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The Underground Economy in the Late 1990s: Evading Taxes, or Evading Competition?*

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Abstract

This paper studies the driving forces behind the considerable expansion of the underground economy during the late 1990s. I propose a novel explanation for this phenomenon: the sharp increase in market competition worldwide, which reduces prices and profits and drives firms into the shadow economy. Empirical evidence from a panel covering 42 countries from 1995 to 2000 shows that increased competition is indeed correlated with an expansion of the underground economy. The effect is weaker in high-income, high-tax, low-corruption countries that provide public services which make it worthwhile for firms to operate in the official economy despite growing competitive pressure.

JEL Classification: H26, L11, O17

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1 Introduction

The underground economy¹ is widely understood as an unpleasant consequence of the burden of taxes and social security contributions, excessive market regulation, and ineffective law enforcement and corruption (see Schneider and Enste (2000), Johnson et al. (1998), Friedman et al. (2000), Lemieux et al. (1994)). Although none of the common measures of the phenomenon is immune to criticism², there is evidence that the late 1990s saw a striking increase in the size of the underground sectors of both industrialized and developing countries. Interestingly, this increase cannot be fully accounted for by the movements in any of the conventional explanatory factors listed above. Hence, the question arises what induced so many businesses to move to the underground economy during this period.

The explanation for this remarkable development could lie in a common change to the environment in which these businesses operate. Now, it is well-known that the 1990s were characterized by a sharp increase in market competition worldwide, which was a consequence of reduced trade barriers, market liberalization programs, and improved communication and transportation (Gupta (1997)). This paper asks the question whether this increase in competitive pressure can help us explain the expansion of the underground economy.

The theoretic literature on this question is very scarce. Some readers may be reminded of Shleifer's (2004) argument that competition may promote unethical behavior (e.g. child labor, corruption, etc.). He highlights the trade-off between cost savings and the firm

¹defined as economic activities which are concealed from public authorities to avoid the payment of taxes and social security contributions, and to avoid compliance with certain legal standards (e.g. labor market regulations, trade licenses)

²See Schneider and Enste (2000) for estimates of the size of the underground economy in numerous countries and a critical discussion of the different measurement methods.

owner's private utility of ethical behavior, and finds that an increase in competition tilts this trade-off in favor of unethical behavior. But unlike the types of behavior studied by Shleifer (2004), tax evasion might not even be classified as "unethical" by many people.³

A model that does without ethical considerations is proposed by Karlinger (2008). Again, cost savings are the primary benefit of operating in the underground economy. However, these cost savings have to be traded off against the risk of being detected and fined by the tax authority. The prediction of this model is that, in equilibrium, an increase in competition makes it more likely for underground activities to spread in the industry.

To my knowledge, there is only one empirical study of the link between the shadow economy and market competition, namely Goldberg and Pavcnik (2003). They study one particular form of intensified competition - the reduction of trade barriers - in two developing countries, namely Brazil and Colombia. While there is no evidence of a relationship between trade policy and the informal sector in Brazil, they do find evidence of such a relationship in Colombia, but only for the period preceding a major labor market reform that increased the flexibility of the Colombian labor market.

My paper wants to broaden our understanding of these results by extending the analysis to a panel of 42 countries covering the period from 1995 to 2000. The panel covers all major OECD countries as well as a number of developing countries, mainly from Latin America and Asia. Data on the size of the underground economy come from Schneider (2005) as well as own calculations. The remaining data were drawn from several World Bank sources and from the Global Competitiveness Report.

To deal with the possible endogeneity problem when explaining the size of a country's shadow economy by the tax rates in this country, I instrument for these tax rates by the

³See Torgler and Schneider (2007), and Alm and Torgler (2006), on cross-country differences in tax morale

corresponding tax rates of a (randomly assigned) neighboring country. The identifying assumption is that a country's tax rates will not change in response to an expansion of the underground economy in any of its neighboring countries.

The first main finding of this cross-country analysis is that more intense competition is indeed correlated with an expansion of the underground economy: A one-standard-deviation increase in the competition variable is associated with an increase in the size of the underground economy (as share of official GDP) of 4 percentage points, or 22 percent of the standard deviation of the latter. I also find a significant impact of per-capita GDP and labor market regulation, while the effect of tax rates on the size of the underground economy is somewhat ambiguous.

The second main finding of my empirical analysis is that the impact of competition on the size of the underground economy is weaker in countries where per-capita GDP and tax rates are high, and corruption is low. Rich countries with high government revenue and low corruption are the ones that can offer high-quality public enforcement services which make it worthwhile for firms to opt for the official economy even when competitive pressure increases. This may also explain why the expansion of the underground sector was not as strong in the OECD and CEE countries as it was in Asia and Latin America, even though all four subsamples experienced a similar increase in the intensity of competition during the late 1990s.

