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# Fiscal and Ethical Determinants of Shadow Economy: Theory and Evidence

## Abstract

This paper introduces a theory of the mechanisms and determinants of why some markets are prone to develop shadow economies. It tests the suggested hypotheses using data on 21 developed OECD countries for 1989/90 - 2002/03. The econometric results provide support for the proposed determinants of shadow economies, including taxation, social security and the tax moral variables. Using the MIMIC method, we find that the estimated average size of the shadow economy relative to the official GDP was 13.2 per cent in 1989/90, rising to 16.8 per cent in 1999/2000. The results allow us to classify the OECD sample into economies with large, medium-sized, and moderate shadow economies.

**JEL Classification:** C23, D43, H26, L13

**Key words:** shadow economy, tax evasion, morality, MIMIC

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# 1 Introduction

Underground economic activities are a fact of life around the world. Most societies attempt to control these activities through various measures, for example, by punishing tax evasion. If tax morale represents a normal good, promotion of economic growth also serves for the same purpose. By investing in education, the society can hope to advance desired social values.<sup>1</sup> The existing research has successfully established that illicit economic activities exist not only in non-industrialized countries but are significant also in western economies.<sup>2</sup> The earlier studies have analyzed two issues in particular, i.e. payment transactions and measures of underground economic activities. Empirical knowledge of the frequency of these activities and the magnitude of them appears important for economic policies which aim at controlling them. This is, however, hard as individuals engaged in these activities wish not to be identified. Our paper therefore has a different focus. Its goal is to overcome these difficulties by introducing a theory of the mechanisms and determinants why shadow economies develop. It then tests the hypotheses suggested by the model using data on OECD countries and the MIMIC estimation method.

People engage in shadow transactions for the purpose of tax evasion especially if the government is viewed as a predatory revenue maximizer. Abstaining from participation of financing the public goods, those visiting the illicit markets exert a fiscal externality on honest consumers. However, people have intrinsic moral sentiments, with preference for obeying inherited social norms and disapproving deviants. In particular, people care what other people think of them and self-esteem is important for them. Free-riders and deviants are disapproved.<sup>3</sup>

Our paper explores the determinants of the borderline between legal and shadow economies. It explores the extent to which moral sentiments can control for shadow activities. It therefore introduces preferences for moral standards, determination of morality as social capital and sustainability of social norms. In the model, we consider explicitly the commodity tax in allocating consumers between the legal and illicit sectors.<sup>4</sup> As a corollary,

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<sup>1</sup>Akerlof (1983) has analyzed the parental incentives to teach their children values leading them best survive economically.

<sup>2</sup>Schneider and Enste (2002).

<sup>3</sup>Fehr and Gächter (2002) indicate that people are willing to invest substantial resources in public goods, as long as they have the possibility to inflict punishment on those who free ride on the co-operation.

<sup>4</sup>The model could be extended to incorporate the input markets and thereby the income taxes. In the model, we however abstract from income taxes if only to simplify.

the paper indicates that illegal transactions are an important determinant of cash holdings despite the fact that more efficient electronic payment systems are at hand.<sup>5</sup>

In our model, morality is viewed as a network good.<sup>6</sup> Apart from consumption opportunities, people value the social approval attached to their behavior within the social network sharing the same moral values. By implication, deviants subject themselves to the risk of being detected and becoming socially stigmatized. Detection is, however, probabilistic and by anonymous transactions immoral people may mimic the moral ones. Morality operates like a particular form of social capital.<sup>7</sup> In our model, the degree of morality is determined by the share of people who choose to commit to honest behavior.<sup>8</sup>

The model suggests that high tax rate, low expected cost of punishment and low relative cost of production shape the industry equilibrium leading to contraction of the legal sector and a boost in the shadow economy. To qualify, rising tax rate tends to expand the shadow economy through the tax evasion effect. There is also an associated public goods effect. Moral sentiments in terms of self-esteem and disapproval operate as mechanisms which limit the shadow market activities.

The empirical results of the paper for the 21 developed OECD countries support the theoretical predictions. Taxation and social security contributions appear as the driving force of the shadow economy. Moreover, the

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<sup>5</sup>Using cash for payments of illegal anonymous transactions appears as an important motive for why people hold cash in spite of the recent innovations in the payment system. Cash payments are convenient for those who seek to hide their motives. The markets for prostitution, for example, are presumably predominantly based on the use of cash, reducing the enforceability of within family contracts. Modern brand products like Nike or Adidas in sportswear and shoes or Prada on ladies fashion are actively copied and marketed in pirate products. With high legal prices of CDs, people have developed ability to copy music freely from internet. In construction, illegal labor is employed with the aim of tax evasion. Many private services are delivered without receipts. In most economies, there are also well-functioning secondary markets for stolen durable goods. Moreover, the rise of terrorism is largely financed by illegal money.

<sup>6</sup>Our model highlights the conflict between opportunistic private incentives and collective values and norms. Some studies in the sociological literature explain crimes as an outcome of evolutionary interplay between productive and expropriative strategies, cf. Cohen and Machalek (1988) and Vila and Cohen (1993).

<sup>7</sup>The reasons for non-opportunistic behavior have been extensively discussed by biologists. Hamilton (1964) introduced the notion of kin selection and Trivers (1971) a more general view of reciprocal altruism. Wilson (1975) represents a comprehensive document of reciprocal behavior among animals extended to human behavior by Binmore (1998). Frank (1988) argued convincingly that the ability of people to behave non-opportunistically serves as a helpful commitment device facilitating beneficial relations like joint ventures.

<sup>8</sup>Cf. Frank (1987) for a pioneering analysis of honesty and dishonesty.

status of the official economy and the tax morale are shown further to contribute to underground activities. We also observe a substantial increase of the estimated size of the shadow economy in the 90s in all countries included in data. Our estimation results with the MIMIC approach allow us to link this development to the rising total tax rate in the OECD economies. Subsequently, however, our estimates suggest that the shadow economy has started to shrink somewhat in most countries in our sample in the late 1990s up to 2003. This again is consistent with our model and the fact that the total tax rate, for example in the EU-area, started on the average to decline as tax policies were changed. Only in a small sub-set of our sample, i.e. in Germany, Austria and Switzerland, the shadow economy has expanded also during the past years.

Our paper is structured as follows. After surveying the previous studies in section 2, we develop our theoretical model in section 3. The model is estimated in section 4 which reports the econometric results. Section 5 concludes.

