

The Global Distribution of Incomes, International Trade and the Labor Market*

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When Adam Smith wrote his foundational *Inquiry Into the Nature and Causes of the Wealth of Nations*, he was not only concerned with the dispersion of prosperity between nations, as the title suggests, but also the distribution of incomes within them. His argument for international trade was that the global division of labor, and the ensuing specialization of economies in their activities with an absolute advantage, raises per-capita incomes around the world. He illustrated the general argument for specialization with an example of a single factory, a pin producing manufacturing plant. In modern terminology, his inspiration for the argument of a global division of labor came from the internal labor market at a local employer. In the opening chapter of his book, just a few paragraphs later, he then took both the single-employer example and the global argument to the question of inequality and poverty within the nations (Smith 1776, Book I, Chapter I):

“It is the great multiplication of the productions of all the different arts, in consequence of the division of labour, which occasions, in a well-governed society, that universal opulence which extends itself to the lowest ranks of the people.”

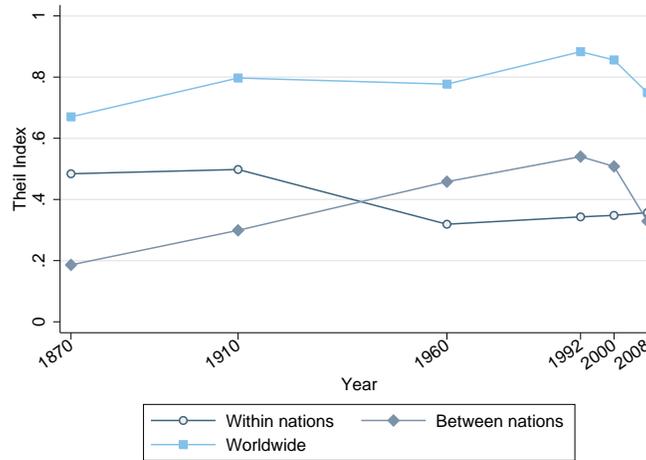
Smith’s statement touches on a number of issues that concern the discourse about globalization until today. The fair distribution of the gains from international trade, including to persons with lower incomes, is not a foregone conclusion, and both recent theory and empirical work come to varying predictions. Interestingly, Adam Smith himself noticed prominently the importance of social choices in a “well-governed society.” In other words, it may take active policy interventions to ensure that prosperity does in fact extend itself to lower income groups.

International trade improves the global use of unevenly distributed technologies and resources, so the global inequality of capabilities is at the heart of the gains from international specialization and trade. Chief among a nation’s resources are the skills of its labor force. Conversely, the inequality of outcomes within countries, that is the distribution of incomes and income risks, determines the social acceptance of economic change and globalization. Inequality between and within countries is therefore a central determinant of globalization and is in turn shaped by globalization.

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Figure 1: Global Inequality in Incomes 1870-2008



Source: Morrisson and Murin (2012, Table 3).

Note: Sample of countries with consistent measurements 1730-2008 (Australia, Canada, Denmark, France, Germany, Italy, Japan, Norway, South Korea, Sweden, United Kingdom, United States; Brazil, Chile, Mexico, Peru, Thailand, Tunisia, Turkey; China, Hungary, Poland, Czech Republic, Russian Federation; Bangladesh, Egypt, Ghana, India, Indonesia, Ivory Coast, Kenya, Pakistan, Philippines, South Africa), based on data at the OECD.

1 Global Inequality

While much of the current public discourse on globalization and inequality is centered around concerns with income inequality within countries, it behooves the discussion of globalization to also take a global perspective on inequality—as if we were looking back on our planet from outer space and asked with what chance we could pick any two Earth inhabitants and find them to have similar incomes. A measure of global income inequality is the Theil index. It offers the attractive feature that it can be split into a within-nation component and a between-nation component, and the sum of the two components adds up to the total Theil index of global inequality. The partial Theil index for between-nation inequality is like picking any pair of typical residents from any two countries on Earth and assess their income gap, while the partial Theil index for within-nation inequality is like picking any pair of residents from within a typical country and check their income dispersion.

Morrisson and Murin (2012) offer a comprehensive empirical effort at computing global inequality with Theil indexes for both within- and between-nation income inequality up to 2008. (Their full time series starts in 1730.) Figure 1 plots their statistics. Inequality between nations continually increased for centuries (even prior to 1870) but exhibits a marked turnaround in the early 1990s. This turnaround coincides in time with major globalization steps: the fall of the Iron Curtain and the subsequent re-integration of Eastern European countries and the Russian Federation into global trade, China's opening to world markets, India's large-scale domestic and foreign-trade reforms, and numerous trade liberalization efforts throughout Latin America and elsewhere. Of course, the simultaneity of foreign-trade opening with other domestic reforms and economic

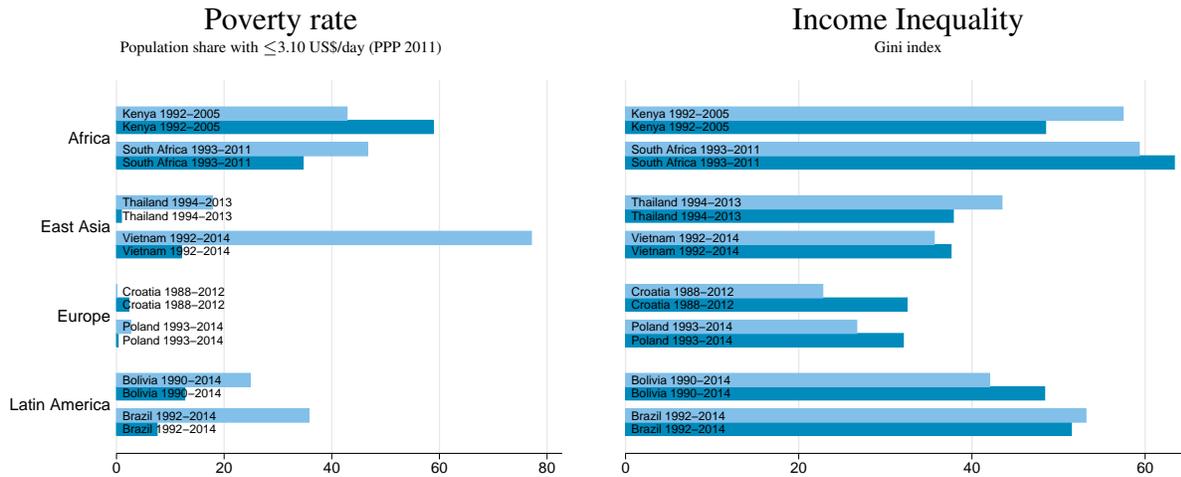
changes makes it impossible to attribute the turnaround in between-nation inequality to globalization alone. Yet, much of the growth performance and poverty reductions especially in China and India seem hard to imagine in the absence of their opening to foreign markets.