The paper proceeds as follows: Section 2 describes the data used in this study. Given that every possible measure of the underground economy is susceptible to criticism, I perform my analysis for two different measures. The first measure is based on the currency-demand approach (drawn from Schneider (2005)), and results are presented in Section 3. The second measure is based on the so-called electricity method, where I use own cal-

culations giving rise to a larger sample (along the time dimension) allowing for in-depth analysis, presented in Section 4. Section 5 concludes.

2 Description of the Data

The analysis is based on a panel that covers 42 countries (OECD, transition and developing countries) for the years 1995 to 2000.⁴ The underlying data were drawn from several sources: Schneider's (2005) estimates of the underground economy as percentage of official GDP; the World Bank's "World Development Indicators", "Doing Business" and "Labor Regulation" databases; and the "Global Competitiveness Report" (GCR), which is published annually by the World Economic Forum.

The World Bank data sources are discussed in more detail below. The measures of most variables contained in the Global Competitiveness Report are based on the results of the Executive Opinion Survey, which asks some 4,000 top and middle managers in the surveyed countries for a personal assessment of the variables of interest.⁵ Each respondent assigned an integer from 1 to 7 to each of the questions contained in the survey, and the Global Competitiveness Report reports the average response for each variable and country.

2.1 The Dependent Variable

The two measures for the size of the underground economy used in the following deserve some more discussion. Of course, the very nature of the subject matter makes it difficult to quantify it. The data series in Schneider (2005) are based on the so-called "currency-

⁴The countries are: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea (Rep.), Malaysia, Mexico, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Russian Federation, Singapore, Spain, Sweden, Switzerland, Thailand, UK, USA, and Venezuela.

⁵Note that the managers' assessments may not be representative for the opinion held by the general public in their country; however, for the purposes of our analysis, what I am interested in is precisely the perception of firm-level decision-makers, as they are the ones who choose whether or not their firm will operate in the underground economy.

demand approach”, while the second measure of the underground economy I will use is obtained from own calculations based on the so-called ”physical input” method (or Kaufmann-Kaliberda method).

(a) Currency-Demand Approach

The underlying assumption is that shadow transactions are settled through cash payments, so as to leave no traces for the authorities. An increase in the shadow economy will therefore increase the demand for currency. This approach originates in Cagan (1958).

To isolate the resulting excessive demand for currency, an equation for currency demand is estimated over time, controlling for all possible conventional factors, such as income, payment habits, interest rates etc. The increase in currency demand unexplained by the conventional factors is then attributed to the rising tax burden and other factors leading people to operate in the shadow economy.

The basic regression equation is

$$\ln \left(\frac{C}{M2} \right)_t = \beta_0 + \beta_1 \ln (1 + TW)_t + \beta_2 \ln \left(\frac{WS}{Y} \right)_t + \beta_3 \ln R_t + \beta_4 \ln \left(\frac{Y}{N} \right)_t + u_t$$

where \ln denotes natural logarithms, $C/M2$ is the ratio of cash holdings to current and deposit accounts, TW is a weighted average tax rate (to proxy changes in the size of the shadow economy), WS/Y is the share of wages and salaries in national income (to capture changing payment and money holding patterns), R is the interest paid on savings deposits (to capture the opportunity cost of holding cash) and Y/N is per capita income.

A base year has to be fixed for which the shadow economy is set to zero. Next, assuming the same income velocity for currency in the shadow economy as for money (measured by M1) in the official economy, the size of the shadow economy can be computed and compared to the official GDP.

Unfortunately, the estimates provided by Schneider (2005) are only available for 3 out of the six periods covered by the GCR (namely 1995, 1998 and 2000); moreover, for the year 1998, this data set only covers 21 OECD countries out of the full set of 42 countries.

(b) Electricity Approach

To measure overall (official and unofficial) economic activity, Kaufmann and Kaliberda (1996) assume that electricity consumption is the single best physical indicator of overall economic activity. With an electricity-output elasticity close to one, the difference between the growth of official GDP and the growth of electricity consumption can be attributed to the growth of the shadow economy.

For the base year, $t = 1995$, we have data on country i 's official GDP, denoted by $GDP_{i,t}$, and Schneider's (2005) estimates of the size of the underground economy as share of official GDP, denoted by $s_{i,t}$. Define country i 's total economic activity in $t = 1995$ as $TEA_{i,t} \equiv (1 + s_{i,t})GDP_{i,t}$.

