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"Preliminary Global Price Comparisons, 1500-1870"

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ABSTRACT

Preliminary returns from a long-term project suggest that Northwest Europe had a distinctive pattern of relative prices since the sixteenth century or earlier. In addition to being a region of high wages and rents, and cheap silver, Northwest Europe was also a region with the world's most expensive food grains vis-à-vis the world's cheapest non-food industrial goods.

This distinctive product-price structure illuminates both the conflicting claims about global inequality and the sources of economic growth. Whether East Asia was overtaken only after 1800 or centuries earlier may hinge on the differences in relative prices. The inter-continental differences in the ability of ordinary workers to buy food grains were not so great, but the ability to buy luxury goods and capital goods was much greater in Northwest Europe. Cheaper inputs into accumulation, illustrated by interest rates and the price patterns for nails and writing paper, invited more accumulation of both non-human and human capital, feeding the growth process.

Such relative price clues cast doubt on some common intuitions about the sources of Northwest Europe's early growth advantage, and suggest that our focus should be on exogenous improvements in the non-agricultural sectors supplying capital goods and knowledge inputs.

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Economic historians can now chart the contours of human real incomes and productivity back across several centuries for six continents. Improvements in communications, copying, and computing keep lowering the costs of illuminating the past. Ours is hardly the first generation to wonder about what made economies decline or grow, what made people live shorter or longer lives, and how humans interacted with their environment. Since at least the late seventeenth century, Europeans have followed Gregory King in trying to guess about the history of living standards around the world. Our ever-improving guesses have recently been summarized in Angus Maddison's national product numbers and in comparative real-wage studies by two of the present authors, among others.[1]

Progress in this area requires tackling two tasks, one not-so-difficult task and a much tougher one. The less difficult task is to chart changes in real incomes and relative prices for any one place from the nineteenth century back across earlier centuries. The tougher task is to compare real incomes and relative prices around the world for any one era. Units of measurement differed greatly in the pre-metric world. Scholars have only begun to convert different societies' historical measures into common units to find how who could produce more, and buy more, than others. While there are some partial compendia of units of measurement, they cover only part of the world's metrological history and have never been wedded with economic data. It takes a large and determined team of historical experts from around the world to shoulder the burden of global comparisons in comparable units.

This paper summarizes the hopes and dangers of such a project, by surveying the main issues to be addressed, the perils of spatial comparisons in

the pre-metric era, and some promising early patterns that are emerging for the sixteenth through nineteenth centuries. We have already begun supplying downloadable data sets on prices, incomes, and productivity, and hope eventually to amass a collection covering many places on six continents from 1200 up to 1950.[2]

Three Key Issues

International Inequality and the "Great Divergence"

Who had higher real incomes, or product per adult, than whom? When did Atlantic Europe pull ahead of the rest of Europe and other continents? Within Europe, can we gain a clearer view of the "great divergence" in real wages between Northwest Europe and the rest of the continent starting in the seventeenth century?[3] In the more global view, were England, the Netherlands, and Northern France already ahead of India and China as far back as 1200? The view that Europe was already ahead in 1200 has now received the endorsement of Angus Maddison, whose guesses imply that Europe had already overtaken Asia in per capita income sometime between 1000 and 1500. His numbers imply that global income inequality has been rising from 1500 or earlier until 1950 or later.[4]

Asia has its defenders, however, who argue that real incomes and real consumption levels were as high as in Europe until the eighteenth century. The best-known recent writing in this vein is Kenneth Pomeranz has generalized this viewpoint with a wide range of clues, focusing mainly on the Lower Yangtze (Jiangnan) but covering all of East Asia and all of Europe.[5] Robert Allen has extended the point to a set of real-wage calculations finding that India in 1595, China in the late seventeenth century, and nineteenth-century Japan had nearly as much basic food and clothing as their working-class counterparts in Germany,

France, and Northern Italy.[6] The same suggestion emerges from single-region studies suggesting that the ability of workers and farmers to feed and clothe themselves was respectable in the Yangtze Delta 1650-1800, South India in the eighteenth century, Java in the early nineteenth century, and the Ottoman Empire in the eighteenth century.[7]

Each of these questions brings a related question about the relationship of real incomes to other dimensions of well-being, particularly health and longevity. Scholars have already found intriguing departures of real income history from the history of health. We hope that our expanding the real income history can complement the monumental project by Richard Steckel and collaborators on the clues about living standards from heights and other physiological indicators over the centuries and millennia.[8]

Intra-national Inequality

When did intra-national inequality experience a secular rise in Atlantic Europe? Did it begin sometime between 1500 and 1800, as suggested by some of the present authors and others?[9] Did it begin even earlier? Or did sharp inequalities within societies widen only during the Industrial Revolution era, as others have suggested?[10] Whatever the timing, the fact that inequality rose within the societies of Atlantic Europe implies that the rich of Atlantic Europe pulled ahead of the rest of the world even faster than the frequent comparisons of workers' real wages can reveal.

