

MEMORANDUM

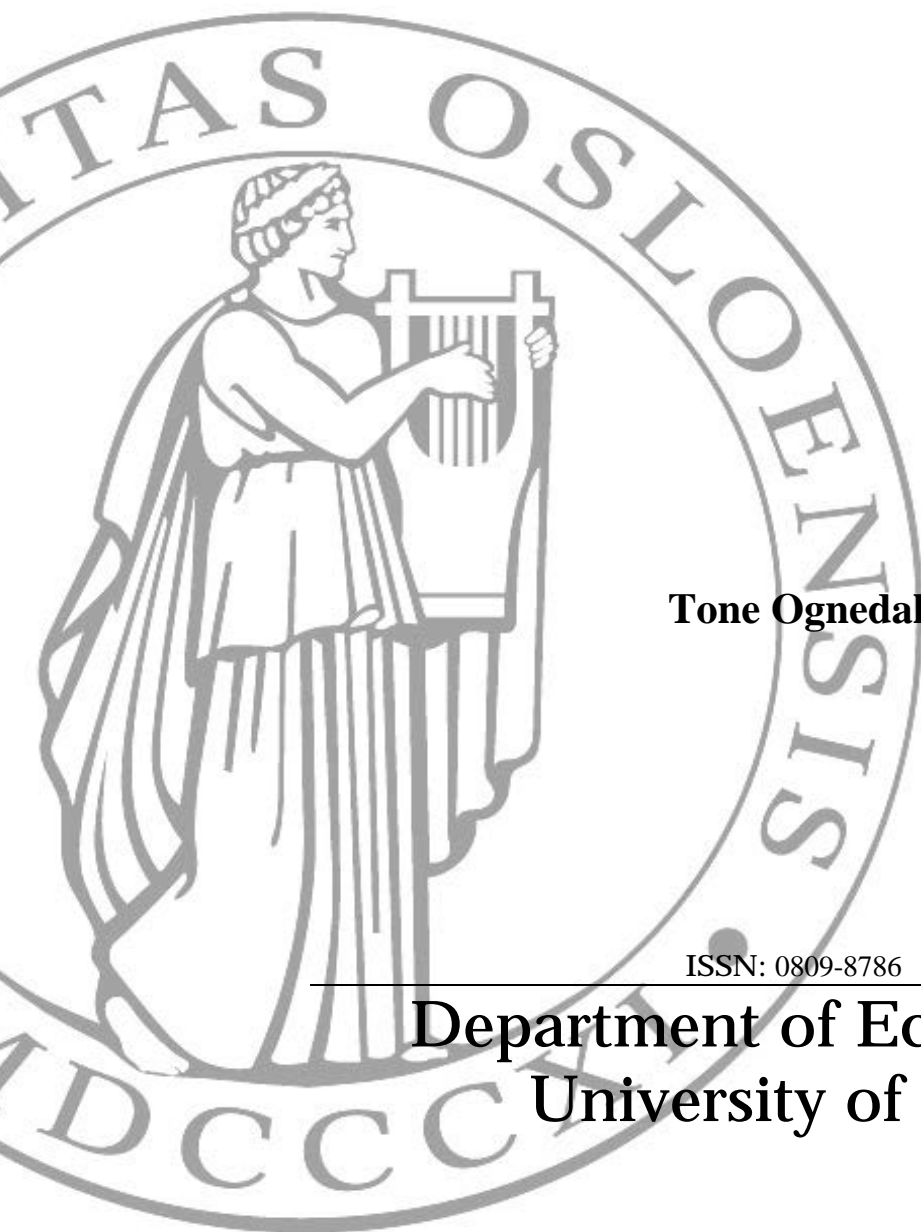
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Morale in the Market

Tone Ognedal

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Department of Economics
University of Oslo



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P. O.Box 1095 Blindern
N-0317 OSLO Norway
Telephone: + 47 22855127
Fax: + 47 22855035
Internet: <http://www.sv.uio.no/econ>
e-mail: econdep@econ.uio.no

In co-operation with
**The Frisch Centre for Economic
Research**

Gaustadalleén 21
N-0371 OSLO Norway
Telephone: +47 22 95 88 20
Fax: +47 22 95 88 25
Internet: <http://www.frisch.uio.no>
e-mail: frisch@frisch.uio.no

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Morale in the Market*

Tone Ognedal, University of Oslo †

Memo 04/2014-v1

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Abstract

I show that while morale may be a substitute for sanctions for each citizen, it is not a substitute in the market. In a model where employed and self-employed individuals differ in their opportunities for tax evasion, I demonstrate that a higher fraction of tax compliant citizens may reduce social surplus and tax revenues since it may lead to less efficient production and exchange. Experiments show how sanctions crowd out morale in some settings. My paper points to the opposite problem in markets: Low sanctions may crowd out morale. While the paper explores the effects of tax morale only, the results apply to a wide range of areas where morale matters for individual choices in the market, such as environmental and safety regulation.

Keywords: Tax morale, Tax evasion, Norms, Sanctions
JEL classifications: H26, K42, D01

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†Department of Economic, University of Oslo, PB 1096 Blindern, 0317 Oslo Norway, e-mail: tone.ognedal@econ.uio.no.

1 Introduction

There is a growing interest in morale as a substitute for sanctions. Indeed, morale matters for individual economic decisions as confirmed by a series of experimental studies. Most people are for instance willing to sacrifice some economic gains for more fairness. Since preventing people from violating the law by sanctions alone is expensive, one may wonder whether morale to some extent can substitute for sanctions. This paper claims that it cannot. Even in situations where morale and sanctions are close substitutes for disciplining bad individual market decisions, they are far from close substitutes for disciplining bad market outcomes that reflect the decisions of many individuals.

Below I substantiate this claim by exploring the effects of tax morale in situations where individuals choose between occupations with different opportunities to evade taxes. I focus on how better morale sometimes induce perverse market outcomes. More tax compliant producers can increase the total production cost and more honest consumers can reduce the efficiency of exchange. As a result, improved morale may reduce social surplus and tax revenue.

The model account for how individuals differ in their entrepreneurial talent, i.e. in their productivity as self-employed relative to employed. Since tax evasion acts like an implicit tax relief for self-employed only, it increases the private profitability of self-employment relative to employment. As a result, too many people become self-employed. Sanctions, such as expected penalties, reduce the private profitability of self-employment relative to employment, and therefore brings the number of self-employed closer to its optimal level. Morale also brings output closer to its optimal level, but it may distort the allocation of production between sellers and allocation of output between buyers.

The reason for these negative effects of moral, as opposed to sanctions, is that while sanctions are the same for all, morale differ between individuals (Cappelen et al.,2007). Sanctions do not change the ranking of profitability between sellers and the willingness to pay between buyers. The different morale concerns, in contrast, change the ranking of sellers and of buyers by creating differences in private gains that do not correspond to differences in social gains. Sellers with low productivity and low tax morale may crowd out sellers with higher productivity but also higher tax morale. Customers with low willingness to pay but low tax morale may crowd out customers with higher willingness to pay but lower tax morale. Although higher tax morale may bring the output closer to its optimal level, it may be less efficiently produced.

It is well known that sanctions may crowd out altruism and morale behavior (Gneezy and Rustichini, 2000, Fehr and Rockenbach 2003, Tirole and Benabou 2006). Frey (1997) suggests that extrinsic motivation of expected penalties may crowd out peoples intrinsic motivation to pay taxes. My paper focus on the opposite problem of how lack of sanctions may crowd out agents with intrinsic motivation, and lower the average morale in those markets where morale matters. Reducing the profitability of tax evaders by sanctions, I claim, makes it easier for tax compliant sellers to survive in the market.

