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AT A GLANCE

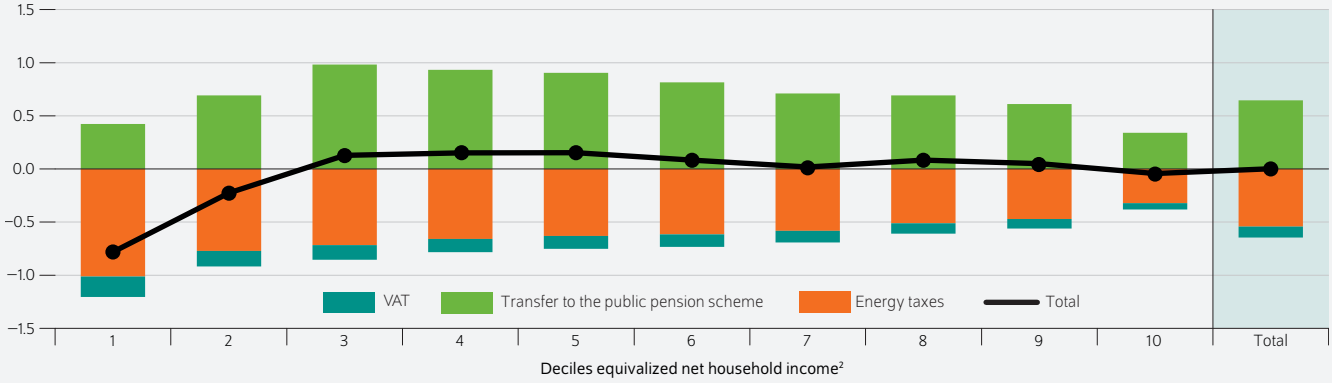
Ecological tax revenue still yields lower pension contributions and higher pensions today

By Stefan Bach, Hermann Buslei, Michelle Harnisch, and Niklas Isaak

- Analysis of the fiscal and distribution effects of the ecological tax reform
- Ecological tax revenue is currently 20 billion euros per year and is used to finance a higher federal grant for Germany's statutory pension scheme
- The pension contribution rate is currently 1.2 percentage points lower and pensions are 1.5 percent higher than they would be without the higher federal grant
- Overall, the ecological tax reform is revenue- and burden-neutral for households
- For various income groups and social groups the reform has resulted in both burden and relief
- Low-income households are burdened

Low-income households are burdened by the ecological tax reform, but it benefits middle-income households

Distribution effects[1] in percent of net household income by deciles of equivalized net household income in 2019



Source: Microsimulation analysis based on the Socio-Economic Panel Study (SOEP), v32, v33.

1 Ecological tax hikes including value added tax.
2 Equivalized by new OECD scale, resident population in households.

FROM THE AUTHORS

"The ecological tax reform is better than reputed and should be devel-oped further."
— Stefan Bach, tax expert and author of the study —

MEDIA

Audio Interview with Stefan Bach (in German)
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ABSTRACT

The ecological tax reform that Germany implemented between 1999 and 2003 increased energy tax rates—especially on gasoline and diesel. Today, the ecological tax hikes yield an annual revenue of around 20 billion euros or 0.6 percent of GDP. The money is used to finance a higher federal grant to the public pension scheme. Calculations based on a pension simulation model show that the contribution rate to the statutory pension fund is currently 1.2 percentage points lower and pensions 1.5 percent higher than they would be without the currently higher federal subsidies. A microsimulation analysis found that overall, the ecological tax reform is neutral with regard to revenue and burden. For various income groups and social groups, there are certain levels of burden and relief. For example, the reform relieves middle-income households of employees and retired persons who benefit from the public pension scheme. Households with low incomes are actually burdened, as are commuters with long commutes. These distribution effects should be taken into account in a further development of ecological taxes.

Germany's ecological tax reform combines environmental and climate policy guidelines with reforms to the tax and social security contribution system. Ecological taxes on broad resource use and material flows—in particular, on energy or carbon emissions—yield considerable revenue. In turn, the revenue can be used to reduce existing taxes and social security contributions that have a negative economic effect or trigger an undesirable burden ("tax bads, not goods"). This is why the existing tax and social security contribution system can be designed to be more efficient or yield a more equal distribution, alongside its contribution to environmental and climate protection ("double dividend").[1]

Related reform concepts have been developed and discussed as part of, within, during a broad economic policy debate since the beginning of the 1990s. In view of high unemployment, the rising financial burden of social security, and the rise of globalization, the usual recommendation was to use the revenue from the ecological tax to lower social security contributions. This proposal was supported by indicating the high proportion of "extraneous benefits" in the social insurance sector—primarily in the public pension scheme.[2]