The Sources of Early Growth

Our perennial curiosity about differences in incomes and living standards has always been accompanied by a desire to know what caused those differences. We are still on that voyage launched by Adam Smith's title *An Inquiry in the Nature and Causes of the Wealth of Nations.* Fortunately, some ingenious quantitative studies have spotlighted the most likely causes. While the

quantitative approach meets resistance from historians steeped in the nuance of historical context, it has the twin virtues of transparency and the ability to see whether general patterns seem to span a wide range of contexts. In one recent quantitative study, Brad DeLong and Andrei Shleifer found that autocratic princes depressed urban, and presumably national, growth in the medieval and early modern eras.[11] Over the same sweep of centuries, the roles of governance institutions and geography emerge as leading actors in the studies by the team of Daron Acemoglu, Simon Johnson, and James Robinson.[12]

In the same quantitative spirit, Robert Allen recently convened a tournament in which several leading proximate causes and deeper causes of growth fought it out econometrically using data from six centuries and nine countries. Separate contests had them competing to explain real wages, agricultural productivity, urbanization, proto-industrialization, and population growth. The top prizes went to the more proximate causes --

- earlier urbanization,
- the rise of textile productivity in northwestern Europe,
- agricultural productivity, and
- the man/land ratio

-- with little or no separate role for some favorite deeper causes:

- literacy,
- autocracy versus representative government,
- empires and intercontinental trade, and
- the Thirty Years' War.[13]

The tournament will no doubt re-convene in the years ahead, as scholars develop new interpretations and better data. On the interpretive front, there is

always room to re-cast the mutual links between those proximate causes and deeper causes. Perhaps some of the deeper forces, such as autocracy or literacy of forces not yet measured, deserve credit for causing some of the proximate causes that seemed to outperform them in this tournament. For example, the productivity growth in agriculture or textiles, or the progress of urbanization, might have depended on a combination of forces not yet tested.

Better data will surely determine which causal forces seem to win out in future tournaments. The truth is that we still need better measures of real wages, other real incomes, sectoral productivities, and factor supplies. We would also like to know how these sources of growth related to movements in income inequality.

On the data front, we are in luck. The kinds of price data that are now easier to gather serve to illuminate all of these indicators at once. Differences in real incomes and sectoral productivities and factor supplies and income inequality are all measured by relative prices, thanks to the price-dual relationship between income performance, factor supplies, and productivity. Knowing relative prices is itself the main way to learn whether, when, and how some regions pulled ahead of others. For example, consider the likely debate over how and why real incomes differed between two historical settings -- say, England 1600 versus England 1800, or England 1600 versus China 1600. Suppose that the historiography wonders about relative real incomes of common laborers, skilled artisans, landowners, and lenders in the two settings, and is debating the roles of progress in four sectors -- staple grains, meat, fuel, and such capital goods as iron products. The debate can advance a long way toward resolution just with good data on the prices of the main outputs and factor inputs. The fortunes of each economic class are usefully measured by the purchasing power of its wage or rent in terms of the grain, meat, fuel, iron, land, and labor services it typically bought or rented. Productivity changes in each sector are measured by the ratio of its input prices to its output price. For example, productivity

differences in the meat sector can be sketched by contrasting the prices of grain, fuel, iron, labor, land, and capital inputs into meat production with the prices of meat. Relative prices are the key.[14]

Source Materials

Dozens of scholars have been building up historical price and wage series extending back to the sixteenth century and earlier. The main pioneers were the leaders of the International Scientific Committee on Price History.[15] A 1929 proposal by E.F. Gay and William Beveridge helped secure funding by the Laura Spelman Rockefeller Foundation in the 1930s. Thus were born the landmark price histories of Europe and America, including books on England (Beveridge 1939), Holland (Posthumus 1946), France (Hauser 1936), Germany (Elsas 1936-1949), Austria (Pribram *et al.* 1938), the United States (Bezanson *et al.* 1935; Benzanson 1936-1937, 1951), Arthur H. Cole 1938), Spain (the Hamiltons 1934, 1936, 1947),[16] and Poland (Furtak 1935; Hoszowski 1954; Pelc 1935, 1937; Siegel 1936, 1949; Tomaszewski 1934). These inspired postwar books that covered most of the rest of Europe. Most of these have been converted to Excel sheets by some of the present authors, especially Robert Allen, David Jacks, and Jan Luiten van Zanden.

The geographic range is already spreading toward our global goal. For Russia, a vast new data trove has been assembled for 1600-1725 by Richard Hellie (1999), and Boris Mironov is currently extending price and wage series from 1550 to the present, building on his earlier grain-price work (Mironov 1985, 2004, in progress). For India, we now have the 1595 and circa-1820 benchmarks (Moosvi (1985), Divekar (1989), Allen (2004a, 2005). Ramón and Larraín (1982) have provided price data for Chile 1659-1808, and Gaspa Feliu i Montfort (1991) had extended and improved the Hamiltons' series for Spain, now adding Barcelona.

Sevket Pamuk (2000a, 2000b, Ozmucur and Pamuk 2002), and Jan Luiten van Zanden is collating Dutch studies to shed light on prices and living standards in Java (Van Zanden 2001).

We aspire in the next few years to deliver price data files on at least the products sketched in Table 1. We should have extensive series for over 60 places on six continents back to the middle ages. We hope to improve on the past coverage of commodities. In particular, the written price histories have been biased toward over-using some prices and over-researching others, relative to expenditure shares:

<u>over-using the prices of:</u>	<u>… and under-using prices of</u>:
• staple products, especially food	• luxuries
• standardized older products	• new products
• internationally traded goods	• non-traded products
• wholesale products	• retail products
• physical goods	• services
• products intensively using land, natural resources, and capital	• products intensive in labor, both unskilled and skilled

Our final coverage will be both better and worse than Table 1 can quickly state. Better, in the sense that prices for other commodities not shown here will be available in some of the same data sets, given the low cost of adding them. Worse, in that data will always be missing, or at least shaky, for some regions and some historical eras.