Survey studies confirm that tax morale differs between individuals, both in strength

and motivation. A large fraction of citizens say they find tax evasion unjustifiable.¹ This is no surprise, since tax evasion means lying and violating the law, both actions that most people think are wrong. Also, tax evasion is condemned as a sin by many religious authorities.² However, as with most moral issues, people's ideals may differ from their actions: According to surveys in Norway (2001 and 2003), almost a third of the 69 percent that find tax evasion unjustifiable say they are willing to evade (Barth et al, 2008). Moreover, tax morale is affected by policy variables such as fairness of the tax system (Fortin and Villeval, 2007 and Barth et al, 2013), the use of tax incomes (Alm et al, 1993), the treatment by the tax authorities (Feld and Frey, 2001) and trust in government (Cummings et al, 2009). Since people's perceptions of fairness and the other policy variables differ, their tax morale also differ.

To what extent people's morale constrain their economic choices is still debated, and belongs to the main issues discussed in the literature on tax compliance. Experiments in a general setting indicate that non-selfish motives, such as reciprocity and fairness, matters (Fehr and Fischbacher, 2002, Cappelen et al, 2010). Yet, the effects of appeals to peoples' tax morale is mixed. In a randomized field experiment, Blumenthal et al (2001) found no effects of letters to taxpayers with morale appeals, while Bott et al (2013) find considerable effects in a similar experiment.³ The premise of my paper is that morale may constrain tax evasion and I explore what happens in the market when some are tax compliant while others are not.

Section 2 presents the model and derive the effects in the market of morale constraints among sellers. I show how an increased fraction of tax compliant citizens may increase the cost of producing. The cost function is used to derive the effects of tax morale on social surplus and tax revenues. Section 3 explores the effects of tax morale among both buyers and sellers. Section 5 concludes the paper.

2 A model of morale differences in the market place

Each individual supplies one unit of labor and chooses between being a self-employed entrepreneur in the market for a service, or an employee in another market. I assume that all self-employed have the opportunity to evade taxes, but no employees have this opportunity. This is in line with the fact that the self-employed report their own incomes, while the incomes of most employees are reported by their employer.

All employees earn the same wage rate w , exogenous in the model. The incomes of the self-employed differ because their productivities as entrepreneurs differ.⁴ Let a_i

¹For example, when the World Value Survey 1990 asked whether tax evasion could be justified, 56 percent answered no in Sweden and 70 in Italy.

²The Roman Catholic Church categorizes tax evasion as a sin. The net-site "Christianity.about.com" sites several places in the Bible as evidence for their claim that "So the gospels leave no doubt that Jesus taught his followers not only in words, but by example, to give to the government any taxes that are owed."

³Both experiments had two types of letters: One stressed the beneficial use of tax revenues, the other appealed to the fact that most taxpayers report their income and wealth correctly.

⁴The crucial assumption is that individuals differ in their relative productivity, i.e. that they have

be output produced by a self-employed individual, i.e. a_i is his productivity as self-employed. The price per unit of output is q , determined by demand equal to supply. All incomes are taxed at rate t .

With no tax evasion, the net income of an individual is $(1 - t)qa_i$ as self-employed and $(1 - t)w$ as employed. Choosing the occupation that gives the highest net income, he becomes self-employed if and only if $q \geq w/a_i$. The choice is socially optimal, since it is based on social gains and costs: An individual becomes self-employed if and only if his social opportunity cost w is lower than his social revenue from self-employment, qa_i .⁵ Since the tax rate is the same for all incomes, it does not distort the choice between occupations.

2.1 The set-up with tax evasion among the sellers

Consider now the effects of opportunities for tax evasion among the self-employed. Let λ be the fraction of income that a self-employed hides from the tax authorities, for convenience also referred to as his evasion. With probability $p(\lambda)$ he is detected and pays a penalty tax rate τ on the evaded income. I assume that the probability of detection is increasing and convex in the fraction evaded, i.e. $p'(\lambda) > 0$ and $p''(\lambda) > 0$. The expected income of a self-employed that evades a fraction λ is

$$y_i(\lambda) = qa_i[(1 - t) + \lambda(t - p(\lambda)\tau)] \quad (1)$$

The last term in the square bracket is the taxes saved from evasion minus the expected penalty, i.e. the expected net gain from tax evasion per dollar earned.

With no moral constraints, the self-employed evades the fraction that maximizes the expected income. The optimal fraction evaded, denoted λ^* , is determined by the first order condition

$$t - p(\lambda^*)\tau - \lambda^*p'(\lambda^*)\tau = 0 \quad (2)$$

Clearly, λ^* is a function of t and τ , increasing in t and decreasing in τ . With no tax morale, all self-employed evade the same fraction, λ^* .

It is now easy to see that opportunities for tax evasion distorts the individual's choice between employment and self-employment. An individual with no tax morale chooses to become self-employed if and only if his maximized net expected income from self-employment, $y_i(\lambda^*)$, exceeds the net income from employment, $(1 - t)w$. Inserting for $y_i(\lambda^*)$ from (1) and defining

$$\alpha(\lambda^*) = \frac{1 - t}{1 - t + \lambda^*[t - p(\lambda^*)\tau]} < 1 \quad (3)$$

we can write the condition for self-employment as:

$$\alpha(\lambda^*)\frac{w}{a_i} \leq q \quad (4)$$

comparative advantage as self-employed or employed.

⁵Another way to phrase this is that he becomes self-employed if and only if the opportunity cost of a unit output he produces, w/a_i does not exceed the output price, q .

Recall that the condition for self-employment with no evasion is $w/a_i \leq q$. Tax evasion lowers the private opportunity cost of output from w/a_i to $\alpha w/a_i$.⁶ Since the social opportunity cost is still w/a_i , tax evasion distorts the choice between employment and self-employment. Evasion acts like a tax relief for self-employment only, increasing its private profitability relative to employment.

2.2 Market equilibrium with honest and dishonest sellers

Consider now the case where some individuals have a tax morale that constrain their evasion as sellers. In this section, I assume that buyers do not know about or do not care about whether his payments are reported for taxation or not. This is a reasonable assumption in markets where each transaction is small, such as the market for haircuts. If each transaction is large, as in construction, a buyer cannot easily ignore the issue of whether or not his payment is reported, and he may care more about it. This case, where both buyers and sellers may be constrained by morale, is discussed in section 3.

A fraction h of all individuals are "honest" if they become self-employed and report their entire income for taxation. The "dishonest" ones evade the optimal fraction λ^* . From above, honest individuals become self-employed if $w/a_i \leq q$ and dishonest ones if $\alpha(\lambda^*)w/a_i \leq q$. Since an honest individual has higher private opportunity cost of self-employment than a dishonest one with the same productivity, the honest one needs a higher output price to become self-employed.

Let x denote the total supply of output from self-employment, referred to simply as output or supply. Since honest and dishonest individuals face different opportunity costs of self-employment, total supply does not only depends on the output price but also on the fraction of honest individuals. If everyone is honest ($h = 1$) the total supply from the self-employed is

$$S(q) = \int_{w/q}^{\bar{a}} adF(a) \quad (5)$$

where $S'(q) > 0$ for values of q such that $dF(w/q)/dq > 0$. The supply at price q if no one is honest ($h = 0$) is the same as if everyone is honest and face a price q/α . Thus, total supply if no one is honest ($h = 0$) is

$$S(q/\alpha) = \int_{\alpha w/q}^{\bar{a}} adF(a) \quad (6)$$

Total supply when a fraction h is honest and the rest dishonest is then

$$x(q, h) = hS(q) + (1 - h)S(q/\alpha) \quad (7)$$

Supply is increasing in q since $S'(\cdot) > 0$, and decreasing in h since $S(q/\alpha) > S(q)$. Using the notation of (7), $x_q(q, h) > 0$ and $x_h(q, h) < 0$.