The Red-Green federal government adopted the concept in 1999. However, the ecological tax's actual design was much less grand than the original ambition, and the long-term effects on energy consumption and climate protection were minimal.[3] The tax rates on gasoline and diesel were the only taxes with perceptible hikes –by 15.35 euro cents per liter each

1 Theoretical optimal tax models were used to analyze environmental taxes' (Pigou taxes) ability to trigger guidance effects as well as efficiency loss (distortions) in the existing tax and social security contribution system. But in a weaker form, the "double dividend" is valid as a rule. See Ronnie Schöb, "The Double Dividend Hypothesis of Environmental Taxes: A Survey," *CESifo Working Paper Series* no. 946 (2003) (available online). In practical discussions of environmental and economic policy, the "double dividend" was primarily considered part of relieving the social security contribution from earned income and the related contribution to decreasing unemployment.

2 This means benefits that do not serve the original protective purpose of the corresponding social insurance scheme or the parties insured do not pay enough for, for example, taking contribution-free professional training periods and child-raising periods into account or pensions based on minimum income levels. See Damian Fichte, Versicherungsfremde Leistungen in der Gesetzlichen Rentenversicherung und ihre sachgerechte Finanzierung, (2011) (in German; available online); and Volker Meinhardt, "Versicherungsfremde Leistungen der Sozialversicherung. Expertise für das IMK," *Hans-Böckler-Stiftung Study*, no. 60 (2018) (in German; available online).

3 See Claudia Kemfert et al., "Umweltwirkungen der Ökosteuer begrenzt, CO_2-Bepreisung der nächste Schritt," *DIW Wochenbericht*, no. 13 (2019): 216 (in German; available online).

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Table 1

Fiscal effects of the ecological tax reform, 1999–2019

	1999	2000	2001	2002	2003	2004	2005	2010	2015	2016	2017	2018	2019
	Billion euros												
Increased energy tax on													
Gasoline	0.9	2.4	3.5	4.6	5.3	5.0	4.8	4.2	3.7	3.7	3.7	3.7	3.8
Diesel	0.8	2.1	3.2	4.2	5.1	5.0	4.9	5.8	6.6	6.7	6.8	6.8	6.8
Light heating oil	0.5	0.6	0.7	0.6	0.6	0.5	0.6	0.5	0.4	0.4	0.4	0.4	0.4
Natural gas	0.5	0.8	0.9	0.9	2.1	2.0	2.0	1.7	1.6	1.6	2.1	2.1	2.1
Total	2.8	6.0	8.3	10.3	13.1	12.6	12.2	12.2	12.3	12.5	13.0	13.0	13.0
Introduction and increase of electricity tax	1.8	3.4	4.3	5.1	6.5	6.6	6.5	6.2	6.6	6.6	6.9	7.0	7.0
Revenue total	4.6	9.3	12.6	15.4	19.6	19.2	18.7	18.4	18.9	19.0	20.0	20.0	20.0
Thereof households	2.6	5.1	6.7	8.4	10.6	10.6	10.5	10.0	9.5	9.6	9.6	9.7	9.7
Therof goverment	0.3	0.5	0.6	0.7	0.8	0.8	0.8	0.9	1.0	1.0	1.0	1.0	1.0
Revenue value-added tax (VAT)[1]	0.5	0.9	1.2	1.4	1.8	1.8	1.8	2.1	2.0	2.0	2.0	2.0	2.0
Transfer to the public pension scheme													
Increase of contributions for child-raising periods	4.3	7.3	7.3	7.4	7.5	7.5	7.4	7.4	7.7	7.9	8.4	8.6	8.9
Increase of the supplementary federal grant		1.3	4.2	6.8	9.1	9.2	9.2	10.0	11.6	12.1	12.6	12.9	13.3
Total	4.3	8.6	11.5	14.2	16.6	16.7	16.6	17.4	19.3	20.0	21.0	21.6	22.2
	As percent of gross domestic product (GDP)												
Revenue total	0.22	0.44	0.58	0.70	0.88	0.85	0.81	0.71	0.62	0.60	0.61	0.59	0.57
Thereof households	0.13	0.24	0.31	0.38	0.48	0.47	0.46	0.39	0.31	0.30	0.29	0.29	0.28
Therof goverment	0.01	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
Revenue value-added tax (VAT)[1]	0.02	0.04	0.05	0.07	0.08	0.08	0.08	0.08	0.07	0.06	0.06	0.06	0.06
Transfer to the public pension scheme	0.21	0.41	0.53	0.64	0.75	0.73	0.72	0.67	0.63	0.63	0.64	0.64	0.63