## 2 Previous Studies

**Shadow Economy, its Magnitude and Payment Systems** Shadow economy arises exclusively from government intervention, i.e. regulation and taxation. Such a policy intervention has side effects. Many empirical studies show that the size of the shadow economy has been most dramatic in the planned socialistic economies with maximum governmental intervention<sup>9</sup>. However, Giles (1999a) suggests that the size of the shadow economy has been growing over the past two or three decades in almost all of the countries for which comparative data have been assembled. According to Giles, growth in the underground economy is associated with increases in the actual or perceived tax burden but also with the degree of economic regulation. The view is shared by Thomas (1999) who hints that a growing shadow economy may be an indication of over-taxation and over-regulation. He also suggests that at least some part of the shadow economy may be social security fraud, making unemployment less bad as it looks.

As early as in 1958, Cagan proposed that people prefer to use cash in illegal economy, especially in black markets and for tax evasion. Modern payment systems have sought to challenge cash, but none has been able to shake the prominent role of money. Thus, Hancock and Humphrey (1998) conclude that factors other than the simple opportunity cost must play primary role in determining holdings and the use of cash. After an extensive

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<sup>9</sup>For recent survey and for methodological review see Schneider (2004).

survey Drehman et al. (2002) conclude that 'bad behavior' creates a demand for anonymous means of payment which for now is the currency.

Some useful figures for understanding the magnitude of illegal demand for cash are provided, for example, by Rogoff (1998). Accordingly, half of the currency holdings in the OECD countries are in the domestic informal economy. It appears that informal economy already is the main holder of cash. Humphrey et al. (2000) suggest, that the technological progress will further distort the demand as the share of the legal use will decrease and the share of illegal use will increase. Thus the authorities will face an unpleasant moral dilemma, as the seigniorage revenues are likely to be due to providing the means of payment for illegal activities, for example, tax evasion!

**Links to Policy** There are several conclusions that have been justified in the light of the above results. Schneider (2000) gives a concerned note by suggesting that under a growing (or substantial) shadow economy, policy is based on mistaken official indicators. In addition, he suggests that a growing shadow economy attracts workers to work in shadow economy and to work less in the official economy. Giles and Caragata (1999) are concerned that unpaid tax in hidden economy or loopholes allowing abusive avoidance in the existing tax system create a deadweight loss on the economy. These will, in turn, undermine taxation equity by shifting tax burden in the direction of honest, socially responsible individuals and corporations. Accordingly, part of the hidden economy is learned response to changing opportunities and constraints in fiscal policy, but on the other hand, there is a threshold level of underground activity that will sustain.

**Theoretical work** Theoretical attempts to analyze the shadow economy include Cowell (1989) who asks how far should taxation authorities go in pursuit of the missing income. In a paper which is closest to ours, Acemoglu (1994) analyzes the pecuniary and non-pecuniary aspects of the reward structure on the allocation of talent across different activities with divergent private and social returns. The non-pecuniary aspects of reward structure consist of social status and prestige received for different activities. For example, the prestige and the status are influenced by the established norms and role models and reference groups<sup>10</sup>.

The determinants and effects of the informal sector are studied in an endogenous growth model by Loayza (1996). Using data on Latin American countries it is found that the informal sector negatively affects growth and its size depends on tax burden, labor-market restrictions and government

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<sup>10</sup>'Bad behavior' may have less damaging stigma when it is more widespread.

institutions. Johnson et al. (1997) propose that supply of public goods tends to result in increasing returns in private firms, leading to multiple equilibria. Data on transition economies suggests that market-supporting institutions are critical for a successful transition. Friedman et al. (2000) suggest that the incentive to go underground to dodge higher tax rates is outweighed by the benefits of remaining official.

Camera (2001) analyzes what would happen if authorities promote the use of e-purse and limit the use of currency. Accordingly, an equilibrium exists with no illegal production if monitoring is sufficiently extensive and money supply is moderate. When enforcement is not too extensive, however, there are monetary equilibria where legal and illicit production coexist. Accordingly, the results provide a rationale for limiting the amount of cash in circulation. Nonetheless, using currency as an exogenous discipline on illicit undertakings may have unintended consequences, such as depressing all trading activities and decreasing welfare. Dabla-Norris and Feltenstein (2003) apply an intertemporal general equilibrium model to explore the link between tax rates, access to credit and the size of the underground economy. Simulation results for Pakistan demonstrate that entry into underground economy can have a cyclical nature. Moreover, the share of underground activity will decline over time and sectors gradually move back into legal economy. With low taxes, there is no underground economy, but due to high budget and trade deficit the low tax regime is not sustainable over time. Thus an economy may have to accept some underground activity as part of an otherwise acceptable tax program.

Davidson, Martin and Wilson (2003) suggest that shadow transactions may increase welfare. They argue in the experience goods framework that by allowing agents to self-select into the black market, the government can target tax breaks to transactions involving low-quality goods. Money in provision of privacy has been recently addressed by Kahn, McAndrews and Roberds (2004). Fortin, Lacroix and Villeval (2004) study the link between tax evasion and social norms and social interactions. The experiment by Carpenter and Matthews (2004) confirms the existence of social reciprocity, demonstrating that more socially efficient outcomes arise when reciprocity can be expressed socially. Earlier, Kandori (1992) followed subsequently by Araujo (2004) suggested that a community can sustain a social norm with agents knowing nothing more than their personal experience. The reason is that defection against one agent causes sanctions by others. Finally, we refer to Kannianen and Pääkkönen (2004) which provides the starting point for the model we introduce below.

## 3 Model

### 3.1 Market Solution and Fiscal Externality

Shadow transactions take a variety of forms (Schneider and Enste (2002)), including household production, neighborhood help, sales of stolen products, imperfect reporting by firms and self-employed, gambling and drugs. The existing literature suggests that taxation, not forgetting social security contributions, motivate people to avoid such taxes. In our theoretical model, we will abstract from input markets and hence from income taxes and social security contributions in order to keep the model manageable. We consider explicitly underground transactions arising from tax evasion by consumers. Building on Kanninen and Pääkkönen (2004), we formulate a model of an industry consisting of legal and illicit producer or services or goods. In the empirical part, we introduce both direct and indirect taxes and social security payments.

Our research strategy is to analyze first the industry equilibrium when one sector is taxed and the other is not. Subsequently, we introduce moral standards to examine their role in controlling the development of shadow economy. We introduce the budget constraint of a revenue maximizing Leviathan government.

**Anonymous Visits to Shadow Economy** Consider a market with a product brand where a producer has market power in pricing. The product is assumed to have some prestige value, determining the basic willingness to pay.<sup>11</sup> In such markets, the entry cost is non-trivial because of the nature of the product or because of barriers to entry. The products are subject to a commodity tax,  $\tau > 0$ .<sup>12</sup> Because of the market power, the producer is able to shift part of the tax to consumers. The two elements, pricing power and the tax wedge in consumer price create an incentive for illicit production. To avoid social punishment, consumers try to visit the illicit market anonymously.<sup>13</sup>

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<sup>11</sup>Alternatively, we could think of paternalistically regulated industries, like casinos, state monopolies in liquor production etc.

