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Devaluation of one's labor in labor–commodities–money–commodities–labor exchange as a cause of inequality growth

by Andranik Tangian

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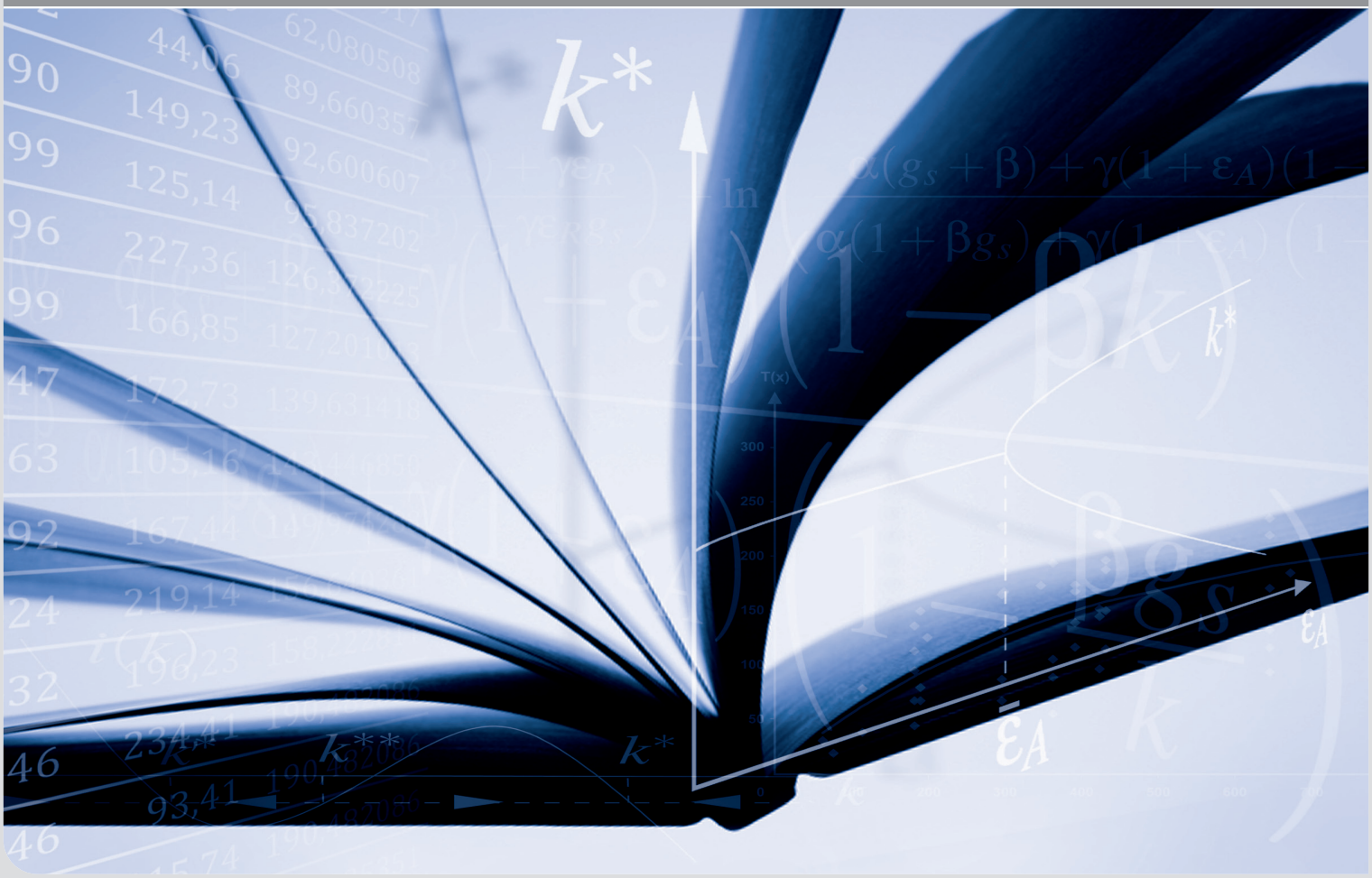

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Andranik Tangian

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E-mail: andranik-tangian@boeckler.de
Tel: +49 211 7778-259
Fax: +49 211 7778-190

Kollegium am Schloss 76128 Karlsruhe Deutschland

Abstract

The inequality growth during the last quarter century is explained as caused by a 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., in a sense 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). Finally, it is shown that the dependence between the degree of inequality and the degree of decline of the labor–labor exchange rate is statistically highly significant.

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

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Contents

Introduction

The Thomas Piketty's (2013) book *Capital in the 21st century,* suggesting a vast overview of the history of wealth accumulation and inequality, made inequality a mainstream topic in economics. One of the book's theses is that the historical accumulation of capital enhances its contribution to general productivity, particularly due to investments in research and development. This implies an increasing role of capital owners and capital managers, explaining a disproportional increase in their income, which implies a significant inequality growth in recent decades. Thereby the increasing inequality, though morally criticized, is indirectly justified economically.

The fact that the rich are becoming more rich much more rapidly than lower classes improve their standing is evidenced for the United States by Paul Krugman:

> 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 1970's. But the income of the richest 1 percent has roughly doubled, and the 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).

The dependence between inequality and capital/labor income shares has been extensively studied by international organizations and numerous scholars, for instance, see 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), Mulas-Granados and Francese (2015), OECD (2008), OECD (2011), ILO (2013), Schlenker and Schmid (2013), Stockhammer (2013). These works confirm the impact of changes of capital/labor income shares on the inequality growth and recognize the ongoing commodification of labor in the sense of Polanyi (1944).

It should be noted that labor develops parallel to technology. Workers are becoming better educated and more advanced technically. They operate complex expensive 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', equalizing its importance to industrial and financial capital. Therefore, the increasing capital's share in gains can hardly be justified even economically. Taking into account advances in labor, the increasing capital income looks as attempts to minimally pay workers just to guarantee the reproduction of labor, which becomes always easier in the background of growing productivity.

In this study, we focus on `circulation of labor' by analogy with Marx' circulation of commodities reflected in his formula "Commodities–Money–Commodities", i.e. `the transformation of commodities into money, and the change of the money back again into commodities' (Marx 1867, Ch. 4). We extend this formula to `Labor–Commodities–Money–Commodities–Labor', i.e. the transformation of one's labor into commodities that are paid

with money, and spending the money to pay the labor of others embodied in the commodities they produce. Skipping the intermediate stages, we focus on the ends of this chain of exchanges and speak about the resulting labor–labor exchange. The aggregate labor is not exchanged 1–1, because the commodities purchased for one's earnings embody also the capital invested in the production, but this is not important for our consideration. Instead, we trace the evolution of the labor–labor exchange with indexing the labor–labor exchange rate. The starting points are the following observations.

Declining labor–labor exchange rate. The car service station charges me with about 40 EUR per hour worked, whereas the worker receives about 20 EUR per hour, meaning that if he decided to repair his car at his own service station he would pay twice more compared with his earnings for the same work. In other words, the return from his labor in the form of others' labor is about 50%. Twenty years ago the service station has charged the clients with the equivalent of 25 EUR/hour while having paid the workers 15 EUR/hour, resulting in the labor return of about 60%. This observation prompts the idea of decreasing labor–labor exchange rate.

Personal computers give an illuminating example of how productivity growth masks the effect described. Thirty years ago a medium salary was hardly sufficient to purchase a personal computer. Now four much better PCs are affordable for a medium salary, creating an illusion of growing value of own labor. In fact, due to technical innovations, the amount of labor embodied in four modern PCs is smaller than that in one PC thirty years ago. This means that the labor return from the labor rewarded with a medium salary did not increase but decreased, contrary to a growing purchase power of a medium salary.

Manifestation of decreasing labor–labor exchange rate: disproportional growth of housing prices. In August 2015, a Norman-French real estate agent told me that now the rich purchase the houses of middle class, the middle class purchase workers' houses, and workers, being unable to afford own housing, stay their whole lives in rented apartments. And the villas of the rich are purchased almost exclusively by superrich foreigners. Or, the houses purchased 40 years ago by middle-class families with one earner, now are affordable for middle-class families with two earners. The fact that the real estate prices grow disproportionally to earnings means that the labor–labor exchange decreases quite rapidly. Indeed, due to relatively little automation, the amount of labor embodied in construction remains almost invariable. Hence, if the labor–labor exchange rate remained constant, the housing prices would rise proportionally to earnings. Therefore, the falling purchasing power of earnings with respect to housing indicates at the falling labor–labor exchange rate. This phenomenon is not clearly seen in most consumer products. Their production is becoming cheaper due to technological advances that progressively reduce the amount of labor required, creating an impression of rising earnings' purchasing power, even when the labor–labor exchange rate decreases.

The objectives of the study are: (1) operationalizing of the notion of labor–labor exchange rate, (2) monitoring its dynamics for G7 countries (Canada, France, Germany, Italy, Japan, United Kingdom, United States) and Denmark (known for its lowest inequality) during the last quarter century with available statistics, and (3) statistically testing the dependence between the degree of inequality in the countries considered and the degree of decline of their labor–labor exchange rate.

Firstly, we show that due to computer-assisted design, automatic lines, and robotics, the share of human labor in manufacturing decreases, reducing production costs and improving the purchasing power of earnings for most consumer products, although not to the extent the productivity grows. Since the amount of human labor in construction remains more or less constant, housing prices are used to monitor the labor–labor exchange rate.

Next, hourly earnings are expressed in housing square meters in the reference year 1990. Proportionally to the productivity growth, the model computes `fair' hourly earnings up to 2014 that is equivalent to the same quantity of housing square meters. For instance, assuming fair (full) pay in 1990, Danish manufacturing workers are `not paid' for about 12% of their working time in 2014, whereas the US manufacturing workers are `not paid' for 37% of their working time in 2014, well in agreement with the inequality trends in both countries.