1 VAT revenue on revenue from households and government.

Sources: Federal Ministry of Finance, Federal Statistical Office, Energy Balances Group, German Statutory Pension Insurance Scheme, own calculations.

in five stages until 2003. An electricity tax was also implemented and raised to 2.05 euro cents per kilowatt hour by 2003. To avoid burdens on the energy-intensive industries and low-income households, the energy tax rates on natural gas and light heating oil only experienced moderate increases. Further, far reaching tax cuts relieved companies in manufacturing, agriculture, and forestry in order to limit their competitive disadvantages in the international market.

Ecological tax rates and revenue nominally constant since 2003, but relative revenue has decreased

The ecological tax hikes ended in 2003. In that year, they generated extra revenue of 19.6 billion euros or 0.9 percent of GDP (see Table 1, Figure 1). In the following years, the revenue from the ecological tax fell since the consumption of taxed energy sources also decreased. This was primarily due to the sharp increase in oil prices, which rose by over 200 percent between 2003 and 2008. This only reinforced public resentment, which the ecological tax hikes triggered from the outset. That is one of the reasons why the energy tax rate on fuel for use in transportation and heating, which represent the largest proportion of the energy tax revenue, have not been changed since 2003.[4] Electricity has been burdened with the sharp increase in the EEG surcharge since 2010, whose rate is now three times as high as the electricity tax itself.[5]

Since 2004, annual revenue from the ecological tax has been between 18 and 19 billion euros. It has not attained its 2003 level until recent years. With regard to fuel for transportation, there was a shift from gasoline to diesel—partially the result of the lower energy tax rate on diesel. This led to an increase in road freight transport and higher use of cars that run on diesel.[6] The total annual revenue generated by higher fuel tax rates has been around ten billion euros in the past few years. With regard to fuel for heating, there was a slight move to natural gas away from light heating oil, and the extra tax revenue has fluctuated between 1.8 and 2.5 billion euros in recent years. The electricity tax revenue has been around seven billion euros per year most recently.

The total extra revenue from the ecological tax has virtually remained constant since 2003, and as a result, its weight in

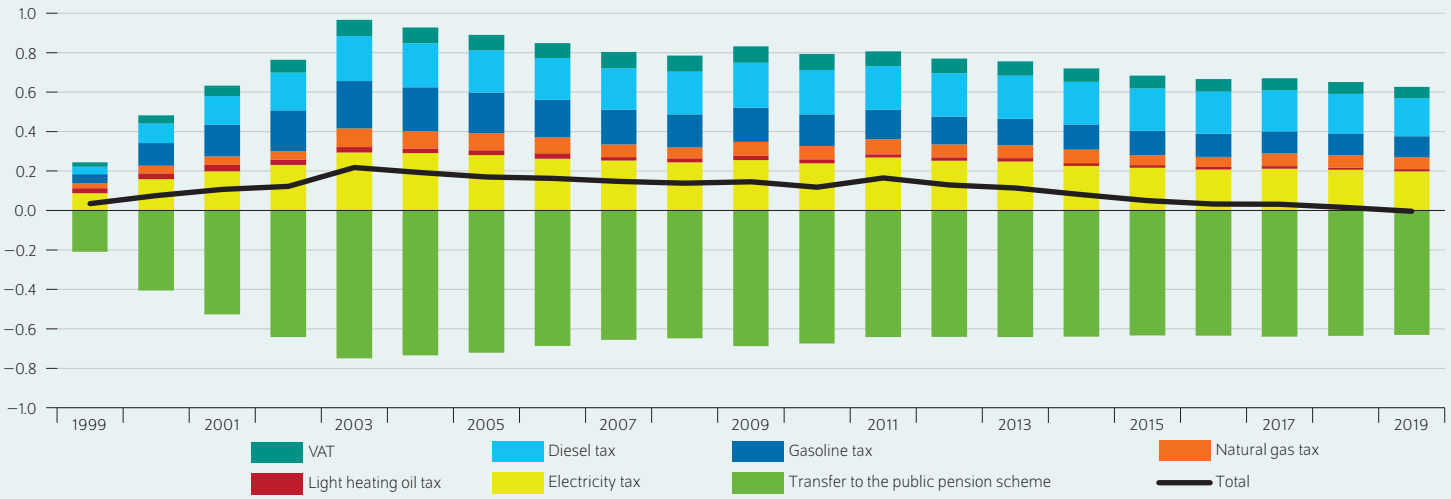
4 For industry and power plants, smaller changes resulted from the 2006 energy tax reform, which implemented the EU's energy tax directive. They penalized taxing gas and heating oil for electricity production, tax reductions for the manufacturing sector and energy-intensive processes or the non-energy-related use of energy sources. And a small tax on coal for heating purposes was implemented.

