The Effect of the VAT rate on Tax Evasion:
Evidence from the Restaurant Industry in Greece

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March 6, 2015

Abstract
This paper examines the effect of Value-Added Tax (VAT) rate changes on tax evasion in an environment of limited tax-shifting opportunities. We focus on the recent VAT rate reduction in the Greek restaurant industry (August 2013) and implement a difference-in-difference methodology using large fast-food restaurants as the control sample, because they exhibit high constraints on under-reporting. We find that the reduction of the VAT rate for non-alcoholic sales from 23% to 13% increases the reported sales to inputs ratio, which we use as a measure of hidden sales uncovering, by 11.8% on average. This result is consistent with VAT ratio targeting, the partial adjustment of VAT revenues to the lower tax rate, in order to maintain a reasonable VAT ratio (revenues to credits) and avoid signaling evading behavior to tax authorities. We also document the reverse effect for the VAT rate increase in September 2011. The effect is more pronounced for small firms and firms with less alcoholic sales. Given the dominant role of these firms in the industry, we show that (i) the partial downward adjustment of VAT revenues and (ii) the higher direct taxes from the increase in reported sales can offset the fiscal cost from the rate reduction.

Keywords: Tax evasion, Value-added Tax, Sales under-reporting, VAT ratio targeting, Semiformality

JEL Classification: H25, H26, D78

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1 Introduction

The effect of tax rates on compliance is a topic of paramount importance for public finance, as evasion is related to economic distortions and government budget under-funding. The relationship is particularly salient for developing countries and economies with extensive shadow sectors which, according to Schneider et al. (2010), constitute the rule rather than the exception. However, the topic remains an open debate in the literature. Even in the case of direct taxes, theoretical predictions rely heavily on model assumptions, as shown in the seminal works of Allingham and Sandmo (1972) and Yitzhaki (1974). Empirical results are also mixed.\footnote{For example Clotfelter (1983) reports significant, positive elasticities of under-reporting with respect to marginal tax rates, whereas Feinstein (1991) finds a significant negative relationship, both examining TCMP data.} For indirect taxes, the empirical testing of the relationship between tax rates and under-reporting is even more challenging as, in addition to substitution and income effects, it involves the possibility of tax-shifting, that is the transfer of the tax-burden to consumers.

In this study, we focus on indirect taxes and examine the effect of Value-Added Tax (VAT) rate changes on tax evasion.\footnote{The term “tax evasion” is broader than “sales under-reporting”, which is the main focus of this paper, since it includes both direct and indirect tax evasion. However, we use the two terms interchangeably, in order to emphasize the effects of sales under-reporting on direct evasion. Because indirect tax evasion proceeds direct tax evasion, the former creates a lower bound for the latter.} We are able to reduce the complexity of the indirect evasion decision framework by considering a setting where tax-shifting opportunities are extremely limited; we examine the recent changes in VAT rates in the Greek restaurant industry. In September 2011, the VAT rate for non-alcoholic restaurant sales increased from 13\% to 23\%, and subsequently decreased back to 13\% in August 2013. Both tax rate changes were largely unanticipated, which is important for the validity of the policy changes as natural experiments (see Hennessy and Strebulaev (2015)). Throughout this period, the VAT rate for alcoholic sales remained unchanged at 23\%.

The initial increase occurred in the midst of the Greek financial crisis, which limited the margin to pass the additional tax-burden on consumer prices, due to the extremely weak demand. Two years later, when the increase was reversed, the effect on prices was also minimal, since the restaurateurs had absorbed the cost of the prior change to a great degree. According to Eurostat, restaurant prices increased by just 2.4\% following the higher tax rate, and realized an even smaller decrease (-1.4\%) after the tax rate reduction. Consistent with these statistics, a campaign to reduce restaurant prices in August 2013, organized by the Greek restaurateur association, revealed that
almost 90% of the firms did not, even partially, pass-on the reduction to their prices.

In this context, we provide a model of VAT evasion without tax-shifting opportunities, where the probability of an audit is a non-increasing function of the VAT ratio (the ratio of VAT revenues to VAT credits), which is used by the tax authorities as a signal for non-compliance. Our model predicts that a decrease in VAT sales rates reduces the optimal level of sales under-reporting, because it limits benefits from evasion and additionally increases the probability of detection through a lower VAT ratio. Interestingly, a reduction of the input VAT rate is consistent with higher under-reporting by final firms, as it increases the VAT ratio and allows for a greater amount of evading activity to be “camouflaged” under its higher value. Finally, a higher penalty is shown to also increase compliance.

We test these theoretical predictions empirically, using the recent reduction of the non-alcoholic VAT sales rate in the Greek restaurant industry in August 2013. We employ a difference-in-difference methodology using large fast-food restaurants as our control group, because of their limited opportunities to under-report sales. Large fast-food restaurants rely heavily on internal and external paper-trail that is embedded on the processing of the high volume of orders. Paper-trail and third-party reporting have a significant role in increasing compliance, as they make evasion harder and the uncovering of violations easier (Kleven et al. (2009), Kleven et al. (2011)). Furthermore, the majority of these firms belong to franchises, therefore they are subject to additional monitoring, reporting requirements, and penalties.

We hypothesize that, in lieu of a significant change in prices, restaurant sales should not change due to a change in the VAT sales rate. Therefore we focus on the effect of rate changes on reported sales. In our main analysis, we scale reported sales by reported inputs (Sales ratio) in order to control for possible growth effects and use changes in the Sales ratio as an indicator of changes in under-reporting. For example, we interpret the increase of the Sales ratio following a tax rate decrease as uncovering of hidden sales. We then test the effect of a tax rate change on the Sales ratio.

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Note that under a single VAT rate, the VAT ratio is equivalent to the Sales to Inputs ratio. We argue that in the case of multiple VAT rates, the VAT ratio is a better signal, as it conveys more direct information regarding the tax liability of the tax-payer. Matthews and Lloyd-Williams (2000) use the VAT ratio as a direct measure of non-compliance in their cross-country study. The discrepancy between the two ratios can be viewed as an indirect cost of the existence of multiple VAT rates. See Tait (1988) for an extensive discussion on the advantages of a single-rate regime.

Note that such a change could be justified by an external shock (e.g. a technological innovation that increases the marginal productivity of inputs). However, given the nature of the services provided by restaurants and the concurrent adjustment of the Sales ratio to tax rate changes suggest that such a shock is not at works here.
ratio for different treatment groups. We examine large and small firms separately. Furthermore, we consider groups with different levels of alcoholic sales, and thus different degrees of exposure to policy changes, as the tax rate for these sales remained the same (23%) throughout our sample period.

Our results indicate that the VAT rate reduction for non-alcoholic sales, from 23% to 13% in August 2013, increases the Sales ratio in the industry by 11.8% on average (9.57% for the quantile model). This estimate is conservative as our sample excludes seasonal and financially constrained firms and entities that deliberately under-report their inputs to retain an artificially high ratio. It is important to note that the increase of the Sales ratio occurs in a period that the economy is still in recession, when a negative trend in reported sales is expected. The effect is more pronounced for small firms and for firms with low levels of alcoholic sales, which collectively account for over 90% of the population and 75% of the turnover in the industry.

We then aggregate the effects of the tax rate reduction of August 2013 and examine the total fiscal cost of the policy change. In contrast to initial predictions by the “troika”\(^5\) that the measure would reduce government revenues by over 160 million euros during the first five months of implementation (until December 2013), our data indicate that VAT revenues actually declined by only 69.8 million euros. Our analysis provides an explanation for the imprecision of these forecasts; they failed to account for the effects of VAT ratio targeting, which results in a partial decrease in VAT revenues and a consequent increase in reported sales. In our setting, the rate reduction is almost equally distributed between a decrease in VAT revenues (-14.17%) and an increase in reported sales (15.20%) across the industry.

Furthermore, we note that to the extent that the higher reported sales originate from the uncovering of hidden sales, and therefore do not involve additional costs, they should be reflected, at least partially, on income and yield additional direct taxes. Along this line of thought, given the 26% direct tax rate, a portion of the additional 325 million euros of sales reported during the second half of 2013 can offset the initial (reduced) losses in VAT revenues.

The results imply that, in environments of pervasive evasion, tax rate reductions can have small fiscal costs. The reason is that, under the VAT model, evading opportunities are bounded

\(^5\)Note that the “troika”, the triad of the European Commission, the International Monetary Fund, and the European Central Bank that oversees the Greek Economic Adjustment Program, strongly opposed the measure initially, on the basis of its impact on government revenues.
by indicators of economic activity, which force evaders to adjust to rate changes. Additionally, it is shown that tax rate cuts mainly benefit compliant entities, therefore increase competitiveness within the industry, and improve the long-term prospects of the sector.

In additional tests, we document the reverse effect during the preceding increase of the VAT rate for non-alcoholic restaurant sales in September 2011. The increase of the base VAT sales rate from 13% to 23% is followed by a significant decrease of the Sales ratio that ranges from 9% to 10% for small firms and firms with low levels of alcoholic sales. We also examine a set of semiformal firms, defined as firms that consistently report a negative VAT liability. These firms are of interest because they appear to be out of the reach of the enforcement mechanism (and the signaling function of the VAT ratio), and as extreme evaders they are unlikely to voluntarily disclose higher levels of sales. Therefore both the enforcement and the voluntary compliance channels seem to be closed. The documented sharp increase of the Sales ratio, following the rate reduction for semiformal firms, is consistent with involuntary uncovering of sales originating from the customers’ side. That is, as enforcement-constrained peers increase compliance, it becomes harder for semiformal firms to continue evading practices of the past at the same pace against a customer base with higher tax morale.