The Agony of Geographic Comparison

Collecting the global data set and making sense of it will not be easy, however.

To illustrate the problems that agonize and humble scholars in this quest, let us begin with the relatively narrow and simple one of choosing staple grain equivalencies. Why and how do scholars convert prices of other grains into "equivalent" prices of wheat? As for why, well, one must choose a staple food product that is as global as possible. That nearly global staple also has to be an intermediate good, not the final product placed in bowls and on plates, since such final products as bread or pasta or fresh-cooked rice are usually not priced in historical data sets. The next wrinkle is that no grain is fully global. Where wheat and another grain are both heavily used, we can use the price ratio between wheat and the other grain, our preferred method. But where either wheat or the other grain, such as rice or rye, is rarely consumed, the price ratio gets out of line because the rarely used grain takes on luxury status. For example, in 1704, the prices of bread and rice were radically different between London and Canton. In Canton, where bread was rarely consumed, it would trade for 44 times as much rice as in London, where bread was common and rice a rare luxury.[17] What is the right price ratio for rice versus bread? Scholars must choose among the following: (a) Search for a place where both commodities were commonly purchased, and use its price ratio as a hedonic adjustment for the whole world; (b) take a geometric average of the two radically different prices, as a middling price consistent with an imaginary global utility function or (c) use a single-attribute equivalence, such as calories or protein in the case of foodstuffs. All have been tried. No one approach enjoys clear superiority in serving both theory and data practicality.

A similar problem of comparison is to choose a unit of measurement for fuels, given that no one fuel is used the world over. How to compare prices of firewood, peat, coal, and charcoal? Again, the same three choices present themselves: a price ratio from places of most balanced purchases, a geometric

average, or an attribute equivalence. Since the goal is to provide heat, the attribute-equivalence approach would convert all of these into prices per unit of delivered energy -- once you figure out how much fuel there is in a "cartload" or similar measure.[18]

More painful is the basic problem of comparing local units of measurement across cultures. To underline this problem, here is an

> Exam question: Which of these prices from around the year 1600 offered buyers the lowest silver price for cloth of given quality --
>
> (a) Santiago de Chile, at 12 reales per vara of imported cotton cloth;
> (b) Winchester College, at 108 shillings per "piece" of ray (dark wool) cloth;
> (c) Modena, Italy, at 155 soldi per braccio of panno alto;
> (d) Wroclaw, at 162 white grosz per lokiec of Silesian cloth;
> (e) Arkhangelsk, at 38.6 kopecks per 10 arshin of sermiazhnoe sukno; or
> (f) Agra, India at 3 dam per gaz-i Ilahi?
>
> Which setting charged the highest silver price -- again, for given quality? Defend your answer.

Little wonder that most scholars have confined themselves to studying changes over time within each place rather than comparing across places. Figuring out the local units and converting them to grams of silver per metric unit or per count for given quality is a tedious, and often hopeless, task. The relevant science of historical metrology, the study of weights and measures in the past, proceeds by patient slow accretion of knowledge. Fortunately, we need not start from scratch. Over a century of publications in metrology have borne some fruit. Some of the price history authors themselves have offered conversion guidelines, though others have not. We are particularly indebted to scholars like

Ronald Zupko for their patient and thorough sleuth work in the history of weights and measures.[19] Laborious use of these materials allows one -- or rather, a team of scholars -- to fit some of the puzzle pieces together. We have found the problem relatively tractable for foods, money, and any goods sold by counts, such as eggs or reams of quarto-sized writing paper. Eventually, we will be able to piece together those fuel prices across types of fuel. Even wines and beers sold by volume can probably be compared meaningfully, if one is very cautious. Global pricing of cloth and apparel may never get beyond using square meters of cloth as a priced attribute.

A clever economist might say "Just apply the trade test. If a particular good, say one of the cloths in our exam question, was exporting from one place to another at positive cost, then we know it was cheaper in the export place than where it was imported. We already know the answer. No need to grapple with the units of measurement and the subtleties or product quality." The simple trade test is indeed useful in a highly integrated economy where all important goods and services are traded. But such an economy has never existed, especially before 1820, despite the literature on an early modern "world economic system" (O'Rourke and Williamson 2002a, 2002b). And even where one good was exportable to distant markets, most were not. Most goods and services were effectively non-tradable, leaving us with the same difficult task.[20]

Even knowing which goods or services were traded and which were not does not reliably tell us which countries' real incomes are overestimated or underestimated by comparing the prices of tradables alone. For the last half-century economists have thought they could predict how true purchasing power parities (PPP) departed from the abilities of different countries to purchase tradables. Data from the 1960-1990s era seemed to reveal a Balassa-Samuelson effect (alias Penn effect). To the extent that Country A was richer or more crowded than Country B, the relative price of the harder-to-measure non-tradables would be higher in A relative to B than the measured relative price of

tradables. Therefore one could use say that purchasing power was actually not as much greater in A than in B, once we allowed for the cheapness of non-tradeables in B. International agencies and scholars have used this predictable bias in judging countries' relative incomes.[21]

The trouble with relying on the systematically greater cheapness of non-tradeables in poorer, or less settled, countries, is that it may not have been true before 1960. the team of Paul Bergin, Rueven Glick, and Alan M. Taylor has shown that the effect was weaker in the 1950s and non-existent earlier in the twentieth century or in the late nineteenth. They note that even theory leaves us without any clear prediction about the relative prices of the harder-to-measure non-tradables.[22]

In addition, scholars must be prepared to grapple with the welfare implications of the non-existence of certain goods in certain settings. This problem of new or disappearing goods is familiar in our studies of real progress over time. Economists have had to adjust our cost-of-living measures to get around such questions "What was the price of a cell phone in 1790?" or "What is the price of buggy whips today?" We have ways of calculating upper or lower bounds on the welfare effects of new goods.[23] These could be applied to value the past appearance of new goods, such as the introduction of New World goods in the Old World, and vice versa, after 1492.

