Identifying the Determinants of the Shadow Economy: The Role of Finance

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ABSTRACT

Although the determinants of the shadow economy have been extensively studied in the literature, the role of financial development has still not been sufficiently explored, and research on developing countries is relatively limited. In order to fill the gap in the literature, through three studies, this dissertation empirically examines different aspects of the relationship between financial development and the shadow economy.

The first study investigates the drivers of the shadow economy for the Baltic region from 2009 to 2019 using the Panel ARDL estimation method. PMG estimates show that a higher tax burden, greater financial development, and financial institutional development lead to the expansion of the shadow economy in the Baltic region. The findings emphasize the role of institutional quality in reducing informal economic activities.

The second study analyzes the determinants of the shadow economy for the CESEE region. For this purpose, a panel dataset containing annual observations for eleven CESEE countries for the 2003-2019 period was analyzed using panel FMOLS and DOLS estimation methods. Obtained empirical findings show that financial development and tax burden have a significant positive impact on the shadow economy. Besides, improvements in institutional quality, trade openness, and economic freedom help alleviate the shadow economy.

The third empirical study examines our main research question for countries with the largest shadow economy. To assess the long-run relationships amongst the variables in a time series setting, conventional ARDL, and novel Fourier ARDL methods were applied. The long-run coefficients suggest that poor institutional quality results in the shadow economy expanding in low-income countries. However, advances in human capital assist in the reduction in the shadow economies' size for all ten countries in our sample. A significant negative association between financial development and the shadow economy is observed for Peru and Thailand.

Obtained findings indicate that institutional reforms should be the primary policy objective to shift activities from the shadow to the formal economy.

Keywords: Shadow Economy; Financial Development; Tax Burden; Institutional Quality; Economic Freedom.

ÖZ

Kayıt dışı ekonominin belirleyicileri literatürde kapsamlı bir şekilde incelenmiş olmasına rağmen finansal gelişmenin rolü yeterince araştırılmamıştır. Ayrıca bu konuda gelişmekte olan ülkeler üzerine yapılan araştırmalar nispeten sınırlıdır. Literatürdeki bahsedilen boşluğu doldurmak için, bu tezde yer alan üç araştırma finansal gelişme ile kayıt dışı ekonomi arasındaki ilişkiyi değişik açılardan incelemektedir.

İlk çalışma, Baltık bölgesi için kayıt dışı ekonominin belirleyicilerini 2009-2019 dönemi için Panel ARDL tahmin yöntemini kullanarak araştırıyor. PMG tahminleri, vergi yükü, finansal gelişme ve kurumsal gelişimin Baltık bölgesindeki kayıt dışı ekonominin genişlemesine yol açtığını gösteriyor. Bulgular, kayıt dışı ekonomik faaliyetlerin azaltılmasında kurumsal kalitenin rolünü vurgu yapmaktadır.

İkinci çalışma, CESEE bölgesi için kayıt dışı ekonominin belirleyicilerini analiz etmektedir. Bu amaçla, on bir CESEE ülkesinin 2003-2019 dönemi yıllık gözlemlerini içeren bir panel veri seti, panel FMOLS ve DOLS tahmin yöntemleri kullanılarak analiz edilmiştir. Elde edilen ampirik bulgular, finansal gelişme ve vergi yükünün kayıt dışı ekonomi üzerinde anlamlı bir pozitif etkiye sahip olduğunu göstermektedir. Ayrıca, kurumsal kalite, ticari açıklık ve ekonomik özgürlükteki gelişmeler, kayıt dışı ekonomiyi kontrol etmede yardımcı olmaktadır.

Üçüncü ampirik çalışma, en yüksek kayıt dışı ekonomiye sahip ülkeler için ana araştırma sorumuzu incelemektedir. Değişkenler arasındaki uzun dönemli ilişkiler

zaman serisi ekonometrisi tahmin yöntemleri - geleneksel ARDL ve Fourier ARDL – kullanılarak test edilmiştir. Uzun vadeli katsayılar, zayıf kurumsal kalitenin, düşük gelirli ülkelerde kayıt dışı ekonominin genişlemesine yol açtığını göstermektedir. Bununla birlikte, beşeri sermayedeki ilerlemeler, örneklemimizdeki tüm ülkelerde kayıt dışı ekonomik faaliyetleri azaltıcı yönde etki etmektedir. Peru ve Tayland için finansal gelişme ile kayıt dışı ekonomi arasında anlamlı bir negatif ilişki gözlemlenmektedir.

Elde edilen bulgular, faaliyetlerin kayıt dışı ekonomiden kayıtlı ekonomiye kaydırılması için kurumsal reformların öncelikli politika hedefi olması gerektiğine işaret etmektedir.

Anahtar Kelimeler: Kayıtdışı Ekonomi; Finansal Gelişme; Vergi Yükü; Kurumsal Kalite; Ekonomik Özgürlük.

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LIST OF ABBREVIATIONS

AIC	Akakie Information Criterion
ARDL	Autoregressive Distributed Lag
CESEE	Central, Eastern, and Southeastern Europe
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares
DGE	Dynamic General Equilibrium
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
ECT	Error Correction Term
EF	Economic Freedom
FD	Financial Development
FDI	Financial Development Index
FII	Financial Institution Index
FMI	Financial Market Index
FMOLS	Fully Modified Least Squares
GDP	Gross Domestic Product
HC	Human Capital
IMF	International Monetary Fund
INF	Inflation
IQ	Institutional Quality
LGDP	Logarithm of Gross Domestic Product
MIMIC	Multiple Indicators Multiple Causes
MWALD	Modified Wald Test

PCA	Principal Component Analysis
PMG	Pooled Mean Group
PS	Political Stability
PWT	Penn World Table
RL	Rule of Law
SE	Shadow Economy
SEM	Structural Equation Modeling
SSE	Stockholm School of Economics
TB	Tax Burden
UPG	Urban Population Growth
VAR	Vector Autoregressive

Chapter 1

INTRODUCTION

The shadow economy, sometimes referred to as the informal, underground, or hidden economy, is considered to be directly unobservable. Hence, the literature on gauging its size and understanding its determinants has utilized several approaches and methods. Due to the employment of various measurement techniques and the use of diverse indicators, included within estimations of the shadow economy magnitude, there is no definitive shadow economy definition. Early studies proclaim that the shadow economy comprises all unrecorded economic activities – which if had been recorded, would be part of the official gross national product (Frey and Pommerehne, 1984; Schneider, 2005). A more recent consensus regarding its definition has been established within the shadow economy literature. It has been defined as consisting of all economic activities that are concealed from observation, regulation, and taxation for a fiscal gain (Williams and Schneider, 2013; Buehn, Dell'Anno and Schneider, 2018; Medina and Schneider, 2019). We opt to adopt this definition within our study investigating the drivers of the shadow economy for transition economies.

The shadow economy is intricate in nature and inflicts consequential outcomes on the formal economy. Thus, over the past several decades, the research has been dedicated to estimating its magnitude to comprehend the implications that the shadow economy imposes on the formal economy (Frey and Pommerehne, 1984;

Schneider and Enste, 2013; Medina and Schneider, 2017). The expansion of the informal economy creates substantial economic and social ramifications. Shadow activities are frequently executed for tax evasion purposes. The avoidance of compulsory tax payments induces a depletion in generated revenues, stimulates budget deficits, and reduces government spending (Goel, Saunoris, and Schneider, 2019). Reduced government spending - caused by a decrease in tax revenues - hinders production and innovation (Dreher, Méon, and Schneider, 2014; Kelmanson et al., 2019), leading to inadequate public service quality (Schneider, 2004). Dissatisfaction with the level of governmental services generates greater participation within the shadow economy, as the informal labor sector benefits from fewer labor costs (Schneider, 2011). The consequences mentioned above impede economic growth prospects. Furthermore, the existence of an informal economy leads to an underestimation of the true gross domestic product (GDP) within the formal economy magnitude; creating a bias within statistics utilized to construct important economic policies (Ahumada, Alvaredo, and Canavese, 2007). Besides, a miscalculation of the official economic statistics could conduce the use of incorrect indicators within the macro-policy decision-making process (Tanzi, 1999).

Within the existing shadow economy literature, various determinants have been observed. The majority of previous studies have considered taxation to be a prominent driver of the shadow economy. The literature has displayed a positive relationship between taxation and the shadow economy, implying that tax increases the excitement in which to engage with the “tax-free” informal economy (Frey and Weck, 1983; Schneider, 1997; Fleming, Roman, and Farrell, 2000; Schneider, 2012). Furthermore, recent studies analyzing the relationship between taxation and the

shadow economy have found tax burden is responsible for the enlargement of the informal economy (Williams and Schnieder, 2013; Buehn, Dell'Anno, and Schneider, 2018; Huynh and Nguyen, 2020). The literature demonstrates a positive association between the shadow economy and tax burden for Europe (Mara and Sabău-Popa, 2013; Schneider, Raczkowski, and Mróz, 2015; Ginevicius, Kliestik, Stasiukynas, and Suhajda, 2020), the Baltic region (Putniņš and Sauka, 2011; Putniņš and Sauka, 2015; Ginevicius et al., 2020), and transition economies (Eilat and Zinnes, 2002; Schneider, 2009; Kelmanson et al., 2019; Mara, 2021).

Putniņš and Sauka (2011) particularly specify that the Baltic region views the tax burden they face to be unjustifiable, stemming from dissatisfaction with the taxation system and the government. This attitude toward paying compulsory taxes has resulted in the Baltic region ranking poorly according to their tax contribution rate (PWC, 2019). Thus providing a clear indication that shadow activities are conducted within the Baltic region to avoid/evade the large tax burden placed on them. Therefore, a larger tax burden spurs the motivation in which to engage in the shadow economy, causing the magnitude of the shadow economy to increase for the Baltic region. Moreover, Caurkubule and Rubanovskis (2014) stress that the excessive tax burden must be reduced to preserve sustainable development and to lower the magnitude of the shadow economy within Baltic states.

Likewise, transition economies (a broader sample) are also subjected to a larger tax burden. As a result of shifting from a planned to a market-based economy, privatization increased within these countries, and tax payments became compulsory. Thus, the transition created a larger tax burden within these economies (Lackó,

2000). Moreover, this region endures a greater labor tax burden when compared with other European countries (International Monetary Fund, 2016). Given the presence of a significant tax burden, demonstrated within the two regions, tax burden is utilized within our two case studies assessing the drivers of the shadow economy for the case of transition economies.

The previous literature also stresses the significance of institutional quality and its ability to combat shadow economy size. Friedman, Johnson, Kaufmann, and Zoido-Lobaton, (2000) study was one of the earliest studies to illustrate the effect of institutional quality on the shadow economy. They suggested that effectively operating institutions suppress the desire to engage in informal activities, as they raise costs related to engaging within the shadow economy, ultimately contracting the magnitude of the informal economy. Furthermore, inadequate institutional quality invites corruption and promotes the enticement to conduct informal activities (Dreher, Kotsogiannis, and McCorriston, 2009). Numerous studies have gone on to reveal the negative association amongst institutional quality and the shadow economy; illustrating that poor institutional quality results in the enlargement of the informal economy (Goel and Saunoris, 2014; Berdiev, Saunoris, and Schneider, 2018; Canh, Schinckus, and Dinh Thanh, 2021).

The critical impact of institutional quality on the shadow economy has also been observed in the Baltic region. Insufficient institutional quality has been held accountable for the expansion of their shadow economy (Putniņš and Sauka, 2017). Remeikiene and Gaspareniene (2015) note that the absence of adequate institutional competence within this region has induced informal economic activity growth.

Williams and Horodnic (2015) suggested that the asymmetry amongst the formal and informal institutions creates lower tax morale within Baltic states; poor tax morale leads to greater engagement within the shadow economy with the aims of evading tax payment and ultimately results in the expansion of the shadow economy. Likewise, the existing literature has displayed a negative relationship between institutional quality and financial development for the case of transition economies (Johnson, Kaufmann, and Zoido-Lobaton, 1998; Bayar and Ozturk, 2016; Kelmanson et al., 2019). Torgler and Schneider (2009) suggest that poor institutional quality in the form of; a flawed legal system, corruption, and insufficient legislation has attributed to the size of the shadow economy within transition economies.

The literature has also assess the role of human capital within the shadow economy, and its ability to curb the informal economy's size. It has been suggested that improvements in human capital are essential for enhancing the formal economy (Schultz, 1961). As greater human capital will increase productivity, innovation, and lead to further development (Hanushek and Wößmann, 2007). The presence of greater human capital, reflected by a higher education level, has also been affiliated with fewer economic and financial crimes, and a reduced informal economy (Berrittella, 2015; Achim et al., 2021). Several studies have reported a negative association amongst the two (Čiutienė et al., 2015; Batrancea, Nichita, Batrancea, and Gaban, 2018; Satrovic, 2019). Given the importance of human capital within the shadow economy, as displayed within the existing literature, we opt to incorporate a human capital measure within our third empirical study.

The relationship amidst financial development and the shadow economy has also been investigated. Since the financial sector provides financial assistance for economic activities, understanding its role within the shadow economy is of importance (Blackburn, Bose, and Capasso, 2012). Findings concerning the role of financial development are inconclusive. Several studies have displayed the presence of a negative relationship amongst financial development and the informal economy. Their results indicate that further financial development contracts the magnitude of the shadow economy (Capasso and Jappelli, 2013; Berdiev and Saunoris, 2016; Khan, Hamid, and Rehman, 2021). However, Berdiev and Saunoris (2016) suggest that this association is only negative for financially developed countries. Further studies imply that the relationship is of an inverted U-shape and dependent on a threshold (Habibullah, Din, Yusof-Saari, and Baharom, 2016; Din, Habibullah, and Abdul Hamid, 2019; Gharleghi and Jahanshahi, 2020). Thus, the literature displays the notion that insufficient financial development drives the informal economy's expansion (Berdiev and Saunoris, 2016; Canh and Thanh, 2020). The link between financial development and the shadow economy has been overlooked for the case of transition economies. Country-specific studies analyzing this relationship are also sparse within the existing literature. We aim to shed light on this relationship in this dissertation.

In order to evaluate the association between financial development and the informal economy, we conducted three case studies. Our first study analyzes shadow economy determinants for a sample of Baltic states. The second study investigates the drivers of the informal economy for the Central, Eastern, and Southeastern Europe (CESEE) region. The third study examines the potential shadow economy determinants for ten

countries with the largest shadow economy to investiage the nature of the relationship between financial development and the informal economy further. According to Putniņš and Sauka (2011) the informal economy within the Baltic region is significantly large. They state that discontent with both the tax system and the government in this region has resulted in taxpayers believing that the tax burden they face is unjust; increasing the desire to engage in shadow activities in aims of tax avoidance. Similarly, the CESEE region is exposed to a larger informal economy in comparison to that of other European countries (Schneider, 2022). Their progression from a planned central economy to a market-based economy has been held accountable for the enlargement of the shadow economy (Johnson et al., 1997). The ten countries included in our third study have a considerably large shadow economy magnitude, according to Medina nad Schneider (2018).