<sup>12</sup>The possibility to avoid the commodity tax by imperfect reporting is product specific. This observation supports the view that the optimal commodity tax is non-uniform, i.e. products which allow for easy tax evasion should be taxed less heavily. One topical example is the Finnish tax reduction on strong liquor, aiming at controlling the (legal and illicit) imports.

<sup>13</sup>To clarify, when we talk about an illicit producer, this should not be understood to refer a registered firm but to an activity which is rival to legal activity. We also notice that we abstract from the possibility that the legal firm operates partly like an illicit producers



**Consumers** Consumers are assumed to have preferences over goods and social approval. By their intrinsic preferences, people are assumed to be all alike. They all are egoists in the sense of utility maximizers. But they also care for what other people think of them.<sup>14</sup> Thus, they have subjective preference both for their self-esteem and they care about the expected social punishment of illegal actions.<sup>15</sup> Thus, morality becomes a *network phenomenon*. However, for tax evasion reasons, it may become profitable to deviate opportunistically from the norm of buying only legal products. By anonymous transactions, deviants try to mimic the legal consumers, though risking themselves to social stigma. Hiding deviations from an established social norm becomes attractive, as hiding may help to maintain the status of an honest person.

We first build the market model without moral sentiments. We assume that consumers differ with respect to their willingness to pay for the prestige of the product brand. We assume that there is continuum of consumers with mass one. They can buy a private product in the legal or illicit market. We denote the producer prices by  $p_l, p_i$ . The marginal utility from buying the private legal product,  $r^k$  for consumer  $k$ , is assumed to be uniformly distributed over  $[0, 1]$ . Consumers also value public goods. We assume that private goods and public goods are complementary in the sense that the willingness to pay for the private good is increasing in the amount of public goods available.<sup>16</sup> Consumers visiting the illicit market are assumed to be caught with probability  $\xi > 0$  and subject to penalty  $z > 0$ . Consumers  $(k, j)$  visiting the legal and illicit market thus are assumed to have net utilities

$$u^k = gr^k - (1 + \tau)p_l, \quad v^j = gr^j - z\xi - p_i. \quad (1)$$

Non-excludability implies that both honest and dishonest consumers derive utility from public goods though the latter ones free-ride in the financing of those goods.

In the industry equilibrium, we expect segmentation of markets, i.e. those consumers with high marginal utility  $r^k$  would buy the legal product while

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in the shadow economy. Though such an activity is common in practice, we leave it out if only to keep the model simple.

<sup>14</sup>Such a subjective status effect is well-known in psychology, cf. Singh-Manoux, Adler and Marmot (2003). In biology, we refer to Ridley (1996). In economics, Fershtman, Weiss and Hvide (2001) have studied status effects.

<sup>15</sup>Binmore (1998) has shown that it is rational for people to commit to social norms and social contracts as long as the commitment gains exceed the short-term gains from deviating. Morality arises in the equilibrium of a repeated game as a social contract.

<sup>16</sup>The public good is more valuable to a consumer with greater willingness to pay for the private good.

those with lower marginal utility buy the illicit product. Denote the marginal consumers by  $(m, n)$  where  $m$  is indifferent between buying the legal and illicit product while  $n$  is indifferent between buying the illicit product and buying none. Thus the marginal utility for any consumer,  $k$ , for buying the legal product is  $g(1 - k)$ . The marginal utility for  $j$  for buying the illicit product is  $g(1 - j) - \xi z$ . Insert  $k = j = m$  to obtain the expressions for the marginal consumer. For indifference,  $g(1 - m) - (1 + \tau)p_l = g(1 - m) - \xi z - p_i$ . Note that the market share of the legal production must be  $x_l = m$ .

The immediate observation is that the consumer price in the legal sector has to exceed the consumer price in the illicit sector,  $(1 + \tau)p_l > p_i$ . The price differential is unaffected by the valuation of public goods. Solving for the expression for the willingness to pay by the marginal consumer of the legal product from condition  $\frac{g-r^m}{x_l} = g$ , yields  $r^m = (1 - x_l)g$ . The condition  $\frac{g-r^m}{x_l} = g$  is obtained from the demand curve. We have a downward-sloping demand, cutting the vertical axis at  $g$  and the horizontal axis at 1 (because the mass of consumers is 1). The willingness to pay for the private good by the consumer who is just indifferent between legal and illicit goods is  $r^m$ . From two triangles with the same slope, we obtain the claimed condition.

To solve for the marginal willingness to pay for the illicit product, we note that  $\frac{g-r^n}{x_i+x_l} = g$ , yielding  $r^n = (1 - x_i - x_l)g$ . Clearly,  $r^m > r^n$ . This implies that  $r^m - (1 + \tau)p_l > 0$ . By implication, the legal firm cannot exploit the full consumer surplus from its customers. Such a market power of the legal consumer arises from that she can "blackmail" the legal producer with her option to visit the illicit market. The illegal producer, in contrast, is able to exploit the full surplus from its marginal customer.

To summarize,  $r^m > r^n > 0$ . Then we know that all those customers with a higher product valuation than the marginal customer  $m$  will buy the legal product. The other active customers buy the illicit product. The third group buys nothing.

Solving for the price differential

$$(1 + \tau)p_l - p_i = \xi z. \quad (2)$$

What this condition suggests is that a consumer is indifferent between visiting the legal and illicit market if the risk of getting caught and penalized is fully compensated by the price differential. For the marginal consumer  $n$ , the net utility from buying the illicit product is zero,  $g(1 - n) - \xi z - p_i = 0$ . Noting that the  $n$  is the last buyer, i.e.  $n = x_l + x_i$ , her net utility is  $(1 - x_l - x_i)g - \xi z - p_i = 0$ . Thus, the valuation of public goods raises the price of the illicit product. Through the first arbitrage condition, this is then reflected in the price of the legal product, too.

The total production thus satisfies  $x_l + x_i = 1 - \frac{\xi z + p_i}{g}$ . Solving for the prices  $p_i = (1 - x_l - x_i)g - z\xi$ ,  $p_l = \frac{(1 - x_l - x_i)g}{1 + \tau}$ .