5 The EEG surcharge finances support for electricity production from renewable energy sources. The financing needs of grid operators are passed on to end consumers. Electricity-intensive companies in the manufacturing sector and railroads are partially exempted from the surcharge. See "EEG-Umlage" in the DIW Glossary (in German; available online).

6 Federal Ministry of Transport and Digital Infrastructure, Verkehr in Zahlen 2018/2019 (2018) (in German; available online).

Figure 1

Fiscal effects of the ecological tax reform, 1999–2019
As percent of gross domestic product (GDP)



Sources: Federal Ministry of Finance, Federal Statistical Office, Energy Balances Group, German Statutory Pension Insurance Scheme, own calculations.

Ecological tax revenue is transferred to the public pension scheme.

relation to added value and income has diminished. The extra revenue's proportion of GDP has dropped by one third, from 0.9 percent in 2003 to 0.6 percent in 2019.

When it comes to final consumption, the ecological tax has expanded the tax base of the value added tax insofar as it has been completely passed on to the consumption prices for households and the government. It has boosted value added tax revenue accordingly. Most recently, the effect has been quantified at two billion euros per year.

"Tank up on pension": the ecological tax still finances the pension contribution decrease and pension increase

The largest portion of the ecological tax revenue has been used to top up the federal government's contribution to the statutory pension scheme. On the one hand, the federal government has paid "contributions" for child-raising periods to the public pension scheme since its introduction. In return, the general federal grant was cut by funds that had previously been paid as a lump sum.[7] The extra revenue from the continuation of the ecological tax reform of 2000 to 2003 was used to increase the supplementary federal grant.[8] In total, the higher payments to the statutory pension fund rose to 16.6 billion euros in 2003: 0.75 percent of GDP (see Table 1). The underfinancing of "extraneous benefits" in the statutory pension fund from federal subsidies was no longer a major theme of socio-political debates. In addition, the ecological tax revenue financed support programs of around 0.5 billion euros in 2003 for renewable energy and benefits as specified in the Pension Fund Act (*Altersvermögensgesetz*). The remaining funds were used for budget consolidation.

When viewed in isolation, estimates indicate that the higher level of federal funding lowered the contribution rate to the statutory pension fund in the years after 2003 by 1.5 to 1.7 percentage points.[9] At the same time, the reduction in the contribution rate significantly increased pensions via the pension adjustment regulations. Actually, the contribution rate to the statutory pension fund only fell from 20.3 percent in 1998 to 19.5 percent from 2003 to 2006 because weak economic growth, high unemployment, and rising pension expenditure, burdened pension finances.

Contributions to the pension scheme were since then adjusted according to the change in gross wages and salaries per employee. This implied that their proportion of the mostly constant ecological tax revenue gradually increased.

7 Law to Correct Social Insurance and Guarantee Employees' Rights (*Act zu Korrekturen in der Sozialversicherung und zur Sicherung der Arbeitnehmerrechte*) (1998) (available online). The amount of the contributions paid is based on the number of children under three. The amount per child is equal to the contribution paid by average earners. The amounts for 1999 and 2000 were specified in the law. Since 2001, the values of one year are updated to the following year, depending on wage changes, any changes in the contribution rate in the statutory pension fund, and the change in the number of children under three. See Deutsche Rentenversicherung Bund, *SGB VI, Text und Erläuterungen, Art. 177*, (2014): 871–873.

8 German Budget Consolidation Law (Gesetz zur Sanierung des Bundeshaushalts, HSanG) dated Dec. 22, 1999, *Bundesgesetzblatt I*, (1999): 2534.

9 Stefan Bach, "Zehn Jahre ökologische Steuerreform: Finanzpolitisch erfolgreich, klimapolitisch halbherzig," *DIW Wochenbericht*, no. 14 (2009): 222 (in German; available online).

Currently, they likely exceed the ecological tax revenue (without the extra revenue from the value added tax) by around two billion euros per year. In other words, all of the current ecological tax revenue of around 20 billion euros per year or 0.6 percent of GDP is now being used to finance higher federal transfers to the statutory pension scheme.