⁶The opportunity cost of a unit output produced by seller i is w/a_i , but since he produces a_i units, his opportunity cost as self-employed is w .

Figure 1 illustrates the supply curves for $h = 0$, $h = 1$ and for $0 \leq h' \leq 1$. From (7), the supply curve in the market can be rewritten as $q(x, h)$, the price that induces output x when a fraction h is honest. The supply curve if everyone is honest is $q(x, 1) = S^{-1}(x)$ and the supply curve if no one is honest is $q(x, 0) = \alpha S^{-1}(x)$. As h' increases, the curve $q(x, h')$ moves upwards. The figure also shows how the price varies with h for a given output \bar{x} . The price is $q(\bar{x}, 0)$ if no one is honest, $q(\bar{x}, h)$ if everyone is honest and $q(\bar{x}, h')$ in between, when a fraction $0 < h' < 1$ is honest.

The equilibrium price and output is determined by demand equal to supply. Let $D(q)$ be the demand for the output from self-employment, where $D'(q) \leq 0$. With the supply function from (7), demand equal to supply gives

$$x(q; h) = D(q) \tag{8}$$

This determines the price q as a function of the fraction of honest individuals, i.e. $\tilde{q} = \tilde{q}(h)$. Since $x_h(q; h) < 0$ and $D'(q) < 0$, the price is increasing in h , i.e. $\tilde{q}'(h) > 0$. The output is $x(\tilde{q}(h); h) = D(\tilde{q}(h)) \equiv \tilde{x}(h)$. Since $D'(q) < 0$ and $\tilde{q}'(h) > 0$, output is decreasing in h , i.e. $\tilde{x}'(h) < 0$. Thus, a higher fraction of honest individuals brings the output closer to its optimal level.

With perfectly elastic demand, it is straightforward to show that morale is unambiguously desirable: For a given q , tax evasion makes some socially unprofitable sellers survive, but does not crowd out socially profitable sellers. The output is too high, but it is produced by the most productive entrepreneurs. As individuals become honest, they face the true social opportunity cost of self-employment, w/a_i . Socially unprofitable sellers leave the market, and the socially profitable ones stay. As a result, output moves closer to its optimal level, tax evasion goes down and tax revenue goes up.

With perfectly elastic supply, the effect of tax morale is also straightforward: Supply is perfectly elastic if all entrepreneurs have the same productivity a . All those who are willing to evade taxes supply at a price equal to their common opportunity cost $\alpha(\lambda^*)w/a$. Since honest entrepreneurs need a higher price to survive, they do not survive as long as there is enough tax evading sellers to satisfy the demand, i.e. as long as demand equals supply at price $\alpha(\lambda^*)w/a$. Morale has no effect in the market: A higher fraction of honest sellers is simply replaced with tax evading sellers. Since the productivity as self-employed is the same for all, this replacement does not effect the output or the cost of producing.

With downward sloping demand and upward sloping supply curves, however, honest individuals do affect the market outcome and the result may not be desirable. In the next section I demonstrate that while morale still reduces the distortion from too many self-employed, it creates another distortion: The ranking of the sellers' private opportunity costs differs from the ranking of their social opportunity costs. This implies that it is no longer those with the highest entrepreneurial productivity who become self-employed. As a result, output is not efficiently produced.

2.3 The social cost of honesty in a dishonest marketplace

To study the cost of morale in a market, it is useful to derive the social cost function. More specific, I derive the social cost of producing x in a market when a fraction h of the citizens are honest, and investigate how these costs vary with h .

The social marginal cost of producing x is the alternative value of those who produce x , i.e. those who are self-employed. All self-employed have an alternative value w , their wage as employees.⁷ With cumulative distribution $F(a)$ for productivity types, the social cost of producing x is then

$$c(\bar{x}; h) = wh \left[1 - F(w/q(x, h)) \right] + w(1 - h) \left[1 - F(\alpha w/q(x, h)) \right] \quad (9)$$

where $q(x, h)$ is the price that induces output x when a fraction h is honest. From (7), $q(x, h)$ is determined by $x = hS(q) + (1 - h)S(q/\alpha)$. The first term inside the large bracket is the supply from honest sellers, i.e. from honest individuals with productivity above $w/q(x, h)$. The second term is the supply from dishonest sellers, i.e. dishonest individuals with productivity above $\alpha w/q(x, h)$.

I demonstrate in Appendix A that the costs as a function of h are minimized for $h = 0$ and $h = 1$, increasing at $h = 0$ and decreasing at $h = 1$. Without further assumptions, we cannot exclude that $c(x, h)$ may have several extreme values for $0 < h < 1$. I focus on the case with one maximum, which holds with constant elasticity of supply.⁸ Houthakker (1955) showed that with Pareto-distributed labor use per unit output, the production function for the industry is a Cobb-Douglas-type, i.e. it has constant elasticity of supply. In this case, the cost of producing a given output is first increasing and then decreasing in the fraction of honest citizens, and we can conclude as follows:

Proposition 1 *A given output is efficiently produced if and only if all or none of the citizens are honest. There is a critical level, \bar{h} , such that a higher fraction of tax compliant individuals increases total production costs if $h < \bar{h}$ and reduces total production costs if $h > \bar{h}$.*

The proof is in Appendix A.

The reason why output is efficiently produced if everyone or no one is honest, is that the ranking of private and social opportunity cost of production is the same in these cases. If everyone is honest, social and private opportunity costs are the same and equal to w/a_i . If no one is honest, the private opportunity cost is lower than the social opportunity costs, i.e. $\alpha w/a_i < w/a_i$, but self-employed with the same social opportunity cost have the same private opportunity cost. This means that output is produced by those who are most efficient as self-employed. When some are honest and some are not, however, the ranking of private and social opportunity costs differ. Among the self-employed with the same social opportunity cost the dishonest ones have

⁷The alternative cost of a unit produced is w/a_i , and type i produces a_i units of them

⁸It also holds for any linear supply function

lower private opportunity cost, which means they are privately more profitable as self-employed. The marginal tax compliant self-employed who does not survive may then be replaced by a tax evader with lower productivity.

It follows from proposition 1 that the effect of a higher fraction of honest individuals depends on how large the fraction is to begin with. With higher h , the private opportunity cost goes up for those who become honest among the sellers, and some of them therefore become employees. The negative shift in supply leads to a higher out price, which in turn induces entry of new sellers. If few individuals are honest, few of the entering sellers have lower social opportunity costs than the ones they replace, they are just more willing to evade taxes. As a result, total costs of producing a given output goes up. If most citizens are honest, most of the entering sellers have lower opportunity costs than the ones they replace. This implies that the cost of producing a given output goes down.

In contrast to improved tax morale, higher sanctions would unambiguously improve welfare. If the expected penalty is increased, the optimal evasion (λ^*) goes down, and it follows from (3) that α goes up. As a result, those who are dishonest evade less, their profitability goes down and so some of them no longer survive in the market. Since the marginal dishonest self-employed has a higher social revenue as employed and the marginal honest employee has higher social revenue as an entrepreneur, this increases the average productivity among the self-employed. It is easily verified that the cost of producing a given output goes down. Total output from self-employment is reduced, which means it is closer to its optimal level. The average morale in the population has not changed, but the average tax morale among the self-employed goes up since more honest individuals are now able to survive as self-employed.

2.4 How honesty can reduce the social surplus and tax revenues

In this section, I use the cost function derived in section 3 to demonstrate the ambiguous effects of improved morale on social surplus and tax revenue. Without moral constraints, the output from self-employment is too high, but efficiently produced. I demonstrate that with different moral constraints, output is closer to its optimal level, but inefficiently produced.