Inequality within countries, however, is rising again since the Second World War, though at a relatively slower pace than between-country inequality used to rise. The time period from 1870 to 2008 spans three distinct periods: a first wave of globalization and relatively fast economic growth from 1870 up to the First World War in 1914, with a convergence in product and factor prices around the world; a middle period of deglobalization and slow economic growth between the two world wars; and a second wave of globalization and relatively fast economic growth since the end of the Second World War until 2008. (For historic accounts see, for instance, Williamson (1996), O'Rourke and Williamson (1999), Findlay and O'Rourke (2007) or Baldwin (2016).) Interestingly, the two periods of globalization—the one prior to 1914 and the other after 1945—coincide with rising within-nation inequality, whereas the middle years exhibit a decline in within-nation inequality. Williamson (1998) argued that both globalization periods were accompanied by intense debates about who gained and lost from globalization and documented that the earlier globalization period until 1914 saw a retreat from open-market policies well before the interwar deglobalization. Williamson warned that, by creating income disparities, the first globalization wave planted the seeds of its own demise, and that inequality today might again erode the support for globalization. As Figure 1 shows, when taken together, within- and between-nation inequality today (in 2008) add up to lower total inequality in the world than around the final years of the first wave of globalization (in 1910). Electorates, however, do not take a view on Earth's total inequality from outer space, their concern is mostly with inequality within their nations.

Historically, increases in national income inequality coincide with episodes of de-globalization. At any moment in time, in the cross section of nations, economies with more tightly woven social safety nets tend to be more open to international trade. Or, as Rodrik (1998) put it, more open economies have bigger governments. He showed that the correlation holds for multiple measures of government spending, in low- as well as high-income samples, and is not easily explained by other simultaneous factors. The correlation does not clarify, however, whether open economies create the prosperity that then allows nations to afford more expansive welfare states, or whether larger governments ensure the redistribution of incomes to mitigate within-nation inequality and provide the insurance against economic risks that prompt societies to then embrace more globalization, or to what extent it is both.

Modern societies balance individual liberty against concerns for equity to varying degrees. Liberty and economic freedoms can result in a concentration of incomes because human activities and abilities generate varying returns. In the tradition of the French Revolution and its mandates of *liberté*, *égalité* and *fraternité*, equity concerns carry special weight, arguably motivated by solidarity considerations. While the tradition of the American Revolution and its emphasis of liberty and the pursuit of happiness places particular weight on individual achievement, its universal application also calls for fairness in the access to opportunity. In those lines of thought, equity considerations permeate the foundational ideas for most varieties of open societies today.

Figure 2: Poverty Rates and Income Inequality in Select Countries over Two Decades



Source: World Development Indicators (September 2017).

Note: The upper (light blue) bar for each country shows the measure for the initial year, and the lower (dark blue) bar for the final year. Time periods of roughly two decades chosen so that measures are available in initial and final years. The poverty rate is the percentage of the population living on less than US\$ 3.10 a day at 2011 international prices. Income inequality is measured with the Gini index (World Bank estimate).

2 Within-nation Inequality and Poverty

Before turning to within-nation inequality in more detail, it is important to highlight the conceptual difference between real incomes of lower-income groups and inequality. They are not the same, even though their unlikeness is frequently treated cavalierly. As per-capita incomes have grown, countries started to supplant the objective of poverty alleviation with the aspiration to reduce inequality. In fact, many statistical agencies in high-income countries have meanwhile adopted measures of poverty that are conceptually measures of inequality.

To illustrate the differences between poverty and inequality in countries that still measure the two concepts individually and precisely, Figure 2 shows changes to poverty and inequality over the past two decades for select nations. By the World Bank’s definition, a nation’s poverty rate is the percentage of the population living on less than US\$ 3.10 a day at 2011 international prices. Income inequality can be measured with many statistics of dispersion, the Theil index above being one, the Gini index in Figure 2 being an alternative. Thailand and Brazil are examples where both poverty rates and income inequality (the Gini index) have come down considerably between the early 1990s and the early 2010s. But poverty alleviation and falling inequality need not go hand in hand. Vietnam lifted residents out of poverty and succeeded in reducing its poverty rate markedly, from a share of 77 percent in 1992 to only 12 percent by 2014. But income inequality rose in Vietnam over the same period. In other words, while the poor saw rising incomes, the incomes of the rich in Vietnam rose even faster. Bolivia and South Africa had a comparable experience of falling poverty but rising inequality, as shown in Figure 2, and anecdotal evidence suggests that China also faced rising inequality in the wake of its poverty reduction. In Europe, poverty rates are only reported in former Communist nations, and low. In Croatia and Poland, for instance,

inequality rose, while poverty rates stayed at 2 percent and below. Kenya saw its poverty rate increase, as more residents fell below the threshold of earning \$3.10 or less a day, but inequality also came down: while the poor lost income, the income of the rich in Kenya fell even faster.

