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Trying to make a good first impression: A natural field experiment to engage new entrants to the tax system

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Sarah Dong
Crawford School of Public Policy,
Australian National University

Mathias Sinning
Tax and Transfer Policy Institute, Crawford School of Public Policy,
Australian National University, RWI & IZA

Abstract

Very little is known about the compliance behavior of first-time taxpayers although their tax paying habits may affect the long-run functioning of a tax system. This paper studies the compliance behavior of new entrants to the tax system using data from a large-scale natural field experiment that was implemented in collaboration with the Australian Taxation Office (ATO). We examine the effectiveness of a welcome letter from the tax authority that aims to nudge first-time taxpayers to lodge their first income tax return. We compare this letter to a standard letter that emphasizes the possibility of penalties and interest charges. We find that both letters have surprisingly similar effects on tax compliance, suggesting that the main channel through which the letters affect individual behavior is by providing information. By contrast, the type of messaging and the way in which information is presented to first-time taxpayers appear to be relatively unimportant. Our analysis of heterogeneous treatment effects indicates that both letters are most effective for young entrants to the tax system and, within this group, more effective for Australian citizens than for visa holders.

JEL Codes: C93, H25, H26.
Keywords: tax compliance, natural field experiment, behavioral insights

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Tax and Transfer Policy Institute

Crawford School of Public Policy

College of Asia and the Pacific

+61 2 6125 9318

tax.policy@anu.edu.au

The Australian National University

Canberra ACT 0200 Australia

www.anu.edu.au

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1 Introduction

The collection of outstanding tax debt constitutes a major challenge for tax administrations around the world. In 2015, the median outstanding tax debt as a fraction of tax revenue in the OECD amounted to 10.5 percent (OECD, 2017).[1] To address this challenge, tax administrations are increasingly interested in finding innovative and cost-effective ways to collect outstanding tax debt and to prevent debt from arising in the first place. While the focus of tax collectors has traditionally been on the enforcement of rules and regulations, a more recent approach has been to study behavioral aspects of tax compliance and to foster voluntary tax compliance (OECD, 2019a,b).

This paper examines the effectiveness of interventions that aim to encourage new entrants to the tax system to lodge their first income tax return. Our analysis is based on data from a natural field experiment that was implemented in collaboration with the Australian Taxation Office (ATO). The target population consists of around 18,000 individuals who have to lodge an income tax return for the first time and who have missed the due date. We are particularly interested in the effectiveness of deterrence and non-deterrence interventions. Our deterrence intervention is a standard ('business as usual') letter from the ATO that emphasizes the possibility of penalties and interest charges. Our non-deterrence intervention is a welcome letter that emphasizes simplicity and tries to create a positive and supportive first experience. Our analysis is based on comparing two treatment groups to a control group that does not receive any communication from the ATO over the duration of the experiment.

The conventional economic framework for modelling individual decisions about tax evasion is based on the comparison of costs (which depend on the detection probability and the legal punishment) and benefits (Allingham and Sandmo, 1972; Yitzhaki, 1974). This framework has been used to motivate deterrence interventions, which were typically designed to make the costs of tax evasion more salient. A considerable amount of research suggests that deterrence interventions are effective in improving tax compliance.[2]

[1] Not including Germany, Israel, Switzerland and Turkey due to missing information.

[2] See Hallsworth (2014) and Mascagni (2018) for reviews of the experimental tax compliance literature.

More recently, researchers have started to focus on the role of other non-pecuniary factors. Luttmer and Singhal (2014) broadly define the term "tax morale" as non-pecuniary motivations for tax compliance, including factors not captured by the standard expected utility framework. This research has led to the use of non-deterrence interventions, such as addressing social norms or highlighting the benefits resulting from the provision of public services. While most studies do not find an effect of non-deterrence interventions on tax compliance (see, e.g., Blumenthal et al., 2001; Torgler, 2004; Wenzel, 2005; Fellner et al., 2013), a few recent studies report effects of addressing social norms in large-scale natural field experiments (Hallsworth et al., 2017; Bott et al., 2020).

Our paper contributes to the tax compliance literature in several ways. To the best of our knowledge, we are the first to provide experimental evidence on new entrants to the tax system despite the strategic relevance of this group from a tax compliance perspective. By providing experimental evidence on the population of first-time taxpayers with an overdue tax return in a large-scale real-world setting, our findings exhibit a high degree of internal and external validity. We consider both deterrence and non-deterrence messages because we cannot simply assume that the experimental evidence on the effectiveness of deterrence and non-deterrence messages presented in the tax compliance literature also applies to first-time taxpayers. Moreover, we estimate heterogeneous treatment effects for subgroups that share the same socio-demographic characteristics. We pay particular attention to the role of age and citizenship status because many new entrants to the tax system are relatively young and/or foreign citizens.[3,4]

Our findings indicate that both letters have large and significant effects of about 14-15 percentage points on lodgment rates when compared to a control group that does not receive any communication from the tax authority over the duration of the experiment. The effect of the deterrence letter is only slightly larger than that of the non-deterrence letter, and multiple hypothesis testing indicates that the difference is not statistically significant. We also consider a number of secondary outcomes, including the use of the

[3]Tax compliance has been linked to both age (Braithwaite et al., 2006; Nordblom and Zamac, 2012; Hofmann et al., 2017) and country of origin (Bastani et al., 2020).

[4]We also estimate heterogeneous treatment effects for a number of other subgroups (see Section 4.2).