To link the inequality with the decrease in the labor–labor exchange rate, correlation analysis is applied. We show that the dependence between the Gini coefficient and the percentage of `unpaid' working time is over 0.83, being statistically highly significant.

Finally, we explain that high taxation can retain the labor–labor exchange rate in reasonable limits and thereby to create preconditions to tackle the inequality growth.

Section `Inequality growth' introduces a few inequality measures with which the inequality growth is monitored.

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 basing on statistics for 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 non-paid working time, or underpaid earnings.

Section `Dependence between inequality and labor–labor exchange rate' provides empirical evidence for significant statistical dependence between the degree of inequality and the degree of decrease in the labor–labor exchange rate.

In Section `Conclusions' the results of the paper are recapitulated and put in the context.

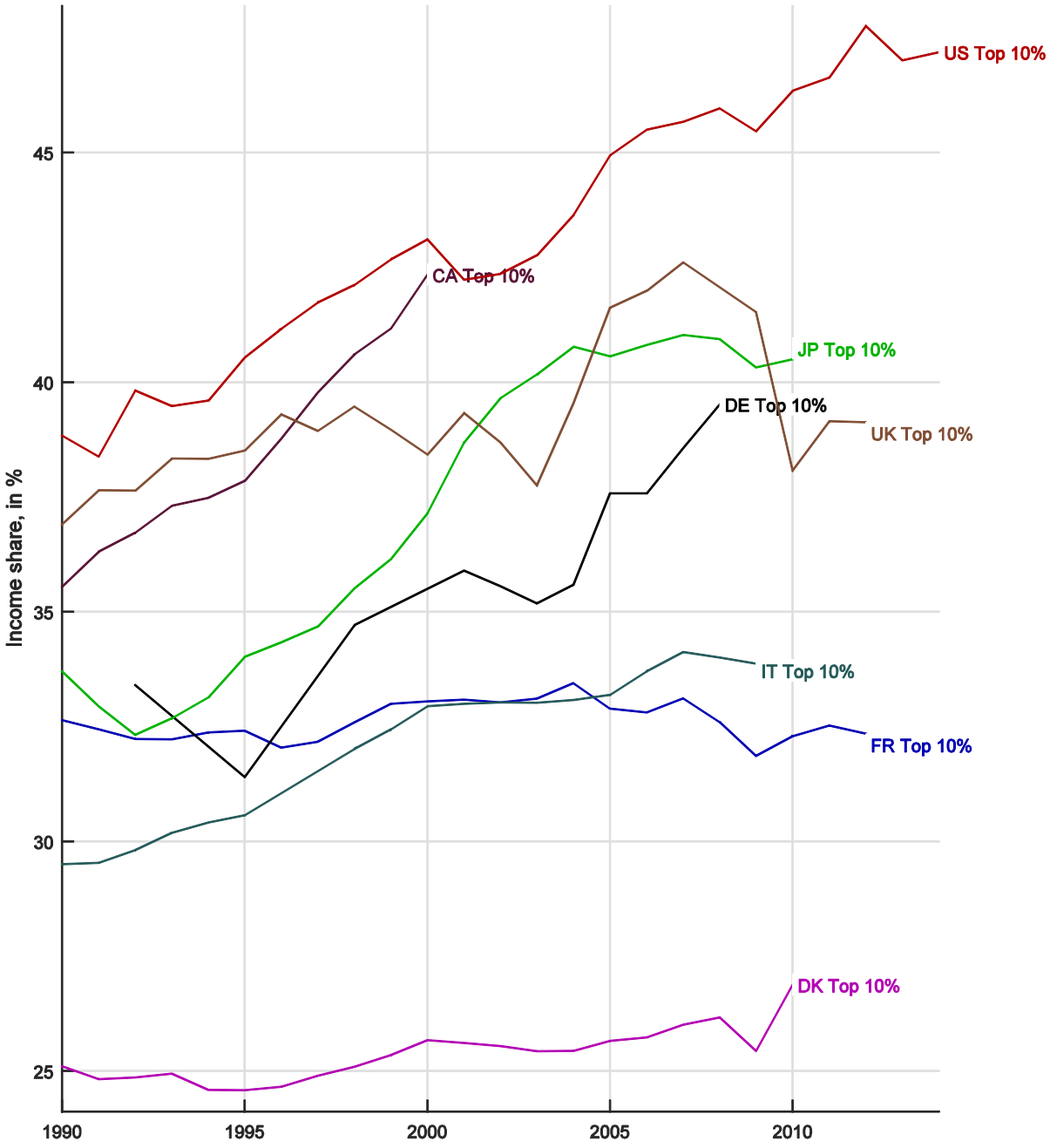
Section `Appendix: Source data and their visualization' contains tables with the data used in the model and figures that illustrate the tables.

Inequality growth

Figures 1–3, visualizing the Appendix' Tables 4–7, illustrate the growing inequality in the G7 countries and Denmark. Figure 1 displays the share of the richest 10% of the population in the total national income. It is the lowest in Denmark, increasing from 25% in 1990 to 27% by 2010, and the highest in the United States, increasing from 39% in 1990 to 47% in 2014. Most of the curves have definitive growing trends, indicating at a disproportional enrichment of this group of top earners.

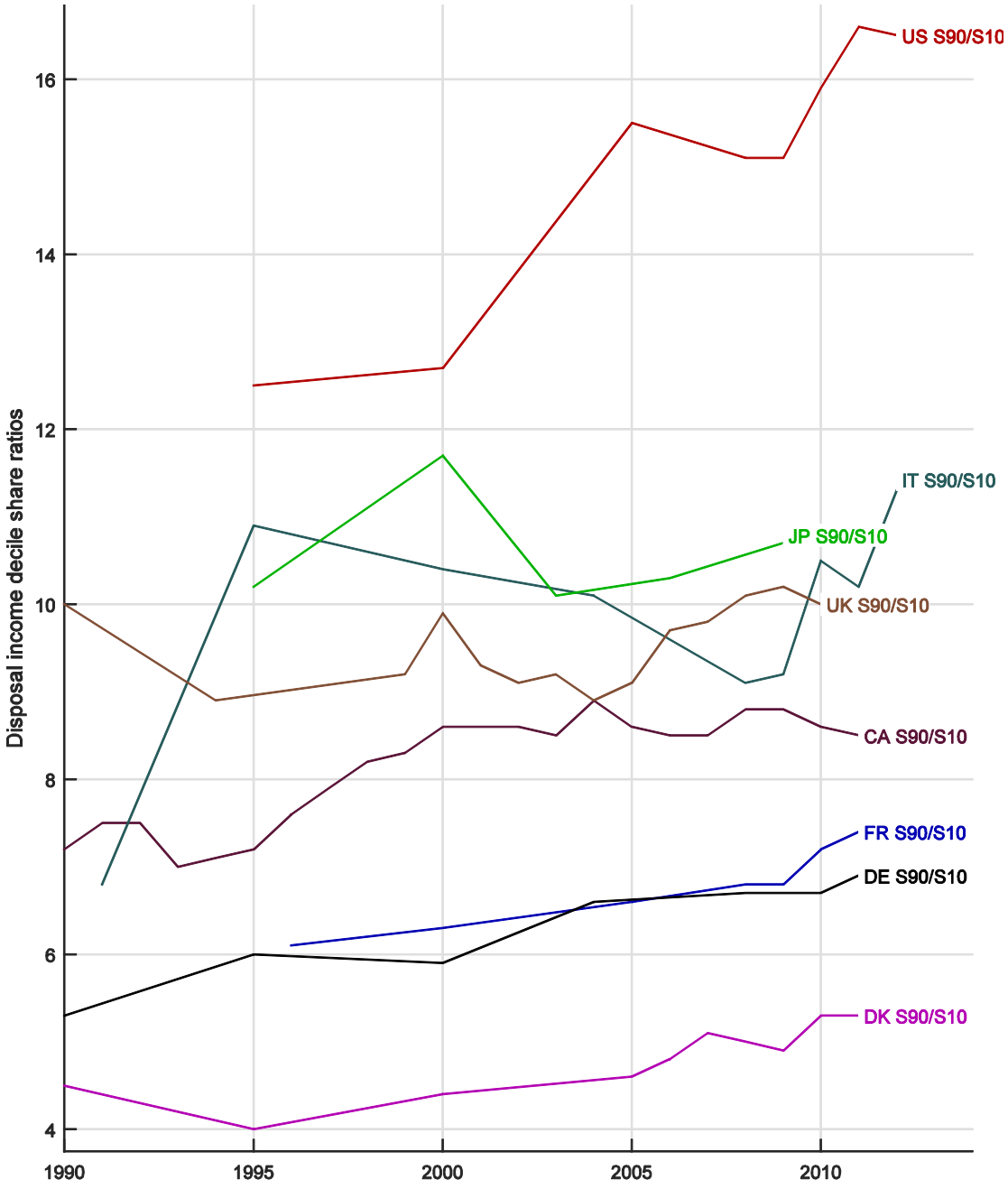
Figure 2 illustrates the relative income difference between the richest 10% and the poorest 10% of the population. Again, this difference is the smallest in Denmark, where the income of the richest 10% is retained about five times higher than that of the poorest 10% during the years 1990–2014. In the United States this ration is increased from 12.5 to 16.5.

Figure 3, which is based on data from Tables 6 and 7, combines the curves for the Gini coefficients for the distributions of income before and post taxes and transfers. The statistical figures are available till 2012, where 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 extent. The Gini coefficient is most used to characterize inequality, and we shall use it as the principal reference.