Denote country i 's total electricity consumption in t as $EC_{i,t}$ (the data on official GDP and on electricity consumption were drawn from the World Bank World Development Indicators). The growth rate of electricity consumption,

$$g_{i,t+1} = \frac{EC_{i,t+1}}{EC_{i,t}}$$

is then used as indicator for the growth rate of total economic activity: $TEA_{i,t+1} = g_{i,t+1}TEA_{i,t}$. Then, we can infer the size of the underground economy in $t + 1$ as

$$s_{i,t+1} = \frac{TEA_{i,t+1} - GDP_{i,t+1}}{GDP_{i,t+1}}$$

This procedure is repeated for the years 1997 to 2000. The correlation between this measure and the Schneider estimates is 0.79. While the electricity-approach measure

of the underground economy is certainly less sophisticated than the currency-demand estimates, it has two main advantages:

(i) data are available for all six periods covered by the GCR (thus providing sufficiently many observations to perform proper panel analysis), and

(ii) the measure is directly derived from consumption of a physical input, and so we do not have to worry about interactions between the variables used to construct the currency-demand estimates and the explanatory variables used in the regressions, which are explained below.

2.2 The Regressors

The choice of regressors used in this analysis is driven by our hypothesis that increased competition leads to an expansion of the underground economy. To test this hypothesis, we need a measure of competition, as well as controls for the common explanatory factors used in the literature (see Schneider and Enste (2000)).

Several measures are available for the intensity of labor regulation: I will focus on the "Employment Laws Index" from the World Bank's "Labor Regulation" database. This index reflects a comprehensive assessment of the legal provisions prevailing in each country in January 2002. It takes values from 0 to 3, with higher values consistent with more regulation. As a supplementary measure, I will also use the GCR's "Flexibility" Index, which is derived from survey responses to the question whether "working hours can be easily adjusted (1=strongly disagree, 7=strongly agree)". Unlike the "Employment Laws Index", this measure is available for all six years covered by our panel.⁶

⁶Table 2D in Appendix A provides correlations between these two measures as well as a third alternative measure, namely the "Employment Laws Index" of the World Bank's "Doing Business" data base (which was constructed in a similar manner as the index of the same name in the "Labor Regulation" data base, and refers to January 2003).

Similarly, there are two possible measures for entry barriers: The cost of starting a new business is directly measured as percentage of per-capita GNI in the World Bank's "Doing Business" database for the year 2003, while the GCR provides response averages on whether "Starting a new business is generally easy (1=strongly disagree, 7=strongly agree)" for each of the six years of interest.

A measure for corruption will be included for the following reasons: First of all, corruption is likely to undermine the enforcement of tax legislation (Bull and Newell (2003)), thereby favoring underground economic activity, and second, the findings of Johnson et al. (1998) suggest that corruption is an important control variable in itself. The corruption question included in the GCR asks whether "Irregular, additional payments connected with import and export permits, business licenses, exchange controls, tax assessments, police protection, or loan applications are very rare (1=strongly disagree, 7=strongly agree)".⁷

The key variable we are interested in is the intensity of competition between firms, in the sense that firms see each other as close rivals for consumer patronage. Following Ades and Di Tella (1999), I use a survey measure for competition, based on the question whether "Competition in local markets is intense and market shares fluctuate constantly (1=strongly disagree, 7=strongly agree)".⁸ Finally, I will control for per-capita GDP (in logs) as well as the income tax rate, corporate tax rate and VAT rates.

To convince the reader of the steady growth of the underground economy and the co-movement of competition during the late 1990s, Table 1 shows results of a regression of the two measures of the underground economy, as well as the competition measure, on

⁷ Alternative measures are provided by the World Bank's "Governance Indicators" database ("Perceptions of Corruption" and "Rule of Law") and by Transparency International ("Corruption Perceptions Index") - see correlations in Table 2D in Appendix A.

⁸ Alternative measures are "share of imports in GDP" (WB WDI) and the "effectiveness of antitrust policies" (GCR). Table 2D in Appendix A reports the correlations between these measures.

a time trend, controlling for country-fixed effects.

= Insert Table 1 here =

Both measures of the underground economy feature a positive and significant time trend for the full sample; however, the two measures differ in the contribution to this overall trend by each of the four subsamples corresponding to OECD, CEE, Asian and Latin American countries: while Schneider's estimates show very similar positive trends for each subsample, the electricity-approach estimates suggest that the trend was strongly positive only in the Asian and Latin American countries, and negative in the OECD and CEE subsamples.

A likely reason for this difference between the two measures is that the electricity-approach estimates are to some extent confounded by changes in electricity consumption patterns that are unrelated to underground activities. During the period under examination, a number of Asian and Latin American countries in the sample (Indonesia, Chile, Brazil, Peru) were engaged in massive electrification programs bringing access to electricity to households that previously had no access. Other countries in these subsamples, like Argentina, Brazil, Colombia, Peru, India, Thailand, Malaysia, China, Philippines, and Indonesia, were undergoing privatization programs which changed the electricity production and distribution system (see Jamasb (2006)). These policies are likely to have contributed to electricity consumption in these countries growing faster than GDP.