**Profits** Market equilibrium can now be analyzed in terms of competition with differentiated products. The legal firm can take opportunistically advantage of honest consumers. On the other hand, the illicit market intensifies competition. This results in fewer consumers in the legal market, exerting a pressure on the legal price.<sup>17</sup> Consumers buy the product with greater net utility.<sup>18</sup> Under Cournot-competition in differentiated products, the behavior of firms obeys

$$\max_{x_l} (p_l - c_l)x_l, \quad \max_{x_i} (p_i - c_i)x_i, \quad (3)$$

where  $c_l, c_i > 0$  are the production costs.<sup>19</sup>

**Nash equilibrium** In Nash equilibrium, market shares satisfy

$$x_l = \frac{g + z\xi + c_i - 2(1 + \tau)c_l}{3g} \quad (4)$$

$$x_i = \frac{g + (1 + \tau)c_l - 2z\xi - 2c_i}{3g}. \quad (5)$$

Similarly, prices are

$$p_l = \frac{g + (1 + \tau)c_l + z\xi + c_i}{3(1 + \tau)} \quad (6)$$

$$p_i = \frac{g - 2z\xi + c_i + (1 + \tau)c_l}{3} \quad (7)$$

We find that the condition for existence of shadow market in the industry equilibrium is  $x_i = \frac{g + (1 + \tau)c_l - 2z\xi - 2c_i}{3g} > 0$ . High tax rate and low expected cost of punishment and low relative cost of production support the development of shadow markets. In particular, increased tax on the legal product shakes

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<sup>17</sup>The firm producing in the legal market obviously has an incentive to capture the consumers also in the illicit market. An example is the illegal production of pirate products of cigarettes in Eastern European countries. The legal firm typically then issue licenses to combat the illegal pirate production.

<sup>18</sup>One can extend the analysis to quality uncertainty in the illicit market. One of the recent examples is the Estonian vodka. When bought in illicit markets, it has killed some consumers.

<sup>19</sup>The decision to become a producer in the illicit market could be analyzed in terms of occupational choice. Such a choice would also be subject to moral considerations which, however, will not be explicitly discussed in the current paper.

the industry equilibrium leading to contraction of the legal sector and a boost in the shadow economy.

However, when tax revenue is used to finance public goods, these natural results no longer hold as their validity is limited to the *ceteris paribus* case. The role of public goods in the determination of the limits to shadow economy thus deserves attention. Solving

$$\frac{\partial x_l}{\partial g} = \frac{1}{g} \left( \frac{1}{3} - x_l \right), \quad \frac{\partial x_i}{\partial g} = \frac{1}{g} \left( \frac{1}{3} - x_i \right). \quad (8)$$

With large market shares ( $x_l > \frac{1}{3}, x_i > \frac{1}{3}$ ), an increase in the supply of public goods reduces both the size of the legal sector and the illicit sector. It is only when the market shares are small that the complementarity effect of public and private goods raises output when more public goods become available. This somewhat surprising finding follows from the profit maximizing behavior of producers. Realizing that the willingness to pay by consumers for the private products has increased with more public goods available, producers can raise their profits by actually cutting the production and charging higher prices.

### 3.2 Balanced Budget Requirement

We consider next the case where public goods available are constrained by the tax revenue generated by taxation of the legal product. In the empirical analysis, we do not impose this constraint for two reasons. First, governments can issue public debt, shifting tax burden on future generations.<sup>20</sup> Second, governments can waste part of the tax revenue as activities of special interests groups and lobbies result in inefficient public spending.

Balanced government budget amounts to considering the industry equilibrium subject to the constraint

$$g = \tau p_l x_l. \quad (9)$$

With a given tax rate, such a constraint endogenizes the supply of public goods in the economy.<sup>21</sup> We now have five equations to determine the five

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<sup>20</sup>The dynamics of the impact of public debt on the development of shadow economies depends on whether the Ricardian equivalence holds or not with a regime shift in tax policies. With Ricardian equivalence between taxes and public debt, shadow economies develop fast, as people discount the future taxes. However, with imperfect discounting, shadow economies emerge over time.

<sup>21</sup>We consider below the case where the tax rate is determined by revenue maximizing government.

endogenous variables  $(x_l, x_i, p_l, p_i, g)$  in the industry equilibrium. Dishonest people understand that by free-riding in financing the public goods production they also suffer if the tax revenue is reduced and less public goods are available. Does this understanding restrict the market share of the shadow economy? What does the uncoordinated equilibrium look like? Our empirical results will shed light on these issues.

Suppose that there is a marginal increase in the tax rate  $\tau$ . What happens to the shadow markets? From the solution above, the new industry equilibrium satisfies

$$\frac{dx_i}{d\tau} = \frac{c_l}{3g} + \left( \frac{1/3 - x_i}{g} \right) \left( \frac{dg}{d\tau} \right). \quad (10)$$

We find that if the tax rate is increased, there are two effects. The first one definitively tends to make the shadow economy larger. This can be called *the tax evasion effect* and its magnitude is measured by  $c_l/3g$ . High production cost in the legal sector makes the tax evasion effect large, while large supply of public goods has a negative impact on the expansion of the shadow economy. These effects follow from production decisions by firms. There is a secondary effect which depends on the impact of tax rate on tax revenue and hence on supply of public goods,  $\frac{dg}{d\tau}$  and on the initial market share of the shadow economy,  $x_i$ . It is appropriate to call this *the public goods effect*. Totally differentiating the budget constraint  $dg = d\tau(p_l x_l) + \tau(dp_l x_l + p_l dx_l)$  and inserting the market reactions, we find

$$\frac{dg}{d\tau} = \frac{\frac{1}{1+\tau} \left( p_l x_l - \frac{\tau c_l}{3} \left( x_l + \frac{2(1+\tau)c_l}{g} \right) \right)}{1 - \frac{1}{3} \frac{\tau}{1+\tau} x_l + \frac{\tau}{3} \frac{2\xi + c_l - 2(1+\tau)c_l}{g^2} p_l}.$$

The denominator is always positive because  $\frac{1}{3} \frac{\tau}{(1+\tau)} x_l < 1$ . The sign of numerator is, however, ambiguous. Despite its sign,  $\frac{1/3 - x_i}{g}$  is positive in when shadow economy is small and negative when it is large. The public goods effect therefore generates accelerating or decelerating mechanisms on the expansion of the shadow economy when the tax rate is increased. Those mechanisms depend on the changed possibility of the legal firm to make profit when the tax rate is greater. Consider a small initial shadow economy. A sharp decline in profit  $p_l x_l$  reduces access to public goods, slowing down expansion of the shadow economy. A minor decline in profit, however, makes tax revenue and hence supply of public goods sustainable. Consumers can move to the shadow economy with less concern of what happens to public goods. When the shadow economy has reached more consumers, the sign of  $(1/3 - x_i)$  changes, the accelerating secondary effect disappears and the

profit effect starts to decelerate. Despite such dynamic mechanisms, the economy settles down in an equilibrium with positive tax revenue and positive supply of public goods as long as the profit of the legal firm,  $p_l x_l$ , does not vanish.

