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Media Bias and Tax Compliance: Experimental Evidence

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Media bias and tax compliance: Experimental evidence*

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January 21, 2020

Abstract

We study the impact of media bias on tax compliance. Through a framed laboratory experiment, we assess how the exposure to biased news about government action affects compliance in a repeated taxation game. Subjects treated with positive news are significantly more compliant than the control group. The exposure to negative news, instead, does not prompt any significant reaction in respect to the neutral condition, suggesting that participants perceive the media negativity bias in the selection and tonality of news as the norm rather than the exception. Overall, our results suggest that biased news act as a constant source of psychological priming and play a vital role in taxpayers' compliance decisions.

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1 Introduction

Economists have traditionally modeled tax compliance as the outcome of a rational choice between risky assets in a portfolio (Becker, 1968; Allingham and Sandmoo, 1992). This approach does not fully explain the compliance behavior of individuals, as moral and social dynamics also drive individual reporting decisions (Andreoni et al., 1998). Previous research suggests that the satisfaction taxpayers have with government action is a critical driver of their propensity to comply. If citizens believe that the government does not spend their taxes well, they may want to reciprocate by refusing to pay their full tax liability (Spicer and Lundstedt, 1976). If, instead, the belief prevails that institutions use taxes to fund public goods and services adequately, taxpayers will be more willing to comply (Alm et al., 1993). Even when they do not receive a full public good equivalent of their payments, citizens may be intrinsically motivated to honestly declare their income as if a “psychological contract” with tax authorities was in force (Frey and Feld, 2002; 2004). According to Feld and Frey (2007), such a contract holds as far as citizens perceive the political process as fair and the policy outcomes as legitimate, resulting in a stronger willingness to contribute to the welfare of the community.

These perspectives imply a vital role for information about government action and the fairness of the political process. The media’s coverage of economic and policy issues, however, is far from being balanced. Mass media tend to overreport negative news as they generate stronger psychophysiological reactions in the audience (Soroka et al., 2019), and they better fit the public’s preference for negative contents (Agridas 2015). The negativity bias has proved particularly pronounced in the presentation of political (Cappella and Jamieson, 1997; Kepplinger et al., 2012; Le Moglie and Turati, 2019) and economic news (Garz 2014; Soroka et al., 2018). Given the role of information in shaping the public’s opinion about public institutions, research on tax compliance should address the impact of the media negativity bias. However, empirically studying how the media affect citizens’ willingness to pay their taxes is challenging in many respects. Existing surveys do not provide information about the possible bias of the news consumed by the public, and the use of survey data entails endogenous sample selection and treatment assignment that prevent ascertaining causality.

To address these issues, we design a framed laboratory experiment that allows us to analyze how the exposure to biased news affects compliance in a repeated taxation game. Experimental manipulations consist of news tickers reporting top stories about public finance and policy issues

that run on subjects' screens during the game. Employing a between-subjects design, we contrast tax compliance outcomes under three different conditions: negative, positive, and neutral news provision. The negative treatment reflects the media negativity bias that is the status quo in the supply of news about public finance and policy issues (Soroka et al., 2018; Soroka et al., 2019). Compared to the neutral treatment, the negative news condition does not affect tax compliance, confirming that participants perceive the media negativity bias as the norm rather than the exception (Cappella and Jamieson, 1997; Kepplinger et al., 2012; Garz, 2014; Soroka et al., 2019; Elejalde et al., 2018). As the selection and tonality of news deviate from the status quo resulting in positive content, participants become significantly more compliant than the control group. The effect is economically sizable: subjects treated with good news reported a compliance rate of 23 percentage points higher than those exposed to negative or neutral news. Overall, our results reveal that how the media present public finance and policy issues is a crucial determinant of tax compliance, suggesting that biased news act as a constant source of psychological priming that may prevent the public sector from fully exploiting its tax revenue potential.

Our paper bridges two strands of literature. The first comprises the economics of tax compliance, which has been approached from many perspectives (see Andreoni et al., 1998, and Alm, 2019, for a review). We focus on the moral and social perspective on taxpayers' behavior, which has linked compliance to the efficiency and fairness of public institutions (Spicer and Lundstedt, 1976; Tyler, 1990; Smith, 1992; Alm et al., 1993; Frey et al., 2004; Feld and Frey, 2007; Hartner et al., 2008; Murphy and Tyler, 2008; van Dijke and Verboon, 2010; Kogler et al., 2016; Gobena and van Dijke, 2017; Koessler et al., 2019). These studies implicitly assume a critical role for information. We clarify this role and add to the literature by showing the compliance implications of biased information about government action and public finance issues. More in general, our findings improve the understanding of the psychological and social drivers of compliance, also including peer effects (Alm et al., 2017b), cultural traits (Torgler, 2006; Alm et al., 2017a), trust in institutions (van Dijke and Verboon, 2010), corruption (Alm et al., 2016), fairness concerns (Alesina and Angeletos 2005; Gualtieri et al., 2019; Sabatini et al., 2020), and intrinsic motivations (Luttmer and Singhal, 2011; 2014; Calvet Christian and Alm, 2014; Dwenger et al. 2016; Cerqueti et al., 2019).

The second strand of literature studies how media bias affects voting behavior (Della Vigna and Kaplan 2007; Chiang and Knight 2011), news contents consumption (Durante and Knight 2012), civic-mindedness (Durante et al. 2019), crime perceptions (Mastorocco and Minale 2018; Benesch

et al., 2019), and consumption behavior (Nguyen and Claus 2013), just to name a few. We contribute to this field by revealing a so far unexplored outcome of media bias. Our experimental approach also adds to the communication literature that has first detected the existence of the media negativity bias (Cappella and Jamieson, 1997; Garz 2014; Trussler and Soroka 2014; Soroka et al. 2018; Soroka et al. 2019), by showing that the systematic tendency of the media to focus on negative news entails hidden social costs connected to the government’s inability to meet its revenue objectives.

The rest of the paper proceeds as follows. Section 2 describes our experimental design and procedures. Section 3 presents our results. We discuss our findings and their possible policy implications in Section 4 and conclude in Section 5.