At the same time, some governments, in particular European, have been quite active in inducing a more efficient use of electricity, which may partly explain the underproportional growth of electricity consumption relative to GDP growth in the OECD subsample. Therefore, the electricity-approach estimates should be taken with a pinch of salt. How-

ever, the regression results obtained from these estimates (see Tables 4 and 5) are hard to reconcile with the suspicion that the electricity-approach estimates measure something completely unrelated to underground activity. Rather, they should be seen as complementary to the results obtained from Schneider's estimates (see Table 3), which have other shortcomings (see Schneider and Enste (2000)).

Table 2A reports summary statistics for the variables of the first (smaller) sample, based on Schneider's estimates of the shadow economy, while Table 2B reports the analogous statistics for the second sample, based on the electricity-approach estimates of the shadow economy. Appendix A provides correlation matrices for all variables entering the regressions (Table 2C) and for alternative measures of explanatory variables (Table 2D).

= Insert Tables 2A and 2B here =

3 Regression Results for Sample 1

We can now test our first hypothesis:

Hypothesis 1: The fiercer is competition, the more likely are underground activities to spread in the economy.

The reasoning is as follows: A firm which operates in the underground economy can buy its inputs, in particular labor, at a lower price (because it avoids payroll taxes, disregards safety and health standards, etc.), thereby reducing its variable cost relative to a firm in the official economy. The underground firm can pass on its savings to consumers, which will reduce market prices, and as a result its competitors' profits fall. Thus, the official firm is put at a competitive disadvantage, and may have to choose between operating underground as well, or going out of business.

After merging Schneider's (2005) estimates of the shadow economy with the available

data for the explanatory variables, we are left with 99 country-years for 42 countries. The basic estimating equation for countries $i = 1, \dots, 42$, and $t = 1, \dots, 6$ can be written as

$$UE1_{it} = \beta_{0i} + \beta_1 COMP_{it} + \beta X_{it} + \varepsilon_{it}$$

where the dependent variable, $UE1_{it}$, is "underground economy", β_{0i} is a constant, $COMP_{it}$ is "competition", X_{it} is the vector of controls ($GDP, Corr, LR1, PT, IT, CT, VAT, EE1$), and ε_{it} is the error term. We are particularly interested in determining the size of β_1 which represents the elasticity of the size of the shadow economy with respect to intensity of competition. Table 3 gives us a first impression of the relevance and magnitude of the single variables.

= Insert Table 3 here =

Regression (1) in Table 3 was performed on the stacked data, without controlling for any country-specific effects. Analysis of the residuals indicates that country-specific effects are likely to be present. Therefore, Regression (2) controls for country-specific fixed effects⁹, while Regression (3) includes country-specific time trends. Regression (4) has competition as the only common explanatory variable, while controlling for both country-specific fixed effects and time trends.

First of all, we see that the competition coefficient has the positive sign we expected, and is significant in Regressions (1) and (4). The insignificance in Regressions (2) and (3) may be due to the relatively low number of observations available (relative to the number of coefficients). It is all the more remarkable that the coefficient is still significant in Regression (4), which includes not only fixed effects but also country-specific time trends.

⁹Recall that the main measures for labor regulation and start-up cost, LR1 and EE1, are only available for one year, so they do not show when including country-fixed effects.

The coefficient on labor regulation appears to be consistently significant and positive. The corruption coefficient has a negative sign in Regressions (1) and (3), and is significant in Regression (1), which is in line with the link between corruption and the shadow economy found by Johnson et al. (1998). With the exception of the VAT rate, which is significant in Regression (1) and has the expected positive sign, the coefficients on the tax rates are quite surprising. Both the payroll tax rate and the corporate tax rate have the wrong sign whenever they are significant, and it seems unclear whether the income tax rate is at all significant. The contribution of the cost-of-entry variable (EE1) is ambiguous: It seems significant, but has the wrong sign. The insignificance of per-capita GDP in all regressions is quite striking as well.

4 Regression Results for Sample 2

4.1 Controlling for the Endogeneity of Taxes

The results in Table 3 are somewhat inconclusive, which could be due to the paucity of the data on the dependent variable, or to some endogeneity bias that we could not take care of. Sample 2 is much larger and may therefore allow us to obtain more reliable results. Table 4 presents the regressions results.

= Insert Table 4 here =

Regression (5) is analogous to Regression (2). Since data on LR1 and EE1 are only available for one year, they do not show in Regressions (5) and (7). Regressions (6) and (8) include the alternative (time-varying) measures LR2 and EE2, so they do not lend themselves to direct comparisons with the Sample 1 results.

The 2SLS estimation in Regressions (7) and (8) deserves explanation. It has been argued that a country's tax rates may to some extent be endogenous to its shadow economy

(see Johnson et al. (1998)): If government tries to stabilize tax revenue by raising tax rates whenever the shadow economy expands (and hence the tax base shrinks), then the causality between tax rates and the underground economy would be reversed, and the coefficient estimates of Regressions (5) and (6) would be inconsistent.