New Relative Prices and Two Old Issues

Subject to these constraints, we are able to broaden the history and geography of prices around the world. In this preliminary study we focus on just nine benchmark dates from 1500 to 1870. For each benchmark date and each place, we take the nine-year average price centered around that benchmark date -

- or the closest substitute for that nine-year average, in cases where prices are missing for some of the nine years.

Silver Inflation

A first fruit of our extended data set, even in its present incomplete form, is to confirm the familiar historical geography of the silver / wheat price ratio between 1500 and 1870. Picking up where Braudel and Spooner (1966) left off, Table 2 sketches this historical geography for four continents. Over these 370 years, silver remained cheapest in Spain, Portugal, and the Americas, and was dearest in most of Asia. There was a strong downward trend for silver in the famous "price revolution" era 1500-1650, even though the rate of wheat price inflation, here shown as silver depreciation, seems tame by the standards of the twentieth century. There was also some global convergence in the grain prices of silver, first in that 1500-1650 era and again in the nineteenth century, as the eastward flow of silver eventually caught up with each new wave of silver mining in the West.

Global Inequality in the Grain Wage for Common Labor

Thus far, most measurements of relative real incomes have used real wages for common laborers or craftsmen, and the real wage indices have used cost-of-living deflators that are heavily based on food, especially staple grain foods. Returning to this popular quest, we offer three advances regarding real wages. First, we extend the grain wage, the simplest kind of real-wage measure, to more places around the globe. Second, we note that the conventional over-emphasis on food prices biases the discussion of international income gaps *away from* finding any great divergence in incomes around the globe. Finally, in the next section, we reveal new patterns in the relative prices of staple foods versus non-foods.

The convenience of judging real incomes by the ability of day laborers to buy grain has made the grain wage a tradition. Even Adam Smith and Robert Malthus retreated to using the English wheat wage in trying to judge what happens to incomes in the long run. Part of Malthus's pessimism may have been caused by his using a wheat deflator at the moment in English history when grain scarcity had peaked.[24] The more we try to reach across centuries or around the globe, the tighter the data constraint that forces us to reconsider the simple grain wage. Thus Van Zanden (1999) used a wheat and rye wage in comparing across all of Europe back to 1500, and we return to a wheat wage for a moment here, in order to reveal some patterns for the world as a whole.

The ability of a day laborer's wage to buy wheat, or its equivalent in rice or rye, in 38 places is sketched in Table 3. Being a ratio of a labor price to a wheat price, the wheat wage sometimes tells stories about the supply of wheat and sometimes tells about the supply of labor. Temperate-zone regions with abundant farmland tended to have high wheat wages in terms of silver. This is one main reason why parts of Eastern Europe and North America seemed to have such high real wage rates in terms of the ability to buy grains or bread. By this yardstick, the height of prosperity for common workers would have been Poland before 1650, or eighteenth-century Bolivia or West Virginia. That England, France and the Low Countries also had high wheat wages must have some other cause, since they had no advantage of climate or of land over the average temperate-zone country.

Table 3 reveals some serious downturns in the grain wage. From 1500 to 1790, European workers in most regions found it harder and harder to buy grain or bread. The outliers were the Low Countries, England, and to a lesser extent Northern France. An even more severe decline in workers' food purchases is implied by comparing Agra under the Mughals in 1595 with Pune (Poona) under the British around 1820. It appears that a slightly broader measure of Indians' real wage was still lower in the 1860s, and possibly even in 1961, than in 1595.[25]

Yet the trends in Table 3 pose an immediate problem for our discussion of the early modern "great divergence" trend. The expanded data set reveals no clear global divergence, either for all observations or for those places yielding continuous series.[26] In fact, a reason for this non-divergence has already been hinted at. Most countries in grain-rich Europe suffered losses in their workers' ability to buy grains between 1500 and 1790. In terms of global inequality, this implies that some of the better-off nations sank toward the lower standards of grain consumption on other continents. Are we to conclude that there was no divergence, no widening of global inequality over those three centuries, except for England and the Netherlands?

Toward a New Historical Geography of Prices and Inequality

A truer perspective on real-income inequalities waits on our introducing a much wider range of incomes, not just workers' real wages, and a much wider range of consumer prices, not just staple foods. The global divergence debate is largely about average real national income, including the middle and upper classes and their very different consumer bundles. The literature on income inequality within Europe has already delivered the relevant warning here: The great divergence that really unfolded between 1500 and 1790 (or 1800) and abated later was not a divergence between North Atlantic workers and the rest of the world, but a divergence between the better-off ranks in North Atlantic countries and the rest of the world, including workers in the same countries.[27] This point is crucial to our understanding of the likely overall rise in international income inequality, the kind that Maddison's guesses about GDP per capita would agree with. *Between 1500 and 1800 real wages did not diverge as much between countries as average real incomes person diverged.*

To sketch this likelihood, we proceed in three steps: (1) introduce some historical geography of non-food prices, (2) consider the likely effect of broadening the consumer price index on global real inequality, and (3) consider the likely effect of the same broadening on *trends in* global real inequality.