2 Experimental design

To circumvent the selection and endogeneity problems arising in the analysis of naturally occurring data, we designed a framed laboratory experiment (Harrison and List, 2004) where we targeted three distinct randomly determined groups of participants with two main treatments respectively based on the exposure to *negative* (T_{NEG}) and *positive* (T_{POS}) media bias. A third control group received a *neutral* (T_{NEU}) treatment characterized by the absence of any salient bias. Experimental manipulations consisted of news tickers reporting top stories about public finance and policy issues that ran on subjects’ screens during a repeated taxation game (Alm et al., 2015; Alm et al., 2019).

As empirical research on tax evasion has shown that compliance decisions might also depend on the source of income (Clark, 2002; Gërkhani and Schram, 2006; Durham et al., 2014), we made individuals earn their endowments under two different configurations for each treatment. In the first configuration, participants earned income by working on a structured series of conventional *real-effort* tasks (C_{RE}) and were rewarded based on their performance.¹ We calibrated the piece rates in order to generate a framed endowment $Y \in (8,500; 55,000)$ ECU compatible with the nominal distribution of income in the Czech Republic.² In the second configuration, subjects exogenously received an endowment in the form of *windfall* money (C_{WF}) drawn for the actual endowment distribution generated in the real-effort sessions. Participants played a conventional taxation game (Malezieux, 2018) in groups of four subjects in a partner-matching protocol. The game was repeated

¹Subjects were asked to work for 2 minutes to each one of following tasks: matrix-counting task (Abeler et al., 2011), anagram task (Charness and Villeval, 2009), adding-to-10 task (Mazar et al., 2008), and a stoop-color test (Scarpina and Tagini, 2017).

²The exchange rate was 200 experimental currency units (ECU) for one Czech Crown (CZK), with 5000 ECU \approx 1 EURO.

for five rounds. Subjects received information about their earnings at the end of each round. The final payment consisted of the sum of the earnings obtained in the five rounds. Each round of the taxation game was partitioned into three sequential stages. (I) The first stage concerned the individual income generation. (II) In the second stage, we asked participants to self-report their income to establish their tax liability. We then taxed the declared income at a flat rate $t = 0.15$ as for the personal income tax rate in the Czech Republic. Tax audits took place between the second and third stages. The probability of receiving an audit was $p = 0.05$. Tax authorities imposed to cheaters a fine equal to the unpaid amount multiplied by a penalty $\alpha = 10$. (III) In the third stage, participants learned about taxation outcomes and anonymized³ audit results. Subjects could also see the amount of taxes overall paid by the group. To model the utility generated by the consumption of the public good funded through the taxation scheme, each participant received a share of the total tax revenue $\beta = 0.125$. As a result, the payoff function was:

$$\pi_i(1-p) = y_i - tx_i + \sum_{i=1}^4 \beta tx_i$$

for subjects who did not receive the audit, and:

$$\pi_i(p) = y_i - tx_i + \sum_{i=1}^4 \beta tx_i - \alpha(y_i - x_i)$$

for participants targeted with a tax inspection.

Throughout the three stages of the game, news headlines appeared every six seconds at the bottom of participants' screens. The main treatment manipulation consisted of randomly assigning headlines with a systematically biased tone (positive, negative, and neutral) to each distinct experimental group of subjects. Under the *positive* treatment, participants regularly saw positive news about the efficient use of the government budget (for example, *State Housing Department Fund will provide advantageous loans*, or *Governmental program supporting science centers and generous grants successful: best minds returning home*). In the *negative* treatment that aimed at reproducing the real-world media negativity bias, subjects saw headlines reporting negative news on the ineffective or inappropriate use of public funds (for example, *National debt increased to CZK 1.68 billion*, or *Low civil servant efficiency decreased the Czech Republic's competitiveness; down to 46th in global ranking*). In the *neutral* treatment (baseline condition), the news reported about public events of

³See Casal and Mittone (2016) about the role of anonymity in income reporting games.

general interest having very neutral contents (for example, *The World Dog Show in Crufts is hosting 28 thousand dogs*). Appendix A reports the full list of top headlines in detail.

A focus group of ten Ph.D. students in political sciences (five males, five females) at Masaryk University selected the news headlines and classified their tone. Building on computational linguistics methods (Taboada et al., 2011), we then assessed the sentiment of the different sets of news through the algorithm developed by Repustate.com. The algorithm delivers a rating ranging between -1.00 and -0.51 if the news is negative, -0.50 and 0.50 in the case of neutral news, and between 0.51 and 1.00 for positive news. In our experiment, the average score was -0.75 for the set of news displayed in the negative treatment, 0.01 for the neutral treatment, and 0.87 for the positive treatment.

A total of 240 subjects, recruited via Hroot (Bock et al., 2014), participated in the experiment. After showing up at pre-scheduled session times, subjects were seated at individual cubicles equipped with computers. Seats were randomly assigned. Sessions took place at the Masaryk University Experimental Economics Laboratory (MUEEL) in Brno (Czech Republic). The language of the experiment was Czech. We programmed and implemented the experiment using zTree (Fischbacher, 2007). Sessions lasted about 60 minutes, including a post-experimental questionnaire, and the average payoff was approximately 10 EURO (250 CZK, including the show-up fee).⁴ Table 1 reports descriptive information about the composition of the experimental sessions in all their treatment-configuration factorial interactions $T_i * C_j$ (3x2 full-factorial design).

Table 1: Summary: factorial design.

Factorial interaction	Subjects	Obs.	% Males	Age
$T_{NEU} * C_{WF}$	24	120	0.50	22.12 (2.71)
$T_{NEG} * C_{WF}$	40	200	0.45	22.65 (2.02)
$T_{POS} * C_{WF}$	40	200	0.42	22.20 (1.80)
$T_{NEU} * C_{RE}$	24	120	0.46	22.45 (1.91)
$T_{NEG} * C_{RE}$	44	220	0.30	22.79 (1.15)
$T_{POS} * C_{RE}$	48	240	0.29	22.44 (1.77)
Total	220	1,100	0.39	22.48 (1.86)

⁴In PPP, 1 EURO in the Czech Republic is equivalent to 1.45 EUROS in Germany, as reference EURO country.