ATO's online lodgment tool, registrations with the Australian government's online portal, the number of days to lodgment, the number of inbound calls and taxpayer's reporting of a change in address. Overall, we find that the effects of two vastly different letters are surprisingly similar, suggesting that the main channel through which the letters affect tax compliance is by providing information about lodging a tax return.[5] Interestingly, both the type of messaging (i.e., deterrence vs. non-deterrence) and the way in which information is presented to taxpayers appear to play a relatively minor role.[6] These findings are in line with Mascagni et al. (2019) who demonstrate that tax compliance may be improved by the provision of information. They are also consistent with studies concluding that tax morale messages do not perform better on average than neutral messages.[7]

Our analysis of heterogeneous treatment effects reveals that within the group of Australian citizens, the effects of both letters on young taxpayers (aged 18-21 years) are about 2-3 percentage points larger than the overall treatment effects mentioned above, while the effects on older taxpayers (aged 22-65 years) are about 3-5 percentage points smaller than the overall treatment effects. These results highlight the importance of providing information to young first-time taxpayers. Moreover, we find that within the group of young taxpayers, those who do not possess Australian citizenship are somewhat less responsive than Australian citizens. This finding is consistent with the tax morale literature, which suggests that the cultural background of taxpayers is one of the main mechanisms through which tax morale may affect tax compliance (Luttmer and Singhal, 2014).

The remainder of this paper is organized as follows. Section 2 provides an overview of the related literature. Section 3 presents the experimental design, discusses the empirical strategy and provides a description of the data. The results are presented in Section 4. Section 5 concludes.

[5]The administrative records provided by the ATO at the end of the collection period indicate that about 99 percent of taxpayers in our analysis sample receive a refund after lodging their tax return, suggesting that the vast majority of first-time taxpayers with an overdue tax return are unaware of the financial benefits resulting from lodging their tax return.

[6]We only observe differential effects on the number of days to lodgment, which were caused by the inclusion of a new deadline in the welcome letter that slowed down lodgments. We also find a slightly larger (2 percentage point) effect of the deterrence letter on notifications of a change in address.

[7]Antinyan and Asatryan (2020) present results from a meta-analysis of this literature.

2 Related literature

Inspired by the work of Thaler and Sunstein (2008), a recent strand of the behavioral economics literature has studied the design of cost-effective interventions that "nudge" people to make better decisions without limiting their choices. Empirical studies in this field have made extensive use of randomized controlled trials (RCTs) to test the effectiveness of interventions that nudge people to make better decisions to improve their wealth, health and happiness.[8] Based on this literature and their own work, the UK's Behavioural Insights Team recommended the use of four design principles to make nudges "Easy, Attractive, Social and Timely" (BIT, 2014, p. 4). The design of our welcome letter was guided by these principles to some extent. Most importantly, the welcome letter emphasizes that lodging a tax return is quick and easy.[9]

We contribute to the tax compliance literature by studying the compliance behavior of new entrants to the tax system. By comparing a letter that emphasizes the possibility of penalties and interest charges to a welcome letter that emphasizes simplicity, we provide evidence on the effectiveness of both deterrence and non-deterrence interventions. We also explore heterogeneous treatment effects for subgroups that share the same characteristics. The following subsections provide an overview of the related literature.

2.1 Tax compliance literature

Based on the economic framework developed by Allingham and Sandmo (1972) and extended by Yitzhaki (1974), the empirical tax compliance literature has focused on the design of deterrence interventions that aim to make the costs of tax evasion more salient, either by trying to increase the perceived probability of being detected or by emphasizing the legal punishment. Most of the contributions to this literature suggest that deterrence interventions improve tax compliance. Important examples include Coleman (1997), Slemrod et al. (2001), Wenzel and Taylor (2004), Wenzel (2006), Hasseldine et al. (2007), Iyer

[8] RCTs include both framed and natural field experiments, depending on whether or not subjects are aware of their participation in an experiment (Czibor et al., 2019).

[9] See Section 3 for a detailed discussion of the design of the letters.

et al. (2010), Kleven et al. (2011), Fellner et al. (2013), Gangl et al. (2014), Dwenger et al. (2016), Dyreng et al. (2016), Mendoza et al. (2017) and Cranor et al. (2020).[10]

Non-deterrence interventions were usually introduced in the form of nudges that aimed to target underlying motivations for tax compliance, including social norms (Coleman, 1997; Blumenthal et al., 2001; Wenzel, 2005; Fellner et al., 2013; Castro and Scartascini, 2015; Carpio, 2014; Dwenger et al., 2016; Hallsworth et al., 2017; Bott et al., 2020), the provision of public services funded by tax revenue (Coleman, 1997; Blumenthal et al., 2001; Torgler, 2004, 2013; Hasseldine et al., 2007; Ortega and Sanguinetti, 2013; Castro and Scartascini, 2015; Hallsworth et al., 2017) or the moral or civic duty to pay tax (Torgler, 2004, 2013; Ortega and Sanguinetti, 2013; Hallsworth et al., 2017).

The findings from these studies are mixed. Torgler (2004), for example, concludes that moral obligation messages have no effect on tax compliance in Switzerland. Castro and Scartascini (2015) find that letters to emphasize social norms and the provision of public services do not increase tax payments in Argentina. Ariel (2012) finds that corporations in Israel claim higher deductions after receiving moral persuasion messages, suggesting that nudges of this type may even backfire. In contrast, two recent large-scale natural field experiments provide evidence on the effectiveness of addressing social norms: Hallsworth et al. (2017) find that social norms letters increase tax payments in the UK, and Bott et al. (2020) conclude that moral suasion messages increase the amount of self-reported income in Norway.

Our analysis contributes to both strands of the tax compliance literature by generating evidence on the effectiveness of deterrence and non-deterrence interventions. Moreover, we fill an important gap in the literature by providing first evidence on new entrants to the tax system.

[10]Slemrod et al. (2001) find that informing taxpayers about their selection for an audit increases the reported income of low- and middle-income earners but reduces the reported income of high-income earners. Mendoza et al. (2017) provide evidence for a U-shaped relationship between auditing level and tax compliance.

2.2 Tax compliance of new entrants to the tax system

Despite the strategic relevance of encouraging new entrants to the tax system to lodge a tax return and to pay the right amount of tax, empirical evidence on the compliance behavior of this group of taxpayers is scarce. Dunning et al. (2017) demonstrate that the habit of paying taxes has a substantial and prolonged impact on tax payments, suggesting that the initial compliance behavior of new entrants to the tax system may have important implications for their compliance behavior in the long run.

