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Vicious Circle or New Paradigm? Exploring the Impact of Shadow Economy on Labour Market in Latin America and Eurozone

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Abstract

The relationship between shadow economy (or informal economy) and development has been extensively researched. But there is a lack of consensus on how institutional quality affects the size of informal economy in any country. Using the Kuznets Curve hypothesis we assess the relationship between institutional quality and the size of SE for a group of Latin American and Eurozone countries for 1991-2015. We examine the rationale of the 'exclusion' and 'escape' theories in short and long-run with the multiple indicators multiple causes (MIMIC) model. We use two techniques, namely an instrumental variable (IV) and Fully Modified OLS (FMOLS) approach. The results show positive and a significant relationship between labour productivity and the size of the shadow economy. We also find that the size of the informal sector is related to the institutional framework, and while the size of the informal sector varies across countries, both formal and informal sectors can co-exist in the long run. High corruption together with an excessive tax burden and adverse socio-economic conditions impact the size of the informal sector in an economy.

JEL classification: O17, O40, O43, C23, C26

Keywords: Shadow Economy; informal sector; development; cointegration; causality

1. Introduction

The relationship between shadow economy (SE) (also termed informal economy) and development has attracted a great deal of academic attention (Medina and Schneider 2018; Hassan and Schneider 2016; Schneider and Williams 2013; Schneider 2011, 2015, 2016; Feld and Schneider 2010; Tresiman, 2007; Gillman and Cziraky 2004; Gerxhani 2003, 2005; Ranis, 2005; Schneider and Entse, 2002). Perry et al. (2007) examine workers' incentives to seek employment in the SE, they find that the choice is attributed to workers' inability to earn high wages in times of market failure. The literature on the determinants of SE comprises a larger body of work with studies highlighting that individual incentives and remuneration impact workers preference to seek employment in the informal sector. This, however, adversely impacts the economy's tax revenues and economic indicators, such as economic growth, unemployment and income distribution (Schneider, 2011; Anno et al., 2006; Gërkhani, 2004; Schneider and Enste, 2000). Studies that examine the relationship between poverty and the size of the SE report a close relationship between income inequality and the size of informal sector (Berdeiv et al., 2020; Berdiev and Saunoris, 2018; Mishra and Ray, 2010; Chong and Gradstein, 2007; Rosser et al., 2000). The seminal work by Kuznets (1955) hypothesised that the structural shift of the labour force would widen inequality in the early phases of development, but the gap narrows over time as development progresses. Studies examining the link between SE and economic growth find that the institutional quality, i.e. governance, level of corruption, bureaucratic quality, the rule of law, and political stability, is an important driver of the size of SE and that that poverty has a positive and significant effect on the size of the shadow economy (Berdiev et al. 2020; Elbahnasawy, et al., 2016; Dreher and Schneider, 2009; Dreher and Schneider, 2010; Dreher, et al., 2009; Torgler and Schneider, 2009).

The growing literature has mainly focussed on the implications of SE for development. There have been only a few studies that examine what determines workers' choice to work in the SE and how wages respond to political interventions (e.g. higher tax) and population growth (Goto and Mano, 2012). To address this gap, we use Kuznets Curve (KCs or inverted-U Curves) to assess how institutional quality impacts market outcomes for 12 Latin American (LATAM) and eight Eurozone (EZ) countries for 1991-2015. Our paper builds on Acemoglu and Robinson's (2002) paper on the political economy model of KCs which highlights the importance of institutions and political factors in Latin America and Asian countries for development. This paper examines the trade-offs between development and

SE for a heterogeneous countries in LATAM and EZ. Using the Multiple indicators multiple causes (MIMIC) model, we provide an insight into the relationship between the cause and indicator variables of the SE in EZ and LATAM. We control for cross-sectional heterogeneity with the Fully Modified-OLS (FMOLS) approach and generalise the VECM technique for more than one country (Pedroni, 1999). We also capture the impact of the business cycle on gross domestic product (GDP) and human capital. The results show that there is a significant and positive relationship between labour productivity and size of the SE and that the choice to seek employment in the informal sector is determined by workers' personal preference. The results confirm that the size of the informal sector is related to a country's institutional framework, and while the size of the sector varies across countries, both sectors (formal and informal) co-exist in the long run. Finally, a high corruption together with an excessive tax burden and adverse socio-economic conditions impact on the workers' incentive to work in the formal economy. The remainder of the paper is organised as follows: Section 2 reviews the relevant literature on SE. Section 3 discusses the methodological and econometric approach, and elaborates on the techniques and variables employed for analysis. Section 4 presents the descriptive statistics. Section 5 discusses the empirical results. Section 6 offers concluding remarks and outlines the implications for policy making.

2. Literature review

SE is defined as “economic activities, whether legal or illegal, which are required by law to be fully reported to the tax administration but not reported, as a result, these go untaxed unlike activities which are so reported” (OECD, 2017). In other words, all economic activities that contribute to the officially calculated (or observed) gross national product but are currently unregistered fall within the SE. There is no widely accepted single definition of the underground economy, as pointed out by Schneider and Enste (2000), Giles and Tedds (2002), and Dell'Anno (2003), which shines a light on the current controversy around the lack of a universally accepted definition and what constitutes SE activities. Further, there is a lack of unanimity on the estimation procedures employed for economic analysis of the SE in a country (Schneider and Enste 2000; Feld and Schneider 2010; Besley and Persson 2010). At the same time the debate on the productivity and legal viewpoints of the SE sector has also grown. The productivity view suggests that workers with lower qualifications are mostly employed in the SE which is characterised by low capital-labour ratio (Fields, 1990). The legal view opines that, in the absence of labour contracts, workers have no

access to social security (i.e. retirement, pensions, health insurance, paid holidays, etc.) which is the basis for workers to opt for the SE. Both perspectives have shortcomings mainly because the productivity measurement of unregistered activities is problematic as a result the findings across countries are heterogeneous (Gasparini and Tornarolli, 2009).

Literature presents two non-mutually exclusive perspectives for employment in the SE with “exclusion” and “escape” theories. Both theories suggest that the SE can co-exist simultaneously and depend on the economic cycle, i.e. troughs, expansions, peaks, or contractions. The “exclusion” theory, which is grounded in labour economics, explains market segmentation as a direct consequence of informality such that some workers are unwilling to leave the informal economy, but others may have joined after being expelled when the GDP shrinks during crises. The “escape” theory explains that the SE absorbs workers who have less chance of earning higher wages. Perry et al. (2007) attribute workers’ decision to join the SE to their inability to earn high wages and market failures, this is explained by several factors such as lack of minimum wages, excessive taxes, mismatch between skills available and required by the employers, as well as institutional weaknesses. Other reasons to choose the informal sector include heterogeneity of skills (e.g. different levels of human capital), preference of self-employed workers for “time and freedom” and the comparative advantage of flexibility compared to traditional jobs.