3 Results

In this section, we first report about the balancedness of several sample’s dimensions across experimental groups. We then document how the exposure to biased news affects participants’ decision to comply in Section 3.2. Section 3.3 presents the results regarding the magnitude of tax evasion. Offering results from additional Double-Hurdle regression models, Section 3.4 blends together - adopting an integrated framework - the two sets of results discussed in Sections 3.2 and 3.3 focusing on extensive and intensive tax evasion margins, respectively.

3.1 Randomization check

Table 2 reports the mean values and randomization checks (p -values according to Chiapello, 2018) of some conventional individual characteristics elicited with a standard post-experimental questionnaire (gender, age, field of studies, religious and political attitudes, and the individual degree of risk aversion).⁵ Most of these individual characters are uniformly balanced across *treatments* (neutral, negative, positive) and *configurations* (real-effort, windfall). In the following parametric analysis (Sections 3.2, 3.3, 3.4), we will also take into consideration this specific array of covariates in order to control for the few non-perfectly balanced characteristics.

3.2 Tax compliance rate

We start by investigating tax compliance along its extensive margin, related to the share of taxpayers who choose to evade under the three experimental treatments (negative, neutral, and positive). We measure compliance as a binary variable having value 1 when participants correctly report their income and 0 when they underreport. In Figure 1, we plot the shares of tax compliers under the three main treatments. While under the *neutral* and the *negative* treatments, the share of compliers ranges between 35 and 40 per cent, under the *positive* treatment, approximately 60 per cent of participants duly reported their actual income. This difference is evocative (Jonckheere–Terpstra

⁵We elicit individuals’ attitudes towards risk through a conventional incentivized multi-lottery choice task (Attanasi et al., 2018). The index, ranging from 0 to 1, captures the increasing gradients of risk version: 0 indicates risk proneness, 1 maximum risk aversion.

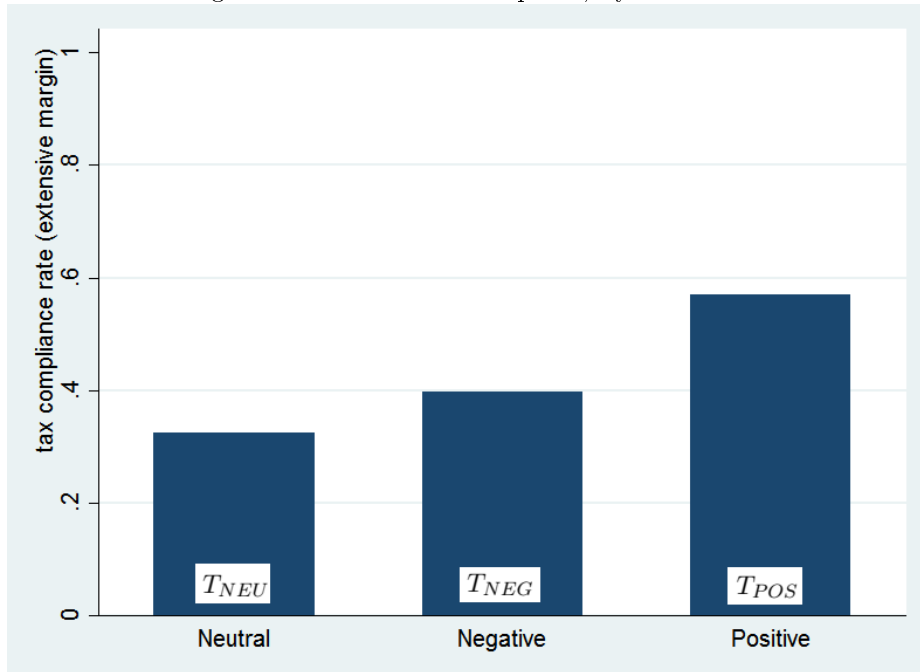
Table 2: Randomization check, by treatments / configurations.

	min-max	$T_{NEU}(a)$	$T_{NEG}(b)$	$T_{POS}(c)$	$\Delta(b-a)$	$\Delta(c-a)$	$\Delta(b-c)$	$C_{WF}(d)$	$C_{RE}(e)$	$\Delta(d-e)$
Age	18-31	22.333 (2.328)	22.726 (1.616)	22.330 (1.779)	0.393 [0.256]	-0.004 [0.992]	0.397 [0.128]	22.356 [2.113]	22.595 [1.593]	-0.245 [0.342]
Male	dummy	0.479 (0.505)	0.369 (0.485)	0.352 (0.480)	-0.110 [0.219]	-0.127 [0.151]	0.017 [0.820]	0.452 [0.500]	0.328 [0.471]	0.124* [0.059]
Econ Edu	dummy	0.771 (0.425)	0.607 (0.491)	0.591 (0.494)	-0.164* [0.056]	-0.180** [0.035]	0.016 [0.829]	0.596 [0.493]	0.672 [0.471]	-0.076 [0.242]
Left Party	dummy	0.208 (0.410)	0.274 (0.449)	0.284 (0.454)	0.065 [0.407]	0.076 [0.338]	-0.010 [0.881]	0.269 [0.446]	0.259 [0.440]	0.011 [0.859]
Religion Beliefs	dummy	0.354 (0.483)	0.345 (0.478)	0.330 (0.473)	-0.009 [0.918]	-0.025 [0.774]	0.016 [0.829]	0.327 [0.471]	0.353 [0.480]	-0.027 [0.680]
Risk Aversion	$[0, \dots, 1]$ (§)	0.498 (0.122)	0.449 (0.180)	0.445 (0.137)	-0.049* [0.097]	-0.052** [0.029]	0.004 [0.885]	0.456 [0.164]	0.461 [0.143]	0.005 [0.811]
Obs.		48	84	88	132	136	172	104	116	220

Note: Std. deviations reported in parentheses. Balance checks p -values according to Chiapello (2018) reported in square brackets.

(§) Individual risk aversion is elicited through a conventional incentivized multi-lottery choice task. The index, ranging from 0 to 1, captures the increasing degree of risk version: 0 indicates risk proneness, 1 high risk aversion.

Figure 1: Share of tax compliers, by *treatments*



test for ordered alternatives, p -value<0.01) but not fully statistically accurate, as these shares stem from repeated observations at the group and individual level.