To investigate the potential drivers of the shadow economy for the Baltic region, a panel composed of Estonia, Latvia, and Lithuania for the period 2009 to 2019 was examined with the employment of panel ARDL, and PMG estimators were obtained to observe the long-term coefficients. For the second study, analyzing the determinants of the shadow economy for the CESEE region, a panel composed of eleven countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia Republic, and Slovenia) for a time span of seventeen years (ranging from 2003 to 2019) was analyzed with the use of multiple econometric techniques. Fully modified least squares (FMOLS) and dynamic ordinary least squares (DOLS) methods were applied to obtain long-term coefficients. Our third study assesses the potential determinants for ten countries with the largest shadow economy magnitudes, namely; Brazil, Burma, Cote d'Ivoire,

Egypt, Ghana, Kenya, Pakistan, Peru, Tanzania, and Thailand for the period 1990 to 2018 inclusively. The long-run relationship amongst variables is assessed using timeseries ARDL and Fourier ARDL.

This dissertation aims to contribute to the existing shadow economy literature by bridging a gap within the existing literature dedicated to analyzing the role of financial development within the shadow economy. To the best of our knowledge, case studies one and two are the first to investigate the role of financial development and its implications for the shadow economy within transition economies. Our third case study offers country-specific insights into the financial development – shadow economy relationship; and is the first to investigate the nature of the relationship with the use of Fourier ARDL. Studies one and two display that the lack of sufficient financial development, within transition economies, leads to the enlargement of the shadow economy. Whereas, our third study suggests that financial development's ability to combat the shadow economy may be country specific. In the conclusion chapter, we offer policy recommendations to assist the reduction of the shadow economy's magnitude.

The thesis structure is as follows: Chapter 2 provides a brief theoretical background on the shadow economy, and Chapters 3, 4, and 5 consist of our empirical case studies examining shadow economy drivers for three separate samples. Chapter 3, which focuses on the Baltic States, includes its own introduction, data, and econometric methods parts, empirical results, and concluding remarks. The fourth chapter includes an introduction, a review of the literature, data, and econometric methods, empirical results, and a conclusion relevant to the CESEE region. Chapter 5

examines the nature of the relationship between financial development and the shadow economy for ten countries individually and includes its own introduction, data, methodology, empirical results, and concluding remarks. The final chapter, Chapter 6, concludes the dissertation and provides the overall findings and policy recommendations to combat the shadow economy.

Chapter 2

THEORETICAL BACKGROUND

The informal economy, amidst the established private sector and government institutions (Hart, 2008). According to Ihrig and Moe (2004), it is a sector that generates legal commodities but does not follow official rules. Another widely used notion is that the shadow economy contains all economic activities that add to the GDP but are not declared or registered (Feige and Urban, 2008). Smith (1994) describes it as the market-based creation of products and services, whether legal or illicit, that are not included in the country's GDP figures. According to Schneider and Enste (2000), it is lawful value-generating activities that are not recorded or taxed and are typically characterized as clandestine or black labor. As per Schneider, Buehn, and Montenegro (2010), it is market-based economic activities that are intentionally disguised from the authorities to escape taxation and regulations. However, there is disagreement among researchers on how to define and study informality (Schneider and Enste, 2000).

The informal economy is a complicated and multifaceted issue influenced by various factors, including the qualities of participating units and institutional and macroeconomic conditions. Due to its multifaceted nature, there is a lack of an inclusive theoretical framework of the shadow economy that is applicable to both developed and developing countries (Goel and Nelson, 2016). Therefore, it is critical to determine the kind of informality a given theory is attempting to interpret. One

view of informality sees it as a means of survival in the face of unemployment and poverty and is often referred to as the informal sector. This perspective focuses on the number of informal units rather than the value of their output and is prevalent in lower-income economies where such units tend to be concentrated (Dell'Anno, 2022). This type of informality is often associated with informal employment. On the other hand, some view informality as voluntary, deviant behavior intended to reduce regulatory and tax burdens by operating outside of the formal economy. This approach focuses on informal value added and is more relevant in developed countries, where the consequences of informality on efficiency and equity are of greater concern (Dell'Anno, 2022).

In his survey for theoretical background on the shadow economy, Dell'Anno (2022) classified the literature into different strands, including the neoclassical and macro-econometric approaches. According to the neoclassical approach to the informal economy, individuals and firms choose to operate informally due to a constrained maximization of their value function, while in macroeconomic models, the equilibrium is achieved through competitive markets. Two main analytical frameworks are used in this approach relative to the nature of informality being analyzed. If the focus is on underreported earnings hidden to avoid taxation, the Allingham-Sandmo model of tax evasion is often used (Alm, 2019). Alternatively, if the informality being studied is primarily related to employment, macroeconomic models based on search and matching models are more common. These models have been used to examine the effects of tax rates, minimum wage policies, and other factors on informality and have led to the conclusion that reducing informality may be more effectively achieved through lower tax rates and increased enforcement

rather than simply increasing the likelihood of getting discovered engaging in shadow activities.

The macro-econometric strand of literature focuses on the estimation and analysis of the drivers of the shadow economy. Early proponents of this approach include Gutmann (1977), Tanzi (1983), and Gaertner and Wenig (1985). These studies tend to concentrate on the value-added hidden from governmental statistics instead of the number of individuals engaged in unofficial activities and, therefore, often give more weight to undeclared shadow production than to informal production. From a theoretical perspective, these empirical studies draw on economic models of tax evasion as well as development and labor literature. The approach has seen significant growth in the literature on the shadow economy over the past two decades, with researchers using estimations of the magnitude of the informal economy to explore the causes and effects of informality (Elgin and Ertuk, 2019; Goel and Nelson, 2016; Jessen and Kluve, 2021; Loayza, 2018; Ohnsorge and Yu, 2021; Schneider and Buehn, 2018; Ulyssea, 2020). Dell'Anno (2021) identifies six categories of potential drivers of the IE, including the taxation system, regulatory system, labor force composition, enforcement system, tax morale, and institutions.

Over time, four prominent schools of thought have emerged addressing the nature and composition of the broad and heterogeneous shadow economy. The schools are the dualist, structuralist, legalist, and voluntarist schools.

The Dualist school suggests that the economy's unofficial sector comprises marginal activities that are apart from the formal sector and generate revenue as well as a safety net during times of turmoil (Hart, 1973; Sethuraman, 1976). As indicated by

this concept, informal operators find it challenging to exploit economic opportunities because of discrepancies in industrial employment and population growth rates, alongside a misalignment among people's skills and the nature of the economic opportunities. The Dualists argue that informal activities and units have little to no link to the formal economy and instead function as a distinct sector with an essentially self-employed informal workforce that is disadvantaged compared to the formal sector. While the Dualist school does not emphasize the linkages between informal firms and government regulations, it suggests that governments should improve employment, grant credit, offer business development services, and provide basic infrastructure and welfare services to informal operators.

The Structuralist school sees the shadow economy as a collection of micro-enterprises and employees who assist formal firms in lowering costs and boosting competitiveness (Moser, 1978; Castells and Portes, 1989). As argued by the advocates of the Structuralist school, the shadow economy is driven by the nature of capitalism and capitalist growth, with registered firms seeking to reduce labor expenses and boost competitiveness and informal enterprises and workers reacting to the power of organized labor, governmental regulation of the economic system, global competition, and the industrialization process. According to the Structuralist school, the formal and informal sectors are strongly intertwined, with informal companies and informal wage employees both supporting the aims of capitalist development by providing cost-effective goods and services. They propose that governments regulate economic and employment relationships to solve the unequal power dynamic between formal and informal companies and workers.

According to the Legalist school, the informal sector comprises of micro-entrepreneurs who opt to operate unofficially to avoid the costs and constraints of formal registration. Due to a cumbersome legal system, these individuals who require legal registration of their assets are forced to operate unofficially. The Legalists concentrate on informal companies and the formal regulatory framework, although they recognize that formal firms may conspire with the government to impose regulations. According to the Legalists, governments should streamline bureaucratic procedures and establish rights for the assets of informal agents to boost production and turn their assets into capital. The Voluntarist school stresses informal businesses that aim to avoid laws and taxes, but it does not ascribe this decision to time-consuming registration processes. According to voluntarists, informal operators balance the costs and gains of informality vs. formality and opt for informality. They also feel that informal firms unfairly compete with formal enterprises by avoiding regulatory expenses, but they believe that these businesses should be brought into the official regulatory system to raise the tax base and level the playing field for formal businesses.

Overall, each of these schools of thought offers insights into different facets of the shadow economy. However, it is essential to recognize that the shadow economy is more heterogeneous and complex than any one perspective alone can capture.

2.1 Measuring the Shadow Economy

Compared to the organized sector, the informal sector is perceived as a labor-intensive, low-productivity sector operating on a small scale with limited access to physical capital (Loayza, 1997; Thomas, 1999; Elgin and Oztunali, 2012). While there has been a growing emphasis on the economic analysis of informality, one key

difficulty in the literature is the absence of sufficient datasets that would allow for meaningful policy analysis of informality, as it is difficult to precisely assess the size of the shadow economy. Overviews of several methods for calculating the size of the shadow economy are provided by Schneider (2005) and Elgin and Oztunali (2012). These methods can be divided into three groups: direct methods, indirect methods, and the model approach, including the Multiple Indicators Multiple Causes (MIMIC) method (Schneider, 2005).

2.1.1 The Direct Approach

The direct method of evaluating the shadow economy involves using surveys, interviews, and questionnaires to calculate the magnitude of shadow economic activity. This concept assumes that the informal sector consists of legal products and services produced outside of official government and private sector entities (Hart, 2008). While the direct approach has the benefit of capturing specific details about the informal sector, it is also prone to measurement mistakes and is frequently seen as providing a lower-bound estimate of the level of informality (Schneider and Enste, 2000).

One of the main limitations of the direct approach is that it relies on subjective responses from individuals or firms about their involvement in informal economic activities. This can lead to measurement errors if respondents are not truthful or do not accurately remember or report their activities (Henley, Arabsheibanim, and Carneiro, 2009). The direct approach is also time-consuming and costly, which hinders its repeatability (Schneider and Enste, 2000). Additionally, the estimates obtained through direct approaches do not have a time dimension, as surveys can only be conducted at a specific point in time (Cantekin and Elgin, 2015).

Despite these limitations, the direct approach is still commonly used to measure informality. Henley, Arabsheibanim, and Carneiro (2009), for instance, utilized household survey data to estimate the magnitude of the Brazilian shadow economy by examining the status of work contracts, social security protection, and employer characteristics. They discovered that estimations of informality varied between 40 and 63%, but they also noticed that different strategies had varying informality trends. Cantekin and Elgin (2015) estimated the scale of the shadow economy in 16 industries using company-level data from 1000 Turkish firms based on replies from firm representatives concerning their registration, bank account status, payment methods, and social security payment ratios. Medvedev and Oviedo (2016) surveyed 1200 Ecuadorian enterprises to explore the influence of the shadow economy on financial performance and discovered that registered firms were more lucrative and had greater production per worker. They created an informality index using survey questions on the companies' tax ID numbers, municipal licenses, and receipt procedures.

2.1.2 The Indirect Approach

There are several types of indirect methods for estimating the shadow economy. The currency demand method, for example, is based on the notion that informal economic activity requires cash transactions, therefore, a rise in money demand may be linked to a surge in shadow activities (Tanzi, 1983). The currency demand method employs an econometric specification that incorporates factors such as fiscal policy, interest rates, and payment patterns to isolate the amount of the rise in money demand that is connected with informality (Feige, 1979; Kaufman and Kaliberda, 1996; Thomas, 1999).

Another indirect method is the income-expenditure discrepancy approach, which uses household income and expenditure surveys to identify discrepancies between income and expenditure that may be attributed to informal economic activity (Dimova, Gang, and Landon-Lane, 2011). This method relies on the assumption that households with informal sources of income are likely to under-report their income and over-report their expenditure. Other indirect methods include the labor force participation approach, which estimates the shadow economy by comparing official and actual labor force participation rates (Feige, 1979; Thomas, 1999), and the transactions approach, which estimates the shadow economy by comparing transactions data to national income statistics (Feige, 1979; Thomas, 1999).

One major criticism of indirect methods is that they are based on a series of assumptions and are, therefore, subject to measurement errors and biases (Schneider and Klinglmair, 2004). For example, the currency demand approach assumes that cash transactions are a reliable indicator of informality, but this may not always be the case, as some formal sector activities may also involve cash transactions. Similarly, the income-expenditure discrepancy approach assumes that households with informal sources of income will under-report their income and over-report their expenditure, but this may not always be true. Additionally, indirect methods tend to focus on a single aspect or indicator of the informal economy and might not fully capture the complexity of the informal economic activity.

2.1.3 The Model Approach

Model approaches, including the Multiple Indicators Multiple Causes (MIMIC) approach, involve using data from multiple sources to gauge the magnitude of the informal economy (Schneider and Klinglmair, 2004). This approach aims to

overcome the limitations of direct and indirect approaches based on assumptions and may focus on only one aspect of informality (Schneider, Buehn, and Montenegro, 2010).

One model approach is the structural equation model developed by Buehn and Schneider (2012b). This model combines information from direct and indirect measures, as well as other variables that might influence the magnitude of the informal sector, like economic growth and corruption (Buehn and Schneider, 2012b). The model is estimated using data from a sample of countries and allows for estimating both the level and the trend of informality over time (Buehn and Schneider, 2012b).

Another model approach is the latent class model used by Elgin and Oztunali (2012). This model measures the size of the informal sector by classifying individuals or firms into different categories based on their likelihood of being informal (Elgin and Oztunali, 2012). The model is estimated using data from household surveys and allows for the estimation of informality at the individual level, as well as for different subgroups within the population (Elgin and Oztunali, 2012).

The Multiple Indicators Multiple Causes (MIMIC) approach and the structural equation modeling (SEM) have several advantages relating to estimating the size of the informal economy, according to Giles and Tedds (2002). These approaches, which allow for considering multiple indicators and causal variables simultaneously, are flexible and can be adapted to the specific characteristics, time period, and available data of the shadow economy being studied. In addition, SEM/MIMIC models use robust testing and estimation procedures, such as maximum likelihood,

which are optimal for large samples (Giles and Tedds 2002). In addition, Schneider and Enste (2000) confirm these models' flexibility and potential superiority compared to other methodologies. Further, Cassar (2001) points out that SEM/MIMIC models do not need strong assumptions to function.

Chapter 3

INVESTIGATING THE DETERMINANTS OF THE SHADOW ECONOMY: THE BALTIC REGION

3.1 Introduction

The shadow economy, composed of informal, unofficial, and unrecorded activities, is a complex global phenomenon. Although there is no conclusive definition for the shadow economy, the most cohesive interpretation is that it contains all unrecorded economic activities – which, if had been recorded, would be part of the official gross national product (Frey and Pommerehne, 1984; Schneider and Enste, 2000; Schneider, 2005). Another broad definition that has been widely accepted is that the informal economy includes all economic activities and income generated that evades observation, regulation, and taxation (Putniņš and Sauka, 2011; Williams and Schneider, 2013; Buehn, Dell'Anno and Schneider, 2018). In this paper, we adopt the definition provided by Putniņš and Sauka (2015), in which the term shadow economy specifies the production of entirely legal goods and services that are consciously unreported to public authorities. The authors' shadow economy measure consists of purposely concealed income, unregistered employees, and undeclared wages.

