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## Abstract

In this paper, we argue that shadow activities and different levels of marketization of household production systematically distort international comparisons of aggregate gross household saving rates (HSRs): Higher shares of hidden income increase observed HSRs. Panel data for 18 (24) OECD-countries covering a period of a decade show that gross HSRs are positively related to the degree of corruption (used as a proxy for the propensity to shift economic activities into the shadow) and to the share of income from property and self employment. At the same time, gross HSRs are negatively related to the female employment rate, the ratio of indirect taxes to direct taxes, and to the tax wedge. One plausible story behind these phenomena might be that unobserved consumption and wages in the shadow labor market induce an upward bias in observed HSRs and profit shares, while the price level effects of a higher share of indirect taxes and a ‘welfare state’ effect lower observed HSRs.

JEL-Classification: E01, E21, O17

Keywords: National Accounts, Saving Rate, Hidden Income, Shadow Economy, Corruption, Dynamic Panels

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# 1 Introduction<sup>1</sup>

Huge and systematic differences in aggregate household saving rates between different countries tend to persist over considerable periods of time. This raises the question of whether these differences are a mere statistical ‘artifact’, or whether behavioral or institutional differences can be identified. This paper argues - basically (albeit not exclusively) - in favor of the first hypothesis: Observed household saving rates still seem to be distorted by ‘non-observable’ income components, in spite of the ambitious attempts to measure GDP and income according to the concept of ‘exhaustiveness’ (*OECD, 2002*). It is clear that such a distortion, if present, might also be relevant to some of the conclusions drawn from the existing literature about determinants of private and/or national saving (*Loyaza et al., 2000; Edwards, 1996; Masson, Bayoumi and Samiei, 1995; Swaleheen, 2007*).

## 2 The macro perspective

As is well known, international comparisons of household saving rates (*Ross, 2004*) at the macro level are minefields of statistical distortions. Some are related to conceptual and definitional divergences between national accounting practices, which - in principle - it should be possible to overcome.

For example, consumption of fixed capital by households is difficult to estimate, and the treatment of private and public pension schemes and of non-profit

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<sup>1</sup>For helpful comments we are grateful to participants of the conference ‘Shadow 2009’ in Münster.

organizations differs. The relative shares of tax-financed public expenditure on health and education (individual public consumption), the relative shares of direct versus indirect taxation, the borderline between corporate savings and household savings - all these conceptual issues matter in this context.<sup>2</sup>

One frequently neglected conceptual problem is related to human capital investment: In highly developed economies, human capital intensity might induce a downward bias in observed saving ratios. Other problems are more difficult to solve than purely conceptual distortions, as they are linked to ‘unobservable variables’, e.g. the different shares of household production for own use and the size of the shadow and underground economy.

Let us take a brief look at the root of some of the measurement problems associated with unobserved income by writing down familiar simplified identities.<sup>3</sup> Household-related terms are indexed by  $h$ , government-related terms by  $g$ , disposable income by  $d$ , and the disposable income of households adjusted for individual government consumption by  $hdj$ . Corporate disposable income (=corporate saving) is indexed by  $c$ . The capital  $T$  indicates taxes (net of transfers or subsidies). For the sake of simplicity, let us ignore potential differences between GDP, GNI and disposable national income, which is the sum of disposable income of households ( $Y_{hd}$ ), of the government ( $Y_{gd}$ ), and of corporations ( $Y_{cd}$ ). Investment,  $I$ , includes private plus government gross investment expen-

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<sup>2</sup>However, by correcting saving rates for some of those definitional distortions, *Ross (2004)* has shown that existing differences between US, Europe and Japan become even larger.

<sup>3</sup>In the following, we focus on the logical relationships between measurement errors in the case of expenditure categories and household saving rates, regularly derived as a ‘residual’, not on the many practical pitfalls (double-counting, coverage, representation) associated with the use of different measurement approaches (production approach, income approach and expenditure approach). See also OECD (2002, 2006).

diture. Aggregate saving (gross) is defined as the sum of aggregate household saving,  $S_h$ , corporate saving,  $S_c (= Y_{cd})$ , and government saving,  $S_g$ .

$$Y = C_h + I + C_g + X - M \quad (1)$$

$$Y = Y_{hd} + Y_{gd} + Y_{cd} \quad (2)$$

$$C_g = C_g^{\text{coll}} + C_g^{\text{indiv}} \quad (3)$$

$$Y_{hd} = Y - Y_{cd} - (T_{\text{ind}} + T_{\text{dir}}) \quad (4)$$

$$s_h = \frac{Y_{hd} - C_h}{Y_{hd}} = \frac{S_h}{Y_{hd}} \quad (5)$$

$$Y_{hdj} = Y_{hd} + C_g^{\text{indiv}} \quad (6)$$

$$s_{hdj} = \frac{Y_{hdj} - (C_h + C_g^{\text{indiv}})}{Y_{hdj}} = \frac{Y_{hd} - C_h}{Y_{hd} + C_g^{\text{indiv}}} \quad (7)$$

$$S_g = T_{\text{ind}} + T_{\text{dir}} - C_g^{\text{coll}} - C_g^{\text{indiv}} \quad (8)$$

$$S_h + S_g + S_c = I + X - M \quad (9)$$

As countries differ substantially in the extent to which they finance individual consumption via taxes, only adjusted disposable saving rates,  $s_{hdj}$ , can be compared in a meaningful way (7). It is obvious from (7) and (5) that ceteris paribus unadjusted saving rates,  $s_h$ , are higher in countries with higher shares of tax-financed expenditures for health or educational purposes. Note also that the structure of taxation might be of some relevance. Observed household saving rates will be lower in countries with higher indirect taxation relative to direct taxation.<sup>4</sup>

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<sup>4</sup>This downward distortion does depend upon specific assumptions with respect to tax incidence: The indirect tax must be shifted forward (at least partly).