To take into account such interdependencies, Table 2 reports a battery of panel estimates from two-way linear probability models with random effects accounting for both potential individual dependencies over rounds and dependency at the group level (Corazzini et al., 2015, 2019).

$$Y_{it} = \beta_0 + \beta_1 T_{NEG} + \beta_2 T_{POS} + \beta_n [\text{controls}]_{it} + v_i + \varepsilon_{it}$$

In the baseline model (column 1 of Table 2), we regress the outcome against the two main treatment variables: negative (T_{NEG}) and positive (T_{POS}) - with the constant term capturing the neutral treatment. In all the specifications, we control for the configuration of the income generation process. The coefficient associated to the real-effort dummy (C_{RE}) is never statistically significant and always has a small size: we do not detect any systematic difference in tax compliance between subjects who earned their income performing the real-effort task and those who exogenously received their endowment in the form of windfall money⁶ (captured in the constant term of the regression). In more saturated models (columns 2-5) we also control for the amount of the individual income,

⁶This finding is in line with previous experimental evidence documented by Bühren and Kundt (2014) – comparing their *endowed* treatment vs. *moderate-effort* treatment.

the fact of having received an audit in previous rounds, the fact of having being sanctioned, period dummies, idiosyncratic risk aversion, and an array of standard demographics (gender, age, field of studies, religious and political attitudes - see Table 2). In all models, the coefficient with the positive treatment turns out to be positive, sizable in its magnitude, and highly statistically significant. On average, subjects exposed to positive news reported a compliance rate of 23 percentage points (p -value < 0.01) higher than those exposed to negative or neutral news. The compliance rate was negatively affected by both high levels of income and individual risk aversion.

Results do not change when we focus on the different factorial combinations by regressing tax compliance on the interaction between treatment dummies and the two income configurations (real-effort vs. windfall). As we show in Table 3, both the factorial coefficients associated with the positive treatment – $T_{POS} * C_{RE}$ and $T_{POS} * C_{WF}$ – are statistically significant and sizable. Considering the encompassing model in column 5, participants exposed to the positive treatment who got their income through windfall money $T_{POS} * C_{WF}$ exhibit a compliance rate of 22 percentage points (p -value < 0.01) higher than those exposed to neutral news who received a windfall income (reference cluster captured by the constant term). The size decreases to a still remarkable 17 percentage points (p -value < 0.05) for subjects exposed to the $T_{POS} * C_{RE}$ condition (Wald test p -value = 0.07). As anticipated by the result reported in Table 3, the coefficients of the two interactions based on the negative treatment turn out not to be statistically different from the constant term at any conventional level. The lack of any significant reaction of compliance to negative news once again supports the interpretation that participants perceive the media negativity bias as the norm rather than the exception, consistently with the prevailing view in the media negativity bias literature (Cappella and Jamieson, 1997; Garz 2014; Trussler and Soroka 2014; Soroka et al., 2018; Soroka et al., 2019).

3.3 The magnitude of tax evasion

The magnitude of tax evasion represents the intensive margin of tax compliance under the three main experimental treatments: negative, neutral, and positive. We measure the magnitude of tax evasion through a continuous index ranging between 0.001 and 1 in case of total evasion. As we are interested in the intensive margin, we focus only on non-compliers. By construction, this gradient

Table 3: Tax compliance probability (extensive margin: 1=tax compliance; 0=tax evasion). Main experimental *treatments*: negative vs. positive.

Outcome: tax compliance - extensive margin	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
T_{NEG}	0.060 (0.063)	0.056 (0.063)	0.054 (0.063)	0.055 (0.064)	0.065 (0.065)
T_{POS}	0.233*** (0.063)	0.233*** (0.063)	0.232*** (0.063)	0.233*** (0.063)	0.238*** (0.065)
C_{RE}	-0.025 (0.051)	-0.046 (0.052)	-0.054 (0.052)	-0.054 (0.052)	-0.059 (0.052)
Income		-0.001*** (0.001)	-0.001*** (0.001)	-0.001*** (0.001)	-0.001*** (0.001)
Inspection lagged				-0.033 (0.092)	-0.035 (0.092)
Sanction lagged				0.020 (0.074)	0.020 (0.074)
Risk Aversion				-0.442*** (0.165)	-0.403** (0.168)
Round dummies	no	no	yes	yes	yes
Demographics	no	no	no	no	yes
Constant T_{NEU}	0.359*** (0.055)	0.525*** (0.075)	0.578*** (0.086)	0.579*** (0.086)	0.476 (0.368)
ll	-548.649	-543.548	-537.822	-534.169	-532.139
$p > \chi^2$	0.002	0.000	0.000	0.000	0.000
Obs.	1,100	1,100	1,100	1,100	1,100

Notes: Linear probability panel two-way model, with random effects - clusters: group, individual. Std. errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

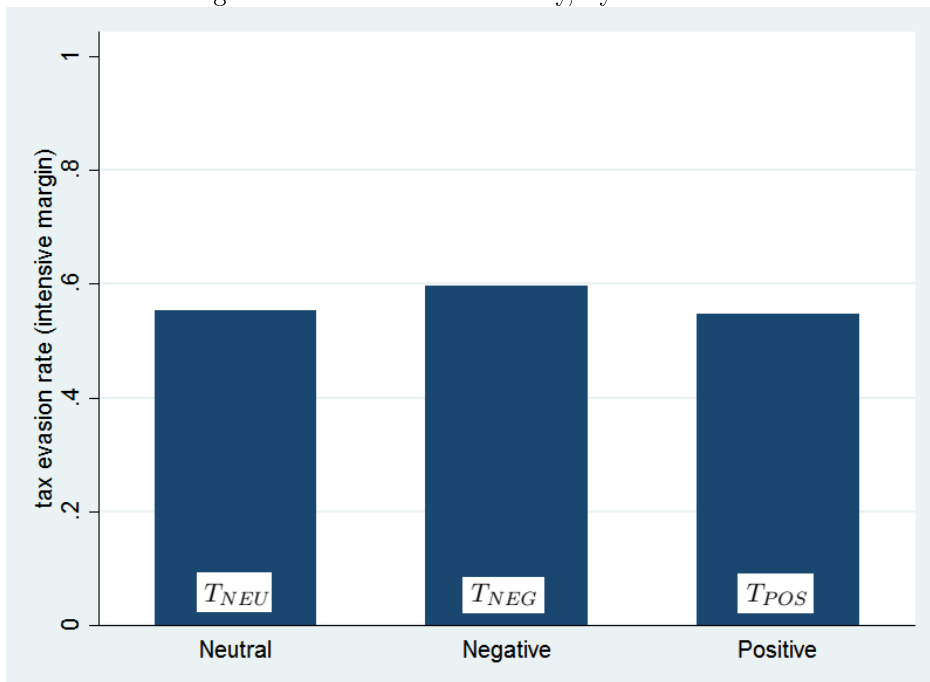
Table 4: Tax compliance probability (extensive margin: 1=tax compliance; 0=tax evasion). Factorial interactions.

