#### CAUSES OF THE SHADOW ECONOMY IN TRANSITION ECONOMIES

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#### I. The shadow economy

#### Shadow economy



- All economic activity that remains hidden from the authorities.
- Also known as "unobserved", "underground", "clandestine", "illegal" or "black" economy.
- Huge losses for society:
  - Tax income.
  - Market distortions.

#### **Examples**



- Illegal employment or underreporting of wages
- Sexual exploitation and forced labor
- VAT fraud
- Unreported rental of property
- Multimedia copyright infringement
- International smuggling of goods, particularly tobacco, drugs, weapons, etc.
- Illegal currency exchange



# Not necessarily illegal activities!



- Three categories:
  - Illegal: the activity itself is illegal.
  - Unreported: the activity itself is legal, but the income from the activity is fraudulently hidden from authorities.
  - Informal: small-scale activity that need not be reported.

#### Shadow economy (% of GDP, IMF, 2018)





#### Shadow economy (% of GDP) in transition economies



Source of figure: Vékás, Haász and Kovács, 2018 Source of data: Medina and Schneider, 2018

#### **Earlier research**



- Dimant and Tosato (2017): overview of literature on causes of corruption.
- Ruge (2010): causes of the shadow economy, cross-sectional data, structural equation models.
- Vékás, Haász and Kovács (2018): same approach as Ruge (2010), on a much larger group of countries, with characteristics of transition economies.

#### **Measurement methods**



- Very difficult to measure, almost 'by definition'.
- Approaches:
  - representative surveys,
  - indirect methods (national accounts, labor force, light intensity, etc.),
  - latent variable models (MIMIC),
  - Medina and Schneider (2018, IMF) combine advantages of previous approaches.

#### Indirect methods



- Difference between GDP's estimated from income and consumption data.
- Difference between official and true labor force (under a constant employment rate, a decrease in employment implies more shadow economy).
- Transactional approach: if the relationship between GDP and demand for cash (or foreign currency) is constant, an increase in cash holdings without an increase in GDP implies an increase in the shadow economy.



#### Light intensity method

- "True" GDP is assumed to be proportional to intensity of night lights.
- Theoretical basis

   (Kaufman and Kaliberda, 1996): the income elasticity of electricity has been shown to be close to 1.



## MIMIC approach



- MIMIC (Multiple Indicators, Multiple Causes, Zellner, 1970): the shadow economy is assumed to be indirectly measurable by multiple indicators (e.g., cash holdings), as well as resulting from multiple measurable causes (e.g., tax rates, unemployment).
- It uses structural equation models, where the shadow economy is a latent (unobserved) variable.

#### Medina and Schneider (2018, IMF)



- Imputation of missing data by 'predictive mean matching': survey data were only available for 49 countries.
- MIMIC model
- Light intensity estimate of GDP on one side of the equation, in order to avoid endogeneity



#### **II.** Data and methods

#### Data

- Panel of 114 countries, 16 years (1824 rows)
- Shadow economy (% of GDP, IMF, 2018)
- Transition economies: 0/1
- Macroeconomic indicators (World Bank):
  - Human Development Index (HDI)
  - Economic growth (GDP per capita change, %)
  - Inequality (Gini index)
  - Inflation (CPI)
- NASDAQ index as a proxy of stock market cycles

#### **Transition** economies



- Countries in Central and Eastern Europe and Central Asia that switched from planned economies to market capitalism starting in the early 1990's.
- Bureaucratic control of the economy and lack of economic incentives led to growth of shadow economy and lower taxation morale.
- Market institutions are relatively new (banking) system, income tax, money and capital markets, etc.).

#### Human Development Index

- Dimand and Tosato (2017) find that development has a strong impact on corruption and the shadow economy.
- Development can be measured in several ways: multicollinearity problem.
- We used the HDI, the official development index of the UN, devised by Indian Nobel laureate Amartya Sen and co-authors in 1990.
- Geometric mean of life expectancy, education and income partial indices.