From a dynamic perspective, we have the following result: rising tax rate tends to expand the shadow economy through the tax evasion effect. There is an associated public goods effect under the requirement of balanced budget, which accelerates or decelerates the expansion of the shadow economy, depending on the possibility of the legal firm to sustain profitability when the tax rate is raised.

### 3.3 Moral Norms in Control of Illicit Transactions

**Morality as a Group Phenomenon** We now introduce two mechanisms to control illicit transactions. First, we introduce the values of consumers in terms of their moral sentiments. Second, we introduce the cost of holding cash which turns out to operate analogously to the tax on legal transactions.

In addition to their basic willingness to pay, consumers are now assumed also to value self-esteem. Moreover, they are sensitive to social disapproval. In other words, they care much of what they think of themselves and what the other people think of them.<sup>22</sup> The strength of self-esteem effect is measured by parameter  $s > 0$  and it is uniform across people. Only deviants are willing to give it up.

The moral sentiments of, say poor and rich are thus equal and independent of, their incomes. The total marginal utility of consumers buying a legal product is then  $gr^k + s$  and is uniformly distributed over  $[s, g + s]$ . Alternatively, consumers can anonymously visit the illicit market with catching-up probability  $\xi$ . If caught, they suffer from social disapproval cost,  $z > 0$ . The model of the previous section is now extended in that the disapproval is assumed to be expressed by those people who adhere to the social norm of visiting the legal market only. The disapproval effect thereby becomes a group phenomenon, eroding with the contraction of the legal market.<sup>23</sup> In terms of consumer valuation, the legal product thus is valued at  $gr^k$  while the illegal product is valued at  $gr^k - x_l \Delta$ , where  $\Delta$  is the expected social

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<sup>22</sup>Existence of moral sentiments has been well-known in economics ever since Adam Smith (1976) and studied more recently by Frank (1987, 1988). The origin of those sentiments has been traced both to genetic forces in evolutionary biology or to memes, cultural genes, cf. Dawkins (1976).

<sup>23</sup>There is no particular need to introduce any restriction on whether it is the self-esteem or the social disapproval which has greater weight in people's valuation. The model allows for both cases.

punishment,  $\Delta = E[P]$  with

$$P = \begin{cases} z & \text{with probability } \xi \\ 0 & \text{with probability } 1 - \xi. \end{cases}$$

We consider fulfilled expectations equilibrium. We assume further that payments in the illicit market are made by cash. More efficient means of payments dominate in the legal market. There is thus an extra cost of making payments in the illicit market in terms of the cost of holding cash. The cost differential is denoted by  $\gamma > 0$ . It would be possible to interpret the model as a cash-in-advance variety with  $p_i$  measuring the amount of cash demanded.

Consumers  $(k, j)$  visiting the legal and illicit markets then have net utilities,

$$u^k = gr^k + s - (1 + \tau)p_l, \quad v^j = gr^j - x_l z \xi - (1 + \gamma)p_i. \quad (11)$$

In our model, the mass of people will be endogenously distributed into moral and immoral ones in terms of their behavior. In equilibrium people thus differ by their *factual behavior*. Moral (honest) and immoral (dishonest) *behavior* is endogenously determined and so is the strength of the social disapproval effect  $x_l z \xi$ . Morality as social capital is thus determined by the moral network, the expected relative size of the group of people expressing social disapproval in case of detection. The deviants<sup>24</sup> are viewed as those taking the risk of being subject to stigma.<sup>25</sup>

Denote again the marginal consumers by  $(m, n)$  where  $m$  is indifferent between buying the legal and illicit product while  $n$  is indifferent between buying the illicit product and buying none. Thus the marginal utility for any consumer, say  $k$ , for buying the legal product is  $g(1 - k)$ . Then the marginal utility for  $j$  for buying the illicit product is  $g(1 - j) - \xi z x_l$ . For the marginal consumer, her net marginal utilities have to be equal  $g(1 - m) + s - (1 + \tau)p_l = g(1 - m) - \xi z x_l - (1 + \gamma)p_i$ .

The price differential now satisfies  $(1 + \tau)p_l - (1 + \gamma)p_i = s + \xi z x_l$ . Thus, both the self-esteem effect and the group effect of moral sentiments are reflected in the price differential, as the legal producer can exploit them. For the marginal consumer  $n$ , the net utility from buying the illicit product is zero,  $(1 - n)g - \xi z x_l - (1 + \gamma)p_i = 0$ . Noting that the  $n$  is the last buyer, i.e.  $n = x_l + x_i$ , her net utility is  $(1 - x_l - x_i)g - \xi z x_l - (1 + \gamma)p_i = 0$ . The total production thus satisfies  $x_l + x_i = g - \xi z x_l - (1 + \gamma)p_i$ .

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<sup>24</sup>The deviants might value positively other deviants, like members in gangs of sub-cultures. It would be easy to extend the model in this direction but for simplicity, we abstract from it.

<sup>25</sup>The stigma effect has previously been discussed in psychology by Puhl and Brownell (2003) or Schulze and Angermeyer (2003).

Solving for the prices

$$p_i = \frac{(1 - x_l - x_i)g - x_l z \xi}{(1 + \gamma)}, \quad p_l = \frac{(1 - x_l - x_i)g + s}{(1 + \tau)}.$$

**Nash equilibrium** With reaction functions

$$x_l = \frac{g + s - (1 + \tau) c_l - x_i}{2}, \quad x_i = \frac{g - (1 + z \xi) x_l - (1 + \gamma) c_i}{2},$$

we solve for the Nash equilibrium

$$x_l = \frac{2s + g + (1 + \gamma) c_i - 2(1 + \tau) c_l}{3g - z \xi} \quad (12)$$

$$x_i = \frac{(g - z \xi) g - 2g(1 + \gamma) c_i - (g + z \xi)(s - (1 + \tau) c_l)}{(3g - z \xi) g} \quad (13)$$

$$p_l = \frac{(g + 2s + (1 + \gamma) c_i) g + (g - z \xi)(1 + \tau) c_l}{(3g - z \xi)(1 + \tau)} \quad (14)$$

$$p_i = \frac{(g - z \xi)(g + (1 + \gamma) c_i) - (g + z \xi)(s - (1 + \tau) c_l)}{(3g - z \xi)(1 + \gamma)} \quad (15)$$

### 3.4 Competition under Morality

**Comparative Statics** We first develop technically the comparative static effects. Their algebra is subject to condition  $g - \xi z > 0$ . This condition only states the natural requirement that the expected cost of punishment cannot be greater than the maximal willingness to pay. Then, the equilibrium is characterized by the following comparative static results

Table 1 Comparative statics

	$x_l$	$x_i$	$p_l$	$p_i$
$s$	+	-	+	-
$z$	+	-	+	-
$\xi$	+	-	+	-
$\gamma$	+	-	+	$\pm$
$\tau$	-	+	-	+
$c_l$	-	+	+	-
$c_i$	+	-	+	$\pm$

These results are to be discussed below.



