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Declining labor–labor exchange rates as a cause of inequality growth

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WORKING PAPER SERIES IN ECONOMICS

Institut für Wirtschaftstheorie und Operations Research

Karlsruhe Institute of Technology

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Working paper Nr. 104

July 2017

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Abstract

The current trends in the capital/labor split and the impacts thereof on the growth of inequality are one of the main concerns of national governments, European Commission and international organizations like UN, ILO, IMF, OECD and WB. These trends are usually studied at the macro level of functional distribution of income, that is, among capital and labor, and less with regard to productivity, remuneration policies or some other particular factors. In this paper, we contribute to the studies of the second type, explaining the decreasing labor income share in terms of unpaid working time and underpaid hourly earnings. For this purpose, we refer to the decreasing labor–labor exchange rate, i.e. devaluation of one's labor in exchange for other's labor embodied in the commodities affordable for one's earnings. We show that the productivity growth allows employers to compensate workers with always a lower labor equivalent, i.e. increasingly underpay works, maintaining however an impression of fair pay due to an increasing purchasing power of earnings. This conclusion is based on the OECD 1990–2014 data for G7 countries (Canada, France, Germany, Italy, Japan, United Kingdom and United States) and Denmark (known for the world least inequality). Then statistically significant implications for the growth of inequality are derived and some policy suggestions are formulated like taxing the enterprises with the inner Gini that surpasses the national level.

Keywords: Inequality, productivity, hourly earnings, consumer prices, housing prices, labor–labor exchange rate

JEL classification: D31—Personal Income and Wealth Distribution; D63—Equity, Justice, Inequality, and Other Normative Criteria and Measurement; E31—Price Level, Inflation, Deflation; E64—Incomes Policy; Price Policy; J24— Human Capital, Skills, Occupational Choice, Labor Productivity; J3—Wages, Compensation, and Labor Costs; O47— Measurement of Economic Growth, Aggregate Productivity, Cross-Country Output Convergence

Acknowledgements

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Introduction

Inequality has been studied for over 250 years. The founders of the modern political economy, Adam Smith (1723–1790) and David Ricardo (1772–1823), discussed the functional distribution of income, that is, between the classes of landlords, capital owners and laborers, whose incomes were rent, profits and wages, respectively. Ricardo even calls this question "the principal problem of political economy" [Ricardo, 1817, Preface]. However, until recently "the field has at times led a somewhat modest existence on the outskirts of mainstream academic research. One of the reasons for this may have been that the study of income distribution is so tied up with normative issues of equity and justice that many economists, keen to pursue a value-free version of their subject, have tended to shy away from it" [Sandmo 2015, p. 5]. Another reason was that "labour shares have long been considered stable and therefore attracted little attention from research and policy discussion" [ILO and OECD 2015, p. 2]; indeed, see [Curtis 1962, Wallis 1960]. For a comprehensive survey of that time see [Asimakopulos 1987].

In the last decade, the trends in the capital/labor split and the impacts thereof on the growth of inequality became one of the main concerns of national governments, European Commission and international organizations [United States Department of Labor 2015; European Commission 2007–2016; United Nations 2015; United Nations Development Program 2016; Hoffer and Spiecker 2011; ILO 2011, 2013, 2015; ILO and OECD 2015; ILO IMF OECD and WB 2015]. On the other hand, the vast overviews of the history and theory of wealth distribution [Atkinson and Bourguignon 2000, 2015; Goldfarb and Leonard 2005; Jenkin 2011; Moscati 2012; Salverda et al 2009] and the monograph [Piketty 2013] have once again made inequality a mainstream topic in economics. One of the theses is that the historical accumulation of capital enhances its contribution to general productivity, in particular through investments in research and development. This implies an increasing role of capital owners and managers, explaining the disproportional increase in their income. On the other hand, the marginal productivity of capital decreases as its stock increases, in other words: "too much capital kills the return on capital" [Piketty 2013, p. 215]. Hence, to maintain a constant return on capital in a developing competitive economy, its income share must grow.[1] Thus the increasing inequality is justified economically, even if indirectly; at the same time, there are serious concerns about the social and political consequences [OECD 2008, 2011, 2015a; United Nations 2015, goal 10].

In this paper, we call into question the fairness of the current trends in the capital/labor split. For this purpose, we avoid abstract notions and conduct our analysis in the more intelligible terms of unpaid working time and underpaid hourly earnings. We compare

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[1] This conclusion is shared by most scholars, also by critics of Piketty's book like [Acemogul and Robinson 2015] who, regarding income distribution, defend the decisive role of political and economic institutions as opposed to the `general laws of capitalism'.

actual wages to fair wages with respect to growing productivity[2] and we monitor their dynamics using 1990–2014 statistics for the G7 countries (Canada, France, Germany, Italy, Japan, United Kingdom and United States) and Denmark (known for having the lowest inequality worldwide). We then derive implications for the growth of inequality and formulate some policy suggestions. We begin by recounting several theoretical advancements in the field.

Adam Smith is probably the first great economist who considered wages in the context of technical progress. He illustrates his train of thought through the example of a pin factory with ten workers, whose individual productivity is several hundred times higher than that of an artisan who performs all the operations himself [Smith 1776, Chapter 1]. However, there is no corresponding difference in their incomes. According to Smith, better pay in one industry would gradually spread across all industries due to competitive labor mobility. The improved living conditions would stimulate the working population to grow and the resulting excessive labor supply would then reverse the initial wage increase. Thereby, Smith prepares the ground for the theory of population by Thomas Malthus (1766–1834), who promotes subsistence wages to prevent a demographic boom, guaranteeing nevertheless the reproduction of labor [Malthus 1798].[3]

The demographic boom is also Ricardo's main concern. He notices that rent is determined by the output from the best rent-free land (in modern terminology, the *margin of production*), where laborers can move to if the rent is too high. Wages are therefore determined by the potential of *marginal land* rather than by labor productivity, because excessive production is appropriated by landlords through rent. As the population grows, land becomes scarce, implying a steady increase of land prices and, correspondingly, the landowners' share of national income.[4] The same is true for capital owners who have the monopoly for the means of production. However, the favorite example of the classical economists, the United States, shows that a developing economy, as well as territorial expansions, cause increases in labor demand and exert an upward pressure on wages. The conclusion is that high wages are caused by economic growth rather than by the country's wealth. If the economy stagnates, then the wages return to the subsistence level, which Ricardo called the "natural price of labor" [Ricardo 1817/1821, Chapter 5].[5]

This conclusion, assuming homogeneous labor, does not however explain wage differentials across professions. Adam Smith enumerates their causes:

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[2] The gap between wages and productivity is mentioned in [ILO et al 2015:14–15]: "Income inequality can arise from numerous sources within the labour market, but five of them are particularly relevant, notably (i) the gap between wages and productivity; (ii) employment levels; (iii) changing patterns of employment relationships; (iv) a weakening of labour market institutions; and (v) increasing wage dispersion". This gap is discussed in a number of papers, see for instance [Bivens and Mishel 2015, Van Reenen and Pessoa 2012].

[3] The modern concept of minimum wage is a kind of tribute to the historical notion of subsistence wage [Minimum wage 2016].

[4] Now, this trend manifests itself in big-city housing prices. They are only constrained by lower housing prices in suburbs + transportation expenses + inconveniences and options farther afield in the countryside.

[5] The concept, promoted worldwide, of "sustained development" [United Nations 2015] stems from this root.

> ...first, the agreeableness or disagreeableness of the employments themselves; secondly, the easiness and cheapness, or the difficulty and expense of learning them; thirdly, the constancy or inconstancy of employment in them; fourthly, the small or great trust which must be reposed in those who exercise them; and, fifthly, the probability or improbability of success in them [Smith 1776, Chapter 10].

For instance, becoming a successful lawyer is difficult, expensive and dependent on auspicious circumstances. Anticipating the idea of human capital as introduced by [Mincer 1958, Becker 1964], Smith draws an analogy between investments in professional training and in industrial equipment:

> ... the wages of labour vary with the easiness and cheapness, or the difficulty and expense of learning the business. When any expensive machine is erected, the extraordinary work to be performed by it before it is worn out, it must be expected, will replace the capital laid out upon it, with at least the ordinary profits. A man educated at the expense of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education, with at least the ordinary profits of an equally valuable capital. It must do this, too, in a reasonable time, regard being had to the very uncertain duration of human life, in the same manner as to the more certain duration of the machine [Smith 1776, Chapter 10].

As noted by [Sandmo 2013, p. 13], the Smith–Malthus–Ricardo subsistence wage theory somewhat contradicts the existing wage differentials. Indeed, if the subsistence wage is assumed to be the average wage, then some professions are always rewarded higher and some lower. Hence, the lower wages provide no subsistence level, so it makes little sense to take these employments. On the other hand, if the subsistence wage is a minimum wage, then the average wage is above the minimum level, which contradicts to the long run trend toward the subsistence wage.

Smith's explanation of wage differentials based on the idea of fair pay is called into question by John Stuart Mill (1806–1873). He finds that Smith is not realistic regarding the competitive role of the "ease and hardship". It ignores the selfish interests of landlords and capital owners who, as in the case of Ricardian rent, exploit the social weakness of laborers to their own advantage. Mill writes that the hardship and the earnings often stand in inverse relationship to each other:

> The really exhausting and the really repulsive labours, instead of being better paid than others, are almost invariably paid the worst of all, because performed by those who have no choice. ...The more revolting the occupation, the more certain it is to receive the minimum of remuneration, because it devolves on the most helpless and degraded, on those who from squalid poverty, or from want of skill and education, are rejected from all other employments [Mill 1848, Book II, Ch. 4].

Elaborating Mills's idea, John Elliot Cairnes (1823–1875) coins the notion of "non-competing groups" to characterize the individuals of the lower classes whose poor education prevents them finding a well-paid and enjoyable employment. Here, the inequality of opportunity implies wage differentials, the inequality of net advantages and higher exposure to unemployment risks [Cairnes 1874].[6]

In contrast to the current promotion of full employment [European Commission 2010b], Karl Marx (1818–1883) asserts that unemployment is in the interest of capitalists. An excessive labor supply allows them to draw on the "industrial reserve army" for low wages even during development and expansion periods, guaranteeing high returns from capital. Marx argues that labor is the fundamental factor of production, because when "regarded as exchange-values all commodities are merely definite quantities of *congealed labour-time*" [Marx 1859, Part 1, italics original]. This means that profits result from *exploitation*—the difference between the value of production and subsistence wages, that is, from the unpaid fraction of working time. Following Mill's logic, the more hopeless the workers' despair, the easier their exploitation. Hence, inequality and poverty meet profound interests of the ruling class. Thus, regardless of growing productivity, income inequality will persist and even increase under capitalism [Marx 1868, Ch. 25, Sect. 3].

According to Thomas Piketty (1971–), "like his predecessors, Marx totally neglected the possibility of durable technological progress and steadily increasing productivity, which is a force that can go to some extent serve as a counterweight to the process of accumulation and concentration of capital." In fact, due to the Industrial Revolution, "in the last third of the nineteenth century, wages finally began to increase: the purchasing power of workers spread everywhere, and this changed the situation radically, even if extreme inequalities persisted and in some respects continued to increase until World War I." Two World Wars and the Great Depression between them moderated inequality. The "thirty glorious years" from 1945 to 1975 are marked by a rapid economic development, and, following Ricardo's conclusions, no significant growth of inequality in industrialized countries is observed. The philosophy "Growth is a rising tide that lifts all boats" is reflected in Simon Kuznetz' (1901–1985) theory of automatic decrease in inequality in advanced capitalism [Kuznetz 1953, 1955]. This perspective is often illustrated using the bell-shaped "Kuznets curve" of inequality, which first rises and then falls along the development stages of a country. Similarly, [Solow 1956] promises a `balanced growth path, that is, a growth trajectory along which all variables—output, incomes, profits, wages, capital, asset prices, and so on—would progress at the same pace, so that every social group would benefit from growth to the same degree, with no major deviations from the norm' [Piketty 2013, p. 9–11]. However, the wave of enthusiasm sparked by Kuznets' theory was perhaps premature:

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[6] All of these resemble the current discussion about traps of precarious employment in weak social groups. Insufficient skills are regarded as one of main causes of low incomes and of mass unemployment [European Commission 2010–2016, OECD 2015b].