Unfortunately, as the ‘true’ aggregates can never be observed perfectly, there will always be unobserved components. Because the sum of observed and unobserved components (indexed below with  $o$  and  $uo$ ) must be equal to the ‘true’ aggregates, the identities shown above must also hold separately for unobserved and observed components.

For the specific question raised, namely whether observed adjusted **household** saving rates,  $s_{hdj,o}$ , are distorted by the unobservable adjusted **disposable** income of households, a broad definition of the unobservable economy (in line with the *OECD (2002)* recommendations, which includes household production for own use, the ‘underground economy’ and the ‘informal economy’) might be better suited than a narrower one. Furthermore, even income from some illegal ‘productive’ activities (e.g. smuggling of cigarettes and drugs, illegal gambling etc., excluding pure redistributive activities) that circumvent government regulation, taxation or observation should also be included in the present context.

The following equations, which are true by definition, will be useful in clarifying certain relationships. The implicit definitional relationship between the ‘true’ adjusted household saving rate ( $s_{hdj}$ ) and the observed adjusted household saving rate ( $s_{hdj,o}$ ) is

$$s_{hdj,o} = \frac{S_{hdj} - S_{hdj,uo}}{Y_{hdj,o}} \quad (10)$$

$$s_{hdj,o} = \frac{S_{hdj}/Y_{hdj}}{Y_{hdj,o}/Y_{hdj}} - \frac{S_{hdj,uo}}{Y_{hdj,o}} \quad (11)$$

$$s_{hdj,o} = s_{hdj} \left(1 + \frac{Y_{hdj,uo}}{Y_{hdj,o}}\right) - \frac{S_{hdj,uo}}{Y_{hdj,o}} \quad (12)$$

Equation (12) will be used as the logical frame of reference for our discussion below.

In the following, let us assume that two countries,  $i$  and  $j$ , are identical in every respect and all components of final demand and income are correctly observed.

## 2.1 Marketization of household services

To refer to a famous example first given by Sir John Hicks, let us assume that someone marries her cook in country  $i$ . Observed production, the adjusted disposable income of households and consumption are reduced by the same amount. As  $S_{hdj,uo} = 0$  and  $Y_{hdj,uo} > 0$ , equation (12) implies  $s_{hdj,o} > s_{hdj}$ . Observed adjusted household saving rates will be distorted upwards in country  $i$ . If the overall tax burden remains unchanged, this is the end of the story. If direct taxes formerly paid by the cook turn into additional disposable income for the household, the upward bias might be even larger.<sup>5</sup>

The inverse process - marketization of household production - obviously lowers the observed household saving rate. Note that former household production (e.g. care for elderly, childcare) might also shift to the public sector, where it would be measured as an increment of non-market production (= 'individual public consumption'). One might call such a process the 'socialization of household production'. Using adjusted income and saving might eliminate at least part of this particular distortion.

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<sup>5</sup>Data provided by Eustat (2004) or by the OECD (1997) show that shares of household production relative to GDP are relatively high (average 38 % of GDP).



## 2.2 Shadow activities

Whether certain trades can be more or less easily concealed in tax audits and/or national accounting depends upon their specific characteristics, in particular upon the expected transaction costs (including all types of legal risks) associated with such a strategy.<sup>6</sup>

### 2.2.1 Unobserved household consumption

On the one hand, small-scale services consumed by households (restaurant- and hotel services, medical and counseling services, educational and other personal services, handicraft and art activities, etc.) seem to fit into shadow activities more easily than large-scale investment or industrial production in general. On the other hand, one has to acknowledge that industrial transfer pricing practices linked to exports and imports might also be a source of significant distortions (see below for a detailed discussion).

At the small-scale level, shadow activities will be found in lines of business, where the share of value added relative to intermediate consumption is large and potential gains from tax evasion can be distributed within a small coalition of trading partners. Statistics are clearly aware of that problem and regularly try to correct official estimates of GDP by measuring the non-observed economy according to the guidelines of the OECD (2002). The decisive question is therefore whether those guidelines are sufficient and whether they are applied

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<sup>6</sup>Compare, for instance, Feige (1997, 1998), Schneider (1994a, 2003), Frey and Weck-Hahnemann (1984).

consistently across countries.

One might expect that with regard to the measurement of household saving rates, the bulk of unobserved activities ignored by official estimates will be linked to household consumption and should be concentrated in small-scale activities, which lower  $C_{hdj,o}$  and  $Y_{hdj,o}$  by similar absolute amounts, thereby definitely increasing observed aggregate household saving rates.

Besides private consumption, however, alternative entry points for ‘shadow distortions’ do exist.

### **2.2.2 Unobserved taxes and public consumption**

Unobserved taxes exist where public officials or civil servants demand payments for services above what they are legally entitled to receive. One example is the health care sector, where certain services (e.g. in Southern European countries) are ‘marketed’ in a more or less corrupt way and patients with obligatory state insurance are often ‘expected’ to pay an additional private fee, although such payments are officially prohibited. Other types of public services (education, public security) might suffer from similar distortions. Because the additional fees are ‘necessary’ to obtain services of adequate quality, unobserved tax revenues are equivalent to unobserved individual public consumption ( $T_{uo} = C_{g,uo}^{indiv}$ ). The observed adjusted disposable income,  $Y_{hdj,o}$ , corrected for these unobserved components will remain unchanged. The unadjusted disposable income of households, however, will be lower. Therefore, the absolute amount of household saving will also be lower. We may conclude that household saving rates will be

distorted upwards by such unobserved ‘productive’ corruption.

On the other hand, unobserved taxes might be pure redistribution via ‘black-mail’. Pure redistribution implies only redistribution within the household sector and does not (systematically) distort aggregate household saving rates.

### 2.2.3 Unobserved investment

Measured investment is distorted by many factors (Kirova and Lipsey, 1998), probably inducing an underestimation of investment expenditures, at least in general.