#### **HDI by country**



#### Data

- Taxation (World Bank):
  - average VAT rate,
  - average tariff rate,
  - effective tax rate (% of GDP),
  - effective income tax rate.
- Institutions
  - Economic Freedom (Heritage Foundation)
  - Political rights (Freedom House)
  - Civil liberties (Freedom House)
  - Conflicts (coup, civil war, war): 0/1





#### **Data preparation**



- Years only between 2000 and 2015
- Omitting countries with too much missing data
- Imputation of missing data
- Transformations and combining categories
- Interactions of all variables with dummy variable of transition economies (for regional effects)

#### Panel linear models

- Commonly encountered model types:
  - a. Pooled model
  - b. Fixed effects
  - c. Random effects
  - d. Dynamic models



#### a. Pooled model



• Assumed that the same linear model is valid for all time points and individuals:

$$y_{it} = \beta_0 + \sum_{j=1}^p \beta_j x_{ijt} + \varepsilon_{it}$$

- Errors  $\varepsilon_{it}$  assumed to be independent.
- Estimated by simple ordinary least squares (OLS).

#### a. Pooled model





#### **b. Fixed effects**



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• Instead of a common constant  $\beta_0$ , we have individual constants (' effects')  $\mu_i$  for each individual:

$$y_{it} = \mu_i + \sum_{j=1}^p \beta_j x_{ijt} + \varepsilon_{it}$$

- Errors  $\varepsilon_{it}$  again assumed to be independent.
- Estimated by OLS with individual-specific dummy variables.

#### **b. Fixed effects**



person	ı year	$\operatorname{income}$	age	sex
1	2016	1300	27	1
1	2017	1600	28	1
1	2018	2000	29	1
2	2016	2000	38	<b>2</b>
2	2017	2300	39	2
<b>2</b>	2018	2400	40	2

Source: <a href="https://en.wikipedia.org/wiki/Panel\_data">https://en.wikipedia.org/wiki/Panel\_data</a>

#### c. Random effects



- Individual effects are assumed to be random variables from a normal distribution, which are uncorrelated with individual errors.
- The Hausman specification test can help decide whether to use fixed or individual effects.

#### d. Dynamic model



- In the dynamic model, there are lagged values of the dependent and independent variables.
- For example, a dynamic panel AR(1) model:  $y_{it} = \phi y_{i,t-1} + \mu_i + \sum_{i=1}^p \beta_j x_{ijt} + \varepsilon_{it}$

#### d. Dynamic models

$\operatorname{person}$	year	$\operatorname{income}$	age	sex
1	2016	1300	27	1
1	2017	1600	28	1
1	2018	2000	29	1
<b>2</b>	2016	2000	38	<b>2</b>
<b>2</b>	2017	2300	39	<b>2</b>
<b>2</b>	2018	2400	40	2

Source: <a href="https://en.wikipedia.org/wiki/Panel\_data">https://en.wikipedia.org/wiki/Panel\_data</a>

#### d. Dynamic models

- Stationarity may be tested using the Levin–Lin–Chu test.
- OLS estimates are biased.
- Generalized Method of Moments (Arellano–Bond, 1991, Blundell–Bond, 1998) is the preferred method of estimation.

#### Modeling



- Imputation of missing data: Bayesian additive model with bootstrapped errors
- Panel linear regression
  - Pooled model: no country or time effects
  - Fixed effects:
  - Random effects
  - Dynamic model
- Everything in R, except dynamic model in Gretl

#### **Specification**



#### • Tests:

- Chow test: a pooled model is not sufficient.
- Hausman test: random effects.
- Lagrange multiplier test: only country effects necessary, no time effects.
- Final model: random country effects.
- Variable selection by partial Wald *F* test of all omitted variables.
- White's heteroskedasticity-consistent errors.