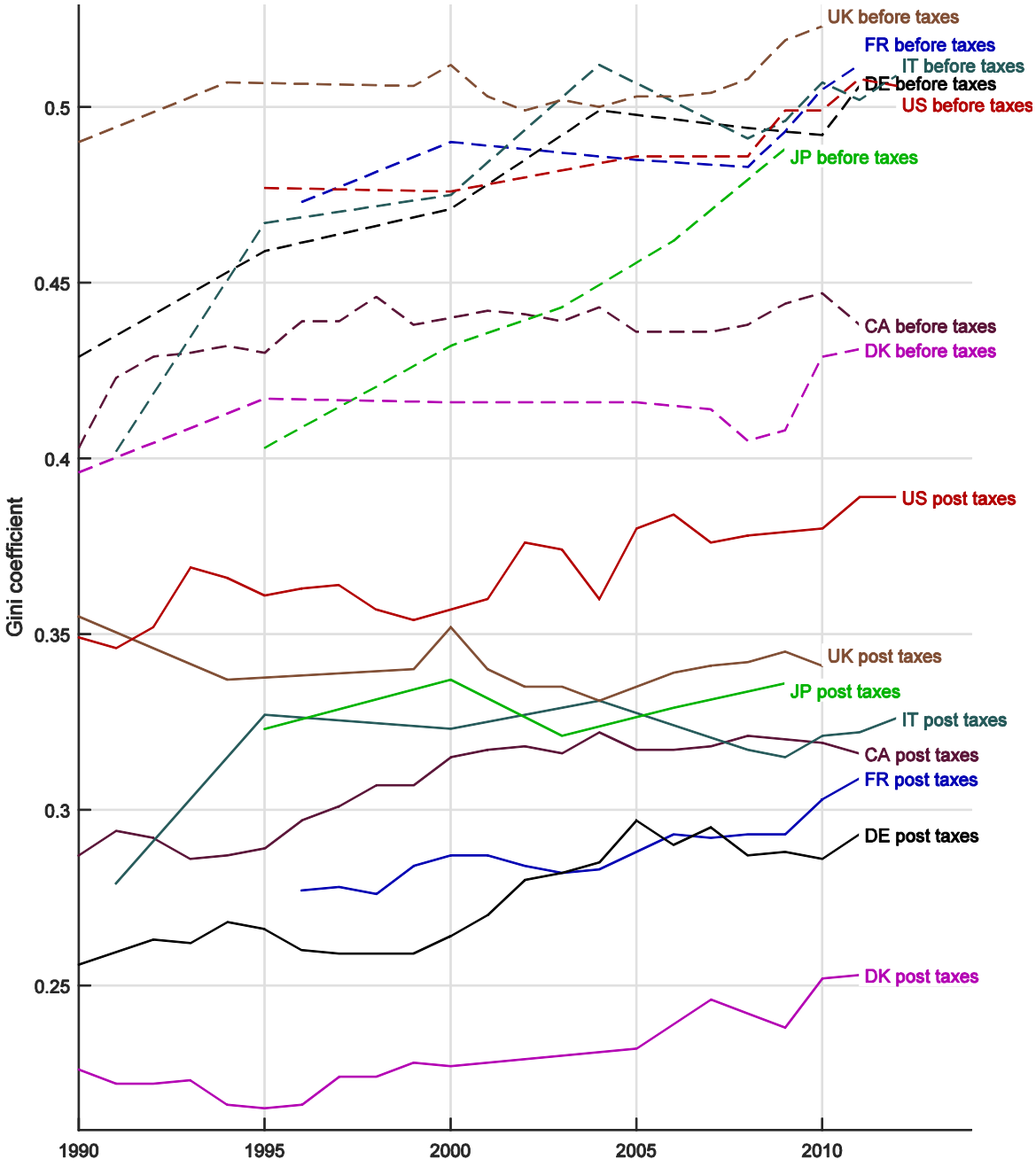
Source: Alvaredo et al. *The World Wealth and Income Database* http://topincomes.g-mond.parisschoolofeconomics.eu/ (10.11.2015) > The Database > Variables: top 10% income share.

Figure 1: The income share of top 10% earners



Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015)> Social protection and Well-Being > Income distribution and poverty > Customize > Selection > Measure: S90/S10 disposable income decile share; Age group: total population; Definition: current definition; Methodology: income definition until 2011.

Figure 2: S90/S10 Disposal income decile share ratios



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

Figure 3: Gini coefficients for market income before taxes and transfers (dashed curves) and for disposable income post taxes and transfers (solid curves)

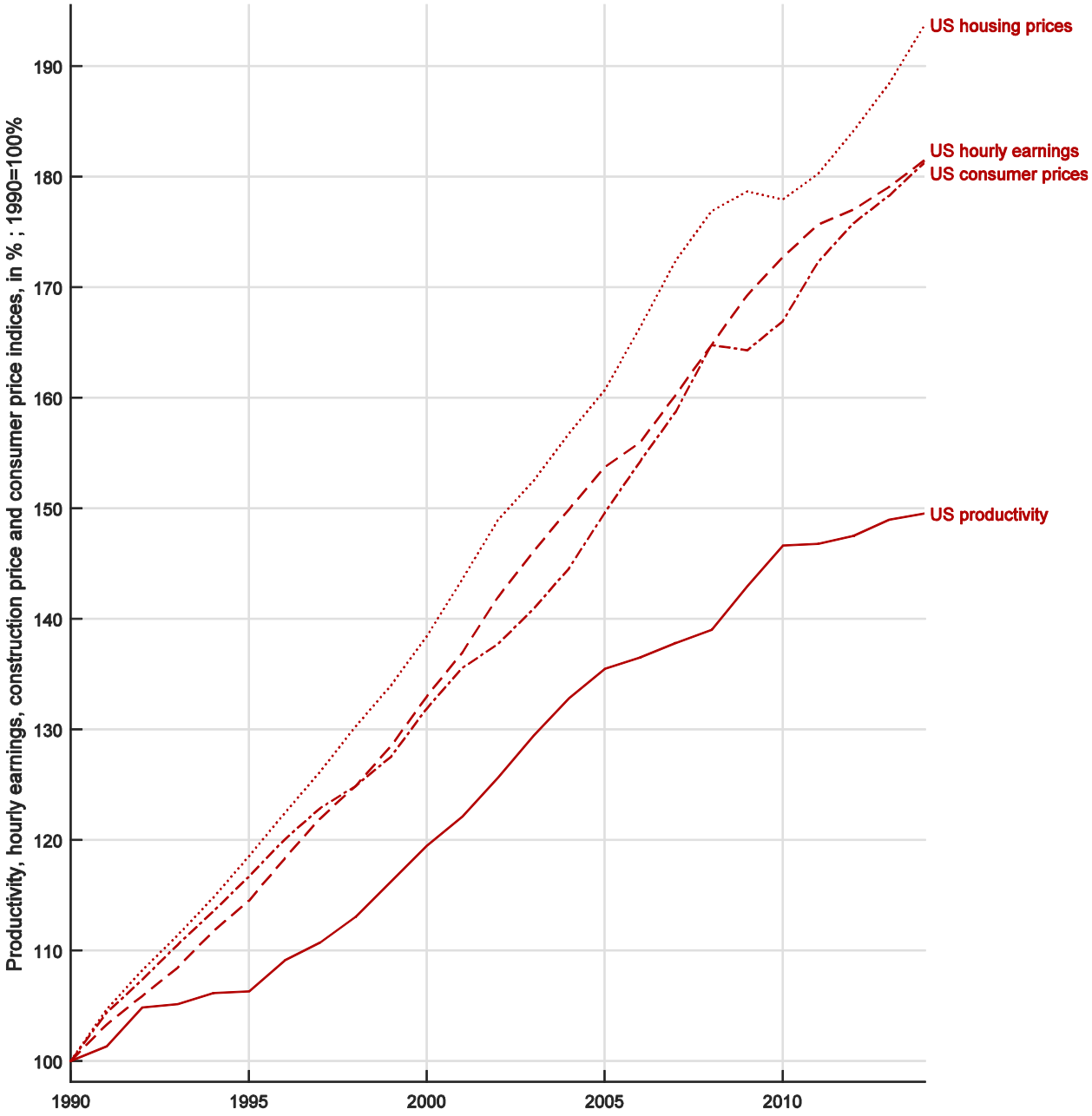
Productivity, earnings, consumer prices and housing prices

To explain our way of thought, let us consider four curves in Figure 4. They display the 1990–2014 US indices of housing prices, hourly earnings in manufacturing (standard reference for earnings), consumer prices and productivity. The price indices are given for current money values, whereas productivity index refers to `constant prices', reflecting the `real', i.e. inflation-adjusted productivity. These US curves are extracted from the Appendix' Figures 9–12. The curves depict the (OECD.Stat 2015) indices 2010=100% in Tables 8 and 10–12 converted to 1990 = 100%. This 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 increase almost synchronically with the factor 1.8, showing that in the last 25 years both the earnings and consumer prices have almost doubled. The synchronous growth of both indices means that the hourly earning's purchasing power remains practically the same over the period considered. Consequently, the US manufacturing workers' living standards improved little during the last quarter century (if there is any improvement then rather due to wealth accumulation than income), which goes in line with Krugman's remark cited in Introduction.

The increase in productivity by factor 1.5 in Figure 4 would suggest a commensurable increase in earnings' purchasing power. The fact that no slightest increase in earnings' purchasing power is observed means that the gains from productivity growth are not distributed among workers. It looks that the productivity growth is attributed exclusively to capital, so that the surplus profit goes exclusively to its owners and managers, aggravating income inequality.

If productivity in construction and in manufacturing were equal, the housing price index in Figure 4 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 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 4.



Source: Derived from *OECD.Stat* http://stats.oecd.org/ (26.11.2015): (1) 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; (2) Labour > Earnings > Hourly earnings (MEI) > Customize > Selection > Subject: manufacturing, index; Time and frequency: annual (3) 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, (c) consumer prices – all items; Time and frequency: annual; Measure: index.

Figure 4: United States indices of productivity (solid curve), hourly earnings in manufacturing (dashed curve), housing prices (dotted curve) and consumer prices (dash-dotted curve); index 1990 = 100%

Labor–labor exchange rate

Now we introduce the notion of labor–labor exchange, explaining it with an example. Let us assume that in 1990 one worker makes four kettles per hour of work and his colleague — 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, and another worker, who makes four coffee pots per hour, to 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 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 considered as maintaining the labor–labor exchange *status quo*, or fair. If in 2014 each worker can afford for his hourly earnings not four but only three production units, the labor–labor exchange turns to be 8:3 = 2.67:1 deteriorating the *status quo* and considered as 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 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 changes over time, so that we can trace the dynamics of labor–labor exchange rate, referring to productivity and purchasing power of earnings without explicitly referring to money values.