We determined the effect on the contribution rate to the statutory pension fund and the pension level for 2019 and subsequent years using a special version of PenPro, our pension simulation model.[10] We simulated the effect of a reduction in the federal government's contributions for child-raising periods and a supplementary federal grant to the extra federal funding of 20 billion euros. The results show that in and of itself, reducing the level of federal funding would raise the contribution rate to the statutory pension fund by 1.6 percent. This would reduce the pension adjustment and in subsequent periods, raise the general federal grant. After several years, the reciprocal adjustment processes would lead to a contribution increase of 1.2 percentage points and a pension reduction of 1.5 percent. The general federal grant would rise to nearly 1 billion euros.

If they reversed the ecological tax reform today and cut the federal grant to the statutory pension scheme by an amount equal to the ecological tax revenue, in the medium term the contribution rate would have to rise by 1.2 percentage points. The pension benefits were 1.5 percent below the level that would be attained without withdrawing this funding.

Pension contribution decrease and pension increase compensate for the ecological tax burden—but not among low earners

We simulated the distribution effects of the ecological tax reform with our STSM microsimulation model based on the Socio-Economic Panel (SOEP) (see box). The results are presented in deciles of equivalence weighted household net incomes.[11]

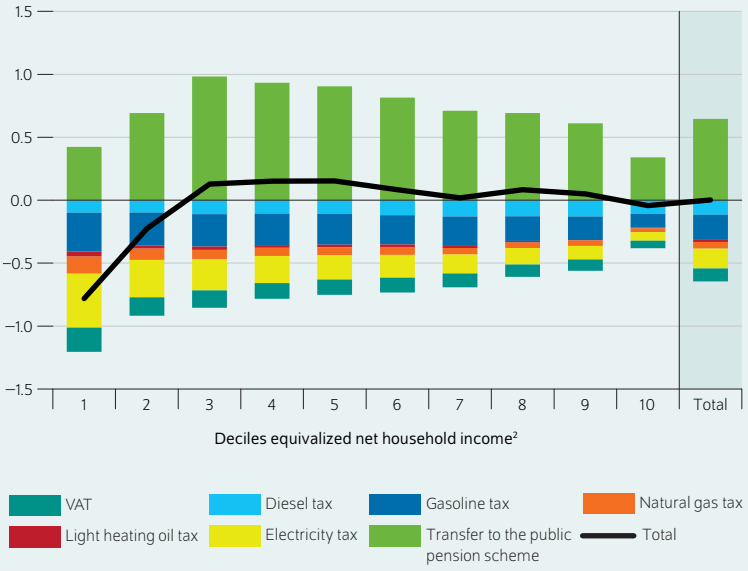
We assumed that 100 percent of the ecological tax hikes would be passed on to consumer prices, including the value added tax on the ecological tax. Accordingly, energy products became more expensive and real income was reduced. The distribution effects are presented in relation to net income (see Figure 2). Based on the current data, the adjustment reactions of the households to the change in energy prices or the reduced pension contributions are included in this analysis since the ecological tax reform has been in effect for many years. Insofar as household adjustment reactions have increased other expenditures—for lower-consumption vehicles, household appliances, and heating systems or energy-efficiency upgrades for buildings, for example—we slightly underestimated the income effects. We also neglected the effects of the ecological tax reform on the prices of energy-intensive products and overall economic growth. However, they are minimal: the various exceptions and benefits outside the transportation sector have left the incentives for energy uses largely unchanged. The effect on macroeconomic growth is presumably more positive than negative.[12]

The ecological tax burdens are regressive across income groups. This means they place a heavier burden relative to net income on poor households than on rich households. The effect is especially marked with regard to the electricity tax. The average electricity consumption of households

Figure 2

Distributional impact of the ecolgical tax reform[1] on households, 2019

As percent of net household income



1 Ecological tax hikes including value added tax.
2 Equivalized by new OECD scale, resident population in households.

Source: Microsimulation analysis based on the Socio-Economic Panel Study (SOEP), v32, v33.

Low-income households are burdened by the ecological tax reform.