Social surplus can be written as

$$W(h) = \int_0^{\tilde{x}(h)} D^{-1}(x)dx - c(\tilde{x}(h); h) \quad (10)$$

The first term is the willingness to pay for the equilibrium output \tilde{x} , i.e. its value to the buyers. The second term is the cost of producing \tilde{x} when a fraction h of the individuals are honest, given by (9).

Differentiating W with respect to h , taking into account that the equilibrium price and output, $\tilde{q}(h)$ and $\tilde{x}(h)$, are determined by (7) and (8), gives the following:

$$W'(h) = [\tilde{q}(h) - c_x(\tilde{x}; h)]\tilde{x}'(h) - c_h(\tilde{x}; h) \quad (11)$$

The first term is the effect of lower output. In appendix B I show that $\tilde{q}(h) < c_x(\tilde{x}; h)$ for all $h < 1$. With an increasing supply-curve, $\tilde{x}'(h) < 0$, and so the first term is non-negative. Intuitively, a higher fraction of honest individuals reduces the output from self-employment, which brings output closer to its optimal level. The second term is the effect of a higher fraction of honest individuals on the cost of producing the output. From proposition 1, $c_h(x, h)$ is first increasing and thereafter decreasing in h . We can therefore conclude as follows:

Proposition 2 *A higher fraction of honest individuals may reduce social surplus for $h < \bar{h}$. Social surplus is reduced if the increased cost of production exceeds the welfare gain from lower output. If supply is perfectly elastic on the margin or demand inelastic, the output effect is zero and an increase in h reduces social surplus for $h < \bar{h}$.*

With perfectly elastic supply or inelastic demand on the margin, output does not change, which means the change in social welfare equals the change in the cost of producing the output. I illustrate this case with an example in figure 2. The figure depicts three productivity-types: n_1 individuals have the highest productivity, a_1 , as self-employed entrepreneur. n_2 individuals have lower productivity, a_2 , and there is an unlimited supply of individuals with the lowest productivity a_3 . The social opportunity costs of production, equal to the opportunity cost of honest individuals, is w/a_i for $i = 1, 2, 3$. The private opportunity cost of dishonest individuals is $\alpha w/a_i$ for $i = 1, 2, 3$. The supply curve is the dotted curve in figure 2 if everyone is honest, and the bold curve if no one is honest.

Figure 2 in here

If everyone is honest, the equilibrium price is $\tilde{q}(1)$ and the corresponding output $\tilde{x}(1)$. Since the price equals the opportunity cost of type 3, i.e. $\tilde{q}(1) = w/a_3$, some of the self-employed with the lowest productivity survive. Supply is perfectly elastic on the margin. If no one is honest, the equilibrium price $\tilde{q}(0)$ equals the private opportunity cost of a tax evading type 3 seller, i.e. $\tilde{q}(0) = \alpha w/a_3$. Output is then $\tilde{x}(0)$. The shaded area is the social loss from too high output in the equilibrium where no one is honest.

Starting from a situation where no one is honest, consider what happens if a fraction h become honest. The private opportunity cost of production for honest sellers increases from $\alpha w/a_i$ to w/a_i , $i = 1, 2, 3$. At the price $\tilde{q}(0)$, the supply from type 1 and 2 goes down. However, since there is a perfectly elastic supply of type 3, there is also perfectly elastic supply of dishonest sellers of type 3. Consequently, the price and output do not change. In the example, the honest sellers with productivity a_1 survive but those with productivity a_2 do not. Honest sellers with productivity a_2 are replaced by dishonest sellers with the lower productivity a_3 . Social surplus is clearly reduced since the same output is now produced by less productive sellers. The dotted area shows the welfare loss from higher tax morale in the population. The loss is equal to the increased social costs of production.

The effect of a higher fraction of honest individuals on tax revenues is ambiguous: On the one hand, tax revenue goes up from those who become honest and still survive as self-employed. On the other hand, the total income may go down because of the mis-allocation of labor between employment and self-employment. With a lower total income, tax revenue may go down even if a larger fraction is reported. In appendix B I prove the ambiguous affect of honesty on tax revenues:

Proposition 3 *A higher fraction of honest individuals may lead to lower tax revenues.*

The two opposite effects of a higher h is easy to demonstrate using the example illustrated in figure 2 above: As long as supply is perfectly elastic on the margin, the change in tax revenue as h goes up is

$$t[\lambda\tilde{q}n_1a_1 - hn_2w(a_2/a_3 - 1)] \quad (12)$$

The first term is the increased tax revenues from sellers with productivity a_1 who become honest. The second term is the lost tax revenues because the taxable incomes goes down when honest sellers with productivity a_2 are replaced with the less productive and dishonest sellers with productivity a_3 .⁹ If the tax loss due to lower taxable incomes exceeds the increased tax payment from the honest sellers of type 1, tax revenue goes down.

3 Moral differences among both buyers and sellers

Consider now the case where both buyers and sellers may be morally constrained. A fraction m of the potential are honest, and a fraction h of the potettial sellers. When evident from context, I drop the precise designation *potential* buyers and sellers and simply refer to sellers and buyers. Each customer either buys one unit of the output or he does not buy. The reservation price, i.e. the willingness to pay for a unit, differs between them. I assume that buyers can distinguish between honest and dishonest sellers at no cost, and that honest buyers can make sure that their payments are reported. The sellers are responsible for paying the taxes, and face the probability of being detected and penalized for income that they do not report.

I model the case where the probability of being detected depends on the total fraction evaded, not the evasion in each transaction. This is a reasonable assumption in markets where each payment is small, such as in the market for haircuts or taxi services.¹⁰ When the probability of detection does not depend on how evasion is allocated between different buyers, the seller may hide the entire income from dishonest buyers and report the entire income from the honest ones. This gives the following result, proven in Appendix C:

⁹The number of type 3 sellers necessary to replace those who leave is hn_2a_2/a_3 .

¹⁰I can show that the results hold also in the case where detection is based on the individual transactions. In markets where each payment is large, such as in construction, the sellers will hide a fraction of the payment from each buyer rather than the entire payment from a fraction of the buyers.

Proposition 4 *For each fraction of honest sellers, h , there is a critical fraction of honest buyers, $\hat{m}(h)$, such that a marginal increase in m has no effect on allocation for $m \leq \hat{m}(h)$ and a marginal increase in h has no effect for $m > \hat{m}(h)$. Output is inefficiently produced, but efficiently allocated between buyers for $m \leq \hat{m}(h)$. Output is efficiently produced, but inefficiently allocated between buyers for $\hat{m}(h) \leq m < 1$. The critical fraction of honest buyers is increasing in h , i.e. $\hat{m}'(h) > 0$.*

The reason why honest buyers have no effect when m is below a critical level, is that part of the output is reported even when no buyers are honest: Honest sellers report their entire income and the threat of sanctions induce the dishonest sellers to report a fraction $1 - \lambda$ of their income. If the output that the sellers would report even without honest buyers exceeds the demand from honest buyers, the honest buyers can be satisfied at no extra cost. Their payments simply become part of the income that the sellers would report in any case. With a marginal increase in the fraction of honest buyers, some payments from dishonest buyers are not reported to make room for the payments from honest buyers on the reported account.¹¹

Since honest buyers can be satisfied at no cost to the sellers when $m \leq \hat{m}(h)$, the price is the same for honest and dishonest buyers. This implies that the allocation of output between them is efficient. When all buyers face the same price, the net revenue differs between honest and dishonest seller. This implies that the output is inefficiently produced. For $m < \hat{m}$, the equilibrium is the same as in an economy where a fraction h of potential sellers are honest but no buyers, explored in section 2. The higher the fraction of honest sellers, h , the higher is the fraction of output that is reported by sellers even without honest buyers, and the higher is the fraction of honest buyers needed to make a difference, \hat{m} .