To the best of our knowledge, there are only two studies that examine the compliance behavior of new entrants to the tax system, and both of these studies focus on small businesses. Gangl et al. (2014) examine the effect of supervision by the tax authority in Austria. They find that supervising new entrants to the tax system reduces tax compliance in terms of on-time payment, suggesting that such an approach may be counterproductive.[11] Mascagni et al. (2019) test the effectiveness of providing tax education in Rwanda and find that participating in a tax education program increases the probability of declaring taxes by 10 percentage points.[12] This finding points to the potential role of information in shaping the compliance behavior of first-time taxpayers.

Our analysis of heterogeneous treatment effects focuses on generating evidence along socio-demographic lines (in particular with regards to age and citizenship status) because new entrants to the tax system are typically relatively young and/or foreign citizens. Several studies conclude that younger taxpayers are generally less compliant than older taxpayers. Braithwaite et al. (2006) analyze self-reported data and find that under 30 year old Australians have a low tax morale and a low perceived likelihood of being caught. Nordblom and Zamac (2012) use calibration exercises to explain the formation of tax morale over the life cycle. Hofmann et al. (2017) present results from a meta-analysis and confirm a positive relation between age and tax compliance.

Various studies have established a link between culture and tax compliance. Luttmer

[11] The results of Gangl et al. (2014) are based on a relatively small sample, especially for the treatment group.

[12] Program participation is not randomly allocated.

and Singhal (2014) point out that culture is one of the main mechanisms through which tax morale may affect tax compliance. One strand of the literature examines the tax compliance behavior of individuals from different cultural backgrounds by comparing similar laboratory experiments across countries (see, e.g., Gërxhani and Schram, 2006; Cummings et al., 2009). Another strand focuses on individuals who live in the same country but have varying cultural backgrounds (see, e.g., Halla, 2012; DeBacker et al., 2015; Kountouris and Remoundou, 2013; Bastani et al., 2020). The findings from both strands of the literature highlight the role of culture in shaping the tax compliance behavior of individuals.

3 Experimental design, empirical strategy and data

3.1 Experimental design

Our natural field experiment was designed and implemented in collaboration with the ATO. The experimental design focused on engaging new entrants to the tax system, particularly with regards to lodging their first income tax return. Two treatments were tested: (1) an existing deterrence letter ('business as usual letter'), which emphasizes the possibility of penalties and interest charges, and (2) a newly designed non-deterrence letter ('welcome letter'), which emphasizes simplicity. The primary intent of the welcome letter was to encourage lodgment of a taxpayer's first income tax return. The welcome letter also advertised the use of *myTax* as a free and easy online lodgment tool, which can be accessed through *myGov*, the Australian government's online portal. The welcome letter sought to create a positive and supportive first experience with the ATO. Both letters include descriptive social norms messaging because the ATO preferred to include a social norms message in the welcome letter even though the business as usual letter already contained a social norms message, which could not be removed.[13] As a consequence, we are unable to isolate the effects of addressing social norms. Despite this limitation, the letters permit an interesting comparison of deterrence and non-deterrence interventions. A copy

[13]The business as usual letter states that the majority of Australians lodge on time, while the welcome letter points out that *myTax* is used by over three million people.

of both letters is provided in the appendix.

The target population consists of individuals aged 18-65 years not in business who were required to lodge their first tax return for the 2017 financial year, but who were late for their 2017 lodgement. These individuals would not have been contacted otherwise by the ATO under existing risk treatments. The letters were sent out in March 2018. The data collection ended in April 2018. De-identified data were made available by the ATO in May 2018 after ethics clearance was obtained and the project was registered in the RCT Registry of the American Economic Association (AEA).[14,15]

The randomization was undertaken by the ATO due to tight internal delivery time-frames. Simple randomization was used to assign about 18,259 individuals to treatment and control groups. The ATO sent 14,261 letters to taxpayers in the two treatment groups; the business as usual letter was sent to 9,965 taxpayers; the welcome letter was sent to 4,296 taxpayers; the remaining 3,998 taxpayers did not receive a letter from the ATO over the duration of the project.

3.2 Empirical strategy

We estimate separate regression models to compare the members of each treatment group to the control group. Each analysis sample includes n_t members of treatment group t, $t = 1, 2$, and n_0 members of the control group. Given this setup, we use the following linear regression model to estimate the effect of treatment t on an outcome measure of interest:

$$Y_i^t = \beta_0^t + \beta_1^t T_i^t + \varepsilon_i^t, \quad i = \underbrace{1, \ldots, n_0}_{\text{control group}}, \underbrace{n_0 + 1, n_0 + 2, \ldots, n_0 + n_t}_{\text{treatment group } t}, \quad t = 1, 2, \qquad (1)$$

where Y_i^t refers to the outcome of taxpayer i, T_i^t is the treatment indicator for the comparison of treatment group t to the control group, and ε_i^t is the model error term. The

[14] ANU human ethics protocol number 2018/342, title: *Testing the effect of nudges for new entrants to the tax system on tax compliance.*

[15] AEARCTR-0002962, `http://www.socialscienceregistry.org/trials/2962`.

parameter of interest is β_1^t, the (unconditional) average treatment effect on the treated. Key outcome measures are variables capturing individual lodgment and reporting behavior.

In addition to equation (1), we also estimate separate regression models for each treatment-control comparison including a set of covariates. Given the notation above, these models may be summarized by the following equation:

$$Y_i^t = \gamma_0^t + \gamma_1^t T_i^t + X_i^t \gamma_2^t + \eta_i^t, \quad i = 1, 2, \ldots, n_0 + n_t, \quad t = 1, 2, \tag{2}$$

where X_i^t is a vector of covariates and η_i^t is the model error term. The parameter γ_1^t is the (conditional) average treatment effect on the treated after controlling for X_i^t.