Outcome: tax compliance - extensive margin	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
$T_{NEG} * C_{WF}$	0.041 (0.083)	0.030 (0.083)	0.025 (0.083)	0.025 (0.083)	0.046 (0.085)
$T_{NEG} * C_{RE}$	0.036 (0.081)	0.016 (0.081)	0.007 (0.081)	0.007 (0.081)	0.013 (0.083)
$T_{POS} * C_{WF}$	0.226*** (0.083)	0.227*** (0.083)	0.227*** (0.083)	0.228*** (0.083)	0.240*** (0.085)
$T_{POS} * C_{RE}$	0.199** (0.079)	0.173** (0.079)	0.163** (0.080)	0.163** (0.080)	0.168** (0.081)
$T_{NEU} * C_{RE}$	0.036 (0.081)	0.016 (0.081)	0.007 (0.081)	0.007 (0.081)	0.013 (0.083)
Income		-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)
Inspection lagged				-0.033 (0.092)	-0.035 (0.092)
Sanction lagged				0.021 (0.074)	0.020 (0.074)
Risk Aversion				-0.457*** (0.166)	-0.418** (0.169)
Round dummies	no	no	yes	yes	yes
Demographics	no	no	no	no	yes
Constant	0.359*** (0.055)	0.525*** (0.075)	0.578*** (0.086)	0.579*** (0.086)	0.476 (0.368)
ll	-548.586	-543.4277	-537.671	-533.825	-531.768
$p > \chi^2$	0.008	0.000	0.000	0.000	0.000
Obs.	1,100	1,100	1,100	1,100	1,100

Notes: Linear probability panel two-way model, with random effects - clusters: group, individual. Std. errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

equals to 0 in case of full tax compliance. For this reason, subjects with an index equal to 0 are thus now not taken into consideration. As a result, the number of observations falls to 604. In Figure 2, we plot the average tax evasion rate observed under the three main treatment conditions. In all cases, the average value is around 0.6 (std. dev. 0.35), meaning that, on average, tax cheaters declared approximately 60 per cent of their actual income. Variations across treatments are negligible and not statistically robust.

Figure 2: Tax evasion intensity, by *treatments*.



In Table 4, we report estimates from two-way panel models with random effects that account for potential individual dependencies over rounds and dependency within groups. In the baseline model (column 1), we regress the outcome against the two main treatment variables: negative (T_{NEG}) and positive (T_{POS}) - with the constant term capturing the neutral treatment. We always control for the income of participants and the configuration under which they earned it (C_{RE} vs. C_{WF}), and in more saturated specifications we include the fact of having received an audit in previous rounds, the fact of having being sanctioned, period dummies, risk aversion, and the array of standard demographics. In all models, the main treatment coefficients (negative and positive) are small in size and never statistically significant at any conventional level. We detect no systematic difference in the intensity of tax evasion between the subjects who gained their income performing the real-effort task and

those who received the endowment exogenously in the form of windfall money. The intensity of tax evasion was negatively associated with higher levels of income. Results do not change when we regress the outcome on the different factorial interactions between media bias treatments (negative, neutral, and positive) and the income configurations (real-effort vs. windfall). As Table 6 shows, no factorial interaction turns out to be economically meaningful and statistically significant at any conventional level.

3.4 Double-Hurdle estimation

Following recent inputs by Alm et al. (2017a) and Guerra and Harrington (2018) in the analysis of laboratory-generated data about the cultural determinants of tax evasion, we replicate the previous panel analyses adopting a Double-Hurdle (DH) approach. This class of models, introduced by Cragg (1971) and computationally developed by Engel and Moffatt (2014) for experimental applications, allow a combined estimation of the two distinct processes underlying the decision to comply and, for tax cheaters, the amount of the evasion (see Alm et al., 2017a section 5.2 and Guerra and Harrington, 2018 section 3.2). In this setup, the key outcome measure is always represented by the magnitude of tax evasion through a continuous index ranging between 0 in case of tax compliance and 1 in case of total tax evasion.

The first hurdle is interpretable as a probability model. It focuses on tax compliance and is particularly suited to capture the effect of media bias occurring at the extensive margin. The second hurdle, interpretable as a censored Tobit model, determines the gradient of tax evasion for those subjects who chose not to comply. It, therefore, captures the effect occurring at the intensive margin of tax evasion.

The series of Double-Hurdles models displayed in Table 7 well maps and combines the distinct results described in Table 3 and Table 5, H1 and H2 columns, respectively. Subjects exposed to the positive treatment are significantly less likely to engage in tax evasion (H1 columns). This effect is always highly statistically significant and sizable in its magnitude. The coefficient is quite stable across the various specifications characterized by different arrays of control variables. Results are also very consistent with the previous analysis as far as it concerns the intensive margin of tax evasion. We do not detect any significant differential treatment effect on the tax evasion intensive margin

Table 5: Tax evasion intensity (intensive margin index: share of individual tax evasion, ranging from 0.001 to 1). Main experimental *treatments*: negative vs. positive.