At this early stage in our work, we introduce the historical geography of just five selected non-foods in Tables 4 through 8.

The Historical Geography of Five Non-Food Prices

There seem to be two rough tendencies in the prices of non-foods, relative staple grains. Historically, some important non-foods have declined in relative price since 1500. Geographically, non-foods tended to be cheaper in Atlantic Europe than in Eastern Europe or other continents. So say the hints from the wheat prices of five non-foods in Tables 4 through 8.

Writing paper. This luxury good, so important to the rise of knowledge, shows both the historical and the geographic pattern. Historically, its price dropped throughout Europe after the sixteenth century, relative to the price of wheat (Table 4), and relative to unskilled wage rates as well. The geographical pattern is also fairly clear in Table 4, despite the difficulties of pricing a luxury product of varying quality. Even though China led in the early invention of paper, after 1500 it was in France and Spain that writing paper was most affordable.[28] Our fragmentary returns suggest that the affluent and literate had to pay much more for writing paper in Eastern Europe, India, China, and the Americas. Given that the price of books seems to have plummeted in England and France,[29] it is plausible to imagine that the supply of these knowledge goods contributed to the rise of Northwest Europe as a center of knowledge.

Nails. One building material can serve to pose suggestions about a vast range of luxury and capital goods. While all luxuries and capital goods pose serious problems of differing product quality, nails are less problematic than most. Their prices are recorded either by weight or by number of nails, usually

with helpful notations about the type of nail. Their relative price, like that of writing paper, declined across these centuries. Geographically, Table 5 suggests that nails were cheapest in Atlantic Europe -- at first in Spain and then, after 1600, in England and Sweden. They were more expensive elsewhere, especially in Tahiti, where they caused such a sensation when first introduced in the 1760s. Russia remained a high-price area until the nineteenth century, because poor transport and other institutions held up its eventual comparative advantage in iron products.

Tallow candles. Candles were another global luxury. Table 6 shows our early gleanings of relative prices for tallow candles, the less luxurious and more frequently recorded variety. In this case, unlike paper and nails, there is no clear decline in relative price, either because major technological gains awaited the nineteenth century or because of continuing scarcity of animal fats. The geographical pattern does reappear, however: Candles were also cheaper in Atlantic Europe than in most places.

Soap. Table 7's sketch of soap prices resembles the patterns for candles. There is again no obvious trend before the nineteenth century, perhaps again because of relative technological stagnation and dependence on animal fats. For both products, however, the labor price had begun to decline in Northwest Europe in the eighteenth century and for other areas in the nineteenth. The global view again suggests that Northwest Europe always had lower prices in terms of wheat and labor, with similar low prices suggested for North American and India.

Cloth. The first non-food in most studies of early wages and prices is cloth, the most convenient proxy for clothing in general. Table 8 shows some initial offerings converted into kilograms of wheat per meter. The historical trend toward cheaper cloth and clothing is not as well revealed here as in other writings that follow indexes of cloth and clothing prices over time. From other literature, we know that European clothing prices started downward after the

mid-eighteenth century, and plummeted in the nineteenth.[30] The geographic patterns, however, are more elusive. Product quality and rarity mar the comparisons, as in the non-common cloths priced for Istanbul in Table 8. As suggested by the exam question we posed earlier, clothing is a sector for which the battle of product heterogeneity will not be won soon.

Turning Tables 4 through 8 on their heads and reading them as five different historical geographies of wheat scarcity yields a simple overall suggestion: *Atlantic Europe was the ultimate zone of expensive food grains* -- in the sixteenth through eighteenth centuries -- relative to other final products.

Implications for Global Inequality Snapshots

What would the geographic pattern suggest about the level of global inequality in purchasing power at any one date? Would differences in the relative prices of non-foods tend to raise, or would they tend to lower, our impressions about gaps in real purchasing power around the world as of any one date, say 1500 or 1790 or 1870? By including more non-foods in the consumer bundle, as we certainly should, would we find more or less global inequality in people's ability to buy that fixed bundle than past writings have sketched using a more food-heavy bundle?

For any date between 1500 and 1790, at least, the fact that non-food goods were relatively cheaper in Atlantic Europe means that global inequality was greater than the ability to buy staple foods has led people to believe. The more we add non-foods to the consumer expenditure bundle, in order to bring it closer to a national average, the cheaper the relative cost of living looks in Atlantic Europe relative to the rest of the world, both because non-foods were cheaper in Atlantic Europe and because their expenditure weight was probably greater there.[31]

Implications for Global Inequality Trends

What would the historical trend toward cheaper non-foods imply about trends in global inequality? It suggests that the high-income groups and regions had their advantages enhanced between 1500 and 1790 because their lifestyle was cheapening relative to the lifestyles prevailing elsewhere. This follows from three facts. First, the cheapening luxury goods were more important for higher-income households than for the poor. Second, hiring servants became cheaper relative to food up to 1790. Finally, these two effects were not offset by the inequality implications of the rising real cost of housing, because housing was no more of a net purchase item for the rich than for the poor.

Relative Prices and the Cost of Capital Inputs

If we are to get better estimates of all of GDP before the twentieth century, and to better understand the long-run growth process, our research efforts must shift toward pricing those non-foods that are inputs or outputs for the capital-goods sectors, either in the conventional sense or in the sense of supplying the human-knowledge sector.

