Does productivity pay off? The link between productivity and pay in the EU.

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Abstract

The aim of this paper is to investigate whether productivity and worker's compensation have decoupled over time in the EU. This link appears to become weaker over time and decoupled in the majority of EU countries. This conclusion is being made by using a descriptive as well as applying an econometric analysis, a country- and year-fixed effects model, to an unbalanced dataset consisting of the 28 EU member states starting in 1960 to 2018. The findings suggest that declining union density played a role in this development. The root of this development is assumed to an institutional change brought by financialization and also global trade.

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1 Introduction

For many years the circumstance of stagnating wages in industrialized countries is concerning not only working people, because their living standard depends mainly on wages, but also economists. The vast majority of economies are growing, but the growth created seems not to be passed onward to low and middle income earning individuals. On the one hand, this situation is being influenced by a change in the functional income distribution between labor and capital, where the capital income is increasing. On the other hand, income inequality referring to a change in the share of labor income being increasingly concentrated at the top of the income distribution. This is crucial since labor has a higher average propensity to consume than capital and also, the propensity decreases with the height of income. Therefore, a change in the functional income distribution and income inequality consequently affects the aggregate demand, further impacting economic growth.

If wage increases were dependent on the change in prices and productivity, it would guarantee that the living standards of all people are rising. But for many countries, a productivity-driven wage policy does not reflect the present status of wage bargaining. The gains of economic growth are relatively unevenly being distributed.

Economists are elaborating on the topic of the relation between productivity and wages since the early 1990s. Bosworth et al. (1994) found that wages and productivity decoupled in the mid-1970s in the US. Recent literature observes this development ongoing until now, also varying the variables's measures. Mishel (2012) even decomposed the gap being created by this divergence identifying income inequality, trade and the decrease in labor share as main drivers behind the development. Most recently Stansbury and Summers (2017) also econometrically confirmed the previous findings. For another observational area, the EU, Pasimeni (2018) found similar results applying a very sophisticated econometric analysis.

The contribution of this paper is that under the main usage of the previous economists' approach new observational area is covered and partly different explanations are offered backed by a modified econometric analysis. Firstly, all EU countries are descriptively analyzed. Secondly, concluding from the existing literature, other explanatory variables are added to the analysis, which has also slightly been changed.

The descriptive evidence suggests that most of the EU countries real average compensation per hour decoupled over time from the real net productivity per hour. The econometric analysis confirms these results. Productivity and compensation is not linked in a one to one relation. The bargaining power of labor represented by the variable union density is correlated with compen-

sation. Also, the EU or, in general, trade globalization seems to play a role in the analysis. As well as unemployment, which controls for the standard Phillip's wage curve.

2 Literature Review

Since the late 1990s, the question of whether wages, in specific for an average worker, grow at the same rate as productivity does, is a present one. Bosworth et al. (1994) found a parallel growth of compensation and productivity of the non farm business sector until the mid-1970s in the US, but after that, until the 1990s this development changed. A divergence was found and productivity gains were not passed onward to the compensation of the workers as before. One decades later, Baker (2007) replicated this work and moreover, also used a different wage measure, median income, and productivity measures for the sake of the robustness of the results. Those had been confirmed and found that the divergence had been ongoing until his publication in the 2000s. But not only US-based research has been done, for Canada Sharpe et al. (2008) also found a stagnation of the median real earnings from 1980 to 2005, whereas at the same time labor productivity gains were close to 40 percent. They further decomposed the pay gap and identified factors affecting it, such as income inequality, trade, a decrease of the share of compensation in GDP and measurement issues. Following this research paper, Mishel (2012) found overall the same decomposition of the gap for the US. The authors showed that the real median wages had been stagnating since 1973 and at the same time productivity increased by 80 percent. Solely examining wages other than the full compensation does not include non-wage benefits provided by the employer. Taking these benefits into account, Bivens and Mishel (2015) descriptive evidence strengthen the previous findings. While real hourly median compensation grew by 0.2 percent each year between 1973 and 2014, the net productivity rose annually by 1.33 percent for the same period of time. Income inequality accounts for two-thirds of this divergence indicating that this potential income growth for typical workers had been actual pay growth for the top households of the income distribution.

More recent research by Stansbury and Summers (2017) improved the analysis by not only descriptively showing the US divergence between different measures of compensation and productivity, but also empirically estimating this relationship. Data availability allowed them to take three different compensation measures, average compensation, median compensation, and production/ non-supervisory compensation. The results suggest that

productivity growth and compensation growth are linked and its linkage became weaker over time. Stansbury and Summers (2017) extended their observational area to the G7 economies. Due to a lack of data only average compensation was used here. The single regressions approach does not result in an overall conclusion. Results for the UK and Canada suggest an even development of compensation and productivity, while other countries' linkage appears to be weak and some insignificant. Since different time spans are estimated here, the comparability or drawing an overall conclusion is relatively difficult. On this issue, Pasimeni (2018) brought a broader analysis forward. The author examines an unbalanced set of 34 countries including 28 EU member states, Canada, Iceland, Japan, Norway, Switzerland and USA available in the Macro-economic database of the European Commission (AMECO). The results of a country fixed effects regression show for all different specifications a significant relation of productivity and compensation, but no one to one link. For an EU sample only, the author also controls for effects on compensation of the Euro finding a rather unstable significant negative effect on compensation.

As Stockhammer (2004) summarized, financialization is a broadly used notion describing the deregulation of the financial industry, increase in household debt, the invention of new financial instruments, as well as the rise of the shareholder value or remarkable increase of wages and investments in the financial sector starting in the mid-1970s. Referring to financialization in respect of this paper it mainly describes the rise in the profit share and a the same time suppression of wage growth. This development on a broader sense crucial to the aggregate demand, therefore economic growth, and has to be considered in this analysis (Stockhammer, 2004; Onaran, Stockhammer, and Grafl, 2011; Stockhammer, 2013). Though, financialization cannot be marked by a specific act, law or occasion that happened on a particular day. It is a process led by institutional changes occurring at different points of times and also has individual country characteristics.

Furthermore, there are papers not only considering financial globalization but also globalization regarding trade and its implications for the functional income distribution. Capital mobility globally became higher than labor mobility. Since the incentive of investing capital is primarily determined by its rate of return and, in this perspective, wages are mainly seen as costs reducing the return, pressure on labor increased due to a rise in international competition allowing capital being less conformable meeting wage demands. This rather induces stagnating or even falling real wages than them rising. Multiple papers provide evidence for this relation affecting the functional income distribution (Lee and Jayadev, 2005; Onaran and Stockhammer, 2008;

Onaran, 2009; Joy et al., 2017).

Another critical factor for the whole wage setting process are unions and collective bargaining agreements representing the institutional strentgh or weakness of working people. It affects not only the wage bargaining of unionized workers but also the non-unionized (Rosenfeld et al., 2016). In this matter, Stockhammer (2009) found that the weakening of unions affects the functional income distribution and need to be considered in the context of this paper.

3 Data and Descriptive Statistics

To compare productivity and compensation macroeconomic measures which data are consistent over time and comparable throughout Europe are needed. Generally speaking, productivity is a measure of output divided by its input. From a macroeconomic perspective, it is being measured by dividing gross domestic product (GDP) by the total annual hours worked. The GDP includes the depreciation, which is the decline in the value of the capital stock due to its usage. This so-called consumption of fixed capital can neither be passed on to the compensation of the employees nor the profits of the firms and therefore, cannot be translated into a change in living standards. This is why the consumption of fixed capital is being subtracted from the GDP to exclude it from the analysis[1]. Another reason for exclusion to be mentioned is that over time the share of depreciation on GDP is not stable and could bias the analysis measuring a change in depreciation rather than in productivity. The then so-called net domestic product is divided by total annual hours worked resulting in the average net productivity per hour.