If $m > \hat{m}$, the demand for reported services exceeds supply, which means that honest buyers are costly to sellers on the margin. As a result, the sellers charges honest buyers a higher price than the dishonest ones. In equilibrium the price difference must be such that the sellers are indifferent between honest and a dishonest buyers. If q is the price paid by an honest buyers, the price paid by a dishonest buyers must be $q(1 - t)$. Since honest and dishonest sellers face the same net price $(1 - t)q$ from all buyers, output is efficiently produced. Since dishonest buyers pay a lower price than the honest ones, exchange is distorted: Dishonest buyers with low valuation may crowd out honest buyers with higher valuation.

To characterize the loss from inefficient exchange I derive the social value of output as a function of output and the fraction of honest buyers, $v(x, m)$. In appendix C I show the following:

Proposition 5 *A given output is efficiently allocated between the buyers if and only if all or none is honest. The social value of a given output is first decreasing and then*

¹¹With market frictions, i.e. if it is costly to get information about which sellers are willing to report payments at no extra cost, honest buyers may have an effect even in when the total demand for reported services is lower than the sellers optimal reported incomes. A market with tax evasion and frictions, but without tax morale among agents, is discussed in Strand (2005).

increasing in the fraction of honest buyers.

The result is parallel to the result in proposition 1: If all buyers were honest ($m = 1$), those with the highest willingness to pay for the output end up buying it. If all buyers were dishonest ($m = 0$), the demand is higher for any given price q , but it is still those with the highest willingness to pay that end up buying the output. When some buyers are honest and some dishonest, output is inefficiently allocated between them because dishonest buyers face lower prices than the honest ones.

As more buyers become honest, i.e. m goes up, the price goes up for all buyers. Starting from a situation where all buyers are dishonest, those who replace the discouraged buyers have lower willingness to pay, but they pay less since they accept that some of their payments is not reported. Consequently, the total value social value of output goes down. Starting from a situation where almost all buyers are honest, the discouraged buyers are replaced by some with higher willingness to pay. Consequently, the social value of output goes up when m goes up. If the value-function has one maximum only, as with constant elasticity of demand, there is a critical value of m , \bar{m} , such that the value is decreasing in m for $m < \bar{m}$ and increasing for $m \geq \bar{m}$.

It follows from proposition 4 that if output is inefficiently allocated between buyers, production is efficient and vice versa. Allocation of output between buyers is inefficient when they face different prices. Prices must differ between them to make the sellers indifferent between honest and dishonest buyers on the margin. To be indifferent, the prices must be such that sellers get the same revenue from honest as from dishonest buyers. This in turn means the marginal revenue from self-employment is the same for both honest and dishonest sellers, inducing the most productive to choose self-employment independent of tax morale. If allocation between sellers is inefficient, they face different net revenues because some evade and some do not. To make buyers indifferent, the buyers must face the same price, which means output is efficiently allocated between them.

The effects on social surplus is also parallel to the case with honesty among sellers only: A higher fraction of honest buyers have two opposite effects on social surplus. One the one hand, social surplus goes up when output is reduced, since output is too high when some buyers accept evasion. On the other hand, more honest buyers may lead to a less efficient allocation of output among those who buy. If output does not change, for example because supply is inelastic, the effect on social surplus is determined by the effect on allocation among buyers.

4 Concluding remarks

I have shown that even if morale is a substitute for sanctions for each individual, this is not the case in the market. The reason is that moral constraints create differences in private costs and gains between people with the same social costs and gains. For example, differences in tax morale creates differences in the private revenue between self-employed with the same productivity. As a result, output is not produced by the

most efficient sellers.

A key result in the paper is that the effect morale depends on how widespread the it is. An increase in the fraction of tax compliant individuals reduces distortions if most people are tax compliant, but increase distortions if most people are not. This has implications for policies that aim at improving the market outcome by improving peoples morale, such as campaigns to increase tax compliance. Paradoxically, it may be better to improve tax morale in a market where most people are already tax compliant than in a market where most people evade. In markets where most people evade, it may be better to do nothing than to improve the tax morale of a small fraction of agents.

Another key result is that the effects of moral constraints depends on whether it is the sellers' or buyers' morale that determine how much of the incomes that are reported for taxation: Changes in morale among buyers have no effect if a large fraction of income would be reported in any case, because sellers are morally constrained or because they are afraid of sanctions. A campaign that increase the fraction of tax compliant buyers have no effect on the market outcome in this case. In particular, tax evasion is not reduced even if more buyers become tax compliant. If the buyers demand for reported transactions exceed the sellers supply, there is no effect of an increase in the fraction of tax compliant sellers.

In some cases, the markets may neutralize morale completely by creating opportunities to escape moral obligations. Entrepreneurs who are morally constrained can profit by selling their businesses to entrepreneurs who are not. Since a business has higher value for a tax evader than one who is tax compliant, high-productive but tax compliant entrepreneurs would start up businesses but sell them to tax evaders. For such sales to be profitable, the productivity of a business must be transferable to the new owner. This is the case if the productivity is not a quality of the entrepreneur, but rather embedded in the firm he starts up, as with a technical invention.

In the same way, a market for intermediaries may relieve buyers of their moral constraints. For example, an honest buyer may feel obliged to pay all taxes if he hires carpenters to build a house, but he may not feel bad about buying a house from an intermediary even if he knows that the intermediary hires tax evading carpenters. Such schemes are well known within the construction sector, where several layers of contractors is common. If there is an efficient market for intermediaries that can take the moral blame, morale clearly has little or no effect on the market outcome.

The model has implications for how to measure morale. In a large random-audit study Kleven et al (2011) find that while evasion is negligible among employees, who are not able to evade, it is substantial among self-employed, who are able to. They conclude that tax compliance is high because most people are unable to cheat on taxes, not because they are unwilling to. This conclusion about peoples tax morale may be too pessimistic if the opportunity to evade affects the choice between self-employment and employment. We would expect the average tax morale among the self-employed to be lower than in the rest of the population, since low tax morale is an advantage in self-employment but not in employment. In the extreme, evading taxes may be necessary to survive as self-employed. Thus, the observed tax morale among self-employed may underestimate

the average morale among citizens. Similarly, experiments may overestimate the role of morale in the market, because the most morally constrained agents do not survive in markets where their moral matters.

I model the market as simple as possible to focus on the costs of moral differences. In particular, I assume a clear distinction between those who have the opportunity to evade, the self-employed, and those who have not, the employed. Moreover, self-employment is assumed to be a one-man business. The reality is of course not as simple. Some entrepreneurs run firms with a few employees, and may agree to not report all wage incomes. Also, employees in large firms with no opportunity to evade wage incomes may do shadow work as "moonlighting". Tax evasion may therefore affect the choice between running a large, taxpaying firm or a smaller one where it is easier to evade. It may also affect the workers' choice between jobs in large firms, with little opportunity to evade, and small firms with more opportunities.¹² However, none of these extensions of the model changes the main result; that differences in tax morale may increase rather than decrease the distortion from evasion.