10 Hermann Buslei, "Erhöhung der Regelaltersgrenze über 67 Jahre hinaus trägt spürbar zur Konsolidierung der Rentenfinanzen und Sicherung der Alterseinkommen bei," *DIW Wochenbericht*, no. 48 (2017) (in German; available online). We used a modified version of the simulation model that only includes the adjustments for the contribution rate, pension value, and general federal grant. All other influencing variables—economic output, wage sum, and the number of contribution payers and pension recipients, etc.—were held constant at the 2019 level. We consciously ignored the regulations on the fluctuating reserve in order to hide their discretionary effects on the variables of interest. Nor did we consider the safeguards as specified in Art. 68a of Social Code IV. As a result, the model calculation yielded a decline in pension benefits. In other words, we proceeded as if the 2019 reform had been implemented several years before in order to observe the distribution effects in the medium term. See similar simulations on the effects of the pension for mothers (*Mütterrente*) in Stefan Bach, Hermann Buslei, and Michelle Harnisch, "Die Mütterrente II kommt vor allem Rentnerinnen mit geringen und mittleren Einkommen zugute," *DIW Wochenbericht* no. 28 (2018): 613–622 (available online).

11 In order to make the income situations of households of varying sizes and compositions comparable, we determined a per-capita needs-adjusted net income for each household member (equivalent income) as per the usual international needs scale ("new OECD scale"). Also see "*Äquivalenzeinkommen*" in the DIW Glossary (in German; available online). Subsequently, the population was assigned to one of ten groups of the same size (deciles) based on level of net equivalent income.

12 Stefan Bach, Michael Kohlhaas, and Barbara Praetorius, "Wirkungen der ökologischen Steuerreform in Deutschland," *DIW Wochenbericht*, no. 14 (2001) (available online); and Stefan Bach et al., "Die ökologische Steuerreform in Deutschland. Eine modellgestützte Analyse ihrer Wirkungen auf Wirtschaft und Umwelt" (Berlin, Heidelberg: Springer Verlag, 2001).

Box

Database and simulations with the STSM microsimulation model

STSM is a comprehensive microsimulation model for empirically analyzing the effect of income tax, social security payments, and monetary social transfers on the economic situation and employment of households.[1] The database for the present study is the 2016 survey wave of the Socio-Economic Panel Study (SOEP).[2] The SOEP records detailed information on income levels (earned income, capital income, and transfer income) and various socio-economic characteristics. On this basis it is possible to simulate income tax, social security contributions, and social transfers with great precision. STSM contains complex simulation modules on personal income tax and the solidarity surcharge, social security contributions, and key social transfers (unemployment benefit, housing allowance, parental benefit, child benefit, child supplement, and social assistance benefits). The incomes used were updated to 2019.

The database can be used to reliably simulate pension contributions for the respective applicable contribution rates and contribution measurement bases. We simulate the effects on the pension level by proportionally adjusting all gross pensions of the statutory pension schemes. The ecological tax burden is simulated based on the 2015 survey wave, in which detailed information on energy consumption was collected.[3]

Consequences for taxes and social transfers

For the microsimulations, we took into account that changes in pension contributions and pensions in turn change the income tax burden and needs-tested social transfers—particularly social assistance benefits, child supplement, and housing allowance. Changes in employer contributions that affect taxable income and therefore, the company's tax burden, were not included. Nor did the analysis take into account the possibility that the reduced employer contribution could benefit employees in the form of higher gross wages.

1 See Stefan Bach et al., "Aufkommens- und Verteilungswirkungen eines Entlastungsbetrags für Sozialversicherungsbeiträge bei der Einkommensteuer (SV-Entlastungsbetrag)," *DIW Berlin Politikberatung kompakt*, no. 128 (in German; available online); and Viktor Steiner et al., "Documentation of the Tax-Benefit Microsimulation Model STSM. Version 2012," *DIW Berlin Data Documentation*, 63 (2012) available online.

2 The Socio-Economic Panel (SOEP) is a representative longitudinal survey of households in Germany. The survey began in 1984 and the 2015 wave encompassed 16,000 households with 41,000 persons.

3 See Stefan Bach, Michelle Harnisch, and Niklas Isaak, Verteilungswirkungen der Energiepolitik – Personelle Einkommensverteilung. Forschungsprojekt im Auftrag des Bundesministeriums für Wirtschaft und Energie, (2018) (in German; available online).

equals 1,550 kilowatt hours per person per year. The figure is practically constant across income groups. Accordingly, all households pay more or less the same amount of electricity tax. Since net incomes in the top decile are around 6.5 times higher than in the lowest decile, the electricity tax's relative burden is larger among low earners. While the households in the lowest decile pay more than 0.4 percent of their net income in electricity taxes, the top decile pays less than 0.1 percent. On average, households have an electricity tax burden of 0.16 percent of net income.

Light heating oil and natural gas are taxed at higher rates and the regressive distribution effect is not as pronounced, since higher income households typically have larger living spaces (and have to heat more). However, at an average 0.07 percent of net income, the heating fuel tax is not especially significant. The proportion in the lowest decile is just under 0.2 percent.