First, there is the well-known problem of physical versus human capital. It seems to be plausible that human capital accumulation becomes more important in richer countries. Such investments, however, are conventionally treated as public or private consumption outlays, creating a downward bias in observed investment (and saving) in highly developed countries, which implies that  $I > I_o$  and therefore  $S_{h,uo} = I_{uo} > 0$ . In European countries, expenditures for software are treated as intermediate consumption in contrast to the practice in the US), resulting in underestimates of investment and saving. Underestimation ( $I_{uo} > 0$ ) might also be the result of private construction activities trying to avoid taxes or building regulations, or because production is completely illegal. As  $I_{uo} > 0$ , unobserved household saving rates will be positive and the observed saving rate will be biased downwards. Because the imputed rents of owner-occupied housing and the corresponding consumption and income components will also be underestimated, this bias is somewhat mitigated.

#### 2.2.4 Unobserved current account deficit/surplus

If imports become partly unobserved due to the smuggling of household consumption goods (cigarettes, drugs, counterfeit branded articles, etc.), then  $M_o < M$ . Therefore, observed adjusted household saving and income are also larger than true saving and income ( $S_{hdj,uo} = Y_{hdj,uo} = -M_{uo} < 0$ ). This implies *ceteris paribus* that observed saving rates are biased upwards by unobserved imports. Unobserved imports due to smuggling might be of some relevance in Italy or Greece with their long EU borders, coast-lines and high levels of corruption.

Entrepreneurs might also shift profits to foreign countries via exaggerated license fees, which would imply a negative value for  $M_{uo}$ , as  $M_o > M$ . Therefore  $S_{hdj,uo} + S_{c,uo} = -M_{uo} > 0$ . Observed household/corporate saving rates are biased downwards if profits are shifted across borders. It seems plausible that the measurement error falls primarily, but not exclusively, on corporate savings. Such effects might be of some relevance in Scandinavia, which is virtually free of corruption. Small high-tax countries, where the shares of exports and imports are larger by definition, will obviously be more vulnerable to this type of distortion.

Similarly, profits might be shifted to foreign subsidiaries by means of lower transfer prices for exports, implying  $X_{uo} > 0$ . Observed (household + corporate) savings (and saving rates) will be biased downwards in high-tax countries (like those in Scandinavia). Conversely, a corresponding upward bias exists in some low-tax country (e.g. Switzerland, Ireland?).

The opposite case,  $X_o > X$ , refers to ‘fictitious’ exports ( $S_{hdj,uo} + S_{c,uo} = X_{uo} < 0$ ). Such exports might be induced by export subsidies or for tax reasons, probably implying ( $S_{hdj,o} > S_{hdj}$ ) and an upward bias in observed adjusted household saving rates. Value-added tax fraud across borders might also contribute to this type of distortion.

### 2.2.5 Shadow activities and profit shares

A decisive question with respect to the relationship between profit shares and shadow activities is whether it is easier to hide revenues or shadow inputs. If a large shadow labor market exists and revenues are more difficult to hide, it seems to be reasonable to expect that observed profit shares would be distorted upwards.<sup>7</sup>

On the other hand, one has to acknowledge that there are many other reasons why higher profit shares might be related to higher household saving rates regardless of shadow activities. In some countries (like Italy), small business firms (and high shares of self-employment) are still a widespread phenomenon, while in other countries (e.g. in Scandinavia) the bulk of profits comes from large corporate firms. It is clear that self-employed subjects have sound economic reasons (retirement, precautionary savings) to raise - *ceteris paribus* - their ‘true’ saving rates above the level common among employees.

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<sup>7</sup>Imagine a construction contract between a principal and an agent where the terms of delivery are fixed (and transparent to fiscal authorities), while the agent employs small-scale subcontractors from the shadow labor market to increase his/her profits.

### 3 Preliminary evidence

Fig. 1 illustrates the relationship between mean gross household saving rates (OECD Annual National Accounts 1995-2006) and mean levels of corruption, defined as ten minus the corruption perception index (Transparency International 1995-2006) for those 18 OECD countries where balanced data were available. (In the econometric estimates below, the ‘unbalanced’ countries of Spain, Ireland, the Czech Republic, Hungary, Poland, and Slovakia are added to our sample.) The corruption level is interpreted as a soft proxy for the country-specific attitudes with regard to law-abiding behavior, and therefore also as a proxy for the tendency to shift economic activities into the shadow.

Gross adjusted household saving is defined as the adjusted net saving of households plus consumption of fixed capital. The ‘change in equities of pension funds’ is excluded from household saving, as this adjustment is still not applied uniformly across OECD countries. The gross adjusted disposable income of households is defined as gross disposable income plus individual public consumption, in order to take account of various levels of tax-financed individual consumption acting as a substitute for private consumption.

There seems to be a remarkably strong positive correlation ( $R = +0.808$ ) between mean gross adjusted household saving rates and the level of corruption.

Let us look for some other indications that saving rates might be biased upwards by unobservable income components. Fig. 2 shows the relationship between female employment rates and saving rates for the same countries as above.