The comparable measure of compensation is the total compensation of employees which refers to the total remuneration consisting of gross wages, salaries and other benefits earned. The compensation divided by the total annual hours worked results in the average compensation of employees per hour. There are also other measures appropriate to analyze this linkage (Bivens and Mishel, 2015; Stansbury and Summers, 2017). Instead of the average compensation measure, a median income measure would also allow observing the share of productivity being passed on to typical workers in the EU. Unfortunately, median income is not available for a long time series analysis gathered in one database for EU countries. Dependent on the income inequality in EU countries the usage of an average compensation measure could lead to an underestimation of a potential delinkage. As observed in the

[1]Nevertheless, for robustness testing reasons the econometric analysis is also being estimated using GDP as the numerator, see Table A.4

US and Canada, average incomes are mostly increasing due to the enormous increase in the top income shares (Sharpe et al., 2008; Mishel, 2012). For EU countries Fredriksen (2012) found an overall increase in income inequality since the 1980s, but not as high as in the US. These results maybe indicate that this analysis using average compensation is not as incomparable as in the US to draw conclusions for typical workers. However, no direct findings concerning this paper can be taken for a median earning individual.

To be able to compare the variables over time they need to be deflated. Productivity is deflated by the GDP price deflator. Otherwise, the deflation of the compensation is not a definite one, because it represents at the same time costs for firms and earnings for employees both facing different rates of inflation. Pessoa, Van Reenen, et al. (2013) noted that using different deflators could eventually result in measuring a price wedge. At the same time, it depends explicitly on what hypothesis is being tested. To analyze the cost structure of firms, the GDP price deflator would be the more appropriate deflator (Feldstein, 2008). Since this paper intends to explore to which extent employees benefited in terms of purchasing power from productivity gains, the consumer price index is the more appropriate deflator here (IMF, 2017; Pasimeni, 2018).

Most of the data used are downloaded from the AMECO database. Additional to the already mentioned variables also the national unemployment rate is being downloaded from AMECO. As can be seen in Table 1, this data set consists of 945 comprehensive observations and is unbalanced including the current 28 member states of the EU using annual data starting in 1960 to 2017. For a specific regression analysis controlling for an impact of trade unions the Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) provide the variable union density. Due to some gaps and to gain observations the variable union density is linearly interpolated. Still, this results in a smaller data set with comprehensive 812 observations. The summary statistics of each country can be found in the appendix Table A.1[2]. Additionally, we created a dummy variable for being a member of the EU or its previous institution European Economic Community (EEC)[3].

Since an unbalanced panel is being observed the summary statistics barely allow to compare or group countries in advance. Countries which data starts in the 1960s or 1970s have partly low means over the whole observational

[2]Unfortunately, I had to drop Bulgaria's observations of 1995 due to questionable credibility caused by an extremely out of line value of the consumer price index.

[3]Also, following Pasimeni (2018) a dummy variable for members of the euro area and the same dummy variable including countries being pegged to the Euro are created, but not significant in the econometric analysis.

Table 1: Summary Statistics

All Countries	N	Min	Mean	Max	St. Dev.
Compensation per hour	945	1.26	14.63	38.48	8.18
Net productivity per hour	945	2.98	24.18	68.87	13.67
Unemployment rate	943	0.00	8.05	27.50	4.38
Union density	812	6.53	38.75	87.43	20.57

period. At the same time, these countries have strong economies regarding GDP and also high levels of compensation nowadays. Mainly, the new member countries of the 2004 enlargement of the EU and later do economically speaking perform weaker compared to the other countries. This, although, does not predetermine the results of the descriptive evidence.

4 Results

4.1 Descriptive Evidence

A graphic analysis is being done to identify whether productivity and compensation have decoupled over time. Real net productivity per hour and real compensation per hour are indexed to observe the change over time. The hypothesis is that financialization is the primary driver of this development. Although the beginning of financialization is suspect to be in the mid-1970s, the basis year of the index is 1980 (Stockhammer, 2013). On the one hand, it is difficult to precisely identify one year as the starting point of this development. Also, a generalization of the beginning of the financialization for all EU countries is rather difficult than easy. The institutional change did not take place in one specific year as it was more an ongoing process. On the other hand, and crucial to the decision of taking 1980 as the basis index year is the data availability. Many countries' data starts here or later. Also, for a latter econometric estimation, the data set is split into two time spans. To have enough observations to draw valid conclusions for the first time span, but at the same time not moving too far away from the mid-1970s, 1980 as a starting point seems a practical and justifiable choice and allows consistent use of one date. All countries that do not have data available back then are indexed to their first observation unless their first reported data starts after 2000. These countries, in specific Croatia, Estonia and Malta, are not included in the graphic analysis, because the explanatory value of a too short

Table 2: Graphic analysis results

Average indexpoints difference	+ 15	+/- 15	- 15
Indexed 1980	BEL, ESP, FIN, FRA, GBR, IRL, ITA, PRT, SWE	DNK, NLD, LUX	
Indexed later	AUT, BGR, GRC, HUN, LVA, POL, ROM, SVK, SVN	CYP, DEU	CZE, LTU
Sum	18	5	2

time period is questionable.

Having longer time series data per country would allow a broader and a more intelligible analysis. The US-based analyses start in the late 1940s. A one to one relation between median compensation and productivity until the mid-1970s and for average compensation until the 1990s can be shown (Stansbury and Summers, 2017). Since the US and the EU countries partly have similar economic growth paths, to show an extended period of a tandem growing in the EU is not possible. On the one hand, because there is potentially no such growth path of compensation and productivity. On the other hand, due to the lack of data, it cannot be illustrated. Solely for France, it can be seen. At the same time, France is the only country which has data starting in 1960. This may indicate the second explanation to be more accurate.

Since there is no precise definition of when a country is decoupling in the literature, a standardized scale is needed. To decide on this graphically a gap between productivity and compensation of on average 15 index points over the observational period is the chosen measure determining a delinkage. This subjectively chosen threshold is debatable. But no objective measure has been developed in this context yet. Still, even without classifying the countries a country-specific and also overall trend can be seen (see Figure B.1).

The graphic analysis appears to confirm a decoupling between productivity and compensation over time. As Table 2[4] summarizes, 18 out of 25 EU countries experienced on average at least 15 index points difference in the growth of productivity compared to their compensation growth. The countries being indexed in 1980 are all having positive gaps except the Nether-

[4]The numeric values of the average gap per country are listed in detail in Table A.2.

lands. This implicates that net real productivity grew faster than the real average compensation in 11 of 12 observed countries since the 1980s. Overall only 4 out of 25 countries have a negative gap.

Every country experienced a productivity growth within the observational period. Whereas for the 1980 indexed countries Spain, Italy, Portugal and Sweden a complete real average compensation stagnation until the 2010s is found. Those four countries, as well as Belgium, Finland, France, Great Britain and Ireland being indexed to 1980 decoupled. Three geographically neighboring countries Denmark, the Netherlands and Luxemburg show a tandem development. Those countries are within the boundaries of 15 index points not indicating an explicit decoupling, also like the later indexed countries Germany and Cyprus do. If Cyprus is being closely observed, it seems as if after a period of tandem growth, starting in 2004 compensation grew faster than productivity.

