



Forecasting tax expenditures:

Personal income taxation

31 January 2024

This paper presents the forecasts undertaken for Federal tax expenditures related to the personal income tax. Tax expenditures are subsidies distributed by way of deviating from the tax regime. There is a time lag of two years from the date of taxation until the date of consolidated data on tax revenues and expenditures. The objective of this paper is to bridge this gap by estimating forecasts for tax expenditures in personal income taxation.

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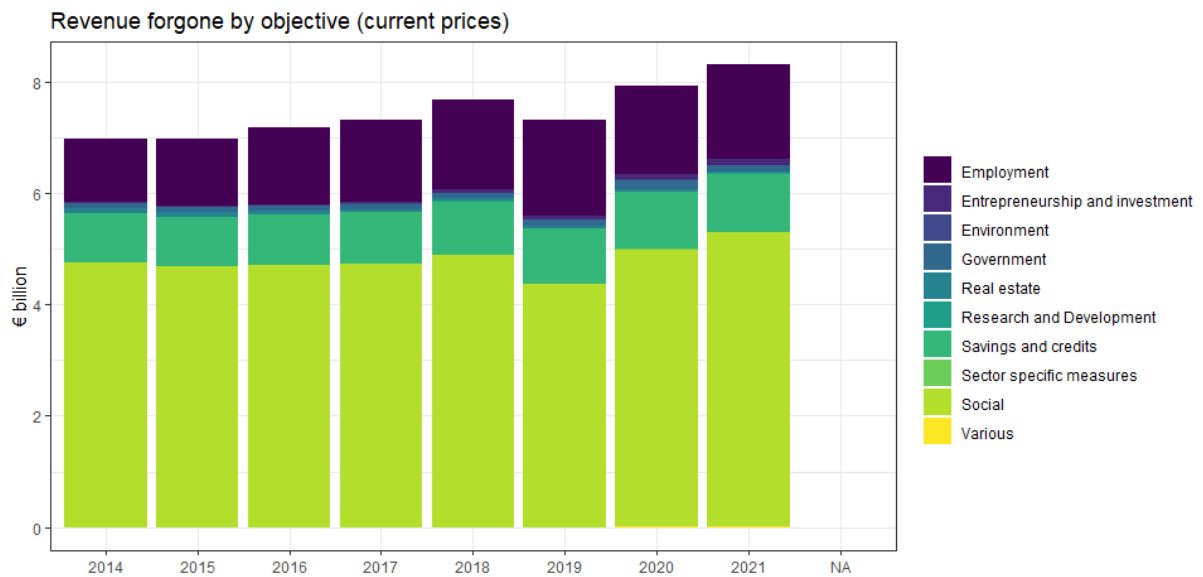
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1 INTRODUCTION

The [Federal Inventory of Tax Expenditures](#) is published annually through the Chamber of Representatives and attached to the General Budget. The consolidated amounts of revenue forgone are only known one or two years after the taxable event. These forecasts are an attempt to bridge this gap. This work is exclusively concerned with tax expenditures enacted on the federal level¹.

1.1 OVERVIEW OF FEDERAL TAX EXPENDITURES

The budgetary cost of tax expenditures is expressed as revenue forgone². The plot below presents the revenue forgone by categories indicating the general objective. The table lists individual federal tax expenditures with the respective amount and total share of revenue forgone in 2021. It does not contain all measures in PIT mentioned in the Federal Inventory of Tax Expenditures. Measures that are excluded are not quantifiable, have too low amounts, or have too few observations.



¹ Forecasts for the tax expenditures that existed before its devolution are available and also reported in the Inventory of Federal Tax Expenditures.

² For more details see methodological notes in the introduction of the Inventory of Federal Tax Expenditures (2022).