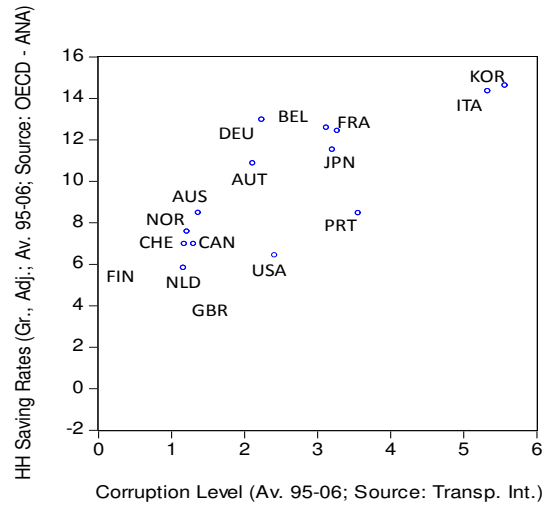


Figure 1: Corruption and gross adjusted household saving rates

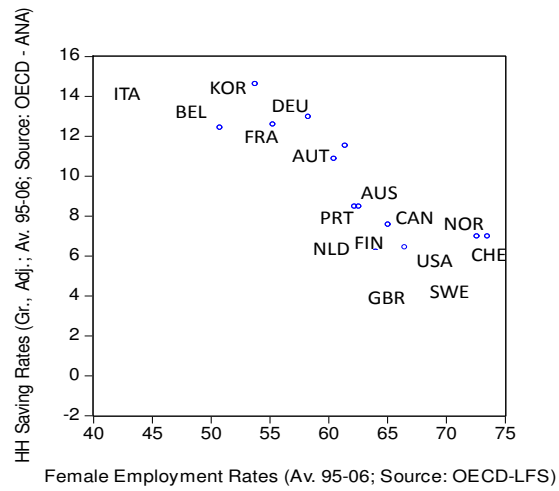


Figure 2: Female employment rates and gross adjusted household saving rates

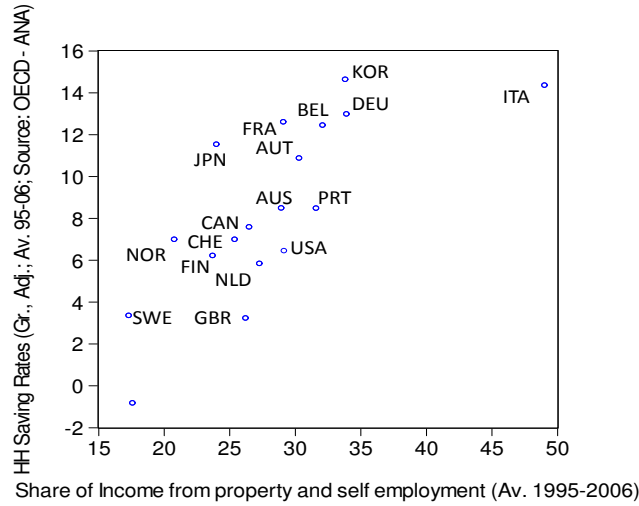


Figure 3: Profit shares and gross adjusted household saving rates

Fig. 3 reveals a similarly close correlation between mean profit shares and gross adjusted household saving rates.

Note that the share of income from property and self-employment varies considerably across countries. At least part of this variation might be a statistical ‘artifact’ caused by the existence of a black labor market. However, let us bear in mind that our concept of ‘shadow activities’ is somewhat broader than usual.

**These scatter plots seem to support the following simple story: Higher levels of corruption are associated with more intense shadow activities, which in turn imply lower levels of ‘visible’ (female) employment and (due to ‘black market’ labor income) higher ‘visible’ shares of profit income.**



Let us now look at further anecdotal evidence and some cross-sectional econometrics.

## 4 Empirical analysis

Household saving rates for 24 developed countries were calculated using the Annual National Accounts (detailed tables). Although various other definitions were also tested, the gross adjusted household saving rate was the preferred one.

The explanatory variables used on the r.h.s. are as follows:

- The Corruption Perception Index as published by Transparency International and adjusted for sampling deficiencies by Lambsdorff (2005) was transformed into an index of corruption ( $corr=10-cpi$ ). This variable was used as an (admittedly ‘soft’) proxy for the general ‘moral’ propensity to accept tax evasion and shadow activities as a ‘way of life’.<sup>8</sup> We expect this variable to be positively related to HSR.
- The female employment rates ( $fem\_rate$ ) based on OECD Labor Force Statistics are used as a proxy for the marketization of household production. We expect this rate to be negatively related to HSR.
- Differences in levels and cyclical shifts of the income distribution (e.g.

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<sup>8</sup>Data for the share of shadow activities provided by Schneider, F. et al. (2006) will not be used for the following reasons: Their shares of the shadow economy in virtually corruption free Scandinavia are approximately as high as the figures for corruption-ridden Slovakia. Given the culture of transparency for tax declarations and the general moral conduct with regard to public affairs in Scandinavia, these results are extremely implausible. Our skepticism gains some support from Renoy, P., Ivarsson, St., van der Wusten-Gritsay, O. & Meijer, E. (2004), who shed severe doubt on the suggested high levels of shadow activities in Scandinavia. See also the methodological criticism raised by Thomas (1999).

increases in the share of income from property and self-employment) will surely be an independent cause - unrelated to measurement distortions - behind cross-sectional differences in levels and changes of the HSR. As the variable *profit\_share* (source: ANA tables) might capture some of the variation related to shadow activities, the expected positive relationship between *corr* or  $\Delta corr$  and the household saving rate will probably be biased downwards.

- The ratio of indirect taxes relative to the sum of indirect and direct taxes on income and wealth, *tind\_share* (source: ANA tables), is postulated to be negatively related to adjusted household saving rates. Behind this hypothesis, an implicit incidence assumption has to be made: indirect taxes are shifted forward. Increasing indirect and lowering direct taxation by compensating amounts raises consumption expenditures and disposable income (approximately) *pari passu*.
- In modern welfare states, at least part of household saving is ‘socialized’ via social security. Social security contributions might be seen by households as a (partial) substitute for voluntary precautionary savings. Therefore, we expect that a higher ‘tax wedge’ (*tax\_wedge*), measured as the ratio of direct taxes on income and wealth plus transfers paid by households relative to the unadjusted disposable income of households, should be negatively related to household saving rates.
- To control for the business cycle effects, we add the current and lagged

values of the GDP-gap ( $= gap$ ) as a further explanatory variable for the HSR.

Specific data limitations and econometric problems exist:

The cross-sectional sample for which balanced OECD data (Annual National Accounts) on household saving rates exist is small (18 countries). As the *cpi* is only available from 1995 to 2005, we have to make do with a decade of data points. The relationships were also tested, however, for an extended, unbalanced sample of 24 OECD countries.

In Section 3, we presented some preliminary evidence for our hypotheses. Those figures demonstrated the correlation between the saving rate and the corruption index, the female employment rates and the profit shares. Table 1 shows the underlying regression results for these scatter plots.