Hirschman (1970) suggests that the informal sector is a consequence of a deliberate “choice” by firms and workers. He study highlights the role of “choice” and explains why workers join the SE and that their decision is linked to the level of skills and smaller benefits from social protection. For some workers, however, “going informal” is an optimal choice because benefits, such as ‘at-will holidays’ lie within their optimisation frontier. Torgler and Schneider (2007) however state that “the violation of social norms is connected with higher costs of being active in the informal sector”. Studies present mixed findings on the relationship between taxes and the size of the SE. Some show that low taxes lead to a small informal sector, which means higher tax revenue for governments that increase spending and improve the provision of public goods which in turn stimulates economic growth (Gërkhani, 2004; Johnson et al., 1997 Loayza et al., 2009, Schneider and Enste 2000). Loayza (1996) highlights the negative impact of the SE on urban services by stressing that low tax collection from a big SE sector affects the government’s ability to fund infrastructure projects. Diametrically opposite is Assea (1996) who states “SE may increase financial resources, generate dynamic entrepreneurship and mould the necessary institutions for capital accumulation”. Hayek argues that the information

about time and space allows entrepreneurs to create new markets. This, however, does not imply that all employment would necessarily be created in the SE. Studies highlight the role of government policies and resources. For example, De Soto (1989) discusses firms' responsibility to comply with the legal requirements and fiscal burden, and suggests that investment by the government in innovation and entrepreneurship leads to high-quality job creation. Studies also show that government policies segment markets between high and less qualified workers¹

Studies highlight the importance of institutional quality (e.g. good governance, level of corruption, bureaucratic quality, rule of law, political instability) as the driver of SE (Dreher and Schneider 2009; Dreher, et al. 2009; Elbahnasawy, et al. 2016; Torgler and Schneider, 2009). Acemoglu and Robinson (2002) outline the importance of institutions in the growth process and use KCs to highlight how institutions have a knock-on impact on economic development.² Studies conclude that better (worse) institutions provide stronger (weaker) incentives to workers/firms to behave legally (illegally) and increase (decrease) the cost of illegal activities from greater institutional accountability. Studies find evidence of small SE in developed countries. For example, in Western Europe the size of the SE ranges between 10-20% of the GDP but in East Europe this ranges between 30-35 %. It is worth highlighting that since 2000 the size of the SE has grown in Croatia, Cyprus, Greece, Serbia, but declined in the Czech Republic and Macedonia. As discussed, the size of the SE is linked to the economic cycle, and study find that the size of the SE increased during the Financial Crisis (2008-2010) but declined to pre-crisis level in 2015 (Kelmanson et al., 2019). Thießen (2003) examines the dynamics of the SE in Ukraine and assesses how state measures can reduce the size of the informal sector effectiveness. Studies on Latin America find that labour informality declined in most countries between 1990-2010; El Salvador and Mexico were exceptions (Tornarolli et al, 2014).³

¹ A note of caution must be added here: if entrepreneurs try to preserve their profitability by cutting labour costs, this segmentation will not happen simply because there will be no highly skilled position to apply for. On the contrary, the role of the State is useful if it focuses on building highly competitive sectors and enterprises through public investment.

² According to the CEIC data, the Chinese Gini coefficient calculated for income inequality has shown a downward trend since 2008, even though it is still high compared to the OECD countries, around 0.46/0.47. Acemoglu and Robinson argue that inequality does not increase with development (p. 194).

³ However, the definition of the informal sector varies by studies which employ the MIMIC approach, but the legal definition (social protection definition) that makes use of informal labour force figures and trends in LATAM are quite similar to many European countries, even though some countries belong to the Eurozone.

3. Econometric approach

This paper draws on study by Medina and Schneider (2018) that uses 1991 – 2015 data for 158 countries, and is the basis for the size of the SE for 12 LATAM and 8 EZ countries (see Annex table 1.1 for the list of countries). In line with Medina and Schneider (2018), the SE includes legal, economic and productive activities which, if recorded, would contribute to national GDP. This definition of the SE avoids illegal or criminal activities, do-it-yourself, or other household activities. The extant literature identifies the institutional factors, e.g. high taxes and burdensome regulations, as determinants of the SE.

We use the MIMIC⁴ measure that captures the size of the SE. Several modelling approaches rely on parameters such as the circulation of currency and national accounts, and MIMIC models examine the relationship between economic variables.⁵ We also draw from Lewbel (2012) to identify the structural parameters in models with endogenous regressors where other sources of identification, such as instrumental variables, repeated measurements or validation studies, are not available. The IV approach are used in linear regression models where the zero conditional is violated and this requires using appropriate instruments to identify the model via exclusion restrictions.

Let M be the set of instruments, then M must satisfy the following conditions:

- 1) They must be orthogonal i.e. $E(\varepsilon M) = 0$ where u is the traditional error term;
- 2) They must have a meaningful correlation with the endogenous regressor(s);
- 3) They must be properly excluded from the model so that their effect on the dependent variable is only indirect.

⁴ For details see Medina and Schneider (2018): this work argues that SE implies (measuring) the non-observed economy. Gyomai and van de Ven (2014) suggest that the non-observed economy involves the underground hidden production, illegal production, the informal sector production, the production of households for own (final) use, and that the statistical underground data is missed due to deficiencies in the statistical system.

⁵ See Schneider (2010, 2015), Feld and Schneider (2010), Abdih and Medina (2016), Vuletin (2008), and Williams and Schneider (2016), Medina and Schneider (2018). Conventionally, the SE is measured with direct (micro) and indirect (macro) methods. Direct methods include using the System of National Accounts Statistics; survey technique; surveys of company managers; and the estimation of the consumption-income-gap of households. Indirect approaches, also termed “indicator” approaches, these are primarily macroeconomic in nature. These are, in part, based on discrepancy between national expenditure and income statistics; official and actual labour force; as well as on “electricity consumption” approach proposed by Kauffman and Kaliberda (1996); “monetary transaction” approach (Feige, 1979); and “currency demand” approach (Cagan, 1958; Tanzi, 1983). The key methods to estimate the size of the underground economy are in Schneider and Enste (2000) that provide an overview on the estimation of the size of the SE.

Finding appropriate instruments that simultaneously satisfy all three conditions is a major obstacle to employing IV techniques. These methods are used not only to address endogenous regressors but also omitted variables, or when there are measurement errors in regressors which can cause bias and inconsistency in OLS estimates. The method we use identifies structural parameters in regression models with endogenous or mismeasured regressors in the absence of traditional identifying information, such as external instruments or repeated measurements. The approach is particularly useful when external instruments are not available.

The identification is by including regressors that are uncorrelated with the product of heteroskedastic errors, which is a feature of many models where error correlations are due to an unobserved common factor. As internal instruments can be used, this approach is similar to the dynamic panel data estimators by Arellano and Bond (1991) as estimators make use of appropriate lagged values of endogenous regressors to identify the model.

Considering a static case, let W be an endogenous observed variable, X a vector of observed exogenous regressors and ε be the unobserved error. We can write the following:

$$Y = X'\beta + W\gamma + \varepsilon \quad (1)$$

If $E(\varepsilon X) = 0$ holds, the reduced form is identified, but in the absence of restrictions, the structural parameters are not. These restrictions often involve setting some elements of the coefficient vector β to zero which makes the instruments available. In many applied contexts, the assumption [(3) above] – i.e. the instrument only indirectly affects the response variable – is difficult to establish. The zero restriction on its coefficient may not be plausible. This assumption is testable, and if it does not hold, IV estimates will be inconsistent. The method used achieves identification by restricting correlations of $\varepsilon'\varepsilon$ with the vector X . This relies upon higher moments and is likely to be less reliable than identification based on coefficient zero restrictions. However, in the absence of plausible identifying restrictions, this approach is the only reasonable strategy.⁶

⁶ Ideally, the best scenario is one in which both type of instruments (i.e. constructed and external) are both implemented. In this way, the researcher may obtain additional information for model tests and for robustness checks.