The data Kuznets had presented in his 1953 book suddenly became a powerful political weapon. He was well aware of the highly speculative nature of his theorizing. Nevertheless, by presenting such an optimistic theory in the context of a "presidential address" to the main professional association of US economists, an audience that was inclined to believe and disseminate the good news delivered by their prestigious leader, he knew that he would wield considerable influence: thus the "Kuznets curve" was born. In order to make sure that everyone understood what was at stake, he took care to remind his listeners that the intent of his optimistic predictions was quite simply to maintain the underdeveloped countries "within the orbit of the free world." In large part, then, the theory of the Kuznets curve was a product of the Cold War [Piketty 2013, p.14].

The stability of the share of income accruing to labor

...has disciplined myriad models over the past half-century. The requirement that the labor share be constant in theoretical models has shaped many economists' intuitions regarding the aggregate production function, economic growth, and inequality. At odds with this background, the labor share of income has exhibited a pervasive global decline since the early 1980s. ...Our main empirical finding is that both gross and net labor shares have in general declined around the world over the past four decades. Some countries, including the United States, experienced increases in the value of depreciation as a share of gross domestic product. As a result, these countries experienced smaller declines in their net labor share relative to their gross labor share. However, the average economy in the world experienced a decline of similar magnitude in both measures. Further, the cross-country pattern of declines in the net labor share closely resembles the cross-country pattern of declines in the gross labor share [Karabarbounis and Neiman, 2014c].

As we now know, the "sustained development" [United Nations 2015] promoted so heavily around the world seems to be insufficient to constrain inequality:

It is now widely accepted that the rise observed in the wage share in Europe in the 1970s can be largely related to either aggressive wage bidding and/or strong resistance by workers to adjust their wages so as to bear the cost of higher oil prices, tax wedges and lower productivity growth. Moreover, this phenomenon was more pronounced in countries where labour market institutions allowed for tougher wage bargaining by workers' unions (in some countries the problem was exacerbated by the introduction of uniform minimum wages) [de Serres, Scarpetta, de la Maisonneuve 2002].[7]

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[7] Some ILO economists also find "aggressive wage bidding" harmful, even in the background of growing inequality:

With the euro, balanced trade requires that wages in all member states grow in line with national productivity plus targeted inflation rate of the ECB. Otherwise countries with relative higher growth in unit labour costs will systematically lose market share and build up trade deficits. The case for a coordinated

No less important during the post-World-War-II years were the policies of left-social democrats. They were adopted not least due to the impressive industrial, military and social advancements of the USSR. After the collapse of communism by 1990, this systemic alternative to capitalism was removed from the political agenda. The world shifted to the right and inequality sharply increased. However, the rise of inequality under globalization is doubly bad, because all the world wealth may end up concentrated in just a few hands, destabilizing entire societies both economically and politically:

> It would be a serious mistake to neglect the importance of the [Ricardian] scarcity principle for understanding the global distribution of wealth in the twenty-first century. To convince oneself of this, it is enough to replace the price of farmland in Ricardo's model by the price of urban real estate in major world capitals, or, alternatively, by the price of oil. In both cases, if the trend over the period 1970–2010 is extrapolated to the period 2010–2050 or 2010–2100, the result is economic, social, and political disequilibria of considerable magnitude, not only between but within countries—disequilibria that inevitably call to mind the Ricardian apocalypse.

> To be sure, there exists in principle a quite simple economic mechanism that should restore equilibrium to the process: the mechanism of supply and demand. If the supply of any good is insufficient, and its price is too high, then demand for that good should decrease, which should lead to a decline in its price. In other words, if real estate and oil prices rise, then people should move to the country or take to traveling about by bicycle (or both). Never mind that such adjustments might be unpleasant or complicated; they might also take decades, during which landlords and oil well owners might well accumulate claims on the rest of the population so extensive that they could easily come to own everything that can be owned, including rural real estate and bicycles, once and for all. As always, the worst is never certain to arrive. It is much too soon to warn readers that by 2050 they may be paying rent to the emir of Qatar [Piketty 2013, p. 6–7].

Even before it comes to paying rent to the emir of Qatar, societies can be significantly destabilized on their own. The fact that the rich are becoming more rich much more rapidly than lower classes improve their standing is clearly illustrated by Paul Krugman (1953–) using the example of the United States:

> Even households at the 95th percentile — that is, households richer than 19 out of 20 Americans — have seen their real income rise less than 1 percent a year since the late 1970s. But the income of the richest 1 percent has roughly doubled, and the

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wage policy to avoid imbalances, beggar thy neighbour policies and a waste of potential growth is overwhelming; it is alarming that it has been ignored for so long. Those who let unit labour costs rise too fast are equally responsible for the explosion of imbalances after the abolition of the exchange rate mechanism as those who gained market shares through wage restraint. This lack of policy coordination resulted in rapidly growing trade imbalances after 1998 [Hoffer and Spiecker 2011].

income of the top 0.01 percent — people with incomes of more than $5 million in 2004 — has risen by a factor of 5 [Krugman 2006].[8]

Responding to the challenges of the 21st century, the capital/labor income shares and their impact on income distribution are extensively studied by international organizations and academic institutions [Adler and Schmid 2013; Arpaia et al 2009; Atkinson 2009; Atkinson et al. 2011; Baccaro and Pontusson 2015; Checchi and Garcìa-Penalosa 2010; Glyn 2009; Karabarbounis and Neiman 2012–2014c; Mulas-Granados and Francese 2015; OECD 2008, 2011, 2015; ILO 2013; Schlenker and Schmid 2013; Stockhammer 2013]. These works confirm the impact of changes in capital/labor income shares on the growth of inequality and acknowledge the ongoing commodification of labor in the sense of [Polanyi 1944].

The analysis of functional distribution of income reveals the growing capital share which is often justified by investments in research and development to increase productivity. The latter could mean that the job of the many is done by much fewer better paid workers, so that the gains are fairly distributed among capital and labor, though with an increasing capital share. Or, the total number of workers remains approximately the same and the extra gains are appropriated almost exclusively by capital owners. The analysis of functional distribution of income makes no distinction here.

It should be noted that labor force is not declining but growing [OECD.Stat 2017], and the European Commission promotes its further increase [European Commission 2010a]. At the same time, labor develops in parallel with technology. Workers are becoming better educated and more advanced technically. They operate expensive, sophisticated equipment and bear responsibility for its safety. As a result, labor is progressively becoming more efficient. The increasing role of skilled labor is reflected in its promotion in terms of "human capital" and "human development", emphasizing its importance compared with that of industrial and financial capital [World Economic Forum 2015, United Nations Development Programme 2016]. This accumulation of human capital is not less important than the accumulation of financial and industrial capitals. Therefore, the explanation of increasing capital income share by the accumulation of capital can hardly be justified — even economically. Taking into account that the recent advances in labor, its decreasing share can mean that fair pay is gradually reduced to a modern kind of subsistence wages, turning back the pages of time. Let us illustrate this process with two personal observations.

Decreasing labor–labor exchange rate. My car service station, which asks not to be identified, charges clients 50 EUR for an hour of work, of which a worker receives 25 EUR. If the worker decided to have his car repaired at his own place of employment, he would pay twice his earnings for the same work. In other words, the return on his own labor expressed in the equivalent labor of others is 50%, resulting in a labor–labor exchange rate (LLER) of 50%. Twenty years ago the service station charged the clients 50 DM/hour (ca. 25 EUR) while paying its workers 30 DM/hour (ca. 15 EUR), resulting in a return on labor of 60%. Thus, twenty years ago a labor unit was

exchanged for 0.6 labor units, whereas now it is worth only 0.5 units. Thus, the LLER has decreased by 1/6, or ca. 17%. The capital income share has increased correspondingly.

The falling purchasing power of earnings in labor units is not that apparent when considering consumer goods. Thanks to technological advancements, their production has gotten cheaper. This improves the purchasing power of earnings in consumer units (but not in labor units), outbalancing the LLER decrease. For instance, in the 1980s the price of a simple personal computer was as high as an average monthly salary. Now an average salary suffices for three much better computers, giving the impression of a significant increase in the value of earnings. However, the amount of labor invested in old versus modern PCs differs by much more than three times, meaning that the average salary's purchasing power in labor units has decreased. All of these result in delusory wealth for the workers and real profits for the computer industry.

Decreasing labor–labor exchange rate in terms of housing. As expressed in a personal communication in August 2015 by Marc Lepeltier, a real estate agent in Cambremer, French Normandy, the rich are now acquiring the properties of the middle class; the middle class are purchasing working-class housing; and the working class, unable to afford their own homes, must content themselves with rented accommodations. And the luxury villas of the rich are attainable exclusively by the superrich, mostly foreigners. Or, to put it differently, the houses purchased 40 years ago by middle-class families with one earner are now affordable only for middle-class families with two earners. It should be noted that, due to the relative lack of automation, the amount of labor embodied in construction remains almost invariable. If the LLER remained constant, the housing prices would rise in proportion to earnings. The falling purchasing power of earnings with respect to housing indicates a falling LLER exchange rate and a corresponding increase in rent and the share of construction capital.

Based on these observations, we consider the circulation of labor by analogy with the circulation of money described by Marx as "M-C-M, the transformation of money into commodities, and the change of commodities back again into money; or buying in order to sell" [Marx 1867, Ch. 4]. Its dual labor analog is L–M–L, the transformation of one's labor into money earned, and spending the money to pay for the labor embodied in the commodities purchased; or selling one's own labor in order to buy others' labor. Both formulas, M–C–M and L–M–L, explain what one gets; in both cases the return is expressed in the input units. Unlike the lucrative exchange M–C–M, the exchange L–M–L is unprofitable, because a fraction of the commodity values is appropriated by capital and real estate owners.[9] The second distinction is that the input/output of M–C–M are expressed in easily

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[9] We do not consider the capital share as accumulated labor — in Marx' terms "*congealed labour-time*" — because it is already appropriated by the capitalist or real estate owner.

countable money units, whereas those of L–M–L assume aggregate labor units that cannot be measured directly. Therefore, we do not consider the exchange L–M–L in absolute figures but estimate its dynamics relative to some reference year, i.e. index its exchange rate: LLER.

To operationalize our approach, we express hourly earnings[10] either in consumer units (reflecting LLER in the domain of industrial capital) or in housing units (reflecting LLER in the domain of real estate). This is done using the OECD indexes for hourly earnings, consumer prices and *new* housing prices. Following the philosophy "Growth is a rising tide that lifts all boats" we compute "fair" hourly earnings whose purchasing power grows in proportion to productivity. Taking into account the above quote from [de Serres, Scarpetta, de la Maisonneuve 2002] about "aggressive wage bidding" in the 1970s and the increase of capital share in the 1980s, we assume that capital–labor income shares came to a reasonable proportion during the decade ending with the fall of communism. Thus, we adopt the year 1990 as a reference for "fair pay", or *status quo*.

Monitoring the LLER country curves for a quarter century, 1990–2014, we find that German manufacturing workers in 2014 are paid 17% "less than they merit" with reference to consumer prices, and 28% less with reference to new housing prices. Among the eight countries considered, the worst situation is seen in the United States (33% and 37%, respectively) and the best in Denmark (–1% and 12%). The worse trends for the LLER with reference to housing prices align with the study on inadequate housing costs [Eurofound 2016]. The correlation between the countries' Gini coefficients and the declines in LLER is 0.83, being statistically highly significant. This indicates the dependence between the decrease in LLER and the growth in inequality.

Section "Productivity, earnings, consumer prices and housing prices" describes the interaction of the time series used in further analysis.

In Section "Labor–labor exchange rate" the central notion of the paper is operationally defined, indexed and visualized based on statistics for the G7 countries and Denmark.

Section "Interpreting labor–labor exchange rate in terms of pay" illustrates how to convert the labor–labor exchange rate indices into absolute figures — either in terms of unpaid working time or underpaid earnings.

Section "Dependence between inequality and the LLER decrease" provides empirical evidence for significant statistical dependence between the degree of inequality and the degree to which the LLER decreases.

In Section "Conclusions" the results of the paper are recapitulated and put into context. Finally, we explain that high taxation can retain the labor–labor exchange rate within reasonable bounds, thereby creating the preconditions to tackle the growth of inequality.

Section "Appendix: Source data and visualization thereof" contains tables with the data used in the model and figures that illustrate the tables.

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[10] In manufacturing — the standard reference for earnings [OECD 2004, p. 8, 57, Note 5, ILO 2016, 5B].