This paper focuses on the empirical testing of the relationship of indirect tax rates and compliance that has been thoroughly investigated on the theoretical level by Marrelli (1984) and Cremer and Gahvari (1993). However, in our setting, the limited opportunities for tax-shifting enable us to center on the effects of tax rate changes on tax evasion. The study contributes to the empirical literature on VAT efficiency and compliance that mainly consists of cross-country studies. Agha and Haughton (1996), Matthews and Lloyd-Williams (2000), and Matthews (2003) find a negative relationship between the level of VAT rates and compliance, while Aizenman and Jinjarak (2008) show that VAT collection efficiency is positively related to political stability, urbanization, and country income level. Our empirical results are consistent with these findings, but the novelty of our setting lies on that we examine the effect of VAT rates on evasion using industry micro-data, and therefore avoiding possible country (and industry) heterogeneities. More recently, evidence regarding the determinants of VAT compliance comes from large-scale experiments; Pomeranz (2013)
finds that firms with low paper trails respond to the threat of an audit by increasing compliance and creating spill-over effects to their trading network, while Naritomi (2013) highlights the role of consumers as tax auditors through a rewards system.

Our results also provide insights regarding the relationship between compliance and firm size, and the U-shaped non-compliance rate suggested by Slemrod (2007). We find that small firms exhibit higher levels of sales under-reporting, as indicated by their suspiciously low average Sales ratio and its sharper adjustment to tax rate changes. This “flexibility” to under-report sales is consistent with the enforcement role of third-party reporting and paper trails (Kleven et al. (2009), Kleven et al. (2011)), which is more constraining for large firms. Since indirect tax evasion proceeds and creates a lower bound for direct tax evasion, non-compliance of small firms primarily originates from their ability to under-report sales. On the other hand, non-compliance of very large firms is related to the existence of more complex operations that facilitates income under-reporting, according to Hanlon et al. (2005). From a policy point of view, the different origins of non-compliance for firms of different size suggest that tax-enforcement efforts should be guided by firm characteristics, and should be focused on direct and indirect tax evasion for large and small firms respectively.

Finally, the examination of the semiformal sample highlights the importance of behavioral factors (see Frey and Torgler (2007), Alm (2012)) that can contribute towards higher tax compliance. However, in contrast to the mainstream behavioral tax literature that focuses on voluntary compliance, in the case of indirect taxes the role of customers seems to be at least as important (see also Naritomi (2013)).

The paper proceeds as follows. Section 2 presents our model of VAT evasion and its theoretical predictions, and section 3 describes the dataset and the methodology. In section 4 we present our empirical results regarding the effect of VAT rates on tax evasion and section 5 discusses the fiscal cost of the rate reduction and its implications to policy-makers. Finally, section 6 concludes the study.
2 A Simple Model of VAT Evasion

2.1 Assumptions and Realities of VAT Evasion

In every model is the effort to balance the trade-off between simplicity and the capacity to describe reality in an accurate way. Before we proceed to the description of the model, it is useful to briefly discuss the assumptions we make and their relevance to the realities of the particular setting we examine.

2.1.1 Limited Opportunities for Tax-Shifting

In deterrence models of tax evasion, tax-payers typically weigh benefits from evading activity against the cost of a penalty by the tax authorities, in case evasion is uncovered. As shown in the seminal works of Allingham and Sandmo (1972) and Yitzhaki (1974) for direct taxes, the effect of tax rates on compliance relies heavily on risk preferences, the penalty structure, and the probability of detection, which give rise to both substitution and income effects. However, in the case of indirect taxes, the decision to evade becomes even more complicated, as it additionally involves the possibility of tax-shifting, the partial or total transfer of the tax-burden to customers (see Marrelli (1984) and Cremer and Gahvari (1993)).

The literature suggests that apart from the case of a full-information, competitive market, the degree of the pass-on of indirect taxes to consumer prices is obscure. The empirical evidence, regarding whether tax rate changes are fully shifted to consumers, is mixed.\footnote{For example, Poterba (1996) and Besley and Rosen (1999) provide evidence that sales taxes are fully shifted in the case of U.S. commodity markets. However, Carbonnier (2007) finds that VAT rate changes are under-shifted in France depending on market characteristics, while Blundell (2009) suggests that only 75% of a temporary VAT cut in UK was passed-on to consumers.} In a setting similar to ours, Harju and Kosonen (2010) find that the decrease of the VAT rate on restaurant services in Finland in 2010 (from 22% to 13%) resulted to a decrease in final prices of just 2% on average, with large restaurants exhibiting a higher tendency to lower prices than smaller establishments. Collectively, the literature suggests that a tax rate change in commodity taxes is, at least partially, reflected on consumer prices.

However, what differentiates our setting is the limited tax-shifting opportunities, due to the extreme macroeconomic conditions in Greece at the time rate changes were implemented. The tax...
rate increase from (13% to 23%) was implemented at the peak of the financial crisis, leaving very limited margin for the Greek restaurateurs to pass-on the increased burden to their customers. Consequently, in August 2013, when the initial increase was reversed, the majority of the establishments did not adjust their prices downwards, as most firms had already absorbed the prior increase.

Unfortunately, we do not have detailed information on price changes at the restaurant level. However, we have very strong evidence for the limitations on tax-shifting at the industry level. According to Eurostat, the tax rate increase was accompanied by an increase in restaurant prices of 2.4%, while the rate cut in August 2013 was followed by an anemic reduction in prices (-1.4%), consistent with Gábriel and Reiff (2006), who find that VAT rate increases are reflected at a greater scale (and more quickly) on prices as compared to the case of VAT rate decreases. Additional evidence for the failure to pass on the tax rate reduction to consumers comes from the Greek restaurateur association who ran a campaign for this goal; restaurants that (partially) reduced their prices (by more than 5%) were provided with a special badge indicating the change. For the reasons indicated above, only a small fraction of firms participated; nearly 90% of the establishments did not, even partially, pass-on the reduction. As in the case of Finland, the participation rate of larger restaurants was higher as compared to smaller establishments (Harju and Kosonen (2010)).

To summarize, the uniqueness of our setting lies on the fact that we observe VAT rate changes in an environment of weak demand, that significantly limits opportunities for shifting the tax-burden to consumers for both the initial increase and the subsequent decrease of the tax rate. This reduces the complexity of the typical indirect tax setting and enables us to focus on the effect of the tax rate changes on tax evasion.

2.1.2 Risk Preferences and Penalty Structure

In the case of direct taxes, the literature typically assumes that tax-payers exhibit a certain degree of risk aversion. This assumption gives rise to substitution and income effects that, in conjunction with the penalty structure, determine the effect of tax rates on compliance. In the case of indirect

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9 Notably Haig and Shoup (1934) also report a low percentage of retailers shifting their prices upwards after the introduction of sales taxes in New York during the period of the Great Depression.

taxes, since the filing entity is a firm, it is reasonable to assume a lower level of risk aversion. The
fact that proceeds from VAT evasion of final firms, especially in the service sector, are typically not
recoupable also supports this argument. Here, following Cremer and Gahvari (1993), we assume
risk-neutrality.

The penalty structure for VAT evasion is usually a significant lump-sum amount that escalates
in the case of repeated violations, because past violations are difficult to be proven, especially in the
service sector. Note that, since VAT evasion proceeds direct evasion and thus creates a lower bound
for it, an effective penalty should be high enough as to bind the decision of under-reporting.\textsuperscript{11}

\subsection*{2.1.3 Paper Trail}

Our model assumes that tax authorities can perfectly observe paper-trail. Because of the chain-
structure of the VAT system, this assumption means that for an intermediate firm (supplier) tax
authorities observe both incoming and outgoing paper-trail. For a retailer (restaurant) tax author-
ities observe the total incoming paper-trail (arm’s length transactions), but only the transactions
recorded by the final firm.\textsuperscript{12} That is, if the restaurant does not produce a receipt for a sale, then
the sale will go unrecorded.

However, the VAT structure puts some limits in these evading opportunities, because transac-
tions are recorded at every stage of production, creating a chain of paper-trail. Thus, even if the
final sales are difficult to be monitored, firms have to use inputs that are recorded by intermediate
firms (suppliers). Since tax authorities can perfectly monitor paper-trail, we can treat these inputs
as exogenous and, more importantly, as an indicator of economic activity. As a result, a low Sales
(sales to inputs) or VAT (revenues to credits) ratio can signal evasion and be used as a basis for
targeted audits.

\textsuperscript{11}This means that the penalty structure should force the tax-payer to decide on the optimal level of under-reporting,
based on the penalty for VAT evasion (and not subsequent penalties, i.e. for income taxes). Otherwise, the tax-payer
has a motive to maximize VAT evasion, which is not recoupable, even in the case income tax evasion is detected.

\textsuperscript{12}Notice that this does not exclude the possibility of vertical integration (as described in Kopczuk and Slemrod
(2006)), fraud collaboration between intermediate and final firms and the existence of non-registered suppliers. Rather
than that, our model picks up evasion behavior in excess to these possibilities.
2.2 A Model of VAT Evasion without Tax-Shifting

In our model, we define true sales as $s^T$, reported sales as $s^R$, and sales understatement as $u = s^T - s^R$. Since firms are subject to different VAT rates, we use the effective VAT rates of sales ($\tau_s$) and inputs ($\tau_i$), defined as the weighted averages of the applicable rates, weighted by the respective amounts reported. We treat $\tau_s$ and $\tau_i$ as exogenous, similarly to inputs ($i$), due to the assumption that tax authorities perfectly observe incoming paper-trail for retailers.