Regressions (7) and (8) account for this possible simultaneity bias: The instruments for country i 's tax rates are the corresponding tax rates of one (randomly assigned) neighboring country j plus a common time trend. The data indicate that tax rates tend to be closely correlated across neighboring countries. The identifying assumption is that a country's tax rates will not be changed in response to an expansion of the underground economy in any of its neighboring countries. The common time trend is not a relevant regressor at the second stage (once we control for all time-varying explanatory factors including competition), but is likely to have an impact on the evolution of tax rates, in particular since the period under consideration covers the run-up for the common currency in Europe (the Euro area representing a quarter of our country sample).

The R^2 's of the first-stage regressions range from 0.61 to 0.97, thus giving no indication for weak instruments. The Durbin-Wu-Hausman test rejects the null hypothesis of consistent estimation of both Regressions (5) and (6) at the 1 percent significance level, confirming the likely endogeneity of the tax rates.

Finally, the Sargan Test statistic (number of observations times the R^2 from the regression of the second-stage residuals on the instruments), which is chi-square distributed with degrees of freedom equal to the number of overidentifying restrictions (1 in our case), has a value of 0.76398 (right-tail probability: 0.38) in Regression (7) and 0.31626 (right-tail probability: 0.57) in Regression (8). Thus, we cannot reject the null hypothesis of exogenous instruments.

Let us now turn to the results presented in Table 4. Most importantly, the coefficient on competition is highly significant and has the predicted positive sign under all four specifications. In terms of Regression (8), a one-standard-deviation increase in the competition variable is associated with an increase in the size of the underground economy (as share of official GDP) of 4 percentage points, or 22 percent of the standard deviation of the latter.

Note that the Flexibility Index is significant and has the expected negative sign: A one-standard-deviation increase in the Flexibility Index is associated with a drop in the size of the underground economy (as share of official GDP) of 3.7 percentage points, or 21 percent of the standard deviation of the latter. Per-capita GDP is now highly significant as well: Not surprisingly, more developed economies tend to have smaller underground sectors. The corruption measure is significant only in Regression (8). With the exception of the payroll tax rates, all tax rates tend to have the right sign now, although the income tax rate is the only one that comes out significant under all four specifications. The anomaly of the sign on the payroll tax rate remains, but it is no longer significant in Regressions (5) and (6). The entry variable (EE2) seems significant, but its positive sign is rather surprising.

Regression (8) is robust to dropping one country at a time, with coefficients on the competition variable ranging from 1.83 to 3.96. These coefficients are significant at the 1 percent level, with one exception (significant at the 2 percent level when Indonesia is dropped). Regression (8) is also robust to including time fixed effects: The magnitude and significance levels of the coefficient estimates remain unchanged, and the Wald test cannot reject the joint insignificance of the year dummies (test statistic = 8.59, which is $\chi^2(5)$ under the null, so that probability is 0.1265). This result is reassuring given that

the time trend was used as instrument for the tax rates: If we found that time also had a direct influence on the dependent variable of the second-stage regression, this would clearly violate the exclusion restriction.¹⁰

4.2 The Impact of Country Characteristics

Finally, recall that there are compelling theoretical reasons to expect that the impact of competition on the incidence of shadow economic activities could also depend on other country characteristics. As Posner (1996) pointed out, using formal market institutions, though costly in terms of tax liabilities, allows to resort to state-guided legal enforcement mechanisms in situations where opportunistic behavior and breach of contract have to be considered likely, e.g. when contracting with total strangers, or if transactions are non-simultaneous and long-term. This insight leads us to our next hypothesis:

Hypothesis 2: Poor countries with low government revenue are not able to provide the kind of public services that could induce firms to move to the official sector and pay the taxes that are needed to fund such services. Such countries are therefore more vulnerable to a competition shock than countries offering high-quality (though expensive) public institutions that keep firms in the official sector even if competition increases.

The second main result of my empirical analysis confirms this conjecture. Table 5 shows the regression results when interaction terms are included in the 2SLS specification of Regression (8).

= Insert Table 5 here =

Competition does not seem to have a differential impact in countries where labor markets are more regulated (Regression (11)) or where entry is more difficult (Regression

¹⁰Recall though that the Sargan test did not give any indication for such a violation.

(13)). The first of these two results suggests that we cannot generalize the findings of Goldberg and Pavcnik (2003), who argue that the relationship between trade policy and the informal sector in Colombia only existed for the period preceding a major labor market reform that increased the flexibility of the Colombian labor market. In other words, liberalizing the labor market does not in general neutralize the effects of competition on the shadow economy.

The remaining regressions in Table 5 show that the effect of competition on the size of the underground economy is significantly weaker when per-capita GDP is high (Regression (9)), when corruption is low (Regression (10)), and when the tax rates are high (Regression 12).¹¹ The interpretation to give to this result is that rich countries with high tax rates and low corruption can offer high-quality public enforcement services which make it worthwhile for firms to opt for the official economy even when competitive pressure increases. This may also explain why the expansion of the underground sector was not as strong in the OECD and CEE countries as it was in Asia and Latin America, even though all four subsamples experienced a similar increase in the intensity of competition during the late 1990s (see Table 1).