We are not the first to call for this shift toward capital goods and their relative price. William Beveridge, a pioneer in the price history enterprise, tried to coax scholars away from the cost-of-living index alone, and toward a deeper range of relative prices:

> In the study of modern prices, determination of the 'general level' of prices and its movements has bulked largely, perhaps at times too largely.... In the present work the emphasis is different. Price[s] for single commodities, rather than index-numbers for commodities in combination, are the main objective....
>
> At Hinderclay in Suffolk, before the Black Death, wheat was being sold at prices varying with the harvest but ranging about 5s. a quarter; steel was

> being bought for ploughshares and other implements, at prices ... ranging about 6 d. a lb., that is to say at £50 and upwards per ton. To-day a normal price for wheat is about 50s. a quarter, and for steel is about £10 a ton. While the price of wheat has multiplied ten times, that of steel has fallen to a fifth' a quarter of wheat will buy fifty times as much steel as it once did. The contrast between the wheat age and the steel age could hardly have been better illustrated.[32]

What Beveridge sought to illustrate with a dramatic change over time should also be applied to the differences in relative prices at a point in time, if we are to understand the role of relative prices in the process of early capital formation.

We are pulled toward the accumulation sectors not just by Beveridge's reminder of the dramatic price change for steel versus wheat, but also by economists' recent interest in the relative price of capital goods. Chad Jones (1994) has pointed the way by noting that both theory and international data suggest a strong link between the relative cheapening of capital goods and the rate of overall economic growth. In a postwar sample of 65 countries, Jones found that a cheaper supply of capital goods, relative to consumer goods, significantly raise the rate of subsequent economic growth, with or without econometric adjustments for data limitations and for simultaneity. His key policy implication was that choosing a tax system that is more lenient to the capital goods sector is better for growth. Bill Collins and Jeffrey Williamson (1999) have shown economic historians how differences in this capital price nexus may help to explain growth performance, by drawing on the experience of eleven countries between 1870 and 1950. Cheap capital goods may have played a bigger role in global growth convergence back in the 1870-1914 period than in the postwar period, they find. Both studies alert us to the possibility of a virtuous circle of accumulation and growth: exogenous stimuli to either the supply of capital goods or to GDP itself can set in motion a cumulative process of cheaper capital and stronger growth.

What fresh data could be added on relative prices in the capital goods sector before 1870? To detect strong international differences in the user cost of capital inputs, we seek data on relative capital goods prices and on interest rates. Regarding capital goods prices, we have use for both the input prices and the output prices experiences by the capital goods sector. Input prices would include factor inputs such as labor, fuel, and interest rates, plus such material inputs as boards, bricks, iron and other metals, nails, pipe, and tar. Capital-good outputs would include such goods as ships, machinery, hammers, saws, horseshoes, wagons, and -- for a belligerent age -- guns. Eventually we should be able to assemble such a wide range of prices, at least for Britain, France, Holland, and Russia.

Some promising extensions of the non-human capital price series await us, once we can derive and verify the conversions to metric and to silver. A first step will be to add several more places to the history of nail prices, and to map a near-global history of iron prices.[33] The iron price series will arm us with a key input price for that other capital good that ruled world history from the fifteenth century to the nineteenth: firearms. Historians have long presumed that cheaper and more abundant guns, cannon, and anchors were key to European conquest. Carlo Cipolla conjectured that it was the cheapening of iron relative to copper that made Sweden, Holland, England military switch more quickly to the new iron ordnance than Italy or Russia.[34] It would be good to have more specific data on the prices or iron and other inputs and outputs of the firearms sector across time and space.

In the meantime, we can make a general point just by reasoning from the definition of capital input prices and the history of interest rates. The price of any capital input, the Jorgensonian "user cost of capital" is the rental one pays, or the implicit rental on a capital asset one owns instead of renting. Its formula is

User cost of = Price of that *times* **(**interest + depreciation - expected price

a capital good capital good rate rate appreciation**)**,

where each term is defined as net of relevant taxes. Ignoring any systematic differences in depreciation rates or expected real-price appreciations across the decades or around the globe, the cost of a capital input therefore depends both on the relative price of that capital good (ship, wagon, machine, etc.) and on the prevailing rate of interest.

Here are two possible sources of cheaper capital inputs, then, for Northwest Europe relative to any other place in the world between 1500 and 1870. One is the possibility that capital goods tended to be cheaper there, as was the case for nails. The other is the fact, not just a possibility, that interest rates were lower there. Indeed, the compendium by Sidney Homer and Richard Sylla shows that they were much lower there from the fourteenth century to the twentieth, when America finally checked in as a low-interest leader.[35] Both nominal and real interest rates were higher in Eastern Europe, the Americas, and Asia. Thus we have strong reason to believe that over all the centuries in which it emerged as the income leader, *Northwest Europe was the world's region of cheap capital inputs*. As we shall suggest in the next section, this is part of a larger price pattern that helps us place our initial bets on the sources of Northwest Europe's better early growth.

Initial Conjectures on Proximate Sources of Northwest Europe's Advantage

We close with a set of conjectures about how the distinctive price patterns of Northwest Europe can be used as a valuable clue to that region's advantage over the rest of the world before the nineteenth century.