3.3 Data

The data provided by the ATO at the end of the collection period include a set of outcome measures and a set of covariates. The outcome measures are (i) a 0/1-variable indicating lodgment after intervention, (ii) a 0/1-variable indicating the use of *myTax*, (iii) a 0/1-variable indicating a new *myGov* registration, (iv) the number of days to lodgment (based on the observed date of first lodgment), (v) the number of inbound calls after the intervention, and (vi) a 0/1-variable indicating an observed change in address. The lodgment indicator is our primary outcome measure of interest. The use of *myTax* and *myGov* should be particularly high among new entrants to the tax system who receive the welcome letter, which highlights the advantages of *myTax*. Effective treatments should reduce the number of days to lodgment, reduce the number of inbound calls (an indicator for a lack of clarity in the ATO's communication) and increase observed changes in address (an indicator for engagement with the tax authority).

Table 1 presents descriptive statistics of the covariates for the two treatment groups and the control group. The set of covariates includes age, gender, taxable income, tax credits, balance of assessment, whether or not the taxpayer will receive a refund for the current assessment after lodgment (based on information available to the ATO), the pay-

as-you-go (PAYG) tax amount withheld, total salaries and wages, whether or not the taxpayer has an Australian business number, a set of new entrant group indicators (see Table 1 for details), year of tax file number registration, and State/Territory of residence. The p-values reported in Table 1 refer to the comparison of sample means of the respective treatment group and the control group.

[Table 1 about here.]

The numbers in Table 1 reveal that the randomization process could successfully balance out differences in covariates between the two treatment groups and the control group. Most of the differences are not statistically significant at a 5 percent significance level (with one exception: the welcome letter group is slightly more likely to receive a refund for the current assessment than the control group). In our analysis, we will compare alternative models with and without control variables to examine the potential impact resulting from the consideration of covariates.

Table 1 also shows that taxpayers in our analysis sample are on average very young (around 22 years) and have a very low income (the average taxable income is below $10,000). Interestingly, about 99 percent of taxpayers in our sample receive a refund from the tax office after lodging their tax return, suggesting that the vast majority of new entrants to the tax system appear to be unaware of the financial benefits associated with lodging their first income tax return. Almost 70 percent of taxpayers in our sample are school leavers. Visa holders make up about 15 percent of taxpayers in our sample.

4 Results

4.1 Average treatment effects

Table 2 shows the estimates of the average treatment effects of the two treatments and compares the treatments to each other. We find that Treatment 1 (the business as usual letter) increases lodgment rates by 15.4 percentage points relative to the control group.

We also observe that Treatment 2 (the welcome letter) increases lodgment rates by 13.9 percentage points. The 1.6 percentage point difference in lodgment rates between the two treatment groups is statistically significant at a 5 percent level, indicating that Treatment 1 is more effective than Treatment 2 with regards to encouraging new entrants to lodge their tax return.

Treatment 1 increases the use of *myTax* by 9.8 percentage points, while the corresponding effect of Treatment 2 is 11.0 percentage points. The 1.2 percentage point gap between Treatment 1 and Treatment 2 is statistically significant at a 5 percent level. The higher fraction of taxpayers that use *myTax* under Treatment 2 is not surprising given that the welcome letter describes *myTax* as a free, quick and easy online tool that is used by over three million people. However, it is surprising that the difference between the two letters is relatively small because the welcome letter provides detailed information about *myTax* on its first (and only) page, while the business as usual letter mentions *myTax* as one of four possible options on page 2. Consistent with the observed increases in the use of *myTax*, both letters increase *myGov* registrations by about 10 percentage points (the use of *myTax* requires a *myGov* account). Differences in new *myGov* registrations between Treatment 1 and Treatment 2 are not statistically significant.

We find that Treatment 1 reduces the time to lodgment by almost six days relative to the control group. The difference between Treatment 2 and the control group is positive, suggesting that the recipients of the welcome letter require more time to lodge than the control group, but this difference is not statistically significant. The difference of 7.7 days between Treatment 1 and Treatment 2 indicates that the business as usual letter clearly outperforms the welcome letter with regards to the amount of time required to lodge. The difference is caused by the provision of a new deadline on the welcome letter, which is not included in the business as usual letter.

[Table 2 about here.]

Both treatments increase the number of inbound calls relative to the control group by about 0.1 calls, reflecting that taxpayers are more likely to call the ATO if they receive a

letter. Differences in the number of inbound calls between Treatment 1 and Treatment 2 are not statistically significant. We also observe that Treatment 1 increases the likelihood of notifying the ATO of a change in address by 6.1 percentage points relative to the control group. The corresponding effect of Treatment 2 is 4.2 percentage points. The 2 percentage point difference between Treatment 1 and Treatment 2 is statistically significant, indicating that taxpayers who receive the business as usual letter are more likely to notify the ATO when their addresses change than taxpayers who receive the welcome letter.

Taken together, our findings indicate that while both letters increase tax compliance of new entrants to the tax system substantially, the welcome letter does not perform better than the business as usual letter. The treatment effects of the two letters on the most relevant outcomes are similar.

Table 3 reports the conditional estimates of the treatment effects on the treated after controlling for covariates. The results presented in Table 3 do not differ qualitatively from those presented in Table 2, indicating that differences in covariates between treatment and control groups could be balanced out successfully by the randomization process. As a consequence, our regression results are insensitive to the inclusion of covariates.

[Table 3 about here.]

To account for the possibility of false positives, we consider multiple hypothesis testing. We carry out hypothesis testing for multiple outcomes (lodgment, use of *myTax*, new *myGov* registration, number of days to lodgment, count of inbound calls and change in address) and treatments (business as usual letter, nudge letter and no letter). Table 4 reports the mean differences between groups together with alternative p-values associated with these differences. List et al. (2016) provide a detailed description of the approach and the interpretation of alternative p-values.

[Table 4 about here.]