The transportation fuel tax is much less regressive. Low earners are significantly less likely to have cars and use them less frequently than households with medium or high incomes. Kilometers driven and fuel consumption are largely defined by trips to and from work.[13] Since commuters frequently use diesel vehicles, the burden of higher diesel tax is actually slightly progressive and does not become regressive until the top decile. The burden resulting from the gasoline tax hike is significantly less regressive in comparison to the heating fuel and electricity taxes.

Overall, ecological tax hikes including VAT for households in 2019 are 0.64 percent of net income. At 1.2 percent, they are perceptible in the lowest decile, while they only represent 0.4 percent of net income in the top decile.

The pension contribution decrease and pension increase ultimately raise net income. For retired persons who receive benefits from the statutory pension fund, the gain in income is slightly reduced by higher social security contributions and the income taxes they have to pay on the pension increase. As pension contributions are deductible from taxable income, lower contributions lead to a marginally higher income tax burden for employees. Households receiving social assistance benefits for the elderly experience little or no relief, as higher pension income is deducted from their needs-based social assistance benefits. These effects were taken into account in the microsimulation analyses and presented in summaries.

Relative to net income, the relief provided by the ecological tax reform to the lower and upper income deciles is lower than the relief to the middle income deciles. In the lower deciles, there are fewer employed persons who benefit from

13 While the proportion of employed persons is low in the lower three deciles—and their distance to the workplace is minimal—the proportion of commuters with long distances to the workplace (over 20 kilometers) steadily increases from 11 percent in the third decile to 28 percent in the ninth decile. In the top decile, it returns to a somewhat lower level.

Table 2

Distributional impact of the ecolgical tax reform on groups of households, 2019

Deciles equivalized net household income[1]	Total households	Haushalte von/in					
		Employees[2]	Commuters[3]	Pensioners[4]	Single parents	Couples with 2 and more children	Rural areas
	As percent of net household income						
1st decile	−0.78	−1.16	−1.37	−0.12	−1.02	−0.98	−0.89
2nd decile	−0.23	−0.75	−0.90	0.66	−0.62	−0.84	−0.27
3rd decile	0.13	−0.48	−0.71	0.78	−0.34	−0.45	0.07
4th decile	0.15	−0.27	−0.47	0.70	−0.06	−0.33	0.15
5th decile	0.15	−0.23	−0.35	0.75	−0.18	−0.26	0.07
6th decile	0.08	−0.18	−0.30	0.68	−0.11	−0.14	0.02
7th decile	0.02	−0.17	−0.34	0.70	−0.18	−0.20	−0.05
8th decile	0.08	−0.07	−0.19	0.73	−0.11	−0.12	0.00
9th decile	0.05	−0.06	−0.18	0.71	−0.28	−0.11	0.02
10th decile	−0.04	−0.10	−0.15	0.51	−0.18	−0.20	−0.11
Total	0.00	−0.19	−0.28	0.70	−0.47	−0.34	−0.06
Decile ratios							
10/1	0.05	0.09	0.11	−4.17	0.17	0.21	0.12
10/5	−0.27	0.43	0.42	0.68	0.98	0.78	−1.57
5/1	−0.20	0.20	0.26	−6.16	0.18	0.27	−0.08

1 Equivalized by new OECD scale, resident population in households.
2 Households with employed persons aged 25 to 64 years, without pensioners.
3 Over 20 kilometers distances to the workplace.
4 Households of pensioners aged 65 and more, without employed persons.

Source: Microsimulation analysis based on the Socio-Economic Panel Study (SOEP), v32, v33.

decreases in the pension contribution: unemployed persons and students, for example. Retired persons with low income often live on social assistance from which the higher pensions are deducted. In the upper income groups, the proportions of the self-employed, civil servants, and civil service pensioners are greater—as is the importance of capital income. This is why the relief is not as great in these groups.

Overall, the ecological tax reform is almost revenue-neutral and therefore, burden-neutral for households. However, varying levels of burden and relief are apparent when income groups and social groups are analyzed. The lowest decile is burdened with 0.8 percent of net income; in the middle income groups the levels of relief are up to 0.15 percent of net income, and the upper two deciles are minimally affected in either direction.