The tax authorities use the VAT ratio ($r$), defined as the ratio of VAT revenues to VAT credits, in order to detect non-compliance. Thus, the VAT ratio can be written as,

$$r = \frac{\tau_s \cdot s^R}{\tau_i \cdot i} = \frac{\tau_s\cdot(s^T - u)}{\tau_i \cdot i}, \text{ with } r'(u) = -\frac{\tau_s}{\tau_i \cdot i} < 0 \quad (1)$$

The probability of detection is endogenous and is a non-increasing function of the VAT ratio ($r$); $p(\text{audit}) = p(r)$, where $p'(r) \leq 0$. It follows from (1) that the detection probability is a non-decreasing function of sales under-reporting. The penalty for a VAT violation is a significant lump-sum amount, denoted by $T$.

Following Cremer and Gahvari (1993), we examine the behavior of a risk-neutral firm. Therefore, the typical entrepreneur attempts to maximize the expected payoff from engaging in VAT-evasion activities, subject to the tax penalty:

$$P = (\tau_s \cdot u) + p(r)(-T)I_v, \quad (2)$$

where $I_v$ is an indicator function that takes the value 1 if the firm under-reports sales, and 0 otherwise.

Notice that the benefit from evasion ($\tau_s \cdot u$) is realized even in the case of detection, reflecting the fact that usually revenues from VAT evasion cannot be recouped. In order to examine the optimal level of under-reporting, we define the following functional form for the probability of detection:

$$p(r) = \begin{cases} 1, & \text{if } r < 1 \\ \frac{1}{rn}, & \text{if } r \geq 1 \end{cases} \quad (3)$$

According to (3), the tax authorities audit all firms that report a VAT ratio less than one,
thus resulting to a negative VAT liability. Firms that report a VAT ratio greater than one have a probability of detection that decreases at an increasing rate, as r increases \((p'(r) < 0, p''(r) > 0)\). The probability of detection is inversely related to parameter \(n\), which is determined by the tax authorities and depends on its budget, the cost of audits, and the distribution of \(r\).

The optimal level of under-reporting is derived by the first order conditions of (2):

\[
\frac{dP}{du} = 0 \Rightarrow \tau_s - T \cdot \frac{\theta_p}{\theta_r} \cdot \frac{\theta_r}{\theta_u} = 0
\]

Using (1) and (3), we have

\[
u^* = s^\tau - \frac{n+1}{n} \cdot \frac{\tau_i \cdot i}{\tau_s}
\]

From (5), it follows that

\[
\frac{\theta u^*}{\theta \tau_s} > 0 \quad \frac{\theta u^*}{\theta \tau_i} < 0 \quad \frac{\theta u^*}{\theta T} < 0
\]

Therefore, according to our model, a decrease in the sales VAT rate \((\tau_s)\) reduces the optimal level of under-reporting, since it simultaneously decreases the benefit from evasion and increases the probability of detection. In contrast, a decrease in the input VAT rate \((\tau_i)\) increases optimal under-reporting, since a greater understatement of sales can be “hidden” under the lower denominator of the VAT ratio \((r)\). Notice that from (5) it follows that the effect of \(\tau_s\) is stronger than the effect of \(\tau_i\); an increase (decrease) in both VAT rates of equal magnitude will result to an increase (decrease) of the optimal level of under-reporting. This reflects the dual impact of \(\tau_s\) in (2), whereas \(\tau_i\) only affects the objective function through \(r\). Finally, an increase of the penalty \(T\) is consistent with lower levels of under-reporting.

\[\text{Note that the second order conditions are also satisfied, as } \frac{d^2 P}{du^2} < 0.\]
3 Data and Methodology

3.1 Data and Samples

The Greek tax authorities have provided us with the complete account of VAT reports from all establishments with restaurant services as their main activity. Our sample period is from January 2010 to December 2013. As mentioned before, in this period we observe two changes of the non-alcoholic sales VAT rate in the industry; an increase from 13% to 23% in September 2011 and a decrease from 23% to 13% in August 2013. Alcoholic sales are subject to a VAT rate of 23% throughout the period.

Firms are classified as small (Category C) and large (Category B) by the tax authorities based on their annual turnover (with a threshold of 150,000 euros). Large firms are subject to higher accounting standards and are required to file VAT reports monthly; small firms file VAT reports quarterly. The industry is heavily populated by small establishments (94.9%) that account for the 73.9% of the annual turnover on average. Since the majority of the establishments are of small size, we sum the monthly amounts reported by larger firms and observe all data on a quarterly basis.

The dataset includes a coded identifier that allows us to observe each firm across periods. Additionally, we are provided with the location of the establishment (zip code and constituency) and a very detailed classification of the main activity; the tax authorities recognize 132 different categories of restaurant services. We group these categories to eight sub-industries based on common features of services provided and characteristics related to evasion opportunities.\(^{14}\)

For each establishment we observe exact amounts for both VAT credits (for inputs) and revenues (from sales) that apply to each VAT rate, separately. Since we observe claims and collections by tax rate, we can calculate the corresponding Reported Inputs and Reported Sales of each firm for each period.

We apply two filters to our data; we require (i) that a firm reports at least 500 euros of inputs each quarter and (ii) that the firm has no missing filings for the entire sample period. These filters aim to exclude firms that engage in unrecorded transactions with suppliers or deliberately under-report inputs in order to artificially keep a high VAT ratio (r) and avoid audits. Additionally, these

\(^{14}\) These sub-industries are the following: restaurants, bars, hosted establishments, suppliers/catering cafeterias, traditional coffee/pastry shops, fast-food, take-away, and others.
filters exclude seasonal firms, the behavior of which is difficult to be modeled in short horizons, and firms that enter/exit the industry during the sample period. A large number of firms is also excluded because of the provisions of the Greek tax code. Until recently, a firm was required to pay the VAT liability at the time of the filing. Hence, it was common practice for businesses, especially if financially constrained, to skip a report and file a cumulative report during the next period paying the corresponding penalty. By excluding these financially constrained firms, which are more probable to evade due to liquidity problems, we aim to focus on a sample for which the decision to under-report sales is not dictated by the need to survive.

3.2 The VAT System and the Restaurant Industry in Greece

As in most countries, VAT represents a significant source of total government revenue in Greece, on average 20% over the period 2000-2011 according to the European Commission.\textsuperscript{15} The same report estimates the VAT gap ratio for Greece at 39% (or 4.7% of GDP) in 2011, which is one of the highest in the European Union.\textsuperscript{16}

The standard VAT rate in Greece is 23%. There also exist a reduced rate of 13% that applies to fresh food, groceries, medicine, and selected services, and a discounted rate of 6.5% for theater tickets, books, newspapers, and selected pharmaceutical products. For islands, excluding Crete, these rates are further reduced by 30% (16% for the standard, 9% for the reduced, and 5% for the discounted rate). As in all European Union countries, no VAT rate applies to exports. Every business establishment in Greece, including restaurants, is subject to a direct tax that amounts to 26% of the net income.

Most industries in Greece are heavily populated by small and medium size firms that account for the largest portion of the industry turnover; the restaurant industry constitutes no exception. Hence, the VAT registration threshold is 9,000 euros (4,000 euros for services), which is low as compared to more developed economies, but consistent with policies followed by countries with similar industry structure and evasion problems (Bird and Gendron (2007)).\textsuperscript{17}

Restaurants are typically regarded as “problematic” from a compliance point of view, because

\textsuperscript{15}See “Study to quantify and analyse the VAT Gap in the EU-27 Member States, Final Report”, Taxation & Customs Union, European Commission (2013).
\textsuperscript{16}The only countries with higher VAT gap ratios are Romania (48%) and Latvia (41%).
\textsuperscript{17}For example, the registration threshold is €17,500 for Germany, €76,300 for France, £61,000 for the UK, while Italy, Spain, and Portugal have implemented a zero-threshold for VAT registration.
of certain characteristics that facilitate evasion; they belong to the service sector, violations are
difficult to be proven after a transaction is completed, and they cater to customers with little or
no incentive to obtain a record of the sale. There is strong evidence that, in the past, restaurant
owners in Greece have taken advantage of evading opportunities to the limit. Artavanis, Morse,
and Tsoutsoura (2012) show, using bank micro-data, that Greek self-employed professionals in the
restaurant and lodging industry under-report their true income by more than half. Furthermore,
tax records indicate that the average reported income of restaurant owners was just 6,105 euros (or
509 euros per month) in 2011. To put this number in perspective, the minimum legal gross wage
for the same year was 751 euros per month.

Before 2011, non-alcoholic restaurant sales were subject to the reduced VAT rate of 13%. In
September 2011 the Greek government, following the Medium-Term Fiscal Strategy agreement with
the “troika”, raised the VAT rate for the industry to 23% (see Figure 1). Initially, the measure was
expected to yield an additional one billion euros of revenues annually. This target was revised to 800
million euros in early 2012, and finally provided only 160 million euros of additional revenue during
its first year of implementation. Two years later, the Greek government, recognizing the failure
of the measure and the importance of the tourism sector for the economy, reversed the increase.
Hence, in August 2013, the VAT rate applied to prepared food and non-alcoholic beverages was
lowered to 13% (reduced rate). The standard rate (23%) continues to apply to alcoholic beverages.
The rate reduction was expected to create a gap in revenues of over 140 million euros just for
the last five months of 2013, according to the predictions of the “troika”, which initially strongly
opposed the change.