In the present single equation context when the appropriate instruments or identifying restrictions are lacking the so called “auxiliary first stage regression” is used for Lewbel’s method. Here, instruments are constructed from the auxiliary equations’ residuals and multiplied by each of the included exogenous variables in mean centered form:

$$Z_j = (X_j - \bar{X})\epsilon \quad (2)$$

Where ϵ is the vector of residuals from the first stage regression for each endogenous regressor found on all exogenous regressors, including a constant. These auxiliary regression residuals have zero covariance with each of the regressors used to construct them, implying that the means of the generated instruments will be zero by construction. However, their element-wise products with the centered regressors will not be zero and will contain sizable elements if there is clear evidence of “scale heteroscedasticity” with respect to the regressors. The greater the degree of scale heteroscedasticity in the error process, the higher will be the correlation of the generated instruments with the included endogenous variables when these are the regressors and in the auxiliary regression(s).

We estimate the following model:

$$SE_{i,t} = llppe_{i,t} + lgdppc_{i,t} + lgdppc_{i,t}^2 + trevsc_{i,t} + Z_{i,t} + \mu_t + \epsilon_{i,t} \quad (3)$$

The SE is the dependent variable which measures the SE over GDP.

- *llppe* is the natural logarithm of the labour productivity per person employed.
- *lgdppc* is the natural logarithm of per capita GDP and the square is taken to account for non-linearities.
- *trevsc* are tax revenue and social contributions over GDP.
- *Z* are controls variables (these are financial crisis, human capital index, labour force participation rate, population growth, trade openness, political corruption, state regulations and socio-economic conditions).

Appendix A.2 list all the variables.

4. Descriptive statistics

The SE is between 7.7% (minimum) and 71.3% (maximum) as a proportion of GDP for LA and EZ countries (Table 1). The average size is less than 25% during 1991-2015, and the GDP per capita and labour productivity are on average

USD 30,000 and USD 66,362, respectively. The dispersion of GDP growth rate indicator is given by the variation coefficient which is between 1.29 and 2.37, respectively. Given the heterogeneity of countries in the sample, a possible explanation is the quality of institutions. For instance, the average corruption index score (corr) is 3.73 out of 6 while the socio-economic condition index is on average 6.93 out of 11 (maximum) which suggests that as the quality of institutions deteriorate (e.g. higher levels of corruption) workers choose to “escape” from the formal into informal economy. On the contrary, lower corruption in developed EZ countries indicates greater “checks and balances” which explains the workers choice to “escape” for higher labour flexibility. The results (a priori) indicate that public policies may not be sufficient to reduce the size of SE.

Table 1: Descriptive Statistics (1991-2015)

Variables	Full Panel					Latin America					Eurozone				
	mean	sd	cv	min	max	mean	sd	cv	min	max	mean	sd	cv	min	max
Shadow economy	24.70	14.20	0.57	7.69	71.30	36.50	14.50	0.40	12.60	71.30	16.90	6.42	0.38	7.69	29.80
GDP per-capita (USD)	30,003.50	18,742.30	0.62	4,227.70	104,449.10	13,187.10	4,918.50	0.37	4,227.70	23,787.50	41,214.40	15,964.90	0.39	22,139.30	104,449.10
GDP (growth)	2.63	3.40	1.29	-10.90	18.30	3.61	3.91	1.08	-10.90	18.30	1.98	2.84	1.43	-9.13	10.60
Population (thousands)	37,528.10	43,186.20	1.15	388.10	206,666.60	54,929.40	55,709.90	1.01	6,731.50	206,666.60	25,927.20	26,634.40	1.03	388.10	82,915.00
Population (growth)	0.91	0.67	0.73	-0.72	2.92	1.44	0.38	0.27	0.79	2.41	0.56	0.57	1.03	-0.72	2.92
Labour productivity (USD)	66,362.40	32,855.60	0.50	11,121.50	150,746.10	32,331.40	12,322.50	0.38	11,121.50	53,611.10	89,049.70	20,233.70	0.23	47,515.50	150,746.10
Labour productivity (growth)	1.10	2.60	2.37	-11.40	13.30	1.09	3.40	3.13	-11.40	13.30	1.10	1.89	1.71	-6.01	7.28
Annual hours worked	1,808	230.50	0.13	1,397	2,370	1,998	167.50	0.08	1,704	2,370	1,703	190.20	0.11	1,397	2,136
Employment (growth)	1.52	2.26	1.48	-7.84	8.46	2.50	2.08	0.83	-5.57	8.21	0.87	2.13	2.45	-7.84	8.46
Labour quality contribution	0.30	0.46	1.56	-1.85	2.83	0.36	0.59	1.63	-1.85	2.83	0.25	0.34	1.36	-1.83	2.75
Human capital	2.77	0.40	0.14	1.74	3.67	2.49	0.30	0.12	1.74	3.07	2.96	0.34	0.12	1.97	3.67
Tax-revenue	30.00	10.60	0.35	9.20	45.80	19.10	6.42	0.34	9.20	34.40	37.30	5.29	0.14	23.20	45.80
Labour participation	68.90	5.02	0.07	57.90	81.70	68.60	4.67	0.07	59.20	81.70	69.10	5.23	0.08	57.90	79.80
Trade openness	76.90	60.00	0.78	13.80	416.40	44.50	16.50	0.37	13.80	85.30	98.60	68.20	0.69	34.00	416.40
Freedom index	7.02	0.97	0.14	2.71	8.32	6.26	1.06	0.17	2.71	7.92	7.53	0.39	0.05	6.15	8.32
Government size	6.02	1.15	0.19	3.01	8.42	6.93	0.95	0.14	4.40	8.42	5.41	0.82	0.15	3.01	7.14
Property rights	6.27	1.71	0.27	2.00	9.14	4.52	1.00	0.22	2.00	6.88	7.44	0.90	0.12	5.34	9.14
Sound money	8.44	1.97	0.23	0.00	9.86	6.90	2.33	0.34	0.00	9.72	9.46	0.50	0.05	6.68	9.86
Freedom trade	7.88	1.12	0.14	3.21	9.22	7.02	1.26	0.18	3.21	8.72	8.46	0.47	0.06	6.83	9.22
Regulations	6.51	1.03	0.16	2.56	8.60	5.95	1.03	0.17	2.56	7.70	6.88	0.85	0.12	4.48	8.60
Socioeconomic condition	6.93	1.89	0.27	2.00	11.00	5.57	1.50	0.27	2.00	8.50	7.84	1.55	0.20	3.92	11.00
Corruption	3.73	1.32	0.35	1.00	6.00	2.66	0.80	0.30	1.00	4.50	4.44	1.09	0.25	2.00	6.00
Observations	500					300					200				