Most high-income countries no longer measure the percentage of their population in poverty with a real-income threshold. The European Union, for example, considers a household as poor if its members earn less than 40 percent of the country's median income. That measure is an inequality statistic, not a poverty measure. Suppose incomes doubled for every household up to the median household, but not for any household above the median, then by the EU's definition the poverty statistic remains unchanged; but both the poverty rate and income inequality actually fell, as poor households were de facto lifted out of poverty. Now suppose incomes doubled for every household below the median household, but the median household and all households above the median tripled their incomes, then by the EU's definition, poverty would have worsened; but poor households were lifted out of poverty, only income inequality rose.¹ In short, a major political concern in high-income countries today is with income inequality, not poverty alleviation, perhaps because their internationally comparable poverty rates have fallen to small levels.

3 International Trade and Wage Inequality

Early trade theory is an application of the division of labor between workers around a pin factory to the division of labor between nations around the world. While Adam Smith considered the absolute advantage of industries within a country as the driving force of global specialization, David Ricardo (1821) pointed out that it merely takes an industry to have a *comparative* advantage for global specialization to benefit all nations that trade. In our household, my wife is better at about every single activity—from managing schedules to raising our children to budgeting. She has the absolute advantage in every activity. However, when it comes to budgeting, I am relatively better at that than at most other necessary activities in our family. By Ricardo's logic of comparative advantage, if I specialize in budgeting and leave other activities to my wife where she has the comparative advantage (in addition to her absolute advantage in everything), then our household is better off.

At a world scale, comparative advantage is a fleeting object, and can build up in a matter of decades, or even years, and dissipate away similarly fast (Hanson, Lind and Muendler 2015). Take a nation's top five export industries at any moment in time, out of total of 130 industries, and ask how many industries are new arrivals at the top: one answer is that, two decades prior, two of the five top exports now were not at the top yet. This process of perpetual churning in comparative advantage creates winners and losers, but it also means that no nation is stuck with its top or bottom activities for long. On whatever activity a nation's comparative advantage falls at any moment in time, specializing in that activity of comparative advantage, and then exchanging the product of the activity through trade, raises every nation's prosperity. If one day machines with artificial intelligence have the absolute advantage in every activity over humans, from computation to manufacturing to creative acts, we humans will still have a comparative advantage in at least one

¹The main poverty measure in the United States is an exception to the tendency of replacing poverty with partial inequality measures in high-income countries: A U.S. household is considered poor if its members earn less than three times the inflation-adjusted cost of the minimum food diet in 1963, correcting for family size and composition.

activity (by the definition of comparative advantage), and both the intelligent machine and we humans will gain from our specialization in that activity and trade.² This may be the profound reason why technological change has not, and arguably will not, reduce overall employment; technical progress merely changes the work tasks in which humans get to specialize.

The principle of comparative advantage not only asserts that trade is beneficial to all participating nations, it also predicts that free and open markets will lead nations to specialize in the activity with their comparative advantage. However, the principle of comparative advantage is silent about the distribution of the gains from trade within nations.

The national accounts naturally generate a measure of within-country inequality as a byproduct: the so-called labor share, that is the fraction of wages in national income (the share of national income that is not capital income). In its most recent economic outlook, the International Monetary Fund (2017) reports that the labor share has declined in most industrialized countries since the 1980s and in many emerging economies since the 1990s. A country's top earners receive much attention, and a considerable share of their income is from returns on capital. Autor (2014) points out, however, that earnings inequality is also strongly affected by the changes that are consequential for the "other 99 percent of citizens," mainly because of the wage premium associated with higher education and cognitive ability. It is therefore important to look within the labor share and analyze the inequality of wage earnings. Wage inequality is partly driven by the so-called college wage premium, that is the additional pay that a college graduate commands compared to a high-school graduate. But there are many other contributing determinants of wage inequality, and globalization can move the wage premia. Wage inequality is of interest in itself, not least because the majority of households derives most income from wage earnings. How does international trade relate to the dispersion of wages within nations?

There are four broad lines of economic thought that guide our understanding of the impact of international trade on income inequality within nations. First, one can apply the principle of comparative advantage to a nation's industries or occupations and consider two or more resources (factors of production) that produce the nation's product mix. The skills of the labor force are among the crucial resources. The resulting classic paradigm predicts that a nation's relatively scarce resources (scarce when compared to their availability in other nations) tend to lose from free trade, while a nation's relatively abundant resources gain real income. Second, modern forms of trade promote the formation of global value chains—the *offshoring* of stages of production that were previously hosted together in one location. Offshoring can worsen inequality within nations on a global scale. Third, modern forms of trade prominently involve dominant firms that export, import and manage global production networks; those globalized firms also tend to be high-wage firms. The global division of labor between firms, or plants, therefore moves wage inequality within nations as employment becomes more or later less concentrated in globalized firms. Fourth, and not least, globalization also affects firms' and plants' choices of their internal labor-market organization, with the different extent of internal specialization depending on the employer's degree of globalization. More globalized plants look more like a pin factory in Adam Smith's sense, with specialized occupations, than less globalized firms do, and wage inequality within plants and occupations varies systematically with their organizational choices. These four

²The idea that comparative advantage will govern human-machine interactions in an age of artificial intelligence is from a book project by Ronald Davies at the University College Dublin.

broad lines of economic thought differ in their empirical relevance for globalization today and also in their predictions for global inequality.

3.1 The global division of labor between industries and occupations

When Eli F. Heckscher and his graduate student Bertil Ohlin worked out their extension of the Ricardian model of comparative advantage and global specialization at the end of the First World War and in the 1920s, they added one dimension: instead of thinking about a single resource and different technologies between industries and nations like Ricardo had, they looked for an origin of comparative advantage not simply driven by given technologies. Instead, they considered technologies as diffusing so quickly around the world that what actually mattered were two other types of characteristics: a country-level feature as to how scarce resources are in a nation, and an industry-level property as to how intensively an industry anywhere in the world needs the resources to produce under its globally available technology. Two profound insights came out of this extension of Ricardo's principle of comparative advantage. First, the unequal distribution of resources around the world results in a clear specialization pattern: a nation has its comparative advantage in activities that intensely rely on its relatively abundant resources. Heckscher and Ohlin were thus able to capture an important aspect of more recent advances of globalization: technology spreads around the world, too.