**Self-Esteem as Conscience and Social Punishment** Comparative static analysis shows the potentially powerful effects of self-esteem and the risk of being caught when deviating and being punished. Those effects tend to maintain the legal sector large. Evaluating we find  $\partial x_l / \partial s = \frac{2}{3g - z\xi}$ . This is positive as  $3g - \xi z > 0$ . Self-esteem operates like a conscience for an individual, supporting the legal production. The mechanism that the social punishment effect depends on the size of the legal sector is confirmed by the result  $\partial x_l / \partial z = \frac{\xi x_l}{3g - z\xi}$ .

The price effects are non-trivial. This results from that the self-esteem and social disapproval effects tend to be priced not only in the illicit product. Their effect also spills over to the legal market. It is easy to see that the net surplus of the marginal consumer in the legal market is lower when he is subject to self-esteem. Insert the expressions for the quantity and price from above in the surplus of the marginal consumer,  $g(1 - m) + s - (1 + \tau)p_l$  and develop the partial derivative with respect to  $s$ . This suggests that with consumers becoming more moral, they pay a price in terms of reduced surplus. The marginal consumer is now the one who previously was a shadow market visitor. They keep the option of returning to the shadow market. It is easy to see that the greater is the shadow market, the more valuable is this option. Pricing of the shadow market producer, however, reduces this option value.<sup>26</sup>

### 3.5 Laffer Curve

The proponents of the view of government as revenue-maximizing Leviathan which uses resources inefficiently obviously welcome the shadow economy.<sup>27</sup> This section studies the effects of illicit transactions on an economy's Laffer-curve. Suppose that the tax revenue,  $T$ , is only partly allocated to public goods and that the government is able to extract a fraction, say  $0 < y < 1$  for its own use. Then the resources available for financing public goods are

$$g = (1 - y)T.$$

Assume that the government chooses the tax rate  $\tau$  to maximize its tax revenue collected from the sales of the legal firm,  $T = \tau p_l x_l$ . We notice that

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<sup>26</sup>Despite that the equilibrium outcome is characterized by stratification of consumers, the shadow markets do not perform a screening function of people between "honest" and "dishonest" in our model, as all consumers are ex ante identical in terms their preferences for moral sentiments.

<sup>27</sup>Waste of tax revenue may result, for example, from influence or bribes by powerful lobbies leading to inefficient public spending. Grossman (2002) shows that if the technology of predation is sufficiently effective in a society, then having a "king" is better for everyone even though the king maximizes the consumption of a ruling elite.

such a government profile, though a burden on tax paying honest consumers, is not necessarily detrimental to public goods production as an increase in tax revenue means also an increase in the supply of public goods. What matters is the magnitude of the fraction,  $y$ , which the government extracts. We assume that  $y$  is constant. Then maximization of  $(1 - y)T$  is equivalent to maximizing  $T$ . Kanninen and Pääkkönen (2004) have shown that with low (positive) tax rates, tax revenue  $T = \tau p_l x_l$  (Laffer curve) is increasing in the tax rate. They also prove that the legal sector disappears at a certain tax rate and that the Laffer curve has a unique maximum.

Production of public goods have conflicting effects on the size of the legal sector. The positive effect rises if people understand that tax payments are the precondition on availability of public goods. The negative effect, however, arises from people's understanding that the government will spend part of tax revenue to satisfy the demands by powerful lobby and interest groups. It is the latter effect which in addition to the free-riding incentive tends to lead to expansion of the shadow economy. We let empirical data judge which of the two effects is the dominating one.

## 4 Econometric Analysis

### 4.1 Method

Causal models which incorporate latent variables have been utilized in estimating the size of the shadow economy by Aigner, Schneider and Ghosh (1988), Giles (1999a,1999b) and Schneider (2000). The latent variables are not directly observable, but have operational implications for relationships among observable variables. The observable variables appear as causes of the latent variables as well as indicators of latent variables. In this paper, we apply MIMIC (multiple indicators, multiple causes) method, a variant of the LISREL models, introduced originally by Zellner (1970) and Jöreskog and Goldberger (1975).

Suppose all variables are measured around their respective population means. It is assumed that the latent variable  $y^*$  is determined by a set of observable exogenous causes  $x_1, \dots, x_k$  and a disturbance  $\epsilon$

$$y^* = \alpha_1 x_1 + \alpha_2 x_2 + \dots + \alpha_k x_k + \epsilon.$$

The latent variable, on the other hand, with disturbances  $u_1, \dots, u_m$  determines the set of observable indicators  $y_1, \dots, y_m$

$$y_1 = \beta_1 y^* + u_1, \dots, y_m = \beta_m y^* + u_m.$$

In vector-form

$$y^* = \alpha'x + \epsilon, \quad (16)$$

$$y = \beta y^* + u, \quad (17)$$

with  $E[\epsilon u'] = 0'$ ,  $E(\epsilon^2) = \sigma^2$  and  $E(u u') = \Theta^2$ .

Substituting (16) to (17) the reduced-form relation is

$$y = \beta(\alpha'x + \epsilon) + u = \Pi'x + v,$$

where the reduced-form coefficient matrix is

$$\Pi = \alpha\beta',$$

and the reduced-form disturbance vector,

$$v = \beta\epsilon + u,$$

has covariance matrix

$$= E(vv') = \sigma^2\beta\beta' + \Theta^2.$$

Estimation of structural parameters is obtained through maximum likelihood, making use of the restrictions implied in both the coefficient matrix  $\Pi$  and the covariance matrix of the error term  $\nu$ . The idea of MIMIC model is that the latent variable accounts completely for the correlations of the indicators. Once the effects of the causal variables  $x$  and the disturbance of  $\epsilon$  on each of the indicators are removed, there is no correlation among indicators. A MIMIC model thus uses observable data on causal variables and data on observable indicator variables to predict the values for an unobservable (latent) variable, the size of the shadow economy relative to the size of the measured GDP.

## 4.2 Hypotheses and Data

The theoretical section suggests that the development and the size of the shadow markets are linked to the following mechanisms and variables:

1. Tax rates

The higher the share of direct and indirect taxation is, the higher is the shadow economy. We also suggest: The higher the share of social security contributions is, the higher is the shadow economy.