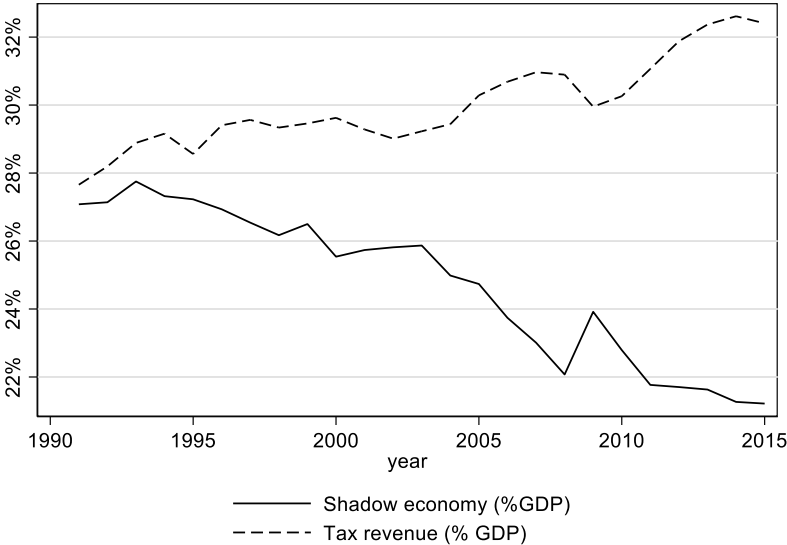
Source: Authors' calculations

The size of the SE for LATAM is 36.5% of the GDP whereas the size of the informal sector is smaller for the EZ countries (16.9%). Table 1 shows that tax revenues follow a pattern as expected – tax collections are lower in LATAM (19.1%) compared to the EZ (37.3%). Labour productivity also varies - countries with higher GDP per capita in the EZ have higher productivity than LATAM which have lower GDP per capita with labour productivity per person of 63.7%, that is lower than the EZ. In addition, the variation coefficient of labour productivity growth has a higher dispersion for LATAM (3.13) compared to EZ (1.71). This suggests that firstly, productivity varies across LATAM and EZ; and secondly, informal workers with lower level of productivity are more likely to join the SE in LATAM.

The results for institutional quality show that state regulations, social conditions and corruption vary between LATAM countries (15.6%, 40.7% and 66.9%, respectively) and the EZ countries. Property rights, price stability and the freedom to trade are in line with the overall macroeconomic environment of LATAM countries which are characterised by high inflation and volatile exchange rates. For example, excessive state regulations tempts the workforce to “escape” the formal sector. An examination of labour market evolution shows that employment growth rate (emp_{gr}) limits the size of SE. However, there is lack of employment growth dynamism in LATAM, which has an average value growth rate of 1.52. But the variation coefficient confirms the contrary result (1.48). A possible explanation is that lower human capital index, i.e. when the lower human capital fail to meet the minimum requirements of the job market, or low labour productivity explains why unskilled workers choose the informal sector. Moreover, from firms’ perspective this could imply that job-destruction rates of low-quality jobs is high under the “exclusion” theory which suggests that the SE absorbs workers who are unable to join the formal economy.

Figure 1 shows the relation between the SE and tax revenue. The results show that for 1991-2005 when the size of the SE diminishes there is an increase in tax revenue. The total tax collections (including social contributions) are 30% of the GDP on average (Figure 1) suggesting that the workers prefer to join the formal economy when governments allocate higher fiscal resources for economic development highlighting the importance of the quality of institutions.

Figure 1: Shadow Economy & Tax Collection



Source: Authors’ calculations

Table 2, however, presents mixed results. On the one hand, there is a negative and statistically significant relationship between tax revenue and the SE for the full sample (-0.627) but, on the other, the evidence for the two group of countries taken separately is negative. For LATAM the correlation is insignificant (0.079), and for the EZ this is highly significant and negative (-0.287). The relationship between SE and labour force participation is positive and statistically significant for LATAM countries (0.452) but this is strongly significantly and negative (-0.605) for the EZ countries. A possible explanation is that the sample of countries included in the sample have effective institutions, which are characterised by strong property rights and state regulations, as well as government size, the ease of trade and price stability reduces the incentive for the workforce to join the SE. Conversely, low quality of institutions encourages the workers to join the SE, i.e. “escape” from the formal system. Nonetheless, based on the evolution of the main indicators, both the “exclusion” and “escape” theories co-exist for the Eurozone countries with no plausible

explanation provided by descriptive statistics or correlation without an econometric specification presented in the next section.

Table 2: Correlation by Region (1991-2015)

Variables	Full Sample		Latin America		Eurozone	
	P.Corr	P-Value	P.Corr	P-Value	P.Corr	P-Value
Shadow economy	1		1		1	
GDP per-capita (USD)	-0.717	0.000	-0.850	0.000	-0.558	0.000
GDP (growth)	0.106	0.018	-0.029	0.688	-0.174	0.002
Population (thousands)	0.181	0.000	-0.112	0.116	0.102	0.078
Population (growth)	0.518	0.000	0.613	0.000	-0.280	0.000
Labour productivity (USD)	-0.789	0.000	-0.861	0.000	-0.500	0.000
Labour productivity (growth)	-0.062	0.169	-0.102	0.152	-0.025	0.665
Annual hours worked	0.596	0.000	-0.001	0.991	0.629	0.000
Employment (growth)	0.232	0.000	0.118	0.097	-0.208	0.000
Labour quality contribution	0.075	0.092	-0.017	0.809	0.024	0.675
Human capital	-0.634	0.000	-0.296	0.000	-0.648	0.000
Crisis	-0.021	0.639	-0.105	0.137	0.151	0.009
Tax-revenue	-0.627	0.000	-0.079	0.267	-0.287	0.000
Labour participation	-0.036	0.425	0.452	0.000	-0.605	0.000
Trade openness	-0.449	0.000	-0.044	0.533	-0.468	0.000
Freedom index	-0.555	0.000	-0.090	0.206	-0.704	0.000
Government size	0.470	0.000	-0.024	0.740	0.194	0.194
Property rights	-0.771	0.000	-0.374	0.000	-0.811	0.000
Sound money	-0.453	0.000	0.008	0.907	-0.361	0.000
Freedom trade	-0.444	0.000	0.038	0.596	-0.314	0.000
Regulations	-0.489	0.000	-0.149	0.035	-0.572	0.000
Social conditions	-0.584	0.000	-0.146	0.040	-0.626	0.000
Corruption	-0.626	0.000	-0.271	0.000	-0.483	0.000