[INSERT FIGURE 1 HERE]

Both tax rate changes were largely unanticipated for different reasons and were legislated just
a few weeks before the implementation date. The VAT rate increase was the last-minute outcome
\footnote{Unfortunately, this trend is not specific to Greece, as enforcement in the restaurant industry has been challenging internationally due to the nature of the services provided and the ingenuity of the restaurateurs. Tait (1988) offers an amusing example from Italy, where escorts were hired to accompany customers to their cars and then pocket the receipts, when police officers were assigned to check whether restaurants had issued a receipt or not.}
\footnote{“Why VAT rate for restaurant services should be reduced”, Christos Staikouras & Stauros Petsas, Kathimerini, April 21, 2013. The data are from the VAT revenue office of the Ministry of Finance.}
of tough negotiations to secure the continuation of the country’s funding in the context of the Medium-Term Fiscal Strategy program. The measure was voted during the last days of June 2011. The rate reduction, even if it always existed in the Greek policy agenda, met the strong opposition of the “troika” and was hindered by provisions of the program that prevented unilateral actions on behalf of the Greek government. The “troika” finally provided its consent in July 2011. This is important to note, since Hennessy and Strebulaev (2015) show that policy changes should be unexpected in order for treatment responses to converge to causal effects.

3.3 Methodology

The aim of our analysis is to examine the effect of VAT rate changes on sales under-reporting, therefore we focus on Reported Sales as our main variable of interest. But since compliance is not the sole determinant of the level of reported sales, we use the Sales ratio, defined as the ratio of reported sales to reported inputs, to control for possible growth effects. In this context, an increase in reported sales can be attributed to growth, however an increase in the Sales ratio is consistent with sales uncovering, unless an exogenous shock is at work (e.g. a technological innovation). Additionally, the Sales ratio partially adjusts for seasonality, which is a prominent characteristic of the industry. Because restaurants exhibit strong seasonality at the quarter level, we use the percentage change of the Sales Ratio ($\Delta SR$) with respect to the same quarter of the previous year as our main dependent variable.

Ideally, we would like to use a set of firms with no evading opportunities as a benchmark, since for this group the effect of tax rate changes on under-reporting should be zero (recall that in the context of our model for these firms, $u = 0$ and $I_v = 0$). Because this is not feasible, we choose a group with low evading opportunities as our control sample, large fast-food restaurants. We focus on large firms, because they rely more heavily on internal and external paper trail, which plays an important role in limiting evading behavior (see Kleven et al. (2009), Kleven et al. (2011)). Due to their size, the role of paper-trail is multi-dimensional; it is used to monitor employees, facilitate accounting, and organize supply orders. Specifically for large fast-food restaurants, internal and external paper-trail is embedded in the processing of the high volume of orders. Furthermore, since the majority of these firms belong to chains and franchises, they are subject to additional monitoring, reporting, and penalties (if a violation is realized) from franchisers.
We implement a difference-in-difference (DD) methodology, in order to access the effect of VAT rate changes on sales under-reporting, as captured by changes on the Sales ratio. In our analysis we look into treatment groups with different characteristics related to evading opportunities and exposure to policy shocks; we examine small and large firms separately, and groups with different levels of dependence on alcoholic sales.\(^{20}\) Since the tax rate for alcoholic sales remains unchanged, these groups represent samples with different exposure to the policy changes. Specifically, we estimate the following equation:

\[
\Delta SR_{it} = \beta_0 + \beta_1 \cdot I_{t>t_0} + \beta_2 \cdot I_{i\in B} + \tau \cdot I_{t>t_0} \cdot I_{i\in B} + X_{it} \cdot \beta + u_{it},
\]

where \(\Delta SR_{it}\) is our main dependent variable, the percentage change of the Sales ratio, \(B\) is our treatment group, \(t_0\) is the quarter of the VAT change, and \(X\) is a vector of control variables for sub-industries, geographies, and seasonality. The variable of interest in (6) is \(\tau\), which captures the treatment effect from the rate change.

We also present results from quantile regressions, in order to ensure that our results are not driven by outliers. Because of the existence of skewness, we focus our empirical discussion on medians and results from the quantile model, which typically are less pronounced than our baseline specification, but are not less significant.

We also examine the effect of rate changes on greater detail by using a difference-in-difference specification, differentiated by quarter, as in Lefebvre et al. (2009), using

\[
\Delta SR_{it} = \beta_0 + \beta_1 \cdot I_{t>t_0} + \beta_2 \cdot I_{i\in B} + \sum_{t=1}^{n} \tau_t \cdot I_t \cdot I_{i\in B} + X_{it} \cdot \beta + u_{it},
\]

where periods 1 to \(n\) refer to the quarters following the policy change.

---

\(^{20}\)We estimate the percentage of alcoholic sales for each firm as the percentage of sales subject to the high tax rate before the change in September 2011. Results presented here use the percentage of alcoholic sales of the second quarter of 2011. In robustness tests, we have used the average percentage of alcoholic sales over the period from January 2010 to June 2011 with no significant differences in our results.
4 Empirical Results

4.1 VAT Ratio Targeting and the Adjustment to the VAT Rate

In our analysis, we examine treatment groups with different characteristics separately. Table 1 provides descriptive statistics for these samples. Our main sample (Panel A) focuses on the effect of the VAT rate decrease (August 2013) and includes 17,673 entities (732 large and 16,941 small firms). Large firms are over 10 times larger than their smaller peers, in terms of both reported sales and inputs. The vast majority of firms in the industry exhibit low levels of alcoholic sales (less than 25%), with larger firms being less dependent on alcoholic sales (19% as compared to 23% for small firms on average). Panel B reports descriptive statistics for our secondary sample that examines the VAT rate increase of September 2011, and exhibits similar properties to our main sample.

Firms in the control group report comparable figures of sales and inputs to other large firms, but exhibit lower skewness. Large fast-food restaurants are also less dependent on alcoholic sales, than any treatment group (5.46% of sales on average, 1.77% at the median). Thus, control firms are typically more exposed to the rate changes of non-alcoholic sales than other firms.

Figure 2 depicts the impact of VAT rate changes to the effective VAT rate of small and large firms. During the low standard rate periods, the ratio of rates \( \bar{\tau}_s / \bar{\tau}_i \) is very close to 1, but during the high rate period it increases by approximately 30%.\(^{21}\) Larger firms appear to be more exposed to policy changes, consistent with their lower dependence on alcoholic sales (see Table 1) and their concentration in areas where the discounted VAT rate does not apply.

The Sales ratio, used in our analysis to access under-reporting, and the VAT ratio, that in our model serves as a signal for evading activity, are related through the effective VAT rates of sales \( \bar{\tau}_s \) and inputs \( \bar{\tau}_i \) as follows:

\(^{21}\)The fact that the average VAT sales rate is below the standard rate 23% is due to the existence of exceptions and discounts (e.g. discounted rates for islands).
\[
\frac{\text{VAT revenues}}{\text{VAT credits}} = \frac{\bar{\tau}_s}{\bar{\tau}_i} \times \frac{\text{Reported Sales}}{\text{Reported Inputs}} \Rightarrow r = \frac{\bar{\tau}_s}{\bar{\tau}_i} \times SR
\] (8)

Hence, as the ratios of the effective VAT rates converge to unity, following the rate reduction of the third quarter of 2013, we expect the Sales and VAT ratios to converge as well. More specifically, unless there is an exogenous reason at work that affects the Sales ratio, we expect a sharp change in the VAT ratio originating from the numerator, since a lower sales rate corresponds to lower revenues. However, as Figure 3 shows, the convergence takes place in a very different manner for small and large firms.\(^{22}\)

[INSERT FIGURE 3 HERE]

For large firms the VAT rate reduction predominately affects the VAT ratio, which is decreased by 28% in Q4 2013 with respect to the same quarter of the previous year, while the Sales ratio (and reported sales) remains fairly stable. In contrast, for small firms the VAT ratio only partially adjusts to the lower VAT rate. The remaining distance for the convergence of the two ratios is covered by an upward adjustment of the Sales Ratio. Interestingly, these two adjustments, in the case of small firms, appear to be approximately of equal magnitude (14-15%).

The fact that the tax rate reduction has a significant impact not only on the VAT ratio, but also on the Sales ratio, can be explained by VAT ratio targeting. In Figure 3(b) the dashed line projects the VAT ratio under the assumption that it had completely adjusted to the VAT rate reduction (as in the case of large firms). Under this scenario, the VAT ratio drops to extremely low levels (below 1.30) providing a strong signal of evasion, which makes an audit more probable. Instead, firms decide to target a more reasonable VAT ratio by partially adjusting VAT revenues downwards that increases the level of reported sales because of equation (8). This behavior is consistent with the optimal decision from our model, as discussed in subsection 2.2.

\(^{22}\)As a sidenote, we comment on the suspiciously low average ratio of small firms. Even though we expect a higher ratio for large firms, due to economies of scale, the significant differences we observe are hard to justify. Average sales ratios of small firms that range from 1.40 to 1.50 are indicative of significant sales under-reporting (Sales ratios of large firms average between 2.40 and 2.50). With the exception of the semiformal sample, discussed in section 4.4, we refrain from presenting levels of Sales ratios, as they constitute valuable tools for conducting targeted audits. Instead, we focus on the percentage change of the ratios with respect to the previous year.
4.2 Effects of VAT Rate Decrease

In this subsection we examine the effects of the VAT sales rate decrease of August 2013. As mentioned earlier, the tax rate for restaurant services, excluding alcoholic sales, was reduced from 23% to 13%. In our setting, we use the first two quarters of 2013 as the control (pre-change) period and the last two quarters of 2013 as the testing (post-change) period. Since the policy change occurred in August, the first quarter of our testing period includes a month (July) with the high rate in effect. The dependent variable is the percentage change of the Sales ratio from the respective quarter of 2012, when the high tax rate was in effect.