Revenue forgone 2021

Tax expenditure measure	Category	€ million	%
Pensions e.a	SOC	4 034,80	48,60
Health insurance benefits	SOC	726,36	8,75
Pension saving	CAP	602,06	7,25
Unemployment benefits	SOC	360,71	4,34
Job bonus	EMP	328,38	3,96
Federal reduction for long-term savings	CAP	305,35	3,68
Tax credit for overtime pay	EMP	304,35	3,67
Profit related pay for wage earners	EMP	302,62	3,64
Reimbursement commuting expenses - Public transport only	EMP	301,44	3,63
Child care expenses	SOC	168,00	2,02
Commuting expenses - Other means of transport	EMP	132,47	1,60
Low earned income	EMP	129,56	1,56
Personal contributions to group insurance	CAP	123,73	1,49
Charitable donations	GOV	119,78	1,44
Flexi-jobs	EMP	95,93	1,16
Investment allowance profits	INV	93,05	1,12
Exemption allowance for bike commuting	EMP	65,64	0,79
Exemption for additional payments for dismissals	EMP	28,90	0,35
Federal housing bonus	IMMO	15,93	0,19
Legal Protection Insurance	VARIA	11,17	0,13
Starter micro companies	CAP	10,72	0,13
Investment allowance proceeds	INV	9,09	0,11
Construction saving	IMMO	6,34	0,08
Bonus for advanced payments	GOV	5,93	0,07
Sharing economy incomes	SEC	4,02	0,05
Innovation premiums	RD	3,03	0,04
Additional staff members SME	EMP	1,64	0,02
Assisting spouse	INV	1,38	0,02
Exempt overtime in the hospitality sector	EMP	1,34	0,02
Green loans	ENV	1,34	0,02
LEA activity	EMP	1,08	0,01
Houses- low or zero energy consumption	ENV	0,91	0,01
Passive houses	ENV	0,91	0,01
Electric cars	ENV	0,83	0,01
Purchase of shares from the employer	CAP	0,81	0,01
Starter small companies	CAP	0,71	0,01
Additional forfait for professional expenses - mayors e.a	GOV	0,52	0,01
Growing companies	CAP	0,36	0,00
Adoption procedure	SOC	0,32	0,00
Expenditure in the framework of microfinance development funds	CAP	0,30	0,00
Additional reduction for low income single parents	SOC	0,23	0,00
Private PC	EMP	0,22	0,00
Domestic workers	EMP	0,21	0,00
Additional staff SME's, export staff e.a	INV	0,04	0,00
Private "Privak/Pricaf" capital loss	CAP	0,01	0,00
Exemption of lump sum crisis premiums for laid-off workers	EMP	0,00	0,00
Total		8 302,49	100,00

2 METHODOLOGY

The objective is to have a short-term prediction ($t+1$) of the probable trend in the budgetary cost without future policy changes. The cost of a tax expenditure depends on its design and scope but also on its use (tax payer behaviour) and context (phase of economic cycle). The point is not to produce the most sophisticated models. Given the complexity, current data limitations, and high uncertainty, the models should be parsimonious and make some theoretical sense. This can be done with a basic trend model or where possible, for major items, estimated with a multivariate linear model.

2.1 EXPONENTIAL SMOOTHING

An exponential smoothing function assigns exponentially decreasing weight to observations. Doing so, it effectively smooths out the series over time to a certain average trend.

Mathematically this model can be expressed as followed.

$$s_0 = x_0$$
$$s_t = \alpha x_t + (1 - \alpha)s_{t-1}, \quad t > 0$$

Where α is the smoothing factor, and $0 < \alpha < 1$.

2.2 ARIMA

An *Auto-regressive integrated moving average* (ARIMA) model can be applied to identify and deal with non-stationary and seasonal time trends. “**AR**” indicates that the variable of interest is regressed on its own lagged values. “**MA**” indicates that the regression error is a linear combination of error terms whose values occurred contemporaneously and at various times in the past. “**I**” indicates that the values have been replaced with the difference between their values and prior values.

Non-seasonal ARIMA models are generally denoted as:

$$ARIMA(p, d, q)$$

Where p is the number of time lags, d is the degree of differencing, and q is the order of the moving-average model. For example, An ARIMA(0, 1, 1) model without constant is a basic exponential smoothing model. ARIMA models can be estimated following the Box–Jenkins approach. To test for autocorrelation the Durbin-Watson and Breusch-Godfrey tests are applied.

2.3 MULTIVARIATE MODELS

The previously discussed models make estimations using the dependent variable in order to extrapolate a basic growth trend. Variations over time are transformed into a smooth line. They do not capture sudden peaks or troughs correlated with external (recurring) factors such as changes in the respective policy regime or the economic environment. These indicators could be used as independent variables in forecast models if they are found to be significantly correlated and theoretically make sense.