To be more specific, let us come back to Figure 4. As already mentioned, the US productivity growth by factor 1.5 suggests a commensurable increase in the purchasing power of hourly earnings. The fact that the purchasing power with reference to consumer products does not change over 25 years, means that the labor–labor exchange rate (with reference to consumer products) decreased by factor 1.5. Generalizing this train of thought, we obtain the following index of labor–labor exchange rate (LLER) as a function of time *t*:

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

The subscripts 1990 = 1 and 1990 = 100 mean that the indices are referred 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 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 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:

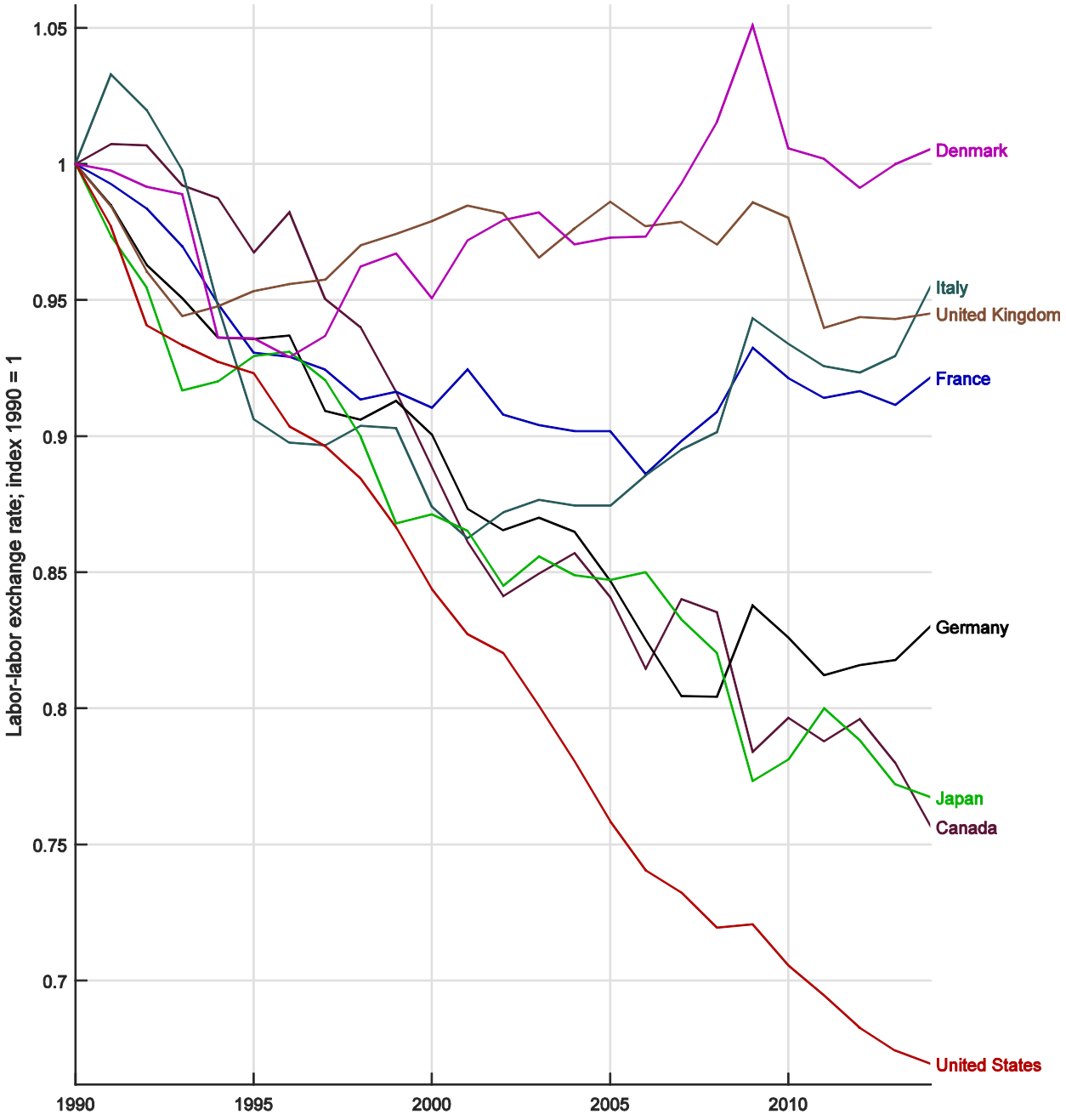
$$\text{LLER with reference to consumer prices}_{1990=1}(t) = \frac{\frac{\text{Hourly earnings}_{1990=100}(t)}{\text{Consumer prices}_{1990=100}(t)}}{\text{Productivity}_{1990=100}(t)}. \qquad (2)$$

This formula is applied to compute the curves in Figure 5 from the data in Tables 8, 10 and 12. 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 5 are more favorable than that of the three non-European countries. The best situation is inherent in Denmark: in 2013 the labor–labor exchange rate returned to its initial 1990 value, with even an increment in 2014. In Italy, United Kingdom and France one's labor has devaluated by 5–8%, whereas in Germany — by 17%. Japan and Canada with their 23% and 24% of labor devaluation, respectively, go 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.

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

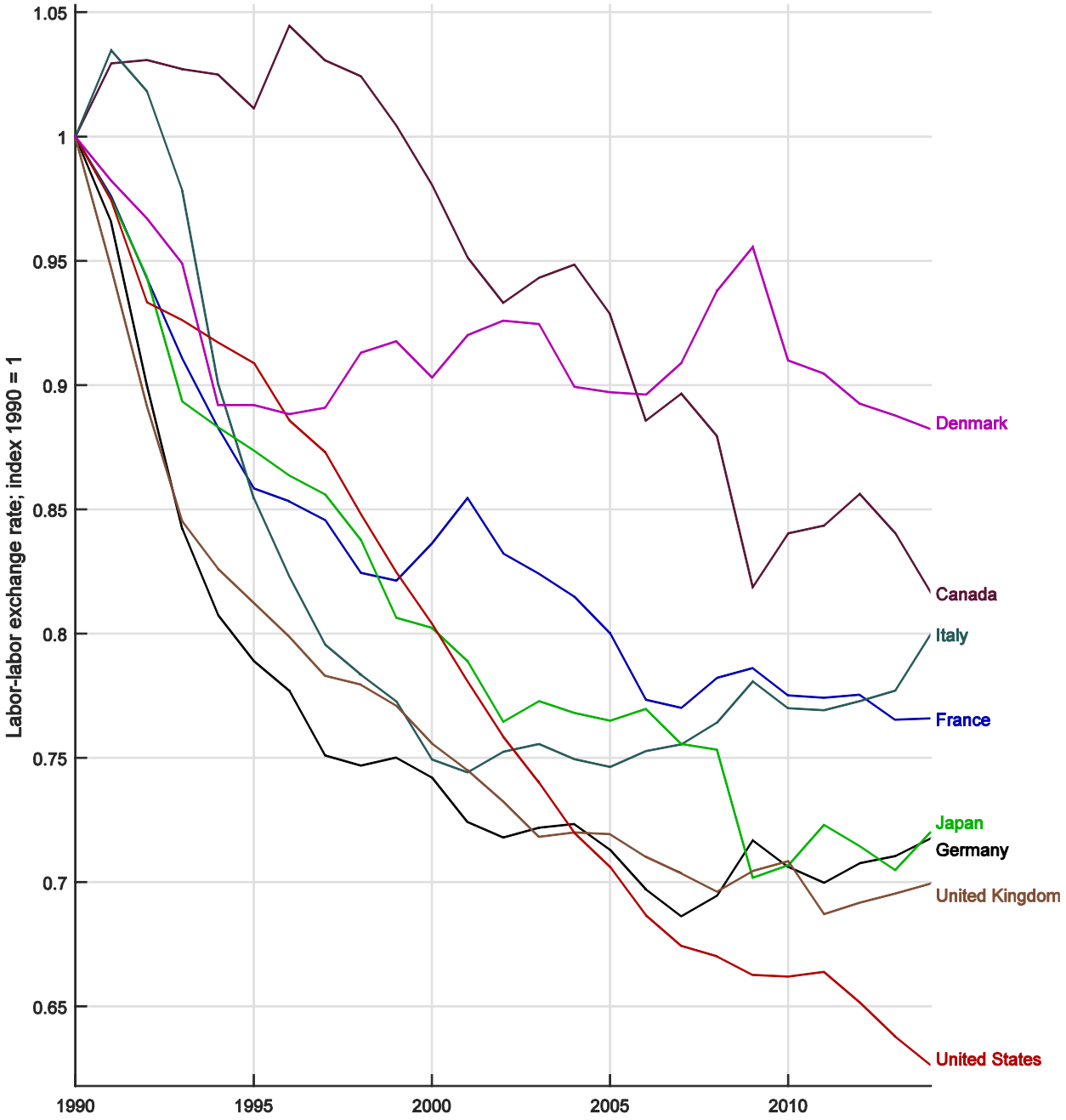
$$\text{LLER w.r.t. housing prices}_{1990=100}(t) = \frac{\text{Hourly earnings in housing units }_{1990=100}(t)}{\text{Productivity}_{1990=100}(t)} = \frac{\frac{\text{Hourly earnings }_{1990=100}(t)}{\text{Housing prices}_{1990=100}(t)}}{\text{Productivity}_{1990=100}(t)}. \quad (3)$$

Figure 6 displays the labor–labor exchange rate with reference to housing prices for the selection of countries and years as in Figure 5. The curves are computed from the data in Tables 8, 11 and 12. 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 hand labor highlight a more dramatic violation of the *status quo* in the labor–labor exchange.