Figure 4 presents median changes of Sales ratio for the control (large fast-food restaurants) and various treatment groups, before and after the policy change. The VAT sales rate reduction in the third quarter of 2013 is followed by an upward trend of our dependent variable that is particularly strong for small firms (Figure 4(b)). Figures 4(c)-(f) indicate an increase in the Sales ratio that is larger for firms that are more exposed to the policy change (lower levels of alcoholic sales).

In Tables 2 and 3 we examine these trends in greater detail. For our total sample the treatment effect is 8.14% (8.54%) and highly significant. The quarter decomposition shows that in the last quarter of 2013, when the lower rate was in effect for all three months of the quarter, the effect is larger, 9.57% (11.8%). Analysis by firm size shows that the effect comes mainly from small firms. For large firms the treatment effect is small, 4.35% (3.11%), and statistically significant only in the case of quantile regressions, while for small firms it is substantially larger, 8.62% (8.77%), and highly significant. The quarter decomposition shows that the increase of the Sales ratio occurs gradually, from 7.45% (5.36%) to 10.17% (12.18%) for Q3 and Q4 of 2013, respectively (Table 2).

The sharp increase of the small firms’ Sales ratio, following the VAT rate decrease, is indicative of an increase in compliance. In comparison, the moderate response of the large firms’ Sales ratio

\[\text{[INSERT FIGURE 4 HERE]}\]

\[\text{[INSERT TABLE 2 HERE]}\]

\[\text{\footnote{Henceforth we focus on results from the \textit{quantile} model and report results from our baseline model in parentheses.}}\]
becomes particularly interesting in view of the fact that large firms are more exposed to the rate change (see Figure 2, Table 1) and exhibit higher tendency to lowering their prices following the rate reduction. Nevertheless, as discussed earlier, the decrease in prices was so minimal that it would imply implausibly high elasticity values, if it was for demand factors to account for the documented treatment effects.

Panel B of Table 3 presents results for groups formed on the basis of their dependence on alcoholic sales. Since the VAT sales rate for alcohol remained unchanged throughout the period, a higher percentage of alcoholic sales indicates a lower exposure to the policy change. Consistent with this, we observe a monotonic treatment effect; there is no significant treatment effect for firms in the high alcohol group and the mid-high alcohol group (except in the quantile specification (4.41%)). In contrast, for firms that are less dependent on alcoholic sales, the increase of the Sales ratio is large and highly significant; firms with alcoholic sales between 25% and 50% realize an increase of 7.53% (9.10% on average), while the Sales ratio of the low alcohol group increases by 9.32% (9.65%).

The fact that the increase of the Sales ratio is concentrated among firms with low alcoholic sales is consistent with VAT ratio targeting. That is, firms with high levels of alcoholic sales do not experience a significant change in their VAT sales rate, therefore do not need to adjust their VAT ratio. On the contrary, firms that specialize on non-alcoholic sales, and face a significantly lower VAT sales rate under the new policy, partially adjust their VAT revenues downwards in order to maintain a reasonable VAT ratio and avoid detection, and thus report higher levels of sales.

4.3 Effects of VAT Rate Increase

Next, we examine the impact of the VAT rate increase for non-alcoholic sales, from 13% to 23% (September 2011). We maintain the same methodological framework used previously and define Q1 and Q2 of 2011 as the control period, and the following three quarters (Q4 2011-Q2 2012) as the testing period. The last quarter of the testing control period includes a month (August) where the high standard rate was in effect.
The results are presented in Tables 4 and 5. As in the case of the rate reduction, the increase of the VAT rate significantly affects the Sales ratio. The treatment effect is -9.02% (-5.11%) for our total sample and is limited for large firms (significant only in the case of quantile regressions). In contrast, the effect is -9.05% (-5.19%) and highly significant for small firms. Interestingly, the decomposition of the treatment effect shows that the Sales ratio adjusts with the lag, as the main portion of the decrease occurs in Q1 and Q2 of 2012 (-6% for large firms and -12% for smaller peers).

[INSERT TABLE 4 HERE]

[INSERT TABLE 5 HERE]

In Table 5, we examine groups with different levels of dependence on alcoholic sales. Consistent with our previous findings, the results exhibit a monotonic relationship between the level of exposure and the treatment effect. The decrease of the Sales ratio is negligible for firms with high percentages of alcoholic sales, but the effect gradually becomes more significant as the percentage declines and reaches -9.96% (-5.86%) for the lowest alcohol group.

Our results suggest that an increase in the VAT sales rate, as predicted by our model in subsection 2.2, increases under-reporting, particularly for small firms and firms with low dependence on alcoholic sales. These findings are consistent with our previous results and the existence of VAT ratio targeting.

4.4 Semiformal Sample

Semiformality describes an environment where entities operate in the formal sector, but understate their results to authorities. Semiformal firms, in contrast to completely submerged ones, remain registered, so as to receive benefits from the public sector, but understate their obligations to the tax authorities. Thus, semiformal firms can be more harmful than informal ones from a social welfare point of view, since they are additionally associated with the depletion of government resources. Artavanis, Morse, and Tsoutsoura (2012) show that a large part of the world operates in a semiformal setting.
Our setting provides a unique opportunity to examine an extreme example of semiformality. We focus on a sub-sample that consists of firms that report a negative VAT liability for the period of the high VAT sales rate (Q3 2011-Q2 2013). More specifically, we define a firm as semiformal if it reports higher total VAT credits than total VAT revenues during the high rate regime, and additionally reports a median VAT ratio less than one.\textsuperscript{24} It is important to note that these entities are not (even temporarily) distressed firms; in contrast, they survive throughout the sample period and file VAT reports each quarter claiming a negative VAT liability on average. The semiformal sample includes 854 firms, that is 5% of our main sample and consists exclusively of small firms, which is indicative of the incidence and the distribution of evasion in the industry.

Figure 5 presents the effects of VAT rate changes on the Sales ratio of semiformal firms. Figure 5(a) depicts the median percentage change of the Sales ratio for the semiformal sample, as presented previously for different treatment groups. The VAT rate reduction is followed by an increase in the Sales ratio that is larger than that of any other treatment group examined earlier. Figure 5(b) presents median Sales and VAT ratios for the entire sample period. Both ratios experience a sharp decrease, falling below unity after the rate increase, while the ratios increase significantly and return to above unity levels after the rate reduction.

\[\text{INSERT FIGURE 5 HERE}\]

These results are of interest for two reasons. First, these firms constitute evident cases of under-reporting, as it is unreasonable to expect that a restaurant business can survive for a long period with a VAT (or Sales) ratio below one.\textsuperscript{25} Thus, the semiformal sample appears to be out of the reach of the enforcement mechanism. Note that according to our model in subsection 2.2, these firms should be subject to audits with probability equal to one (see equation (3)). The fact that the semiformal firms continuously report a negative VAT liability is consistent with a story of corruption, or it might indicate the difficulty of the tax authorities to prove violations (as discussed in Klepper and Nagin (1989) and Kleven et al. (2011)). Regardless of the reason, these firms are

\textsuperscript{24}The second criterion ensures that a firm is not defined as semiformal due to high VAT credits reported over a single quarter. We thank a tax authority officer for this suggestion.

\textsuperscript{25}Note that since the average VAT sales rate is greater than the average VAT input rate during the high rate period, the Sales ratio is typically lower than the VAT ratio.
not subject to the signaling function of the VAT ratio. Therefore, the documented adjustment of the Sales ratio cannot be attributed to the enforcement channel (the probability of an audit).

A different channel that may be responsible for the observed increase in compliance is related to behavioral factors. As Andreoni, Erard, and Feinstein (1998) note, deterrence models of tax evasion are insufficient to account for the high levels of compliance we observe. A growing body of literature suggests that behavioral, psychological, and social factors are also important in determining compliance, including fairness considerations of the tax system (Spicer and Becker (1980)), moral sentiments (Erard and Feinstein (1994)), psychological costs of non-compliance (Gordon (1989), Cowell (1990)), patriotism (Konrad and Qari (2012)), cultural differences (Torgler and Schneider (2007)), and social norms (Alm et al. (1999)).

The behavioral tax literature focuses on direct tax evasion, and consequently on the filing entity, thus examining factors that might induce voluntary compliance. In contrast, our study examines indirect tax evasion, which follows from transactions that involve more than one parties. Since the semiformal sample consists of “professional evaders”, who are unlikely to disclose higher levels of reported sales voluntarily, increased compliance can be induced by customers asking for receipts.26 This sample provides an excellent setting to test the effect of involuntary compliance motivated by the customers’ side, since for semiformal firms both the enforcement and the voluntary compliance channels appear to be closed.

Considering the environment in which the tax rate reduction was implemented, further supports the involuntary compliance story; the VAT rate decrease of August 2013 was an industry-specific measure, implemented in a period of crisis with sharply declining incomes and increasing tax-burdens. As a result, the restaurant industry was regarded as “privileged” compared to other sectors that remained subject to the high (standard) tax rate. Furthermore, the policy change had the nature of an experiment and would be expanded to other industries if it was successful. These facts increase social pressure on retailers for higher compliance and customers’s tax morale. In this context, it is plausible that semiformal firms found it harder to continue the evading practices of the past, especially when enforcement-constrained peers significantly reduced under-reporting.