Expansion within the informal economy has several substantial economic and social implications for the formal economy. Firstly, the avoidance of taxes depletes revenues generated, provokes budget deficits, and reduces government spending

(Goel, Saunoris, and Schneider 2019), creating inadequate public service quality (Schneider, 2004). Secondly, forgoing tax contributions redirect resources from creating goods and services to covering costs associated with monitoring and penalizing those in pursuit of shadow activities. This alternative use of resources hinders productivity and innovation (Dreher, Méon, and Schneider, 2014; Kelmanson et al., 2019) and causes greater engagement in the informal labor sector due to fewer labor costs (Schneider, 2011). Therefore, stunting economic growth prospects arise. Finally, the presence of the informal economy creates bias within statistics, underestimating the true magnitude of gross domestic product (GDP) used to devise important policies (Ahumada, Alvaredo, and Canavese, 2007). Given the undesirable consequences shadow economy and its complicated nature, studies have focused on gauging its size and discovering its possible determinants (Schneider and Enste, 2000; Goel and Nelson, 2016; Almenar, Sánchez, and Sapena, 2020). We aim to shed light on the potential determinants of the shadow economy within the Baltic region.

Researchers have examined a vast number of factors that contribute to the shadow economy, which imposes detrimental ramifications on economic activity and the output level of the formal economy (Choi and Thum, 2005). The role of taxation has been considered to be one of the primary drivers of the informal economy, as it stimulates the appeal to engage in the "tax-free" informal sector (Frey and Weck, 1983; Schneider, 1997). Higher tax burdens are associated with the expansion of the informal economy, as they increase the desire to engage in tax evasion (Williams and Horodnic, 2015; Mazhar and Méon, 2017). Thus, it has been suggested that large tax

burdens are accountable for the magnitude of the shadow economy (Buehn, Dell'Anno, and Schneider, 2018; Huynh and Nguyen, 2020).

The shadow economy within the Baltic region is remarkably large in correspondence to the GDP generated (Putniņš and Sauka, 2011). Taxation is one factor contributing to this region's informal economy. Enticement to engage in shadow practices within Baltic states is strengthened due to the presence of a large taxation burden (EPICENTER, 2015). The main determinants of the shadow economy in this territory are considered to be undeclared wages, unreported employment, and undisclosed income (Sauka and Putniņš, 2019); all of which are informal activities utilized for tax evasion purposes. Estonia, Latvia, and Lithuania rank between 10th and 20th lowest out of a hundred and ninety worldwide countries according to total tax and contribution rate and score highly on the difficulty of paying taxes (PWC, 2019). Discontent with both the tax system and the government, within the Baltic states, indicates that citizens believe the tax burden they face is unfair (Putniņš and Sauka, 2011). This perception may provoke the motivation to conduct shadow economic activities.

Studies within the previous literature devoted to measuring and understanding the drivers and effects of the shadow economy, within the Baltic region, have noted the importance of taxation. Several studies have stressed the prominence of taxation in diminishing the pursuit of informal economic activities (Putniņš and Sauka, 2011; Williams and Horodnic, 2015; Williams and Horodnic, 2016). According to Putniņš and Sauka (2011), a negative view of both the taxation system and the government is responsible for the decrease in tax morality, resulting in a greater participation rate

within informal economy activities. Caurkubule and Rubanovskis (2014) denote that the unnecessarily significant tax burden must be resolved to reduce the shadow economy size and maintaining sustainable development within Baltic states. The literature provides irrefutable documentation that the costs associated with taxation encourage engagement in shadow activities within the Baltic region. Thus, the tax burden is incorporated within our empirical models – estimating the determinants of the informal economy.

The role of institutions on the shadow economy has not gone unnoticed within the literature. Institutional quality is often used to reflect governance, demonstrating the quality of institutions exercising authority within a given country (Kaufmann, Kraay, and Mastruzzi, 2011) – thus reflecting the effect of governmental institutions. Poor institutional quality is to blame for the expansion of the shadow economy, and consequentially, institutional quality declines further as a result of decreased tax revenues (Friedman, Johnson, Kaufmann, and Zoido-Lobaton, 2000). Furthermore, insufficient institutional quality encourages corruption and brings forth the incentive to conduct shadow economic activities (Dreher, Kotsogiannis, and McCorriston, 2009). It has been suggested that greater institutional quality is vital for decreasing the magnitude of the shadow economy (Bayar and Ozturk, 2016; Canh, Schinckus, and Dinh Thanh, 2021), given that they are responsible for setting favorable conditions within the formal economy.

Several institutional aspects have been investigated as potential determinants of the shadow economy. Institutional measures include; the rule of law (Goel and Saunoris, 2014; Luong, Nguyen, and Nguyen, 2020), political stability (Razmi and

Jamalmanesh, 2014; Baklouti and Boujelbene, 2019), and bureaucracy (Friedman et al., 2000). Often political stability is used to capture institutional quality, where greater stability displays higher institutional quality. Studies show greater political stability reduces the motivation to participate in shadow economic activities, thus reducing the magnitude of the informal economy (Elgin and Uras, 2013; Yalaman and Gumus, 2018; Batrancea, Nichita, Batrancea, and Gaban, 2018). Commonly, a rule of law measure is used to depict the role of institution quality within the informal economy, inferring an established legal system would assist in lessening the shadow economy (Bayar, Odabas, Sasmaz and Ozturk, 2018; Canh, Schinckus and Dinh Thanh, 2021). The literature states that an ineffective rule of law induces the pursuit of informal activities (Goel and Saunoris, 2014; Kelmanson et al., 2019).

The lack of sufficient institutional quality has also been held accountable for the large shadow economy within the Baltic region. Remeikiene and Gaspareniene (2015) stated that the lack of government institutional competence is the main driving force behind the shadow economy. They specifically pointed to inadequate legislation enforcement and the ease with which citizens can participate in tax evasion and informal work without getting caught. Williams and Horodnic (2015) indicated that discrepancies amongst formal and informal institutions, in tax morale, are responsible for expanding the shadow economy within the Baltic region. They claimed that low tax morale – greater asymmetry amongst formal and informal institutions – results in greater participation within the informal economy. According to them, boosting institutional quality is critical for achieving symmetry between the two - improving tax morale - thus assisting the reduction of shadow activities within Baltic states.

Coherent empirical evidence that points to the importance of institutional quality in the fight against the informal economy has led researchers to examine the role of financial sector development on the shadow economy. The financial sector, which provides financial assistance for the conduct of economic activities, can play an essential role in curbing the magintude of the informal economy. The relationship between financial development and the shadow economy is complex, and the research has displayed mixed findings. The majority of studies indicate a negative association, suggesting advancements in financial development contract the shadow economy (Blackburn, Bose, and Capasso, 2012; Bayar and Ozturk, 2016; Berdiev and Saunoris, 2016). However, Berdiev and Saunoris (2016) claim that further financial development could only reduce the shadow economy size of a considerably financially developed country.

Some recent studies have documented an inverted U-shaped relationship between financial development and the shadow economy, inferring that the relationship is positive at low levels of financial development. However, at high levels of financial development, further financial development leads to a reduction in the size of the informal economy (Din, Habibullah, and Abdul Hamid, 2019; Canh and Thanh, 2020). Other studies have implied that the association between these variables depends on a certain threshold (Elgin and Uras, 2013; Habibullah, Din, Yusof-Saari, and Baharom, 2016). Gharleghi and Jahanshahi (2020) investigate the threshold level for twenty-nine developed and developing countries. Their research indicates a GDP per capita of $33,600 or higher is necessary, in order for financial development to reduce the size of the informal economy. They stated that while further financial development offers greater access to financial services, it can cause income

disparities and hinder those less fortunate, in turn, boosting the incentive to participate in shadow activities. Although their sample is large, it does not include Northeast European countries (Estonia, Latvia, and Lithuania), which have a GDP per capita considerably lower than the stated threshold. Therefore, we aim to fill the gap in the existing literature by analyzing the relationship between financial development and the shadow economy within the Baltic region.

Within the extensive previous literature devoted to investigating the shadow economy, a vast number of control variables have been incorporated into empirical models. One of the most popular ones is trade openness. Trade barriers considerably increase associated labor costs within the formal economy, thus driving the desire to engage in the informal economy (Johnson et al., 1997). Felbermayr, Prat, and Schmerer (2011) stated that an escalation in trade openness helps reduce unemployment in the formal sector by reducing the motivation to participate in the informal economy. Several studies have displayed the negative association amongst trade openness and the shadow economy (Buehn and Schneider, 2012a; Medina and Schneider, 2017; Canh, Schinckus, and Dinh Thanh, 2021).

Another commonly used control variable within the shadow economy literature is inflation. Existing literature reveals mixed findings regarding the influence of inflation on the shadow economy. Earlier studies argued that greater inflation results in larger production costs, ultimately increasing the incentive to participate in shadow activities (Eilat and Zinnes, 2002; Ahumada, Alvaredo, and Canavese, 2007; Schneider, Buehn, and Montenegro, 2010). Gomis-Porqueras, Peralta-Alva, and Waller (2014) reexamined this relationship utilizing dynamic general equilibrium

models and found a negative association among inflation and the shadow economy. More recent studies suggest higher inflation creates greater uncertainty concerning informal labor costs. This uncertainty might shift jobs from the informal to the formal sector, reducing the shadow economy (Aït Lahcen, 2018; Kwon, Lee, and Park, 2020).

Urbanization is often utilized as a control variable in shadow economy literature. Lee (2013) proposes greater urbanization boosts tax morale as urban regions reap the benefits of improved public good provisions more than rural districts. His findings imply that an urbanization escalation diminishes the informal economy's magnitude. Further studies found an inverted U-shape relation amongst urbanization and the shadow economy. These studies state that in the later stages of urbanization, a rise in urbanization will contract the size of the shadow economy (Elgin and Oyvat, 2013; Acosta-González, Fernández-Rodríguez, and Sosvilla-Rivero, 2014). Given the consistent use of trade openness, inflation, and urbanization measures within the existing shadow economy literature, we opt to incorporate them as control variables.

The well-documented devastating ramifications of the shadow economy led us to reexamine its potential determinants for the case of the Baltic region. Our study aims to fulfill a gap within the existing literature by emphasizing the role of financial development, which has been overlooked thus far. We utilized the financial development index and the financial institution index to represent financial development. Besides, major shadow economy determinants from the existing literature were utilized within our empirical models. These include; tax burden (Borlea, Achim, and Miron, 2017; Ginevicius, Kliestik, Stasiukynas, and Suhajda,

2020), institutional quality in the form of political stability (Schneider, Khan, Hamid, and Khan, 2019; Canh, Schinckus, and Dinh Thanh, 2021), and the rule of law (Torgler and Schneider, 2009; Medina and Schneider, 2018). The most widely used control variables, trade openness (Medina and Schneider, 2018), inflation (Baklouti and Boujelbene, 2019), and urbanization (Elgin, 2020), were also integrated within the models to avoid committing omitted variable bias. To analyze the short- and long-run relationships, the panel Autoregressive Distributed Lag Model (ARDL) was applied; due to the stochastic characteristics of the data. Based on our empirical findings, we discuss potential actions that can be taken to lessen the shadow economy in the conclusion section.

3.2 Data

This study employs a panel dataset consisting of three cross-sections (Estonia, Latvia, and Lithuania) for a time span of eleven years ranging from 2009 to 2019 inclusively; due to data limitations. Our dependent variable SE is proxied by the shadow economy index provided by the Stockholm School of Economics (SSE) in Riga. The index uses the methodology established by Putniņš and Sauka (2015), in which surveys are distributed to company managers within the Baltic region, and data collection techniques are applied to appraise the magnitude of the shadow economy as a percentage of GDP. We opt to use this measure as the index comprises several shadow economy attributes such as; misreporting of profits and the number of employees, undeclared wages, bribery, and corruption. In this regard, the shadow economy index developed by Putniņš and Sauka (2015) transparently discloses the components used within their index computations, unlike macro-based shadow economy measures, making their measure more precise and composed. For more detailed discussions concerning the pitfalls associated with the use of macro-based

measures, see Schneider and Enste (2000), Breusch (2005), and Schneider and Buehn (2018).

Our study's primary focus is to investigate the role of institutional factors on the magnitude of the shadow economy for Baltic countries. To this aim, several common institutional measures were incorporated into the empirical models. To analyze the impact of financial development on the informal economy, the financial development index (FDI) and financial institution index (FII) were gathered from the International Monetary Fund's (IMF) financial development index database. FDI assesses the depth, access, and efficiency of both financial institutions and financial markets, ranking countries' financial development accordingly. FII appraises the depth, access, and efficiency of exclusively the financial institutions – consisting of banks, insurance companies, and mutual and pension funds. In the case of both FDI and FII; where values range from 0 to 1, a larger observation signifies greater development.

To capture the impact of institutional factors to the greatest extent, institutional quality measures - frequently used within the existing literature - were also integrated into our models. Namely, we incorporated a political risk measure in the form of political stability and absence of violence (PS) and a regulation variable in the form of the rule of law (RL), both obtained from World Governance Indicators. The two, PS and RL, values range from -2.5 to +2.5, where larger values imply better institutional quality.

We include control variables most widely used within previous literature within our empirical models. All of these were obtained from the WorldBank database; trade openness (TO) measured by the sum of imports and exports as a proportion of GDP,

inflation (INF) measured by the consumer price index, and an urbanization measure in the form of urban population growth (UPG). Finally, our taxation environment measure – used to assess how tax constraints affect the shadow economy - proxied by tax burden (TB) was gathered from the Index of Economic Freedom. TB comprises the tax rates for both personal and corporate income and the overall taxation level for a country (including both direct and indirect taxation) as a percentage of GDP. Each country is scored from 0 to 100, where a greater score indicates a larger tax burden for the said country.

Before conducting our analysis, a preliminary data check was carried out. Table 3.1 and Table 3.2, reported below, display the descriptive statistics and correlations for both the dependent and independent variables utilized within our study. From Table 3.1, we observe that the dataset used to be a strongly balanced panel as there are no missing observations; and according to maximum and minimum observations, we see that data does not suffer from any extreme values. Table 3.2 suggests that there may be multicollinearity issues within our dataset, thus we constructed different models to resolve this issue.

The integration order of the variables used to construct the empirical models was assessed with Maddala and Wu (1999) Fisher ADF and Choi (2001) Fisher PP panel unit root tests. The unit root test results are displayed in Table 3.3 below. The findings concerning the unit root tests are as follows; according to both tests, SE is considered to be stationary at the first difference, integrated order of one, (I(1)). Both FDI and FII are stationary at level, (I(0)). Institutional quality measures, TB and RL, are stationary at the first difference, (I(1)); whilst PS is stationary at level, (I(0)). In

regards to the control variables incorporated within empirical models, TO, UPG, and INF, are stationary at level, (I(0)).