Second, factor incomes will tend to equalize around the world. When Heckscher and Ohlin discussed the conceptual implications of their ideas, they wrote about a global tendency that incomes would converge around the world once technologies were available everywhere. Stolper and Samuelson (1941) worked out an important mathematical counterpart to that insight: in the Heckscher-Ohlin model with two countries, two industries, and two factors of production, a nation's scarce resource loses in real terms, while the relatively abundant resource gains. For generalizations to more industries and resources, researchers later showed that the relatively scarce resources suffer real income losses on average but the prediction is not sharp anymore as to which resource exactly is to lose or gain; we only know that some resources will face a decline in real income. From Ricardo's principle of comparative advantage we know, however, that the nation as a whole raises its overall prosperity, so we can infer that the winners are able to more than compensate the losers in principle, and still be better off with global specialization and trade. But markets will not perform that redistribution. Societies need to find ways to redistribute incomes to compensate the losers, through transfers, taxes, and other means.

As profound and beautiful as Heckscher-Ohlin's extension of the Ricardian model is, a key prediction that Stolper and Samuelson worked out for this model frequently fails empirically: labor incomes for different skill groups do not move in the predicted directions. Especially in developing and emerging economies, where less skilled labor is relatively more abundant than in the industrialized nations, the model predicts that we should see low-skilled workers' wages catch up to the high-skilled workers, while the relatively scarce high-skilled workers in developing nations should lose real income. Mostly the opposite happened for the past two to three decades (Goldberg and Pavcnik 2007): the wage premium for high-skilled workers such as college graduates rose in many developing nations, while those economies further globalized. Only for industrialized countries did the Stolper-Samuelson theorem get things right: the relatively abundant resource is high-skilled labor in high-income nations, and the skill wage premium rose in industrialized nations just as it did

elsewhere. The increasing inequality within nations contradicts Heckscher-Ohlin's extension of the classic paradigm in developing countries, where less skilled workers are a relatively abundant resource, so the classic paradigm needs a reconsideration.

3.2 Offshoring and the global division of labor between production stages

If globalization is to globally predict wage inequality correctly, it must be some other form of globalization that drives labor-market outcomes. Smith, Ricardo, and Heckscher and Ohlin were thinking mostly about globalization 1.0, when nations traded final goods for final goods, such as wine for cloths as in Ricardo's own early example. For the early trade economists, the pin factory, the vineyard, and the cloth manufacturing plant all produced in a single place. That changed with globalization 2.0, at least as early as the mid 1800s for certain goods such as textiles (for a recent historic account see for example Juhász and Steinwender 2017), but perhaps much earlier. Mankind figured out how to insert the factors of production into the production process at different locations around the world, production stage by production stage, and started shipping components and intermediate products or services from an early production stage somewhere in the world to a later production stage elsewhere. Today, a product's origin can be in multiple countries, and its components might have crossed borders multiple times. The iPhone design originated in California, its microprocessors in Japan, its body and main assembly in China or Brazil, and its final package at an Apple store near you. This formation of global value chains is a form of globalization 2.0; it is also called offshoring in English or *délocalisation* in French. Increasing within-nation inequality can be a consequence of the formation of global value chains.

Offshoring is essentially a reshuffling of the locations of production stages around the globe. Think of production stages as books, and their locations as book shelves. When I recently borrowed a book from my office neighbor, a mathematician who became an economic theorist, he remarked that I did not need to return the book any time soon because, by taking it off his shelf and placing it on mine, I had raised the average quality of books on both our shelves. His low regard for the quality of my readings aside, he had just given an example of an offshoring theory that trade economists have come to consider a realistic explanation for rising within-nation inequality through globalization 2.0 (for a formal statement of the idea see Feenstra and Hanson 1996).

Like books vary in quality, production stages vary in the intensity of their need for skilled labor. If industrialized nations are relatively more abundant in skilled labor, then the skilled wage premium will be lower in high-income nations than in emerging economies, so the more skill-intensive production stages locate in industrialized countries—my theory neighbor's book shelf hosts high-quality books. When offshoring costs fall, because transport and communication technologies advance and facilitate more trade in components and intermediate products or services, the first production stages to relocate from industrialized to developing nations will be those that are least intensive in skilled labor—a relatively low quality book from my theory neighbor's book shelf moves over to mine first. The average quality of his book shelf consequently improves. However, compared to the average skill intensity of the production stages already located in developing nations, the newly arriving production stages are relatively skill intensive—as my colleague's book enters my book shelf, the average book quality on my shelf improves, too. The economic counterpart to book quality is the demand for skilled labor. Just as the book quality on both shelves improves, skilled labor demand increases in both the offshore and the onshore economies. As a

Table 1: COMPONENTS OF RESIDUAL WAGE INEQUALITY

Contribution of component (%)	1996-2014	Exponentiated Mincer log wage residual			
		1996-2014	1999	2006	2012
within industry*	88
within occupation	84	87	91	85	85
within plant	71	76	83	73	72
within plant-layer	65	69	77	65	63
within plant-occupation	54	58	61	52	53

Source: Becker, Egger, Koch and Muendler (2018), based on German matched plant–worker data (LIAB) 1996-2014. *Note:* Residual log wage from standard Mincer regression, exponentiated in later four columns. Residual log daily wage from a standard Mincer regression—including demographic, education and tenure information together with time, industry and region fixed effects, $R^2 = 53\%$. (* Mincer regression excludes industry effects, $R^2 = 0.42$.) Layers of organizational hierarchies and occupations based on 357 German 3-digit KldB-88 codes.

consequence, within-nation wage inequality rises everywhere in the world. This mechanism has been shown to explain the increase in the U.S. skill wage premium before the turn of this century well (Feenstra and Hanson 1999), and its prediction of a simultaneous increase of wage inequality in the offshore economies makes it realistic.

However, the main component of wage inequality is not between industries, production stages or occupations, the main component of wage inequality is *within* industries and occupations. In this sense, the offshoring model offers a useful explanation but may not consider the main suspect. One source for the wage variation within industries and occupations is that employers differ. Within the pin making industry, not all pin manufacturing plants are the same. Some pin manufacturers are more productive than others.