Outcome: tax evasion - intensive margin	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
T_{NEG}	0.041 (0.057)	0.037 (0.057)	0.037 (0.057)	0.038 (0.056)	0.051 (0.057)
T_{POS}	0.013 (0.060)	0.010 (0.059)	0.009 (0.059)	0.012 (0.059)	0.021 (0.060)
C_{RE}	-0.024 (0.048)	-0.038 (0.048)	-0.035 (0.048)	-0.036 (0.048)	-0.023 (0.048)
Income		-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)
Inspection lagged				-0.119 (0.179)	-0.076 (0.177)
Sanction lagged				0.054 (0.052)	0.051 (0.052)
Risk Aversion				-0.004 (0.156)	-0.103 (0.157)
Round dummies	no	no	yes	yes	yes
Demographics	no	no	no	no	yes
Constant T_{NEU}	0.546*** (0.043)	0.673*** (0.063)	0.645*** (0.073)	0.649*** (0.073)	0.242 (0.337)
ll	-60.873	-57.171	-56.012	-55.248	-49.946
$p > \chi^2$	0.869	0.085	0.229	0.357	0.110
Obs.	604	604	604	604	604

Notes: Linear probability panel two-way model, with random effects - clusters: group, individual. Std. errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 6: Tax evasion intensity (intensive margin index: share of individual tax evasion, ranging from 0.01 to 1.00). Full factorial design.

Outcome: tax evasion - intensive margin	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
$T_{NEG}^*C_{WF}$	0.056 (0.076)	0.047 (0.076)	0.046 (0.076)	0.046 (0.076)	0.056 (0.076)
$T_{NEG}^*C_{RE}$	-0.017 (0.084)	-0.018 (0.083)	-0.020 (0.083)	-0.015 (0.083)	-0.006 (0.083)
$T_{POS}^*C_{WF}$	-0.031 (0.084)	-0.048 (0.083)	-0.046 (0.083)	-0.046 (0.083)	-0.035 (0.081)
$T_{POS}^*C_{RE}$	-0.001 (0.073)	-0.015 (0.073)	-0.013 (0.073)	-0.011 (0.073)	0.014 (0.072)
$T_{NEU}^*C_{RE}$	0.005 (0.074)	-0.015 (0.074)	-0.013 (0.074)	-0.012 (0.074)	0.009 (0.073)
Income		-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)
Inspection lagged				-0.112 (0.179)	-0.070 (0.177)
Sanction lagged				0.054 (0.052)	0.051 (0.052)
Risk Aversion				-0.012 (0.158)	-0.120 (0.159)
Round dummies	no	no	yes	yes	yes
Demographics	no	no	no	no	yes
Constant (T_{NEU})	0.548*** (0.049)	0.676*** (0.068)	0.647*** (0.078)	0.651*** (0.077)	0.254 (0.338)
ll	-60.644	-57.007	-55.841	-55.103	-49.683
$p > \chi^2$	0.946	0.203	0.367	0.496	0.166
Obs.	604	604	604	604	604

Notes: Linear probability panel two-way model, with random effects - clusters: group, individual. Std. errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

captured on the second hurdle (H2 columns). Tax noncompliance (H1) is positively associated with income, while the intensity of tax evasion (H2) decreases with participants' earnings.

The general result picture does not change when we regress the outcome on the different factorial interactions between media bias treatments (negative, neutral, and positive) and the income configurations (real-effort vs. windfall). Focusing on the first hurdle (H1 columns) reported in Table 8, both the factorial coefficients associated with the positive treatment — $T_{POS} * C_{RE}$ and $T_{POS} * C_{WF}$ — are always statistically significant and stable in their magnitudes throughout the different specifications (1 to 5). On the other hand, the coefficients associated with the interactions based on the negative treatment turn out not to be systematically different from the constant term. Results are also very consistent with the previous analysis regarding the intensive margin (H2 columns) of tax cheating behavior. In all the second hurdle models, no factorial interaction turns out to be economically meaningful and statistically significant at any conventional level.

4 Discussion

Our study provides the first experimental evidence that biased information about government action and public finance affects tax compliance, suggesting that news headlines act as a constant source of psychological priming. In the experiment, priming participants with positive news induced a significant change in their probability to comply. The exposure to negative news, instead, failed to elicit a behavioral response. The lack of effect can be interpreted as a form of expectation matching (negative news on government spending is what taxpayers routinely expect to see on a television screen) or as a sort of immunization effect: people are so used to an unfavorable presentation of public finance and policy issues that they fatalistically take negative news about the public sector as business as usual. In either case participants seem to perceive the media negativity bias as the norm rather than the exception. This result is in full accordance with evidence that a negativity bias systematically pervades political (Kepplinger et al., 2012; Lengauer et al., 2012; Elejalde et al., 2018) and economic (Garz, 2014; Soroka et al., 2018) news making. This phenomenon is demand-driven, as it is likely a product of a human tendency to be more attentive to negative news content (Soroka et al., 2019), and generates a sort of 'spiral of cynicism' (Cappella and Jamieson, 1997), in that the public's demand for sensational news strengthens the incentive for providing negative contents

Table 7: Double-Hurdle estimation, by treatments.

	Model (1)		Model (2)		Model (3)		Model (4)		Model (5)	
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
T_{NEG}	-0.413* (0.218)	0.068 (0.059)	-0.336* (0.184)	0.048 (0.056)	-0.325* (0.18)	0.046 (0.055)	-0.296 (0.21)	0.063 (0.056)	-0.282 (0.195)	0.075 (0.055)
T_{POS}	-0.883*** (0.218)	-0.012 (0.064)	-0.803*** (0.183)	-0.034 (0.062)	-0.798*** (0.181)	-0.036 (0.062)	-0.820*** (0.212)	-0.007 (0.062)	-0.760*** (0.198)	-0.01 (0.062)
C_{RET}	0.105 (0.121)	-0.03 (0.047)	0.202 (0.132)	-0.064 (0.048)	0.203 (0.134)	-0.061 (0.049)	0.133 (0.144)	-0.047 (0.05)	0.134 (0.135)	-0.041 (0.046)
Income			0.001** (0.0001)	-0.001** (0.0001)	0.001** (0.0001)	-0.001** (0.0001)	0.001** (0.0001)	-0.001** (0.0001)	0.001** (0.0001)	-0.001** (0.0001)
Inspection lagged							-0.149 (1.335)	-0.612* (0.357)	-0.705 (0.802)	-0.347 (0.367)
Sanction lagged							5.13 (9.436)	0.093 (0.102)	0.675 (0.412)	0.220* (0.117)
Risk aversion							1.713*** (0.421)	0.043 (0.148)	1.564*** (0.384)	-0.004 (0.154)
Period dummies	no	no	no	no	yes	yes	yes	yes	yes	yes
Demographics	no	no	no	no	no	no	no	no	yes	yes
Constant	0.919*** (0.228)	0.415*** (0.06)	0.135 (0.328)	0.766*** (0.129)	0.172 (0.381)	0.744*** (0.156)	0.514 (0.438)	0.673*** (0.170)	1.736* (1.054)	-0.22 (0.332)
χ^2 overall	37.801 ***		49.123 ***		52.060 ***		72.235 ***		118.080 ***	
Pseudo R^2	0.031	0.0216	0.032	0.022	0.034	0.023	0.058	0.042	0.061	0.048
Obs.	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100