Main Variables	Coefficient	t-Value
<i>corr</i>	2.22	5.48
<i>fem_rate</i>	-0.40	-4.91
<i>profit_share</i>	0.44	4.58
<i>tax_wedge</i>	-0.12	-2.31
<i>tind_share</i>	3.56	2.47

Table 1: Simple regression coefficients and t-values for regressions of the mean of gross household saving rates to the means of the corruption index, the female employment, the profit share, the tax wedge and the share of indirect

taxes.<sup>9</sup>

With the exception of *tind\_share*, all correlations show the expected sign and are highly significant. However, as these are the results of simple univariate regressions, they can only represent the starting point for further analysis.

In the following, we will proceed with pooled regression analysis and several panel data models, including fixed effects models, dynamic fixed effects models, panels with autocorrelated disturbances, and last but not least, dynamic panel data models based on the system GMM estimators of the Arellano-Bover and Blundell-Bond type.<sup>10</sup> All of these estimation techniques have their specific strengths and weaknesses. We will address these issues in some detail when we discuss our estimation results.

The estimation results are summarized in Table 2. In all cases, the dependent variable is the gross household saving rate. All reported t-values are robust against heteroscedastic and autocorrelated errors. Estimation was generally carried out with Stata 10; only variant (4) was estimated using Eviews 6.0.

**Column (1)** shows the results for a static pooled OLS regression. Besides our main variables in Table 1, the GDP gap for the current and previous period is also included, thus accounting for business cycle effects on the saving rate. This basic set of variables is common to all our estimated variants. With the exception of *tind\_share*, all our main variables exhibit the expected sign and are at least statistically significant at a 10% level. *Tind\_share* shows the ‘wrong’

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<sup>9</sup>Indirect taxes/(taxes on income and wealth + transfers paid by households + indirect taxes)

<sup>10</sup>Arellano and Bover (1995), Blundell and Bond (2000).

sign but with a t-value of 0.8 this is clearly not conclusive. In some other variants of static pooled OLS not reported here, *tind\_share* showed a negative sign, but these results were insignificant as well. Overall  $R^2$  is about 0.66, meaning that the equation fits the data quite well.

The main advantage of simple pooled regression is that cross-sectional as well as time series information is taken into account. However, this method also leaves several issues unresolved. First, variant (1) does not consider any dynamic effects. Second, in the presence of some unobserved country-specific and time-invariant effects which could be correlated with our right-hand variables, biased and inconsistent results are to be expected. This is a major drawback, as some country-specific effects on saving rates are highly probable. Third, we have the usual endogenous difficulties and possibly an additional error in variables problem, leading also to inconsistent estimates. In some fortunate instances, these biases could offset each other to some extent, but there is no guarantee for this.

The following estimated variants serve to address these issues step by step.

In **Column (2)** of Table 2, the pooled regression is extended to include the lagged saving rate in order to take some dynamic effects into account. The results are rather poor. Only the profit share is statistically significant. The rest of our main variables are insignificant or even exhibit the wrong sign. The coefficient of the lagged saving rate is nearly 0.9 and highly significant, so the saving rate is mainly explained by its own history.  $R^2$  was about 0.92, thus the overall fit improved remarkably. However, it is well known that in the presence

**Table 2**

<b>Coefficients</b>	<b>(1) OLS,stat</b>	<b>(2) OLS,dyn</b>	<b>(3) FE</b>	<b>(4) GLS-FE</b>	<b>(5) BB</b>	<b>(6) BB+TD</b>	<b>(7) IV</b>
<i>corr</i>	0.777***	-0.0102	0.424*	0.323***	0.664**	0.428*	0.941**
	(3.08)	(-0.088)	(1.70)	(2.64)	(2.46)	(1.81)	(2.14)
<i>fem_rate</i>	-0.170***	0.00753	-0.0771	-0.107*	0.0401	0.0858	0.0707
	(-3.31)	(0.28)	(-1.15)	(-1.69)	(0.37)	(0.92)	(0.54)
<i>profit_share</i>	0.104*	0.0495*	0.335***	0.367***	0.0949	0.182*	0.234
	(1.66)	(1.76)	(3.42)	(5.19)	(0.70)	(1.68)	(1.24)
<i>tax_wedge</i>	-0.0439***	-0.00398	-0.224***	-0.359***	0.0283	-0.0108	0.0598
	(-3.62)	(-0.68)	(-3.66)	(-7.81)	(0.88)	(-0.32)	(0.98)
<i>tind_share</i>	0.370	-0.0780	-4.043**	-5.364***	-1.371	-1.041	-2.875*
	(0.80)	(-0.38)	(-2.35)	(-5.95)	(-1.15)	(-0.84)	(-1.95)
<i>gap</i>	-0.458***	-0.374***	-0.338***	-0.251***	-0.255	-0.509***	-0.447***
	(-2.67)	(-3.65)	(-6.51)	(-5.31)	(-1.25)	(-4.07)	(-3.39)
<i>gap(-1)</i>	0.350**	0.479***	0.302***	0.077	0.467**	0.585***	0.379***
	(2.17)	(5.39)	(4.43)	(1.41)	(2.51)	(6.98)	(2.98)
<i>srh(-1)</i>	-	0.888***	0.457***	0.059	0.785***	0.769***	0.716***
	-	(19.7)	(4.22)	(0.77)	(8.58)	(7.45)	(7.45)
<i>srh(-2)</i>	-	-	-0.157***	-0.073	-	-0.0972**	-0.109**
	-	-	(-4.51)	(-1.19)	-	(-2.47)	(-2.29)
<i>constant</i>	15.91***	-0.880	16.47**	28.4***	-4.704	-7.347	-9.384
	(3.20)	(-0.36)	(2.64)	(4.78)	(-0.50)	(-0.88)	(-0.83)
<i>AR(1)</i>	-	-	-	0.49	-	-	-
<i>Obs</i>	195	194	176	158	194	176	159
<i>R2</i>	0.66	0.92	0.96	0.98	-	-	-
<i>S.E.</i>	2.69	1.24	0.88	0.78	1.55	1.53	2.55
<i>AR1-prob</i>	-	-	-	-	0.003	0.005	0.008
<i>AR2-prob</i>	-	-	-	-	0.798	0.790	0.958
<i>J-prob</i>	-	-	-	-	0.082*	0.148	0.065*
<i>J-Diff-prob</i>	-	-	-	-	0.228	0.224	0.331
<i># of Instruments</i>	-	-	-	-	24	33	26

Dependent Variable: Gross household saving rate. Data for 18 western OECD countries form 1996 -2006.