As an example:

$$Y \sim Gdp + Inflation + Savingrate + Productivity + Exemptionrate + \varepsilon$$

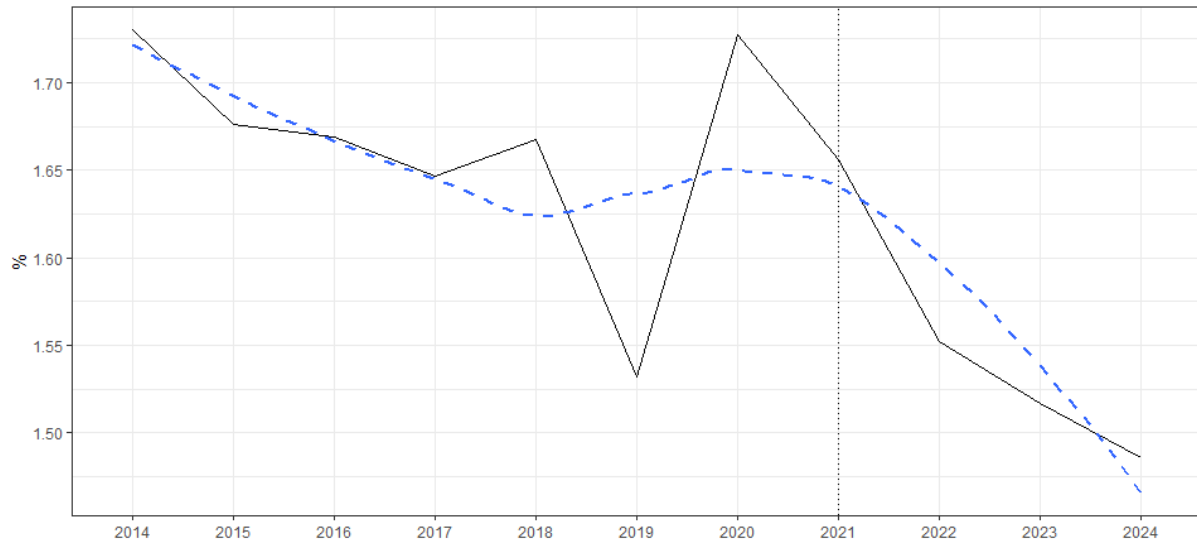
Where Y is revenue forgone³ in year $t - 2$. In this example, economic output, savings, productivity and the relevant exemption rate are assumed to correlated with the growth rate of the tax expenditure. However, policy parameters can often not be integrated into a linear model. Additionally, significant variation over time is an essential condition before it can be attempted. The independent variables used in these models are originally based on the macro-economic and population forecasts of the Federal Planning Bureau⁴.

³ Alternatively, Y is based on tax payer's expenditure amounts rather than the derived revenue forgone.

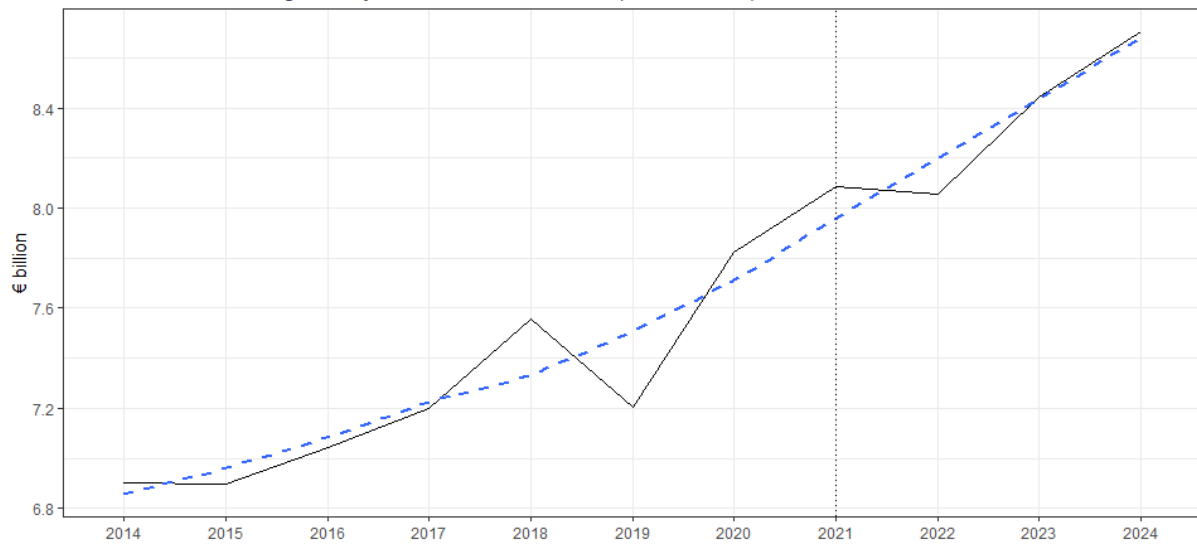
⁴ September 2023 forecasts: [Federal Planning Bureau](#).