#### **III. Results**

#### **Final model**



Predictor	Coefficient	z	р	Significance
Konstans	4,77	51,38	0,0000	***
HDI	-1,70	-21,09	0,0000	***
GDP_per_capita_growth	0,00	-6,16	0,0000	***
Taxrevenue	0,00	-4,26	0,0000	***
Gini	0,00	4,62	0,0000	***
Transition	2,06	10,95	0,0000	***
Taxpayments	0,00	3,05	0,0023	**
Ecofreedom	0,00	-2,30	0,0216	*
Conflict	0,02	1,80	0,0723	
VAT	0,00	3,58	0,0004	***
Log_tariff	0,02	3,21	0,0014	**
Civil_liberties_not_free	0,04	1,97	0,0491	*
Civil_liberties_partly_free	0,02	2,34	0,0192	*
Log_inflation	-0,04	-3,49	0,0005	***
Log_inflation*Log_inflation	0,28	3,06	0,0022	**
log(NASDAQ)	-0,04	-5,52	0,0000	***

#### Final model



Predictor	Coefficient	z	p	Significance
Transition*HDI	-2,38	-13,27	0,0000	***
Transition*GDP_per_capita_growth	0,00	-1,68	0,0925	
Transition*Taxrevenue	0,01	5,25	0,0000	***
Transition*Log tariff	-0,02	-2,90	0,0038	**
Transition*Political rights not free	0,12	2,94	0,0033	**
Transition*Poliical rights partly free	0,12	3,58	0,0003	***
Transition*Civil liberties not free	0,17	3,20	0,0014	**
Transition*Civil liberties partly free	0,08	2,76	0,0058	**
Transition*Log inflation	-0,05	-2,39	0,0171	*

#### **Dynamic models**



- Lagged dependent and independent variables on the right hand side.
- OLS estimation is biased and inconsistent.
- Generalized Method of Moments (GMM, Arellano–Bond, 1991, Blundell–Bond, 1998).
- Two-step estimation: to account for heteroskedasticity.

#### **Dynamic models**



- Strong multicollinearity after adding lagged dependent and independent variables: the parameters cannot be estimated.
- We excluded past taxes and monetary incentives based on economic rationality.
- Variable selection by partial Wald F test of all omitted variables.
- White's heteroskedasticity-consistent errors.
- Diagnostic tests (AR(2), Sargan, F) signalled no problem.

#### **Final model**



Predictor	Coefficient	z	р	Significance
Intercept	0,71	4,81	0,0000	***
Log_shadow(-1)	0,85	27,49	0,0000	***
HDI	-0,25	-3,60	0,0003	***
Gini	0,00	3,62	0,0003	***
GDP per capita growth	-0,01	-7,26	0,0000	***
Ecofreedom	0,00	-3,09	0,0020	***
VAT	0,00	1,67	0,0959	*
Transition	0,08	3,09	0,0020	***
Transition*Incometax	0,00	2,90	0,0037	***
Transition*Civil liberties free	-0,09	-3,73	0,0002	***
Diff Log NASDAQ	-0,04	-4,95	0,0000	***
Diff Log NASDAQ(-1)	-0,02	-3,78	0,0002	***



#### **IV.** Conclusions

#### Main findings



- Social and economic development lessens the motivation for tax evasion.
- Economic crises increase the shadow economy, while growth decreases it.
- Income inequalities increase the shadow economy.
- Increasing tariffs and VAT increases the shadow economy.

#### Main findings



- Strong market institutions and economic freedom reduce the shadow economy.
- Inflation worsens tax morale.
- Increasing civil rights decreases the shadow economy.
- Armed conflicts increase the shadow economy.

#### **Regional effects**



- Economic development has a significantly stronger positive impact on the shadow economy in TE's than in the rest of the world.
- The positive impact of political rights and civil liberties is stronger in TE's than elsewhere.
- High potential in the region for low shadow economy, given the right economic and political environment.
- Increasing tariffs does not increase the shadow economy in TE's: smuggling not a big issue.





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