In two countries an inverse decoupling took place, namely the Czech Republic and Lithuania. On the one hand, an explanation of those two countries' exceptional position in this descriptive analysis could be that they were part of the 2004 enlargement of the European Union and their observational period starts in the 1990s. On the other hand, for most of the other countries entering the EU after 2000, an opposing view can be seen. No plain answer can be given here. Outliers are Bulgaria and Romania with an average gap of over 100 index points, but also Greece, Lithuania and Portugal have average gaps of above +/- 80 index points. Countries which data starts in the 1990s mainly decoupled, Austria, Bulgaria, Greece, Hungary, Latvia, Poland, Romania, Slovenia and Slovakia.

Since a randomly chosen threshold is being used, it has to be mentioned that five countries are as close as five index points apart from the threshold. In other words, a small change in the index point threshold could have changed the results slightly, but all in all are mostly robust against variation.

4.2 Econometric Evidence

The implication of the econometric analysis is to estimate the real compensation regressed on the real net productivity. So, two hypotheses can be tested. Firstly, is there a significant correlation between real net productivity and real compensation? Secondly, if so, how strong is the linkage of this correlation?

To estimate a time series, first, a unit root test is needed to be carried out. The Im-Pesaran-Shin unit-root test is appropriate for testing panel data (Im et al., 2003). Unit roots would cause problems with the statistical inference due to an unpredictable systematic pattern. Furthermore, non-stationary

data could lead to a very high R-squared and significant estimates, although there is no actual valid correlation. More precisely, for the test we took the two variables' logarithms and as can be seen in Table A.3 the unit root testing confirms stationary[5].

Related to this work, other authors further transformed those variables by taking the logarithm, the first difference and the three year-moving average (Stansbury and Summers, 2017). Similar to that Pasimeni (2018) takes logarithms and first differences of the variables. Since taking the logarithm is sufficient enough for valid estimates, no first or second differences are taken. Taking the logarithm allows interpreting most regression results as elasticity.

The here applied empirical strategy concerning the statistical method also differs from previous papers. Stansbury and Summers (2017) did a single regressions approach using OLS estimator for the single country analysis of the US and further also for a G7-economies unbalanced panel estimates. Dependent on the research question, the panel structure of the G7-economies could be used differently for an estimation. For instance, as Pasimeni (2018) chose for his panel using a country fixed effects model. The panel structure of the data allows us to exploit the advantage of a fixed effects regression meaning that time-invariant effects caused by single countries cannot bias the estimation's results. Moreover, Schwellnus et al. (2017) suggest in their analysis that institutional country-specific factors play a decisive role in the decoupling of wages from productivity in OECD countries. Indeed, time-specific characteristics could also be an issue leading to non-consistent estimates. This is why yearly dummies are inserted ending up with a country- and time-fixed effects model.

$$log\, compensation_{ti} = \alpha + \beta\, log\, productivity_{ti} + \gamma\, unemployment_{ti} + \pi_{ti} + \epsilon_{ti}$$

Further control variables are added and also different estimation specifications are conducted. Following Bivens and Mishel (2017) and Pasimeni (2018) the unemployment rate is added to the regression to control for the standard Philips wage curve. Considering financialization in the estimates, the baseline regression is being reestimated by splitting the data into two time spans in 1980. A change in the scale of an expected correlation between productivity and compensation could indicate an institutional shift in time due to financialization. To control for an organizational change in the

[5]Croatia had to be excluded from the panel unit root testing, because it has less than ten consistent observations being needed to compile the Im-Pesaran-Shin unit-root test in stata.

Table 3: Regression results

	Dependent variable:				
	Log compensation per hour				
	1960-2018	1960-1980	1981-2018	1960-2018	1960-2018
	(1)	(2)	(3)	(4)	(5)
Log net productivity per hour	0.639**	1.251	0.620**	0.864***	1.043***
	(0.263)	(0.872)	(0.302)	(0.285)	(0.299)
Unemployment rate	−0.015***	−0.028	−0.013***	−0.013***	−0.011**
	(0.005)	(0.035)	(0.004)	(0.005)	(0.005)
Union density				0.009*	0.009**
				(0.005)	(0.005)
EU					−0.152***
					(0.057)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	943	147	736	812	812
R^2	0.370	0.562	0.318	0.486	0.505
Adjusted R^2	0.306	0.434	0.253	0.428	0.448
Note:	robust standard errors; legend: *p<0.1; **p<0.05; ***p<0.01				

wage setting institutions and the bargaining power of labor, union density is added to another estimation. Accounting for the globalization of trade an EU dummy is added to a further regression[6]. This is supposed to control for an increase in wage competition caused by an intensification of the competition of the price in goods and services in an integrated economic area.

All regressions are estimated using robust standard errors to obtain unbiased standard errors caused by potential heterogeneity.

Equation 1 of the estimation in Table 3 of the baseline model is found

[6]Thereby, partly following Pasimeni (2018), who added different Euro-related dummies. Although, he did not argue for controlling for trade globalization or international trade related reasons.

to be significant for all variables. A 1 percent increase in real productivity leads ceteris paribus to a 0.639 percent increase in real compensation. This implicates that productivity growth is passed onward to compensation in the observational period and country sample. Also, this is in line the graphic analysis to the extent that it has not been a one to one relation. Also, the size of the effect appears to be reasonable. Further, a 1 percentage point increase in the unemployment rate leads ceteris paribus to a 1.5 percent decrease in real compensation. The standard Phillips wage curve hypothesis is found to be valid in this context and underlines the importance of including the unemployment rate to guarantee an unbiased estimation.

The following two equations have to be considered together. Equation 2 estimating equation 1 for the time span 1960-1980 is found to be not significant. This could be simply because in this time span is no correlation. Another factor could be the small number of observations only containing 147 in this estimation. Equation 3 is estimating equation 1 for the time span 1981-2018. A 1 percent increase in productivity leads ceteris paribus to a 0.62 percent increase in real compensation. This effect is lower than for the estimation of the whole sample indicating a weaker correlation between productivity and compensation in this time period. Although the difference is barely worth mentioning. Also, the unemployment rate is significant here. A 1 percentage point increase of the unemployment rate leads ceteris paribus to a 1.3 percent decrease in real compensation.

The 4th equation includes union density to its baseline model for the whole sample. The number of observations decreases to 812 due to the data availability of the variable union density. Again, a 1 percent increase in productivity leads ceteris paribus to a 0.864 percent increase in real compensation. The effect of productivity contributing to compensation becomes stronger if union density is included. Also, the adjusted R squared increases implicating a better fit to examine real compensation. The unemployment rate is again found to be significant. More interesting here, the variable union density. A 1 percentage point increase of the union density leads to a 0.9 percent increase in real compensation. This correlation suggests a profound impact of unions on the bargaining power of labor.

Lastly, the EU dummy variable is added to the estimation and found to be significant. Being today an EU member country, but not in the observational period in the EU yet, decreases ceteris paribus the compensation by 15.2 percent. This effect suggests that EU member countries have on average lower real compensation than they had before they entered the EU. Although there is statistical significance, the causality is not completely clear. The correlation between the unemployment rate and union density stays unchanged and significant. The correlation between productivity and compensation can

be interpreted here as a one to one relation.

All regressions are estimated using gross productivity instead of net productivity as a robustness check. As shown in the Appendix Table A.4, neither changes in the direction of the correlations nor significance are found supporting the usage of both gross and net productivity.