3 RESULTS

Estimated revenue forgone in % of GDP



Estimated revenue forgone adjusted with GDP deflator (base = 2014)



Forecasted annual growth rates (%) 2022 - 2024

Tax expenditure measure	Model	2022	2023	2024
Sharing economy incomes	ES	41,54	0,00	0,00
Legal Protection Insurance	ES	37,45	27,24	21,41
Innovation premiums	AR	23,76	4,11	4,81
Assisting spouse	ES	22,95	-2,24	-1,83
Additional reduction for low income single parents	AR	15,74	0,00	0,00
Exemption for additional payments for dismissals	AR	11,26	0,00	0,00
Commuting expenses - Other means of transport	AR	8,91	5,61	3,64
Flexi-jobs	ES	7,32	12,37	11,01
Job bonus	LM	5,47	2,20	-6,56
Starter small companies	ES	4,90	0,00	0,00
Health insurance benefits	LM	4,21	4,04	3,88
Child care expenses	AR	3,83	3,69	3,56
Pensions e.a	LM	3,24	3,14	3,04
Pension saving	LM	3,04	2,95	2,86
Unemployment benefits	LM	2,78	0,00	0,00
Profit related pay for wage earners	LM	2,27	0,77	0,83
Purchase of shares from the employer	ES	1,80	0,00	0,00
Starter micro companies	AR	1,45	0,00	0,00
Exempt overtime in the hospitality sector	LM	0,99	1,19	0,64
Tax credit for overtime pay	LM	0,99	1,19	0,64
Expenditure in the framework of microfinance development funds	AR	0,52	0,40	0,31
Construction saving	ES	0,02	0,00	0,00
Investment allowance proceeds	AR	0,00	0,00	0,00
Green loans	ES	0,00	0,00	0,00
Bonus for advanced payments	ES	0,00	0,00	0,00
Additional staff members SME	AR	0,00	0,00	0,00
Additional forfait for professional expenses - mayors e.a	AR	0,00	0,00	0,00
Houses- low or zero energy consumption	AR	0,00	0,00	0,00
Private PC	AR	0,00	0,00	0,00
Reimbursement commuting expenses - Public transport only	AR	-0,00	0,00	0,00
Exemption allowance for bike commuting	AR	-0,00	0,00	0,00
Investment allowance profits	AR	-0,00	0,00	0,00
Personal contributions to group insurance	LM	-0,18	1,46	0,45
Low earned income	LM	-0,36	0,37	0,00
Electric cars	ES	-3,89	0,00	0,00
Charitable donations	LM	-4,04	2,01	16,61
Federal reduction for long-term savings	AR	-4,70	-3,36	-2,36
Domestic workers	AR	-7,09	-7,63	-8,26
Private "Privak/Pricaf" capital loss	ES	-10,37	22,03	18,05
Growing companies	ES	-14,26	0,00	0,00
Federal housing bonus	ES	-22,08	-27,28	-36,28
Additional staff SME's, export staff e.a	AR	-25,56	-47,55	95,43
Adoption procedure	ES	-34,24	-20,68	-26,07
LEA activity	ES	-73,09	0,00	0,00
Passive houses	AR	-79,19	-15,67	-8,39
Exemption of lump sum crisis premiums for laid-off workers	AR			