26Naritomi (2013) emphasizes the role of customers as auditors through a rewards system based on lotteries in Brazil. In the past, the Greek government attempted to motivate tax-payers to gather receipts. These motives, which were not specific to the restaurant industry, were significantly reduced during our testing period (2013) because of their high fiscal cost. If any, the effect of these motives should be negative for the period of the reduced VAT rate as compared to the control period.

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Thus, the finding that even extreme-evading firms decrease under-reporting after the rate reduction is consistent with involuntary compliance induced by the opposite side of transactions, i.e. the customers.

At this point it is important to note that although the channel of involuntary compliance should work across the industry, it does not contradict the role VAT ratio targeting. The reason is that restaurateurs that target VAT ratios can cater for the increased demand for receipts by reducing paper-trails to clientele that does not request them. The fact that the Sales ratio of semiformal firms is significantly lower than that of small firms, both before and after the rate reduction, implies that the effect of the involuntary compliance channel on the amount of sales reported is not binding for the majority of firms.

5 Policy-making and Fiscal Cost

In this section we discuss the policy implications of the rate reduction and its fiscal cost. Both aspects are particularly important in order to evaluate the overall impact of the measure. Here, we work with aggregate amounts of sales and VAT flows, in order to quantify its total effects on the industry and the economy.

Our analysis demonstrates the importance of VAT and Sales ratios for tax enforcement. The usefulness of these tools in identifying evaders and constraining evading activities is not limited to environments of pervasive evasion. VAT and Sales ratios can be used to uncover evaders in any setting by using industry benchmarks and conditioning on important firm characteristics (e.g. location, size, type of service).

The main empirical result of our previous analysis is that the VAT rate reduction increases compliance, especially for smaller firms and firms with low dependence on alcoholic sales. As mentioned earlier, these firms have a dominant role in the sector and collectively account for over 75% of the industry’s turnover. As we have shown, the measure is more beneficial to more compliant firms; the tax rate reduction increases competitiveness within the sector and with foreign competitors, which improves the long-term prospects of the industry and the economy. These benefits should be carefully weighed against the fiscal cost of the measure that we discuss next.

\footnote{At the time that the high VAT rate was implemented, the main competitors of Greece in the tourism sector were subject to significantly lower VAT rates, ranging from 5.5% in France to 13% in Italy.}
The overall fiscal cost is an important aspect of any policy change, and in the case of Greece it is critical for two additional reasons. First, as mentioned earlier, the policy change had the nature of an experiment, a predecessor for more tax-rate cuts that the Greek government aimed to implement. Its impact on revenues had the potential of determining tax policy in a country that is in severe financial distress. Second, the country is currently subject to a fiscal adjustment program, closely monitored by the “troika”, which strongly opposed the measure on the basis of its expected impact on government revenues. Initial estimates amounted to losses over 140 million euros just for the first five months of the implementation of the lower VAT rate (until the end of 2013). Hence it is of great interest to examine how the final results compare to this forecast.

Table 6 presents aggregate VAT revenues and reported sales for all firms in the industry. In the second half of 2013, VAT revenues declined by only 69.8 million euros compared to the previous year, almost half than the “troika”’s predictions. Our analysis provides an explanation for this fact. Firms with high evading behavior follow an active VAT ratio targeting strategy, that is partially adjusting their VAT revenues downwards in order to maintain a reasonable VAT ratio. This process, described in section 4 and reflected on the Sales ratio through equation (8), is also apparent in the aggregate reported sales presented in Table 6. For large firms the VAT rate reduction is almost totally reflected on VAT revenues (-24.16%), in contrast to small firms that only partially adjust their VAT revenues downwards (-10.80%). This partial adjustment of VAT revenues corresponds to an increase in reported sales (19.24%), as it follows from equation (8). Across the industry, due to the predominant role of small firms, the rate reduction is distributed almost equally between a decrease in VAT revenues (-14.17%) and an increase in reported sales (15.20%).

[INSERT TABLE 6 HERE]

The second feature that should be factored in the fiscal cost of the measure is its effect on direct taxes, following the increase in reported sales. To the extent that this increase comes from the uncovering of “hidden” sales that do not involve additional production costs, we expect that it will be reflected on the firms’ annual results, at least partially. Since reported sales increased by 352 million euros in the second half of 2013 (Table 6), a fraction of this amount, given the 26% direct tax rate, can offset the initial loss in VAT revenues (69.8 million euros).
6 Conclusions

This paper examines the effect of VAT rate changes on tax evasion in an environment with limited opportunities for tax-shifting. We examine reported sales scaled by inputs and show that a reduction of the VAT sales rate significantly increases compliance, especially for firms with more evading opportunities. This result is consistent with VAT ratio targeting, the attempt to maintain a reasonable VAT ratio (revenues to credits) in order to avoid signaling evasion to the tax authorities. The result of this process is the partial adjustment of VAT revenues downwards and the corresponding increase in reported sales (uncovering “hidden sales”). We also document the reverse effect in the case of a VAT rate increase.

These findings are very important from a policy-making point of view. We show that in an environment of pervasive evasion, the reduction of the VAT rate not only reduces under-reporting, but also improves competitiveness by mainly benefiting compliant firms. Furthermore, the fiscal cost of such measures should take into account the partial adjustment of VAT revenues by evaders and the effect on direct taxes that results from the uncovering of “hidden sales”. Depending on the incidence and distribution of under-reporting, we show that, accounting for these effects, the final fiscal cost can be minimal compared to benefits.

Our findings suggest that in environments of pervasive evasion and extensive semiformality, the optimal policy might be the reduction of tax rates, as it increases compliance at a small fiscal cost. Both results stem from the fact that evasion is bounded by indicators of economic activity (VAT and Sales ratios), which constitute powerful tools for enforcement. Finally, we show that, in addition to the enforcement channel, a change in tax rates can activate behavioral factors originating from the customers’ side and create a separate channel of involuntary compliance for retailers.
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Figures

Figure 1: Sales VAT Rates in the Restaurant Industry (2010-2013)
The figure presents the VAT rates that applied to alcoholic and non-alcoholic sales in the restaurant industry from January 2010 to December 2013.
Figure 2: Effective VAT Rates of Inputs and Sales
The figure presents quarterly averages of the effective VAT rates for reported inputs and sales from small and large firms from Q2 2011 to Q4 2013. Effective VAT rates are defined as the weighted average of the applicable rates weighted by the respective amounts reported. Firm size is defined by the tax authorities on the basis of annual turnover.
Figure 3: Sales & VAT Ratios of Small and Large Firms

The figures present average Sales (reported sales to reported inputs) and VAT (VAT revenues to VAT credits) ratios for the period between Q2 2012 and Q4 2013. Figure 3(a) refers to large firms and Figure 3(b) to small firms. Firm size is defined by the tax authorities on the basis of annual turnover. The dashed line in Figure 3(b) projects the VAT ratio reduced by the percentage decrease of the effective VAT sales rate, with respect to the same quarter of the previous year (2012). The red lines indicate the time of the VAT sales rate reduction. The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter.
Figure 4: Sales Ratio and VAT Rate Reduction
The figures present median percentage change of the Sales ratio with respect to the same quarter of the previous year for the control group (large fast-food restaurants) and the treatment groups. Figures 4(a) and (b) refer to large and small firms, as defined by the tax authorities, based on annual turnover. Figures 4 (c), (d), (e), and (f) refer to groups of firms with alcoholic sales over 75%, 50-75%, 25-50%, and less than 25% of the turnover, respectively, in the second quarter of 2011. The policy change occurred in August 2013. The control and testing periods include Q1 & Q2 and Q3 & Q4 of 2013, respectively.
Figure 5: Sales Ratios of Semiformal firms
Figure 5(a) presents median percentage changes of the Sales ratio with respect to the same quarter of the previous year for the control group (large fast-food restaurants) and the group of semiformal firms. Figure 5(b) presents median Sales and VAT ratios of semiformal firms from Q1 2010 to Q4 2013. The red lines in Figure 5(b) indicate the time of policy changes (VAT rate increase, VAT rate decrease). Semiformal firms are defined as the set of firms that (i) report a negative total VAT liability (VAT revenues < VAT claims) and (ii) a median VAT ratio below one over the high standard VAT rate period (Q4 2011-Q2 2013). The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter.
# Tables

## Table 1: Sample Descriptive Statistics

The table presents summary statistics of the main variables of the VAT rate decrease (Panel A) and VAT rate increase (Panel B) sample. The table presents averages and medians (in parentheses) by firm across the respective sample period. All figures refer to euros per quarter, except the *Percentage of Alcoholic Sales* that refers to the percentage of sales subject to the high VAT rate in the second quarter of 2011 (before the initial increase of the standard industry VAT rate). The control group consists of large fast-food restaurants and is not included in the Total group. Size is defined by the tax authorities based on annual turnover. High, Mid-High, Mid-Low, and Low Alcohol groups include firms with alcoholic sales over 75%, 50-75%, 25-50% and less than 25% of the turnover, respectively, in the second quarter of 2011. The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter. *VAT Revenues* refer to the total VAT collected from sales per quarter. *VAT Credits* refer to the total VAT claimed for inputs per quarter. *Reported Sales* and *Reported Inputs* are calculated based on the VAT figures, using the applicable rates.