Productivity, earnings, consumer prices and housing prices

To explain our way of thinking, let us consider four curves in Figure 1. They display the 1990–2014 US indices of housing prices, hourly earnings in manufacturing, consumer prices and productivity. The earnings and two price indices are given for current money values, whereas the productivity index refers to `constant prices', reflecting the inflation-adjusted productivity. These US curves are extracted from Figures 5–7 and 9 in the Appendix, which are in turn derived from the indices (OECD.Stat 2015) given in Tables 5–8 (also in the Appendix) and from the data (Bureau of Labor Statistics, US Department of Labor 2012) given in Table 9 (ditto). The conversion of the OECD indices 2010 = 100% to 1990 = 100% is done by dividing each OECD index by its 1990 value and multiplying by 100%.

As one can see, the US hourly earnings and consumer prices (both in current prices) increase almost synchronically by a factor of 1.8, showing that in the last 25 years both earnings and consumer prices have almost doubled. The synchronous growth of both indices means that the purchasing power of hourly earning remains practically the same over the period considered. Consequently, the US manufacturing workers' living standards have improved little during the last quarter century (if there is any improvement at all, then it is rather due to wealth accumulation than to income), which is in line with Krugman's remark as cited in Introduction.

The increase in productivity (inflation-free, i.e., real increase) by a factor of 1.5 in Figure 1 would suggest a commensurable increase in the earnings' purchasing power. The fact that no increase in purchasing power is observed means that the gains from productivity growth are not distributed among the workers but appropriated by capital owners and top managers, aggravating income inequality.[11]
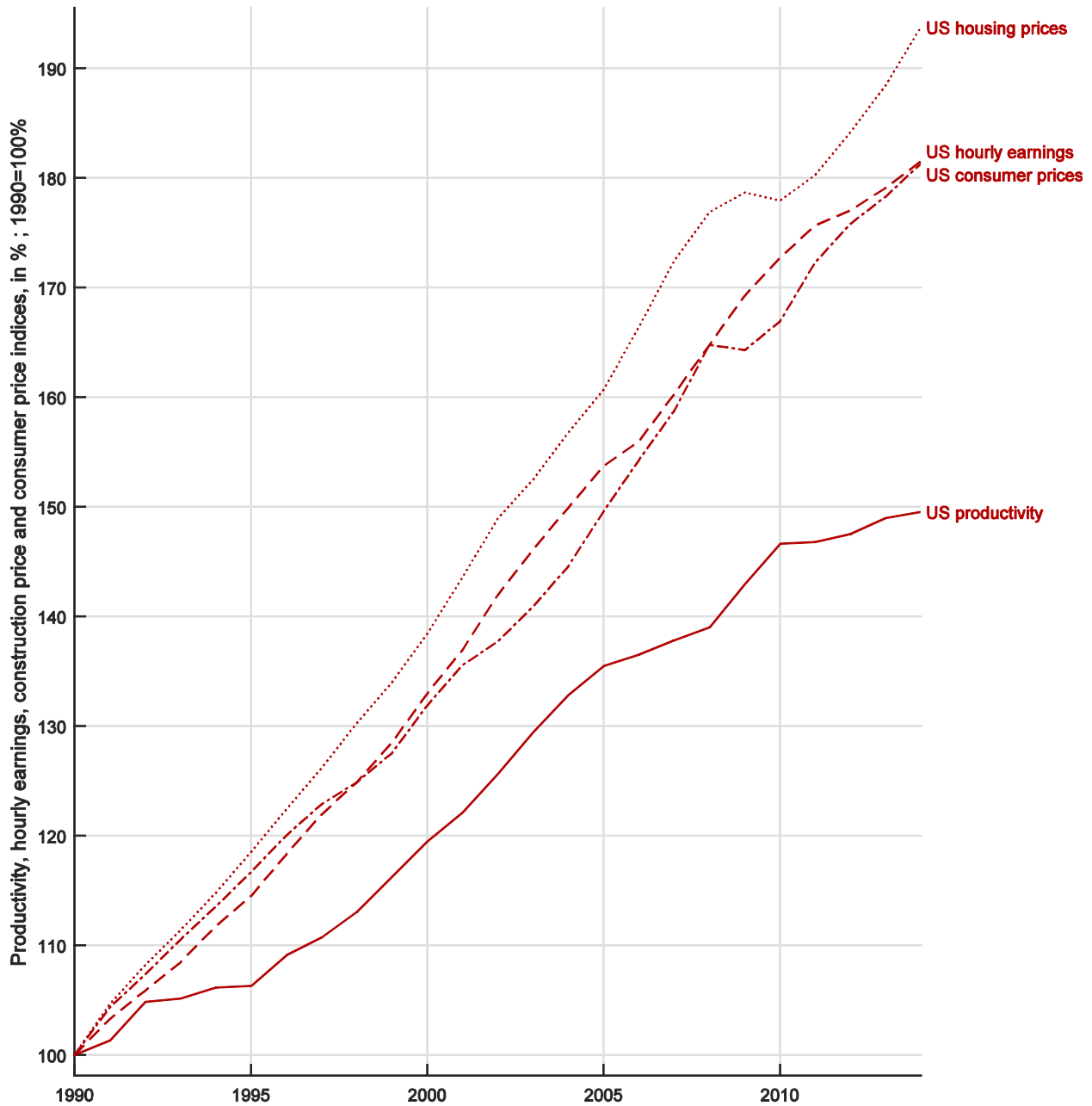
If productivity in construction were equal to that in manufacturing, the housing price index in Figure 1 would grow more or less synchronically with the more manufacturing-dependent consumer price index. In actuality, the productivity in construction grows slower than in manufacturing, because the share of human labor in construction remains

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[11] This viewpoint is not that self-evident. Some prominent US economists moderate the related concerns:

> If wages rise at the same pace as productivity, labor's share of national income remains essentially unchanged. This paper presents specific evidence that this has happened: the share of national income going to employees is at approximately the same level now as it was in 1970 [Feldstein 2008].

> In recent years, labor's share in income has fallen off a bit. (Between 2000 and 2005, employee compensation as a percentage of gross domestic income fell from 58.2 to 56.8 percent.) From the Cobb-Douglas perspective, this means that the marginal productivity of labor has fallen relative to average productivity. This modest drop in labor's share is not well understood, but its importance should not be exaggerated [Mankiw 2006]; see also [Mankiw 2003].

It should be noted however that "within the labour share, the highest earners have captured an increasingly large portion, while those at the bottom have seen their shares decline significantly" [ILO et al 2015, p. 2].

Figure 1: United States indices of productivity (solid line), hourly earnings in manufacturing (dashed line), housing prices (dotted line) and consumer prices (dash-dotted line); index 1990 = 100%

rather constant, whereas in manufacturing it decreases due to rapidly developing robotics, automated production lines and computer-assisted design. To provide the same capital return in less productive construction, housing prices are disproportionally boosted. This is visualized in Figure 1.

Labor–labor exchange rate (LLER)

Now we operationalize the notion of labor–labor exchange rate using an example. Let us assume that in 1990 one worker makes four kettles per hour of work and his colleague makes four coffee pots. These production units require the same amount of labor and have the same retail price. Taking into account capital investments, social security contributions and other factors, we assume that the hourly earnings allow the worker who makes four kettles per hour to purchase two coffee pots, while another worker, who makes four coffee pots per hour, can purchase two kettles. In this situation, the labor embodied in four units is exchanged for the labor needed for two units. Thus, the labor–labor exchange rate is 2:1, which is regarded as a *status quo*. If the productivity doubles by 2014, that is, each worker makes eight units per hour instead of four and the labor–labor exchange rate remains the same at 2:1, then the real purchasing power of hourly earnings must double as well, i.e. each worker's hourly earnings must suffice to purchase four units produced by his colleague. This situation is seen as maintaining the labor–labor exchange *status quo*, or fair. If in 2014 each worker's hourly earnings means ha can afford not four but only three production units, the labor–labor exchange is now 8:3 = 2.67:1 — thus deteriorating the *status quo* and considered unfair.

The labor–labor exchange rate from the above example can be naturally generalized to aggregate labor. We operationalize it using aggregate productivity and aggregate prices. The idea is that "abstract" labor units invested in production are remunerated with hourly earnings. The latter are used to purchase the labor units of others embodied in aggregate consumer goods. Productivity in constant prices (= real productivity), hourly earnings and consumer prices are statistically monitored with indices of relative change over time, so that we can trace the dynamics of the labor–labor exchange rate, without referring explicitly to money values — just "productivity" and "purchasing power".

To be more specific, let us come back to Figure 1. As already mentioned, a US productivity growth by a factor of 1.5 suggests a commensurable increase in the purchasing power of hourly earnings. The fact that the purchasing power with reference to consumer products has not changed over 25 years means that the labor–labor exchange rate (with reference to consumer products) actually decreased by a factor of 1.5. Generalizing this train of thought, we obtain the following index of labor–labor exchange rate (LLER) as a function of time t:

$$\text{LLER}_{1990=1}(t) = \frac{\text{Hourly earnings in consumer units}_{1990=100}(t)}{\text{Productivity}_{1990=100}(t)} \qquad (1)$$

The subscripts 1990 = 1 and 1990 = 100 mean that the indices refer to the *status quo* year 1990, where the index values are 1 or 100%, respectively.

Let us apply this formula to our example with kettles and coffee pots. Since the hourly earnings in consumer units increases from two units in 1990 to four in 2014, and the productivity doubles:

$$\text{Hourly earnings in consumer units}_{1990=100}(2014) = 200\%$$
$$\text{Productivity}_{1990=100}(2014) = 200\% \,.$$

Substituting these values into (1), we obtain

$$\text{LLER}_{1990=1}(2014) = \frac{200\%}{200\%} = 1 \,.$$

That is, the labor–labor exchange rate remains the same as in 1990, maintaining the *status quo*, and the hourly pay in 2014 is considered fair. If in 2014 the purchasing power of the workers' hourly earnings increased from two to only three units instead of four, then we would have

$$\text{LLER}_{1990=1}(2014) = \frac{\text{Hourly earnings in consumer units}_{1990=100}(t)}{\text{Productivity}_{1990=100}(t)}$$
$$= \frac{150\%}{200\%} = 0.75 \,.$$

This means a decrease in the labor–labor exchange rate to 0.75 of its initial 1990 state, or a devaluation of one's labor in the labor–labor exchange by 25% . This is regarded as unfair.

The dynamics of hourly earnings in aggregate (conditional) consumer units can be expressed as the following index:

$$\text{Hourly earnings in consumer units}_{1990=100}(t) = \frac{\text{Hourly earnings}_{1990=100}(t)}{\text{Consumer prices}_{1990=100}(t)} \times 100\%.$$

Substituting this expression in (1), we finally obtain the index of labor–labor exchange rate with reference to consumer prices:

$$\text{LLER with reference to consumer prices}_{1990=1}(t) = \frac{\frac{\text{Hourly earnings}_{1990=100}(t)}{\text{Consumer prices}_{1990=100}(t)}}{\text{Productivity}_{1990=100}(t)}. \qquad (2)$$