However, what cannot be shown is wage inequality in this context. Bivens and Mishel (2015) found out that an increase in the average income does not guarantee an increase of the income of a typical worker. This reflects the growing income inequality of the last decades in the USA. As Pasimeni (2018) mentioned in his EU analysis, observing average compensation instead of a wage measure more accurately reflecting the income of a typical worker results in an underestimation of the actual impact of productivity on typical worker's pay. This is also true for this analysis.

5 Conclusio

This paper shows a weakening of the linkage between real net productivity and real average compensation took place in most EU countries. Different, appropriate analysis methods allow answering the hypothesis' of this paper. This is examined by the empirical examination of an unbalanced panel downloaded from the AMECO database. Following the literature, a descriptive analysis of every single EU country allows deciding on economies' productivity decoupling from their compensation. Further an econometric estimation of the panel applying a country- and year-fixed effects regression is carried out to at best validate the descriptive results. Additional to that, other determinants affecting this development are identified.

The descriptive evidence suggests that the majority of EU countries experienced a decoupling of their real average compensation from real net productivity. Therefore, the two main variables are indexed to 1980 to be able to observe if they develop similarly or not in the specific country. Countries that have no data available in 1980 are indexed to their first available data. To decide on this using a standardized measure an index scale is introduced. It appears that the longer the data being analyzed is, the more evident the results get. Due to the usage of an unbalanced panel, a geographic or other historical classification of the analyzed countries cannot be reasonably made.

The econometric evidence confirms the descriptive analysis. There is no one to one relation between productivity and compensation in the observational period. A 1 percent increase in real productivity increases real average compensation by 0.639 percent. Dependent on which control variables are included in the estimates, this value changes. Unemployment is

negatively correlated with compensation, also as the EU-entrance appears to be. Whereas if union density increases compensation rises. The econometric method being used did not result in financialization directly influencing this change. Although, the descriptive evidence does support a change over time, which could be an indication for an institutional change due to financial globalization.

Who is profiting and who is not out of this circumstance? It appears that power has shifted from labor to capital, which means capital is in benefit of this development in the short run. But due to a weakening of aggregate demand and further smaller economic growth, this cannot be in favor of capital in the long run. This development did not unconsciously occurred. Policy choices being made or not made directly impact this change and therefore, can also restore it. Although, it became more difficult in times where economic growth slowed down.

To balance the functional income distribution in favor of the whole economy's development, unions or some collective bargaining institutions are needed (Cooper and Mishel, 2015). The trickle down economics failed in this respect. If wages grow aligned to a change in inflation and productivity, it could guarantee higher living standards on a broader scale (Mesch et al., 2015). The overall goal should be that everyone benefits from the economic prosperity and growth in a country.

There are many suggestions for further research. Concerning the EU and many other countries, an analysis using different wage measures, such as median income, could be done. This would also capture income inequality and the effects on middle income earning individuals. Preferably more extended periods of time will be observed. A more independent standardized measure of when a country is decoupling would be preferable. Also, a country-specific analysis by industry as Pessoa, Van Reenen, et al. (2013) did for the UK would be very interesting. Other potential research could be to analyze the gap between productivity and compensation to identify its determinants.

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Appendix

A Tables

Table A.1: Country summary statistics

Austria, 1995 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	21	17.52	19.25	21.39	1.09
Net productivity per hour	21	28.71	33.25	36.87	2.76
Unemployment rate	21	3.90	4.82	5.70	0.56
Union density	19	27.40	33.50	41.06	4.63
Belgium, 1970 - 2018	**N**	**Min**	**Mean**	**Max**	**St. Dev.**
Compensation per hour	49	8.22	20.90	26.74	5.38
Net productivity per hour	49	17.44	34.31	44.19	8.20
Unemployment rate	49	1.70	7.51	11.00	2.31
Union density	44	39.86	51.28	56.35	3.66
Bulgaria, 1996 - 2018	**N**	**Min**	**Mean**	**Max**	**St. Dev.**
Compensation per hour	23	1.26	2.73	13.13	2.35
Net productivity per hour	23	3.49	5.03	6.73	1.04
Unemployment rate	23	5.60	10.93	19.50	3.65
Union density	17	16.97	22.52	41.06	6.71
Cyprus, 1995 - 2015	**N**	**Min**	**Mean**	**Max**	**St. Dev.**
Compensation per hour	21	8.13	10.44	12.30	1.47
Net productivity per hour	21	18.05	21.44	23.11	1.75
Unemployment rate	19	3.50	6.98	16.10	4.30
Union density	17	45.19	58.50	69.24	7.48
Czech Republic, 1993 - 2015	**N**	**Min**	**Mean**	**Max**	**St. Dev.**
Compensation per hour	23	3.09	5.17	7.13	1.55
Net productivity per hour	23	8.13	11.49	14.59	2.24
Unemployment rate	23	3.80	6.39	8.80	1.61
Union density	21	12.72	26.89	64.38	13.50
Germany, 1991 - 2015	**N**	**Min**	**Mean**	**Max**	**St. Dev.**
Compensation per hour	25	19.27	22.26	24.41	1.04
Net productivity per hour	25	28.56	34.70	39.02	3.26
Unemployment rate	25	4.60	7.81	11.20	1.81
Union density	23	17.71	24.21	35.99	5.34

Denkmark, 1966 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	50	10.52	23.20	32.86	6.44
Net productivity per hour	50	17.77	38.18	53.69	10.49
Unemployment rate	50	0.60	5.21	9.60	2.41
Union density	48	57.36	71.12	80.21	6.47
Spain, 1970 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	46	12.97	15.19	18.99	1.44
Net productivity per hour	46	11.36	22.22	27.99	4.94
Unemployment rate	46	2.60	13.87	26.10	6.58
Union density	37	11.26	16.55	45.09	5.90
Estonia, 2000 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	19	3.63	6.14	8.22	1.46
Net productivity per hour	19	8.08	11.39	13.51	1.63
Unemployment rate	19	4.60	9.53	16.70	3.34
Union density	13	6.53	9.75	14.52	2.87
Finland, 1970 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	49	9.25	17.34	23.07	4.06
Net productivity per hour	49	12.17	26.65	38.31	8.85
Unemployment rate	49	1.60	7.37	16.60	3.71
Union density	44	51.29	70.51	80.65	6.14
France, 1960 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	59	5.81	18.36	27.43	6.29
Net productivity per hour	59	8.98	28.85	43.75	11.06
Unemployment rate	59	1.20	6.68	10.70	3.33
Union density	54	7.55	13.95	22.19	5.79
Great Britain, 1970 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	46	12.28	17.71	25.47	3.68
Net productivity per hour	46	13.98	24.71	33.91	6.68
Unemployment rate	46	2.00	6.65	11.20	2.56
Union density	44	25.67	38.29	51.95	9.12
Greece, 1983 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	36	6.08	8.88	21.84	3.74
Net productivity per hour	36	13.82	17.39	21.20	2.14
Unemployment rate	36	6.40	12.17	27.50	6.57