The numbers in Table 4 indicate that the multiple hypothesis test results are largely in line with the findings presented in Tables 2 and 3. According to the results in Table 4,

differences in lodgment rates and the use of *myTax* between Treatment 1 and Treatment 2 are not necessarily significant, suggesting that these differences may be less relevant then the differences reported in Tables 2 and 3. The remaining group differences are confirmed by the results in Table 4.

4.2 Heterogeneous treatment effects

This section presents the estimates of our analysis of heterogeneous treatment effects for subgroups that share the same characteristics. We pay particular attention to differences in age and citizenship status because many new entrants to the tax system are either young and/or foreign citizens. Specifically, we divide our sample into four subgroups: (1) Australian citizens who are 18-21 years old ('Australian school leavers'), (2) Australian citizens who are 22-65 years old ('Australian mature entrants'), (3) visa holders who are 18-21 years old ('foreign school leavers'), and (4) visa holders who are 22-65 years old ('foreign mature entrants'). We compare the treatment effects of each of these subgroups to the overall treatment effects. Table 5 presents the deviations of the subgroup-specific treatment effects from the overall treatment effects for the sample of Australian citizens. Table 6 presents the corresponding results for the sample of visa holders.

[Table 5 about here.]

The results in Table 5 indicate that, when compared to the overall treatment effects, both letters have stronger effects on Australian school leavers. Specifically, the effects of both letters on lodgment, the use of *myTax* and *myGov* registrations are about 2-3 percentage points larger than the overall treatment effects reported in Table 3. In contrast, the treatment effects on lodgment, the use of *myTax* and *myGov* registrations of Australian mature entrants are about 3-4 percentage points lower than the overall treatment effects. These results imply that within the group of Australian citizens, both treatments are more effective for school leavers than for mature entrants.[16]

[16]We also observe somewhat lower effects of the business as usual letter on address changes and of the welcome letter on the number of inbound calls for the sample of Australian mature entrants. The differences between treatments presented in Table 5 are not statistically significant.

Table 6 reveals that the treatment effects of foreign school leavers do not differ significantly from the overall treatment effects.[17] Therefore, our finding of stronger treatment effects for Australian school leavers cannot be extended to foreign school leavers. The finding that foreign school leavers are less responsive to nudges than Australian school leavers is consistent with the child migration literature, which demonstrates that language skills of child migrants may have disadvantageous effects on their economic outcomes (Bleakley and Chin, 2004, 2010). In contrast, the treatment effects on lodgment, the use of *myTax* and *myGov* registrations of foreign mature entrants are significantly smaller than the corresponding overall treatment effects, similar to the effects observed for Australian mature entrants (Table 5).

[Table 6 about here.]

We also estimate heterogeneous treatment effects for a number of other subgroups using the covariates presented in Table 1. We find no heterogeneity across gender and some nonlinearities in the effectiveness of the two treatments across income quartiles, tax credit quartiles, balance of assessment quartiles, and total salary and wage quartiles, with deviations from overall treatment effects on lodgment rates, the use of *myTax* and *myGov* registrations ranging from zero to about 3 percentage points. We also find that the effect of the business as usual letter on *myGov* registrations of Australian business owners is about 2 percentage points smaller than the overall treatment effect, which may be due to the obligation of Australian businesses to lodge regular business activity statements, which can be done through *myGov*.

Interestingly, we find that the treatment effects of the two letters on our key outcome variables are generally somewhat larger if taxpayers registered their tax file number at an earlier point in time. This trend is more pronounced for the welcome letter than for the business as usual letter. This finding is somewhat surprising because the welcome letter was designed to achieve a positive and supportive first interaction with new taxpayers

[17] The only exception is the lower effect of the welcome letter on *myGov* registrations among foreign school leavers. The corresponding differences between the two treatments are not statistically significant.

rather than to improve the interaction with taxpayers who received a tax file number several years ago without making use of it. At the same time, it is possible that individuals who received a tax file number at an earlier point in time are more closely attached to the labor market, which may make them more likely to comply with rules and regulations.

In sum, the estimates of our analysis of heterogeneous treatment effects reveal that the effects of both letters vary significantly across age groups. Both letters are less effective for mature entrants and more effective for school leavers. Within the group of school leavers, both letters are more effective for Australian citizens than for visa holders. Our finding of similar effects of two very different letters on various subgroups suggests that the provision of information about lodging the first income tax return is the main channel through which both letters affect the compliance behavior of new entrants to the tax system. Both the type of messaging (deterrence vs. non-deterrence) and the way in which information is presented to first-time taxpayers appear to be relatively unimportant.

5 Conclusions

This paper provides first experimental evidence on the effectiveness of deterrence and non-deterrence messages designed to encourage new entrants to the tax system to lodge their first income tax return. A large body of experimental research has studied the effectiveness of deterrence and non-deterrence interventions in the context of tax compliance, but we still know very little about the ability of tax administrations to engage new entrants to the tax system despite the strategic relevance of cultivating a habit of paying taxes among this group of taxpayers.

We present the findings of a large-scale natural field experiment that was implemented in collaboration with the Australian Taxation Office (ATO). Our target population includes about 18,000 individuals who have missed the due date for lodging their first income tax return. We test the effectiveness of two treatment letters. The first letter is a business as usual letter, which is typically sent to taxpayers if they have to lodge an overdue income tax return. The second letter is a welcome letter that was specifically de-

signed to encourage new entrants to the tax system to lodge their first income tax return and to promote the use of *myTax*, the ATO's online lodgment tool. We compare the two treatment groups to a control group that does not receive any communication from the ATO over the project period.