This formula is applied to compute the curves in Figure 2 from the data in Tables 5, 7 and 8. These curves show the development of LLER w.r.t. consumer prices$_{1990=100}(t)$ for the G7 countries and Denmark. The trends in the labor–labor exchange rate of the five European states in Figure 2 are more favorable than that of the three non-European countries. The best situation is found in Denmark: in 2013 the labor–labor exchange rate returned to its initial 1990 value, even increasing in 2014. In Italy, United Kingdom and France one's labor has devaluated by 5–8%, whereas in Germany it is down by 17%. Japan and Canada, with their 23% and 24% labor devaluation, respectively, come next, and the greatest decline of the labor–labor exchange rate is observed in the United States, where one's labor has lost 33% of its 1990 value.
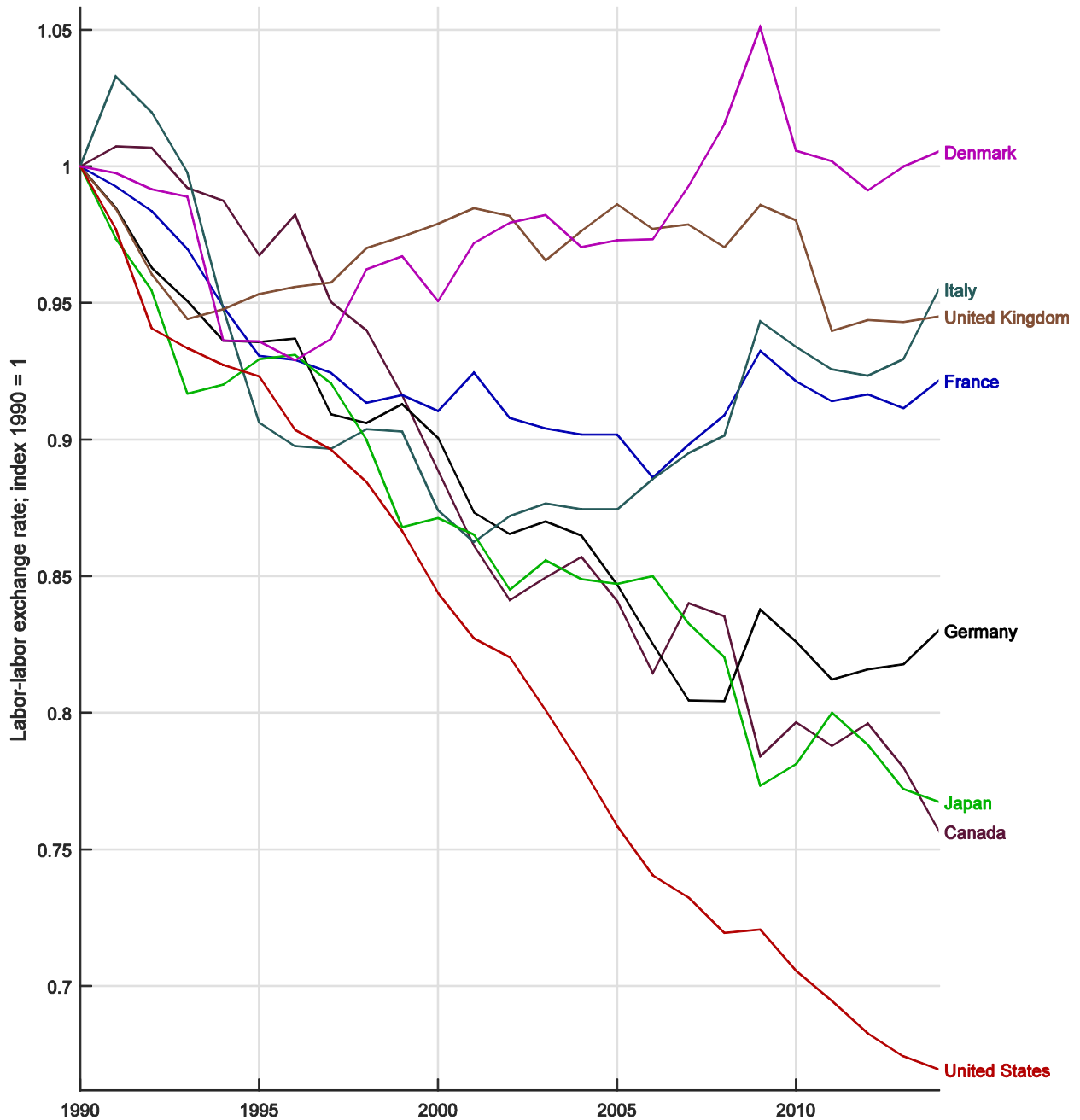
Source: Derived from *OECD.Stat* http://stats.oecd.org/ (26.11.2015): (1) Labour > Earnings > Hourly earnings (MEI) > Customize > Selection > Subject: manufacturing, index; Time and frequency: annual; (2) Prices and Purchasing Power Parities > Consumer and Producer Price Indices > Consumer Prices > Consumer price indices > Customize > Selection > Subject: consumer prices – all items; Time and frequency: annual, Measure: index; (3) Productivity > Productivity and ULC – Annual, Total Economy > Growth in GDP per capita, productivity and ULC > Customize > Subject: GDP per hour worked, constant prices; Measure: index.

Figure 2: Labor–labor exchange rate with reference to consumer prices; index 1990 = 1.

In addition to consumer units as an embodiment of labor, we refer to housing units measured, say, in square meters. Since the share of manual labor in construction remains relatively stable over time (strictly speaking, it decreases much slower than in manufacturing), square meters of housing can be regarded as embodiment of a more or less constant amount of labor — and construction, in turn, as a rather reliable reference for the labor–labor exchange. By analogy with the derivation of (2), we obtain

$$\text{LLER w.r.t. housing prices}_{1990=100}(t) = \frac{\text{Hourly earnings in housing units}_{1990=100}(t)}{\text{Productivity}_{1990=100}(t)}$$

$$= \frac{\frac{\text{Hourly earnings}_{1990=100}(t)}{\text{Housing prices}_{1990=100}(t)}}{\text{Productivity}_{1990=100}(t)}. \tag{3}$$

Figure 3 displays the labor–labor exchange rate with reference to housing prices for the selection of countries and years as in Figure 2. The curves are computed from the data in Tables 6–8. Here, the trends look less favorable. Even in Denmark, one's labor is devaluated by 12% and in the United States — by 37%. This means that construction units, with their rather constant share of manual labor, highlight a more dramatic violation of the *status quo* in the labor–labor exchange.

Figure 3: Labor–labor exchange rate with reference to housing prices; index 1990 = 1.

Interpreting the labor–labor exchange rate in terms of pay

A decreasing LLER means that an increasing fraction of working time is not compensated for by the labor of others. This may have a number of causes, for instance, increasing employers' social security contributions, new tax burdens, rising energy prices, and, not least, attributing productivity gains to capital by rewarding its owners and managers more generously. Anyway, if we isolate the LLER from other factors, we can speak of a deficit in reciprocal labor compensation measured in working time, which we simply call a "unpaid percentage of working time". As before, the "fair", i.e. full, compensation (100% of working time) is associated with the 1990 *status quo*.

In our context, the unpaid percentage of working time is the decrease in the LLER expressed in percent. Since we use two types of references for the LLER, we compute the unpaid percentage of working time in two versions:

$$\text{Non-paid percentage of working time}(t) = \begin{cases} [1-\text{LLER with reference to consumer prices}_{1990=1}(t)] \ \times 100\% \\ [1-\text{LLER with reference to housing prices}_{1990=1}(t)] \ \times 100\% \end{cases}$$

The results for selected years are shown in Table 1. The full time series are depicted in Figures 10–11 in the Appendix. As seen from Table 1, the most favorable situation is in Denmark (–1%, 12% in 2014), and the least favorable is found in the United States (33%, 37% in 2014).

Table 1: Unpaid percentage of working time, assuming full pay (100% of working time) in 1990 (visualized in Figures 2–3)

Country	Labor–labor exchange reference	1990	1995	2000	2005	2010	2014
Canada	with reference to consumer prices	0	3	11	16	20	24
	with reference to housing prices	0	–1	2	7	16	18
France	with reference to consumer prices	0	7	9	10	8	8
	with reference to housing prices	0	14	16	20	22	23
Germany	with reference to consumer prices	0	6	10	15	17	17
	with reference to housing prices	0	21	26	29	29	28
Italy	with reference to consumer prices	0	9	13	13	7	4
	with reference to housing prices	0	15	25	25	23	20
Japan	with reference to consumer prices	0	7	13	15	22	23
	with reference to housing prices	0	13	20	24	29	28
United Kingdom	with reference to consumer prices	0	5	2	1	2	5
	with reference to housing prices	0	19	24	28	29	30
United States	with reference to consumer prices	0	8	16	24	29	33
	with reference to housing prices	0	9	20	29	34	37
Denmark	with reference to consumer prices	0	6	5	3	–1	–1
	with reference to housing prices	0	11	10	10	9	12

Source: Author's computations based on the variables previously defined

We also compute "fair" hourly earnings, i.e. those that retain the same LLER as in the reference year 1990, and compare them with the existing ones. For this purpose, we take the 2011 hourly earnings in manufacturing expressed in EUR from Table 9, convert the hourly earnings indices 2010 = 100 in Table 8 into indices 1 = 2011 (by dividing them by their 2011 values), and with these new indices we calculate the actual hourly earnings. Taking into account the percentage of unpaid working time (for selected years, they are given in Table 1), we get the fair hourly earnings, that is, with the 1990 *status quo* in the labor–labor exchange. Figures 4–5 visualize both actual and fair hourly earnings in two versions, and Table 2 provides the comparison of actual and fair pay in selected years.

Table 2: The actual hourly earnings in manufacturing and fair hourly earnings understood as having the same labor–labor exchange rate as in 1990 (visualized in Figures 10–11)

Country	Pay pattern	1990	1995	2000	2005	2010	2014
Canada	**Actual pay**	**12.35**	**14.47**	**15.92**	**17.88**	**19.07**	**20.40**
	Fair pay with reference to consumer prices	12.35	14.96	17.92	21.27	23.93	26.96
	Fair pay with reference to housing prices	12.35	14.31	16.24	19.26	22.69	24.99
France	**Actual pay**	**9.29**	**10.67**	**12.34**	**14.43**	**16.36**	**17.80**
	Fair pay with reference to consumer prices	9.29	11.47	13.55	16.00	17.76	19.32
	Fair pay with reference to housing prices	9.29	12.43	14.75	18.04	21.11	23.25
Germany	**Actual pay**	**12.31**	**15.55**	**17.53**	**19.12**	**20.87**	**23.18**
	Fair pay with reference to consumer prices	12.31	16.62	19.46	22.57	25.26	27.93
	Fair pay with reference to housing prices	12.31	19.70	23.62	26.81	29.55	32.30
Italy	**Actual pay**	**7.89**	**10.17**	**11.65**	**13.22**	**15.41**	**16.90**
	Fair pay with reference to consumer prices	7.89	11.22	13.32	15.12	16.50	17.70
	Fair pay with reference to housing prices	7.89	11.90	15.54	17.71	20.01	21.13
Japan	**Actual pay**	**13.07**	**14.43**	**15.19**	**15.76**	**15.3**	**15.77**
	Fair pay with reference to consumer prices	13.07	15.52	17.44	18.60	19.58	20.56
	Fair pay with reference to housing prices	13.07	16.51	18.94	20.60	21.65	21.90
United Kingdom	**Actual pay**	**7.21**	**9.52**	**11.78**	**14.26**	**16.74**	**18.04**
	Fair pay with reference to consumer prices	7.21	9.99	12.04	14.46	17.08	19.09
	Fair pay with reference to housing prices	7.21	11.72	15.59	19.83	23.63	25.80
United States	**Actual pay**	**10.42**	**11.93**	**13.86**	**16.02**	**18.00**	**18.91**
	Fair pay with reference to consumer prices	10.42	12.93	16.42	21.12	25.50	28.25
	Fair pay with reference to housing prices	10.42	13.13	17.24	22.68	27.18	30.20
Denmark	**Actual pay**	**14.45**	**17.08**	**20.75**	**25.06**	**29.55**	**31.68**
	Fair pay with reference to consumer prices	14.45	18.25	21.82	25.76	29.38	31.51
	Fair pay with reference to housing prices	14.45	19.15	22.97	27.93	32.48	35.91

Dependence between inequality and the decrease in LLER

Figure 4, which visualizes the data from Tables 10a–b in the Appendix, illustrates the growing inequality in the G7 countries and Denmark. It depicts the curves of the Gini coefficients for the distributions of income pre and post taxes and transfers. The data are available up to 2012, at which point six countries have very close Gini coefficients for the distributions of income before taxes. Different tax and social policy in these countries reduce the inequality to different extents.

Table 3 shows the dependence between inequality and the *decrease in* LLER 1990–2014 by means of correlation between five variables, each with eight observations (for eight countries). The inequality is represented by two variables: (1) Gini coefficients for market income before taxes and transfers and (2) Gini coefficients for disposable income post taxes and transfers. We take the latest available data in Tables 10a–b.

The increase in productivity in 2014 compared with 1990 is computed from the data in Table 7. These increases for eight countries correspond to the right-hand ends of the curves in Figure 7. For instance, for the USA this factor is 1.5, and for Denmark it is 1.35.

The countries' *decreases* in LLER with reference to either consumer or housing prices are replaced by the equivalent derivatives "Unpaid percentage of working time assuming full pay in 1990" with the same two references. Both of these variables are taken from the last column of Table 1.

The third column of Table 3 shows that both Gini variables are weakly correlated with productivity growth. This means that, though investments in productivity are expected to increase the capital's share in gains, the productivity alone has a low impact on inequality. Rather, inequality results from unfair remuneration of labor—this follows from the high correlation of the Gini variables with "Unpaid percentage of working time" (columns 4–5).