3.3 The global division of labor between firms and plants

Since at least a century ago, when economists started to work with matched employer–employee data that identify both the individual workers and their employing firms or plants, it has been documented that larger employers pay higher wages, even after controlling for workers’ observed education and other skill-related characteristics. In 1911, for example, Moore (1911) showed for Italian female textiles workers that employers with higher revenues paid higher wages to their workers, employed more workers, had lower worker turnover (employed workers with longer tenure on average), and granted their workers shorter workdays. These labor market characteristics have not changed much: still today, larger employers pay higher wages and offer more generous benefits.

Table 1 shows a breakdown of the sources of wage dispersion from such matched employer–employee data in a more recent period, taking Germany as an example. The data come from social security records and therefore reflect wage inequality in the economy as a whole. Before breaking the variance of daily wages down into employer-related components, it is important to be clear about the worker-side characteristics that are behind the wages. Mincer (1974) specified a regression of the logarithm of the wage on worker characteristics to see how much wage variability is explained by observed education and other skill-related characteristics: applying such a regres-

sion to the German wage data between 1996 and 2014, 53 percent of wage variation comes from demographic, education and tenure information on the worker side as well as year, industry and region categories. While existing theories largely relate to those observed worker characteristics, much of the interest in newer theories lies on the other half, the unexplained part. Table 1 therefore considers the so-called *residual wage*: the part of the (exponentiated) log daily wage that known variables in a Mincer (1974) regression cannot account for.

The variance is a basic measure of inequality and can be linearly decomposed into a within-group and a between-group part. Table 1 pursues such decompositions step by step, breaking down the dispersion of the wage residual progressively. (A breakdown of the full wage dispersion is quite similar, and so is the breakdown of the plain residual wage reported in the second column.) As the first column shows, 12 percent of residual log wage variability is between industries—those 12 percent are the part of wage dispersion that industry-level theories under the classic paradigm can explain at most; the remaining 88 percent of residual log wage dispersion are within industries. Instead of thinking of economic activities as industries, one can think of occupations in which nations specialize. But occupations, too, fail to explain much wage variability by themselves, 84 percent of the residual wage dispersion is within, not between, occupations.

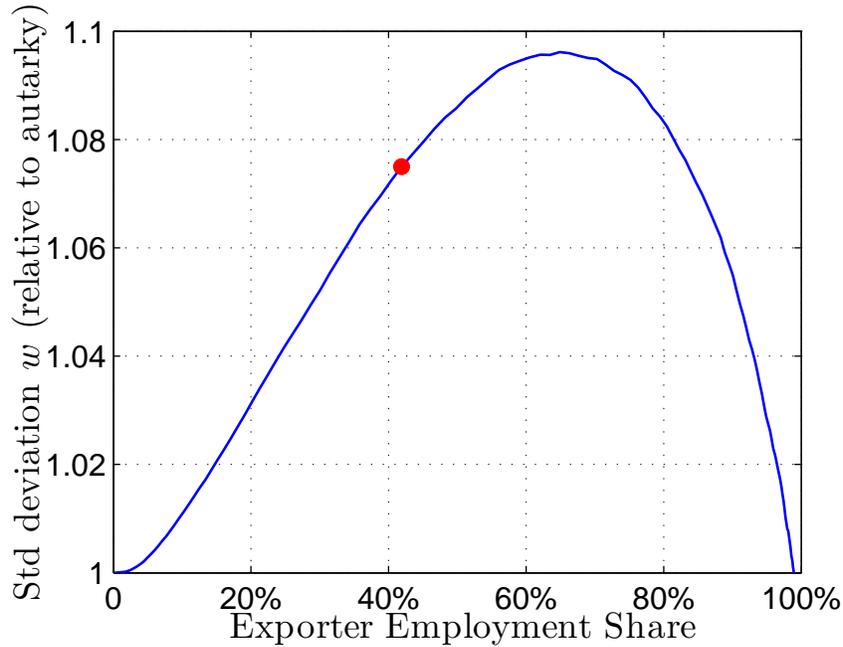
Wage differences between plants, in contrast, do a better job: 29 percent of economy-wide residual wage differences, that is more than one-quarter, are between plants. Over time, as the additional columns show, the within-plant part declines a bit, which implies that the between-plant component becomes more important (together with the between-occupation component). Hence the interest here in employers as agents of globalization and labor-market outcomes.

Once plants are split into their layers of organizational hierarchy in addition, using occupational descriptions that relate to management, 35 percent of residual log wage dispersion is predictable, or more than two-thirds. These statistics dispel the common notion that the wage differential between senior managers and other employees—the oft-cited gap in pay between the CEO and a factory-floor worker—might be a main driver of wage inequality; the pay gap to senior management can only account for six additional percentage points (the change from 71 to 65 percent). The bulk of wage dispersion is within occupations. To see that, workers can be categorized into plant-occupation bins. Then 46 percent of the residual log wage variance are accounted for. However, another way to look at the same share is to note that more than one-half of the residual wage variability (54 percent) occurs within plant occupations. This dominant within-plant-and-occupation component is not related to the pay gap between senior management and other employees and is also not explicable by theories that look at the matching of workers to plants and occupations. I will come back to this dominant component of wage variation within plant-occupations below, when I revisit the pin factory.³

Turning for now to the between-employer component in wage dispersion (which accounts for 29 percent of pay variability in Germany over the past two decades), recent trade theories offer novel explanations. At the heart of the new firm-level approaches to globalization is a framework by Marc J. Melitz (2003), in which diverse firms decide about export-market participation: given fixed costs of access to foreign markets, and variable trade costs in addition, only the more pro-

³The assignment of workers to plant-occupations explains substantively more wage dispersion than the matching to plants alone in many countries. In a review of the literature on the structure of wages within and across employers around the world, Lazear and Shaw (2009) conclude that the wage structure appears to be more dependent on the within-employer matching of workers to occupations than on the matching of workers to employers.