Robust *t*-values in parentheses. Variables described in the text.

\*, \*\*, \*\*\* significant at 10%, 5% and 1% respectively.

Regarding the variable *corr*, we sometimes actually used the lagged value. Generally, a richer dynamic specification occasionally seems to be preferable, especially for *corr*, as both current and lagged values of *corr* seem to play a role (with the same sign). To limit the number of variables and to make the results more comparable we had chosen to present the results with only one time period per main variable.

of unobserved country-specific effects, the coefficient of the lagged dependent variable is biased heavily upward.<sup>11</sup>

**Column (3)** tries to deal with these unobservable country specific effects explicitly by presenting a dynamic fixed effects model (within estimator). All our main variables show the ‘correct’ sign and, with the exception of *fem\_rate*, are at least statistically significant at a 10% level.  $R^2$  is about 0.96. Note that we included an additional lag for the saving rate here. We did so in all cases where this additional lag led to a noticeably improved fit. The sum of the coefficients of the lagged dependent variable is now about 0.3, which is clearly far smaller than in the pooled regression variant shown in Column (2). However, the lagged dependent variable is biased downward in this case.<sup>12</sup> This is due to the fact that the within estimator could be seen as a model with transformed variables. This transformation consists in subtracting the country means from all variables. However, the country mean of the dependent variable is clearly correlated with the unobserved country-specific effects, leading to a negative correlation between the lagged dependent variable and the error term. However, it can be shown that this bias vanishes with longer time series. Our sample spanned 10 years, which is quite long for a panel, so we can hope that this bias will not play a major role.

In **Column (4)**, we present a further variant of the dynamic fixed effects model. This time, the equation is estimated using a GLS procedure with cross

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<sup>11</sup>This is because the lagged dependent variable is automatically positively correlated with the country-specific effect. This bias does not vanish, neither with more cross section units nor with longer time series (e.g. Bond 2002).

<sup>12</sup>E.g. Bond (2002).

section weights. The results are similar to the previous ones. Now, however, *fem\_rate* is also significantly negative at a 5% level. The overall fit is also better than in variant (3), so the GLS procedure appears to increase efficiency.

All of the variants presented above may suffer from an endogeneity problem or an ‘error in variables’ problem (the latter might be especially relevant to the corruption variable). To deal with these issues, instrumental variable methods are indicated. In the last several years, a growing body of literature has emerged on estimation methods for dynamic panels which deal with both the endogenous problem and the dynamic panel bias problem. Most prominent in this respect are the contributions by Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998, 2000) and Blundell, Bond and Windmeijer (2000).<sup>13</sup>

These estimation methods, which rest on a General Methods of Moments (GMM) approach, primarily focus on models with a large number of entities and a comparatively small number of periods (N-asymptotic). Our data do not have this property. We apply these methods nonetheless, but we must bear in mind that there some problems may arise due to the big number of instruments which these techniques typically generate.<sup>14</sup>

The main advantage of these methods is the fact that both time series and cross section information is used, in contrast to the within estimators or first difference estimators, which primarily rely on time series information. This is achieved by a so-called ‘system estimator’ whereby the model is estimated in first differences and simultaneously in levels. Blundell and Bond (1998) dis-

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<sup>13</sup>For a good survey, see Bond (2002).

<sup>14</sup>For a discussion of these problems, see Roodman (2007).



cuss the necessary assumptions for this approach. The basic idea is that lagged differences in the right-hand-side variables are often uncorrelated with the unobserved country-specific effects,<sup>15</sup> meaning that these differenced variables could be used as instruments in the level equation. This crucial assumption can be tested using a Sargan or Hansen difference test in overidentified models.

For our analysis, we used the Stata procedure ‘xtabond2’ written by David Roodman.<sup>16</sup> This program offers a variety of possibilities and options for dealing with the ‘large instrument problem’, so we can hope to apply these methods to our data in a useful manner.<sup>17</sup>

**Column (5)** presents the result of this Blundell-Bond system estimator. Here we assume that all right-hand variables are endogenous and are therefore instrumented appropriately.<sup>18</sup> In the case of the corruption index, we could easily argue that this variable is exogenous, but there is probably an ‘error in variables’ problem involved here, so we decided to treat *corr* as an endogenous variable.<sup>19</sup>

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<sup>15</sup>Even if the levels of the variables are correlated with the country specific effect.

<sup>16</sup>See Roodman (2006) for a detailed introduction to this program.

<sup>17</sup>In the context of saving rates, these methods have already been applied by Loayza, Schmidt-Hebbel and Serven (2000).

<sup>18</sup>As mentioned above, these GMM estimators usually generate a large set of (internal) instruments. In particular, as the number of instruments is quadratic in the time dimension, this is a problem in panels with many time periods compared to the number of entities. As Windmeijer (2005) shows, too many instruments lead to a sort of overfitting and to biased outcomes. As a generally accepted guideline, the number of instruments should not be much larger than the number of entities. Without any further measures to reduce the number of instruments, the estimation procedure would generate 242 (!) instruments for equation (5), which is undoubtedly too many. Fortunately, the program “xtabond2” makes it possible to restrict the number of lags used for the GMM-style instruments (we used two lags) and also offers the possibility of concentrating (collapsing) the information contained in the moment restrictions. With both measures, we are able to reduce the number of instruments for equation (5) from 242 to 24. For further details, see Roodman (2006).