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 Parties > 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 5: Labor–labor exchange rate with reference to consumer prices index 1990 = 1.



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

Interpreting labor–labor exchange rate in terms of pay

A decreasing labor–labor exchange rate means that an increasing fraction of working time is not compensated with 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 the least, attributing productivity gains rather to capital with rewarding its owners and managers more generously. Anyway, if we separate the labor–labor exchange from other factors, we can speak of a deficit of reciprocal labor compensation measured in working time, which we simply call a `non-paid 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 non-paid percentage of working time is the decrease in the labor–labor exchange rate expressed in percent. Since we use two types of references for the labor–labor exchange, we compute the non-paid percentage of working time in two versions

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

and consider their mean as a `more neutral' figure. The results for selected years are shown in Table 1. Like in Figures 5–6, the most favorable situation with the mean 6% of non-paid working time is inherent in Denmark, and the least favorable — in the United States (35%).

Table 1: Non-paid percentage of working time, assuming full pay (100% of working time) in 1990

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

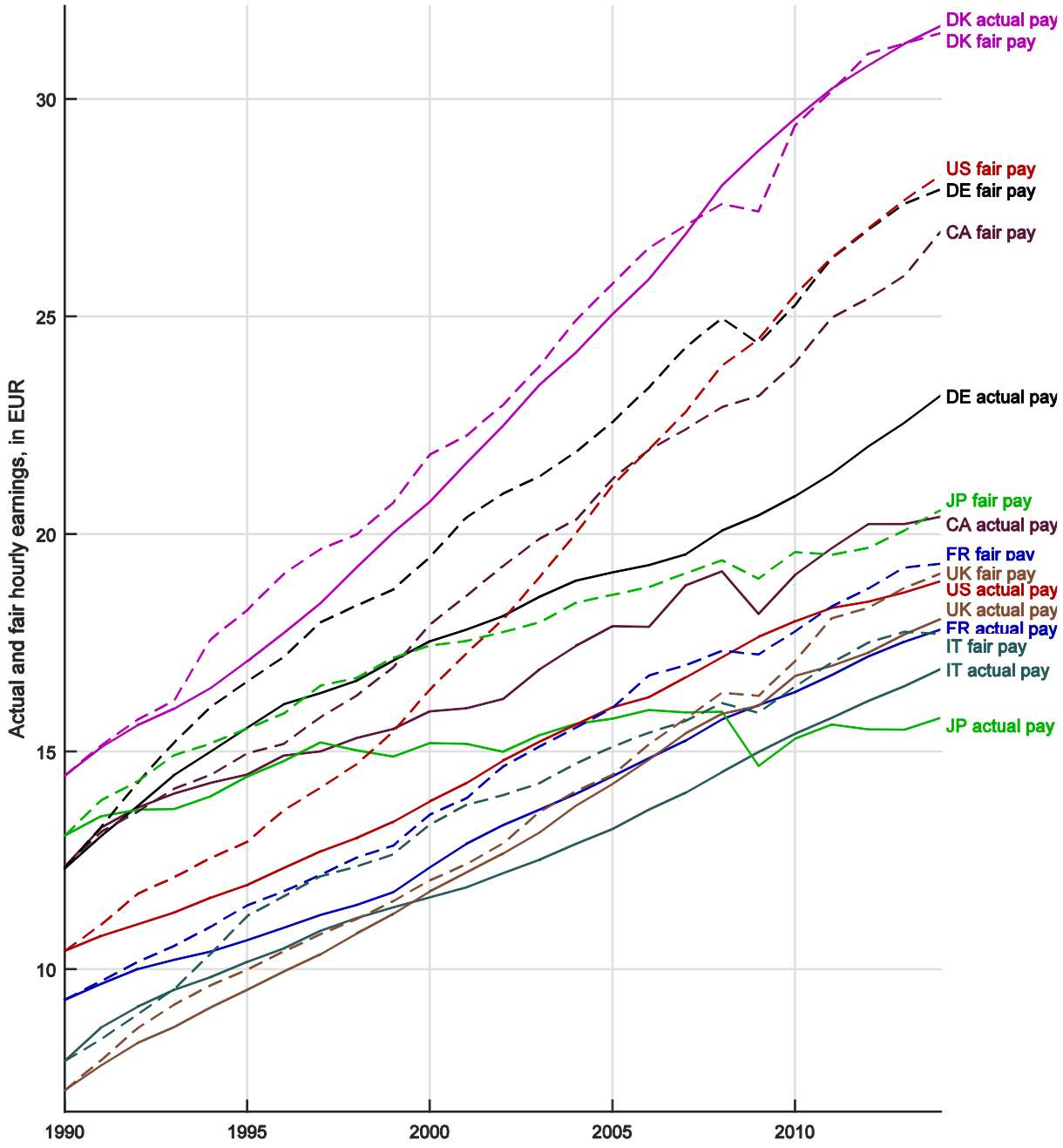
Another way to illustrate the decreasing labor–labor exchange rate is to compute `fair' hourly earnings, that retain the same labor–labor exchange rate as in the *status quo* year 1990, and to compare them with the existing ones.

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 this new indices calculate the actual hourly earnings. Taking into account the percentage of non-paid 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 7–8 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

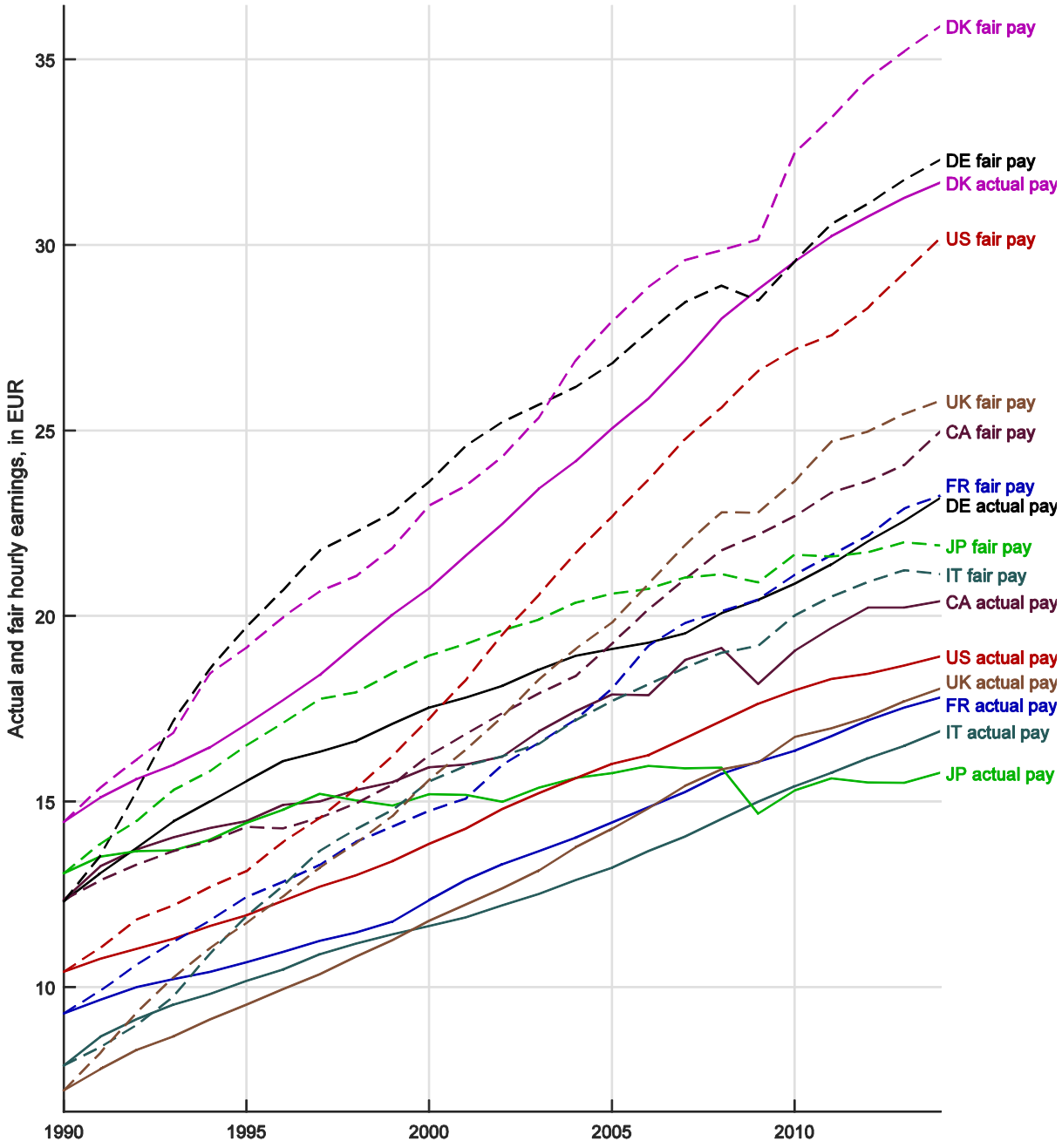
Country	Pay pattern	1990	1995	2000	2005	2010	2014
Canada	**Actual pay**	**12.35**	**14.47**	**15.92**	**17.88**	**19.07**	**20.4**
	Fair pay with reference to consumer prices	12.35	14.96	17.92	21.27	23.93	26.96
	Fair pay with reference to housing prices	12.35	14.31	16.24	19.26	22.69	24.99
France	**Actual pay**	**9.29**	**10.67**	**12.34**	**14.43**	**16.36**	**17.8**
	Fair pay with reference to consumer prices	9.29	11.47	13.55	16	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	19.7	23.62	26.81	29.55	32.3
Italy	**Actual pay**	**7.89**	**10.17**	**11.65**	**13.22**	**15.41**	**16.9**
	Fair pay with reference to consumer prices	7.89	11.22	13.32	15.12	16.5	17.7
	Fair pay with reference to housing prices	7.89	11.9	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	18.6	19.58	20.56
	Fair pay with reference to housing prices	13.07	16.51	18.94	20.6	21.65	21.9
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	25.8
United States	**Actual pay**	**10.42**	**11.93**	**13.86**	**16.02**	**18**	**18.91**
	Fair pay with reference to consumer prices	10.42	12.93	16.42	21.12	25.5	28.25
	Fair pay with reference to housing prices	10.42	13.13	17.24	22.68	27.18	30.2
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

Source: Author's computations based on the variables previously defined and the 2011 hourly earnings in manufacturing in USD 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; converted with the USD--EUR rate 0.77220 on 31.12.2011 (OANDA 2015) http://www.oanda.com/currency/converter/.