<table>
<thead>
<tr>
<th>Panel A: VAT rate decrease (Q2 2011-Q4 2013)</th>
<th>Total</th>
<th>Control</th>
<th>Large</th>
<th>Small</th>
<th>High Alcohol</th>
<th>Mid-High</th>
<th>Mid-Low</th>
<th>Low Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported Sales</td>
<td>28,345</td>
<td>253,572</td>
<td>236,018</td>
<td>19,371</td>
<td>25,153</td>
<td>14,075</td>
<td>17,020</td>
<td>34,104</td>
</tr>
<tr>
<td></td>
<td>(9,285)</td>
<td>(185,696)</td>
<td>(107,842)</td>
<td>(8,694)</td>
<td>(8,439)</td>
<td>(5,089)</td>
<td>(6,035)</td>
<td>(12,214)</td>
</tr>
<tr>
<td>Reported Inputs</td>
<td>16,279</td>
<td>99,709</td>
<td>104,260</td>
<td>12,477</td>
<td>17,229</td>
<td>8,743</td>
<td>10,302</td>
<td>19,141</td>
</tr>
<tr>
<td></td>
<td>(6,640)</td>
<td>(74,032)</td>
<td>(49,512)</td>
<td>(6,268)</td>
<td>(6,369)</td>
<td>(3,929)</td>
<td>(4,357)</td>
<td>(8,460)</td>
</tr>
<tr>
<td>VAT Revenues</td>
<td>5,380</td>
<td>48,539</td>
<td>45,151</td>
<td>3,662</td>
<td>5,492</td>
<td>2,911</td>
<td>3,373</td>
<td>6,347</td>
</tr>
<tr>
<td></td>
<td>(1,757)</td>
<td>(36,380)</td>
<td>(20,749)</td>
<td>(1,646)</td>
<td>(1,789)</td>
<td>(1,046)</td>
<td>(1,187)</td>
<td>(2,228)</td>
</tr>
<tr>
<td>% of Alc. Sales</td>
<td>22.82%</td>
<td>5.46%</td>
<td>18.93%</td>
<td>22.99%</td>
<td>90.29%</td>
<td>60.65%</td>
<td>36.03%</td>
<td>8.85%</td>
</tr>
<tr>
<td></td>
<td>(14.21%)</td>
<td>(1.77%)</td>
<td>(11.03%)</td>
<td>(14.37%)</td>
<td>(91.52%)</td>
<td>(59.52%)</td>
<td>(35.19%)</td>
<td>(8.02%)</td>
</tr>
<tr>
<td>Number of Firms</td>
<td>17,673</td>
<td>184</td>
<td>732</td>
<td>16,941</td>
<td>784</td>
<td>1,625</td>
<td>3,642</td>
<td>11,622</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: VAT rate increase (Q1 2010-Q1 2012)</th>
<th>Total</th>
<th>Control</th>
<th>Large</th>
<th>Small</th>
<th>High Alcohol</th>
<th>Mid-High</th>
<th>Mid-Low</th>
<th>Low Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported Sales</td>
<td>33,581</td>
<td>291,369</td>
<td>236,658</td>
<td>20,374</td>
<td>32,778</td>
<td>16,892</td>
<td>21,232</td>
<td>39,773</td>
</tr>
<tr>
<td></td>
<td>(10,242)</td>
<td>(214,392)</td>
<td>(121,229)</td>
<td>(9,388)</td>
<td>(8,885)</td>
<td>(5,355)</td>
<td>(6,701)</td>
<td>(13,559)</td>
</tr>
<tr>
<td>Reported Inputs</td>
<td>17,473</td>
<td>112,116</td>
<td>100,156</td>
<td>12,095</td>
<td>23,551</td>
<td>9,696</td>
<td>11,511</td>
<td>19,931</td>
</tr>
<tr>
<td></td>
<td>(6,551)</td>
<td>(81,092)</td>
<td>(50,205)</td>
<td>(6,053)</td>
<td>(6,237)</td>
<td>(3,922)</td>
<td>(4,564)</td>
<td>(8,179)</td>
</tr>
<tr>
<td>VAT Revenues</td>
<td>5,589</td>
<td>46,489</td>
<td>39,730</td>
<td>3,369</td>
<td>7,212</td>
<td>3,303</td>
<td>3,831</td>
<td>6,326</td>
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<tr>
<td></td>
<td>(1,695)</td>
<td>(33,763)</td>
<td>(20,190)</td>
<td>(1,552)</td>
<td>(1,859)</td>
<td>(1,041)</td>
<td>(1,195)</td>
<td>(2,057)</td>
</tr>
<tr>
<td>% of Alc. Sales</td>
<td>22.94%</td>
<td>5.46%</td>
<td>18.93%</td>
<td>22.99%</td>
<td>90.29%</td>
<td>60.65%</td>
<td>36.03%</td>
<td>8.85%</td>
</tr>
<tr>
<td></td>
<td>(13.95%)</td>
<td>(1.70%)</td>
<td>(11.83%)</td>
<td>(14.17%)</td>
<td>(92.19%)</td>
<td>(59.38%)</td>
<td>(35.13%)</td>
<td>(7.71%)</td>
</tr>
<tr>
<td>Number of Firms</td>
<td>12,610</td>
<td>206</td>
<td>770</td>
<td>11,840</td>
<td>630</td>
<td>1,147</td>
<td>2,558</td>
<td>8,275</td>
</tr>
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</table>
Table 2: Sales Ratio and VAT Rate Reduction by Size
The table presents the results for the VAT rate reduction of August 2013 using equation (6),
\[ \Delta SR_{it} = \beta_0 + \beta_1 \cdot I_{t>t_0} + \beta_2 \cdot I_{i \in B} + \tau \cdot I_{t>t_0} \cdot I_{i \in B} + X_{it} \cdot \beta + u_{it}. \]
Treatment effects are reported for the total sample and sub-samples of large and small firms, according to the tax authorities’ specification. The control group includes all large fast-food restaurants. Sales ratios are winzorized at the 1% level for the total sample, per quarter. The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter. Model (1) presents the results of OLS regressions, while Model (2) refers to quantile regressions. Models (1a) and (2a) decompose the treatment effect to the two quarters of the testing period (Q3 & Q4 2013) using equation (7). All specifications include sub-industry, region, and quarter fixed effects. Heteroscedasticity robust standard errors, clustered by firm, are reported in brackets. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

<table>
<thead>
<tr>
<th>Treat. Group:</th>
<th>Total Sample</th>
<th>Large Firms</th>
<th>Small Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(1a)</td>
<td>(1)</td>
</tr>
<tr>
<td>( \tau )</td>
<td>0.0854***</td>
<td>0.0311</td>
<td>0.0877***</td>
</tr>
<tr>
<td></td>
<td>[0.0248]</td>
<td>[0.0307]</td>
<td>[0.0248]</td>
</tr>
<tr>
<td>( \tau_1 )</td>
<td>0.0527**</td>
<td>0.0327</td>
<td>0.0536**</td>
</tr>
<tr>
<td></td>
<td>[0.0229]</td>
<td>[0.0300]</td>
<td>[0.0229]</td>
</tr>
<tr>
<td>( \tau_2 )</td>
<td>0.1180***</td>
<td>0.0296</td>
<td>0.1218***</td>
</tr>
<tr>
<td></td>
<td>[0.0337]</td>
<td>[0.0415]</td>
<td>[0.0337]</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td>(2a)</td>
<td>(2)</td>
</tr>
<tr>
<td>( \tau )</td>
<td>0.0814***</td>
<td>0.0435***</td>
<td>0.0862***</td>
</tr>
<tr>
<td></td>
<td>[0.0125]</td>
<td>[0.0150]</td>
<td>[0.0118]</td>
</tr>
<tr>
<td>( \tau_1 )</td>
<td>0.0703***</td>
<td>0.0411**</td>
<td>0.0745***</td>
</tr>
<tr>
<td></td>
<td>[0.0154]</td>
<td>[0.0175]</td>
<td>[0.0159]</td>
</tr>
<tr>
<td>( \tau_2 )</td>
<td>0.0957***</td>
<td>0.0513***</td>
<td>0.1017***</td>
</tr>
<tr>
<td></td>
<td>[0.0143]</td>
<td>[0.0183]</td>
<td>[0.0145]</td>
</tr>
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<td>Num. of Firms</td>
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<td>17,763</td>
<td>732</td>
</tr>
<tr>
<td>Sub-industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Region FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Table 3: Sales Ratio and VAT Rate Reduction by Alcoholic Sales

The table presents the results for the VAT rate reduction of August 2013 using equation (6),

\[
\Delta SR_{it} = \beta_0 + \beta_1 \cdot I_{t>t_0} + \beta_2 \cdot I_{i \in B} + \tau \cdot I_{t>t_0} \cdot I_{i \in B} + X_{it} \cdot \beta + u_{it}.
\]

Treatment effects are reported for treatment groups formed on the basis of dependence on alcoholic sales; High, Mid-High, Mid-Low, and Low groups include firms with a percentage of alcoholic sales (as of Q2 2011) greater than 75%, 50-75%, 25-50%, and less than 75%, respectively. The control group includes all large fast-food restaurants. Sales ratios are winzorized at the 1% level for the total sample, per quarter. The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter. Model (1) presents the results of OLS regressions, while Model (2) refers to quantile regressions. Model (2a) decomposes the treatment effect to the two quarters of the testing period (Q3 & Q4 2013) using equation (7). All specifications include sub-industry, region, and quarter fixed effects. Heteroscedasticity robust standard errors, clustered by firm, are reported in brackets. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