## 2. State regulation/intervention

The higher the state regulation (measured in share of public administrative employment in % of total employment) is, the higher is the shadow economy.

## 3. Tax morale

The higher the tax morale is, the lower is the shadow economy. The tax moral variable is based on data from the 1990 World Values Survey (WVS) and the 1999 European Values Survey (EVS). The World Values Survey is a worldwide investigation of socio-cultural and political change, based on representative national samples. It was first carried out in 1981-83, and subsequently in 1990-91, 1995-96 and 1999-2001. To assess the level of tax morale in the WVS and the EVS, we use the following question: "Please tell me for each of the following statements whether you think it can always be justified, never be justified, or something in between: *Cheating on tax if you have the chance*". The question leads to a ten-scale index of tax morale with the two extreme points "never justified" and "always justified". In our case, the natural cut-off point is at the value 1 on this scale index, if a high amount of respondents assert that the cheating on tax is "never justifiable". Then, our tax morale variable takes the value 0 if the respondent says that cheating on tax is "never justified", and 1 otherwise.

## 4. Public goods and state transfers

The higher the state transfers and/or public goods and the better the quality of these goods and transfers are, the lower is the shadow economy.

## 5. Status of the economy

The worse the economy is, the greater is the shadow economy. This is measured here in unemployment with the hypothesis: The higher the unemployment is, the higher is the shadow economy. Another variable is GDP per capita with the hypothesis: The higher the GDP per capita, the lower the shadow economy.

## 6. Payment habits

The higher the share of cash payments the higher is the shadow economy.

These 6 hypotheses will be tested with the help of an econometric analysis in order to explain the size and development of the shadow economy of 21

industrialized OECD countries. In Table 2, the econometric estimation using the MIMIC approach (latent estimation approach) is presented for the 21 industrialized and developed OECD countries for which we have data for four points of time: 1990/91, 1994/95, 1997/98 and 1999/2000. As cause variables we have the following ones:

- share of direct taxation (positive sign expected),
- share of indirect taxation (positive sign expected),
- share of social security contribution (positive sign expected),
- burden of state regulation, share of public administrative employment relative total employment (positive sign expected),
- tax morale (positive sign expected ),
- state transfers, per capita (negative sign expected),
- unemployment quota (positive sign expected),
- GDP per capita (negative sign expected).

As indicator variables we have the following ones:

- employment quota, share of of population 18-64 (negative sign expected),
- average working time per week (negative sign expected),
- annual rate of GDP, adjusted for the mean of all 21 OECD countries (negative sign expected),
- change of currency per capita (positive sign expected).

### 4.3 Estimation Results

To report our estimation results, we first discuss the diagnostics from table 3. The overall fit of the model is tested using several statistics. Steiger's (1990) test-statistics (RMSEA test of fit) obtains the value 0.004.  $RMSEA \leq 0.05$  is typically considered "close fit", Steiger (1990), Brown and Cudeck (1993). The value of the Chi Square statistic is 8.46 which is sufficiently small. The p-value for multivariate normality is quite low. However, the AGFI-value, 0.739, is quite large.

Table 2: MIMIC Estimation of the Shadow Economy. Data: 21 developed OECD Countries, 1990/91, 1994/95, 1997/98, 1999/2000 and 2001/02.

Cause Variables	Estimated	Coefficients
Share of direct taxation (in % of GDP)	$\alpha_1 =$	0.410** (3.41)
Share of indirect taxation (in % of GDP)	$\alpha_2 =$	0.213* (1.92)
Share of social security contribution (in % of GDP)	$\alpha_3 =$	0.523** (4.59)
Burden of state regulation (share of public administrative employment in % of total employment)	$\alpha_4 =$	0.203* (1.84)
Tax morale	$\alpha_5 =$	0.614** (4.06)
State transfers (per capita)	$\alpha_6 =$	-0.189* (-1.85)
Unemployment quota	$\alpha_7 =$	0.399** (3.41)
GDP per capita	$\alpha_8 =$	-0.134** (-3.64)
Indicator Variables	Estimated	Coefficients
Employment quota (in % of population 18-64)	$\beta_9 =$	-0.713** (-3.49)
Average working time (per week)	$\beta_{10} =$	1.00 (Residuum)
Annual rate of GDP (adjusted for the mean of all 22 OECD countries)	$\beta_{11} =$	-0.345** (-3.513)
Rate of change of currency per capita	$\beta_{11} =$	0.384** (4.71)

Note: t-statistics are given in parentheses; a t-statistic significant at 1 % level denoted by \*\*, significant at 5 % level denoted by \*. One-sided t-test is used.

The estimated coefficients of all seven cause variables are statistically significant and have the theoretically expected signs. We notice that unlike the situation in a conventional regression model, the values of the estimated coefficients can be compared in relative terms because of the normalization that has been introduced (coefficient of the average working time  $\beta_{10} = -1.00$ .) The estimated coefficients of the tax and social security burden variables are not only significant but taken together, they are quantitatively the most important ones. In the relative importance, they are followed by the tax morale

variable which has a quite large coefficient. The state regulation variable also obtains a significant coefficient estimate. The transfer variable obtains a negative coefficient. It may allow for an interpretation that tax moral is a normal good, becoming stronger if people are taken care of. This can also allow for an interpretation that people understand that part of of taxes they pay result in supply of public goods or income transfers to them. The positive and large coefficient of the social security variable, however, makes this interpretation somewhat shaky. People do not seem to appreciate the benefit linked to their contributions. Such an interpretation may, in turn, be possible in the light of demographic development which makes people uncertain as to whether their future consumption will be protected by the future pensions.

The results suggest the tax payers' attitude towards the state institutions and governments tax policies is quite important in determining whether one is engaged in shadow economy activities, or not. Also the shape of the official economy measured in unemployment and GDP per capita have an important influence on the size and development of the shadow economy of these 21 OECD countries. Turning to the four indicator variables, they all have a statistically significant influence and the estimated coefficients have the theoretically expected signs. The quantitatively most important are the unemployment quota and the rate of change of currency per capita.

Table 3: MIMIC model: diagnostic tests<sup>28</sup>

Test-statistics	
RMSEA <sup>1)</sup> = 0.004	TMNCV <sup>3)</sup> = 0.043
(p-value = 0.9412)	AGFI <sup>4)</sup> = 0.739
Chi-square <sup>2)</sup> = 8.46	N <sup>5)</sup> = 105
(p-value = 0.903)	D.F. <sup>6)</sup> = 65

For the calculation of the size and the evolution of the shadow economy for the 21 OECD countries, a combination of the MIMIC method with a currency

<sup>28</sup>Notes: 1) Steiger's (1990) Root Mean Square Error of Approximation (RMSEA) test of fit. RMSEA-value varies between 0.0 and 1.0. RMSEA < 0.05 means close fit.