The prices in Northwest Europe relative to any other place tended to be greatest for land and housing rents, next greatest for labor, followed by staple

foods, then by non-food goods, and least for interest rates and the user cost of capital. Again, in shorthand,

The likely ranking of the **(Northwest Europe / other place) price ratios** in terms of any accounting unit looks like this for anytime from the middle of the seventeenth century to the middle of the nineteenth:

housing rent and land rents
> wages for skilled and unskilled labor
> staple food prices
> prices of capital goods and luxury goods
> interest rates and the user cost of capital

We have already reported the initial evidence that leads us to believe in the product-price inequality in the middle of this chain: staple goods > luxury goods, in terms of the (Northwest Europe / other place) price ratio. The fact that interest rates and the user cost of capital tend to be much cheaper there leads us to suggest that these belong on the right end of the chain. Our Table 3 also showed that labor became more expensive in England and Holland, relative to staple foods, by the seventeenth century, even though Eastern Europe and North America were somewhat competitive on this measure. Hence our ranking "skilled and unskilled wage labor > staple foods," with this qualification about Eastern Europe and North America. As for the extreme cost of land and housing in Northwest Europe, this seems likely, even though the comparisons with other regions are still in progress. We know, in any case, that within Northwest Europe rents shot up relative to everything else. On the housing front, that result has already been published by Gregory Clark. On the land front, farmland rents rose strongly relative to the rising price of labor in England, the Paris basin, and

the Low Countries up to the early nineteenth century. Jeffrey Williamson has followed a similar story in the pre-industrial Third World from 1820 through 1939.[36]

This chain of inequalities in the (Northwest Europe / other places) price ratio educates our guesses about the kind of advantages that the favored region developed early on. Briefly, here are three common intuitions disfavored by the emerging relative-price patterns, and one intuition it does favor.

(1) *The distinctive advantage of Northwest Europe was <u>not</u> embodied in superior food-grain productivity.* A key part of the agricultural revolution idea is contradicted by our relative-price pattern. If it was a superior ability of Northwest Europe to grow food grains that led to its faster income gains and its faster population growth, why were grains so much scarcer there than were the prices of other sectors' products? Any Western European advantage in agricultural productivity was apparently small enough to be eclipsed by other determinants of relative prices, suggesting indirectly that it may not have dominated the accounting for inter-regional differences in product per capita.

(2) *Its advantage was <u>not</u> driven from the demand side, by the income effects of higher productivity balanced across all sectors.* If a general productivity advantage gave Northwest Europe higher incomes and therefore greater demand for products, why again were grains so much scarcer there than were the prices of other sectors' products? Engel's law says that the higher incomes should have *lowered* the relative price of grains in a world of limited trade.

(3) Finally, the best candidate is the intuition that *Northwest Europe led in the development of non-agricultural productivity concentrated in the capital-goods and knowledge-goods sectors.* For reasons just sketched, this is the most likely proximate locus of Northwest Europe's better growth before 1870. Much of our search for the sources of growth should concentrate on these sectors.

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ENDNOTES

[1] Maddison (1995, 2001), Van Zanden (2000), Allen (2001).

[2] Data will be downloadable from at least three group members' websites, in Amsterdam, Davis, and Oxford. Three sites have already been set up (http://aghistory.ucdavis.edu, http://www.economics.ox.ac.uk/Members/robert.allen/WagesPrices, and http://www.iisg.nl.hpw). As of this writing, the Davis site is a temporary place-holder for a much larger collection at the UC Davis Institute of Governmental Affairs, to be launched in 2005. The number of such Excel files will expand greatly, as we convert a few dozen other sets into silver and metric. Some of these are based on the work of the Carnegie-funded International Price Commission of the 1930s-1950s. Others are our newly developed series from around the world.

Included in the present research team are the following scholars who are not authors of this paper: Metin Cosgel (University of Connecticut), Martin Cuesta (UADE, Buenos Aires), Seong Ho Jun (Sung Kyun Kwan University, Korea), Eona Karakacili (University of Western Ontario), and James B. Lewis (Oxford).

[3] Allen (2001).

[4] Maddison (2001, p. 264). Maddison's estimates have been criticized. In the context of his estimates extending back to 1820, Marianne Ward (2000) and Leandro Prados de la Escosura (2000) have suggested plausible revisions. Ward takes a direct approach international comparisons before 1950, revising Maddison with new direct observations of prices around the world starting in 1872. Prados uses the systematic pattern of bias in international PPP estimates of GDP per capita to back-cast to the nineteenth century with a systematically shifting pattern of relative prices, instead of Maddison's reliance in a fixed set of international relatives based at 1950. As we note below, Prados's assumption of a fixed pattern of PPP bias has been challenged in turn by Bergin *et al.* (2004).

[5] Pomeranz (2000).

[6] Allen (2004a, 2005). For an alternative comparison involving India in 1595, see Broadberry and Gupta (2003).

[7] Pan (1997), Parthasarathi (1998 and forthcoming), van Zanden (2001), and Ozmucur and Pamuk (2002).

[8] Steckel and Rose (2002), Steckel (2003).

[9] Van Zanden (1995), Lindert (2000), Allen (2001), Hoffman *et al.* (2002), and Lindert and Williamson (2003).

[10] Kuznets (1955), Williamson (1985), Morrisson (2000).

[11] DeLong and Shleifer (1993).

[12] Acemoglu, Johnson, and Robinson (2001, 2002).

[13] Allen (2003).