References

- Alm, J., B. R. Jackson and M. McKee, 1993. Fiscal Exchange, Collective Decision Institutions, and Tax Compliance., *Journal of Economic Behavior and Organization* 22, 285-303.
- Barth, E., A. Cappelen and T. Ognedal, 2008. Norms and tax evasion, Frisch-report 4.
- Barth, E., A. Cappelen and T. Ognedal, 2013. Fair tax evasion. *Nordic Journal of Political Economy* 38.
- Blumenthal, M., C. Christian and J. Slemrod, 2001. Do normative appeals affect tax compliance? Evidence from a controlled experiment in Minnesota. *National Tax Journal*, March 54 (1), 125-38.
- Camerer, C. F., 2003. *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton University Press
- Cappelen, A., A. D. Hole, E. Ø. Sørensen and B. Tungodden, 2007. The Pluralism of Fairness Ideals: An Experimental Approach, *American Economic Review* 97(3), 818-827.
- Cappelen, A., B. Tungodden and E. Sørensen, 2010. Responsibility for what? An experimental approach to responsibility and fairness, *European Economic Review* 54(3), 429-44.
- Bott, K., A. W. Cappelen, B. Tungodden and E. Ø. Sørensen, 2013. You've got mail: A randomized field experiment on tax evasion, working paper.

¹²These problems are discussed in Ognedal (2014)

- Cummings, R.C. J. Martinez-Vasquez, M. McCree and B. Torgler, 2009. Tax morale Affects Tax Compliance: Evidence from Surveys and an Artefactual Field Experiment. *Journal of Economic Behaviour and Organization* 70, 447 – 457.
- Fehr, E. and U.Fischbacher, 2002. Why social preferences matter: The impact of non-selfish motives on competition, cooperation and incentives, *The Economic Journal* 112 (473)
- Fehr, E. and B.Rockenbach,2003. Detrimental effects of sanctions on human altruism, *Nature* 422, 137-140.
- Feld, L.P. and B.S.Frey, 2001. Trust Breeds Trust: How Taxpayers are Treated, *Economics of Governance* vol.2 , pp. 87 – 99.
- Fortin, B., G.Lacroix and M.C.Villeval,2007. Tax Evasion and Social Interactions, *Journal of Public Economics* 91.
- Frey, B.,1997. A Constitution for Knaves Crowds Out Civic Virtues. *The Economic Journal* 107(443), 1043-53.
- Gneezy,U. and A.Rustichini, 2000. Pay enough or don't pay at all. *Quarterly Journal of Economics* 115 (3).
- Houthakker,H.(1955). The Pareto distribution and the Cobb-Douglas production function in activity analysis. *The Review of Economic Studies*, 23,27-31.
- bibitem[a] Kleven, H.J.,M.B.Knudsen,C.T.Kreiner,S.Pedersen and E.Saez,2010. Unwilling or unable to cheat? Evidence from a randomized tax audit experiment in denmark. *Econometrica* 79, 651-692.
- Ognedal,T.,2014. Shadow labor, unpublished working paper, University of Oslo.
- Sandmo,A. ,2005. The theory of tax evasion: A retrospective view. *National Tax Journal* 58(4), 643-663.
- Slemrod,J. 2007. Cheating ourselves: The economics of tax evasion. *Journal of economic perspectives* 21(1).
- Tirole,J. and R. Benabou, 2006. Incentives and Prosocial Behavior. *American Economic Review* 96(5),1652-1678.
- Strand, J.,2005. Tax distortion, household production and black-market work. *European Journal of Political Economy* 21, 851-871.

A Proof of proposition 1

Recall that the social cost of producing an output x in a market where a fraction $1 - h$ evade taxes, given by (9), is :

$$c(x; h) = \left[h[1 - F(w/q(x, h))] + (1 - h)[1 - F(\alpha w/q(x, h))] \right] w \quad (\text{A.1})$$

where $q(x, h)$ is the price that induces supply x when a fraction h of potential suppliers is honest, determined by (7), i.e. by $hS(q) + (1 - h)S(q/\alpha) = x$. The partial derivative of q with respect to h is

$$q_h(x; h) = \frac{S(q/\alpha) - S(q)}{hS'(q) + (1 - h)S'(q/\alpha)/\alpha} \quad (\text{A.2})$$

To find how a higher fraction of honest citizens affect the cost of producing a given output \bar{x} , we take the partial derivative of $c(x; h)$ with respect to h .

$$c_h(x; h) = F(\alpha w/q) - F(w/q) + \frac{w}{q^2} [hf(w/q) + (1 - h)f(\alpha w/q)\alpha] q_h(x, h) \quad (\text{A.3})$$

Using $q_h(x; h)$ from (A.2) and rearranging gives us

$$\text{sign } c_h(x; h) = \text{sgn} \left[\left(S(q/\alpha) - S(q) \right) - \frac{1}{K} \frac{w}{q} [F(w/q) - F(\alpha w/q)] \right] \quad (\text{A.4})$$

where

$$K = \frac{hf(w/q) + (1 - h)f(\alpha w/q)\alpha}{hf(w/q) + (1 - h)f(\alpha w/q)\alpha^2} \quad (\text{A.5})$$

Since $S(q/\alpha) - S(q) = \int_{\alpha w/q}^{w/q} af(a)da$, it follows that

$$w/q [F(w/q) - F(\alpha w/q)] > S(q/\alpha) - S(q) > \alpha w/q [F(w/q) - F(\alpha w/q)] \quad (\text{A.6})$$

From (a.5), $K = 1$ for $h = 1$ and $K = 1/\alpha$ for $h = 0$. It then follows from (A.4) and (A.6) that $c_h(x; h) > 0$ for $h = 0$ and $c_h(x; h) < 0$ for $h = 1$.

Let \bar{h} be the value of h that makes $c_h(x, h) = 0$. If $c_{hh}(x, \bar{h}) < 0$, the cost function has one maximum only, for \bar{h} . I show that this condition holds for constant elasticity of supply, as when labour input per unit produced is Pareto distributed. With supply function $S(q) = q^s$, the cost function is

$$c(\bar{x}, h) = h \int_0^{q^s} x^{1/s} dx + (1 - h) \int_0^{(q/\alpha)^s} x^{1/s} dx \quad (\text{A.7})$$

Integrating gives

$$c(\bar{x}, h) = \frac{s}{1 + s} (q(\bar{x}, h))^{s+1} [h + (1 - h)/\alpha] \quad (\text{A.8})$$

From $\bar{x} = hq^s + (1-h)(q/\alpha)^s$ we derive

$$q(\bar{x}, h) = \left[\frac{\bar{x}}{h + (1-h)/\alpha^s} \right]^{1/s} \quad (\text{A.9})$$

The cost function (A.6) can then be rewritten as

$$c(\bar{x}, h) = \frac{s}{1+s} \left[\frac{\bar{x}}{h + (1-h)/\alpha^s} \right]^{\frac{s+1}{s}} [h + (1-h)/\alpha] \quad (\text{A.10})$$

Differentiating with respect to h yields

$$c_h(\bar{x}, h) = \frac{\bar{x}^\gamma}{\gamma} \left[h + \frac{1-h}{\alpha^s} \right]^{-\gamma} \left[\left[h + \frac{1-h}{\alpha^s} \right] \left(1 - \frac{1}{\alpha} \right) - \frac{s+1}{s} \left[h + \frac{1-h}{\alpha} \right] \left(1 - \frac{1}{\alpha^s} \right) \right] \quad (\text{A.11})$$

where $\gamma = \frac{s+1}{s}$. Define $A(h) = \frac{\bar{x}^\gamma}{\gamma} \left[h + \frac{1-h}{\alpha^s} \right]^{-\gamma}$ and $B(h) = \left[h + \frac{1-h}{\alpha^s} \right] \left(1 - \frac{1}{\alpha} \right) - \frac{s+1}{s} \left[h + \frac{1-h}{\alpha} \right] \left(1 - \frac{1}{\alpha^s} \right)$, such that (A.9) can be rewritten as $c_h(\bar{x}, h) = A(h)B(h)$. Since $A(h) > 0$, $c_h = 0$ if $B(h) = 0$. Let \bar{h} be a value of h such that $B(\bar{h}) = 0$. Differentiating c_h with respect to h gives $c_{hh} = A'(h)B(h) + A(h)B'(h)$. Since $B(\bar{h}) = 0$, $c_{hh}(\bar{x}; \bar{h}) < 0$ if $B'(\bar{h}) < 0$, which is easily verified. Thus, with constant elasticity of supply, the cost function has maximum for \bar{h} only, which implies that $c_h(x, h) > 0$ for all $h < \bar{h}$ and $c_h(x, h) < 0$ for all $h > \bar{h}$.