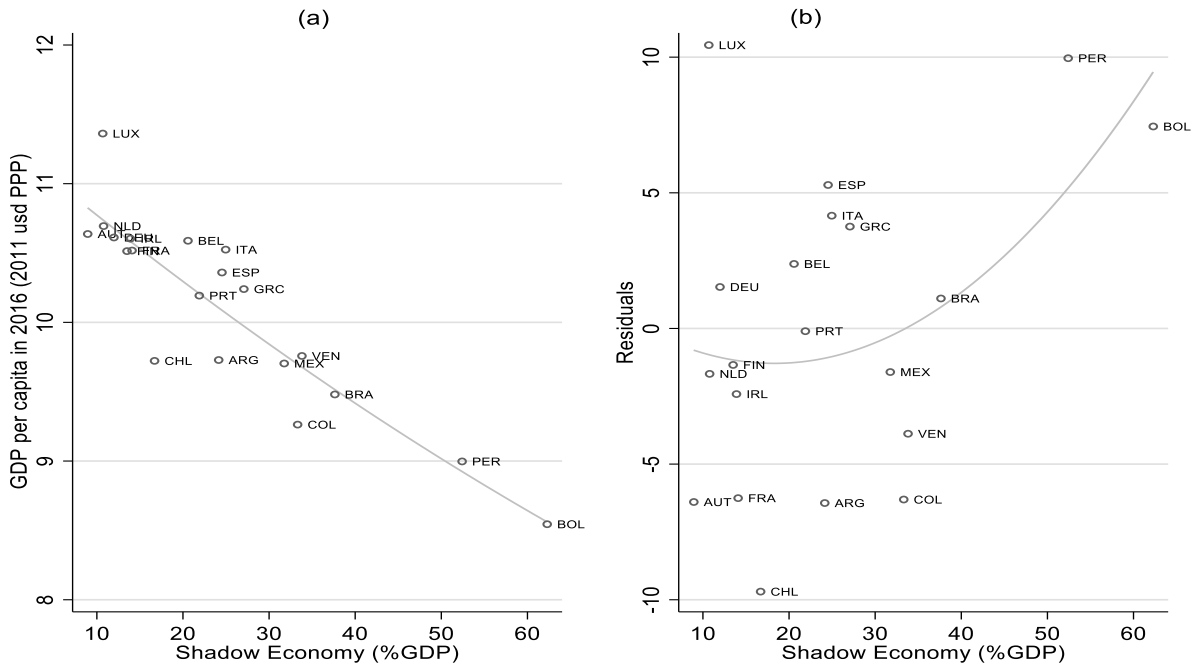
Source: Authors' calculations

Figure 2 presents the relationship between SE (to GDP) and GDP per capita. Panel (a) shows that as economies grow (i.e. higher GDP per capita growth) the level of the informal sector shrinks but this does not disappear completely due to the nature of the economic cycles (i.e. troughs, expansions, peaks or contractions). Conversely, panel (b) plots the SE on the horizontal axis against the residuals of the following regression:

$$\overline{SE} = \alpha + \beta_1 \overline{hc} + \beta_2 \overline{sgov} + \beta_3 \overline{reg} + \beta_4 \overline{corr} + \varepsilon \quad (4)$$

In (4) the \overline{SE} is the time-averaged from 1991 to 2015 and the regressors are time-averaged values of all countries for: \overline{hc} (human capital index); \overline{sgov} (government size index); \overline{reg} (state regulations index) and \overline{corr} (corruption index).⁷ Panel (b) presents that the negative relation between variables disappears with controls. Furthermore, the relation is not quasi-linear as it becomes positive more or less at 20% of the SE to GDP.

Figure 2: Relationship between Shadow Economy and Economic Development



Source: Authors' calculations

5. Empirical Results

a. IV estimation with heteroskedasticity-based instruments

To estimate the threshold of per capita income we calculate the value at which the first derivative becomes zero, i.e., the point which reaches a certain maximum or minimum level. We also deal with an endogenous regressor, namely labour productivity. If this endogeneity were not accounted for, it would lead to biased estimates. To overcome this,

⁷ We also plot a Lowess regression with country-year point which is harder to visualise and has no additional information.

we estimate a linear model for labour productivity⁸ and use the selected exogenous instrument along with the lags of the endogenous variable. Simply put, the instruments both internal and external are constructed as simple functions of the data generating process so that unobserved common factors are more likely to be identified. We also rely on the u-test to assess the presence of a U-shape or monotone/inverted relationship (Lind and Mehlum, 2010).

Table 3 presents the instrumental panel approach, the endogenous regressors (labour productivity) are instrumented with the total hours worked in each country and labour productivity lags.⁹ The four specifications presented differ by presence (or absence) of different institutional controls.

⁸ Burnside, Eichenbaum and Rebelo (1993), Basu and Kimball (1997) find that movements in labour productivity are endogenous due to labour hoarding and variable capacity utilisation.

⁹ Our best specification found is that with four lags of internal and one lag with external instruments. In addition, country fixed-effects were included for all the models. According to Ohanian et al. (2006), differences in taxes can explain much of the variation in hours worked both over time and across countries. In our case, in a fixed-effect specification, the inclusion of total hours worked in a year combined with labour productivity lags internally generated can be good predictors for our casual inference.

Table 3: Instrumental Variable Heteroskedasticity-Based Regression

Panel (a)	Full Panel				Latin America				
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)
IV Estimation									
(Log) Labour productivity	-5.736** [0.038]	-5.426** [0.047]	-4.650* [0.099]	-5.849** [0.041]	-5.521 [0.449]	-3.386 [0.650]	-5.040 [0.521]	-6.666 [0.369]	-7.708*** [0.000]
Log(Gdp-pc)	-157.954*** [0.000]	-158.805*** [0.000]	-161.678*** [0.000]	-168.219*** [0.000]	-251.536*** [0.000]	-255.889*** [0.000]	-250.555*** [0.000]	-273.635*** [0.000]	-122.485** [0.000]
Log(Gdp-pc)^2	7.298*** [0.000]	7.292*** [0.000]	7.428*** [0.000]	7.827*** [0.000]	12.350*** [0.000]	12.491*** [0.000]	12.276*** [0.000]	13.588*** [0.000]	5.520*** [0.001]
Tax-revenue	-0.011 [0.787]	-0.044** [0.351]	-0.041** [0.355]	-0.043 [0.321]	-0.047 [0.436]	-0.051 [0.432]	-0.055 [0.368]	-0.092 [0.153]	-0.159*** [0.001]
Crisis	0.324** [0.037]	0.196 [0.287]	0.147 [0.427]	0.086 [0.655]	0.361 [0.351]	0.328 [0.412]	0.323 [0.410]	0.160 [0.673]	0.439*** [0.009]
Trade openness	-0.030*** [0.000]	-0.034*** [0.000]	-0.033*** [0.000]	-0.037*** [0.000]	-0.064** [0.032]	-0.064** [0.033]	-0.065** [0.031]	-0.076** [0.014]	-0.017** [0.031]
Human capital		1.627* [0.080]	2.207** [0.023]	1.976** [0.029]		0.606 [0.614]	0.417 [0.713]	0.969 [0.429]	
Regulations			-0.530*** [0.003]	-0.483*** [0.007]			-0.068 [0.854]	-0.239 [0.473]	
Corruption				-0.099 [0.292]				0.097 [0.684]	
Socioeconomic conditions				-0.147* [0.062]				-0.373*** [0.008]	
J statistic	[0.130]	[0.238]	[0.498]	[0.407]	[0.357]	[0.438]	[0.264]	[0.246]	[0.173]
C statistic	[0.082]	[0.184]	[0.282]	[0.426]	[0.294]	[0.371]	[0.115]	[0.116]	[0.132]
F statistic (first stage)	43.960	44.440	44.720	43.620	15.860	11.530	17.080	17.420	112.600
R-squared (uncentered)	0.858	0.860	0.865	0.868	0.923	0.923	0.923	0.930	0.693
Number of observations	391	391	391	391	139	139	139	139	252
Number of countries	19	19	19	19	7	7	7	7	12
Panel (b)									
Non-monotonic test									
Minimum SE (t-statistic)	-12.227 [0.000]	-12.753 [0.000]	-13.422 [0.000]	-13.570 [0.000]	-6.255 [0.000]	-6.387 [0.000]	-5.935 [0.000]	-6.651 [0.000]	-3.591 [0.000]
Maximum SE (t-statistic)	2.368 [0.009]	1.928 [0.027]	2.128 [0.017]	2.700 [0.004]	5.286 [0.000]	5.263 [0.000]	4.944 [0.000]	5.560 [0.000]	0.283 [0.389]
U-shape overall test (t-statistic)	2.370 [0.009]	1.930 [0.027]	2.130 [0.017]	2.700 [0.004]	5.290 [0.000]	5.260 [0.000]	4.940 [0.000]	5.560 [0.000]	0.280 [0.389]
Confidence interval (Fieller at 90%)									
Lower	10.627	10.693	10.699	10.537	9.931	9.981	9.919	9.783	10.862
Upper	11.044	11.111	11.088	10.981	10.433	10.499	10.485	10.347	11.643
Estimated minimum	10.822	10.889	10.883	10.746	10.184	10.243	10.205	10.069	11.095