<sup>19</sup>We report the results of the so-called one-step estimator. The results of the two-step estimator hardly differ.

Looking at the results, we can see that the corruption index is still highly significant. However, the other main variables have lost their significance, but *profit\_share* and *ind\_share* still show the expected sign. The estimated standard error, S.E., which is now higher than in the previous variants, shows the well-known fact that instrumental variable estimators generally fit the data less well and lead to larger standard errors in the coefficient. Therefore, consistency has its price. Considering the coefficient of the lagged saving rate, we note that the estimated value lies between the dynamic OLS estimation of (2), which is known to be biased upward, and the fixed effects estimation of (3), which is known to be biased downward.

A basic requirement for this estimation technique (i.e. for identification) is that the residuals in the level equation are not autocorrelated. This implies that the residuals of the differenced equation have to follow an AR(1) process (i.e. should be near a unit root). The row ‘AR(1)’ in Table 2 shows a test for an AR(1) process. In order to yield a valid estimation, this test should reject the null of no AR(1) process. As we can see, this is the case. On the other hand, the residuals of the differenced equation may not exhibit autocorrelation of an order higher than one, otherwise the residuals in the level equation would not be uncorrelated. Row ‘AR(2)’ shows that this is also the case, so there seems to be no problem in that respect.

Lastly, we used the Sargan test to investigate whether we were using valid instruments, i.e. whether the instruments are exogenous. This is only possible for an overidentified model, which is clearly the case here. The row ‘J-prob’

shows the probability values of the J-statistic for an overall test.<sup>20</sup> The row ‘J-Diff-prob’ shows the probability values for a test of whether the instruments used in the level equation are valid. Remember that the lagged differences of the variables must be uncorrelated with the unobserved country-specific effects in order to be valid instruments.<sup>21</sup>

The J-Diff statistic does not indicate an endogenous problem in the level equation. The overall J-statistic may be somewhat better, but this could be due to heteroscedasticity.

In **Column (6)**, we investigate the same equation as in (5), but here we include additional time-dummies. This procedure is often recommended as a way to reduce heteroscedasticity. The results are very similar to the previous case. However, *profit\_share* is again statistically significant, *tax\_wedge* has the correct sign and the overall J-statistic is now better. Therefore, the results are somewhat ‘better’, but we are now using 33 instruments, which is already quite a large number.

The final equation (7) is a somewhat more usual iv-estimator. The main variables are conventionally instrumented with lag two of the first difference in the difference equation and with lag one of the first difference in the level equation. The lagged saving rate is instrumented as above with its ‘GMM-

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<sup>20</sup>In Table 2 we generally present results with robust standard errors and t-values. In the case of the Sargan test, we show the non-robust results. The reason is that the robust variant of the Sargan test, the Hansen test, is weakened by many instruments (we have 24, and this is a considerable number). We observed that the robust Hansen statistics were too good (nearly one), which is a clear indication of that problem. Therefore we used the non-robust (against heteroscedasticity) Sargan test. For details, see Roodman (2006).

<sup>21</sup>This problem does not occur in the differenced equation, as the constant country-specific effects drop out due to differencing.

style' instruments. The results are similar to the two previous variants. *Corr* and *tind\_share* are statically significant, and *tax\_wedge* and *profit\_share* show the expected signs; only *fem\_rate* exhibits the wrong sign, but it is far from significant.

The J-statistic indicates that there might be a problem with the instruments.<sup>22</sup>

#### **Discussion of the estimation results:**

The results of table 2 support our hypothesis of a positive correlation between the gross adjusted household saving rate and the degree of corruption. In all estimated variants with the exception of (2), the variable *corr* showed the expected sign and was statistically significant at least at a 10% level. Therefore, we believe this is a quite robust result, which confirms our simple scatter plot in Fig. 1 with sophisticated econometrics. The estimated magnitude ranges from 0.32 to 0.94, which means that increasing the level of corruption by one point leads to an approximate rise in the gross adjusted household saving rate of 0.5 percentage points, which is about 5% of the mean saving rates. However, this is only the first-round effect. If we consider the dynamics through the lagged saving rate, the long run effect is even stronger, about twice as large.

*Profit\_share* was also a variable of main interest. In every variant we tried, *profit\_share* showed the 'correct' sign, and most of the time this was a statistically significant effect. Only for the iv-variants (5) and (7) was this effect of minor importance. However, iv-methods very often suffer from large standard

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<sup>22</sup>But once again, estimation with additional time dummies resolved that problem.

errors. The estimated magnitude ranges from 0.1 to 0.36, meaning that an increase in profits relative to wages of one percent point leads to an increase in the saving rate of about 0.2 percent points. As mentioned above, the long-run effect is about twice as large.

Regarding the two tax variables, *tax\_wedge* and *tind\_share*, our results also indicate the expected negative effect. Although these variables exhibit the ‘wrong’ sign in a few specifications, only the expected sign turned out to be statistically significant.

According to our analysis, the effect of *fem\_rate* on household saving rates is more questionable. Generally, this effect seems to be weak. In only two cases did we obtain a statistically significant negative effect. We got the ‘wrong’ sign in five cases, but all were very far from any significance. It is noticeable that GLS methods seem to favor our hypothesis about the female employment rate. We tried several other specifications with GLS and always got the expected significant effect. This may indicate a possible heterostatic problem. Nonetheless, the results regarding *fem\_rate* are slightly unsatisfactory, especially for the iv-methods. Therefore, we cannot draw a clear conclusion in this case. One possible explanation for these results is that the ‘welfare state effect’ (via *tax\_wedge*) may absorb (too?) much of the influence of the female employment rate. Furthermore, female employment rates will be biased downwards in countries with higher shares of shadow activities. It is therefore difficult to measure the marketization effect in isolation.