B Proof of proposition 2 and 3

Proof of proposition 2

Differentiating social surplus, as given by (11) with respect to h yields

$$dW/dh = [D^{-1}(\tilde{x}) - S^{-1}(\tilde{x})]\tilde{x}'(h) + [c_x(\tilde{x}; 1) - c_x(\tilde{x}; h)]\tilde{x}'(h) - c_h(\tilde{x}, h) \quad (\text{B.1})$$

If supply is perfectly elastic on the margin, output does not change as h goes up, i.e. $\tilde{x}'(h) = 0$. This makes the first two terms equal to zero, and so the sign of dW/dh depends only on the sign of $c_h(\tilde{x}, h)$. From proposition 1, $c_h(\tilde{x}, h) > 0$ for $h = 0$ and $c_h(\tilde{x}, h) < 0$ for $h = 1$. Consequently, welfare is decreasing in h for $h = 0$ and increasing in h for $h = 1$. If $c_h(\tilde{x}, h) > 0$ for all $0 < h < \bar{h}$ and $c_h(\tilde{x}, h) < 0$ for all $\bar{h} < h < 1$, welfare is decreasing in h for $h < \bar{h}$ and increasing in h for $h > \bar{h}$.

Consider the case where supply is decreasing in h on the margin, i.e. $\tilde{x}'(h) < 0$. Since $D^{-1}(x) < S^{-1}(x)$ for all units from $x(1)$ to \tilde{x} , the first term is zero for $h = 1$ and positive for $h < 1$. By differentiating (A.1), it is easily verified that $c_x(\tilde{x}; h) > c_x(\tilde{x}; 1)$ for all $h < 1$. Since $\tilde{x}'(h) < 0$, this implies that the second term is also zero for $h = 1$ and positive for all $h < 1$. From proposition 1, the third term, $c_h(\tilde{x}, h)$, is positive for $h < \bar{h}$, zero for $h = \bar{h}$ and negative for $h > \bar{h}$. This gives us the following: $dW/dh > 0$ for $h > \bar{h}$ since the two first terms are positive and $c_h(\tilde{x}, h) \geq 0$. dW/dh may be negative for $h < \bar{h}$ since the first two terms are positive but $c_h(\tilde{x}, h) < 0$.

Proof of proposition 3

The total reported income, i.e. the tax base, is given by

$$R = h \left[wF(w/q) + \int_{w/\tilde{q}}^{\bar{a}} qadF(a) \right] + (1-h) \left[wF(\alpha w/q) + \int_{\alpha w/\tilde{q}}^{\bar{a}} qadF(a) \right] - \lambda(1-h) \int_{\alpha w/\tilde{q}}^{\bar{a}} qadF(a) \quad (\text{B.2})$$

The sum of the first four terms is the total income from employment and self-employment, hereafter denoted I . The last term is the unreported income, denoted U . Thus, $R = I - U$.

The total income I can be rewritten as

$$I(h) = \tilde{q}(h)\tilde{x}(h) + w - c(\tilde{x}(h), h) \quad (\text{B.3})$$

Differentiating with respect to h , and using that $W'(h) = [\tilde{q}(h) - c_x(\tilde{x}; h)]\tilde{x}'(h) - c_h(\tilde{x}; h)$ yields

$$I'(h) = W'(h) + \tilde{q}'(h)\tilde{x}'(h) \quad (\text{B.4})$$

With increasing supply and decreasing demand, the last term in (B.4) is positive since $\tilde{q}'(h) > 0$ and $\tilde{x}'(h) > 0$. A sufficient condition for $I'(h) > 0$ is then that $W'(h) \geq 0$. From proposition 2, $W'(h) \geq 0$ for $h \geq \bar{h}$. $W'(h)$ may be negative for $h < \bar{h}$ and so $I'(h)$ may be negative.

Differentiating U with respect to h yields

$$U'(h) = \lambda \left[- \int_{\alpha w/q}^{\bar{a}} qadF(a) + (1-h)f\left(\frac{\alpha w}{q}\right)\left(\frac{\alpha w}{q}\right)^2 \tilde{q}'(h) \right] \quad (\text{B.5})$$

The effect of an increase in h on unreported income is ambiguous: On the one hand, more honest individuals means that fewer of the self-employed are evading, the first term. On the other hand, the value of the hidden output may go up when \tilde{q} goes up, the second term.

It follows from the ambiguous sign of both $I'(h)$ and $U'(h)$ that the sign of $R'(h) = I'(h) - U'(h)$ is ambiguous. This is the case even in the example illustrated in figure 2, where $\tilde{x}'(h) = 0$, $\tilde{q}'(h) = 0$ and $c_h(\tilde{x}, h) > 0$: From (B.5), $\tilde{q}'(h) = 0$ implies that the last term is zero and so $U'(h) < 0$. From (11), $\tilde{x}'(h) = 0$ implies that $W'(h) = -c_h(\tilde{x}, h)$. From (B.4), $I'(h) = -c_h(\tilde{x}, h) < 0$. This implies that $I'(h) < 0$ and $U'(h) < 0$, and we cannot sign $R'(h) = I'(h) - U'(h)$.

C Proof of proposition 4 and 5

Proof of proposition 4

Let \tilde{q} be the equilibrium price if there are no honest customers and a fraction h of honest

sellers. \tilde{q} is determined by (7) and (8), i.e. by $D(\tilde{q}) = hS(\tilde{q}) + (1 - h)S(\tilde{q}/\alpha)$. Assume now that a fraction m of the customers become honest. Let \hat{m} denote the fraction of honest customers that gives demand equal to supply of reported output at price \tilde{q} , i.e.

$$mD(\tilde{q}) = hS(\tilde{q}) + (1 - h)(1 - \lambda)S(\tilde{q}/\alpha) \quad (\text{C.1})$$

The first term on the right hand side is the supply of reported output from honest sellers and the second term from dishonest sellers. Using the equilibrium condition $D(\tilde{q}) = hS(\tilde{q}) + (1 - h)S(\tilde{q}/\alpha)$, derived from (7) and (8), (C.1) can be rewritten as

$$m \leq 1 - \frac{\lambda(1 - h)S(\tilde{q}/\alpha)}{D(\tilde{q})} \equiv \hat{m}(h) \quad (\text{C.2})$$

\hat{m} is the fraction of the output that would be reported even if there are no honest buyers.

If $m < \hat{m}(h)$, the demand for reported services is lower than the supply at \tilde{q} . With the assumption that buyers and sellers of reported services can find each other at no cost, honest buyers are satisfied at no extra cost to the sellers. This implies that the equilibrium price is the same for both honest and dishonest buyers, and equal to \tilde{q} . When all buyers face the same price, the allocation of output between them is efficient. Since all buyers pay the same price, honest and dishonest sellers with equal productivity face different net revenues. This implies that production is inefficient for $0 < h < 1$. For all $m < \hat{m}$, the equilibrium is the same as for $m = 0$, the case discussed in section 2. Thus, a marginal increase in m has no effect as long as $m < \hat{m}$.