Figure 3: **Employment at Global Firms and Log Worker Wage Inequality**



Source: Helpman, Itskhoki, Muendler and Redding (2017), based on Brazilian matched plant–worker data (RAIS) 1986-2001.

Note: Relative counterfactual standard deviation of log worker wages plotted against exporter employment share in the simulated model. Parameters of model held constant at 1994 estimated values, with exception of the variable trade cost, which varies from prohibitively high to negligibly low values over the depicted range of exporter employment shares on the horizontal axis. The red dot indicates the inequality level in the 1994 estimated model (the corresponding standard deviation of log worker wages is 0.46).

ductive and thus more profitable firms choose to export. Helpman, Itskhoki and Redding (2010) built on the Melitz framework and combined it with labor-market theories of search and matching between workers and firms by Diamond (1982), Pissarides (1985) and Mortensen and Pissarides (1994). The combined model allows Helpman et al. (2010) to examine the labor-market consequences of globalization and show that more productive firms attract more able workers, more productive firms then share the additional surplus with their workers through higher wages, and the additional surplus from exporting increases the paid wage even more.

In this framework, the dispersion of given firm productivities and given worker abilities results in a baseline level of within-nation inequality, which is standardized to 1 in Figure 3. The plot is based on estimates of an extended version of the Helpman et al. (2010) model for the Brazilian economy by Helpman, Itskhoki, Muendler and Redding (2017). (Capuano and Schmerer (2015) estimate the model for Germany, for example.) When no single Brazilian firm is global (no single firm is an exporter), then the economy is at the origin in the plot (zero employment at exporters) and inequality is at the baseline level of 1. At the other extreme, when every Brazilian firm is global (100 percent of employment is at exporters), then inequality is roughly back at the baseline level of 1 because given firm productivities and given worker abilities result in the same level of wage inequality after workers are matched to firms. Now consider an intermediate level of trade costs

so that the economy is somewhere to the right of the origin, where some firms started to export but others remain non-exporters. Then the additional surplus from exporting, that is shared in exporter wages, goes only to the workers who happen to be employed at exporters, and wage inequality is therefore higher than at the origin and higher than in the fully globalized economy at the other extreme. As a consequence, there must be a peak level of within-nation wage inequality somewhere between no globalization and complete globalization; where exactly the peak is depends on the nation and the global environment. In the Brazilian case in 1994 (depicted with the red dot in Figure 3), the economy had not yet reached peak inequality.

From the peak on, however, a country reaps a double dividend as it globalizes further: the nation achieves higher overall prosperity because its specialization under international trade progresses, and the nation sees wage inequality decline past the maximum. The implications are profound. When it comes to the between-employer component in wage dispersion, a globalization critic who fears an increase in inequality from globalization to the left of the inequality peak can always be rebutted with the argument that the country has simply not globalized enough yet to push past the maximum and realize declining inequality.

3.4 Globalization and employers' internal division of labor

None of the classic and new trade theories discussed so far operates at the level of economic decisions within plants and occupations, where most wage variability occurs (lower-most row of Table 1). To get an empirical handle on the economic choices that affect wages within plant-occupations, it is useful to turn back to Adam Smith (1776, Book I, Chapter I) and his pin factory example itself:

“[M]aking a pin is . . . divided into about eighteen distinct operations. . . . [T]en persons . . . could make among them upwards of forty-eight thousand pins in a day. But if they had all wrought separately and independently . . . they certainly could not each of them have made twenty, perhaps not one pin in a day.”

Systematic German labor force surveys since 1979 query around one-tenth of one percent of the German working population, every seven years or so, about their workplace activities when they are at work (and many other aspects of their work life). From these surveys, fifteen distinct tasks—actual workplace activities—can be isolated in a time consistent manner (Becker and Muendler 2015). These tasks resemble Adam Smith’s idea of distinct pin making operations, though they are coarser in detail than the pin-specific work steps and apply to more occupations than just pin making.⁴ Table 2 lists the fifteen time-consistent tasks as observed in the German labor force in 2012. The most frequent tasks across all occupations are organizational and informational in nature: coordination tasks, consulting tasks, information gathering and inspection tasks. Managers perform one more task out of the fifteen, on average, than the mean employee.

⁴These tasks are workplace activities in that they describe “what” workers do on their jobs. As Becker and Muendler (2015) show, multi-tasking in those workplace activities increased from less than two tasks per plant-occupation on average in 1979 to more than seven in 2006. In contrast, much of the research on tasks that stems from the U.S. ONET data base reflects “how” workers perform their duties—including the routine nature, manual dexterity requirements, and cognitive demands of their jobs. Those tasks do not naturally cumulate in the sense of Adam Smith’s work operations. As Becker and Muendler (2015) document for Germany, their frequencies stay broadly the same from 1979 to 2006.

Table 2: COMPONENTS OF RESIDUAL WAGE INEQUALITY

Task (Activity)	All Layers	Managers
Manufacture, Produce Goods	.19	.15
Repair, Maintain	.36	.31
Entertain, Accommodate, Prepare Foods	.28	.30
Transport, Store, Dispatch	.45	.34
Measure, Inspect, Control Quality	.60	.63
Gather Information, Develop, Research, Construct	.75	.92
Purchase, Procure, Sell	.47	.50
Program a Computer	.10	.18
Apply Legal Knowledge	.52	.69
Consult and Inform	.84	.95
Train, Teach, Instruct, Educate	.51	.70
Nurse, Look After, Cure	.27	.35
Advertise, Promote, Conduct Marketing and PR	.40	.55
Organize, Plan, Prepare (others' work)	.65	.80
Oversee, Control Machinery and Techn. Processes	.35	.28
<i>Total Number of Tasks (Sum)</i>	6.66	7.58

Source: Becker, Egger, Koch and Muendler (2018), based on German labor force survey data (BIBB-BAuA) 2012.