Table 3.1: Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
SE	33	19.930	5.801	12.500	38.100
FDI	33	0.261	0.031	0.210	0.310
FII	33	0.463	0.051	0.380	0.550
TB	33	84.385	4.459	77.000	93.600
PS	33	0.623	0.150	0.320	0.960
RL	33	0.988	0.193	0.730	1.370
TO	33	137.165	19.254	86.412	170.760
UPG	33	-0.730	0.747	-2.282	0.616
INF	33	1.953	1.756	-1.085	4.982

Table 3.2: Matrix of Correlations (all models)

Variables	SE	FDI	FII	TB	PS	RL	TO	UPG	INF
SE	1.000								
FDI	0.390**	1.000							
FII	0.399**	0.966***	1.000						
TB	-0.238	-0.671***	-0.593***	1.000					
PS	-0.694***	-0.455***	-0.404**	0.494***	1.000				
RL	-0.506***	0.228	0.123	-0.471***	0.272	1.000			
TO	-0.696***	-0.150	-0.170	-0.011	0.652**	0.583***	1.000		
UPG	-0.538***	0.091	-0.027	-0.353**	0.194	0.851***	0.475***	1.000	
INF	0.067	0.116	0.103	-0.205	-0.135	-0.051	0.153	-0.072	1.000

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Table 3.3: Unit Root Tests Results

Level	**SE**	**FDI**	**FII**	**TB**	**PS**	**RL**	**TO**	**UPG**	**INF**
τ_{T} fisher ADF Choi	1.043	-2.019**	-2.471***	2.595	-1.406*	-0.321	-3.575***	-2.244**	-1.379*
τ_{μ} fisher ADF Choi	-0.321	-0.416	0.360	0.147	-2.4771***	1.053	-3.399***	-0.571	-2.702***
τ fisher ADF Choi	-0.892	-1.957**	-3.513***	-0.090	0.629	2.666	-0.398	-1.763**	-2.851***
τ_{T} fisher PP Choi	1.832	-2.282**	-3.282***	4.138	-2.816***	-0.238	-4.062***	-1.633*	-0.733
τ_{μ} fisher PP Choi	-0.780	-0.761	0.117	0.062	-4.010***	0.579	-3.875***	2.068	-2.004**
τ fisher PP Choi	-1.188	-3.338***	-4.983***	-0.112	1.366	2.889	1.605	-1.801**	-2.229**
First difference									
τ_{T} fisher ADF Choi	-1.558*	-0.494	-2.875***	-2.536***	-3.234***	-2.459***	0.894	-1.859**	-1.588*
τ_{μ} fisher ADF Choi	-1.853**	-2.502***	-4.355***	-2.254***	-3.358***	-3.510***	-1.722**	-2.679***	-3.210***
τ fisher ADF Choi	-3.465***	-3.540***	-4.024***	-2.765***	-5.161***	-4.740***	-4.696***	-3.265***	-5.066***
τ_{T} fisher PP Choi	-2.187**	-1.177	-3.540***	-2.534***	-4.994***	-3.732***	0.324	-1.936**	-2.189**
τ_{μ} fisher PP Choi	-1.621**	-3.444***	-4.872***	-2.227***	-5.699***	-3.958***	-2.854***	-3.143***	-3.539***
τ fisher PP Choi	-3.446***	-3.920***	-4.136***	-4.660***	-6.472***	-4.765***	-4.612***	-3.285***	-5.182***

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

3.3 Methodology

We applied the panel ARDL model to analyze the drivers of the shadow economy (*SE*). Pooled Mean Group (PMG) estimators, developed by Pesaran, Shin, and Smith (1999), were obtained to observe the short- and long-run coefficients and the error correction term (ECT). Panel ARDL is the chosen estimation method in our study for two defining reasons. Firstly, panel ARDL is able to provide both the short- and long-run coefficients; despite the existence of mixed integrated order regressors (Pesaran and Shin, 1998). Conventional static panel estimations such as pooled OLS, fixed-effects, and random-effects are not suited as they are not able to differentiate amongst short- and long-run dynamics. Secondly, the variables used within our empirical models are of a mixed integration order. Thus, the use of aforementioned panel estimation techniques – in which estimations require variables to be stationary (I(0)) – in the presence of mixed integrated order would result in spurious results. Likewise, the application of the panel cointegration tests such as Pedroni (1999) and Johansen-Fisher developed by Maddala and Wu (1999), which require all variables to be integrated order of one (I(1)), are not applicable given the dataset used within our study. Granted the nature of the integrated order of the variables employed within our research, panel ARDL is the most suitable technique to obtain long-run coefficients. In order for the ARDL procedure to be an appropriate analytical technique, the regressand should be I(1); the method is suitable irrespective of whether regressors within the model are I(0) or I(1). Our unit root test results confirm that none of the variables employed are I(2), as this would cause the ARDL method to produce spurious results (Haldrup, 1994).

Moreover, in the case where T is bigger than N (such as in our case), ARDL is the preferred method. Pesaran and Shin (1998), alongside Narayan (2004), illustrated that even in the presence of a small sample, the ARDL method provides super-consistent long-run coefficients. The ARDL estimators are also regarded to be consistent and efficient when employed in the presence of small samples (Haug, 2002).

Panel ARDL estimation method has been used in several recent studies within the previous literature analyzing the role of financial development on the shadow economy (Canh and Thanh, 2020; Akçay and Karabulutoğlu, 2021; Hajilee and Niroomand, 2021); given its properties discussed above.

The ARDL model relaxes the limitations of a static model by augmenting the regression equation with lags of the dependent and independent variables. The goal of augmenting the model is to generate a dynamically complete model with no serial correlation in the regression error term, ϵit. Additionally, a set of exogenous variables can be incorporated into the model.

The ARDL model specification can be displayed as follows:

$$\Delta SE_{it} = \sum_{j=i}^{p-1} \gamma_{ij} \Delta SE_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{i} \Delta X_{i,t-j} + \varphi^{i}\left[SE_{i,t-1} - \left\{\beta_0^i + \beta_i' X_{i,t-1}\right\}\right] + \epsilon_{it} \quad (3.1)$$

Where *SE* is the dependent variable, shadow economy, *X* consists of the set of independent variables incorporated within the model, short-run coefficients of lagged dependent and independent variables are represented by γ and δ, respectively. The

part of the equation in square brackets represents the long-term relationship, where β is the vector of long-run coefficients. Cross-sectional and time dimensions are subscribed by i and t, respectively; where i = 1, 2, 3 represents the cross sections in our sample (Estonia, Latvia, and Lithuania and t = 1, 2, 3…11 reflects the time dimension of the dataset, from 2009 to 2019.

In equation 1, the error correction term (φ) provides crucial information regarding the speed of adjustment toward the long-run equilibrium. This coefficient displays the speed at which the dependent variable reverts to its long-run relationship, following a distortion. If φ=1, deviations from equilibrium are restored immediately; however, if φ=0, the dependent variable will not return to its equilibrium path. Values of φ between these two thresholds imply a partial adjustment process, where the equilibrium is gradually reestablished over time. Thus, the presence of a negative and significant ECT, no smaller than negative one, signifies that any potential short-run deviations from the long-run equilibrium amongst the regressand and regressors will converge back to the equilibrium in the future. ARDL PMG estimator, developed by Pesaran, Shin, and Smith (1999), was conducted; this application is employed in the presence of heterogeneous panels. PMG allows intercepts, short-run coefficients, and error variances to differ across groups; and provides average long-run coefficients for all groups within the sample. This is practical when the long-run relationships are expected to be similar for each cross-section.

3.3.1 Model Specifications

The main aim of this research is to analyze the role of financial development as a potential driver of the shadow economy. This study utilizes eight models to

investigate the possible long-run cointegrating relations among the Baltic region's shadow economy, institutional measures, and economic factors. As one of the primary interests of our study is the role of taxation on the size of the shadow economy, this variable is incorporated within all eight models estimated. Two different proxies for financial development are employed to ensure the robustness of our findings. In this regard, the first four models include overall financial development in the form of FDI. Models five to eight contain financial institution development in the form of FII. We opt to include institutional quality measures (PS and RL) within the models as control variables, given their importance displayed within the existing literature. Lastly, the most widely used economic variables (TO, INF, and UPG) are added to our models.

The study consists of eight different models to avoid multicollinearity issues, given that several proxies were used to represent financial development, institutional quality, and macroeconomic variables. To observe the impact of institutional quality, in isolation, base models one and five contain our main independent variables – reflected in all models (FDI/FII and TB) – and institutional quality measures PS and RL. Models two, three, six, and seven contain the addition of different economic variables. Models two and six contain urbanization (UPG), and models three and seven include trade openness (TO). This was done to observe the effect of financial development on the shadow economy; when controlling for taxation, institutional quality, and popular economic aspects. Models four and eight specifically analyze the impact of financial development, taxation, and economic factors – trade openness (TO) and inflation (INF).

The following linear equations express the models:

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}TB_{it} + \beta_{3it}RL_{it} + \beta_{4it}PS_{it} + \varepsilon_{it} \quad (3.2)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}TB_{it} + \beta_{3it}PS_{it} + \beta_{4it}UPG_{it} + \varepsilon_{it} \quad (3.3)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}TB_{it} + \beta_{3it}RL_{it} + \beta_{4it}TO_{it} + \varepsilon_{it} \quad (3.4)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}TB_{it} + \beta_{3it}TO_{it} + \beta_{4it}INF_{it} + \varepsilon_{it} \quad (3.5)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}TB_{it} + \beta_{3it}RL_{it} + \beta_{4it}PS_{it} + \varepsilon_{it} \quad (3.6)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}TB_{it} + \beta_{3it}PS_{it} + \beta_{4it}UPG_{it} + \varepsilon_{it} \quad (3.7)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}TB_{it} + \beta_{3it}RL_{it} + \beta_{4it}TO_{it} + \varepsilon_{it} \quad (3.8)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}TB_{it} + \beta_{3it}TO_{it} + \beta_{4it}INF_{it} + \varepsilon_{it} \quad (3.9)$$

Where *i* is the cross-sectional unit, and *t* is the time element.

The existing literature provides mixed findings regarding institutional factors (FDI and FII). We expect TB to positively impact SE, as increasing the tax burden should induce shadow economy activities. We anticipate a negative relationship amongst PS and SE as greater political stability will hinder the desire to conduct shadow economic activities. Likewise, we predict RL will negatively affect SE as greater regulation control should enable the contraction of the informal economy. Following suit, we forecast a negative relationship for TO with SE, as greater fluidity of trade across boards (within the formal economy) will reduce the motivation to engage in shadow activities. Finally, we predict a negative coefficient for UPG, as it is assumed that greater urbanization will decrease the incentive to participate within the shadow economy.

3.4 Empirical Findings

Tables 4 and 5 report the findings of ARDL PMG estimators, in which an optimum lag of (1, 1, 1, 1, 1) was selected according to the Akaike Information Criterion (AIC) for all eight models. Table 3.4 displays the findings for models one to four, in which FDI is used to reflect financial development. Table 3.5 reports the results of models five to eight, where FII is utilized as a proxy for financial development.

Table 3.4: Pooled Mean Group ARDL Estimations

	Model 1	**Model 2**	**Model 3**	**Model 4**
Panel A: Short-run				
EC_{t-1} term	-1.292**	-0.813***	-0.962***	-0.372*
D.FDI	-55.573	-114.161	-37.395	-67.512
D.TB	-0.703*	-0.228	-1.437	-0.267
D.PS	-5.511	15.268***		
D.RL	24.888***		-4.075	
D.UPG		-4.573		
D.TO			0.096***	0.078
D.INF				0.223
Panel B: Long-run				
FDI	21.113***	40.947***	96.217***	105.082**
TB	0.143***	0.300***	0.217***	1.037***
PS	-20.185***	-29.468***		
RL	-5.799***		-8.581***	
UPG		-2.060***		
TO			-0.113***	-0.759***
INF				0.188

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Table 3.5: Pooled Mean Group ARDL Estimations

	Model 5	**Model 6**	**Model 7**	**Model 8**
Panel A: Short-run				
EC_{t-1} term	-0.619**	-0.675***	-0.781**	-0.659*
D.FII	7.479	-4.097	34.761	26.103
D.TB	-2.204	-0.548***	-1.537	-2.160
D.PS	16.347***	12.853***		
D.RL	-1.387		11.245	
D.UPG		-1.273		
D.TO			0.227	0.105
D.INF				-0.278
Panel B: Long-run				
FII	19.017***	18.375***	47.772***	119.292***
TB	0.464***	0.372***	1.319***	3.200***
PS	-32.754***	-35.202***		
RL	-7.129***		-4.780***	
UPG		-2.430***		
TO			-0.127*	-0.054
INF				1.020***

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

As displayed in Tables 3.4 and 3.5, ECT is negative and statistically significant, suggesting any disequilibrium expressed in the short run is corrected, and the equilibrium is restored in the long run. We find the majority of the long-run coefficients - within all eight models - to be statistically significant. Our findings indicate that all factors investigated within our analysis, including financial development, institutional factors, tax burden, and economic factors (such as trade openness, inflation, and urbanization), influence the shadow economy within the Baltic region. FDI and FII significantly positively impact SE within all eight models. This suggests that further financial development and financial institution improvements (in depth, access, and efficiency of the institutions) induce greater participation in informal economy activities. These findings align with the theoretical threshold for financial development, established by Gharleghi and Jahanshahi (2020),

as the countries within our study have a GDP per capita less than the threshold observed within their study. The magnitude of both FDI and FII long-run coefficients are similar to those in the article by Canh and Thanh (2020). In their study, they analyzed the effect of financial development on the informal economy for a global sample of one hundred and four economies, utilizing the financial development index provided by the International Monetary Fund.

Institutional quality measures PS and RL display a significant negative relationship with SE, implying greater institutional reforms reduce the magnitude of the shadow economy within Baltic states. The highly significant negative coefficient of PS indicates greater political stability reduces the shadow economy for the Baltic region, as it dwindles the desire to participate in undeclared work and tax evasion (two major shadow economy activities). Strengthening political stability declines the motive to conduct informal acts, as a stable political system promotes a steady economic stance and more efficient public spending. Our finding aligns with several other studies' findings (Torgler and Schneider, 2009; Elgin and Uras, 2013; Huynh, Nguyen, Nguyen, and Nguyen, 2020).

Likewise, a negative relationship amongst the rule of law and the shadow economy infers an increase in the rule of law brings forth better protection for the participants, which is needed to establish a business-friendly environment. Quality improvements would create favorable conditions for improving tax compliance and decreasing tax evasion incentives, thus reducing the informal economy. The long-run coefficient obtained for the rule of law is comparable, in size, to that of Torgler and Schneider (2007), who investigate the effect of taxation and institutional quality on the shadow

economy for the case of Europe. Our findings are in accordance with that of the literature devoted to investigating the impact of institutional quality on the shadow economy, suggesting enhancing institutional quality is vital for reducing the size of the shadow economy (Torgler and Schneider, 2009; Medina and Schneider, 2018; Canh, Schinckus, and Dinh Thanh, 2021).