Notes: We apply to the IV covariance matrix the heteroskedasticity and autocorrelation consistent (HAC) correction proposed by Newey and West (1987) by setting a maximum lag of 2 for (2013). p-values are reported in square brackets. ***, ** and * indicate significance at 1%, 5% and 10%, respectively. Source: Authors' calculations

Irrespective of the country under consideration all the variables exhibit the same sign. An increase in labour productivity impacts the size of SE over GDP negatively, particularly for the EZ though this does not apply to LATAM.¹⁰ An increase in per capita GDP has a negative and statistically significant impact on the SE for all countries taken together, and as a group it is higher - up to 2.7 pp for a 1% increase - in LATAM (see, LATAM model IV). Conversely, the square presents positive coefficients, particularly in LATAM which corroborates the U-shape hypothesis. Tax revenues have a negative and generally significant influence on the SE, i.e. the higher the taxes, the lower the SE. In terms of causation, we interpret it in the following manner: higher taxes are collected when a larger number of people have a formal job, i.e. a higher number of official employees increase taxes paid. The figures are smaller when further controls are included. The crisis dummy is significant in the absence of institutional controls. For LATAM countries the variable is positive though insignificant. One possible explanation is that within the sample only a few countries are considered.¹¹ Accordingly, we cannot rule out any structural changes to the size of the SE after the 2008 financial crisis.

Irrespective of the group of countries trade openness affects the SE negatively,. The effect is significant but this is small because the measurement of the SE excludes tax elusion (or evasion) by multinational enterprises when the informal, low-tech sectors within a country are considered. Thus, trade openness reduces the importance of the informal sector, as measured by the size of SE.

For the other regressors, there are differences between LATAM and EZ. Human capital has a positive sign and a strong effect on the SE. This especially applies to the EZ where an increase in the human capital index by one unit results in 3 - 4% increase in the SE, but the effect is not significant for LATAM. The possible interpretation includes firstly, workers with higher educational qualifications are likely to avoid legal regulations in their country of residence; second, individuals often ignore extant policies and operate stealthily. State regulations have a significant and negative effect on the SE (0.53%) in all countries and 0.40 (see Eurozone, model III). Similarly, an increase in the corruption index reduces the size of the SE (0.39%) in the EZ. Finally, better socio-economic conditions are likely to reduce the

¹⁰ When the independent variables are expressed in logarithmic form, figures must be interpreted as it is done in a classic level-log model. Thus, the coefficients must be divided by 100 to compute the effect of a 1% variation of the regressor on the dependent variable.

¹¹ Data on total hours worked in Bolivia is unfortunately missing. Hence, the country was excluded from the group regressions.

size of the SE in LATAM (0.37%) and 0.15% for the whole panel. EZ has a negative sign but the coefficient is insignificant in the short-run.

For the U-shape test (measured at 90% Fieller interval), results show the presence of minima when the null hypothesis is rejected in all panel specifications for LATAM countries but this is not the case for EZ countries where an inverted or mostly a monotone relation is more likely to occur. The estimated minima are within bounds (see last three rows of table 3). Overall, the models present a static and aggregated view of the possible determinants of SE. To address heterogeneity, we use a more disaggregated approach that allows disentangling the long-run relationship to evaluate the causality links.

b. Panel Analysis

Table 4 employs the Pedroni (1999) test to detect co-integration between the SE, development and institutional variables¹², this considers per capita GDP, population growth, tax revenue over GDP, trade openness and a human capital index. We augment the test with several institutions controls proxied by political corruption, a socio-economic condition index and regulations in the market for the panel cointegration analysis to examine how labour productivity interacts with the SE in long run.¹³

¹² Pedroni test is an Engle-Granger based panel cointegration test which allows for heterogeneous intercept and trend coefficients across countries. Building on the Engle-Granger procedure, firstly a regression of the dependent SE variable on the above listed independent variables is performed; secondly, residuals of this regression are obtained and analyzed by means of an Augmented Dickey Fuller (ADF) to estimate whether they are integrated of first order — i.e. I(1)—, using the following test regression for each country: $\Delta e_{i,t} = \rho_{i,t} e_{i,t} + \sum_{j=1}^{p_i-1} \psi_{i,j} \Delta e_{i,t-j} + v_{i,t}$. Of course our variables must be I(1) as well. To check their non stationarity, panel unit roots tests have been performed and results for the individual variables are available on request.

¹³ For the sake of space, we present only the Pedroni test for the main development controls leaving aside the institutional controls which are available to the interested reader.

Table 4: Pedroni Cointegration Test

	Relation	No constant		Constant		Constant and Trend	
Within-Dimension	Modified variance ratio	-2.815**	[0.002]	-2.643**	[0.004]	-3.536***	[0.000]
	Modified Phillips-Perron	1.094	[0.137]	1.084	[0.139]	1.731**	[0.042]
	Phillips-Perron	-3.451***	[0.000]	-5.565***	[0.000]	-8.216***	[0.000]
	Augmented Dickey-Fuller	-3.000***	[0.001]	-5.553***	[0.000]	-7.969***	[0.000]
Between-Dimension	Modified Phillips-Perron	2.412**	[0.008]	2.551**	[0.005]	3.304**	[0.001]
	Phillips-Perron	-3.910***	[0.000]	-6.582***	[0.000]	-8.626***	[0.000]
	Augmented Dickey-Fuller	-3.057**	[0.001]	-5.817***	[0.000]	-7.671***	[0.000]

Notes:

- 1) Cross-Sectional means removed. Augmented lags: 1. The null hypothesis is no cointegration. Under the null all statistics are distributed as standard normal distributions.
- 2) All variables must have the same order of integration (i.e. I(1)). If the condition is not fulfilled, then, variables are excluded from the analysis. Also, the dummy crisis was excluded because it is time-invariant within cross-section.
- 3) ***, ** and * indicate significance at 1%, 5% and 10% respectively. P-values are in brackets. Source: Authors' calculations

Table 4 examines the long-run relationship. The choice of the estimator is attributed to the OLS bias when there is cointegration. We address autocorrelation, heteroskedasticity and endogeneity between the lags and leads of variables with a modified regression approach and capture the relationship between variables.

The basic idea of FMOLS lies in the nature of the series. Consider the following fixed effect model:

$$SE_{i,t} = \alpha_i + x_{i,t}\beta + u_{i,t} \text{ where } x_{i,t} \text{ represents the vector of regressors for country } i \text{ at time } t.$$

Being I(1), these regressors follow the following autoregressive process: $x_{i,t} = x_{i,t-1} + \epsilon_{i,t}$. In this specification α_i is the intercept (i.e. the country time-invariant effect) and $u_{i,t}$ is the stationary disturbance term.

The innovation vector can be written as: $\omega_{i,t} = (u_{i,t}, \epsilon_{i,t}) \sim I(0)$. In this case, the series are cointegrated for each country in the panel with cointegrating vector β . The OLS estimator is consistent but converges at a faster than the standard rate. However, in the cointegration analysis for the time series, when there exists a long-run correlation between the cointegrating equation error $\mu_{1,t}$ and the regressors innovation $\mu_{2,t}$ that are $\omega_{1,2}$ or cross-correlation between them ($\lambda_{1,2}$), the OLS estimators will have an asymptotic distribution that is generally non-Gaussian,

asymptotically biased, asymmetric and involve non-scalar nuisance parameters (Wang and Wu, 2012).¹⁴ Consequently, the estimator of Phillips and Hansen (1990) is appropriate.