The correlation with the LLER is higher for "Gini for disposable income post taxes and transfers". As seen from Figure 4, taxes and transfers reduce income inequality in the eight countries to different degrees (six countries have almost the same Gini before taxes). As indirectly follows from Table 3, the higher the taxes, the smaller the decrease in LLER. Probably, high taxes reduce the purchasing power of earnings, constraining solvent demand. When this is exacerbated by unfair pay, demand is reduced further with negative consequences for sales. Roughly speaking, high taxes reduce stimuli to significantly increase the capital's share in gains, even in the case of investments. On the other hand, high taxes enable generous social security transfers to weak population groups, increasing solvent demand and stimulating economic development. Thereby, high taxes contribute to maintaining a fair LLER and reduce the growth of inequality. All of these are easily visible in the example of Denmark as opposed to that of the United States.
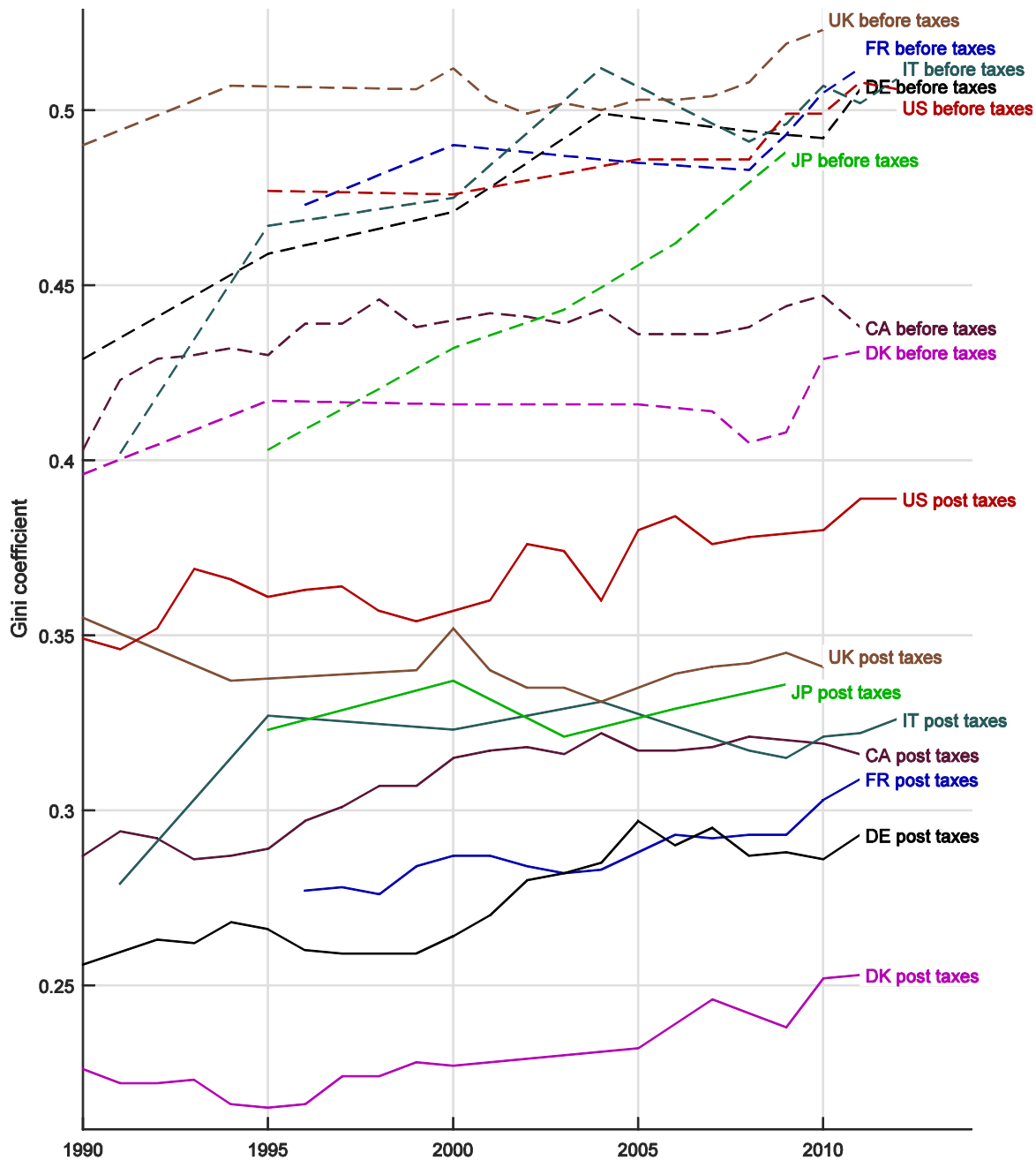
Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Social protection and well-being > Income distribution and poverty > Customize > Selection > Age group: total population; Definition: current definition; Methodology: income definition until 2011; Measure: (a) Gini (market income, before taxes and transfers), (b) Gini (disposable income, post taxes and transfers)

Figure 4: Gini coefficients for market income before taxes and transfers (dashed lines) and for disposable income post taxes and transfers (solid lines); see Tables 10a–b

Table 4: Pearson correlation between the model variables

	Actual Gini market income before taxes	Actual Gini post taxes and transfers	Growth of general productivity in 1990–2014	Unpaid % of working time in 2014 w.r.t. consumer prices assuming full pay in 1990	Unpaid % of working time in 2014 w.r.t. housing prices assuming full pay in 1990
Actual Gini market income before taxes	1	0.555	0.183	0.021	0.718**
Actual Gini post taxes and transfers	0.555	1	0.347	0.660*	0.831***
Growth of general productivity in 1990–2014	0.183	0.347	1	0.497	0.659*
Unpaid % of working time in 2014 w.r.t. consumer prices assuming full pay in 1990	0.021	0.660*	0.497	1	0.626*
Unpaid % of working time in 2014 w.r.t. housing prices assuming full pay in 1990	0.718**	0.831***	0.659*	0.626*	1

***   PVAL ≤ 0.01
** 0.01 < PVAL ≤ 0.05
*   0.05 < PVAL ≤ 0.10

Conclusions

Goal of the paper. We have analyzed current trends in the capital/labor split and its impact on inequality growth in the more intelligible terms of unpaid working time and underpaid hourly earnings. "Looking inside" the split, we see that a higher productivity due to accumulation of capital and its investments in research and development, implying fewer workers for the same job, does not imply that these fewer workers are better remunerated. Instead, the gains are appropriated by the capital owners and its managers— contrary to the idea of proportional returns on the accumulation of human capital.

Notion of labor–labor exchange rate (LLER). For analytical purposes, we introduce the notion of labor–labor exchange rate, i.e. the return on one's labor in the form of the labor of others embodied in goods and services affordable for one's earnings. As references, we use the aggregate labor embodied in consumer products and in housing.

Decrease of the LLER. Using statistical data for the G7 countries and Denmark, we provide empirical evidence for a general devaluation of one's own labor in the labor–labor exchange.

Dependence between the degree of inequality and the degree of decline of LLER. The dependence between the *degree* of inequality and the *degree* of labor devaluation is statistically highly significant. It is no accident that the smallest LLER decrease is seen in Denmark with its lowest inequality, and the greatest is found in the United States, where the inequality is the highest of the eight countries considered.

Controlling LLER decrease using common taxes. Under high taxes, the purchasing power of earnings is reduced, constraining solvent demand. When it is multiplied by unfair pay, demand is reduced further with negative consequences for sales. Roughly speaking, high taxes reduce stimuli to significantly increase the capital's share in gains, even in the case of investments. On the other hand, high taxes enable generous social security transfers to weak population groups, increasing solvent demand and stimulating economic development. Thereby, high taxes contribute to maintaining a fair LLER and reduce the growth of inequality.

**Other policy incentives and inequality tax.** To keep the LLER at some reasonable level, enterprises could receive tax exemptions or other privileges for keeping the inter-enterprise Gini index below the national level. If high inequality may be likened to "social pollution", then exceeding the national level could be penalized by an "inequality tax" — by analogy with environmental protection.

Appendix: Source data and visualization thereof

Table 5: Consumer price indices 2010 = 100% (visualized in Figure 5)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	67.3	71.2	67.5	55.8	94.5	62.4	59.9	66.1
1991	71.1	73.5	70.2	59.3	97.6	67.1	62.5	67.7
1992	72.1	75.2	73.8	62.5	99.3	70	64.3	69.1
1993	73.5	76.8	77.1	65.3	100.5	71.7	66.2	70
1994	73.6	78.1	79.1	68	101.2	73.2	68	71.4
1995	75.2	79.5	80.5	71.6	101.1	75.1	69.9	72.9
1996	76.4	81.1	81.6	74.4	101.2	77	71.9	74.4
1997	77.6	82	83.2	75.9	103	78.3	73.6	76
1998	78.4	82.5	84	77.4	103.7	79.6	74.8	77.4
1999	79.7	83	84.5	78.7	103.4	80.7	76.4	79.4
2000	81.9	84.4	85.7	80.7	102.7	81.3	79	81.7
2001	84	85.8	87.4	83	101.9	82.3	81.2	83.6
2002	85.9	87.4	88.6	85	101	83.3	82.5	85.6
2003	88.2	89.3	89.6	87.3	100.7	84.5	84.4	87.4
2004	89.9	91.2	91	89.2	100.7	85.6	86.6	88.4
2005	91.9	92.7	92.5	91	100.4	87.3	89.6	90
2006	93.7	94.3	93.9	92.9	100.7	89.4	92.4	91.7
2007	95.7	95.7	96.1	94.6	100.7	91.5	95.1	93.3
2008	98	98.4	98.6	97.7	102.1	94.8	98.7	96.5
2009	98.3	98.5	98.9	98.5	100.7	96.8	98.4	97.8
2010	100	100	100	100	100	100	100	100
2011	102.9	102.1	102.1	102.8	99.7	104.5	103.2	102.8
2012	104.5	104.1	104.1	105.9	99.7	107.4	105.3	105.2
2013	105.5	105	105.7	107.2	100	110.2	106.8	106.1
2014	107.5	105.5	106.7	107.5	102.8	111.8	108.6	106.7

Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Prices and Purchasing Power Parities > Consumer and Producer Price Indices > Consumer Prices > Consumer price indices > Customize > Selection > Subject: Consumer prices – all items; Time and frequency: annual; Measure: index.
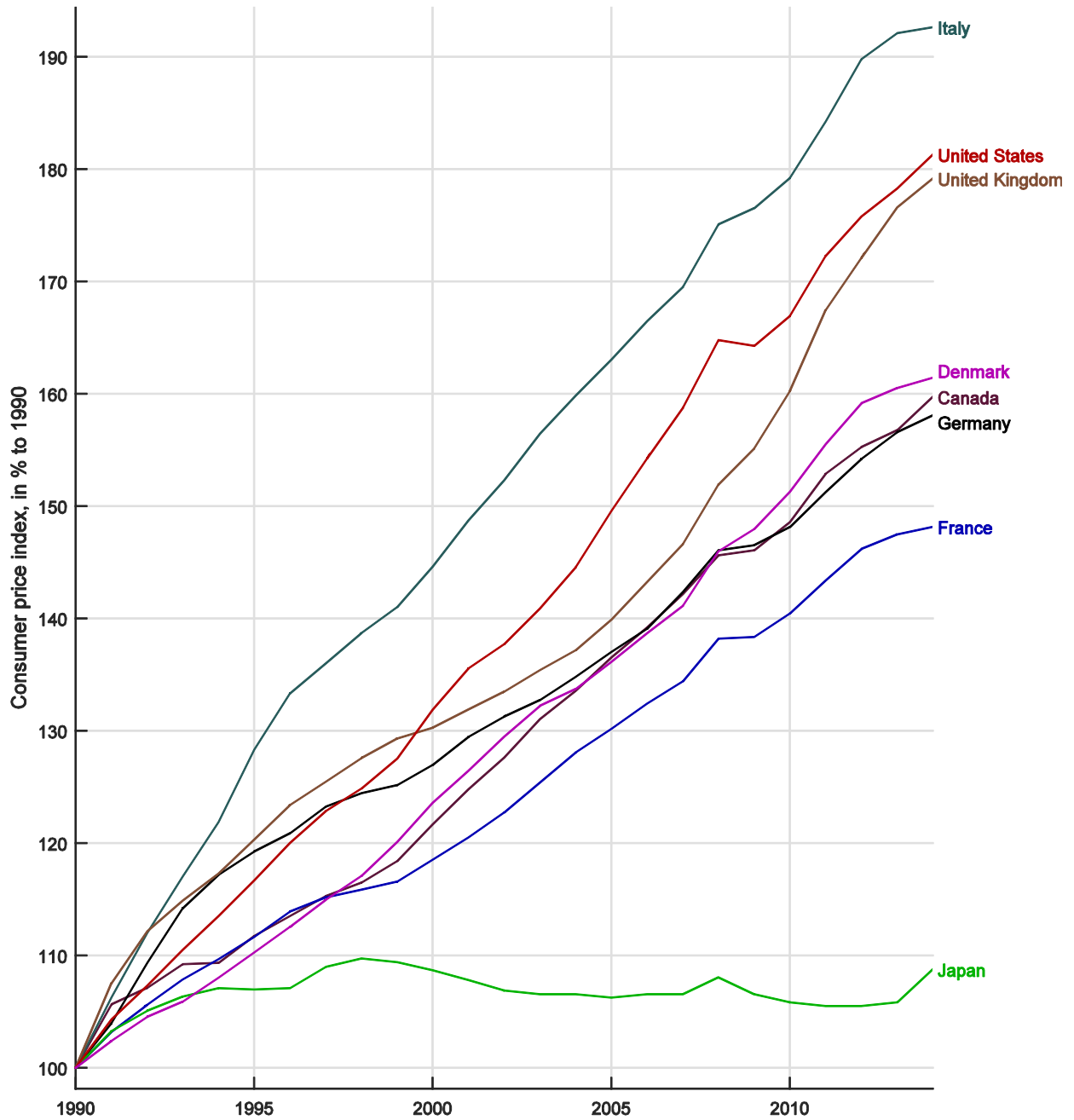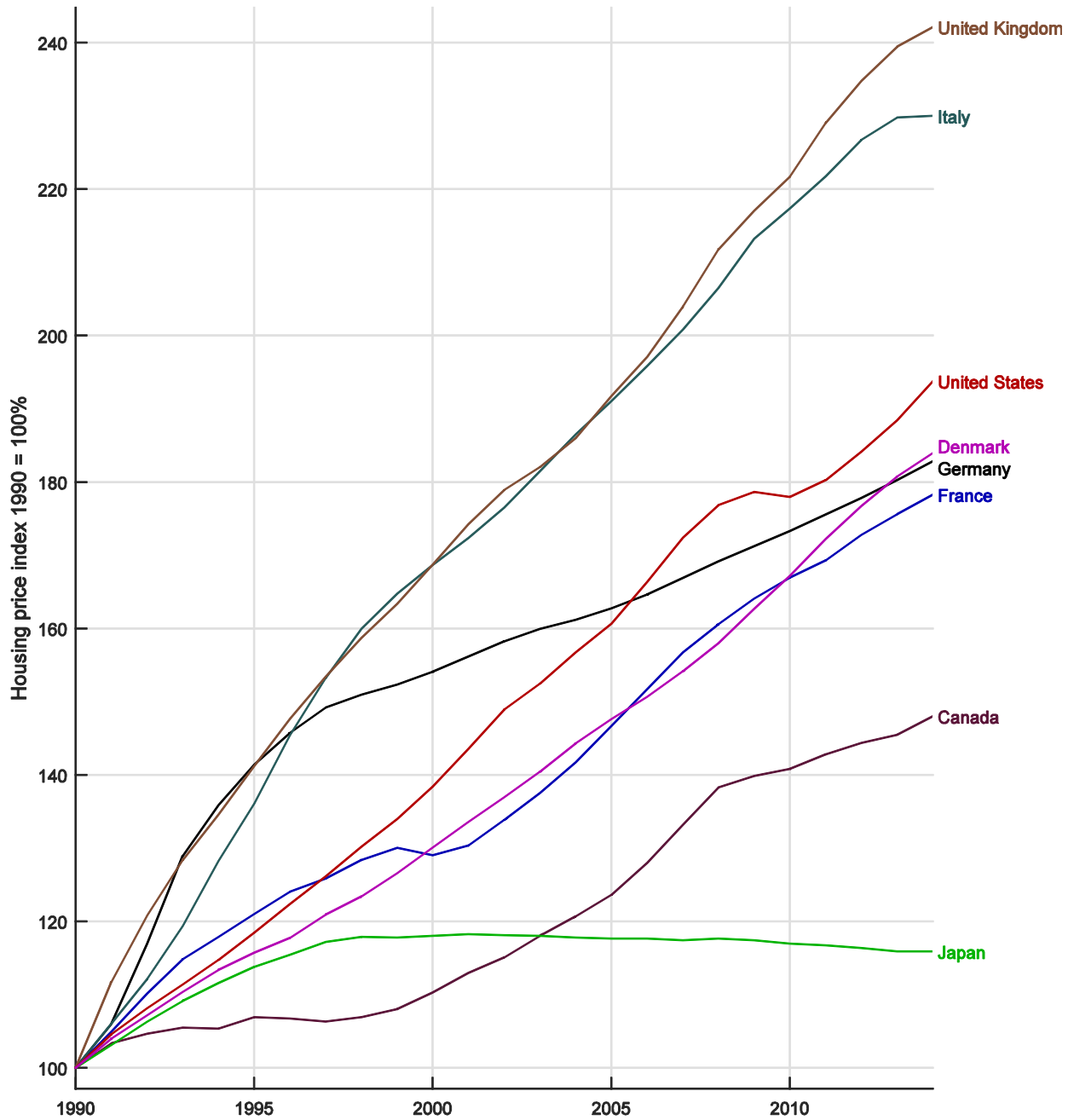
Source: Table 5 recalculated to 1990 = 100%

Figure 5: Consumer price index 1990 = 100%

Table 6: Housing price indices 2010 = 100% (visualized in Figure 6)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	71	59.9	57.7	46	85.5	45.1	56.2	59.8
1991	73.4	62.9	61.2	48.8	88.2	50.4	58.8	62.2
1992	74.3	66	67.5	51.6	90.9	54.5	60.8	64.1
1993	74.9	68.8	74.4	54.9	93.3	57.9	62.6	66
1994	74.8	70.6	78.4	59	95.4	60.7	64.5	67.8
1995	75.9	72.5	81.6	62.6	97.3	63.7	66.6	69.2
1996	75.8	74.3	84.1	66.9	98.7	66.6	68.8	70.4
1997	75.5	75.4	86.1	70.5	100.2	69.2	70.9	72.3
1998	75.9	76.9	87.1	73.6	100.8	71.6	73.2	73.8
1999	76.7	77.9	87.9	75.8	100.7	73.7	75.3	75.7
2000	78.3	77.3	88.9	77.6	100.9	76.1	77.8	77.8
2001	80.2	78.1	90.1	79.3	101.1	78.6	80.7	79.9
2002	81.7	80.2	91.3	81.2	101	80.7	83.7	81.9
2003	83.8	82.4	92.3	83.5	100.9	82.1	85.7	84
2004	85.7	84.9	93	85.8	100.7	83.9	88.1	86.3
2005	87.8	87.9	93.9	87.9	100.6	86.5	90.3	88.3
2006	90.9	90.9	95	90.1	100.6	88.9	93.5	90.1
2007	94.6	93.9	96.3	92.4	100.4	92	96.9	92.2
2008	98.2	96.2	97.6	95	100.6	95.5	99.4	94.5
2009	99.3	98.3	98.8	98.1	100.4	97.9	100.4	97.3
2010	100	100	100	100	100	100	100	100
2011	101.4	101.4	101.3	102	99.8	103.3	101.3	103
2012	102.5	103.5	102.6	104.3	99.5	105.9	103.5	105.7
2013	103.3	105.2	104	105.7	99.1	108	105.9	108.1
2014	105.1	106.8	105.5	105.8	99.1	109.2	108.9	110

Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Prices and Purchasing Power Parties > Consumer and Producer Price Indices > Consumer Prices > Consumer price indices > Customize > Selection > Subject: (a) Consumer prices – housing, (b) Consumer prices – housing excluding imputed rent; Time and frequency: annual; Measure: index.
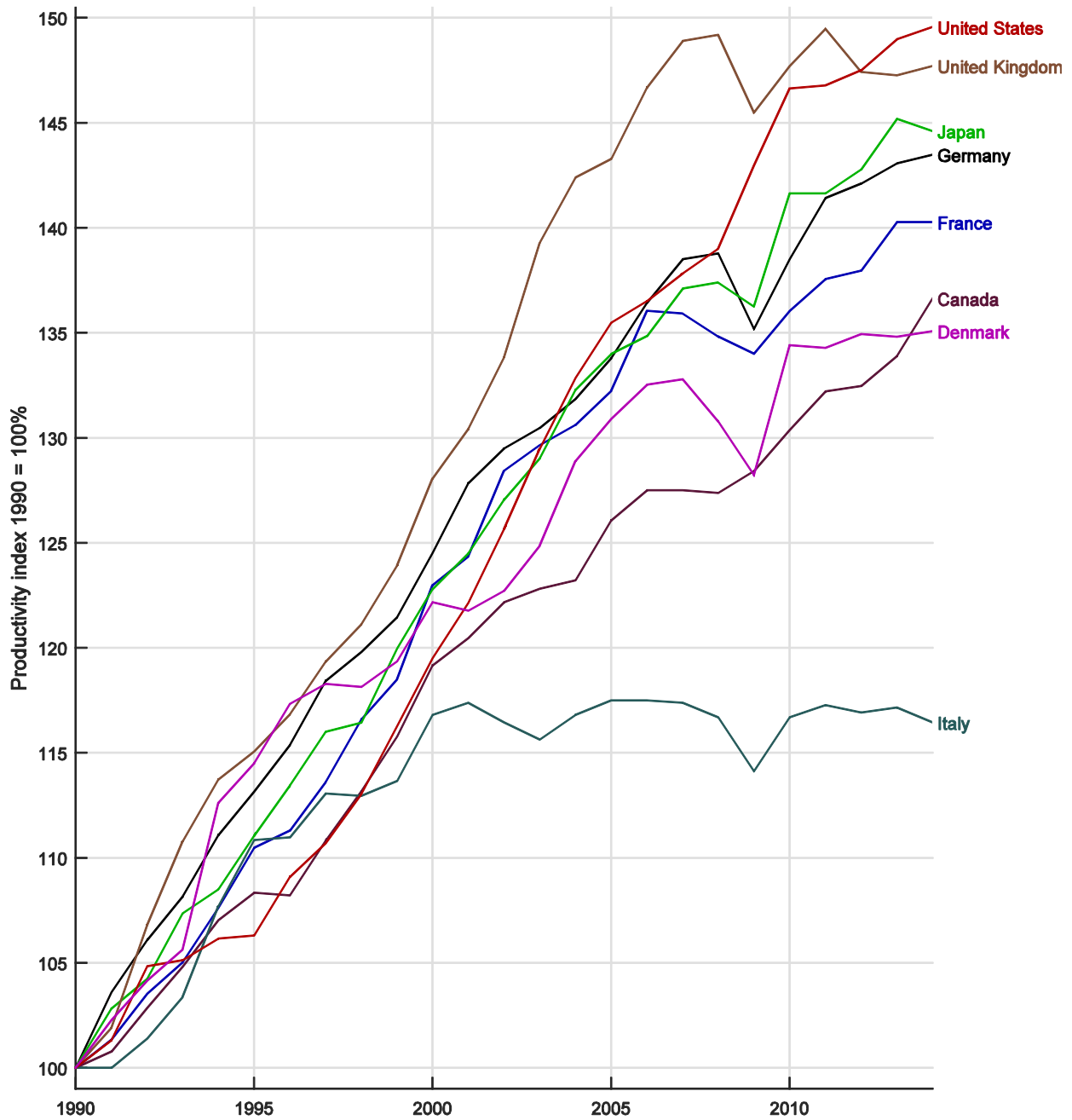
Source: Table 6 recalculated to 1990 = 100%