When comparing the magnitude of the institutional quality measure coefficients PS and RL, we observe PS display a larger negative impact on SE. This finding implies greater political stability is essential for curbing the magnitude of the ever-growing shadow economy within the Baltic region.

When turning our interests to the role of taxation on SE, we observe TB to display a highly significant positive association with SE, within all eight empirical models, for the long run. This finding suggests that an increase in tax burden results in greater participation within the shadow economy. This evidence is as expected and in line with the existing literature investigating the shadow economy's determinants. A greater tax burden increases the motivation to perform informal economic activities to evade tax payments (Frey and Weck, 1983; Schneider, 2005; Schneider, 2012). Our results, in terms of long-run coefficients magnitudes, align with the findings of other studies investigating the impact of tax burden and institutional quality on the shadow economy (for example, Elgin and Oyvat, 2013; Baklouti and Boujelbene, 2020b). Moreover, Canh and Thanh (2020) used the same measures as ours to proxy financial development, institutional quality, and tax burden and found long-run relationships of similar magnitudes.

In regards to economic control factors, we observe a significant negative relationship between TO and SE, implicating greater trade openness to reduce the shadow economy. As international trade escalates, the need for shadow activities dwindles (Medina and Schneider, 2017; Kelmanson et al., 2019; Canh, Schinckus, and Dinh Thanh, 2021). The size effect that we observe within our study is comparable with those observed in Torger and Schneider (2007) and Canh, Schinckus, and Thanh (2020). INF exhibits a significant positive influence on SE, suggesting that a rise in INF will result in the expansion of SE. This finding aligns with the previous literature, in which developed countries observe a positive association (Mazhar and Méon, 2017; Baklouti and Boujelbene, 2019). A higher INF results in greater seigniorage revenue, driving the desire to participate in shadow activities with the aim of tax evasion (Koreshkova, 2006). Finally, we observe the presence of a significant negative association amongst UPG and SE, signifying that as the urban population grows, the shadow economy diminishes, which is true for countries of low urbanization (Elgin and Oyvat, 2013; Acosta-González, Fernández-Rodríguez, and Sosvilla-Rivero, 2014).

In terms of the short-run cointegrating coefficient, we find all - except PS - to be statistically insignificant in the majority of the empirical models. This indicates that our regressors have no effect on the informal economy in the short run. This finding is expected as the determinants incorporated within our models are all factors that change gradually; hence, adaptations take time, and changes are reflected progressively.

3.5 Conclusion

This study investigates the determinants of the shadow economy for the Baltic region, fulfilling a gap within the previous literature by considering the role of financial development. Findings suggest that financial development and financial institutions enhance the shadow economy for Baltic countries; due to the fact that the sample's financial development falls below the necessary threshold needed to combat the shadow economy. According to Gharleghi and Jahanshahi (2020), financial development's role in mitigating the shadow economy is dependent on a sufficient GDP per capita level ($33,600 or higher); below this threshold, financial development enhancements assist the expansion of the shadow economy. Thus, greater financial development - with insufficient GDP per capita - brings forth income inequality and therefore stimulates the desire to engage in informal economic activities.

We observe the rule of law and political stability to display contracting effects on the shadow economy, suggesting that advancements in institutional quality assist the reduction of the informal economy. We advise the utilization of political reforms (advocating democracy and political inclusion) to combat political polarization and further increase political stability. To reduce the pursuit of informal activities, we advocate tighter regulations and greater supervision, as it would reduce the likelihood of engaging in shadow activities. We suggest legal and regulatory transparency, explaining the benefits of engaging in the formal and the cost associated with participating within the informal economy in support of curbing the interests of taking part in shadow economy activities.

Our results indicate that large tax burdens within the Baltic region drive the incentive to participate in informal activities. We recommend using tax policy reforms to decrease the tax burden and, ultimately, the shadow economy within the Baltic states. Improving the efficiency of the taxational system will enable mandatory tax contributions to generate a healthy supply of public goods. Institutional reforms are at the forefront of establishing the perception of fair taxation in taxpayers' minds. We suggest modifying institutional reforms with redistributive fiscal policies to provide transparency on the usage of public resources (tax contributions) and assist the formation of trust within institutions. This will encourage a greater willingness to complete the compulsory tax payments, thus reducing the motivation to conduct shadow activities with the aim of carrying out tax evasion. Likewise, we recommend further regulatory framework development; utilized to increase 'taxpayers' awareness regarding the trade-off between the benefits of tax evasion and the penalties for conducting such activities. We notice a highly significant negative association amongst trade openness and the shadow economy, suggesting fewer barriers within trade would decrease the benefits of conducting informal economy activities, as it will reduce the labor costs associated with operating in the formal economy.

Chapter 4

ANALYZING THE DRIVERS OF THE SHADOW ECONOMY FOR THE CASE OF THE CESEE REGION

4.1 Introduction

The shadow economycan be defined as comprised of all economic activities concealed from regulation for fiscal gain (Buehn, Dell'Anno, and Schneider, 2018; Medina and Schneider, 2019). The shadow economy is a complex phenomenon that imposes ramifications on the formal economy. For this reason, over the past several decades, economists have been tasked with measuring the size of the shadow economy and better comprehending its implications (Schneider and Enste, 2013; Medina and Schneider, 2017). The shadow economy's intricate nature and the economic and social problems it causes led to a vast literature devoted to measuring its size, possible drivers, and consequences (Schneider and Medina, 2017; Almenar, Sánchez, and Sapena, 2020).

The shadow economy creates many undesirable outcomes. Often shadow activities are conducted for tax avoidance purposes. An increase in tax avoidance results in the depletion of public revenues, ultimately causing a decline in government spending (Goel, Saunoris, and Schneider 2019). Besides, resources intended for creating and delivering public goods and services are redirected to offset costs concerning the observance and discipline of those conducting tax-avoiding acts. Reducing

government spending and inefficient use of resources constitutes inadequate public service quality (Schneider, 2004), impedes production and innovation (Dreher, Méon, and Schneider, 2014), stunts economic growth prospects, and therefore boosts the incentive to engage in shadow activities. The shadow economy causes a miscalculation of the gross domestic product (GDP) and generates bias within statistics used in establishing economic policies (Ahumada, Alvaredo, and Canavese, 2007). Moreover, underestimating official economic statistics can lead to false indicators being utilized in macro-policy decisions.

The extensive shadow economics literature can be classified in several ways. Considering the methods used, many researchers prefer panel data econometrics due to data limitations (Alm and Embaye, 2013; Berdiev and Saunoris, 2018). These studies examine many different samples; these include global (Nguyen, Schinckus, and Thanh, 2020; Canh, Schinckus, and Dinh Thanh, 2021), developed and developing countries (Schneider, 2016; Mazhar and Méon, 2017; Baklouti and Boujelbene, 2020a), European countries (Schneider, Raczkowski, and Mróz, 2015; Mara, 2021), and transition economies (Johnson et al., 1997; Bayar, Odabas, Sasmaz, and Ozturk, 2018). The literature, thus far, is yet to analyze the drives of the shadow economy for the Central, Eastern, and Southeastern Europe (CESEE) region. Therefore, this study attempts to identify the drivers of the shadow economy within the CESEE region to bridge a gap in the existing literature.

The CESEE region consists of European transition economies exposed to a larger shadow economy than other European countries (Schneider, 2022). The region's countries, which had a centrally planned economic structure under Soviet political

and economic control post world war two, later switched to a market-based economy. The transition process imposed challenges related to creating a legal framework for the market economy – requiring the transformation of political and social institutions, price freedom, privatization, instituting a banking system, setting a minimum wage rate, and others (Krelle, 2000). Johnson et al. (1997) hold the transition from communism to capitalism responsible for the growth of the shadow economy, stating that politicization creates greater participation within the informal economy to evade tax payments and regulation, resulting in resource reallocation from the formal to the informal sector.

Large tax burdens, poor institution quality, and income inequality can characterize the CESEE region. The privatization policy followed in the transition period made it compulsory to pay taxes, resulting in a significant increase in the tax burden (Lackó, 2000). A larger tax burden intensifies the desire to engage in the shadow economy - "tax-free" - to avoid taxes (Frey and Weck, 1983). Poor institution quality, defined as a flawed legal system, strict regulatory restraints, corrupt activities, and inadequate legislation, provides a conducive environment for the enlargement of the shadow economy within these countries (Torgler and Schneider, 2009). Besides, transition economies experienced significant income inequality, which creates mistrust within the formal economy, driving the desire to conduct shadow activities (Rosser Jr, Rosser, and Ahmed, 2000).

We analyze the potential determinants of the shadow economy for the case of CESEE countries for the 2003-2019 period, using panel data econometrics. The present study contributes to the literature in several aspects. First, the literature lacks

studies focusing on transition economies within the CESEE region. Second, the role of financial development in the shadow economy for transition economies (such as the CESEE region) has been ignored. Understanding this relationship can offer essential insights to policymakers. Third, to represent the shadow economy, we used a comprehensive newly measured index developed by Schneider (2022) and included several control variables to avoid bias or model misspecifications. Furthermore, we assess the impact of institutional quality by incorporating an index comprised of six distinctive factors. For robustness, we utilized several proxies to reflect our primary variable of interest – financial development - in the forms of overall financial development, financial market development, and financial institution development. The stochastic properties of the variables and the existence of a long-run relationship between the variables were examined using multiple econometric methods. Then, fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) were employed to estimate the long-run coefficients of the study. Lastly, we applied Toda Yamamoto's (1995) causality test to reveal the direction of the relationship among the variables.

Our findings suggest that increased financial development in all forms results in expanding the shadow economy for the CESEE region. This exciting result is discussed in the empirical findings section in detail. Our analysis also documents the detrimental role of the tax burden on the formal economy. In contrast, we observe that institutional quality, trade openness, economic freedom, and urbanization negatively affect the shadow economy. In the conclusion of our study, based on our

findings, we offer policy recommendations intended to reduce the magnitude of the shadow economy.

The rest of the paper is as follows; the next section provides a literature review, the third section explains the variable selection and discusses the model specifications used within our study, followed by section four consists of methodology. Section five includes empirical findings and a discussion of the results. Finally, section six concludes with remarks and policy recommendations.

4.2 Literature Review

The term "informal economy" was first conceived by Hart (1973), who attempted to assess the differences between the formal and informal economy. Subsequently, researchers began focusing on gauging the size of the informal economy (Gutmann, 1977). These early studies led to further research defining what constitutes the shadow economy (Frey and Weck, 1983). Frey and Pommerehne (1984) claimed that the direct measurement approaches utilized previously to gauge the shadow economy size often result in biased findings. They deemed the informal economy as directly unobservable and suggested that several causes and indicators be included within shadow economy measurement techniques. Their suggestion was widely accepted in the literature and led to the reexamination of the size of the shadow economy (Dell'Anno and Schneider, 2009; Tafenau, Herwartz, and Schneider, 2010). Reconsideration regarding the measurement of the shadow economy has resulted in more recent literature documenting its potential drivers (Schneider, 2015; Goel and Nelson, 2016).

Due to the importance of the research question, an extensive literature has emerged on the determinants of the shadow economy. In this literature, many country groups were examined as samples. Although findings regarding the potential determinants of the shadow economy may vary from sample to sample, there is a broad consensus in the literature on the importance of some variables. Many researchers preferred to use a global sample to examine shadow economy determinants (Canh, Schinckus, and Dinh Thanh, 2021). Schneider (2005) analyzed a sample of a hundred and ten countries and found that a greater tax burden, lower GDP per capita, poorer institutional quality, and poor economic freedom promote the shadow economy. Studies that use a global sample strongly emphasize the positive and negative impact of taxation (Buehn, Dell'Anno, and Schneider, 2018; Medina and Schneider, 2019) and institutional quality (Torgler and Schneider, 2009; Berdiev and Saunoris, 2016; Canh, Schinckus, and Dinh Thanh, 2021) on the shadow activities, respectively.

Fleming, Roman, and Farrell (2000) questioned whether the developmental stage of a country matters for shadow economy research. Their study was the first to evaluate the shadow economy for samples of developed, developing, and transition countries. They concluded that social, political, and legal disparities cause the shadow economies to vary in composition and size for each sample. Following this study, researchers began analyzing the shadow economy for samples of countries with common characteristics. Especially, the literature on the case of Europe is quite large. Studies have reported a positive relationship between tax burden and the shadow economy, suggesting that a greater tax burden results in the expansion of the informal economy (Schneider, Raczkowski, and Mróz, 2015; Ginevicius, Kliestik,

Stasiukynas, and Suhajda, 2020). The literature also displays a negative association between institutional quality and the shadow economy, suggesting that better institutional quality contracts the magnitude of the shadow economy within Europe (Kelmanson et al., 2019; Mara, 2021).

Previous studies have also investigated the drivers of the shadow economy for transition economies (Tudose and Clipa, 2016; Bayar et al., 2018). Researchers assessing the determinants of the informal economy for transition countries have displayed the notion that a larger tax burden leads to an increase in the size of the shadow economy (Bayar et al., 2018; Kelmanson et al., 2019; Mara, 2021). A negative relation between institutional quality and the shadow economy has also been reported for transition economies. Research suggests that poor institutional quality leads to the enlargement of the shadow economy (Bayar and Ozturk, 2016; Kelmanson et al., 2019). Given the strong support regarding the importance of tax burden and institutional quality within the literature, we incorporate these variables within our empirical models to assess the possible drivers of the shadow economy for the case of the CESEE region.

Several control variables have been incorporated within empirical models analyzing the shadow economy. Commonly trade openness has been used within the existing literature. As trade barriers extensively raise labor costs within the formal economy, it's suggested that trade restrictions increase the incentive to participate in the shadow economy (Berdiev and Saunoris, 2018). Previous studies have recorded evidence of a negative relationship between trade openness and the shadow economy (Medina and Schneider, 2017; Canh, Schinckus, and Dinh Thanh, 2021).

Urbanization is a demographic aspect that has been accounted for frequently in the shadow economy literature. Further urbanization is associated with greater tax morale and is expected to alleviate the shadow economy (Lee, 2013). Some studies have found an inverted U-shape relationship between the two, indicating that in the later stages of urbanization, greater urbanization diminishes the size of the shadow economy (Elgin and Oyvat, 2013; Xu, Lv, and Xie, 2018; Pang et al., 2022). The relationship between economic freedom and the shadow economy has also been investigated. Greater economic freedom brings advanced human development and reduces poverty (Gwartney et al., 2017). Thus, more economic freedom minimizes the need to engage within the shadow economy (Berdiev, Saunoris, and Schneider, 2018; Bayar and Öztürk, 2019; Khan, Hamid, and Rehman, 2021). We incorporate the aforementioned control variables within our models to avoid omitted variable bias.

Lately, studies have investigated the role of financial development in implicating the shadow economy size, as they provide vital financial aid for economic activities (Blackburn, Bose, and Capasso, 2012). Many studies suggest the relationship is negative, indicating that further financial development reduces the shadow economy (Bayar and Ozturk, 2016; Khan, Hamid, and Rehman, 2021). Berdiev and Saunoris (2016) argued that the effect of financial development on the shadow economy's growth differs depending on a country's financial development level. Other studies display an inverted U-shape relation between the two, suggesting that the relationship is dependent on a specific threshold (Habibullah, Din, Yusof- Saari, and Baharom, 2016). Thus far, the impact of financial development on the shadow

economy for transition economies has been overlooked by the existing literature. We aim to shed light on this relationship for the case of the CESEE region. The association between financial development and the shadow economy - for this Region - is of particular interest, as countries within CESEE are considerably less financially developed than other European countries (Reininger and Walko, 2020).