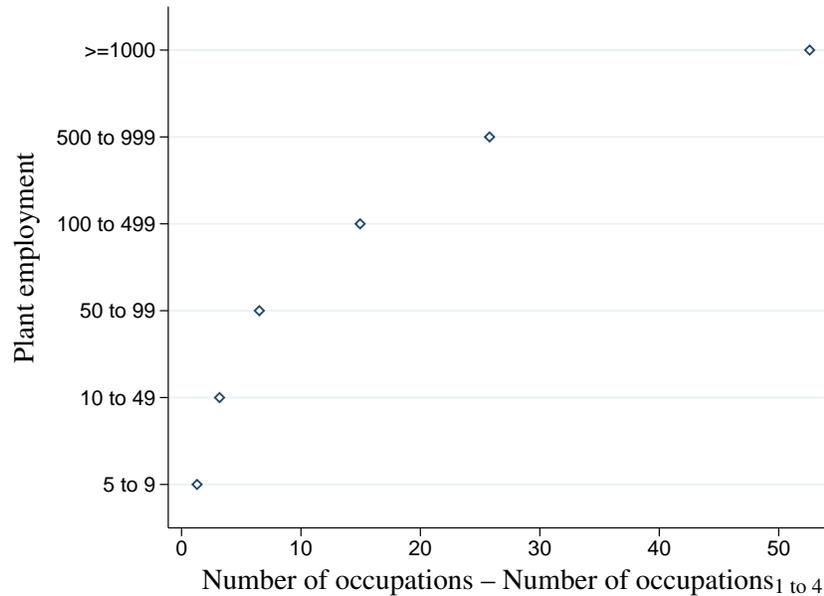
Note: Worker frequencies (inverse sampling weights).

To analyze the division of labor within plants, one can start by simply counting up the number of occupations that an employer assigns. More productive plants are larger, as mentioned, so Adam Smith's tenet that a finer division of labor leads to higher labor efficiency predicts that larger plants offer more occupations. As Figure 4 shows, this is indeed the case: plants with larger workforces offer strictly more occupations (out of a total of more than 350 occupation categories). However, other and simpler explanations could lead to the same fact. One worker only reports one occupation, so no plant can have more occupations than employees and larger plants will trivially have more occupations by design. We therefore need to observe directly the range of tasks performed at a plant within its occupations to check whether adding occupations indeed implies that a larger plant splits the full range of tasks into finer partitions.

Figure 5 provides just that direct look. It shows the count of tasks that workers in a plant perform within their occupations, and relates that count to plant size. Adam Smith's pin-factory idea clearly shows in the data. At larger plants, the range of tasks that a worker performs in a given occupation is narrower than at smaller plants. In other words, an employer's internal division of labor is finer the larger the plant, and larger plants are known to adopt more occupations (Figure 4) and to be more productive (as research has shown time and again). One consistent explanation is that plants face fixed span-of-control costs that increase when they adopt a finer division of labor, as they have to coordinate across more specialized occupations, so only more productive and hence more profitable employers choose to afford finer partitions of their overall task ranges.

How can these findings be linked back to globalization and linked forward to wage inequality?

Figure 4: **Plant Employment and Occupation Counts**

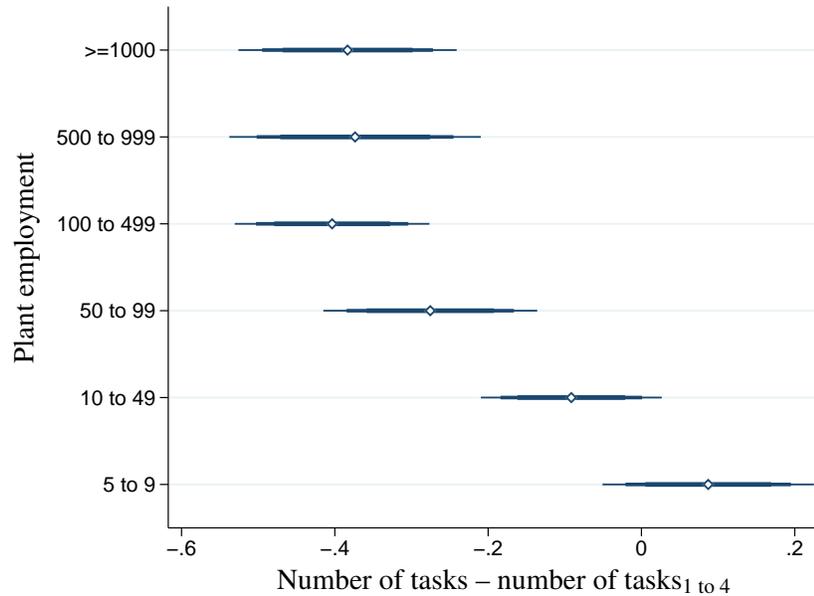


Source: Becker, Egger, Koch and Muendler (2018), based on German matched plant-worker data (LIAB) 1996-2014. *Note:* Prediction of occupation count by plant employment category, controlling for sector, region, occupation and worker characteristics. Results are differences to smallest plant-size category (1 to 4 workers). Thick, medium, and thin lines represent the 99, 95, and 90 percent confidence intervals. Occupations based on 357 German 3-digit KldB-88 codes.

As to wage inequality, Figure 6 shows the dispersion of wages (measured by the log of the coefficient of variation of the daily wage residual) *within* plant-occupations alone (ignoring all other components of wage inequality) and relates the dispersion to plant size. Larger plants are more productive (as is well established), they partition their work flow into more occupations (Figure 4), they assign narrower task ranges within their occupations (Figure 5), and they exhibit higher wage inequality within their occupations (Figure 6). One consistent explanation is that workers who are more narrowly specialized in fewer tasks can, if their initially unknown abilities are not well matched to the task range, cause costly losses to the employer when they make mistakes, but well matched workers also boost the plant's performance strongly if they do well. The plant shares a part of the surplus that the worker generates with the worker through wage payments, so wages can vary strongly within plant-occupations if surplus is highly sensitive to worker performance.