If $m > \hat{m}(h)$, the demand for reported output exceed the supply at price \tilde{q} , which means that sellers are no longer indifferent between customers at a common price \tilde{q} . To be indifferent, they must charge honest and dishonest customers different prices. Let q be the price paid by an honest customer and q^d the price paid by a dishonest one. Since a dishonest seller gets net revenue $(1 - t)q$ from an honest customer and $q^d(1 - p(\lambda)\tau)$ from a dishonest one, he is indifferent if and only if $q^d = q(1 - t)/(1 - p(\lambda)\tau)$. Since sellers with the same productivity face the same net revenue $(1 - t)q$ from all customers, output is efficiently produced. Since honest and dishonest customers face different prices, the allocation of output between them is inefficient. Since the value of q and q^d that make sellers indifferent are independent of h , a marginal change in h has no effect as long as $m > \hat{m}(h)$.

Proof of proposition 5

To evaluate the allocation of output between the buyers, it is useful to derive the social value of output as a function of the fraction of honest customers, m . Define $(1 - t)/(1 - p(\lambda)\tau) \equiv \gamma$, i.e. $q^d = \gamma q$. The honest buyers are those who are willing to pay at least q and the dishonest buyers are those who are willing to pay at least γq . I have assumed that each customer buys one unit. Let u_i be the value of a unit to customer i , and $G(u_i)$ its cumulative distribution function. The demand is then $m[1 - G(q)]$ from honest buyers and $(1 - m)[1 - G(\gamma q)]$ from dishonest buyers. The social value of output x is

then

$$v(x, m) = m \int_q^{\bar{u}} u dG(u) + (1 - m) \int_{\gamma q}^{\bar{u}} u dG(u) \quad (\text{C.3})$$

where $q = q(x, m)$ is determined by $x = m[1 - G(q)] + (1 - m)[1 - G(\gamma q)]$, i.e. it is the price that induces demand x when a fraction m of consumers are honest. Since total demand is decreasing in q and m , $q(x, m)$ is decreasing in x and m .

To find how the social value of a given output x varies with m , I take the partial derivative of $v(x; m)$ with respect to m . Using $q_m(x; m)$ and rearranging gives us

$$v_m(x; m) = - \int_{\gamma q}^q (qH - u) dG(u) \quad (\text{C.4})$$

where

$$H = \frac{mg(q) + (1 - m)g(\lambda q)\lambda^2}{mg(q) + (1 - m)g(\lambda q)\lambda} \quad (\text{C.5})$$

Since $H = \gamma$ for $m = 0$ and $H = 1$ for $m = 1$ it follows from (C.4) that $v_m(x, m) < 0$ for $m = 0$ and $v_m(x, m) > 0$ for $m = 1$. Let \bar{m} be the value of m that makes $v_m(x, m) = 0$. If $v_{mm}(x, \bar{m}) > 0$, the value function has only one minimum, which means that $v_m(x, m) < 0$ for all $m < \bar{m}$ and $v_m(x, m) > 0$ for all $m > \bar{m}$. It can be shown that this holds for example with constant elasticity of demand

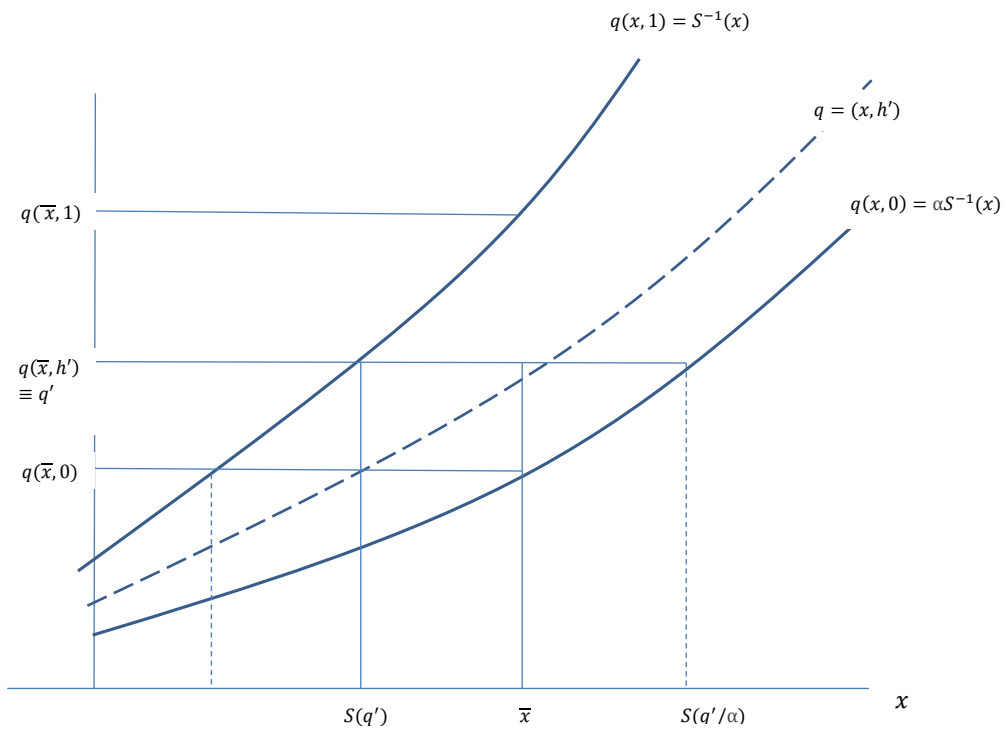


Figure 1

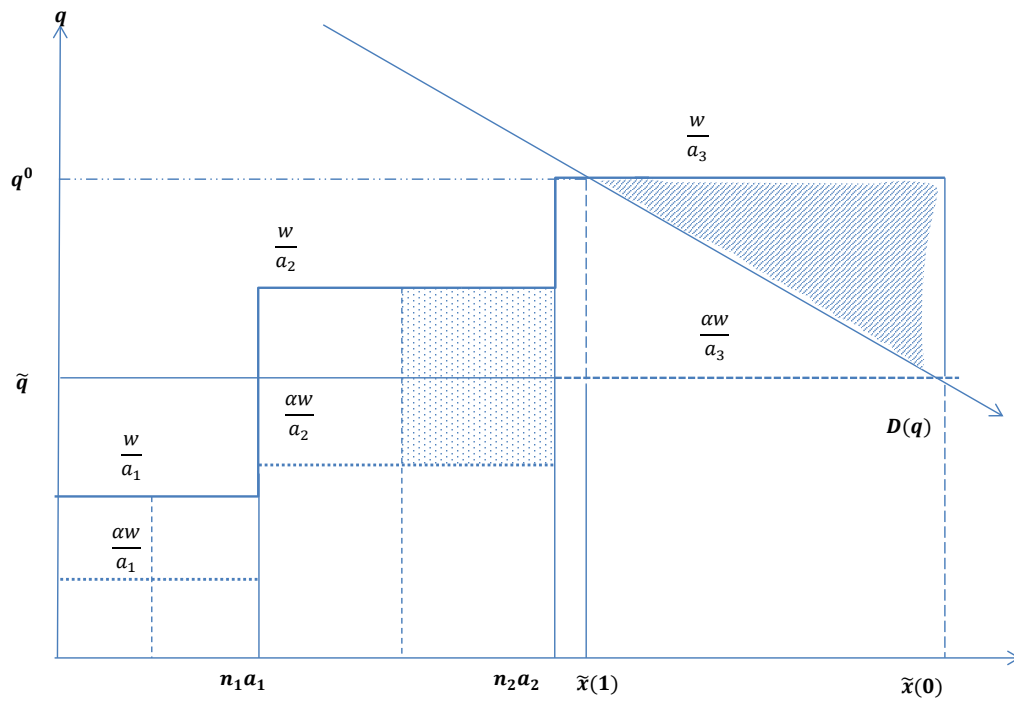


Figure 2