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 7: Actual pay in manufacturing (solid curves) and fair pay (dashed curves) 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 8: Actual pay in manufacturing (solid curves) and fair pay (dashed curves) understood as having the same labor–labor exchange rate with reference to housing prices as in 1990

Dependence between inequality and labor–labor exchange rate

Finally, we analyze the dependence between inequality and devaluation of one's labor in labor–labor exchange. For this purpose, we compute correlation coefficients between five variables, each with eight observations (for eight countries) displayed in Table 3.

Table 3: 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**	**Non-paid percentage of working time in 2014 w.r.t. consumer prices assuming full pay in 1990**	**Non-paid percentage 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*
Non-paid percentage of working time in 2014 w.r.t. consumer prices assuming full pay in 1990	0.021	0.660*	0.497	1	0.626*
Non-paid percentage 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

The inequality is represented by two variables: (1) Gini coefficients for market income before taxes and transfers and (2) Gini coefficients for disposal income post taxes and transfers. They are the latest available figures in Tables 6 and 7. For instance, in case of Italy these figures are for 2012, and in case of United Kingdom — for 2010.

The country factors of productivity growth in 1990–2014 are computed from the data in Table 12. They correspond to the curves' right-hand ends in Figure 13. For instance, for the USA this factor is 1.5, and for Denmark 1.35.

The trends in the labor–labor exchange rate are represented by their devaluation coefficients for 2014 assuming 1990 = 1, otherwise interpreted as `Non-paid percentage of working time assuming full pay in 1990'. As previously, we consider two references— consumer prices and housing prices. These both variables are extracted from the last column of Table 1.

The third column of Table 3 shows that both Gini variables are low correlated with productivity growth. This means that though the productivity growth is generally due to investments that increase the capital's share in gains, the productivity alone has a low impact on inequality. The inequality is much more dependent on the unfair remuneration of labor, as follows from the correlation of the Gini variables with the variables `Non-paid percentage of working time', particularly with the one referring to housing prices, where the correlation attains 0.831; see columns 4–5 in Table 3.

It is noteworthy that the correlation with devaluation of labor is higher for the variable `Gini for disposal income post taxes and transfers'. As seen in Figure 3, the reduction of income inequality by taxes and transfers differs considerably among the eight countries considered. The countries that significantly reduce income inequality also have a more favorable labor–labor exchange rate. Indeed, when taxes are high, the hourly earnings post taxes have a limited purchasing power, constraining solvent demand. A reduction of labor–labor exchange rate would reduce it further with negative consequences for marketing. Social security transfers, on the contrary, stimulate demand and thereby sales of products. Roughly speaking, high taxes reduce stimuli to increase the capital's share in gains, even in case of investments, leaving little room for constraining real earnings without negatively affecting marketing on the one hand, and, on the other hand, generous social support of weak population groups from applicable taxes increases solvent demand of the population, supporting economic development. High taxation, thereby, contributes to maintaining a fair labor–labor exchange and thereby reduces the inequality growth. All of these are well seen with the example of Denmark as opposed to that of the United States.

Conclusions

Notion of labor–labor exchange. To study possible sources of inequality growth, the notion of labor–labor exchange rate is introduced. It reflects the returns from one's labor in the form of others' labor embodied in goods and services affordable for one's earnings. As references, we use the aggregate labor embodied in consumer products and in housing.

General decrease in the labor–labor exchange rate. Using statistical data for the G7 countries and Denmark, we provide empirical evidence for a general devaluation of one's labor in the labor–labor exchange. This can be explained by increasing capital shares in gains, which implies an increasing bias in income distribution in favor of capital owners and capital managers.

Dependence between the degree of inequality and the degree of decline of the labor–labor exchange rate. Moreover, the dependence between the *degree* of inequality and the *degree* of labor devaluation is statistically highly significant. Therefore, it is not due to chance that the smallest labor devaluation is inherent in Denmark, where the inequality is the lowest among the countries considered, and that the greatest labor devaluation is inherent in the United States, where the inequality is the highest.

Control over the labor–labor exchange rate with taxes. High taxes, like in Denmark, moderate the motivation to increase the capital share in gains, protecting the labor share from significant reductions, retaining the labor–labor exchange rate. Such a tax policy constrains the inequality growth not only at the expense of top earners. Workers earn more, and the applicable taxes enable generous social transfers reducing the inequality from the side of weak social groups. A general economic effect is enforcing solvent demand and, thereby, stimulating marketing and production.

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Appendix: Source data and their visualization

Table 4: The income share of top 10% earners (visualized in Figure 1)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	35.54	32.64		29.5	33.7	36.9	38.84	25.1
1991	36.31	32.44		29.53	32.94	37.65	38.38	24.82
1992	36.72	32.23	33.4	29.81	32.32	37.64	39.82	24.86
1993	37.31	32.22		30.19	32.68	38.34	39.48	24.94
1994	37.48	32.37		30.41	33.14	38.33	39.6	24.59
1995	37.85	32.41	31.4	30.57	34.02	38.51	40.54	24.58
1996	38.77	32.04			34.33	39.3	41.16	24.66
1997	39.78	32.17			34.68	38.94	41.73	24.9
1998	40.61	32.59	34.71	32.01	35.51	39.47	42.12	25.09
1999	41.17	33		32.44	36.15	38.97	42.67	25.35
2000	42.34	33.05		32.94	37.15	38.43	43.11	25.67
2001		33.09	35.9	33	38.69	39.33	42.23	25.61
2002		33.03	35.56	33.03	39.65	38.69	42.36	25.54
2003		33.11	35.18	33.02	40.17	37.75	42.76	25.43
2004		33.45	35.59	33.08	40.77	39.54	43.64	25.44
2005		32.89	37.58	33.19	40.56	41.62	44.94	25.66
2006		32.81	37.58	33.7	40.81	41.99	45.5	25.73
2007		33.12	38.57	34.12	41.03	42.61	45.67	26.01
2008		32.6	39.52	34	40.94		45.96	26.17
2009		31.86		33.87	40.32	41.53	45.47	25.44
2010		32.29			40.5	38.08	46.35	26.88
2011		32.52				39.15	46.63	
2012		32.34				39.13	47.76	
2013							47.01	
2014							47.19	

Source: Alvaredo et al. *The World Top Incomes Database* http://topincomes.g-mond.parisschoolofeconomics.eu/ (10.11.2015) > The Database > Variables: top 10% income share.

Table 5: Disposal income decile share ratios (visualized in Figure 2)

Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	7.2		5.3			10		4.5
1991	7.5			6.8				
1992	7.5							
1993	7							
1994	7.1					8.9		
1995	7.2		6	10.9	10.2		12.5	4
1996	7.6	6.1						
1997	7.9							
1998	8.2							
1999	8.3					9.2		
2000	8.6	6.3	5.9	10.4	11.7	9.9	12.7	4.4
2001	8.6					9.3		
2002	8.6					9.1		
2003	8.5				10.1	9.2		
2004	8.9		6.6	10.1		8.9		
2005	8.6	6.6				9.1	15.5	4.6
2006	8.5				10.3	9.7		4.8
2007	8.5					9.8		5.1
2008	8.8	6.8	6.7	9.1		10.1	15.1	5
2009	8.8	6.8	6.7	9.2	10.7	10.2	15.1	4.9
2010	8.6	7.2	6.7	10.5		10	15.9	5.3
2011	8.5	7.4	6.9	10.2			16.6	5.3
2012				11.3			16.5	

Source: *OECD.Stat* http://stats.oecd.org/ (26.11.2015) > Social protection and Well-Being > Income distribution and poverty > Customize > Selection > Measure: S90/S10 disposable income decile share; Age group: total population; Definition: current definition; Methodology: income definition until 2011

Table 6: Gini coefficients for market income before taxes and transfers (dashed curves in Figure 3)

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	

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

Table 7: Gini coefficients for disposable income post taxes and transfers (solid curves in Figure 3)