Figure 6: Housing price indices 1990 = 100%

Table 7: Productivity indices 2010 = 100% (visualized in Figure 7)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	76.7	73.5	72.2	85.7	70.6	67.7	68.2	74.4
1991	77.3	74.5	74.8	85.7	72.6	69	69.1	76.1
1992	78.9	76.1	76.6	86.9	73.6	72.3	71.5	77.5
1993	80.4	77.2	78.1	88.6	75.8	75	71.7	78.6
1994	82.1	79.1	80.2	92.3	76.6	77	72.4	83.8
1995	83.1	81.2	81.7	95	78.4	77.9	72.5	85.2
1996	83	81.8	83.3	95.1	80.1	79.1	74.4	87.3
1997	85	83.5	85.5	96.9	81.9	80.8	75.5	88
1998	86.8	85.7	86.5	96.8	82.2	82	77.1	87.9
1999	88.8	87.1	87.7	97.4	84.7	83.9	79.3	88.8
2000	91.4	90.4	89.9	100.1	86.7	86.7	81.5	90.9
2001	92.4	91.4	92.3	100.6	87.9	88.3	83.3	90.6
2002	93.7	94.4	93.5	99.8	89.7	90.6	85.7	91.3
2003	94.2	95.3	94.2	99.1	91.1	94.3	88.3	92.9
2004	94.5	96	95.2	100.1	93.4	96.4	90.6	95.9
2005	96.7	97.2	96.6	100.7	94.6	97	92.4	97.4
2006	97.8	100	98.5	100.7	95.2	99.3	93.1	98.6
2007	97.8	99.9	100	100.6	96.8	100.8	94	98.8
2008	97.7	99.1	100.2	100	97	101	94.8	97.3
2009	98.5	98.5	97.6	97.8	96.2	98.5	97.5	95.4
2010	100	100	100	100	100	100	100	100
2011	101.4	101.1	102.1	100.5	100	101.2	100.1	99.9
2012	101.6	101.4	102.6	100.2	100.8	99.8	100.6	100.4
2013	102.7	103.1	103.3	100.4	102.5	99.7	101.6	100.3
2014	104.8	103.1	103.6	99.8	102.1	100	102	100.5

Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Productivity > Productivity and ULC – Annual, Total Economy > Growth in GDP per capita, productivity and ULC > Customize > Subject: GDP per hour worked, constant prices; Measure: index.
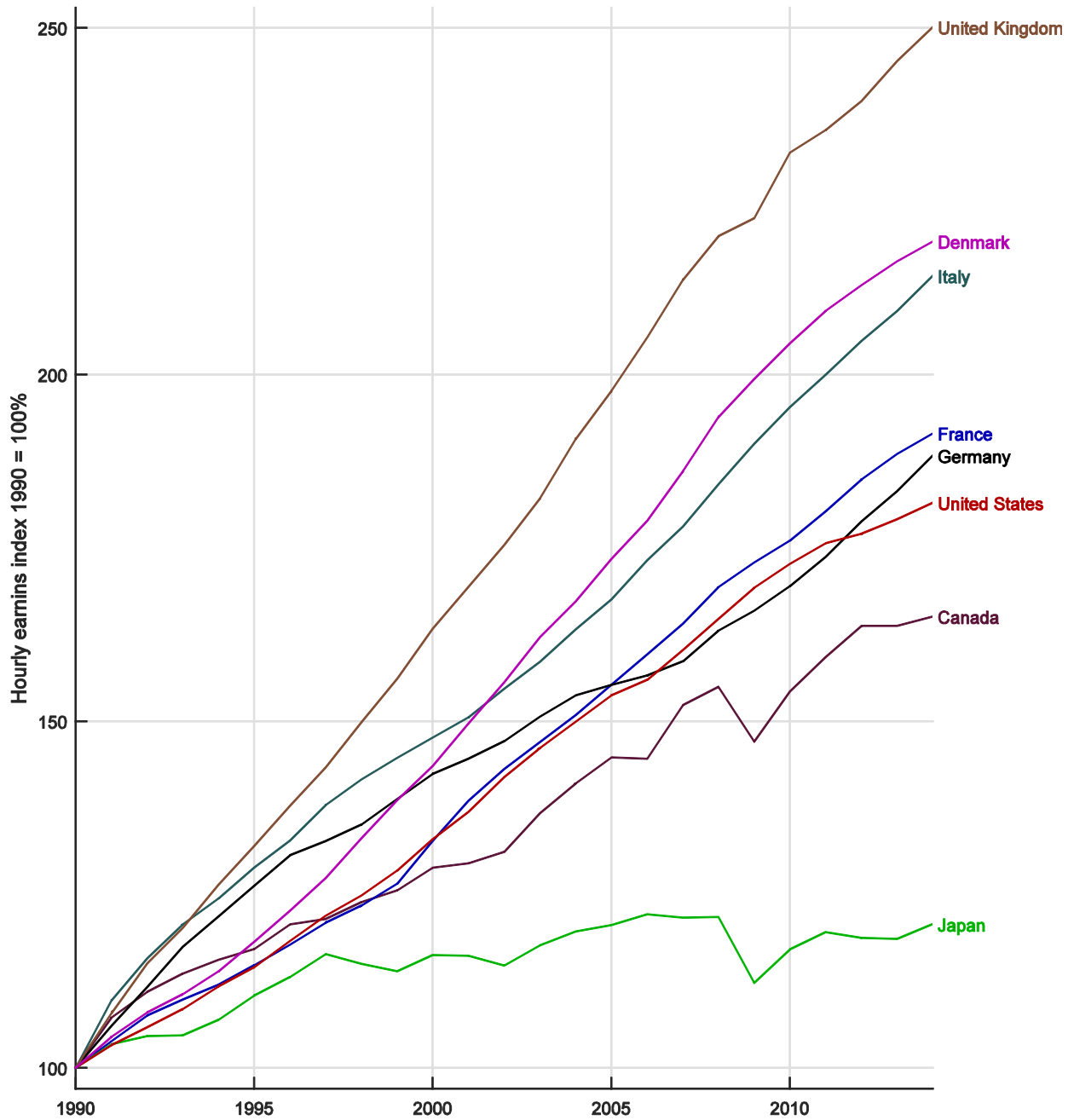
Source: Table 7 recalculated to 1990 = 100%

Figure 7: Productivity indices 1990 = 100%

Table 8: Hourly earnings in manufacturing indices 2010 = 100% (visualized in Figures 8–9)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	64.8	56.8	59	51.2	85.4	43.1	57.9	48.9
1991	69.5	59	62.6	56.2	88.3	46.5	59.8	51.1
1992	71.9	61.1	65.9	59.3	89.3	49.6	61.3	52.8
1993	73.6	62.4	69.3	61.8	89.4	51.8	62.8	54.1
1994	74.9	63.6	71.9	63.7	91.3	54.5	64.7	55.7
1995	75.9	65.2	74.5	66	94.3	56.9	66.3	57.8
1996	78.2	66.9	77.1	68	96.6	59.4	68.5	60
1997	78.7	68.7	78.3	70.6	99.4	61.8	70.6	62.3
1998	80.3	70.1	79.7	72.5	98.2	64.6	72.3	65.1
1999	81.4	71.9	81.9	74.1	97.3	67.3	74.4	67.8
2000	83.5	75.4	84	75.6	99.3	70.4	77	70.2
2001	83.9	78.7	85.3	77.1	99.2	73	79.3	73.2
2002	85	81.3	86.8	79.2	98	75.6	82.2	76.1
2003	88.6	83.5	88.9	81.2	100.5	78.5	84.6	79.3
2004	91.4	85.7	90.7	83.6	102.2	82.2	86.8	81.8
2005	93.8	88.2	91.6	85.8	103	85.2	89	84.8
2006	93.7	90.7	92.4	88.7	104.3	88.5	90.3	87.5
2007	98.7	93.2	93.6	91.2	103.9	92.1	92.8	91
2008	100.4	96.2	96.2	94.3	104	94.8	95.4	94.8
2009	95.3	98.2	97.9	97.3	95.9	95.9	98	97.5
2010	100	100	100	100	100	100	100	100
2011	103.2	102.4	102.5	102.4	102.1	101.4	101.7	102.3
2012	106.1	105	105.5	104.9	101.4	103.2	102.5	104.1
2013	106.1	107.1	108.1	107.1	101.3	105.7	103.7	105.8
2014	107	108.8	111.1	109.7	103.1	107.8	105.1	107.2

Source*: OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Labour > Earnings > Hourly earnings (MEI) > Customize > Selection > Subject: manufacturing, index; Time and frequency: annual.
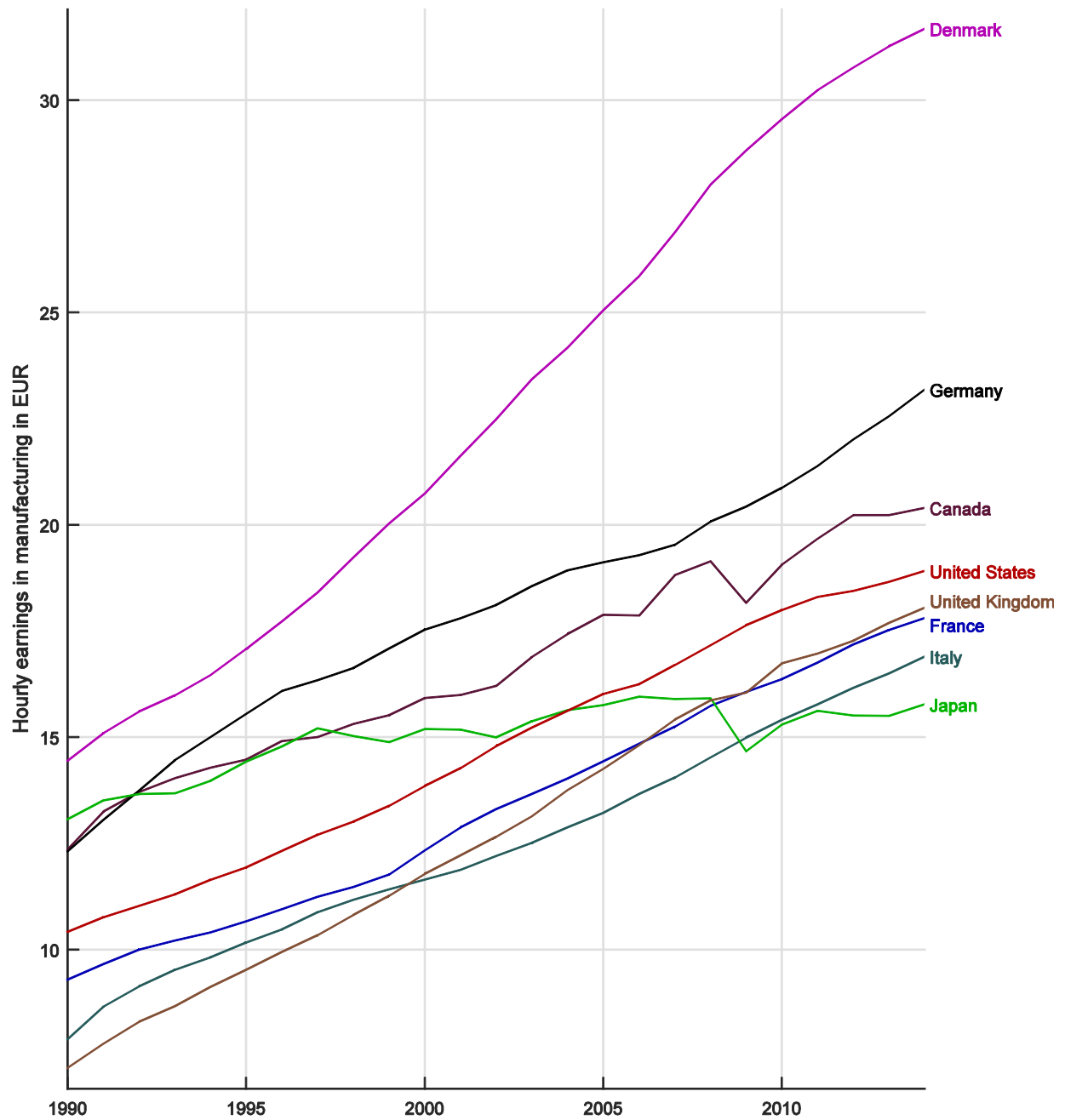
Source: Table 8 recalculated to 1990 = 100%