5 Conclusion

The purpose of this paper is to explain the striking increase in the size of the underground economy in both industrialized and developing countries during the late 1990s. I propose a novel rationale for this expansion of the shadow economy: the intensity of market competition among firms. The empirical analysis presented here was performed on a panel

¹¹The Wald test rejects the null hypothesis of joint insignificance of the four tax interaction terms in Regression (12) at the 1 percent level. When the tax interaction terms are included one by one, each comes out negative and significant at the 5 or 1 percent level.

that covers 42 countries (OECD, transition and developing countries) from 1995 to 2000. The regression results show that tax rates, labor market regulation, and enforcement are not the only forces behind the emergence of the underground economy. I find evidence for my first hypothesis, namely that the growing incidence of shadow-economic activity is indeed correlated with an increase in the intensity of competition during this period.

The second main finding of my empirical analysis is that the impact of competition on the size of the underground economy is weaker in countries where per-capita GDP and tax rates are high, and corruption is low. Rich countries with high government revenue and low corruption are the ones that can offer high-quality public enforcement services which make it worthwhile for firms to opt for the official economy even when competitive pressure increases. This may also explain why the expansion of the underground sector was not as strong in the OECD and CEE countries as it was in Asia and Latin America, even though all four subsamples experienced a similar increase in the intensity of competition during the late 1990s.

We can draw several policy implications from these results: First of all, liberalizing product markets may come at the cost of an expanding underground economy, unless the liberalization is accompanied by a more rigorous enforcement of tax laws. This effect is more likely to be felt in poor, corrupt countries with low tax revenue. Finally, liberalizing the labor market may not be sufficient to countervail the negative effects of intensified product market competition on the size of the underground economy.

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6 Appendix A - Descriptive Statistics

Table 2C shows the correlation matrix for all variables used in the regressions (For an explanation of the abbreviations used in Table 2C, see Tables 2A and 2B).

Note that the two measures for the underground economy, the one based on the currency-demand approach (UE1) and the one based on the electricity approach (UE2), are strongly correlated to each other (0.79). The correlation between the two measures for labor regulation, LR1 and LR2, is much weaker (-0.33), while the two measures for ease-of-entry, EE1 and EE2, do not seem to be correlated at all (-0.09).

Also note the high correlations between the absence-of-corruption measure (Corr) and the two ease-of entry variables (EE1 and EE2) as well as the competition variable (Comp), which brings to mind the findings of Ades and Di Tella (1999), who argue that the presence of economic rents tends to be conducive to corruption.

Table 2C: *Correlations among regression variables*

	UE2	GDP	Corr	LR1	LR2	PT	IT	CT	VAT	EE1	EE2	Comp
UE1	0.79	-0.57	-0.49	0.54	-0.13	0.04	-0.26	-0.24	0.13	0.13	-0.28	-0.20
UE2		-0.47	-0.47	0.40	0.06	-0.18	-0.15	-0.17	-0.13	0.29	-0.19	-0.16
GDP			0.75	-0.42	-0.03	-0.05	0.29	-0.02	0.10	-0.50	0.36	0.22
Corr				-0.51	0.23	-0.17	0.38	-0.04	0.05	-0.42	0.64	0.54
LR1					-0.33	0.41	-0.03	0.08	0.22	0.10	-0.37	-0.18
LR2						-0.43	-0.14	-0.20	-0.41	0.03	0.47	0.23
PT							0.21	0.22	0.46	-0.19	-0.25	0.02
IT								0.04	0.34	-0.20	0.16	0.44
CT									0.03	-0.01	-0.21	-0.04
VAT										-0.21	-0.12	-0.05
EE1											-0.09	-0.14
EE2												0.46

Table 2D reports correlations among the variables used in the regressions and alternative measures, as far as available. We see that "Local Competition" (Comp) is fairly correlated to the "Effectiveness of Antitrust" (Ant) as reported in the GCR, but both

measures are uncorrelated to the imports of goods and services as share of GDP (Imp), indicating that openness to foreign trade does not measure quite the same thing as local competition.

As for the alternative measures of corruption, the GCR's variable (Corr) is highly correlated to both the World Bank's "Rule of Law" Index (ROL) and "Control of Corruption" Index (Corr-WB) as well as to Transparency International's Corruption Perceptions Index 2001 (Corr-TI).

The two measures of labor regulation, the World Bank's Employment Laws Index from the Labor Regulation database (LR1) and the GCR's Flexibility Index (LR2) appear to be correlated in the right way to the World Bank's Employment Laws Index from the Doing Business database (EL), although the (positive) correlation between the two World Bank Indices is stronger than their respective (negative) correlation with the GCR's Flexibility Index.