We find that both letters have large and significant effects on lodgment rates and on the use of *myTax*. Interestingly, our analysis reveals that the two letters have very similar effects on a number of outcome measures, suggesting that the provision of information about lodging a tax return, which is included in both letters, is a major channel through which the letters affect tax compliance. By contrast, the type of intervention (deterrence or non-deterrence) and the way in which information is presented to taxpayers (such as emphasizing the ease of using *myTax*) appear to be relatively unimportant. Our analysis of heterogeneous treatment effects shows that within the group of Australian citizens, the effects of both letters on young taxpayers are somewhat larger than the overall treatment effects, while the effects on older taxpayers are somewhat smaller than the overall treatment effects. We also find that within the group of young taxpayers, those who do not possess Australian citizenship are slightly less responsive than Australian citizens.

Our study was limited by the extent to which we could control the design of the two treatment letters. The business as usual letter was already in use at the beginning of our project and could not be modified. Final decisions about the design of the welcome letter were made by the tax authority. As a consequence, both letters include descriptive social norms messaging even though we would have preferred to be able to isolate the effects of addressing social norms in our experiment. The inclusion of a new deadline in the welcome letter slowed down tax return lodgments but did not seem to affect other outcomes. Despite these limitations, the opportunity to compare the two letters has given us interesting insights into the effectiveness of deterrence and non-deterrence interventions. By providing experimental evidence on the population of new entrants to the tax system with an overdue tax return in a real-world setting, our findings exhibit a high degree of internal and external validity.

Tables and Figures

Table 1: Taxpayer Characteristics

	Control		Treatment 1			Treatment 2		
	Mean	N	Mean	N	p-value	Mean	N	p-value
Age in years	22.2	3,998	22.0	9,965	0.086	22.2	4,296	0.972
Female	0.448	3,998	0.463	9,965	0.111	0.438	4,296	0.330
Taxable income amount	9,285	3,998	9,230	9,965	0.826	9,855	4,296	0.357
Tax credits amount	894	3,998	851	9,965	0.495	1,216	4,296	0.260
Balance of assessment	-459	3,998	-441	9,965	0.632	-502	4,296	0.162
Refund for current assessment	0.987	3,998	0.985	9,965	0.484	0.992	4,296	0.030
PAYG tax amount withheld	887	3,998	842	9,965	0.480	1,210	4,296	0.258
Total salary and wages	8,817	3,998	8,788	9,965	0.905	9,469	4,296	0.290
Australian business number	0.108	3,998	0.107	9,965	0.805	0.106	4,296	0.699
New entrant group								
Australian school leaver	0.610	3,998	0.620	9,965	0.264	0.607	4,296	0.731
Australian mature entrant	0.237	3,998	0.230	9,965	0.406	0.252	4,296	0.112
Foreign school leaver	0.067	3,998	0.065	9,965	0.705	0.063	4,296	0.522
Foreign mature entrant	0.086	3,998	0.084	9,965	0.723	0.078	4,296	0.194
Tax file number registration date								
2013 and before	0.167	3,998	0.176	9,965	0.186	0.174	4,296	0.378
2014	0.135	3,998	0.134	9,965	0.894	0.128	4,296	0.394
2015	0.127	3,998	0.129	9,965	0.715	0.130	4,296	0.678
2016	0.350	3,998	0.344	9,965	0.488	0.348	4,296	0.855
2017	0.222	3,998	0.217	9,965	0.548	0.220	4,296	0.817
State								
Australian Capital Territory	0.018	3,998	0.020	9,965	0.420	0.018	4,296	0.824
New South Wales	0.355	3,998	0.366	9,965	0.237	0.354	4,296	0.861
Northern Territory	0.016	3,998	0.012	9,965	0.058	0.012	4,296	0.183
Queensland	0.177	3,998	0.174	9,965	0.680	0.170	4,296	0.439
South Australia	0.048	3,998	0.049	9,965	0.795	0.053	4,296	0.317
Tasmania	0.015	3,998	0.015	9,965	0.999	0.012	4,296	0.254
Victoria	0.282	3,998	0.270	9,965	0.159	0.294	4,296	0.224
Western Australia	0.090	3,998	0.094	9,965	0.369	0.087	4,296	0.635

Note: Treatment 1: Business as usual letter; Treatment 2: Welcome letter. p-values refer to the comparison of means between treatment and control groups. School leavers are individuals aged between 18 and 21, mature entrants are individuals aged 21-65 years. School leavers and mature entrants are labelled as 'Australian' or 'foreign' to distinguish between Australian citizens and visa holders.

Table 2: Treatment Effects – Unconditional Estimates

	Treatment 1 vs. Control	Treatment 2 vs. Control	Treatment 1 vs. Treatment 2
Lodged (Y/N)	0.154**	0.139**	0.016*
	(0.005)	(0.007)	(0.007)
	[13,963]	[8,294]	[14,261]
Use of myTax (Y/N)	0.098**	0.110**	-0.012*
	(0.004)	(0.005)	(0.006)
	[13,963]	[8,294]	[14,261]
New myGov registration (Y/N)	0.099**	0.107**	-0.008
	(0.004)	(0.005)	(0.006)
	[13,963]	[8,294]	[14,261]
Number of days to lodgment	-5.998**	1.735	-7.733**
	(1.116)	(1.186)	(0.557)
	[2,045]	[898]	[2,651]
Count of inbound calls	0.110**	0.097**	0.013
	(0.005)	(0.006)	(0.007)
	[13,963]	[8,294]	[14,261]
Change in address (Y/N)	0.061**	0.042**	0.020**
	(0.004)	(0.005)	(0.005)
	[13,963]	[8,294]	[14,261]

Note: Treatment 1: Business as usual letter; Treatment 2: Welcome letter. Robust standard errors in parentheses. Number of observations in brackets.
* $p < 0.05$, ** $p < 0.01$.