Union density	31	21.52	29.35	38.94	5.99
Croatia, 2008 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	8	6.36	6.57	6.89	0.16
Net productivity per hour	8	11.27	12.04	12.57	0.47
Unemployment rate	8	8.60	13.74	17.40	3.49
Union density	5	30.90	32.49	34.00	1.41
Hungary, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	4.74	5.99	7.52	0.71
Net productivity per hour	24	7.66	10.45	12.58	1.69
Unemployment rate	24	3.90	7.69	11.20	2.19
Union density	18	10.71	21.52	49.11	10.65
Ireland, 1970 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	49	8.89	14.52	22.91	4.72
Net productivity per hour	49	9.62	27.64	52.42	13.03
Unemployment rate	49	3.90	9.97	16.80	4.21
Union density	44	31.02	46.20	57.63	9.56
Italy, 1970 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	49	11.93	15.81	22.94	2.77
Net productivity per hour	49	15.38	26.33	31.28	4.85
Unemployment rate	49	5.00	8.64	12.70	2.10
Union density	44	33.57	39.96	50.46	5.43
Lithuania, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	1.46	4.14	6.28	1.57
Net productivity per hour	24	4.37	8.88	12.17	2.61
Unemployment rate	24	4.30	10.78	17.80	4.01
Union density	18	8.99	16.16	31.35	7.37
Luxemburg, 1970 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	49	8.97	25.89	37.11	8.96
Net productivity per hour	49	27.25	51.85	68.87	13.89
Unemployment rate	49	0	2.96	6	1.88
Union density	43	32.82	44.70	52.17	4.90
Latvia, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	2.19	4.38	6.87	1.45
Net productivity per hour	24	3.19	7.17	10.74	2.35
Unemployment rate	24	6.10	12.38	19.50	3.45

Union density	18	13.12	19.83	27.40	4.64
Malta, 2000 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	16	7.34	8.19	9.41	0.58
Net productivity per hour	16	13.91	16.04	19.03	1.37
Unemployment rate	16	5.40	6.68	7.70	0.63
Union density	13	52.05	55.98	60.30	3.17
Netherlands, 1969 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	47	7.36	19.43	25.12	4.96
Net productivity per hour	47	19.42	33.92	43.76	6.86
Unemployment rate	47	1.00	5.69	11.80	2.26
Union density	45	18.03	27.17	37.76	6.69
Poland, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	3.12	3.89	4.92	0.58
Net productivity per hour	24	5.29	8.90	12.30	2.18
Unemployment rate	24	4.40	11.74	20.00	4.69
Union density	18	12.73	17.06	20.50	2.73
Portugal, 1970 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	46	6.46	13.53	38.48	10.37
Net productivity per hour	46	6.51	12.31	16.70	3.23
Unemployment rate	46	1.70	7.71	16.40	3.28
Union density	35	18.34	31.11	60.76	13.10
Romania, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	1.84	4.06	18.95	3.99
Net productivity per hour	24	2.98	5.46	8.70	1.87
Unemployment rate	24	5.30	6.93	9.70	0.97
Union density	18	19.79	37.85	59.23	9.87
Slovakia, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	3.49	5.30	7.60	1.41
Net productivity per hour	24	7.01	12.00	16.30	2.97
Unemployment rate	24	7.60	13.62	19.50	3.40
Union density	19	13.29	26.71	56.06	12.26
Slovenia, 1995 - 2018	N	Min	Mean	Max	St. Dev.
Compensation per hour	24	9.97	11.23	12.26	0.63
Net productivity per hour	24	11.51	16.60	19.42	2.43
Unemployment rate	24	4.40	7.08	10.10	1.37

Union density	19	21.25	35.74	50.48	9.61
Sweden, 1970 - 2015	N	Min	Mean	Max	St. Dev.
Compensation per hour	46	15.58	21.52	27.69	3.00
Net productivity per hour	46	21.24	32.36	44.09	6.99
Unemployment rate	46	1.60	5.13	9.90	2.77
Union density	43	67.38	77.73	87.43	5.78

Table A.2: Summary of gaps

Gap	N	Mean	St. Dev.
Austria	21	14.69	5.49
Belgium	39	16.05	5.25
Bulgaria	23	120.90	35.17
Cyprus	21	−9.56	9.83
Czech Republic	23	−26.26	23.47
Germany	25	5.98	8.32
Denmark	36	2.04	5.32
Spain	36	46.98	16.42
Finland	39	16.51	20.84
France	39	28.13	8.33
Great Britain	36	30.43	19.48
Greece	36	85.19	27.90
Hungary	24	55.97	22.68
Ireland	39	68.46	37.77
Italy	39	42.54	18.85
Lithuania	24	−81.35	50.11
Luxemburg	39	6.56	12.38
Latvia	24	24.68	19.86
Netherlands	36	−1.23	4.43
Poland	24	52.44	27.21
Portugal	36	89.52	33.71
Romania	24	161.91	73.43
Slovakia	24	19.01	12.85
Slovenia	24	52.51	20.71
Sweden	36	43.23	19.65

Table A.3: Unit-root tests

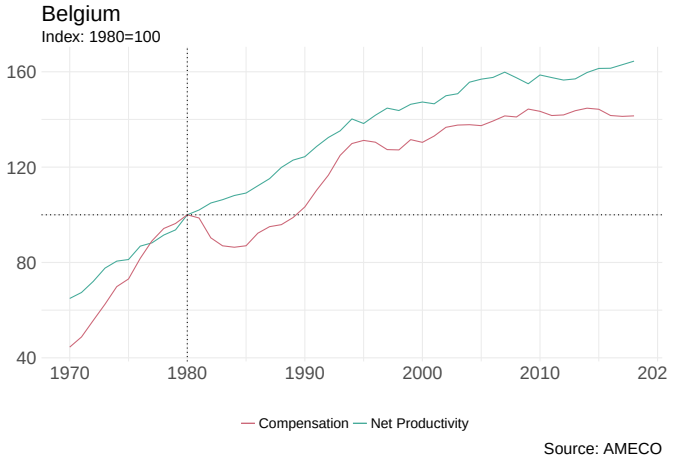
```
Im-Pesaran-Shin unit-root test for log_real_compensation_per_hour
------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     27
Ha: Some panels are stationary              Avg. number of periods =  34.70

AR parameter: Panel-specific                Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included

ADF regressions: No lags included
-------------------------------------------------------------------------
                                             Fixed-N exact critical values
                    Statistic      p-value         1%      5%      10%
-------------------------------------------------------------------------
 t-bar               -2.6631                          (Not available)
 t-tilde-bar         -2.1565
 Z-t-tilde-bar       -4.7148        0.0000
-------------------------------------------------------------------------

Im-Pesaran-Shin unit-root test for log_real_net_productivity_per_ho
------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     27
Ha: Some panels are stationary              Avg. number of periods =  34.70

AR parameter: Panel-specific                Asymptotics: T,N -> Infinity
Panel means:  Included                                      sequentially
Time trend:   Not included

ADF regressions: No lags included
-------------------------------------------------------------------------
                                             Fixed-N exact critical values
                    Statistic      p-value         1%      5%      10%
-------------------------------------------------------------------------
 t-bar               -3.1662                          (Not available)
 t-tilde-bar         -2.5384
 Z-t-tilde-bar       -7.2250        0.0000
-------------------------------------------------------------------------
```

Table A.4: Robustness check of regression using gross productivity

	Dependent variable:				
	Log compensation per hour				
	1960-2018	1960-1980	1981-2018	1960-2018	1960-2018
	(1)	(2)	(3)	(4)	(5)
Log gross productivity per hour	0.648***	0.857	0.646**	0.862***	1.027***
	(0.251)	(1.003)	(0.294)	(0.285)	(0.292)
Unemployment rate	−0.016***	−0.025	−0.013***	−0.014***	−0.013***
	(0.004)	(0.036)	(0.004)	(0.005)	(0.005)
Union density				0.009*	0.009*
				(0.005)	(0.005)
EU					−0.137**
					(0.057)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	945	147	738	814	814
R^2	0.366	0.550	0.310	0.475	0.490
Adjusted R^2	0.301	0.418	0.245	0.415	0.432
Note:	robust standard errors; legend: *p<0.1; **p<0.05; ***p<0.01				