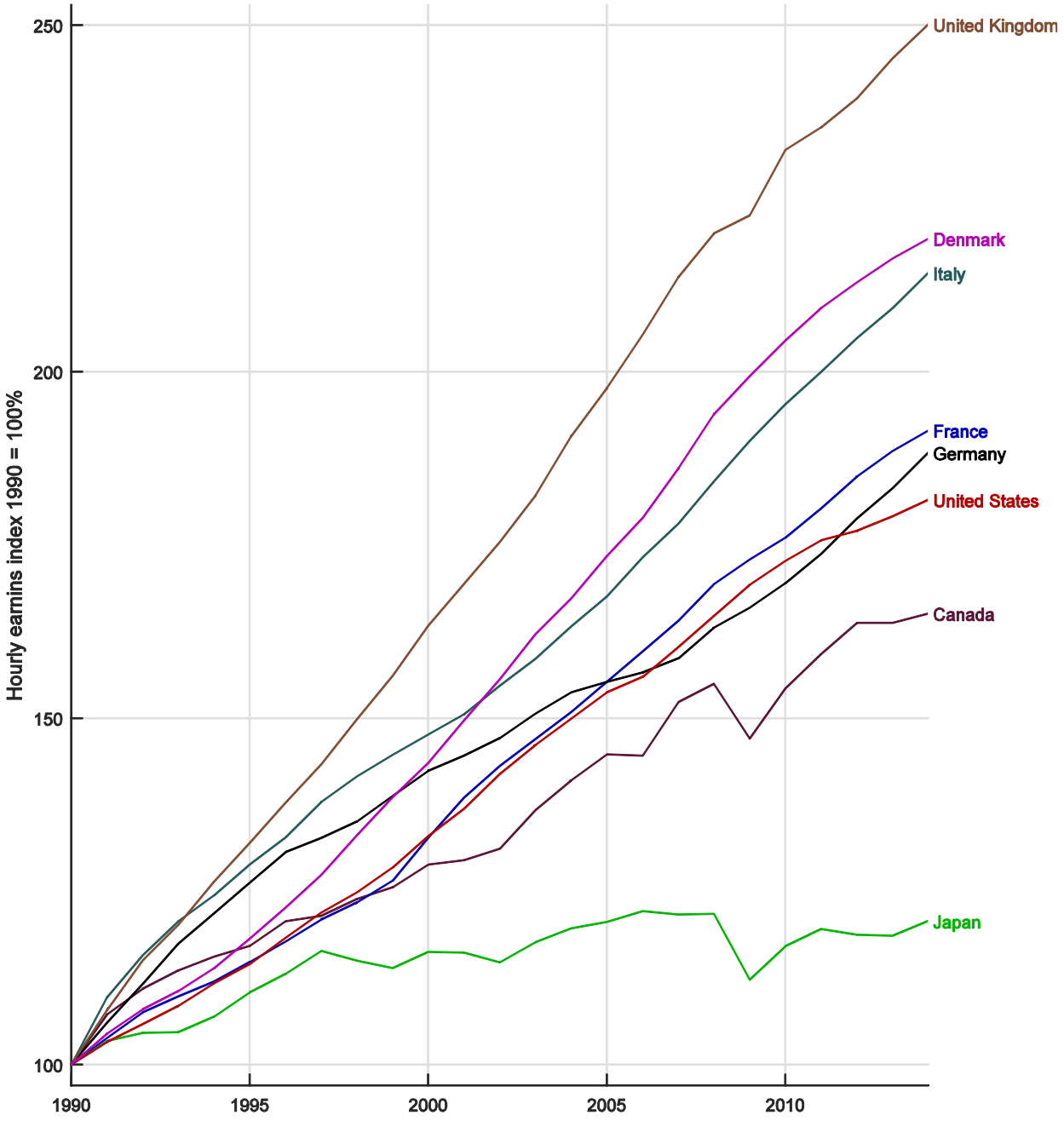
Years	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Denmark
1990	0.287		0.256			0.355	0.349	0.226
1991	0.294			0.279			0.346	0.222
1992	0.292		0.263				0.352	0.222
1993	0.286		0.262				0.369	0.223
1994	0.287		0.268			0.337	0.366	0.216
1995	0.289		0.266	0.327	0.323		0.361	0.215
1996	0.297	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 > Measure: Gini (disposable income, post taxes and transfers); Age group: total population; Definition: current definition; Methodology: income definition until 2011

Table 8: Hourly earnings in manufacturing indices 2010 = 100% (visualized in Figures 9–10)

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.



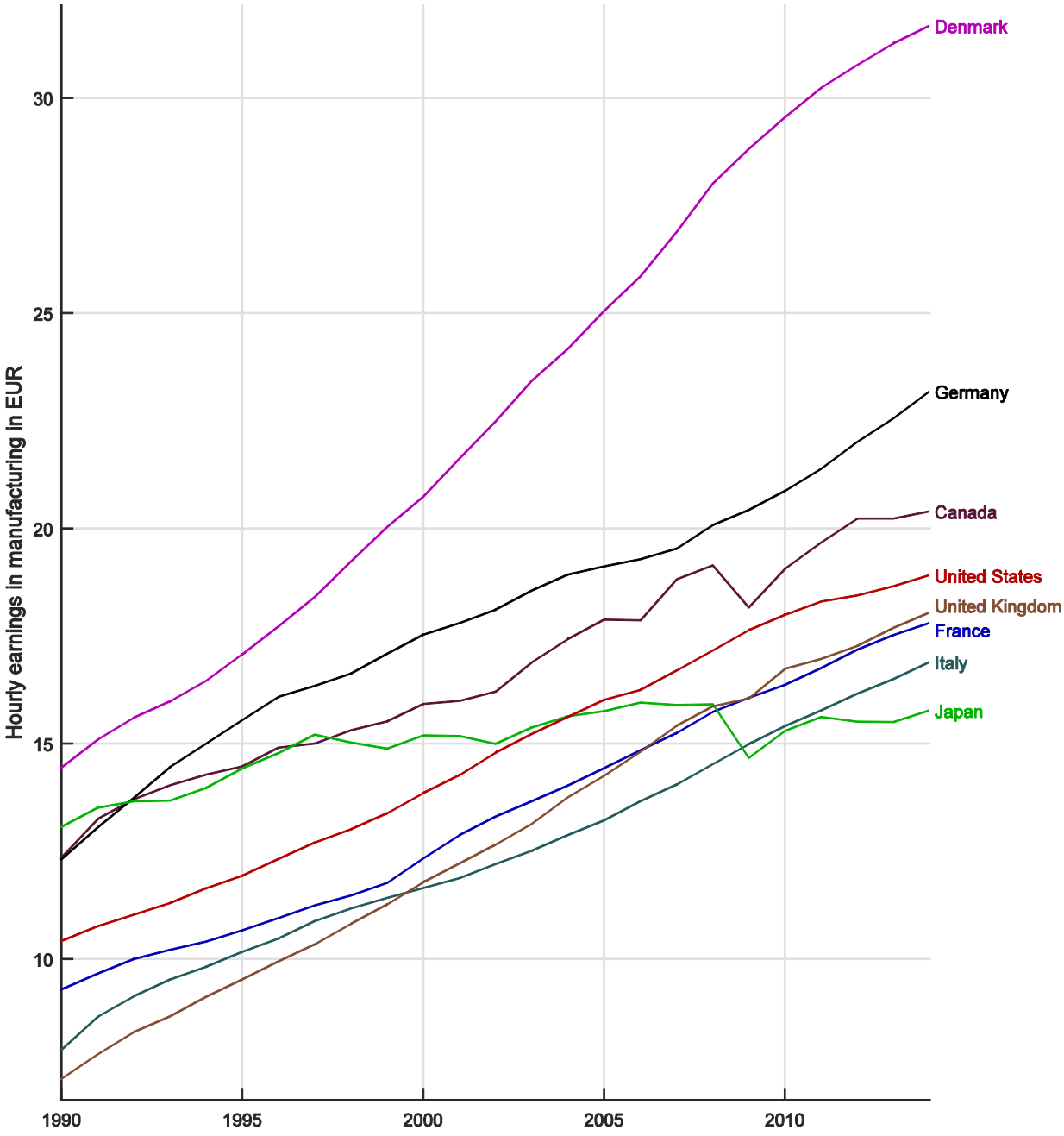
Source: Conversion of the *OECD.Stat* Hourly earnings in manufacturing index 2010 = 100%

Figure 9: Hourly earnings in manufacturing indices 1990 = 100%

Table 9: Hourly earnings in manufacturing in USD and EUR in 2011 (visualized in Figures 10 with using data in Table 8)

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/.



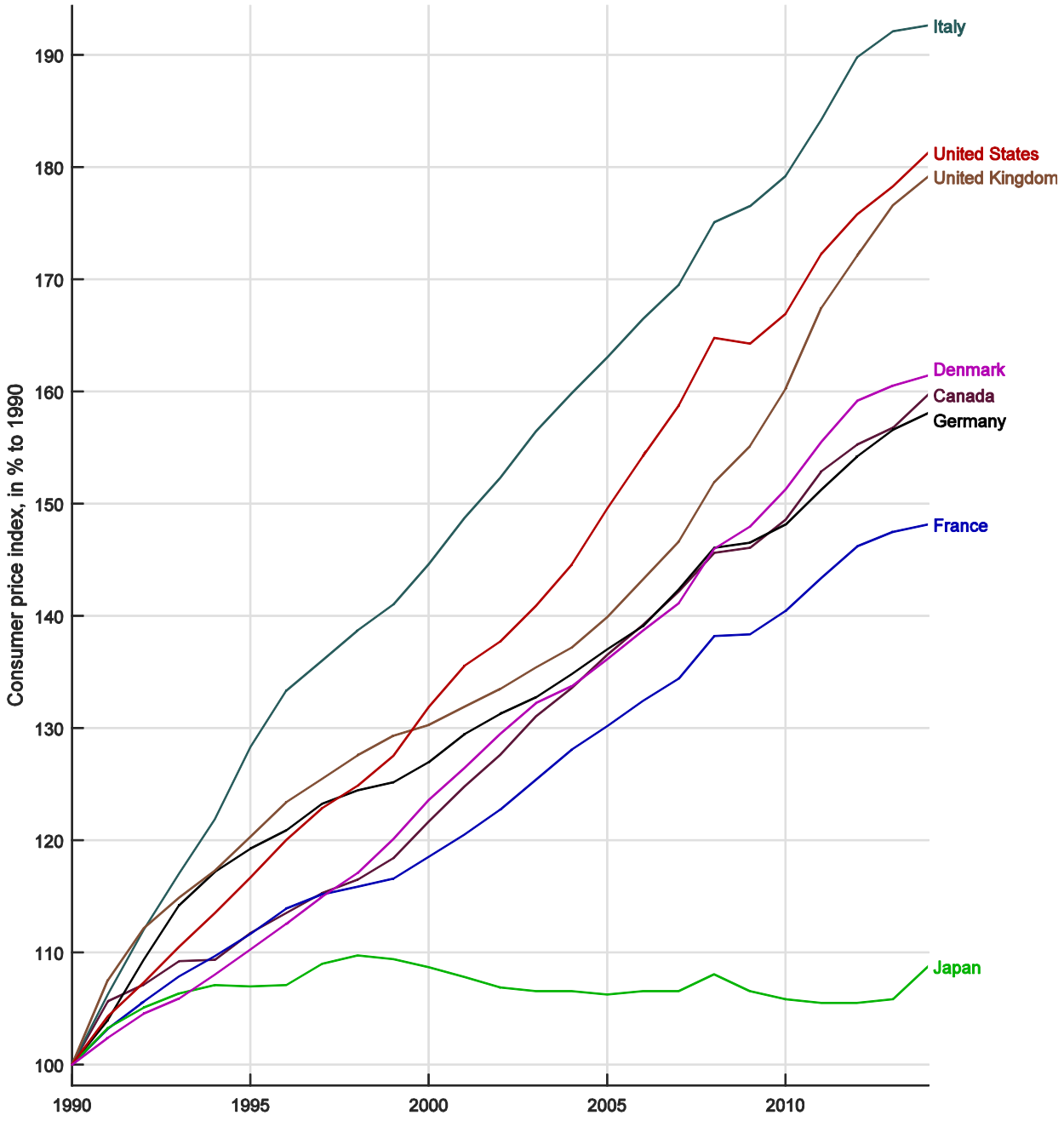
Source: Conversion of the OECD.Stat Hourly earnings in manufacturing index 2010 = 100% and data from Table 'Hourly earnings in manufacturing in EUR in 2011'.