Notes: Double-hurdle model. Std. errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 8: Double-Hurdle estimation, factorial design

	Model (1)		Model (2)		Model (3)		Model (4)		Model (5)	
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
$T_{NEG} * C_{WF}$	-0.366 (0.273)	0.1 (0.084)	-0.283 (0.245)	0.068 (0.081)	-0.262 (0.239)	0.063 (0.08)	-0.097 (0.269)	0.063 (0.082)	-0.206 (0.289)	0.094 (0.08)
$T_{NEG} * C_{RE}$	-0.241 (0.279)	0.013 (0.084)	-0.102 (0.259)	-0.033 (0.081)	-0.093 (0.252)	-0.031 (0.081)	-0.03 (0.276)	-0.008 (0.081)	-0.128 (0.28)	0.024 (0.077)
$T_{POS} * C_{WF}$	-0.794*** (0.276)	-0.05 (0.094)	-0.742*** (0.251)	-0.067 (0.091)	-0.736*** (0.243)	-0.068 (0.091)	-0.618** (0.271)	-0.053 (0.094)	-0.718** (0.296)	-0.027 (0.09)
$T_{POS} * C_{RE}$	-0.753*** (0.269)	-0.009 (0.088)	-0.573** (0.251)	-0.074 (0.088)	-0.558** (0.244)	-0.074 (0.088)	-0.542** (0.268)	-0.046 (0.087)	-0.571** (0.281)	-0.033 (0.082)
$T_{NEU} * C_{RE}$	0.239 (0.398)	-0.029 (0.094)	0.295 (0.323)	-0.066 (0.088)	0.309 (0.320)	-0.065 (0.088)	0.479 (0.384)	-0.074 (0.089)	0.213 (0.32)	-0.034 (0.082)
Income			0.001** (0.0001)	-0.001** (0.0001)	0.001** (0.0001)	-0.001** (0.0001)	0.001** (0.0001)	-0.001** (0.0001)	0.001** (0.0001)	-0.001** (0.0001)
Inspection lagged							-0.153 (1.326)	-0.607* (0.36)	-0.7 (0.812)	-0.344 (0.372)
Sanction lagged							5.119 (46.077)	0.087 (0.102)	0.682 (0.42)	0.213* (0.119)
Risk aversion							1.761*** (0.428)	0.027 (0.153)	1.581*** (0.396)	-0.009 (0.165)
Period dummies		no no	no no	no no	yes yes	yes yes	yes yes	yes yes	yes yes	yes yes
Demographics		no no	no no	no no	no no	no no	no no	no no	yes yes	yes yes
Constant	0.864*** (0.258)	0.413*** (0.072)	0.096 (0.352)	0.754*** (0.136)	0.129 (0.399)	0.730*** (0.161)	-0.687 (0.458)	0.670*** (0.178)	1.627 (1.117)	-0.216 (0.348)
$T_{NEU} * C_{WF}$										
χ^2 overall	37.832 ***		50.044 ***		53.026 ***		73.219 ***		119.080 ***	
Pseudo R^2	0.031	0.022	0.032	0.022	0.034	0.023	0.058	0.042	0.062	0.049
Obs.	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100

Notes: Double-hurdle model. Std. errors in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

in journalists and newsmakers (Soroka et al., 2019). The recent spreading of anti-establishment narratives have further exacerbated the negativity bias in reporting about the efficiency and fairness of public institutions (Wettstein et al., 2018; Couttenier et al., 2019).

The analysis of the intensive margin of evasion also suggests that, once individuals have decided to cheat on taxes, media bias has no significant impact on the magnitude of tax evasion. It is in the first, and perhaps most important, stage of taxpayers' decision to comply that the bias of news about public finance and policy seems to play a crucial role.

These discouraging results, however, are balanced by the promising finding of the positive effect on tax compliance of even brief exposure to good news about the public sector's activity. Contrary to intuition, according to which a piece of adverse news is more salient than a good one, merely exposing participants with a few, authentic, information about the appropriate use of tax revenues acts as a powerful determinant of higher levels of tax compliance. This result is consistent with previous evidence that politeness in expressing a difference of opinions in social media is more salient than online incivility, and therefore prompts a stronger behavioral response across participants in a trust game (Antoci et al., 2019).

The effect of positive news is not only highly statistically significant and economically sizable but even robust to further manipulation in terms of whether participants earned their money based on a real-effort task or the exogenous decision of experimenters. This evidence indicates that the bias of information about public finance and policy matters more than the source of taxpayers' income.