Forecasted revenue forgone (million euros) 2022 - 2024

Tax expenditure measure	2022	2023	2024
Pensions e.a	4 165,53	4 296,26	4 427,00
Health insurance benefits	756,95	787,54	818,14
Pension saving	620,36	638,66	656,95
Unemployment benefits	370,75	370,75	370,75
Job bonus	346,34	353,94	330,71
Profit related pay for wage earners	309,48	311,86	314,45
Tax credit for overtime pay	307,37	311,04	313,02
Reimbursement commuting expenses - Public transport only	301,44	301,44	301,44
Federal reduction for long-term savings	291,00	281,23	274,58
Child care expenses	174,43	180,87	187,30
Commuting expenses - Other means of transport	144,27	152,36	157,90
Low earned income	129,09	129,56	129,56
Personal contributions to group insurance	123,51	125,31	125,88
Charitable donations	114,93	117,24	136,72
Flexi-jobs	102,95	115,69	128,43
Investment allowance profits	93,05	93,05	93,05
Exemption allowance for bike commuting	65,64	65,64	65,64
Exemption for additional payments for dismissals	32,15	32,15	32,15
Legal Protection Insurance	15,35	19,53	23,71
Federal housing bonus	12,42	9,03	5,75
Starter micro companies	10,87	10,87	10,87
Investment allowance proceeds	9,09	9,09	9,09
Construction saving	6,34	6,34	6,34
Bonus for advanced payments	5,93	5,93	5,93
Sharing economy incomes	5,69	5,69	5,69
Innovation premiums	3,75	3,90	4,09
Assisting spouse	1,70	1,66	1,63
Additional staff members SME	1,64	1,64	1,64
Exempt overtime in the hospitality sector	1,35	1,37	1,38
Green loans	1,34	1,34	1,34
Houses- low or zero energy consumption	0,91	0,91	0,91
Purchase of shares from the employer	0,82	0,82	0,82
Electric cars	0,80	0,80	0,80
Starter small companies	0,74	0,74	0,74
Additional forfait for professional expenses - mayors e.a	0,52	0,52	0,52
Growing companies	0,31	0,31	0,31
Expenditure in the framework of microfinance development funds	0,30	0,30	0,30
LEA activity	0,29	0,29	0,29
Additional reduction for low income single parents	0,27	0,27	0,27
Private PC	0,22	0,22	0,22
Adoption procedure	0,21	0,17	0,12
Domestic workers	0,20	0,18	0,17
Passive houses	0,19	0,16	0,15
Additional staff SME's, export staff e.a	0,03	0,02	0,03
Private "Privak/Pricaf" capital loss	0,01	0,01	0,01
Exemption of lump sum crisis premiums for laid-off workers	0,00	0,00	0,00
Total	8 530,51	8 746,69	8 946,76

4 APPENDIX

4.1 APPLIED MODELS

The tables below present the regression results for the measures where a linear model was used. In each case, the first model includes all selected variables. If possible, a second model shows an optimized version retaining the most relevant variables.

	<i>Dependent variable:</i>	
	Replacement income	
	(1)	(2)
Real disposable income	-3.144 (2.762)	-3.565 (2.530)
Health index	4.166 (2.682)	4.278 (2.595)
Working age population	2.917 (6.363)	
Constant	-0.320 (7.296)	1.778 (5.519)
Observations	17	17
R ²	0.228	0.216
Adjusted R ²	0.050	0.104
Residual Std. Error	9.569 (df = 13)	9.295 (df = 14)
F Statistic	1.282 (df = 3; 13)	1.927 (df = 2; 14)
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01	

	<i>Dependent variable:</i>	
	Profit related pay	
	(1)	(2)
Profit margins	5.685 (3.296)	5.708* (3.067)
Real disposable income	-1.568 (0.866)	-1.534** (0.654)
CPI	1.918 (1.412)	1.915 (1.320)
unemployment rate	-0.012 (0.187)	
Constant	-2.811 (3.946)	-2.820 (3.690)
Observations	12	12
R ²	0.621	0.620
Adjusted R ²	0.404	0.478
Residual Std. Error	1.923 (df = 7)	1.800 (df = 8)
F Statistic	2.863 (df = 4; 7)	4.359** (df = 3; 8)
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01	

	<i>Dependent variable:</i>	
	Pension saving	
	(1)	(2)
Real disposable income	-18.391 (31.797)	
Saving rate	-14.043 (10.511)	-15.361* (8.620)
unemployment rate	-3.012 (7.120)	
Pension saving fund contributions	-2.009 (1.591)	
Constant	732.853*** (158.711)	732.121*** (132.776)
Observations	18	18
R ²	0.266	0.166
Adjusted R ²	0.040	0.113
Residual Std. Error	96.067 (df = 13)	92.334 (df = 16)
F Statistic	1.178 (df = 4; 13)	3.175* (df = 1; 16)
Note:	*p<0.1; **p<0.05; ***p<0.01	