Table 5 shows the estimated long run coefficients for GDP per capita PPP as highly significant and negative for LATAM, whereas for the EZ and the whole panel the coefficients are negative and only one-third of LATAM.

¹⁴ Super consistency means that the variance converges to zero at a rate proportional to $1/T$ rather than $\sqrt{1/T}$.

Table 5: Fully Modified OLS Results

Parameter estimation	Full Panel				Latin America		
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)
(Log) Gdp-pc	-8.377*** (0.808)	-9.096*** (0.772)	-10.880*** (0.722)	-8.762*** (0.791)	-30.112*** (2.208)	-31.666*** (2.150)	-31.653*** (1.969)
(Log) Labor productivity	-10.659*** (1.086)	-9.830*** (1.035)	-8.455*** (0.951)	-9.281*** (0.916)	4.160* (2.323)	6.282** (2.271)	6.394*** (2.081)
Population growth	-0.296** (0.112)	-0.286** (0.106)	-0.236** (0.096)	-0.225** (0.092)	-4.329*** (0.642)	-3.313*** (0.645)	-3.244*** (0.590)
Tax revenue	-0.264*** (0.018)	-0.256*** (0.017)	-0.241*** (0.016)	-0.234*** (0.015)	-0.094** (0.041)	-0.036 (0.041)	-0.031 (0.037)
Trade openness	-0.048*** (0.004)	-0.052*** (0.003)	-0.055*** (0.003)	-0.058*** (0.003)	-0.151*** (0.011)	-0.163*** (0.011)	-0.167*** (0.010)
Human capital	5.895*** (1.008)	5.714*** (0.958)	6.298*** (0.871)	7.409*** (0.859)	6.070** (1.922)	7.768*** (1.867)	8.200*** (1.713)
Regulations		0.536*** (0.069)	0.471*** (0.063)	0.509*** (0.060)		0.819*** (0.156)	0.789*** (0.143)
Corruption			-0.470*** (0.045)	-0.480*** (0.043)			-0.363*** (0.122)
Socio-economic conditions				-0.151*** (0.027)			
Number of observations	480	480	480	480	192	192	192
Number of countries	20	20	20	20	8	8	8
Panel	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled
Constant + Trend	YES	YES	YES	YES	YES	YES	YES
Long-run variance	0.244	0.219	0.180	0.163	0.486	0.446	0.372

Robust standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1. Source: Authors' calculations

The results are positive and highly significant for labour productivity per person employed in LATAM when compared with EZ. The divergence between these two groups indicates that “escape” theories are more suited to LATAM unlike EZ that is associated with “exclusion” in the long run. In line with Perry et.al (2007) skilled workers from developing countries may choose SE as a form of “escape” from the formal economy not only of their educational attainment, but also because employment freedom or self-independent work is another variable within the economic calculus. A better socio-economic environment shows that workers are likely to remain in the formal economy, and the size of the SE shrinks. Conversely, when social economic conditions worsen (e.g. higher levels of unemployment and poverty), the “escape” theory applies regardless of the countries under consideration. For instance, studies for LATAM show that corruption and excessive tax-burden may impact workers’ incentive to join the formal economy. Hence, a deterioration of this indicator in the long-run implies that workers prefer to “escape” from the formal sector to join the SE. In broader terms, some workers remain in the formal economy while others exit suggesting that “exclusion” and “escape” theories can coexist.¹⁵

The results hold when we compare performance in terms of corruption. On the one hand, strong government is associated with small size of SE in the long-run. On the other, when socio-economic conditions or corruption variables are included, the results present an opposite sign for LATAM. Studies show that corruption and excessive tax-burden may impact workers’ incentive to join the formal economy. An improvement in the these indicators in the long-run imply that workers prefer to “escape” from the formal sector once countries in LATAM achieve a certain level of development. On the contrary, for countries in the EZ some workers remain in the formal economy while others choose to exit. Again both theories (“exclusion” and “escape”) simultaneously co-exist.

The results for development indicators, such as population growth, tax revenue, force rate and human capital, are in line with economic literature. As population grows, new workers enter the market and some retire, which explains the negative impact on the size of the SE, other things equal. In this case, given the natural growth rate of an economy the

¹⁵ It is worth stressing that we have not analysed workers satisfaction in regards the type of job, the required skills as well as the educational level. Naturally, these divergences in the labour market are present irrespective the group of country under consideration. It is most likely that given the level of economic development, the presence of this two perspectives of the SE is more likely to be found in LATAM countries rather than EZ. In this vein, it is also possible that individual causality runs in opposite directions. Expressed differently, in some countries the exclusion theories would hold while in others the escape one, but on the aggregate only one perspective could prevail. This paper tackles the causality issue with FMOLS. To account for causality, strategies exploit causality to account for cross-sectional dependence among units (see Konya, 2006).

size of the SE is smaller. However, tax revenue over GDP displays a negative and significant coefficients for the EZ and the whole sample but is insignificant for LATAM when we control for institutional quality. Our results confirm that tax revenues and the size of the SE are inversely related in the long-run. This suggests that as economies develop more workers join the formal economy and tax revenues increase which eventually reduces the size of the SE. Nonetheless, given the positive and highly significant coefficient of labour productivity displayed by LATAM the results suggests that the “escape” explanation is more suited than “exclusion”. The quality of institutions plays an important role. When corruption and taxes levels are high this can curb workers’ incentives to join the formal sector withare potentially negative outcomes on participation rates.

The effect of trade openness in the long-run exhibits a negative and significant relation under all the specifications. Trade liberalisation may hinder workers from joining the formal economy because skilled vis à vis unskilled workers adapt quickly to competitive environments. In light of the heterogeneity displayed by skilled and unskilled workers along with institutional quality there is no clarity whether technology could allow for both “escape” and “exclusion”. But the SE and the formal economy have different technologies and thus, the levels of productivity varies. Goto and Mano (2012) point out that in the presence of higher entry costs and based on the assumption that firms employ skilled (and fewer unskilled workers) the number of firms in the informal sector decrease (i.e. “exclusion” effect). Thus, uneducated individuals - possibly those expelled from the formal sector - are forced to enter the SE and take up less productive jobs. Hence, in the short-run, the SE expands and the size of the formal economy decreases. On the contrary, as the population grows in the long-run the SE returns to its initial level because of wage competition between workers and firms. Higher wages along with social protection (e.g. pensions, holiday pay, etc) allow workers to invest in human capital (e.g., college education). Hence, as the number of educated children increase, the formal sector expands and the size of SE shrinks.

6. Concluding remarks and policy implications

Research implications

This paper tests the relationship between the SE and development. We draw on Medina and Schneider (2018) to examine KCs (inverted-U Curves) and institutional quality for LATAM and EZ countries. The results show that

institutional parameters proxied by government size, socio-economic conditions and corruption influence the size of the SE and affects economic development. The IV linear model, however, presents mixed results. The institutional quality affects development and labour productivity for countries in the EZ. High taxes and low corruption in the EZ impacts economic development, measured by GDP per capita, positively. The results do not apply to LATAM where the ‘escape’ theory applies.