From an economic perspective, the results of our experiment suggest that the satisfaction of taxpayers with the functioning of the public sector and the use of tax revenues is a critical driver of their compliance decisions. Citizens probably feel intrinsically motivated to honestly declare their full tax liability to the extent to which they perceive the outcomes of public policy as fair and legitimate, as if a sort of psychological contract with tax authorities was in force (Feld and Frey, 2007). The belief that the government does not spend well citizens' taxes may encourage them to reciprocate by refusing to pay their full tax liability (Spicer and Lundstedt, 1976). If, instead, the belief prevails that the government uses its tax revenue to appropriately fund public goods and services, taxpayers will be more willing to comply (Alm et al., 1993), even if they do not personally receive a full public good equivalent of their payments (Frey and Feld, 2002; Frey et al., 2004; Feld and Frey, 2007). Theories of the psychological contract imply a crucial role for information about public policy. However, citizens' awareness of the efficiency and fairness of public institutions does not

only depend on the government’s ability to fairly and adequately communicate about its use of tax revenues. Rather, it basically relies on the media’s presentation of the efficiency and fairness of public institutions. Freedom in the provision, selection, and tone of information about the government is a cornerstone of democracy, and we indeed do not advise any form of governmental interference with the media’s freedom of expression and critique. Our results instead suggest that stronger attention to impartially reporting – also – good news (Iggers, 2018) may ultimately strengthen the psychological contract between taxpayers and the state by allowing the public sector to fully exploit its tax revenue potential, which could, in turn, be conducive to improvements in the provision of public goods and services.

5 Conclusion

In this paper, we designed a framed laboratory experiment to study how the media bias in reporting about public finance and policy issues affects tax compliance in a repeated taxation game. The striking result of our study is that even minimal exposure to authentic news about the appropriate use of tax revenues by the public sector has a statistically significant and economically sizable effect on the probability to comply. This result suggests that what is at stake in taxpayers’ reporting decisions may not be merely the rational choice between risky assets in a portfolio under the constraint of the tax audits and penalties. Individuals may tend to reciprocate the behavior they observe in the government, and more in general in public institutions, as if they were bounded to them by a psychological contract (Frey and Feld, 2002; Feld and Frey, 2007). If citizens believe the government is pursuing its objectives with efficiency and fairness, they may be more intrinsically motivated to pay their taxes to contribute to the welfare of the community. Theories of the psychological contract do not explicitly point out the crucial role of communication and information in nudging taxpayers’ behavioral responses based on reciprocity. In our experiment, we highlighted and clarified this role. Overall, our results reveal that biased news function as a constant source of psychological priming influencing tax compliance decisions. The systematic tendency of the media to focus on negative news entails hidden social costs related to the government’s inability to fully exploit its tax revenue potential and meet its fiscal goals, with detrimental effects on the efficient provision of public goods and services.

The take-home message for policymakers is rather straightforward. Public policy can create the

preconditions to promote tax compliance in previously unsuspected ways. The design of strategies and incentives nudging the provision of more balanced information that impartially reports also positive news (Iggers, 2018) could help the government to meet its tax revenue objectives, possibly feeding a virtuous cycle through the more efficient provision of public goods and services. In doing so, the preservation of freedom of expression and critique would play a crucial role not only in supporting democracy but also in strengthening the belief that the political process is fair and the policy outcomes legitimate, which could, in turn, further underpin tax morale and compliance.

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Appendix

[A] **Headline news:**

i) **Negative treatment** (T_{NEG})

- National debt increased to CZK 1.68 billion.
- Each Czech citizen owes CZK 160,000.
- Bill for 2013: Czech Railways exceeded budget by CZK 2 billion.
- Public employment service in chaos. Disbursement of benefits not working.
- Low civil servant efficiency decreased the Czech Republic's competitiveness; down to 46th in global ranking.
- Due to illegal acquisition of locomotives, Czech Railways to pay a fine of CZK 25 million.
- Proposed budget criticized: Government not saving, only choking off investments.
- Eurovia could get a 72 million contract from the ministry without a tender.
- The public sector is being unscrupulously milked, warns SIS. Leopold Cerný: ProMoPro is a textbook example of tunneling with the state's assistance.
- Water leaking into Blanka tunnel. Grand opening in December jeopardized.
- Tenders organized by entrepreneurs themselves; civil servants just observers.
- Deputies met for only hours and three-quarters did not attend the meeting.
- Overpriced hospital equipment means the Czech Republic to return CZK 163 million to the EU.
- Ministry of Defense declassified an audit revealing overpriced warehouse security.
- Reconstruction of D1 at Velká Bíteš may be delayed up to year, says head of RSD.

ii) **Positive treatment** (T_{POS})

- South Bohemian Hospitals achieved efficient operations.
- Investment of CZK 818 million brings increased comfort and modern medical technologies to patients in Czech hospitals.
- Governmental program supporting science centers and generous grants successful: Best minds returning home.
- Foreign experts confirm top-class research at CEITEC.
- State housing development fund can provide advantageous loans to renovate housing estates thanks to new CZK 600 million project.
- During Q1, public employment service financially supported retraining of 14 173 job applicants. Unemployment rate fell by 1.3%.
- During Q1, public employment service granted CZK 972 million to support employment of disabled.

- Bikeway system to connect three regions in autumn with completion of construction in Zlín Region.
- Czech Republic's economy is the 26th freest - improvement of 3 places.
- State financing ground-breaking research on bowel cancer. New research center to be established in Prague.
- State agency CzechInvest successfully introduced several Czech startups in San Francisco.
- The campaign to attract tourists a success, says state agency CzechTourism. Year-on-year increase in foreign visitors to the Czech Republic 18.5
- Departments keeping operating costs low. This has decreased state budget deficit.
- Compensation paid out for delayed trains has fallen. Czech Railways trains running on schedule. 24

iii) Neutral treatment (T_{NEU})

- The International Space Station could be replaced by a base on the Moon.
- Gray cars, unobtrusive star in sales. Popularity of white color begins to decline.
- Skier Strachova finished fifth in Flachau.
- Volkswagen Beetle celebrates 70 th anniversary.
- Car speed will not be measured in km / h but in bit / s.
- Activision Blizzard Studios will be led by Stacey Sher.
- Actor Javorský plays Burian, Novotný plays Marvan.
- An asteroid flew through the Solar system.
- The winner of the Grand Prix of Architects 2015 was the Cottage by the Lake by FAM Architekti.
- World dog show Crufts started.
- Fish oil, wine and swimming. Stašová revealed the secret of her figure.
- Hunters moved hare from a strictly guarded area of Temelín power plant.
- Magnesia Litera 2015: The book of the year is Poet Martin Reiner.
- Singer Hana Zagorova finally in the Hall of Fame!
- Tesla's first SUV has wings. Electricity will cover over 400 kilometers.

[B] Online supplementary material:

VIDEOS: <http://bit.ly/388jDgL>

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