Figure 8: Hourly earnings in manufacturing indices 1990 = 100%

Table 9: Hourly earnings in manufacturing in USD and EUR in 2011 (visualized in Figure 9)
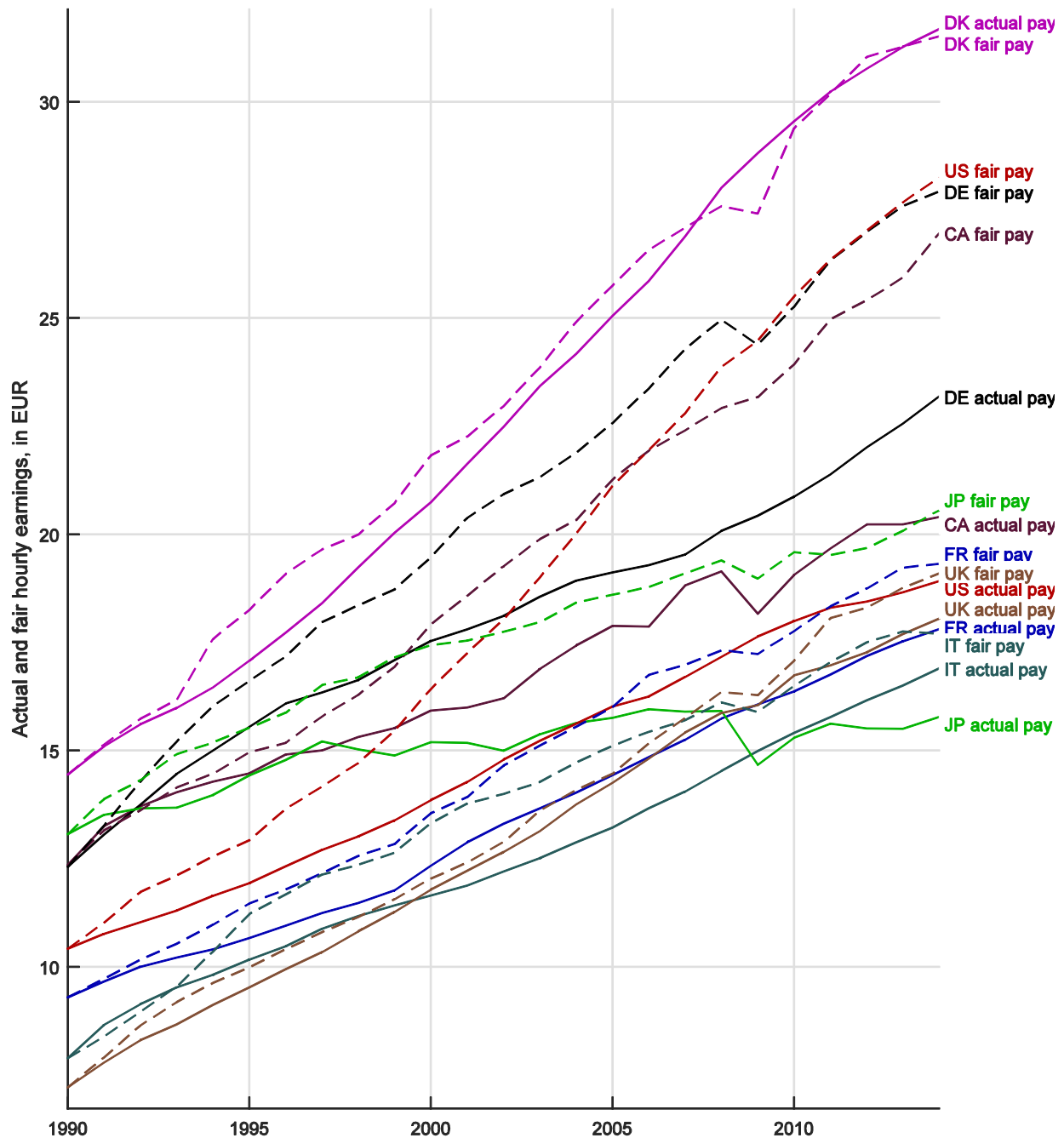
Country	Hourly earnings in manufacturing in 2011, USD	Hourly earnings in manufacturing in 2011, EUR
Canada	25.48	19.68
France	21.70	16.76
Germany	27.70	21.39
Italy	20.43	15.78
Japan	20.23	15.62
United Kingdom	21.98	16.97
United States	23.70	18.30
Denmark	39.15	30.23

Source: (Bureau of Labor Statistics, US Department of Labor 19.12.2012*) International Comparisons of Hourly Compensation Costs in Manufacturing, 2011*, p. 10, Table 3, last column http://www.bls.gov/news.release/pdf/ichcc.pdf; the USD–EUR conversion rate 0.77220 for 31.12.2011 is from (OANDA 2015) http://www.oanda.com/currency/converter/.
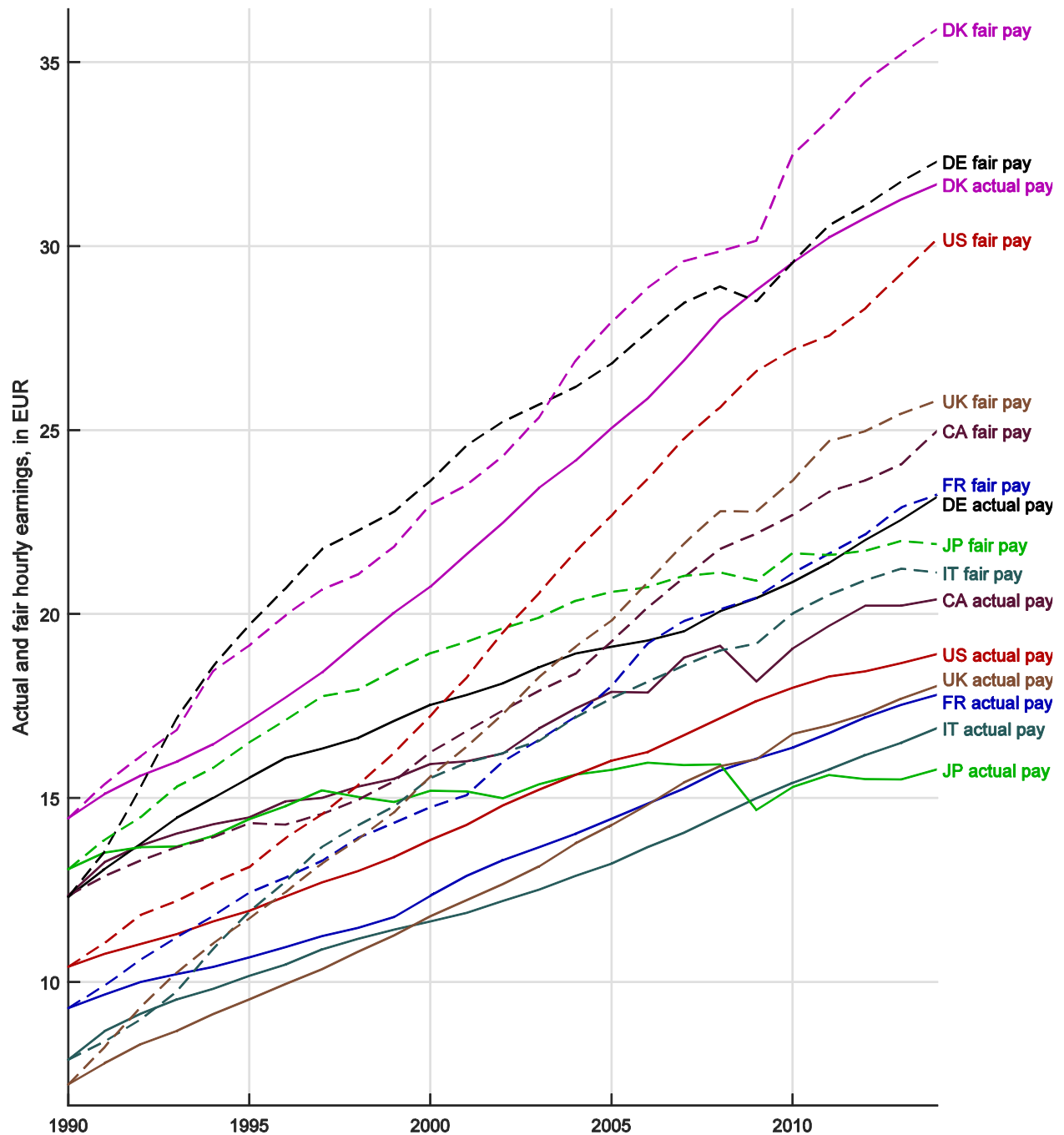
Source: Author's derivation from Tables 8 and 9

Figure 9: Hourly earnings in manufacturing, in EUR

Source: Author's computations based on the variables previously defined, taking into account the 2011 hourly earnings in manufacturing as given in (Bureau of Labor Statistics, U.S. Department of Labor 19.12.2012*) International Comparisons of Hourly Compensation Costs in Manufacturing, 2011*, p. 10, Table 3, last column http://www.bls.gov/news.release/pdf/ichcc.pdf; and the USD–EUR rate 0.77220 on 31.12.2011 as given by (OANDA 2015) http://www.oanda.com/currency/converter/.

Figure 10: Actual pay in manufacturing (solid lines) and fair pay (dashed lines) understood as having the same labor–labor exchange rate with reference to consumer prices as in 1990

Source: Author's computations based on the variables previously defined, taking into account the 2011 hourly earnings in manufacturing as given in (Bureau of Labor Statistics, U.S. Department of Labor 19.12.2012) *International Comparisons of Hourly Compensation Costs in Manufacturing, 2011*, p. 10, Table 3, last column http://www.bls.gov/news.release/pdf/ichcc.pdf; and the USD–EUR rate 0.77220 on 31.12.2011 as given by (OANDA 2015) http://www.oanda.com/currency/converter/.

Figure 11: Actual pay in manufacturing (solid lines) and fair pay (dashed lines) understood as having the same labor–labor exchange rate with reference to housing prices as in 1990

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Table 10a: Gini coefficients for market income before taxes and transfers (dashed lines in Figure 4)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	0.403		0.429			0.49		0.396
1991	0.423			0.402				
1992	0.429							
1993	0.43							
1994	0.432					0.507		
1995	0.43		0.459	0.467	0.403		0.477	0.417
1996	0.439	0.473						
1997	0.439							
1998	0.446							
1999	0.438					0.506		
2000	0.44	0.49	0.471	0.475	0.432	0.512	0.476	0.416
2001	0.442					0.503		
2002	0.441					0.499		
2003	0.439				0.443	0.502		
2004	0.443		0.499	0.512		0.5		
2005	0.436	0.485				0.503	0.486	0.416
2006	0.436				0.462	0.503		0.415
2007	0.436					0.504		0.414
2008	0.438	0.483	0.494	0.491		0.508	0.486	0.405
2009	0.444	0.493	0.493	0.496	0.488	0.519	0.499	0.408
2010	0.447	0.505	0.492	0.507		0.523	0.499	0.429
2011	0.438	0.512	0.506	0.502			0.508	0.431
2012				0.509			0.506	

Table 10b: Gini coefficients for disposable income post taxes and transfers (solid lines in Figure 4)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	0.287		0.256			0.355	0.349	0.226
1991	0.294			0.279			0.346	0.222
1992	0.292		0.263				0.352	0.222
1993	0.286		0.262				0.369	0.223
1994	0.287		0.268			0.337	0.366	0.216
1995	0.289		0.266	0.327	0.323		0.361	0.215
1996	0.297	0.277	0.26				0.363	0.216
1997	0.301	0.278	0.259				0.364	0.224
1998	0.307	0.276	0.259				0.357	0.224
1999	0.307	0.284	0.259			0.34	0.354	0.228
2000	0.315	0.287	0.264	0.323	0.337	0.352	0.357	0.227
2001	0.317	0.287	0.27			0.34	0.36	
2002	0.318	0.284	0.28			0.335	0.376	
2003	0.316	0.282	0.282		0.321	0.335	0.374	
2004	0.322	0.283	0.285	0.331		0.331	0.36	
2005	0.317	0.288	0.297			0.335	0.38	0.232
2006	0.317	0.293	0.29		0.329	0.339	0.384	0.239
2007	0.318	0.292	0.295			0.341	0.376	0.246
2008	0.321	0.293	0.287	0.317		0.342	0.378	0.242
2009	0.32	0.293	0.288	0.315	0.336	0.345	0.379	0.238
2010	0.319	0.303	0.286	0.321		0.341	0.38	0.252
2011	0.316	0.309	0.293	0.322			0.389	0.253
2012				0.326			0.389	

Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Social protection and well-being > Income distribution and poverty > Customize > Selection > Age group: total population; Definition: current definition; Methodology: income definition until 2011; Measure: (a) Gini (market income, before taxes and transfers); (b) Gini (disposable income, post taxes and transfers);

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