The researchers investigating the shadow economy's determinants in transition economies display the notion that a high tax burden and poor institutional quality result in the expansion of the shadow economy (Schneider, 2009; Kelmanson et al., 2019). However, the literature has been silent about the role of financial development. In this respect, our main research question differs from those previously answered within the existing literature. Our selected research topic is similar to that of Canh and Thanh (2020). They assessed the role of financial development within the shadow economy for a global sample. Results imply that an appropriate level of financial development reduces the shadow economy's magnitude. Our study differs from theirs in terms of sample and control variables. Their sample ignores the different economic characteristics of the countries utilized, which may influence the interaction between financial development and the shadow economy. Furthermore, unlike Canh and Thanh (2020), we opt to include economic freedom and urbanization to enhance the robustness of our empirical models. We aim to close a gap within the existing literature by investigating the relationship between financial development and the shadow economy in the case of transition economies, specifically the CESEE region. Our finding offers policy recommendations to reduce the relatively large shadow economy within transition countries.

4.3 Data and Model Specifications

4.3.1 Data

Our study uses a panel dataset composed of eleven countries within the CESEE region (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia Republic, and Slovenia) and seventeen years spanning from 2003 to 2019 inclusively. We chose the CESEE countries as our sample due to several reasons, including their larger shadow economy (Schneider, 2022), higher tax burden (in the form of labor tax) (International Monetary Fund, 2016), and lower financial development (Reininger and Walko, 2020) in comparison to other European countries.

The dependent variable SE is obtained from Schneider's (2022) study measuring the shadow economy of thirty-six European and OECD countries. Schneider's shadow economy index uses Multiple Indicators Multiple Causes (MIMIC), and currency demand methods. We opt to utilize this index as the MIMIC approach is able to approximate the size of the shadow economy, an unobservable phenomenon, using quantitative measurable causes and indicators of the shadow economy to forecast its size as a percentage of official GDP. For comprehensive discussions concerning the advantages of using the MIMIC approach to gauge the size of the shadow economy, see Dell'Anno and Davidescu (2019), Bashlakova and Bashlakov (2021), and Medina and Schneider (2021).

Three different proxies for financial development - the financial development index (FD), financial market index (FM), and financial institutional index (FI) - are utilized

to ensure the robustness of our findings. These proxies were gathered from the International Monetary Fund's financial development index database. FD evaluates financial institutions' and markets' depth, access, and efficiency. FM assesses the depth, access, and efficiency of financial markets – including stock market capitalization, stocks traded, and debt securities of financial and non-financial corporations. FI appraises the depth, access, and efficiency of solely financial institutions – accounting for banks, insurance companies, and mutual and pension funds. For all three measures, observations range from 0 to 1; a greater value indicates further financial development.

To represent institutional quality, an index (IQ) was created and incorporated within our empirical models. The index consists of six unique indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, the rule of law, and control of corruption. The indicators were collected from World Governance Indicators. Observational values range from -2.5 to +2.5, where bigger values signify better institutional quality. We applied Principal Component Analysis (PCA) technique to convert the six indicators into the IQ index. Tax burden (TB) is composed of personal and corporate income tax rates and the country's overall level of taxation as a percentage of GDP. Observational values range from 0 to 100, where a greater value implies a greater tax burden. The data was gathered from the Index of Economic Freedom.

We used gross domestic product (LGDP), trade openness (TO), economic freedom (EC), and urbanization (UPG) as control variables. LGDP, TO, and UPG were obtained from the WorldBank database; where LGDP is the logarithm of gross

domestic product per capita, TO is calculated by the sum of imports and exports as a portion of GDP, and UPG is the urban population growth. Lastly, EF is proxied by the Index of Economic Freedom, which comprises twelve distinctive freedoms (property rights, government integrity, judicial effectiveness, tax burden, government spending, fiscal health, business freedom, labor freedom, monetary freedom, trade freedom, investment freedom, and financial freedom). Reported values range from 0 to 100, where a larger value implies greater economic freedom.

4.3.2 Model Specifications

We estimate twelve distinctive models to assess the determinants of the shadow economy. Given the importance of taxation and institutional quality within the existing shadow economy literature, TB and IQ are incorporated within all twelve models. To avoid multicollinearity, models one to four include overall financial development in the form of FD, models five to eight utilize financial market development in the form of FM, and models nine to twelve contain financial institutional development in the form of FI. Models one, five, and nine are our base models - consisting of a financial development measure, gross domestic product, tax burden, and institutional quality - evaluating the impact of financial development on the shadow economy, whilst controlling for institutional quality and tax burden. The remaining models build on the base models to include several popularly utilized economic factors. Models two, six, and ten extend the base models by adding economic factor trade openness (TO). Likewise, models three, seven, and eleven include a further addition of economic freedom (EF). Lastly, models four, eight, and twelve include the addition of economic factor urbanization (UPG).

The following linear equations express the empirical models:

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \varepsilon_{it} \quad (4.1)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \varepsilon_{it} \quad (4.2)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \beta_{6it}EF_{it} + \varepsilon_{it} \quad (4.3)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FDI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \beta_{6it}EF_{it} + \beta_{7it}UPG_{it} + \varepsilon_{it} \quad (4.4)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FMI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \varepsilon_{it} \quad (4.5)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FMI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \varepsilon_{it} \quad (4.6)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FMI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \beta_{6it}EF_{it} + \varepsilon_{it} \quad (4.7)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FMI_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \beta_{6it}EF_{it} + \beta_{7it}UPG_{it} + \varepsilon_{it} \quad (4.8)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \varepsilon_{it} \quad (4.9)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \varepsilon_{it} \quad (4.10)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \beta_{6it}EF_{it} + \varepsilon_{it} \quad (4.11)$$

$$SE_{it} = \beta_{0it} + \beta_{1it}FII_{it} + \beta_{2it}LGDP_{it} + \beta_{3it}TB_{it} + \beta_{4it}IQ_{it} + \beta_{5it}TO_{it} + \beta_{6it}EF_{it} + \beta_{7it}UPG_{it} + \varepsilon_{it} \quad (4.12)$$

Where *i* is the cross-sectional unit, and *t* is the time element.

4.4 Methodology

Our study employs panel data econometrics to investigate the potential determinants of the shadow economy (SE) for the CESEE region. We begin our empirical analysis by assessing the stationarity of the variables using Breitung (2001), Im, Pesaran, and

Shin (2003), and Maddala and Wu (1999) Fisher ADF unit root tests. The panel unit root test is considered to be of great power in the case of small samples, and the test power improves as N→ ∞ and T→ ∞.

The null hypothesis of difference stationary for the Breitung (2001) test is evaluated using the equation illustrated below:

$$\text{H0: } \rho_i \equiv \sum_{k=1}^{p+1} \alpha_{ik} - 1 = 0 \tag{4.13}$$

Where $i = 1,\ldots, N$.

The null hypothesis of nonstationary for the IPS test are assessed using the following equation:

$$\Delta y_{it} = \varphi_{it}\beta_{i,t-1} + \rho * y_{i,t-1} + \sum_{j=1}^{ni} \varphi_{ij}\Delta y_{i,t-1} + \varepsilon_{it} \tag{4.14}$$

Where φ_{it} represents the individual deterministic component, ρ represents the autoregressive coefficient varying across all i's, n is the number of lags and ε_{it} is the error term.

Individual time series regressions are conducted for each cross-section for the Fisher ADF panel unit root test. The p-value of each series is then combined, unlike the IPS test, where individual test statistics are averaged.

For all the unit root tests conducted in this study, the null hypothesis is that the series is nonstationary (H0: ρ_i=0 for all i's); where the alternative hypothesis assumes at least one individual within the series is stationary (H1: ρ_i<0 for at least one i). All panel unit root tests confirm the presence of unitary roots I(1) within the variables.

After confirming that all variables within our study are integrated order of one (I(1)), we employ two different panel cointegration tests, Pedroni (1999) and Kao (1999), to confirm the presence of long-run relationships amongst variables. Kao's (1999) panel cointegration test allows for cross-sectional intercepts and homogenous coefficients. The augmented pooled auxiliary regression model formulated by Kao (1999) is presented below:

$$\varepsilon_{it} = \hat{\rho}_i \varepsilon_{i,t-1} + \sum_{j=1}^{\rho} \varphi_{ij} \Delta\varepsilon_{i,t-j} + \vartheta_{it} \tag{4.15}$$

Kao (1999) cointegration test has the null hypothesis of no-cointegration and uses the augmented ADF test statistic, which for $\rho > 0$ is displayed below:

$$ADF = \frac{\tau ADF + \frac{\sqrt{N6\hat{\sigma}_{\vartheta}}}{2\hat{\sigma}_{0\vartheta}}}{\sqrt{\frac{\sigma_{0\vartheta}^2}{2\hat{\sigma}_{\vartheta}^2} + \frac{3\sigma_{\vartheta\vartheta}^2}{10\hat{\sigma}_{0\vartheta}^2}}} \tag{4.16}$$

Which converges to $N(0,1)$ asymptotically.

The Pedroni (1999) panel cointegration test includes two alternative measures, within statistics (for panel cointegration) and between statistics (for group mean panel cointegration). The within statistics consist of four distinctive test statistics; panel-v (nonparametric statistic), panel-rho, panel-PP, and panel-ADF. The between statistics consists of three test components that pool the residuals along the between dimensions of the panel. The test statistics assume heterogeneous trends and intercept coefficients across all cross-sections. The test assesses whether the regression residuals are integrated order of one (I(1)), using auxiliary regression. The auxiliary regression is reported below:

$$\varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + \sum_{j=1}^{\rho} \varphi_{ij} \Delta\varepsilon_{i,t-j} + \vartheta_{it} \tag{4.17}$$

For both Pedroni (1999) and Kao (1999) panel cointegration tests, ε_{it} is integrated order of one (I(1)), under the null hypothesis of no-cointegration.

After observing the presence of a long-run relationship amongst variables, we employ the FMOLS panel estimation method proposed by Phillips and Hansen (1990), which accounts for serial correlation and endogeneity within the model (Philips, 1995). The long-run cointegrating relationship can be expressed as follows:

$$Y_{i,t} = \alpha_i + \beta_i X_{i,t} + \varepsilon_{i,t} \quad (4.18)$$

Where t=1,…..,T, i=1,…..,N, and β_i represents the cointegrating slope between Y and X.

We apply the DOLS panel estimation method (Saikkonen, 1991; Stock and Watson, 1993) to confirm the findings obtained using FMOLS. DOLS is considered to be an asymptotically efficient estimator. The estimation process, in extension to FMOLS, includes both lags and leads in the cointegration regression, on the assumption that the expected value of the sum of all errors is equal to zero within the cointegration equation. The DOLS estimation equation is displayed below:

$$Y_t = \alpha_i + \beta X_t' + D_{1t}' + D_{\gamma 1}' + \sum_{j=-q}^{r} \Delta X_{t+j}' \rho + \vartheta_{i,t} \quad (4.19)$$

FMOLS and DOLS methods are advantageous for two purposes; firstly, they can correct endogeneity and serial correlation problems. Secondly, they eliminate sample bias errors, making them better estimation methods for the case of small samples (Narayan and Narayan, 2005).

Lastly, we apply Toda and Yamamoto's (1995) long-run causality test to analyze the possibility and direction of causal relationships amongst the variables. The test procedure minimizes risks related to incorrectly identifying the integrated order (Mavrotas and Kelly, 2001) by fitting a vector autoregressive (VAR) model to the levels of the variables. As a result, a modified Wald test (MWALD) is generated for the causality test. This testing procedure overcomes the problems associated with testing for Granger causality as it solves any issues stemming from possible non-stationarity or cointegration between series (Zapata and Rambaldi, 1997). The Toda and Yamamoto (1995) test procedure ensures that the usual Granger causality test statistic is of standard asymptotic distribution.

4.5 Empirical Findings

A data check was conducted prior to carrying out our econometric analysis. Tables 4.1 and 4.2 report the descriptive statistics and the correlation matrix for all variables used within our study. Table 4.1 shows that the dataset is a strongly balanced panel, as there are no missing values. Maximum and minimum observations imply that our data does not suffer from extreme values. According to the correlation matrix, we could claim that our dataset does not contain any severe multicollinearity issues.

Table 4.1: Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
SE	187	25.089	5.458	12.150	34.900
FDI	187	0.356	0.103	0.110	0.570
FMI	187	0.188	0.164	0.020	0.630
FII	187	0.511	0.097	0.170	0.690
LGDP	187	4.601	0.769	3.873	6.623
TB	187	77.936	9.345	53.100	94.000
IQ	187	0.002	0.984	-2.521	1.376
TO	187	121.749	32.630	56.180	190.699
EC	187	66.351	5.968	50.000	79.100
UPG	187	-0.201	0.620	-2.282	1.332

Table 4.2: Matrix of Correlations (all models)

Variables	SE	FDI	FMI	FII	LGDP	TB	IQ	TO	EF	UPG
SE	1									
FDI	-0.161	1								
FMI	-0.264	0.883	1							
FII	0.102	0.609	0.167	1						
LGDP	-0.356	0.652	0.840	-0.050	1					
TB	0.088	-0.536	-0.557	-0.180	-0.288	1				
IQ	-0.528	0.145	0.162	0.034	0.131	-0.260	1			
TO	-0.606	0.021	0.002	0.042	0.205	0.115	0.567	1		
EF	-0.291	-0.284	-0.271	-0.113	-0.076	0.570	0.483	0.530	1	
UPG	-0.353	0.626	0.601	0.303	0.478	-0.575	0.213	0.242	-0.252	1

Panel unit root test results are recorded in Table 4.3. According to all three tests, our dependent variable SE is considered to be integrated order of one (I(1)), stationary at the first difference. Our main independent variable (proxied using FDI, FMI, and FII), control variables (LGDP, IQ, and TB), and economic factors (TO, EF, and UPG) are stationary at first difference. Thus, all variables within our study are integrated order of one (I(1)).