B Figures

Figure B.1: Descriptive country analysis



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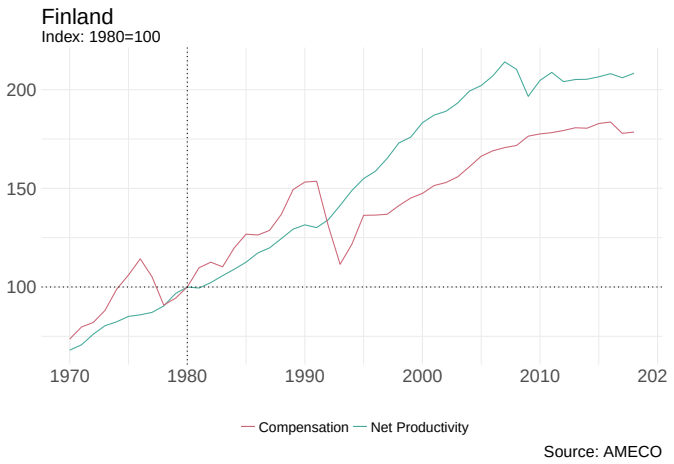
(b) 1b



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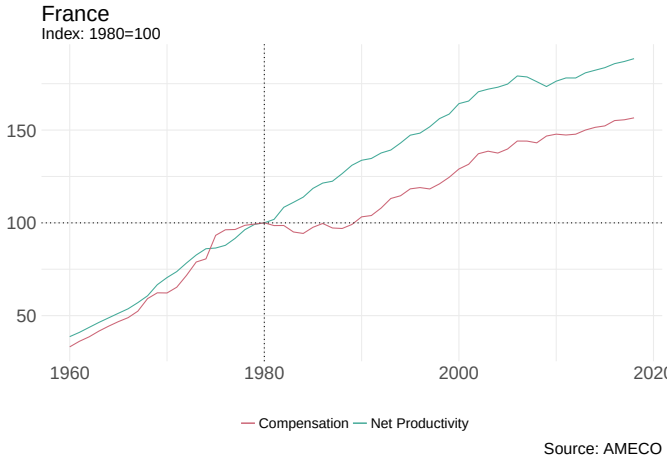
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Compensation
Net Productivity
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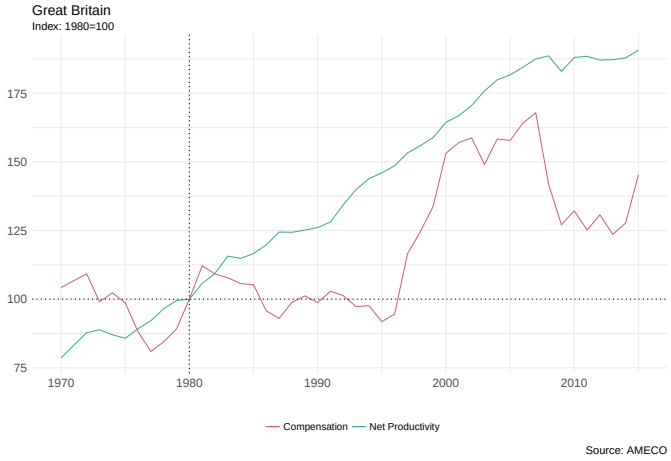
(d) 1d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Net Productivity
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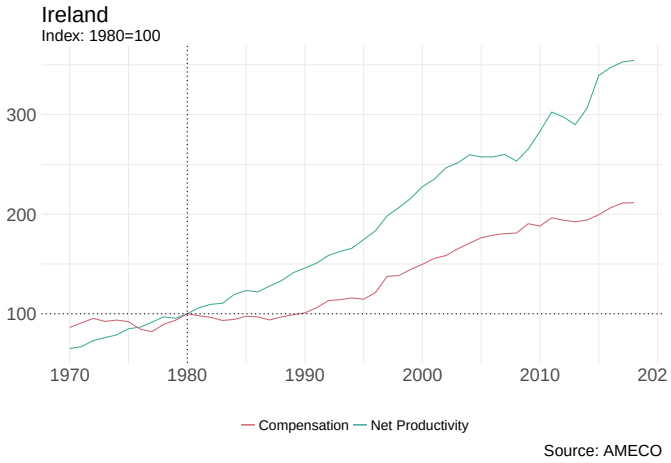
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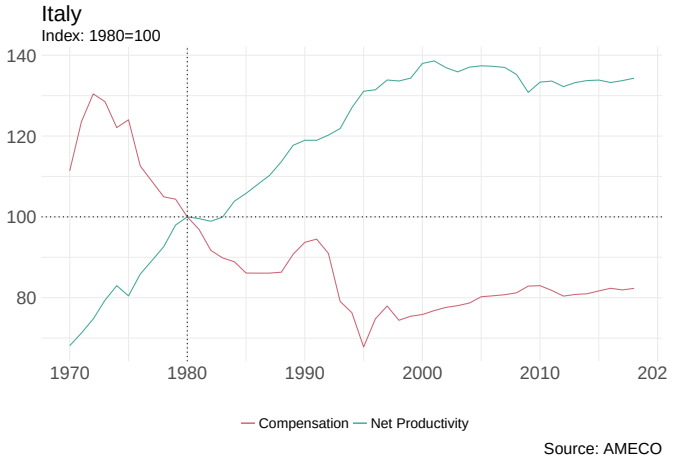
202
Compensation
Net Productivity
Source: AMECO

(f) 1f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2010
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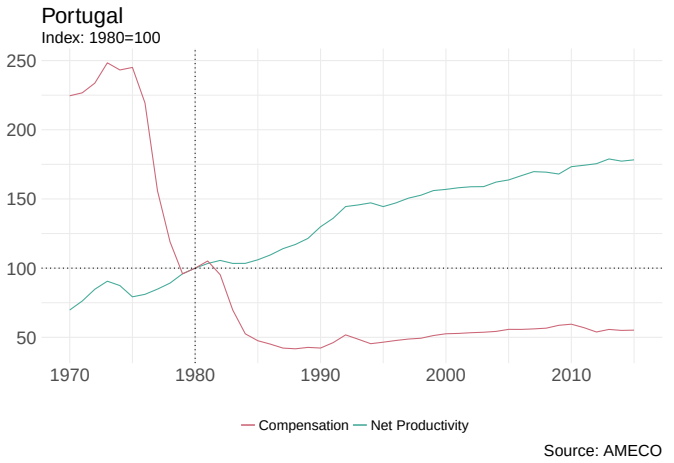
Compensation
Net Productivity
Source: AMECO