Figure 10: Hourly earnings in manufacturing, in EUR

Table 10: Consumer price indices 2010 = 100% (visualized in Figure 11)

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 Parties > Consumer and Producer Price Indices > Consumer Prices > Consumer price indices > Customize > Selection > Subject: Consumer prices – all items; Time and frequency: annual; Measure: index.



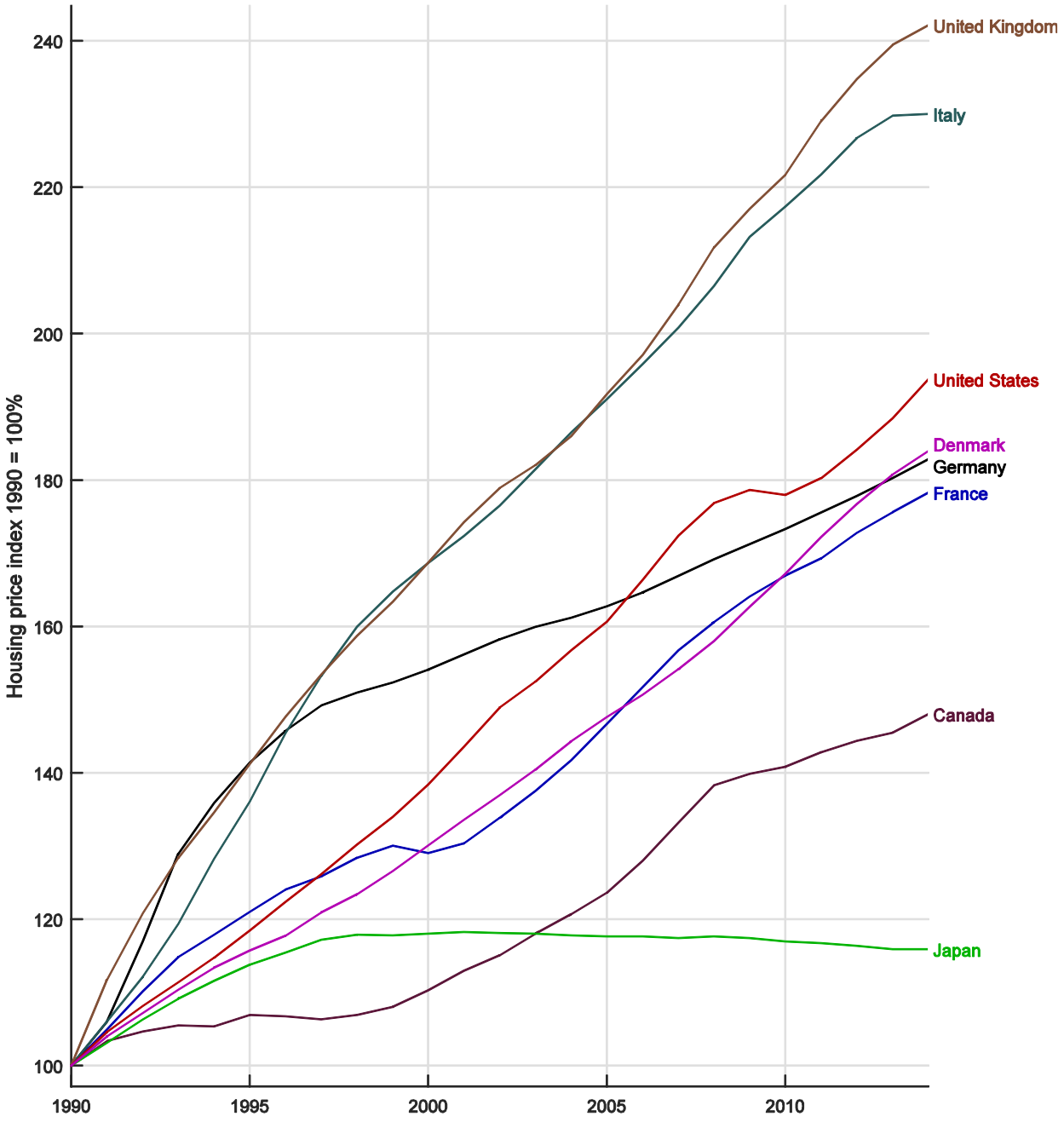
Source: Conversion of the *OECD.Stat* Consumer price index 2010 = 100%

Figure 11: Consumer price index 1990 = 100%

Table 11: Housing price indices 2010 = 100% (visualized in Figure 12)

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.



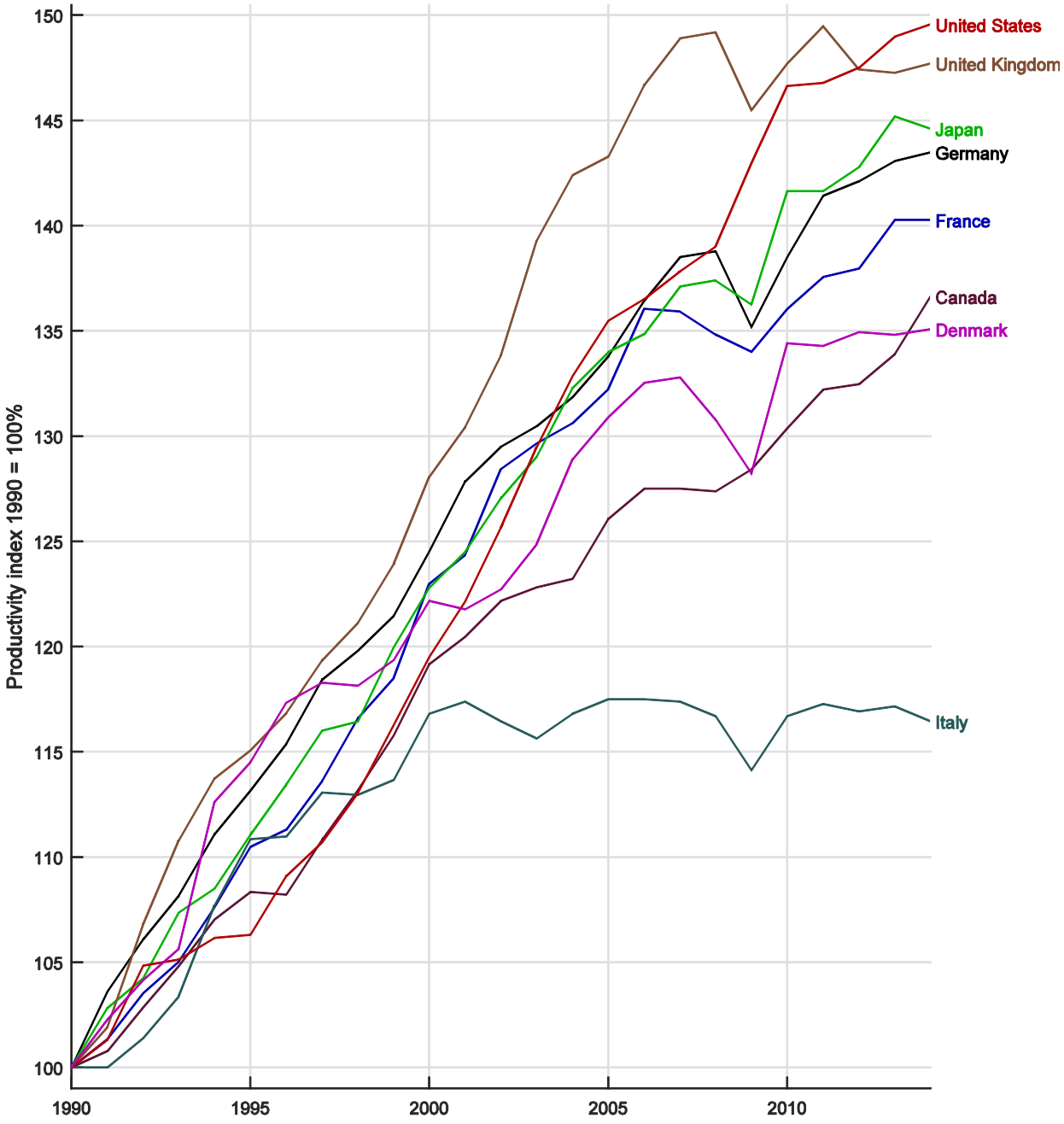
Source: Conversion of the *OECD.Stat* Housing index 2010 = 100%

Figure 12: Housing price indices 1990 = 100%

Table12: Productivity indices 2010 = 100% (visualized in Figure 13)

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: Conversion of the *OECD.Stat* Productivity index 2010 = 100%.

Figure 13: Productivity indices 1990 = 100%

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