Table 4.3: Unit Root Tests Results

Level	**SE**	**FDI**	**FMI**	**FII**	**LGDP**	**TB**	**IQ**	**TO**	**EF**	**UPG**
$\tau_{T\ Breitung}$	2.498	0.560	-0.800	2.355	-2.157**	1.500	-1.034	-0.678	-0.179	-1.917**
$\tau_{T\ IPS}$	1.782	-0.412	-1.357*	-0.300	-0.873	-0.062	0.102	-1.044	-0.387	-0.999
$\tau_{\mu\ IPS}$	4.021	-1.323*	-1.229	-2.376***	3.699	0.233	0.220	-0.129	0.460	-1.195
$\tau_{T\ fisher\ ADF\ Chi\text{-}square}$	14.636	23.836	32.153*	25.756	30.687	29.432	17.702	27.870	24.306	28.495
$\tau_{\mu\ fisher\ ADF\ Chi\text{-}square}$	8.349	30.694	28.322	40.033**	3.664	15.062	17.173	20.869	18.670	29.673
$\tau_{fisher\ ADF\ Chi\text{-}square}$	86.231***	11.591	17.725	10.788	1.784	8.205	20.607	3.858	7.672	27.730
First difference										
$\tau_{T\ Breitung}$	-4.677***	-2.726***	-2.692***	-3.872***	-2.913***	-2.219**	-5.496***	-7.163***	-0.027	-2.567***
$\tau_{T\ IPS}$	-2.449***	-4.184***	-4.329***	-1.117*	-4.636***	-3.649***	-3.359***	-2.920***	-2.652***	-3.575***
$\tau_{\mu\ IPS}$	-3.327***	-4.449***	-6.470***	-1.649**	-5.147***	-4.588***	-5.293***	-4.717***	-3.834***	-5.478***
$\tau_{T\ fisher\ ADF\ Chi\text{-}square}$	37.781**	57.570***	55.733***	26.894	61.802***	53.329***	47.940***	42.708***	44.424***	52.496***
$\tau_{\mu\ fisher\ ADF\ Chi\text{-}square}$	47.667***	59.561***	79.228***	30.365	68.033***	63.443***	68.429***	61.330***	53.124***	71.317***
$\tau_{fisher\ ADF\ Chi\text{-}square}$	41.530***	98.635***	124.929***	69.581***	84.207***	109.642***	162.012***	96.581***	79.335***	117.013***

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

As all the variables within our empirical models are considered to be integrated order of one (I(1)), we test for the cointegration relationship between the variables. Table 4.4 reports the finding of the Kao (1999) panel cointegration test. According to Table 4.4, we find cointegration for all twelve models. Table 1, in Appendix A, displays the results for the Pedroni (1999) panel cointegration test for models one to three, five to seven, and nine to eleven. The panel cointegration test can detect cointegration for a maximum of seven covariates. Thus models four, eight, and twelve could not be tested using Pedroni (1999) due to the inclusion of eight variables (Pedroni, 2004).

Table 4.4: Kao Cointegration Test Statistics

	Model 1	**Model 2**	**Model 3**	**Model 4**
ADF	-2.835***	-2.994***	-1.964**	-2.295**
	Model 5	**Model 6**	**Model 7**	**Model 8**
ADF	-2.707***	-2.864***	-1.723**	-2.021**
	Model 9	**Model 10**	**Model 11**	**Model 12**
ADF	-2.927***	-2.407***	-2.311**	-2.495***

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Tables 4.5 and 4.6 display the long-run coefficients obtained; Table 4.5 reports results from FMOLS, and Table 4.6 presents the findings using DOLS.

Table 4.5: FMOLS Estimations

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
FDI	4.648*	3.414***	6.096***	6.062***								
FMI					2.151**	1.114***	1.595**	2.505***				
FII									4.095**	3.534***	6.050***	5.205***
LGDP	-12.235***	-10.973***	-9.320***	-8.514***	-12.302***	-10.790***	-9.438***	-8.054***	-12.663***	-11.305***	-9.480***	-9.359***
TB	0.045*	0.0252***	0.105***	0.100***	0.025**	0.035***	0.083***	0.105***	0.023	0.015*	0.089***	0.060***
IQ	-1.364***	-1.254***	-0.929***	-0.758**	-1.381***	-1.365***	-0.990***	-0.985***	-1.123***	-1.080***	-0.666**	-0.564***
TO		-0.024***	-0.031***	-0.035***		-0.026***	-0.028***	-0.039***		-0.025***	-0.035***	-0.029***
EF			-0.183***	-0.200***			-0.156***	-0.173***			-0.210***	-0.195***
UPG				-0.717**				-0.854***				-0.269***
R squared	0.971	0.974	0.977	0.977	0.972	0.974	0.977	0.976	0.972	0.975	0.977	0.979

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Table 4.6: DOLS Estimations

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
FDI	5.464**	5.024**	6.245***	5.903***								
FMI					2.770*	0.640	0.275	1.518				
FII									6.354***	6.609***	7.864***	7.288***
LGDP	-12.823***	-11.838***	-9.799***	-8.474***	-12.387***	-10.592***	-8.750***	-7.662***	-13.768***	-13.204***	-11.560***	-10.410***
TB	0.028	0.054**	0.121***	0.130***	0.041	0.072***	0.144***	0.138***	0.008	0.033*	0.101***	0.1140***
IQ	-1.406***	-1.330***	-1.032***	-0.726***	-1.553***	-1.387***	-1.117***	-0.717**	-0.766***	-0.884***	-0.628**	-0.492***
TO		-0.025***	-0.030***	-0.036***		-0.034***	-0.041***	-0.042***		-0.018**	-0.027***	-0.034***
EF			-0.188***	-0.237***			-0.181***	-0.222***			-0.165***	-0.203***
UPG				-0.901***				-0.951***				-0.655**
R squared	0.983	0.987	0.990	0.991	0.980	0.984	0.987	0.989	0.986	0.988	0.991	0.992

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

We observe that most of the long-run coefficients - within all twelve models - are statistically significant. Our findings imply that all variables analyzed within our study, such as financial development, institutional factors, tax burden, and economic factors (trade openness, economic freedom, and urbanization) affect the CESEE region's shadow economy. We find our main independent variables; proxies for financial development - FD, FM, and FI - to be positive and statistically significant in both the FMOLS and DOLS estimations. Our finding implies that further financial development, financial institution, and financial market improvements contribute to the size of the shadow economy within the CESEE region.

This result deserves some discussion on it. Although the dominant view in the literature is that there is a negative relationship between financial development and the shadow economy, there are also different ideas that the researchers have put forward. There are pieces of evidence that the effect of financial development on the shadow economy might differ due to some factors, such as time span and the level of financial development. Din et al. (2019) investigated the role of financial development on the size of the shadow economy for the case of Malaysia and found an inverted U-shaped relationship. This finding indicates that while at the early stage of financial development, this variable might lead to an increase in the shadow economy, the relationship will become negative above a threshold. In their recent study, Canh and Thanh (2020), claimed that the shadow economy-financial development relationship might be non-linear. They examined a sample of 114 countries with the help of various econometric methods and concluded that financial depth and financial access have a positive effect on the shadow economy in the short

run. These findings emphasize the importance of time span and the level of financial development while investigating the financial development-shadow economy nexus. Gharleghi and Jahanshahi (2020) argue that the effect of financial development on the shadow economy depends on the national income level of the country. If a country's GDP per capita is below the threshold of $33,600, financial development does not seem to have a reducing effect on the shadow economy.

CESEE countries generally have low levels of financial development, and none of them is among the top 20 countries. However, there is another striking point about the level of financial development in these countries. For the last two decades, the general trend in the world is towards an increase in financial development and a decrease in the shadow economy. CESEE countries also seem to be in line with the general trend for the decline of the shadow economy. However, in a significant part of the region (Estonia, Hungary, Latvia, Lithuania, and Slovenia), a substantial deterioration in financial development was observed after 2010. The region's unique conditions can explain this divergence from the general trend. In addition, the GDP per capita of these countries is below the threshold stated by Gharleghi and Jahanshahi (2020). When the empirical findings of the studies mentioned above (Din et al., 2019; Canh and Thanh, 2020) are considered together with the unique characteristics of the countries of the Region, the positive relationship between financial development and shadow economy becomes meaningful.

We observe LGDP to display a significant negative relationship with SE in all twelve models estimated with both FMOLS and DOLS. This suggests an increase in gross domestic product reduces the shadow economy within the CESEE region. This

finding is consistent with the existing literature (Torgler and Schneider, 2009; Schneider, 2011; Khan, Hamid, and Rehman, 2021; Imamoglu, 2021). Herwartz, Tafenau, and Schneider (2015) stated that greater GDP per capita offers more job creation within the formal economy, decreasing the necessity to look for employment within the informal economy.

When analyzing the role of taxation on the shadow economy, we find a significant positive relationship amongst TB and SE for all models analyzed with FMOLS and the majority of the models investigated with DOLS. This observation implies an increase in tax burden causes the shadow economy to increase in size, for the CESEE region. A larger tax burden encourages participation within the shadow economy to evade the associated large tax payments. The finding aligns with the existing shadow economy literature (Dreher, Kotsogiannis, and McCorriston, 2009; Elgin and Oyvat, 2013; Baklouti and Boujelbene, 2020b; Canh and Thanh, 2020).

Turning our interests to the effect of institutional quality on the shadow economy, we observe a significant negative relationship between IQ and SE. The IQ coefficient is negative and significant for all twelve models estimated with both FMOLS and DOLS. This finding indicates that institutional quality improvements assist in curbing the shadow economy size within CESEE countries. Our result is compatible with existing studies analyzing the effect of institutional quality on the shadow economy (Torgler and Schneider, 2007; Dreher, Kotsogiannis, and McCorriston, 2009; Gaspareniene and Remeikiene, 2015; Bayar and Ozturk, 2016). Many studies have suggested that poor institutional quality is responsible for the growing size of the shadow economy (Friedman, Johnson, Kaufmann, and Zoido- Lobaton, 2000).

Several papers imply that poor institutional quality results in higher labor costs within the formal economy, thus, increasing the desire to participate in the informal economy (Enste, 2018; Su, Nguyen, and Christophe, 2019; Canh and Thanh, 2020).

In order to refrain from omitted variable bias, we opted to incorporate popular economic factors utilized within the existing literature as control variables. Our economic factors include namely; TO, EF and UPG. We find TO to exhibit a negative relationship with SE for all models and both estimation techniques applied. Our findings imply that greater trade openness decreases the magnitude of the shadow economy for the CESEE region. Fewer trade barriers and greater trade within the formal economy diminishes the motivation to conduct shadow activities (Felbermayr, Prat, and Schmerer, 2011; Medina and Schneider, 2017; Kelmanson et al., 2019). Our observation aligns with existing studies (Torgler and Scheinder, 2007; Canh, Schinckus, and Dinh Thanh, 2021).

We observe EF to display a significant negative association with SE, suggesting that greater economic freedom reduces the shadow economy within the CESEE region. Our finding is consistent with previous literature (Schneider, Buehn, and Montenegro, 2010; Enste, 2018; Bayar and Öztürk, 2019). Berdiev, Saunoris, and Schneider (2018) note that a lack of economic freedom induces the development of the shadow economy and argue its necessity within the formal economy to reduce the size of the informal economy.

Finally, we identify the presence of a significant negative relation between UPG and SE which implies as the urban population increases, the shadow economy decreases.

Our finding is in line with the existing literature (Elgin and Oyvat, 2013; Acosta-González, Fernández- Rodríguez, and Sosvilla-Rivero, 2014).

Table 4.7 below reports the finding of Toda and Yamamoto's (1995) causality test. We observe significant unidirectional causalities from all independent variables to the shadow economy (dependent variable). This finding suggests all factors investigated in our study Granger cause the shadow economy. We find a significant bidirectional relationship amongst SE and LGDP, suggesting that the shadow economy Granger causes gross domestic product and the gross domestic product Granger causes the shadow economy, for the case of the CESEE region.

Table 4.7: Toda-Yamamoto Causality Test Results

	Chi-Square
SE → FDI	2.354
FDI → SE	13.938***
SE → FMI	1.327
FMI → SE	16.451**
SE → FII	7.156
FII → SE	14.896***
SE → LGDP	10.112**
LGDP → SE	18.985***
SE → TB	6.052
TB → SE	8.809***
SE → IQ	3.612
IQ → SE	17.314***
SE → TO	0.112
TO → SE	0.597
SE → EF	1.838
EF → SE	8.004**
SE → UPG	4.289
UPG → SE	24.195***

Note: ***, **, and * signify 1%, 5%, and 10% significance for Chi-Square test statistics, respectively.

4.6 Conclusion

This study analyzes the possible determinants of the shadow economy for the CESEE region. Although the previous literature has explored the determinants of the shadow economy for many country panels, they ignored the CESEE region. To the best of our knowledge, this is the first study investigating drivers of the shadow economy in the case of CESEE countries. Another novelty of our research is to utilize Schneider's (2022) new dataset gauging the shadow economy size. Besides, our study investigates the role of financial development using three proxies - financial development, financial market development, and financial institution development - for robustness.

Our findings indicate that further financial development escalates the shadow economy size for the CESEE region. The main explanation of this interesting finding is that the financial development of the Region's economies is below a certain level, as discussed in detail above. According to our results, a larger tax burden stimulates growth in the size of the shadow economy for our sample. To reduce the magnitude of the shadow economy, we recommend informing and educating taxpayers on where and what their tax payments are spent on to make. This will make fulfilling the tax obligation more enticing to citizens. Besides, taxpayers should be made aware of the trade-off concerning the benefits of tax evasion and the penalties for operating within the informal sector to increase tax attractiveness and compliance. Furthermore, promoting trust in the government through transparency and democracy will lessen tax evasion and reduce participation in the shadow economy (Goel and Saunoris, 2016). Lastly, we suggest using tax policy reforms to decrease the tax burden within CESEE countries.

We observe institutional quality to diminish the shadow economy, suggesting that greater institutional quality aids the reduction of the informal economy for CESEE countries. Political reforms that advocate democracy and political inclusion should be pursued to increase institutional quality further. In addition, adopting a well-functioning law system is required to discourage the pursuit of informal activities. Tighter regulations and more supervision would decrease the prospects of conducting shadow activities. Legal and regulatory transparency, pinpointing the benefits of engaging in the formal and the cost associated with engaging within the informal economy, is vital for reducing the desire to take part in informal economy activities.

Turning our interest to the economic factors, we observe that enhanced trade openness reduces the informal economy for the CESEE region. Thus, we advocate fewer international trade restrictions to lessen the cost associated with operating within the formal economy. Our results suggest economic freedom improvements assist the shadow economy reduction. Thus, we recommend implementing policies intended to eliminate oppressive regulations. These policies should diminish the necessity to engage in shadow activities; hence they cause a shift from the informal to the formal sector. Thus, policies that improve economic freedom are vital for combating the shadow economy within the CESEE region.

Chapter 5

SHADOW ECONOMY AND FINANCIAL DEVELOPMENT: EVIDENCE FROM FOURIER ARDL

5.1 Introduction

The shadow economy is intrinsic in nature and is considered to consist of underground, informal, and unreported economic activities. Although there is no definitive definition for the shadow economy, given the vast number of measurement techniques utilized to gauge its size, it has been defined as associated with all economic activities that evade regulation, observation, and taxation for a financial benefit (Williams and Schneider, 2013; Medina and Schneider, 2019). The expansion of the shadow economy imposes several economic and social ramifications on the official economy. Due to the implications it causes, a vast literature on measuring the shadow economy's magnitude has developed (Schneider and Enste, 2013; Medina and Schneider, 2017). Previous research has focused on gauging its size, identifying its potential determinants, and understanding the consequential outcomes it causes for the formal economy (Schneider and Enste, 2000; Almenar, Sánchez, and Sapena, 2020).