(g) 1g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Compensation
Net Productivity
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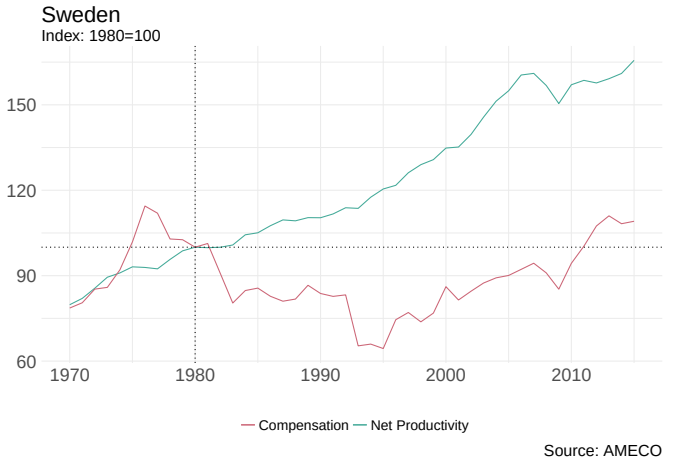
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Compensation
Net Productivity
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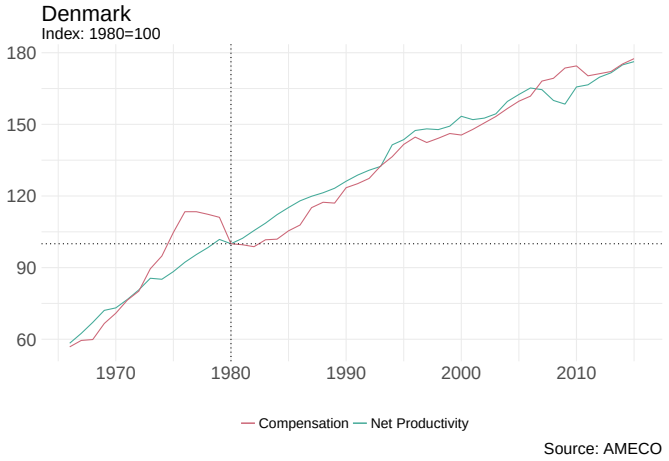
(i) 1i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Compensation
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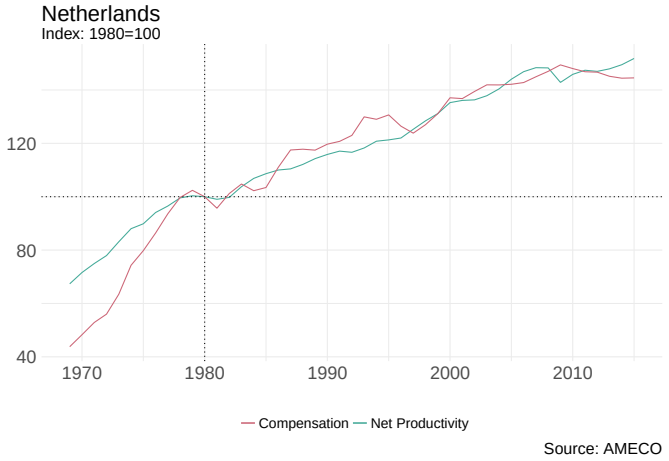
(j) 1j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Compensation
Net Productivity
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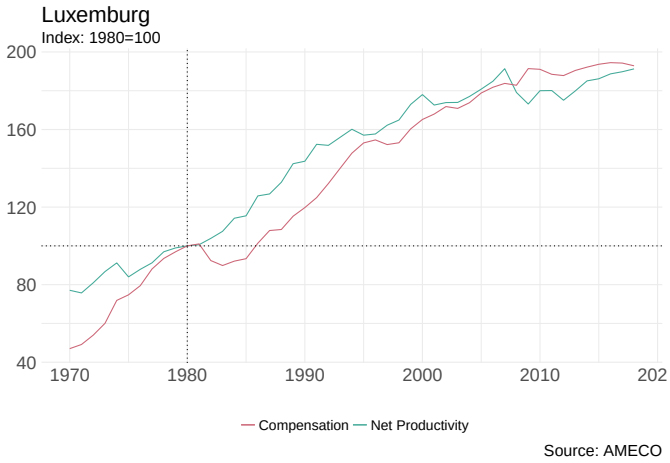
(k) 1k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Compensation
Net Productivity
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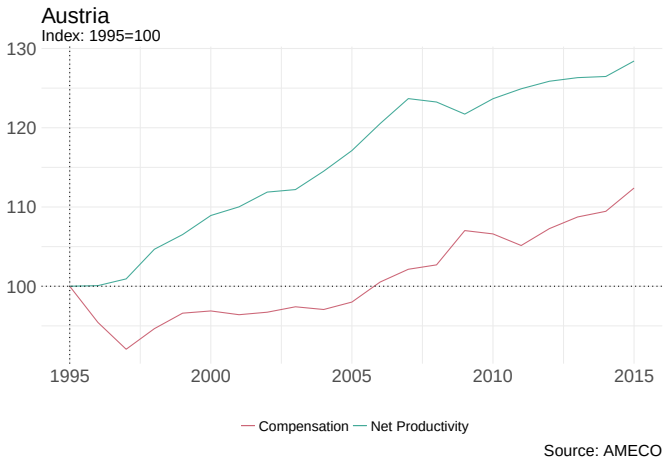
(l) 1l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2015
Compensation
Net Productivity
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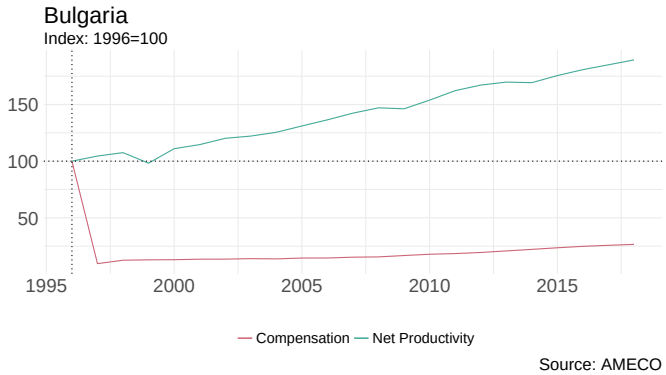
(m) 1m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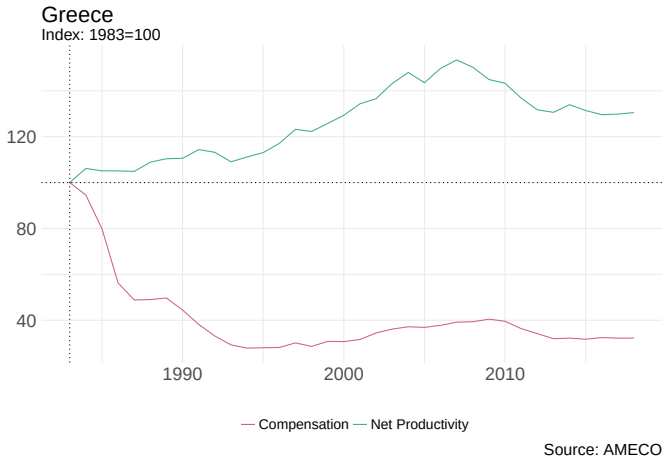
(n) 1n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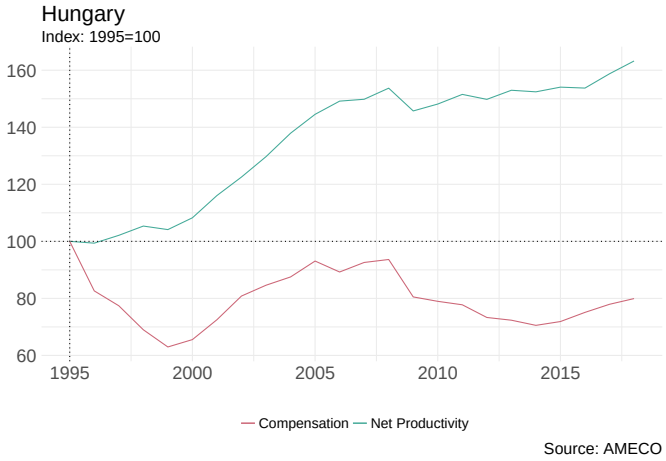
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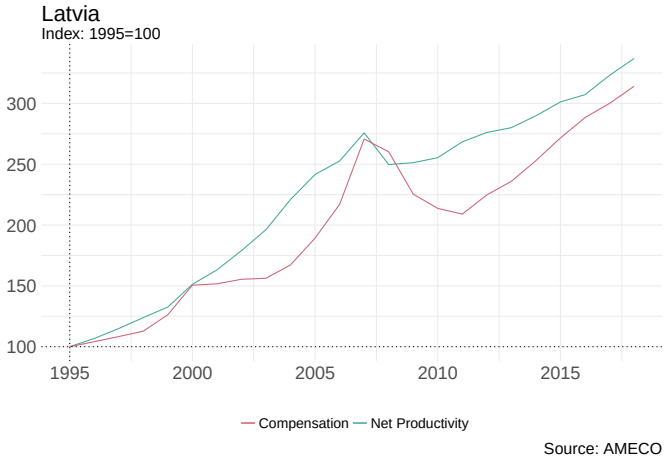
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Net Productivity
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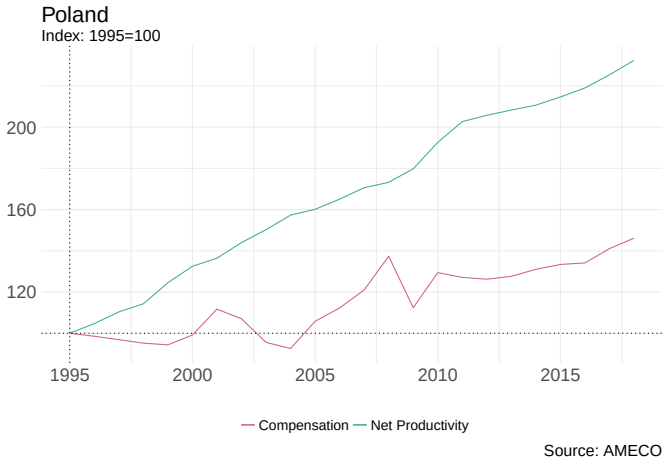
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Compensation
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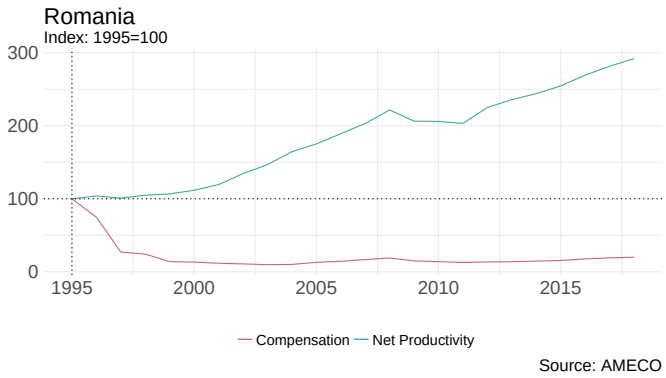
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2015
Compensation
Net Productivity
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(s) 1s