2) The Chi Square statistic in Table 3 tests the specification of the MIMIC model against the alternative that the covariance matrix of the observed variables is unconstrained (see Jöreskog and Sörbom (1993) and Giles (1999b)).

3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-value of skewness and kurtosis, cf. Mardia (1970).

4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 to 1. Good fit is suggested if AGFI is close to 1.

5) Number of observations.

6) The degrees of freedom are determined by  $0.5 \cdot (p + q)(p + q + 1) - t$ ; with  $p$  = number of indicators;  $q$  = number of causes;  $t$  = the number of free parameters.

demand method is used. The results are presented in Table 4 for 1989/90, 1994/95, 1997/98, 1999/2000, 2001/02, and 2002/03. Considering the latest period 2002/03, Greece is the country with the largest shadow economy, amounting to 28.3% of official GDP. It is followed by Italy with 26.2% and Portugal and Spain with 22.3% share. The middle class includes important central European economies like Germany (16.8%), France (14.8%) and the Nordic welfare states, Sweden (18.7%), Norway (18.7 %), Finland (17.6 %) and Denmark (17.5 %). In the lower end are the USA (8.6 %), Switzerland (9.5 %), Austria (10.8 %) and Japan (11.0 %).

As another result, we find a dramatic increase of shadow economies during the 90s throughout the OECD countries in our sample. On the average, the shadow economy was 13.2% in these countries in 1989/90, rising to 16.8% towards 1999/2000. This development is consistent with the view that rising tax burden intensifies incentives to participate in underground activities. Considering the results on the turnover of the millennium 2000, we realize that for the majority of the OECD countries, the shadow economy is no more increasing but slightly decreasing. This development can be linked to intensified tax competition, limiting the expansion of the public sectors and reducing the (total) tax rates in those countries. The only exceptions in our sample are the German speaking economies, Germany, Austria and Switzerland where the size of the shadow economy has continued to increase, converging towards the mean of the sample.



Table 4: The Size of the Shadow Economy in OECD Countries

OECD-Countries	Size of the Shadow Economy (in % of GDP) using the Currency Demand and MIMIC Method					
	Average 1989/90	Average 1994/95	Average 1997/98	Average 1999/2000	Average 2001/02 <sup>1)</sup>	Average 2002/03 <sup>1)</sup>
<b>Countries with Large Shadow Economies</b>						
1. Greece	22.6	28.6	29.0	28.7	28.5	28.3
2. Italy	22.8	26.0	27.3	27.1	27.0	26.2
3. Portugal	15.9	22.1	23.0	22.6	22.4	22.2
4. Spain <sup>2)</sup>	16.1	22.4	23.3	22.8	22.6	22.4
<b>Countries with Medium Sized Shadow Economies</b>						
5. Australia	10.1	13.5	14.0	14.3	14.1	13.8
6. Belgium	19.3	21.5	22.5	22.2	22.0	21.5
7. Canada	12.8	14.8	16.2	16.0	15.8	15.4
8. Denmark	10.8	17.8	18.3	18.0	17.9	17.5
9. Germany	11.8	13.5	14.9	16.0	16.3	16.8
10. Finland	13.4	18.2	18.9	18.1	18.0	17.6
11. France	9.0	14.5	14.9	15.2	15.0	14.8
12. Great Britain	9.6	12.5	13.0	12.7	12.5	12.3
13. Ireland	11.0	15.4	16.2	15.9	15.7	15.5
14. Netherlands	11.9	13.7	13.5	13.1	13.0	12.8
15. New Zealand <sup>3)</sup>	9.2	11.3	11.9	12.8	12.6	12.4
16. Norway	14.8	18.2	19.6	19.1	19.0	18.7
17. Sweden	15.8	19.5	19.9	19.2	19.1	18.7
<b>Countries with Small Shadow Economies</b>						
18. Austria	6.9	8.6	9.0	9.8	10.6	10.8
19. Japan	8.8	10.6	11.1	11.2	11.1	11.0
20. Switzerland	6.7	7.8	8.1	8.6	9.4	9.5
21. USA	6.7	8.8	8.9	8.7	8.7	8.6
<b>Unweighted average over 21 OECD countries</b>	<b>13.2</b>	<b>15.7</b>	<b>16.7</b>	<b>16.8</b>	<b>16.7</b>	<b>16.4</b>

Sources: Own calculations

1) Preliminary values.

2) The figures are calculated using the MIMIC-method and currency demand approach. Source: Giles (1999b); values for 1999/2000, 2001/2002 and 2002/2003 own calculations.

3) The figures have been calculated for 1989/90, 1994/95 and 1997/98 from Mauleon (1998) and for the later periods own calculations.

## 5 Final Remarks

The econometric results provide support for the proposed causes for shadow economies. Taxation and social security variables were found to be significant. As a policy implication, this finding suggests that an increase in the size of the public sector with high tax burden has side-effects: hidden economy expands. Such an implication provides support for the view that by controlling tax burden, tax competition also provides brakes for shadow economies while the tax harmonization may have the opposite effect. The econometric success with the tax moral variable in control of the shadow economy points to the importance of social capital in the society. It appears also important to make sure that the public is informed of the link between the benefits associated with their contribution. In terms of our theoretical model, the state of the official economy is reflected in the willingness to pay function. Such effects are captured by the unemployment variable and the GDP per capita variable which both turned out to be significant. As to employment promoting policies, the social benefits may thus be greater than often thought. The significant negative coefficient of the state transfer variable points to the possibility that the transfers might operate like a bribe on people, persuading them out of the shadow economy.

The limits to shadow economy are sensitive to economic performance of an economy. We indeed observe a rather substantial increase of the estimated size of the shadow economy in the 90s in all countries included in data. Our estimation results with the MIMIC approach allow us to link this development to the rising total tax rate in the OECD economies. There is, however, substantial cross-country variation in the development of the shadow economies over time. Our estimates suggest that the shadow economy has started to shrink somewhat in the late 1990s up to 2003 in most countries included in our sample. This is again consistent with our model and the fact that the total tax rate, for example in the EU-area, has started on the average to decline as tax policies have adjusted to intensified tax competition. Only in small sub-set of our sample, i.e. Germany, Austria and Switzerland, the shadow economy has expanded also over the past years. This findings can perhaps best be explained in terms of highly regulated labor markets and the overall tax burden in those economies which has remained high. Via this development, the share of their shadow economies is approaching the OECD average.

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