<table>
<thead>
<tr>
<th>Treat. Group:</th>
<th>High Alcohol</th>
<th>Mid-High Alcohol</th>
<th>Mid-Low Alcohol</th>
<th>Low Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(2a)</td>
<td>(1)</td>
</tr>
<tr>
<td>(\tau)</td>
<td>0.0080</td>
<td>0.0023</td>
<td>0.0303</td>
<td>0.0910</td>
</tr>
<tr>
<td></td>
<td>[0.0410]</td>
<td>0.0195</td>
<td>[0.0326]</td>
<td>[0.0271]</td>
</tr>
<tr>
<td>(\tau_1)</td>
<td>0.0236</td>
<td>0.0370**</td>
<td>0.0622***</td>
<td>0.0780***</td>
</tr>
<tr>
<td></td>
<td>[0.0206]</td>
<td>[0.0177]</td>
<td>[0.0147]</td>
<td>[0.0162]</td>
</tr>
<tr>
<td>(\tau_2)</td>
<td>-0.0088</td>
<td>0.0539**</td>
<td>0.0802***</td>
<td>0.1128***</td>
</tr>
<tr>
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<td>[0.0252]</td>
<td>[0.0216]</td>
<td>[0.0175]</td>
<td>[0.0151]</td>
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<td>Num. of Firms</td>
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<td>784</td>
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<td>3,642</td>
</tr>
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<td>Sub-industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Region FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Table 4: Sales Ratio and VAT Rate Increase by Size

The table presents the results for the VAT rate increase of September 2011 using equation (6),
\[ \Delta SR_{it} = \beta_0 + \beta_1 \cdot I_{t>t_0} + \beta_2 \cdot I_{i \in B} + \tau \cdot I_{t>t_0} \cdot I_{i \in B} + X_{it} \cdot \beta + u_{it}. \]

Treatment effects are reported for the total sample and sub-samples of large and small firms, according to the tax authorities’ specification. The control group includes all large fast-food restaurants. Sales ratios are winzorized at the 1% level for the total sample, per quarter. The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter. Model (1) presents the results of OLS regressions, while Model (2) refers to quantile regressions. Models (1a) and (2a) decompose the treatment effect to the three quarters of the testing period (Q4 2011, Q1 & Q2 2012) using equation (7). All specifications include sub-industry, region, and quarter fixed effects. Heteroscedasticity robust standard errors, clustered by firm, are reported in brackets. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

<table>
<thead>
<tr>
<th>Treat. Group:</th>
<th>Total Sample</th>
<th>Large Firms</th>
<th>Small Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(1a)</td>
<td>(1)</td>
</tr>
<tr>
<td>(\tau)</td>
<td>-0.0511**</td>
<td>-0.0383</td>
<td>-0.0519**</td>
</tr>
<tr>
<td></td>
<td>[0.0252]</td>
<td>[0.0334]</td>
<td>[0.0253]</td>
</tr>
<tr>
<td>(\tau_1)</td>
<td>0.0614**</td>
<td>0.0397</td>
<td>0.0628**</td>
</tr>
<tr>
<td></td>
<td>[0.0261]</td>
<td>[0.0358]</td>
<td>[0.0262]</td>
</tr>
<tr>
<td>(\tau_2)</td>
<td>-0.0822***</td>
<td>-0.0658*</td>
<td>-0.0833***</td>
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<tr>
<td></td>
<td>[0.0249]</td>
<td>[0.0346]</td>
<td>[0.0249]</td>
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<tr>
<td>(\tau_3)</td>
<td>-0.1325***</td>
<td>-0.0889*</td>
<td>-0.1353***</td>
</tr>
<tr>
<td></td>
<td>[0.0371]</td>
<td>[0.0457]</td>
<td>[0.0371]</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td>(2a)</td>
<td>(2)</td>
</tr>
<tr>
<td>(\tau)</td>
<td>-0.0902***</td>
<td>-0.0395***</td>
<td>-0.0905***</td>
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<td>(\tau_1)</td>
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<td>-0.0093</td>
<td>-0.0475***</td>
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<tr>
<td></td>
<td>[0.0093]</td>
<td>[0.0141]</td>
<td>[0.0095]</td>
</tr>
<tr>
<td>(\tau_2)</td>
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<td>-0.0613***</td>
<td>-0.1288***</td>
</tr>
<tr>
<td></td>
<td>[0.0129]</td>
<td>[0.0173]</td>
<td>[0.0131]</td>
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<tr>
<td>(\tau_3)</td>
<td>-0.1170***</td>
<td>-0.0601***</td>
<td>-0.1201***</td>
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<tr>
<td></td>
<td>[0.0104]</td>
<td>[0.0159]</td>
<td>[0.0112]</td>
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</table>

<table>
<thead>
<tr>
<th>Num. of Firms</th>
<th>12,610</th>
<th>12,610</th>
<th>770</th>
<th>770</th>
<th>11,840</th>
<th>11,840</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Region FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 5: Sales Ratio and VAT Rate Increase by Alcoholic Sales

The table presents the results for the VAT rate increase of September 2011 using equation (6),

\[ \Delta SR_{it} = \beta_0 + \beta_1 \cdot I_{t>t_0} + \beta_2 \cdot I_{i \in B} + \tau \cdot I_{t>t_0} \cdot I_{i \in B} + X_{it} \cdot \beta + u_{it}. \]

Treatment effects are reported for treatment groups formed on the basis of dependence on alcoholic sales; High, Mid-High, Mid-Low and Low groups include firms with a percentage of alcoholic sales (as of the second quarter of 2011) greater than 75%, 50-75%, 25-50%, and less than 75%, respectively. The control group includes all large fast-food restaurants. Sales ratios are winzorized at the 1% level for the total sample, per quarter. The samples include all firms in the restaurant industry with no missing VAT reports during the sample period that report at least €500 of inputs per quarter. Model (1) presents the results of OLS regressions, while Model (2) refers to quantile regressions. Model (2a) decomposes the treatment effect to the three quarters of the testing period (Q4 2011, Q1 & Q2 2012) using equation (7). All specifications include sub-industry, region, and quarter fixed effects. Heteroscedasticity robust standard errors, clustered by firm, are reported in brackets. Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

<table>
<thead>
<tr>
<th>Treat. Group:</th>
<th>High Alcohol</th>
<th>Mid-High Alcohol</th>
<th>Mid-Low Alcohol</th>
<th>Low Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(2a)</td>
<td>(1)</td>
</tr>
<tr>
<td>( \tau )</td>
<td>0.0387</td>
<td>0.0077</td>
<td>-0.0502</td>
<td>-0.0713***</td>
</tr>
<tr>
<td></td>
<td>[0.0434]</td>
<td>[0.0199]</td>
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<td>[0.0158]</td>
</tr>
<tr>
<td>( \tau_1 )</td>
<td>0.0592**</td>
<td>-0.0165</td>
<td>-0.0936***</td>
<td>-0.1320***</td>
</tr>
<tr>
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<td>[0.0201]</td>
<td>[0.0147]</td>
</tr>
<tr>
<td>( \tau_2 )</td>
<td>-0.0416*</td>
<td>-0.1105***</td>
<td>-0.1262***</td>
<td>-0.1279***</td>
</tr>
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<td>[0.0196]</td>
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<td>630</td>
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<td>1,147</td>
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<td>Sub-ind. FE</td>
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<td>Yes</td>
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<tr>
<td>Region FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Table 6: Aggregate Reported Sales and VAT Revenues (Q3-Q4, 2012 & 2013)
The table presents aggregate reported sales and VAT revenues for the third (Q3) and forth (Q4) quarters of 2012 (high base rate) and 2013 (reduced base rate). The third quarter of 2013 includes a month (July), during which the high standard rate was in effect. Figures are presented for small and large firms according to the tax authorities' classification, along with industry totals. Percentage changes are calculated over the respective figures of the previous year. The number of firms is the average population of the industry over the respective period. All figures are measured in euros.

<table>
<thead>
<tr>
<th></th>
<th>Reported Sales (in '000s)</th>
<th>% Change</th>
<th>VAT revenues (in '000s)</th>
<th>% Change</th>
<th>Num. of firms</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Q3 2012</td>
<td>1,121,517</td>
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<td>231,907</td>
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<tr>
<td>Q4 2012</td>
<td>630,730</td>
<td></td>
<td>136,689</td>
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</tr>
<tr>
<td>Total Q3 &amp; Q4</td>
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<td>74,754</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Q3 2012</td>
<td>1,265,873</td>
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<td>205,637</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 2012</td>
<td>823,480</td>
<td></td>
<td>123,150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Q3 &amp; Q4</td>
<td>2,089,353</td>
<td>19.24%</td>
<td>328,786</td>
<td>-10.80%</td>
<td>73,699</td>
</tr>
<tr>
<td>Q3 &amp; Q4 ’12:</td>
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<td>492,740</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3 2013</td>
<td>1,265,873</td>
<td></td>
<td>205,637</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 2013</td>
<td>823,480</td>
<td></td>
<td>123,150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,089,353</td>
<td>19.24%</td>
<td>328,786</td>
<td>-10.80%</td>
<td>73,699</td>
</tr>
<tr>
<td>Large</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Q3 2013</td>
<td>307,860</td>
<td></td>
<td>51,493</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 2013</td>
<td>285,956</td>
<td></td>
<td>42,656</td>
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<td></td>
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<tr>
<td>Total</td>
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