Table 2D: *Correlations among alternative measures*

	Comp	Imp	Corr-TI	Corr-WB	Corr	LR2	LR1
Ant	0.61	0.05					
Comp		0.09					
ROL			0.94	0.97	0.87		
Corr-TI				0.96	0.86		
Corr-WB					0.89		
EL						-0.40	0.89
LR2							-0.33

7 Appendix B - Tables

Table 1: *The Underground Economy and Competition 1995-2000*

Dependent Variables: (1) Underground Economy (Schneider),
(2) Underground Economy (own calc.), (3) Competition (GCR)

Regressor: Time Trend

	(1) UE1	obs.	(2) UE2	obs.	(3) Comp	obs.
Full Sample (42 countries)	0.36*** (0.07)	105	0.87*** (0.32)	252	0.48*** (0.02)	252
OECD countries (26)	0.26*** (0.08)	73	-0.65*** (0.18)	156	0.49*** (0.03)	156
Asia (12)	0.51*** (0.07)	27	2.92*** (0.65)	72	0.46*** (0.05)	72
CEE (4)	0.88 (0.72)	8	-2.23*** (0.40)	24	0.47*** (0.06)	24
Latin America (7)	0.35*** (0.03)	14	2.99*** (0.59)	42	0.49*** (0.06)	42
Country Fixed Effect	yes		yes		yes	

Standard errors are in parentheses.

*/**/** denotes significance at 10/5/1 percent.

Table 2A: *Summary Statistics - Sample 1 (Schneider's estimates)*

	stacked data				
	Obs.	Mean	Std. Dev.	Min.	Max.
Shadow Econ'y - Schneider (UE1)	99	21.57	10.69	7.80	59.40
Local Competition (Comp)	99	4.37	1.34	1.66	6.50
Per-capita GDP (GDP)	99	9.32	1.19	5.94	10.71
Low corruption (Corr)	99	4.83	1.58	1.37	6.91
Labor regulation:					
1. Employment Laws Index (LR1)	99	1.50	0.45	0.81	2.35
2. Flexibility (LR2)	99	3.49	0.77	2.10	5.17
Payroll tax rate (PT)	99	27.00	15.97	0.00	61.00
Income tax rate (IT)	99	31.46	13.98	0.00	60.00
Corporate tax rate (CT)	99	31.94	6.65	15.00	55.00
VAT (VAT)	99	15.71	6.62	0.00	31.00
Ease of Entry:					
1. Cost of Start-up (EE1)	99	20.00	41.19	0.40	269.00
2. New Business (EE2)	99	3.91	1.27	1.54	6.40

Table 2B: Summary Statistics - Sample 2 (own calculations)

	stacked data				
	Obs.	Mean	Std. Dev.	Min.	Max.
Shadow Econ'y - own calc. (UE2)	238	24.20	17.77	0.00	87.28
Local Competition (Comp)	238	4.54	1.10	1.66	6.50
Per-capita GDP (GDP)	238	9.16	1.22	5.94	10.71
Low corruption (Corr)	238	4.83	1.47	1.37	7.00
Labor regulation:					
1. Employment Laws Index (LR1)	238	1.52	0.44	0.81	2.35
2. Flexibility (LR2)	238	3.70	0.85	2.00	5.81
Payroll tax rate (PT)	238	27.15	16.27	0.00	65.00
Income tax rate (IT)	238	29.66	13.72	0.00	60.00
Corporate tax rate (CT)	238	31.71	6.85	6.78	55.00
VAT (VAT)	238	15.67	6.48	0.00	31.00
Ease of Entry:					
1. Cost of Start-up (EE1)	238	22.48	44.99	0.40	269.00
2. New Business (EE2)	238	4.38	1.16	1.54	6.45

Table 3: Regression Results - Sample 1
Dependent Variable: Shadow Econ'y - Schneider (UE1)

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	43.70*** (15.43)		36.07 (24.37)	
Competition (Comp)	2.50*** (0.80)	0.39 (0.29)	2.20 (2.34)	0.37* (0.20)
Per-capita GDP (GDP)	-2.72 (1.71)	-0.62 (5.81)	-1.56 (2.69)	
Low corruption (Corr)	-2.64** (1.12)	0.04 (0.35)	-1.86 (1.65)	
Empl. Laws Index (LR1)	9.67*** (1.88)		9.70** (3.76)	
Payroll tax rate (PT)	-0.22*** (0.06)	0.04 (0.03)	-0.14* (0.08)	
Income tax rate (IT)	-0.09 (0.12)	0.05* (0.03)	-0.06 (0.19)	
Corporate tax rate (CT)	-0.15* (0.08)	-0.01 (0.05)	-0.37** (0.14)	
VAT (VAT)	0.35*** (0.11)	-0.14 (0.12)	0.25 (0.25)	
Cost of Start-up (EE1)	-0.07*** (0.02)		-0.06* (0.03)	
Fixed Effects	no	yes	no	yes
Country Time Trend	no	no	yes	yes
Number of observations	99	99	99	105
Adjusted R^2	0.50	0.98	0.71	0.99

Standard errors (white heteroskedasticity-consistent) are in parentheses.