The link from Adam Smith's pin factory to globalization then follows a similar logic as in the new trade model with diverse employers by Melitz (2003) discussed above. More productive plants are more likely to go global and export, the additional surplus they generate abroad allows them to afford finer partitions of their overall task ranges at home, and wage inequality within globalized plants increases. Becker et al. (2018) work out the implications of such a model of globalization-induced internal divisions of labor. They show that, if worker performance is sensitive to narrowing the task range, the within-plant-occupation wage inequality rises around the world, as the globalized and more unequal plants capture larger shares of product and labor markets. While income inequality can rise around the world, the advance in a further division of labor between nations,

Figure 5: **Plant Employment and Task Ranges per Occupation**



Source: Becker, Egger, Koch and Muendler (2018), based on German labor force survey data (BIBB-BAuA) 1999-2012.

Note: Prediction of number of tasks within plant-occupation by plant employment category, controlling for sector, region, occupation and worker characteristics. Results are differences to smallest plant-size category (1 to 4 workers). Thick, medium, and thin lines represent the 99, 95, and 90 percent confidence intervals.

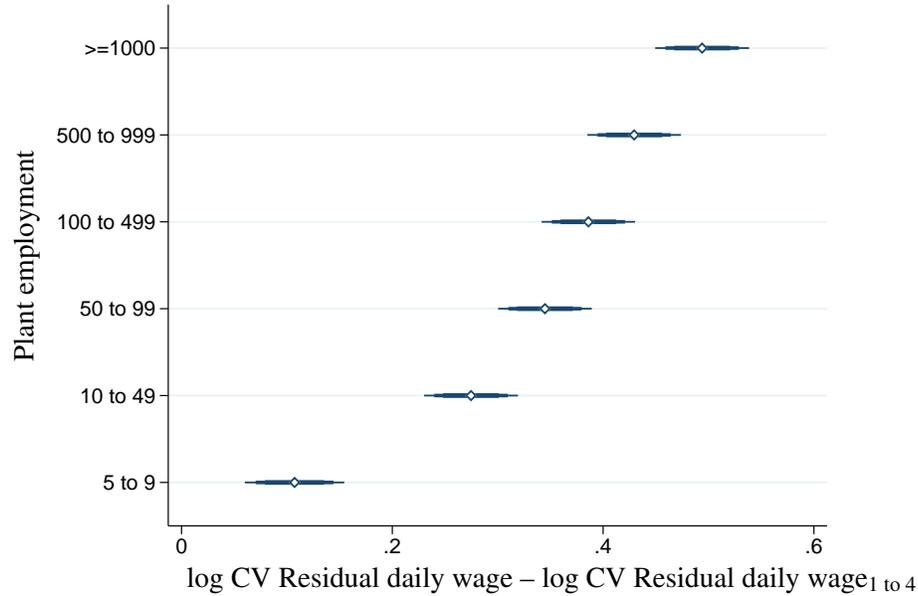
between employers across industries, and within employers across and within occupations raises global prosperity.

4 Concluding Remarks

The classical paradigm, based on industry-level comparative advantage and its origin in the varying scarcity of resources between nations, offers clear predictions for induced wage inequality within nations, but the predictions are not borne out in practice: wage inequality is predicted to fall in skill-scarce nations, but the opposite tended to happen when emerging markets opened to freer trade over the past decades. Globalization 2.0 is no longer about the exchange of final goods for final goods alone, as globalization 1.0 arguably used to be to a larger extent. We now trade components and intermediate products and services after we slice up the value chains into production stages that can locate at far distances from the final assembly plant. When production stages move offshore from relatively skill-abundant to skill-scarcer offshore economies, they tend to be at the low end of the skill intensity spectrum in the economies that they leave but at the upper end of skill-intensity in the nations where they arrive. Offshoring therefore tends to raise the demand for skilled labor and thus within-nation wage inequality around the globe.

A breakdown of the sources of wage inequality within countries shows, however, that most wage variation is not between industries or production stages, but within industries and between

Figure 6: **Plant Employment and Within-occupation Wage Inequality**



Source: Becker, Egger, Koch and Muendler (2018), based on German matched plant-worker data (LIAB) 1996-2014. *Note:* Prediction of log coefficient of variation of daily wage residual (exponentiated Mincer residual) $\ln CV$ within plant-occupation by plant employment category, controlling for sector, region, occupation and worker characteristics. Results are differences to smallest plant-size category (1 to 4 workers). Thick, medium, and thin lines represent the 99, 95, and 90 percent confidence intervals.

employers to a larger extent, and within employers and occupations for the most part. Other aspects of globalization 2.0 therefore deserve further scrutiny. The wage gaps between employers, with larger and more globalized firms paying higher wages to workers with similar observed education levels and similar other known skills, is an important feature of the economy moved by globalization. As some but not all firms globalize, they share their additional surplus from globalization with their workers and raise wage inequality up to a peak point. Once the economy is sufficiently integrated into world markets, and many firms have gone global, further globalization reduces wage inequality, simply because once all firms are global there is no between-firm difference anymore. Globalization 2.0 in its effects on individual firms therefore also tends to reduce within-nation inequality. A final mechanism contributes to rising within-nation wage inequality again. As firms globalize, they also adopt finer partitions of their tasks and become closer look-alikes of Adam Smith's highly specialized pin factory. Data (for Germany where the within-occupation specialization in tasks is systematically surveyed) show that more specialized plants also exhibit a higher within-occupation wage dispersion. As a consequence, the globalization of more plants leads to more within-nation inequality because plants with higher within-occupation inequality capture larger shares of the labor market.

How exactly the consequences of further globalization affect within-nation inequality is therefore a matter of relative importance. How relevant is each of the multiple mechanisms through which globalization works as we go forward? Recent advances in theory have provided us with a

more profound understanding of within-nation inequality and its sources, and how different forms of globalization play out. While within-nation inequality may go up or down, as different forms of globalization prevail, the basic insight that economic changes—be it globalization, technological change or changes in consumer tastes—cause winners and losers. The mere uncertainty of future income and employment prospects can bring about a reluctance to accept, or even a fear of, economic progress. In the overall division of labor, it is the task of us as citizens, as participants in the social dialogue and political process, to balance the prosperity that free markets generate with the needs of an equitable distribution of the proceeds from that prosperity.

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