990: 222-225]; The series was interpolated using a 21-year moving average.
Cotton cloth	1690-1812: Tandeter and Wachtel [1990:215-218]; The series was interpolated using a 21-year moving average.
Firewood	1627-1770: Macera [1992, 98]; The average price of firewood in Lima was substituted in Potosi because firewood prices were not available.
Wages	
Unskilled	1677-1813: Tandeter and Wachtel [1990: 265-268]; Wages were constant across the long eighteenth century, so the wage was interpolated at a value of 4 reales/day.

Table A.4. Sources for prices and wages in Boston

Food	
Maize	1631-1789: Weedon [1891: 878-903]; 1635-1859: Wright [1885: 337-338]; Missing years interpolated with moving averages.
Beans	1639-1783: Weedon [1891: 878-903]; 1759-1860: Wright [1885: 336-337]; Peas from Weedon and beans for Wright were averaged and interpolated using moving averages.
Meat	1637-1786: Weedon [1891: 878-903]; 1752-1859: Wright [1885: 401-402]; Missing years interpolated with moving averages.
Butter	1634-1787: Weedon [1891: 878-903]; 1762-1860: Wright [1885: 357-358]; Missing years interpolated with moving averages.
Non-food	
Candles	1747-1859: Wright [1885: 418-419]; Price held constant at 6 g Ag/kg until 1747. Moving averages were used to interpolate missing years thereafter.
Lamp oil	1758-1841: Wright [1885: 419-420]; Tallow prices used. Price held constant at 6 g Ag/kg until 1758. Moving averages were used to interpolate missing years thereafter.
Soap	1783-1859: Wright [1885: 416-417]; Price held constant at 4 g Ag/kg with a gradual increase from 1747-1787 from 4 to 7 g Ag/kg. Moving averages were used to interpolate missing years thereafter.
Linen	1756-1857: Wright [1885: 373]; Price held constant at 6 g Ag/m until 1747. Moving averages were used to interpolate missing years thereafter.
Firewood	1660-1765: Weedon [1891: 878-903]; 1752-1858: Wright [1885: 395-396]; Missing years interpolated with moving averages.
Wages	
Unskilled	1630-1776: Wright data extrapolated backwards using Main [1994: 48]. Weedon [1891: 878-903] gives a few earlier values, which are higher than the extrapolations and raise the welfare ratios towards the London values.

Table A.5. Sources for prices and wages in Philadelphia

Food	
Maize	1720-1790: Bezanson *et al.* [1935]; 1784-1861: Bezanson *et al.* [1936]; The Bezanson volumes are the ultimate sources of our Philadelphia prices; however, we have taken our Bezanson prices from the online compilation prepared by Peter Lindert and associates and available as (http://gpih.ucdavis.edu/files/Penn_spliced_1720-1896.xls) Wholesale prices were given a retail mark-up of 25%. No interpolations were necessary.
Beans	Assumed to equal 150% of the Philadelphia maize price.
Meat	1720-1790: Bezanson *et al.* [1935]; 1784-1861: Bezanson *et al.* [1936], as transcribed by Lindert; Wholesale prices were given a retail mark-up of 78%. No interpolations were necessary.
Butter	1784-1861: Bezanson *et al.* [1936], as transcribed by Lindert; Wholesale prices were given a retail mark-up of 31%. Prices before 1784 were predicted using the 1784 butter to beef price ratio.
Non-food	
Candles	1784-1861: Bezanson *et al.* [1936], as transcribed by Lindert; Wholesale prices were given a retail mark-up of 40%. Prices before 1784 were predicted using the 1784 candle to beef price ratio.
Lamp oil	1783-1859: Wright [1885; 419-20]; Massachusetts tallow prices substituted for Philadelphia prices.
Soap	1784-1861: Bezanson *et al.* [1936], as transcribed by Lindert; Wholesale prices were given a retail mark-up of 57.8%. Prices before 1784 were predicted using the 1784 soap to beef price ratio.
Cotton cloth	1753-1813: Cole [1938] July price recorded as prices changed little over the year. 1814-60: Zevin, [1971: 134] Russian brown sheeting prices. Cloth prices held constant at 9 g Ag/m from 1720 to 1752 reflecting constancy in European markets. Wholesale prices were given a retail mark-up of 75%.
Firewood	1754-1800: Smith [1981: 184] 1800-32: assumed to cost between $4 and $6 per cord. Between 1785 and 1800, the prices of coal and wood imply similar prices of energy, and this assumption extends that equality to 1832. 1833-1913: energy cost computed from anthracite coal (white ash lump), which became cheaper than wood after 1840. Coal price from Carter et al. [2011], series Cc 237.
Wages	
Unskilled	1727-1776: Nash [1979: 392-4] and Smith [1981: 184] 1785-1830: Adams [1968: 420]; 1840:1899: United States Bureau of Labor Statistics [1934: 253-60]

Table A.6. Sources for prices and wages in Maryland

Food	
Maize	1862-1720: Menard [1975: Table A-12] 1721-1775: Kulikoff, [1976: Table 13-6] 1776-1820: *Historical Statistics of the US*, series Eg290
Beans	These were assumed to sell for the same price as wheat, which was taken from the following plus some interpolations: 1680-1709: Clemens, [1974: Appendix I-A] 1710-1775: Kulikoff [1976: Table 13-7] 1776-1820: *Historical Statistics of the US*, series Eg297
Meat	Pork price from 1663-8: Carr, Menard, and Walsh [1991, p. 220]. 1677-1732: Clemens [1974: 168] 1733-1806: Walsh, Martin, and Bowen [1997: 376-7]
Butter	1666: Carr, Menard, and Walsh [1991: 183] 1726-1807: Walsh, Martin, and Bowen [1997: 363-4]
Non-food	
Candles	Set equal to butter. This and the corresponding equivalences for soap are supported by a very few quotations for tallow, soap, and butter in Carr, Menard, and Walsh [1991: 183, 184, 194, 198]
Lamp oil	Set equal to butter
Soap	Set equal to butter
Cotton cloth	Price per yard of Osnaburg sack cloth from Clemens [1974: 167] and Walsh, Martin, and Bowen [1997: 375]
Firewood	1740-1807: Walsh, Martin, and Bowen [1997: 369]. Earlier values roughly interpolated following Massachusetts pattern.
Wages	
earnings per day in growing tobacco and maize on a small farm	The calculation is an elaboration of the model developed by Carr, Menard, and Walsh [1991: 59] in various publications. One man worked 158.3 days per year in growing tobacco and maize. Production per man per year of these crops from Walsh (2010, pp. 183, 349, 544, 589, 604) for various time periods. Values were chosen to correspond as closely as possible to a farm operated by a single farmer. Prices of maize as above. Tobacco prices from: 1631-1740: Menard [1975: 475-8] 1741-75: Kulikoff [1976:Table 13-8] 1776-1820: Carter et al. [2011], series Eg283