Table 3: Treatment Effects – Conditional Estimates

	Treatment 1 vs. Control	Treatment 2 vs. Control	Treatment 1 vs. Treatment 2
Lodged (Y/N)	0.153**	0.139**	0.015*
	(0.005)	(0.006)	(0.007)
	[13,963]	[8,294]	[14,261]
Use of myTax (Y/N)	0.098**	0.110**	-0.012*
	(0.004)	(0.005)	(0.006)
	[13,963]	[8,294]	[14,261]
New myGov registration (Y/N)	0.098**	0.107**	-0.009
	(0.004)	(0.005)	(0.006)
	[13,963]	[8,294]	[14,261]
Number of days to lodgment	-5.575**	1.737	-7.734**
	(1.136)	(1.219)	(0.559)
	[2,045]	[898]	[2,651]
Count of inbound calls	0.110**	0.097**	0.012
	(0.005)	(0.006)	(0.007)
	[13,963]	[8,294]	[14,261]
Change in address (Y/N)	0.061**	0.042**	0.019**
	(0.004)	(0.005)	(0.005)
	[13,963]	[8,294]	[14,261]

Note: Treatment 1: Business as usual letter; Treatment 2: Welcome letter. Robust standard errors in parentheses. Number of observations in brackets. Covariates include age, gender, taxable income, tax credits, balance of assessment, refund indicator, PAYG tax amount withheld, total salaries and wages, business indicator, new entrant group (Australian school leaver, Australian mature entrant, foreign school leaver, foreign mature entrant), tax file number registration year and State/Territory.
* $p < 0.05$, ** $p < 0.01$.

Table 4: Hypothesis Testing with Multiple Outcomes and Treatments

Group 1	Group 2	Mean Difference	p-values Remark 3.1	Theorem 3.1	Bonferoni	Holm
Lodged (Y/N)						
Control	Treatment 1	0.1544	0.0003	0.0003	0.0060	0.0023
Control	Treatment 2	0.1387	0.0003	0.0003	0.0060	0.0053
Treatment 1	Treatment 2	0.0156	0.0286	0.1046	0.5160	0.1433
Use of myTax (Y/N)						
Control	Treatment 1	0.0984	0.0003	0.0003	0.0060	0.0026
Control	Treatment 2	0.1099	0.0003	0.0003	0.0060	0.0060
Treatment 1	Treatment 2	0.0115	0.0446	0.1370	0.8040	0.1786
New myGov registration (Y/N)						
Control	Treatment 1	0.0986	0.0003	0.0003	0.0060	0.0036
Control	Treatment 2	0.1069	0.0003	0.0003	0.0060	0.0030
Treatment 1	Treatment 2	0.0082	0.1530	0.1530	1	0.1530
Number of days to lodgment						
Control	Treatment 1	5.9981	0.0003	0.0003	0.0060	0.0040
Control	Treatment 2	1.7348	0.1483	0.2763	1	0.2966
Treatment 1	Treatment 2	7.7330	0.0003	0.0003	0.0060	0.0020
Count of inbound calls						
Control	Treatment 1	0.1101	0.0003	0.0003	0.0060	0.0056
Control	Treatment 2	0.0970	0.0003	0.0003	0.0060	0.0043
Treatment 1	Treatment 2	0.0130	0.0653	0.1706	1	0.1960
Change in address (Y/N)						
Control	Treatment 1	0.0613	0.0003	0.0003	0.0060	0.0050
Control	Treatment 2	0.0418	0.0003	0.0003	0.0060	0.0046
Treatment 1	Treatment 2	0.0195	0.0003	0.0003	0.0060	0.0033

Note: Treatment 1: Business as usual letter; Treatment 2: Welcome letter. See List et al. (2016) for a detailed description of the approach and the interpretation of mean differences and alternative p-values.

Table 5: Deviation of Australian Citizens from Overall Treatment Effect by Age Group

	School leavers			Mature entrants		
	Treatment 1 vs. Control	Treatment 2 vs. Control	Treatment 1 vs. Treatment 2	Treatment 1 vs. Control	Treatment 2 vs. Control	Treatment 1 vs. Treatment 2
Lodged (Y/N)	0.020**	0.028**	-0.007	-0.034**	-0.047**	0.011
	(0.006)	(0.009)	(0.009)	(0.009)	(0.011)	(0.012)
	[8,623]	[5,046]	[8,789]	[3,242]	[2,029]	[3,377]
Use of myTax (Y/N)	0.018**	0.026**	-0.008	-0.026**	-0.041**	0.014
	(0.005)	(0.007)	(0.008)	(0.006)	(0.009)	(0.010)
	[8,623]	[5,046]	[8,789]	[3,242]	[2,029]	[3,377]
New myGov registration (Y/N)	0.021**	0.029**	-0.008	-0.031**	-0.042**	0.012
	(0.005)	(0.007)	(0.008)	(0.007)	(0.009)	(0.010)
	[8,623]	[5,046]	[8,789]	[3,242]	[2,029]	[3,377]
Number of days to lodgment	0.257	0.116	-0.392	5.367	4.051	0.415
	(1.354)	(1.497)	(0.660)	(3.057)	(3.390)	(1.372)
	[1415]	[632]	[1857]	[363]	[158]	[467]
Count of inbound calls	0.007	0.014	-0.007	-0.018	-0.026*	0.009
	(0.006)	(0.008)	(0.009)	(0.010)	(0.012)	(0.014)
	[8,623]	[5,046]	[8,789]	[3,242]	[2,029]	[3,377]
Change in address (Y/N)	0.002	0.001	0.002	-0.018*	-0.003	-0.017
	(0.005)	(0.006)	(0.006)	(0.008)	(0.010)	(0.010)
	[8,623]	[5,046]	[8,789]	[3,242]	[2,029]	[3,377]

Note: Treatment 1: Business as usual letter; Treatment 2: Welcome letter. Robust standard errors in parentheses. Number of observations in brackets.
* $p < 0.05$, ** $p < 0.01$.