An analysis by social group found that employed persons and above all, commuters with long distances to the workplace are burdened, and those with low incomes are perceptibly burdened (see Table 2). Single parents also experience a relatively high burden. They typically do not have high fuel costs but are burdened when it comes to electricity and heating fuel and benefit less from the pension contribution decrease and pension increase. Families with two or more children are burdened across all income groups. In this case, higher transportation fuel consumption for commuters probably plays a stronger role. Retired persons, on the other hand, are primarily relieved, since they benefit from the pension increase and have lower transportation fuel expenditures. Households in rural regions benefit slightly less than households overall because they do not have significantly higher energy expenditures in comparison to the average.

The calculations neglect to reflect that households receiving needs-based social assistance benefits are partially compensated for higher electricity and heating fuel taxes because the state pays their heating costs and adjusts the standard benefits. To this extent, we have slightly overestimated the effect of the ecological tax increases on low earners. However, the proportion of people who do not take up needs-based social assistance benefits and the children's allowance is also significant.

Ultimately, the question is what effect decreasing the pension contribution had on the income distribution and the labor market. In the microsimulation analysis, we only took the reduced pension contribution for employees into account and ignored the employer contribution. With regard to companies, energy tax hikes and reductions in employer contributions basically balanced each other out. Insofar as individual employers were relieved by the pension contribution decrease in the long term, their profits rose. Since companies and corporate shares are concentrated in the upper deciles and the top percentiles, only high and very high income groups benefit from this. In reality, to some extent reduced employer contributions trickled down to their employees in the form of higher gross wages—corresponding to the typical

assumption of the long-term effective burden (incidence) of the employer contribution. In this case, employees and pensioners—particularly those in the middle income groups—benefited somewhat more than indicated in the present study.

In accordance with the relevant consensus estimates and rules of thumb,[14] the pension contribution decrease may have created up to 150,000 full-time jobs. This is surely just a small contribution to the "employment miracle" of the past decade. Since 2005, the number of employees has risen by six million, and the number of employees who contribute to the social insurance system has risen by a solid seven million.

Conclusion: the ecological tax reform was better than reputed and should be developed further

Germany's ecological tax reform was an abiding environmental and financial policy innovation of the 1990s. Its implementation by the Red-Green federal government as of 1999 was inadequate with regard to environmental and climate policy but was quite successful in fiscal and social policy. The revenues generated by the ecological tax were used to significantly lower the contribution rate to the statutory pension fund and increase pensions.

Due to the sharp energy price increases at the middle and end of the aughts, the ecological tax hikes were abandoned after 2003. Germany's energy and climate policies relied on the expansion of the European emissions trade and support for renewable energy. This sharply increased the price of electricity in the sectors without beneficial treatment. In transportation and heating, on the other hand, broad price incentives were no longer issued and at the same time, these areas were thought to hold great potential for energy savings.

As for fiscal and social policy the reform was successful. Today, the ecological tax hikes still yield revenues of 20 billion euros or 0.6 percent of GDP. Due to the higher level of federal funding for statutory pension funds, the contribution rate to the statutory pension fund is 1.2 percentage points lower and pensions 1.5 percent higher than they would have been without the extra funding.

Above all, the households of employees and retired persons who receive benefits from the statutory pension fund with medium incomes are the beneficiaries. Civil servants, pensioners, and self-employed persons have not experienced relief. This can be explained by the assumption of "extraneous benefits," which have primarily been financed by pension contributors and retired persons. However, the reform led to certain hardships for households with low incomes. And higher taxes on gasoline and diesel burden commuters with long distances to their workplaces.

Currently, an appreciable carbon tax is being proposed as a way of setting up policy guidelines for the energy consumption areas that are not subject to emissions trading—above all, heating and transportation. In order to relieve households with low incomes, lowering the electricity tax and EEG surcharge or returning tax revenues as a uniform sum per person or household (ecobonus, climate bonus, carbon dividend) are under debate in Germany.[15] They would provide significantly more relief to low-income households than decreasing social security contributions or taxes would. The self-employed, pensioners, single parents, and families with several children would also reap greater benefits.

14 Olivier Bargain, Kristian Orsini, and Andreas Peichl, "Comparing Labor Supply Elasticities in Europe and the United States: New Results," *Journal of Human Resources*, 49 (2014): 723–838.

15 Ottmar Edenhofer and Christoph M. Schmidt, "Eckpunkte einer CO_2-Preisreform. Gemeinsamer Vorschlag von Ottmar Edenhofer (PIK/MCC) und Christoph M. Schmidt (RWI)," *RWI Position* no. 72 (2018) (in German; available online); and Economists' Statement on Carbon Dividends. Bipartisan agreement on how to combat climate change, (*Wall Street Journal*, Jan. 17, 2019) (available online).

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