[14] That is, where relative prices capture the relative scarcities of things in separate markets. Of course, many things are made scarce by denial of sale, the most familiar example being the rationing of credit. Our pursuit of relative prices should be augmented by information on scarcities in the absence of recorded prices.

[15] Earlier pioneers include Rogers (1866-1902), Hanauer (1878), and d'Avenel (1894-1926).

[16] The effective co-authorship by Gladys Dallas Hamilton is acknowledged by Earl Hamilton in Hamilton (1934, xi and 1947, ix).

[17] Allen (2004b, Table 1).

[18] Even then, a comparison of living standards would have to reckon with the geographic differences in the need for fuel. Heating the home does not have the same true cost in Agra as in Arkhangelsk, even if the prices were the same in grams of silver per BTU.

[19] See Zupko (1978, 1981, 1985, and 1990) on Western Europe. For readers of German gothic script, a handy global compendium for the late nineteenth century is Klimpert (1896), but its usefulness is limited for earlier centuries. Spanish and Spanish-American weights and measures can be worked out by combining Klimpert (1896) with Hamilton (1934, 1947); Carrera Stampa (1949); Ramón and Larraín (1982, 359-378); and Feliu (1991). Theses sources indicate which Spanish measures seem to have been copied, and which revised, in the colonies.

[20] The problem of non-tradability is more severe for services than for goods, because services tend to be site-specific. Clear examples are transport services (all route-specific), housing, and haircuts.

[21] As already noted, Leandro Prados de la Escosura (2000) has used the systematic Balassa-Samuelson patterns of 1950-1990 to adjust the real income estimates back to 1820.

[22] Bergin, Glick, and Taylor (2004). Similarly, Ward and Devereux (2003) get no Balassa-Samuelson effect using direct price comparisons for the period 1872-1930. Robert Allen's (2004b) contrast between the price structures of Canton and London in 1704 shows that the prices of non-tradables were generally higher (relative to traded goods prices) in Canton than in London. That would have fit the Balassa-Samuelson pattern if people were known to have had clearly higher incomes in Canton than in London. Yet Allen shows that real wages were higher in Canton only if we choose the Canton price vector of either tradables or all documented goods. If we choose London prices, real wages were higher in London, the setting with relatively low prices of non-tradables, contrary to the Balassa-Samuelson prediction.

[23] For measures of upper- and lower-bound estimates on the welfare effect of new goods, see Feenstra (1994) and Hausman (2003).

[24] Hoffman *et al.* (2002, 351).

[25] Allen (2004a, 2005).
[26] The last clause is based on the decline in the log-variance of wheat wages among 8 places with data in 1500 and 1790, and the stability of the log-variance among 12 places with data in 1600 and 1790.

We should note that the biased view given by grain wages plays a role in this non-divergence. The grain wages in Table 3 show Polish cities and Moscow to be initially high-wage countries, and Istanbul to be an initially low-wage country. The fast gain in the grain wage in Istanbul, and the relative stagnation of the grain wage in Poland and Moscow helps explain the non-divergence. The lack of clear divergence would also show up in measures based on a broader bundle of goods' prices, but without Istanbul and Poland-Moscow playing the same roles as here.
[27] Van Zanden (1995), Hoffman *et al.* (2002).
[28] We are still investigating what held the price of paper higher in England and the Netherlands from 1700 on. In the case of England, the war with France in the 1690s shut off imports of French paper, and the growth of domestic supply may have been further retarded by the new excise tax on paper.
[29] According to work in progress by Gregory Clark and Philip Hoffman.
[30] For a multi-country view of the relative decline in clothing or textile price indexes, see Hoffman *et al.* (2002), Clingingsmith and Williamson (2004), and the sources cited there.
[31] This simple point based on the cheapness of non-food goods can be offset or reinforced by differences in the relative price of services. As some of us have argued in another paper (Hoffman *et al.* 2002), high-income groups consumed labor services, especially servants, to a large extent. Whether the advantage of the high-income groups in Atlantic had an even greater advantage in true purchasing power therefore depends on the wage rate for servants and others. If we are comparing a rich Atlantic Europe place with another place having a high grain wage, such as grain-rich Poland or Moscow in 1550 or 1600, then the higher-income groups would have their advantage magnified both by cheaper luxury goods and by cheaper servants. But in other comparisons, the relatively costliness of labor in Atlantic Europe would offset the cheapness of luxury goods, with no clear revision to offer on the subject of global inequality.
[32] Beveridge (1939, xxv-xxvi). This passage was also cited in Cipolla (1956, 52), to dramatize the same point and relative prices. The wheat prices of iron and copper also declined in northern India between 1595 and 1861-1870, though only by 24 percent for iron and 88 percent for copper (Moosvi 1987, 332).
[33] Regarding nails, several series await us for German and Polish cities. In order of the year of earliest data, these are Krakow 1391-1795, Munich 1414-1569, Austria/Vienna 1414-1771, Würzburg 1477-1794, Lviv 1526-1795, and Frankfurt 1536-1738. We also have series on iron for a wider range of places including, from west to east, British Navy 1566-1788 (anchors), Amsterdam 1609-1843

(Swedish iron), Würzburg 1490-1706, Florence 1528-1613, Stockholm 1540-1914, Krakow 1394-1791 (with splices), four regions of Russia 1600-1800, and several Asian countries.

[34] Cipolla (1965, 155-157).

[35] Homer and Sylla (third edition, 1991, esp. Chs. XXIII-XXVIII)

[36] Clark (2002), Williamson (1999).