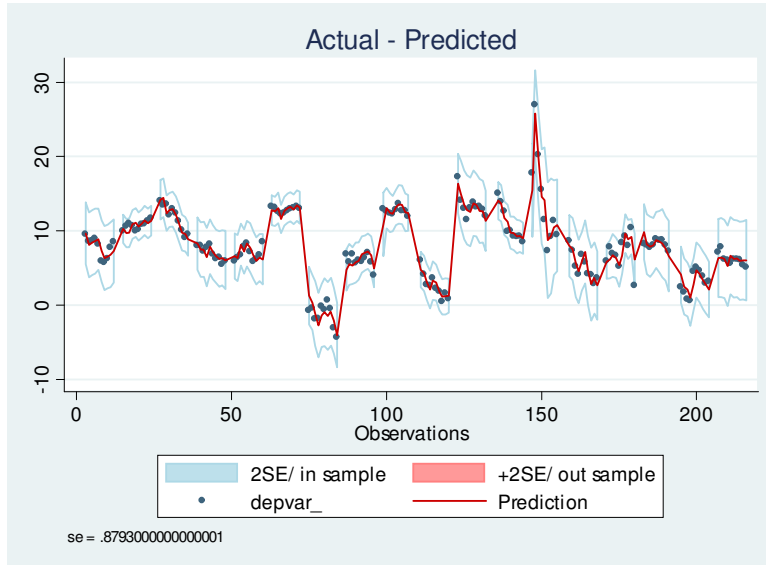


Figure 4: Actual versus predicted HSR for the FE (3)

Finally, let us visualize some of the results we have obtained so far. Fig. 4 shows actual and predicted values for the fixed effect estimation (Column (3)).

One might also be interested in the upward bias induced by corruption in the mean observed household saving rates (Fig. 5). In this case, we used the parameters from the fixed effects model (4). For Italy, the effect is remarkable - the ‘true’ HSR would be approximately three percentage points lower.<sup>23</sup> However, the overall message is more important: Differences in aggregate household saving rates might be considerably smaller than observed.

We also tried a number of other data sets. First, we included two additional western OECD countries, Spain and Ireland, for which we have only a limited

<sup>23</sup>This implies a share of unobserved income in total income of approximately 21 %. However, we definitely do not intend to produce a new estimate of ‘shadow activities’.

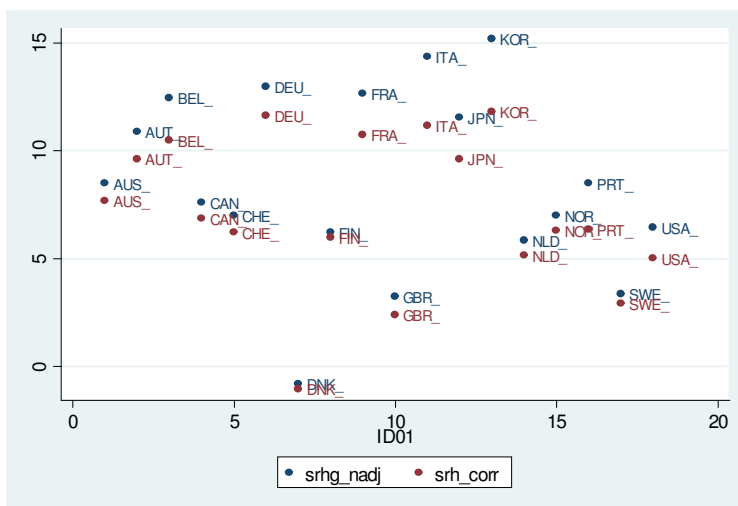


Figure 5: The distortive effect of corruption

data range beginning with 2000 and 2002, respectively. Our results remain practically unchanged with this extended data set.

Second, we added four Central European countries, for which the data set is also limited in some cases. For this data set, we obtained similar results to those presented above, but the statistical significance was somewhat lower, especially regarding the corruption index. We do not know the specific reason for this difference. Maybe these countries are already correcting the GDP more generously for shadow activities, thereby reducing their reported saving rates. However, we should note that applying GLS methods appears to mitigate this problem. The GLS estimates for this data set were very similar to the results reported above.

Third, we tried a data set based on the OECD outlook data for our 20 western OECD countries. Once again, the results were practically identical to those reported here.

## 5 Summary and conclusion

We have followed different traits and indications to look behind the officially published household saving rates in 24 OECD-countries. Preliminary evidence and econometric results basically supported our suspicion that international comparisons of household saving rates are distorted by hidden income components - in spite of ongoing attempts to uphold the principle of ‘exhaustiveness’ in national accounting. Official data seem to exaggerate cross-sectional differences in aggregate adjusted household saving rates.

While it seems somewhat presumptuous to make any precise suggestions as to the quantitative dimension of the shadow economy, it is obvious that policy-oriented studies relying on or requiring cross-sectional comparisons of *aggregate* household saving rates are built on shaky foundations. Let us also add that we do not believe that statistics offices should simply extend the concept of ‘exhaustiveness’ by adding more and more ‘imputed’ or indirectly estimated unobservable income components. Rather, statistics authorities should publish uncorrected and corrected data as well in order to make it clear which ‘shadow adjustments’ were implemented in various countries. This is particularly important within the EU, where the fulfillment of the Maastricht criteria on the one



hand, and the fiscal redistribution on the other hand both depend on reliably comparable GDP data.

### *Appendix*

The sources of household saving data are the Annual National Accounts (SNA 93). From the household sectoral accounts of ANA, the following definition of the gross household saving rate was derived: (net savings minus change of equities in pension funds plus consumption of fixed capital)/(net disposable income plus consumption of fixed capital plus individual public consumption). Gross savings were preferred because practices of calculating the consumption of fixed capital might differ considerably in various countries. The change of equities in pension funds was not added to household savings, as this correction is still implemented only in some - but not all - countries. In addition, it is subject to considerable uncertainties. Balanced data over the period from 1995 to 2006 are available only for AUS, AUT, BEL, CHE, CAN, DEU, DNK, FIN, FRA, GBR, ITA, JPN, KOR, NLD, NOR, PRT, SWE and USA, but not for IRL, ESP, CZE, HUN, POL and SVK.

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