	<i>Dependent variable:</i>	
	Tax exemption for overtime	
	(1)	(2)
Overtime	-2.674** (1.015)	-2.520** (0.976)
Employment rate	11.878 (15.880)	
Constant	224.401*** (23.699)	236.611*** (16.888)
Observations	15	15
R ²	0.368	0.339
Adjusted R ²	0.263	0.288
Residual Std. Error	53.807 (df = 12)	52.887 (df = 13)
F Statistic	3.496* (df = 2; 12)	6.659** (df = 1; 13)
Note:	*p<0.1; **p<0.05; ***p<0.01	

	<i>Dependent variable:</i>	
	Tax credit for low earned income	
	(1)	(2)
unemployment	-4.771 (5.699)	
gross wage	-3.942** (1.499)	-3.498** (1.387)
C_brutolonen	-5.032 (3.034)	-5.222 (2.993)
Constant	138.661*** (10.101)	134.338*** (8.587)
Observations	17	17
R ²	0.348	0.313
Adjusted R ²	0.197	0.214
Residual Std. Error	18.561 (df = 13)	18.362 (df = 14)
F Statistic	2.310 (df = 3; 13)	3.183* (df = 2; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

	<i>Dependent variable:</i>	
	Long term savings	
	(1)	(2)
Real disposable income	-5.876 (8.141)	
Saving rate	4.506 (2.733)	4.046* (2.235)
unemployment rate	-0.406 (1.857)	
Constant	193.249*** (40.938)	194.169*** (34.430)
Observations	18	18
R ²	0.205	0.170
Adjusted R ²	0.035	0.118
Residual Std. Error	25.051 (df = 14)	23.943 (df = 16)
F Statistic	1.203 (df = 3; 14)	3.276* (df = 1; 16)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

		<i>Dependent variable:</i>
		Group insurance contributions
Real disposable income	-2.351 (3.955)	
CPI	-1.934 (4.113)	
Employment rate	-2.383 (3.607)	
Pension saving fund contributions	-0.209 (0.213)	
Constant	115.695*** (7.704)	
Observations	18	
R ²	0.176	
Adjusted R ²	-0.078	
Residual Std. Error	12.664 (df = 13)	
F Statistic	0.693 (df = 4; 13)	
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01	

		<i>Dependent variable:</i>	
		Public commuting expenses	
		(1)	(2)
Real disposable income	-0.389 (5.861)		
CPI	4.779 (6.498)		
Number of employees	3.495 (3.377)	4.123 (2.552)	
Constant	-4.984 (6.081)	-1.041 (3.472)	
Observations	8	8	
R ²	0.425	0.303	
Adjusted R ²	-0.006	0.187	
Residual Std. Error	6.840 (df = 4)	6.150 (df = 6)	
F Statistic	0.987 (df = 3; 4)	2.610 (df = 1; 6)	
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01		

<i>Dependent variable:</i>	
Childcare expenses	
Real disposable income	-7.175 (10.889)
unemployment rate	-2.468 (2.124)
eligible children	7.540 (13.675)
Constant	138.886*** (14.781)
Observations	16
R ²	0.117
Adjusted R ²	-0.104
Residual Std. Error	31.652 (df = 12)
F Statistic	0.529 (df = 3; 12)
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01

<i>Dependent variable:</i>	
Charitable donations	
unemployment rate	-2.685 (1.774)
CPI	-1.450 (8.426)
Household consumption	-7.193** (2.730)
Constant	86.177*** (13.916)
Observations	14
R ²	0.441
Adjusted R ²	0.274
Residual Std. Error	26.216 (df = 10)
F Statistic	2.632 (df = 3; 10)
<i>Note:</i>	* p<0.1; ** p<0.05; *** p<0.01

5 REFERENCES

Hlavac M (2022). *stargazer: Well-Formatted Regression and Summary Statistics Tables*. Social Policy Institute, Bratislava, Slovakia. R package version 5.2.3, <https://CRAN.R-project.org/package=stargazer>.