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Compensation
Net Productivity
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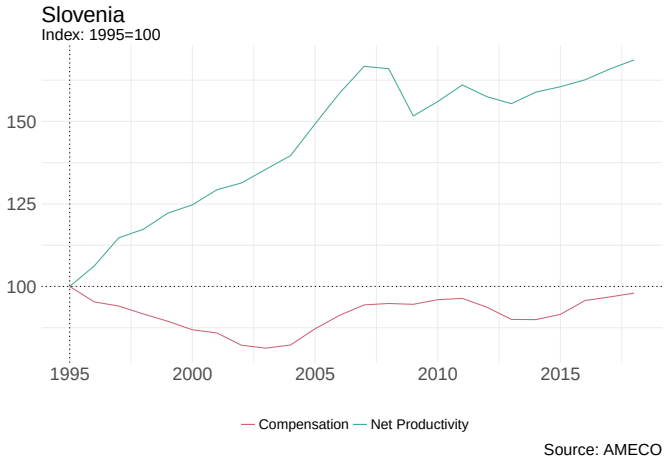
(t) 1t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Net Productivity
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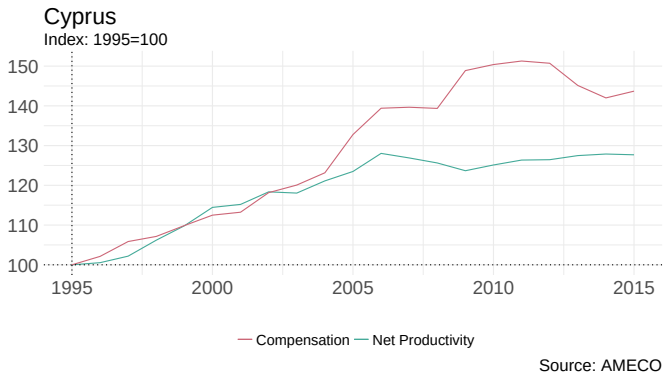
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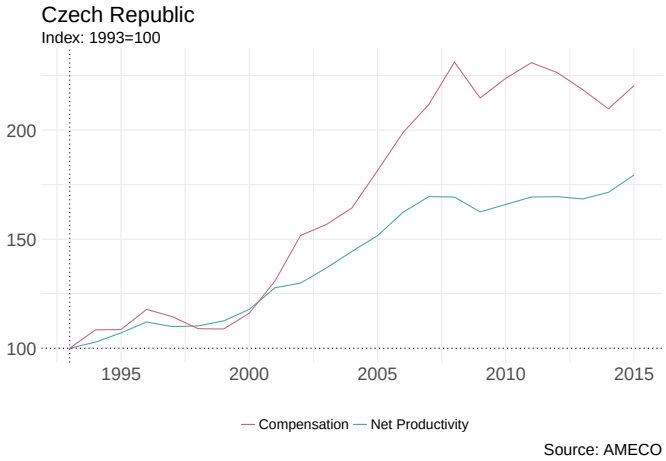
2000
2005
2010
2015
Compensation
Net Productivity
Source: AMECO

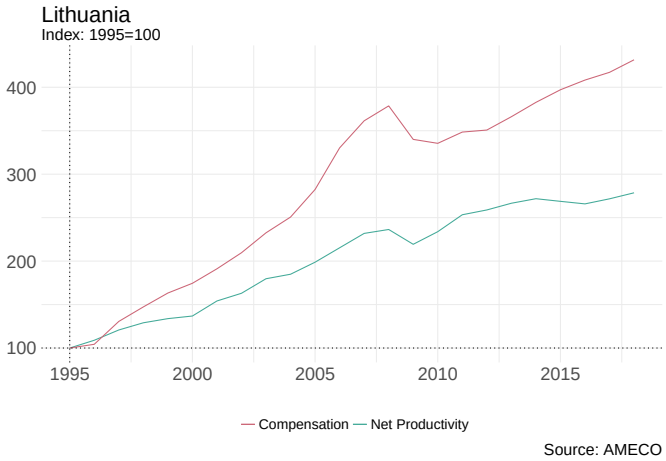
(v) 1v


Germany
Index: 1991=100
130
120
110
100
1990
1995
2000
2005
2010
2015
Compensation
Net Productivity
Source: AMECO

(w) 1w


Czech Republic
Index: 1993=100
200
150
100
1995
2000
2005
2010
2015
Compensation
Net Productivity
Source: AMECO

(x) 1x


Lithuania
Index: 1995=100
400
300
200
100
1995
2000
2005
2010
2015
Compensation
Net Productivity
Source: AMECO

(y) 1y