The short and long-term results are also different. In the short run, when we use the IV technique the exclusion-theory applies because as economies grow the size of the SE shrinks. The dummy crisis, which captures this effect is positive and insignificant for LATAM. The FMOLS model for the long run shows that the “escape” theory applies. Labour productivity has a positive and statistically significant effect on LATAM countries. Therefore, workers choose to join the SE because the formal benefits (e.g. holidays, other perks) are not relevant. However in the EZ, an increase in labour productivity is significantly associated with a reduction in the size of SE.

Policy implications

The findings presents important policy implications. Policy makers in LATAM may consider automatization of tax procedures to reinforce worker’s incentives to join the formal economy, this can be done by reducing registration costs which will facilitate accountability and exchange of tax information between governmental agencies. LATAM governments could also prioritise improving government effectiveness in tax collections through efficient payment channels (e.g. online electronic systems) and provide incentives to the private sector to create jobs in the formal sector and offset “escape” reasons which apply in the current context where corruption is rampant in lower socioeconomic conditions. The governments could provide better quality public services from higher tax revenues collected from the economy. Further, for workers at the lower end of the income distribution policymakers could consider implementing active labour market policies, which include for example initiating policies that provide free education to workers and eliminate barriers of entry for unskilled workers in the formal economy. The effect of such measures will be positive in the long-run, reduce workers exclusion and inequality in the economy. It is worth mentioning that countries closer cooperation on tax and policy convergence on macroeconomic indicators is suggested in LATAM to address the problem of SE. This could be achieved with automation of tax procedures increase accountability and the exchange of tax information between governmental agencies. As with the EZ which enjoys macroeconomic policy coordination,

LATAM countries could consider macroeconomic coordination in the long run. However, policymakers cannot have ‘one-size-fits-all’ but incorporate changes through wider institutional reforms that take contextual factors into account.

Methodological limitations

First, “exclusion” and “escape” theories can co-exist due to heterogenous tax collection systems. Second, this paper does not examine cultural variables that determine an individual’s willingness to pay taxes and the relation institutional quality and tax burden, which is an area for future research.

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Annex

Table A1: List of countries

Countries	Codes	Region
Argentina	ARG	Latin America
Austria	AUT	Eurozone
Belgium	BEL	Eurozone
Bolivia	BOL	Latin America

Brazil	BRA	Latin America
Chile	CHL	Latin America
Colombia	COL	Latin America
Finland	FIN	Eurozone
France	FRA	Eurozone
Germany	DEU	Eurozone
Greece	GRC	Eurozone
Ireland	IRC	Eurozone
Italy	ITA	Eurozone
Luxembourg	LUX	Eurozone
Mexico	MEX	Latin America
Netherlands	NLD	Eurozone
Peru	PER	Latin America
Portugal	PRT	Eurozone
Spain	ESP	Eurozone
Venezuela	VEN	Latin America

Table A2: Variables and Data Sources

Variables	Definition	Sources
SE	Shadow Economy (% GDP) (MIMIC Approach)	Medina-Schneider
gdp _{ppp}	GDP per capita in 2016 US\$ 2011 PPP	Total Economy Database
gdp _{gr}	Growth of GDP (% Change)	Total Economy Database
pop	Midyear population (in thousands of persons)	Total Economy Database
pop _{gr}	Growth of population (% Change)	Total Economy Database
lppe	Labour productivity per person employed in 2016 US\$ 2011 PPP	Total Economy Database

glpe _{gr}	Growth of labour productivity per person employed (% Change)	Total Economy Database
emp _{gr}	Growth of employment (% Change)	Total Economy Database
lqcgdp	Labour quality contribution to GDP	Total Economy Database
hc	Human capital Index	Penn World Tables
tresvc	Total tax revenue (including social contributions)	Government Revenue Dataset
fscore	Economic freedom index	Fraser Institute
sgov	Government size	Fraser Institute
prights	Legal system & property rights	Fraser Institute
smoney	Sound money	Fraser Institute
ftrade	Freedom to trade Internationally	Fraser Institute
reg	Degree of regulations in the market	Fraser Institute
s.cond	Social economic conditions index	International Country Risk Guide
corr	Corruption index	International Country Risk Guide
lpfr	Labour participation force rate - ILO	World Development Indicators
tradeo	Trade openness	World Development Indicators
crisis	Dummy variable = 1 if $gdp_{gr} < 0$	Own calculations

Table A3: Unit Root Analysis (to satisfy FMOLS conditions variables must be I(1))

Variables	CIPS Test				Lags	Trend	Conclusion
	Statistic	Critical-Values					
		10%	5%	1%			
Shadow economy	-1.83	-2.63	-2.72	-2.88	1	Yes	non-stationary
GDP per-capita	-1.20	-2.63	-2.72	-2.88	1	Yes	non-stationary
Labor productivity	-1.35	-2.63	-2.72	-2.88	1	Yes	non-stationary
Tax-revenue	-2.48	-2.63	-2.72	-2.88	1	Yes	non-stationary
Labor participation	-2.52	-2.63	-2.72	-2.88	1	Yes	non-stationary
Trade openness	-1.63	-2.63	-2.72	-2.88	1	Yes	non-stationary
Human capital	-0.55	-2.63	-2.72	-2.88	1	Yes	non-stationary

Government size	-2.05	-2.63	-2.72	-2.88	1	Yes	non-stationary
Regulations	-2.42	-2.63	-2.72	-2.88	1	Yes	non-stationary
Freedom index	-2.04	-2.63	-2.72	-2.88	1	Yes	non-stationary
Property rights	-2.10	-2.63	-2.72	-2.88	1	Yes	non-stationary
Sound money	-2.38	-2.63	-2.72	-2.88	1	Yes	non-stationary
Freedom trade	-2.06	-2.63	-2.72	-2.88	1	Yes	non-stationary
Social conditions	-1.88	-2.63	-2.72	-2.88	1	Yes	non-stationary
Corruption	-1.95	-2.63	-2.72	-2.88	1	Yes	non-stationary
Shadow economy	-1.92	-2.63	-2.72	-2.88	2	Yes	non-stationary
GDP per-capita	-1.42	-2.63	-2.72	-2.88	2	Yes	non-stationary
Labor productivity	-1.51	-2.63	-2.72	-2.88	2	Yes	non-stationary
Tax-revenue	-2.43	-2.63	-2.72	-2.88	2	Yes	non-stationary
Labor participation	-2.56	-2.63	-2.72	-2.88	2	Yes	non-stationary
Trade openness	-1.84	-2.63	-2.72	-2.88	2	Yes	non-stationary
Human capital	-1.16	-2.63	-2.72	-2.88	2	Yes	non-stationary
Government size	-2.67	-2.63	-2.72	-2.88	2	Yes	stationary*
Regulations	-2.40	-2.63	-2.72	-2.88	2	Yes	non-stationary
Freedom index	-2.35	-2.63	-2.72	-2.88	2	Yes	non-stationary
Property rights	-2.38	-2.63	-2.72	-2.88	2	Yes	non-stationary
Sound money	-2.11	-2.63	-2.72	-2.88	2	Yes	non-stationary
Freedom trade	-2.04	-2.63	-2.72	-2.88	2	Yes	non-stationary
Social conditions	-1.99	-2.63	-2.72	-2.88	2	Yes	non-stationary
Corruption	-2.18	-2.63	-2.72	-2.88	2	Yes	non-stationary

*The CIPS test rejects the null hypothesis of homogenous non-stationary at 10% level.