*/**/** denotes significance at 10/5/1 percent.

Table 4: Regression Results - Sample 2
 Dependent Variable: Shadow Econ'y - own calculations (UE2)

Explanatory Variable	(5) OLS	(6) OLS	(7) ¹⁾ 2SLS	(8) ²⁾ 2SLS
Competition (Comp)	2.05*** (0.77)	2.11*** (0.72)	3.01*** (1.12)	3.58*** (1.22)
Per-capita GDP (GDP)	-81.65*** (12.16)	-87.48*** (12.31)	-88.43*** (11.32)	-94.14*** (12.22)
Low corruption (Corr)	0.77 (0.74)	-0.17 (0.99)	-1.89 (1.38)	-3.90** (1.57)
Flexibility Index (LR2)		-2.14* (1.26)		-4.39** (1.90)
Empl. Laws Index (LR1)				
Payroll tax rate (PT)	-0.06 (0.09)	-0.10 (0.10)	-1.93*** (0.41)	-1.38*** (0.35)
Income tax rate (IT)	0.27*** (0.04)	0.28*** (0.04)	0.55*** (0.08)	0.59*** (0.09)
Corporate tax rate (CT)	0.08 (0.12)	0.08 (0.11)	0.77 (0.63)	1.49** (0.71)
VAT (VAT)	0.13 (0.21)	0.11 (0.23)	0.86 (1.05)	-1.01 (1.14)
New Business (EE2)		1.75** (0.81)		4.21*** (1.21)
Cost of Start-up (EE1)				
Fixed Effects	yes	yes	yes	yes
Common Constant	no	no	no	no
Number of observations	238	238	196	196
Adjusted R^2	0.88	0.88	0.90	0.90

Standard errors (white heteroskedasticity-consistent) are in parentheses.

*/**/*** denotes significance at 10/5/1 percent.

1),2) tax rates are instrumented by the neighboring country's tax rates and time trend

Table 5: Interaction between Competition and Country Characteristics - Sample 2
 Dependent Variable: Shadow Econ'y - own calculations (UE2)

Explanatory Variable	IV-2SLS ¹⁾				
	(9)	(10)	(11)	(12)	(13)
Competition (Comp)	21.45*** (6.63)	8.92*** (2.47)	1.04 (2.19)	11.69*** (3.54)	6.33** (2.83)
Comp×GDP	-1.92*** (0.64)				
Comp×Corr		-1.12*** (0.37)			
Comp×LR2			0.71 (0.51)		
Comp×PT				-0.02 (0.03)	
Comp×IT				-0.16*** (0.04)	
Comp×CT				-0.10 (0.11)	
Comp×VAT				-0.04 (0.09)	
Comp×EE2					-0.63 (0.50)
Per-capita GDP (GDP)	-87.20*** (12.83)	-88.70*** (11.34)	-91.28*** (12.32)	-77.64*** (11.22)	-94.68*** (12.54)
Low corruption (Corr)	-4.30*** (1.47)	0.12 (1.64)	-3.78** (1.63)	-4.72*** (1.63)	-4.19*** (1.56)
Flexibility Index (LR2)	-3.63** (1.70)	-3.93** (1.73)	-7.85** (3.39)	-4.87** (1.89)	-4.14** (1.85)
Payroll tax rate (PT)	-1.83*** (0.38)	-1.49*** (0.34)	-1.41*** (0.36)	-1.51*** (0.37)	-1.35*** (0.34)
Income tax rate (IT)	0.61*** (0.08)	0.62*** (0.09)	0.59*** (0.08)	1.42*** (0.25)	0.60*** (0.09)
Corporate tax rate (CT)	1.28* (0.76)	1.48** (0.71)	1.60** (0.73)	2.41*** (0.89)	1.37* (0.71)
VAT (VAT)	-1.82 (1.55)	-1.48 (1.18)	-0.88 (1.17)	-1.61 (1.21)	-1.14 (1.12)
New Business (EE2)	4.18*** (1.08)	3.95*** (1.08)	4.28*** (1.23)	4.58*** (1.15)	6.53*** (2.44)
Fixed Effects	yes	yes	yes	yes	yes
Number of observations	196	196	196	196	196
Adjusted R^2	0.92	0.91	0.90	0.91	0.90

Standard errors (white heteroskedasticity-consistent) are in parentheses.

*/**/** denotes significance at 10/5/1 percent.

¹⁾ tax rates are instrumented by the neighboring country's tax rates and time trend