Table 6: Deviation of Visa holders from Overall Treatment Effect by Immigration Status

	School leavers			Mature entrants		
	Treatment 1 vs. Control	Treatment 2 vs. Control	Treatment 1 vs. Treatment 2	Treatment 1 vs. Control	Treatment 2 vs. Control	Treatment 1 vs. Treatment 2
Lodged (Y/N)	-0.020	-0.021	0.004	-0.036*	-0.054*	0.022
	(0.017)	(0.023)	(0.026)	(0.018)	(0.022)	(0.023)
	[915]	[539]	[920]	[1183]	[680]	[1175]
Use of myTax (Y/N)	-0.011	-0.027	0.013	-0.049**	-0.048**	0.003
	(0.013)	(0.018)	(0.021)	(0.012)	(0.017)	(0.018)
	[915]	[539]	[920]	[1183]	[680]	[1175]
New myGov registration (Y/N)	-0.012	-0.039*	0.018	-0.053**	-0.053**	0.002
	(0.014)	(0.019)	(0.021)	(0.013)	(0.017)	(0.018)
	[915]	[539]	[920]	[1183]	[680]	[1175]
Number of days to lodgment	-6.178	-14.514	5.015	-1.608	3.223	-0.448
	(5.367)	(8.461)	(2.689)	(3.357)	(4.020)	(2.507)
	[107]	[44]	[139]	[160]	[64]	[188]
Count of inbound calls	0.027	-0.030	0.046	-0.019	-0.005	-0.007
	(0.023)	(0.026)	(0.031)	(0.018)	(0.029)	(0.031)
	[915]	[539]	[920]	[1183]	[680]	[1175]
Change in address (Y/N)	-0.001	0.016	-0.019	0.039*	-0.009	0.055**
	(0.014)	(0.019)	(0.019)	(0.016)	(0.018)	(0.018)
	[915]	[539]	[920]	[1183]	[680]	[1175]

Note: Treatment 1: Business as usual letter; Treatment 2: Welcome letter. Robust standard errors in parentheses. Number of observations in brackets.
* $p < 0.05$, ** $p < 0.01$.

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Appendix

Treatment 1: Business as usual letter (page 1)

<PO Box 908 ALBURY NSW 2640>

Australian Government
Australian Taxation Office

<Title> <First Name> <Middle Name> <Surname>
<Suffix><Organisation>
<Address Line 1>
<Address Line 2>
<LOCALITY> <STATE> <POSTCODE>

Our reference: <our reference>
Phone: <13 11 42>
<Client ID>: <TFN><ABN> <CAC>

<Letter Date>

We have not received your tax return

- We note you are late with your return
- Please lodge soon to avoid increased penalties and action

Dear <First name><Sir/Madam><Trustee>

We have noticed you are yet to lodge your overdue return. We have listed them for you over the page. If you have lodged recently, thank you – you do not need to do anything further with this letter.

Did you know that the majority of Australians lodge on time. If you are experiencing difficulties, we encourage you to get in touch with us. Our information indicates you need to lodge as your employer withheld tax from your payments during the year.

As you have not lodged you may incur penalties and can be charged interest daily on unpaid amounts.

It is also important that you tell us if you are no longer required to lodge.

We have provided additional information on the back of this letter which may help you to lodge.

Yours sincerely

<NAME>
DEPUTY COMMISSIONER OF TAXATION

Help is available

We can help you with your questions about this or any other tax matter. Support is available online or by phone.

Go to **www.ato.gov.au**to find the answer to your question or phone 13 11 42 between 8.00am and 6.00pm, Monday to Friday and have your TFN or ABN with you.

70571.368595-01-2016

Treatment 1: Business as usual letter (page 2)

Your overdue tax obligations	Overdue period
Income tax return	01 July 2016 – 30 June 2017

IMPORTANT INFORMATION

Tax return

Do I need to lodge a tax return?
Most people need to lodge a tax return each year. Even if you earned less than the tax-free threshold, you may be required to lodge a return. You can check if you are required to lodge by accessing our tool at **www.ato.gov.au/doineedtolodge**

When to lodge your tax return
Tax returns are due by 31 October each year but you may have a different due date if you use a registered tax agent.

How do I lodge?
You can prepare and lodge your tax return:

- online using myTax or e-tax
- by using a registered tax agent
- by mailing a paper return. Forms can be ordered online at **www.ato.gov.au/onlineordering** or by phoning 1300 720 092.
-

Treatment 2: Welcome letter

<PO BOX 908 ALBURY NSW 2640>

Australian Government
Australian Taxation Office

<TITLE> <FIRST NAME> <SURNAME>
<ORGANISATION>
<ADDRESS LINE 1>
<ADDRESS LINE 2>
<LOCALITY> <STATE> <POSTCODE>
<COUNTRY>

Our Reference: <Siebel Receipt ID>
Phone: <13 28 61>
Client ID: <TFN>

<Letter Date>

Welcome to the tax system – you need to lodge your first tax return

Dear <First Name>,

You need to lodge a tax return because you earned income in the 2017 financial year (between 1 July 2016 and 30 June 2017) and had tax taken out of your income.

You can lodge online with myTax – it's free, quick, and easy, and is used by over three million people. Lodging online with myTax usually only takes 15 to 30 minutes.

How it works

When you lodge with myTax:

- you will see that we have done most of the work for you by including lots of information in your tax return already
- you may need to add some extra information, such as any cash income you've earned and work-related expenses you've paid
- if too much tax was taken out of your income, we'll send you a refund – generally within two weeks of receiving your tax return.

What you need to do

You need to lodge by 31 October each year. If you haven't lodged recently, your 2017 tax return is now late.

To avoid hearing from us again about this matter, lodge your return as soon as possible and make sure we receive it by **<DD Month CCYY>**.

We know people can get busy at times but most people lodge on time each year. This supports a fair tax system for everyone.

Yours <sincerely>
<Deputy Commissioner's Name>
Deputy Commissioner of Taxation

NEED HELP?

If you need help with lodging your first tax return:

- phone us on <13 28 61> between 8.00am and 6.00pm, Monday to Friday
- speak with a registered tax professional.

FIND OUT MORE

To find out more about lodging with myTax or other lodgment options visit <ato.gov.au/lodgemyreturn>.

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