The conduct of shadow economy activities imposes several detrimental ramifications on the formal economy. Firstly, the execution of shadow activities results in resources, intended for the production of formal goods and services, being redistributed towards financing the costs associated with the observation and

discipline of individuals carrying out informal activities. This misuse of resources impedes public service quality (Schneider, 2004). Dissatisfaction as a result of inadequate public service quality ultimately leads to greater engagement within informal sector; as the informal circumvents the higher labor costs associated with operating within the formal sector (Schneider, 2011). Secondly, reduced tax revenues, resulting from the conduct of informal economic activities, provokes a depletion in government spending (Goel, Saunoris, and Schneider 2019). A reduction of government spending hinders the innovation and production of formal goods and services (Dreher, Méon, and Schneider, 2014); in turn impeding economic growth and driving the enticement to participate in shadow activities. Due to the undesirable outcomes the informal economy enforces on the formal economy, our study aims to shed light on the potential determinates of the shadow economy for a sample of ten countries enduring a significantly large shadow economy magnitude.

Numerous studies devoted to investigating the shadow economy have noted the importance of institutional quality. Within the existing literature, poor institutional quality has been held accountable for the enlargement of the informal economy's magnitude (Friedman, Johnson, Kaufmann, and Zoido-Lobaton, 2000; Schneider, 2005; Torgler and Schneider, 2009; Medina and Schneider, 2018; Canh, Schinckus, and Dinh Thanh, 2021). As institutions are responsible for creating favorable conditions within the formal economy, studies have conveyed the necessity of institutional quality to combat the growth of the shadow economy (Berdiev, and Saunoris, 2016; Canh, Schinckus, and Dinh Thanh, 2021). The previous literature displays a negative association between institutional quality and the shadow

economy (Bayar and Ozturk, 2016; Kelmanson et al., 2019), implying that greater institutional quality assists in the reduction of the informal economy's magnitude.

Dreher, Kotsogiannis, and McCorriston (2009) study suggests that inadequate institutional quality promotes corruption and spurs the incentive to engage in the informal economy. Given the link amidst institutional quality and corruption, corruption is often used to assess the relationship between institutional quality and the shadow economy, where corruption measures are used to display insufficient or lack of institutional quality. Studies incorporating corruption within their empirical analysis have illustrated the positive association between the two (Buehn and Schneider, 2012a; Goel and Saunoris, 2014). Their findings suggest that greater corruption leads to the expansion of the informal economy's size (Buehn and Schneider, 2009). Berdiev, Goel, and Saunoris (2018) examined the relationship between political corruption and the shadow economy specifically for a global study. They identified a unidirectional causal relationship from political corruption to the informal economy, indicating that greater political corruption results in the expansion of shadow economy. Goel and Saunoris (2019) also observed a positive association between the two, and suggest the presence of corruption reduces the costs associated with conducting - or being caught conducting - shadow activities; and thus prompts the incentive to engage within the informal economy. For this reason, we opt to reflect institutions quality with a political corruption measure within our empirical model to investigate the determinants of the shadow economy.

The previous shadow economy literature has also mentioned the importance of human capital and its ability to curb the informal economy's size. Human capital has

been credited as pivotal for enhancing the formal economy (Schultz, 1961), increasing productivity, innovation, and furthering development (Glomm and Ravikumar, 1992; Hanushek and Wößmann, 2007). Wu and Schneider (2019) suggest that the resulting advancements in the official economy, due to a larger human capital, causes a shift from the informal to the formal sector leading to a decline in the size of the shadow economy. Greater human capital in the form of a higher education level has also been associated with less economic misconduct, financial crime, and a smaller shadow economy (Berrittella, 2015; Achim et al., 2021). Berrittella (2015) study observed a negative association amongst human capital and the informal economy for the global sample investigated within the study; and suggests that a sufficient educational level provides an understanding of the risks associated with operating within the informal economy, reducing the desire in which to participate in shadow activities. Farzanegan, Hassan, and Badreldin (2020) claim that human capital induces economic liberalism and therefore causes the shadow economy to shrink for the case of Egypt. Several studies have displayed a negative relationship between human capital and the shadow economy (Čiutienė et al., 2015; Batrancea, Nichita, Batrancea, and Gaban, 2018; Satrovic, 2019). As the literature highlights the importance of human capital within the shadow economy, we include a human capital measure within this study.

More recently, the literature has turned its interest to analyzing the role of financial development and its ability to combat the magnitude of the shadow economy. As the financial sector offers financial support to carry out economic activities, it may reduce the informal economy's magnitude. Previous studies have depicted mixed findings concerning the relationship between financial development and the shadow

economy. However, several studies suggest that the relationship is negative (Blackburn, Bose, and Capasso, 2012; Berdiev and Saunoris, 2016; Khan, Hamid, and Rehman, 2021). Their results indicate that greater financial development results in the decline of the shadow economy's size (Bayar and Ozturk, 2016). Other studies have found the presence of an inverted U-shape relationship amongst the two, suggestive that high levels of financial development are required in order for it to assist the contraction of the informal economy (Din, Habibullah, and Abdul Hamid, 2019; Canh and Thanh, 2020). Whilst alternative studies imply that the association may be dependent on a certain threshold (Elgin and Uras, 2013; Gharleghi and Jahanshahi, 2020). Nevertheless, the majority of the studies focusing on the role of financial development have been conducted using a panel dataset. Thus, the literature lacks country-specific interpretations regarding the nature of the relationship between financial development and the shadow economy.

The existing shadow economy literature devoted to investigating its determinants has mentioned the importance of institutional quality, human capital, and financial development. However, the majority of studies have focused on analyzing a panel of countries. For this reason, country-specific studies with the previous informal economy literature are sparse. More specifically, the role of financial development - for the case of individual country studies - has been greatly overlooked. Our study intends to shed light on the relationship between financial development and the shadow economy for separate countries in order to better understand the nature of the association between the two. To this aim, our study investigates the determinants of the shadow economy for ten individual countries that exhibit a large informal economy magnitude, according to Medina and Schneider (2018). The top ten

countries within our sample possess a gross domestic product (GDP) equivalent to or greater than $50 billion to ensure that our estimates remain unbiased. Given the prominent evidence within the literature, we opt to incorporate both an institutional quality measure and human capital measure, in the form of political corruption and educational level, respectively, within our empirical model. To observe the long-run relationships between the variables utilized within our study, Autoregressive Distributed Lag Model (ARDL) and Fourier Autoregressive Distributed Lag Model (Fourier ARDL) were applied. To the best of our knowledge, ours is the first study to investigate the determinants of the shadow economy accounting for breaks (smooth and sharp) using Fourier functions. Based on the study's findings, we report policy recommendations aimed at reducing the shadow economy magnitude within the conclusion section.

5.2 Data

Our study investigates the drivers of the shadow economy for ten countries with the largest shadow economy, according to Medina and Schneider (2018). We excluded countries that have a GDP of less than $50 billion and those with data limitations. Countries analyzed within our study are Brazil, Burma, Cote d'Ivoire, Egypt, Ghana, Kenya, Pakistan, Peru, Tanzania, and Thailand. The timespan of each ranges from 1990 to 2018 inclusively.

Our dependent variable shadow economy (SE), proxied using Dynamic General Equilibrium model-based (DGE) estimates of informal output as a percentage of the official GDP, was gathered from the Informal Economy Database provided by World Bank (Elgin, Kose, Ohnsorge, and Yu, 2022). The institutional quality (IQ) measure is represented by the Political Corruption Index obtained from the Varieties of

Democracy Dataset, provided by Gothenburg University (Coppedge et al., 2011). Where the index observations range from less to more politically corrupt, larger observations signify greater political corruption. Our human capital (HC) variable is proxied by a human capital measure obtained from Penn World Table (PWT) 9.0 provided by Groningen Growth and Development Centre, the University of Groningen (Feenstra, Inklaar, and Timmer, 2015). The human capital index is measured using the average of years of education, where a longer span of education implies greater human capital. Lastly, our main variable of interest financial development (FD) was proxied by a financial depth measure, gathered from the Global Financial Development Database provided by World Bank (Čihák, Demirgüç-Kunt, Feyen, and Levine, 2012), where financial depth is measured by private credit by deposit money banks to GDP as a percentage. The study uses all of the variables in logarithmic forms.

The following linear equation represents our empirical model:

$$SE_{it} = \beta_{0it} + \beta_{1it} IQ_{it} + \beta_{2it} HC_{it} + \beta_{3it} FD_{it} + \varepsilon_{it} \quad (5.1)$$

Before conducting our analysis, a preliminary data check was carried out. Table 1 and 2, reported in Appendix B, display the descriptive statistics and correlations for the dependent and independent variables used in our analysis. According to Table 1, our data does not suffer from any extreme values. Table 2 indicates that our dataset does not suffer from any severe multicollinearity issues. We also report graphical representations of the relationships between the dependent variable SE and each independent variable within the appendix. The integration order of variables utilized within our analysis was investigated with the application of Zivot and Andrews (1992) unit root test reported in Table 3 within Appendix B. The Zivot-Andrews unit

root test results indicate that the variables used within our study are of mixed integrated order.

5.3 Methodology

Pesaran and Shin (1995) proposed the Autoregressive Distributed Lag (ARDL) model, which was further developed by Pesaran, Shin, and Smith (2001). When compared to other cointegration methods, the ARDL cointegration test approach has several advantages. One of the key advantages is that, unlike other cointegration approaches, it is not necessary for the variables being studied to be of the same integrated order. This suggests that the ARDL model approach can be used regardless of the variables' integration order (I(1) or I(0)) or fractional integration. Another advantage is that the ARDL method is applicable even with a small sample size (Narayan, 2004). Therefore, we use the ARDL technique to investigate the long-run relationship between the variables within our model. The ARDL bounds test approach proposes estimating the error correction model (ECM) as shown below:

$$\Delta SE_t = \alpha_{0Y} + \sum_{i=1}^{n} b_{iY}\Delta SE_{t-i} + \sum_{i=0}^{n} c_{iY}\Delta IQ_{t-i} + \sum_{i=0}^{n} d_{iY}\Delta HC_{t-i} + \sum_{i=0}^{n} e_{iY}\Delta FD_{t-i} + \vartheta_{1Y}SE_{t-1} + \vartheta_{2Y}IQ_{t-1} + \vartheta_{3Y}HQ_{t-1} + \vartheta_{4Y}FD_{t-1} + \varepsilon_t \quad (5.2)$$

Where ε_t is the white noise error term, α_{0Y} is the intercept, and Δ is the first difference operator. The equation describes the long-run relationships and the error correction dynamics. The joint F-statistic, often known as the Wald statistic, provides the foundation for the bounds-testing approach of the cointegration analysis. The null hypothesis of no cointegration between the variables within the equation is $\vartheta_{1Y} = \vartheta_{2Y} = \vartheta_{3Y} = \vartheta_{4Y} = 0$; while the alternative hypothesis is $\vartheta_{1Y} \neq \vartheta_{2Y} \neq \vartheta_{3Y} \neq \vartheta_{4Y} \neq 0$. To determine the existence of cointegration among the variables, the computed F

statistics are compared with the critical values provided by the study of Narayan (2005).

ECM is utilized to estimate the error correction term and short-run coefficients after confirming the existence of long-run relationships. The following is a representation of the ECM:

$$\Delta SE_t = \alpha_{0Y} + \sum_{i=1}^{n} b_{iY}\Delta SE_{t-i} + \sum_{i=0}^{n} c_{iY}\Delta IQ_{t-i} + \sum_{i=0}^{n} d_{iY}\Delta HC_{t-i} + \sum_{i=0}^{n} e_{iY}\Delta FD_{t-i} + \gamma ECT_{t-1} + \varepsilon_t \quad (5.3)$$

Where ECT_{t-1} stands for the error correction term, which reflects the speed of adjustment to reach long-run equilibrium.

To test the model's stability, Pesaran and Pesaran (1997) suggested running both the cumulative sum (CUSUM), and cumulative sum of squares (CUSUMSQ) tests described by Brown, Durbin, and Evans (1975). McNown, Sam, and Goh (2018) developed the bootstrap Autoregressive Distributed Lag (ARDL) bounds testing method to enhance the classic ARDL technique's weak power and size characteristics. According to Pesaran, Shin, and Smith (2001), a cointegration relationship must meet two criteria: the coefficients of the lagged explanatory variables and the ECT in the ARDL model must be statistically significant. As a way of proving the first condition, the lower and upper critical bounds are proposed. However, the second condition has no applicable upper and lower critical bounds. The order in which the variables are integrated determines whether the second condition is valid. The second criterion is confirmed if the model's input variables are first-order stationary I(1). Low-power of the traditional unit root testing should be taken into consideration at this stage (Goh, Sam, and McNown, 2017). McNown,

Sam, and Goh (2018) suggested using the bootstrap ARDL method to address this issue. This approach requires no assumption of the integration order of the variables. Furthermore, when there are several explanatory variables, the bootstrap ARDL approach has greater power than the traditional ARDL test (McNown, Sam, and Goh, 2018).

The F_A and t statistics provide the foundation of the ARDL method. To determine if there is a cointegration relationship, the test statistics are compared with the lower and upper bounds I(0) and I(1). The null hypothesis, which states that there is no cointegration, can be rejected if the test statistic exceeds the upper boundaries critical values. However, it is hard to determine whether cointegration exists if the test statistics fall between the lower and upper bounds (Pesaran et al., 2001). The solution to this issue is to use bootstrap critical values (McNown et al., 2018). McNown et al. (2018) also developed a brand-new test statistic (F_B) for the independent variables' lagged values. The following are the null hypotheses utilized for these three test statistics:

F_B H0 : $\vartheta_{1Y} = \vartheta_{2Y} = \vartheta_{3Y} = \vartheta_{4Y} = 0,$ (5.4)

t H0 : $\vartheta_{1Y} = 0,$ (5.5)

F_A H0 : $\vartheta_{2Y} = \vartheta_{3Y} = \vartheta_{4Y} = 0$ (5.6)

The bootstrap ARDL test was expanded by Solarin (2019) to include Fourier terms. Fractional frequency flexible Fourier form Bootstrap ARDL technique was also suggested by Yilanci, Bozoklu, and Gorus (2020). The following model is built to take smooth changes in cointegration relations into consideration:

$$\Delta SE_t = \alpha_{0Y} + \sum_{i=1}^{n} b_{iY}\Delta SE_{t-i} + \sum_{i=0}^{n} c_{iY}\Delta IQ_{t-i} + \sum_{i=0}^{n} d_{iY}\Delta HC_{t-i} +$$

$$\sum_{i=0}^{n} e_{iY}\Delta FD_{t-i} + \vartheta_{1Y}SE_{t-1} + \vartheta_{2Y}IQ_{t-1} + \vartheta_{3Y}HC_{t-1} + \vartheta_{4Y}FD_{t-1} +$$

$$\vartheta_{5Y}\sin\left(\frac{2\pi kt}{T}\right) + \vartheta_{6Y}\cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_t \quad (5.7)$$

Where k is the Fourier terms' frequency length. The cointegration link between SE, IQ, HC, and FD exists if all three test statistics are all bigger than the estimated bootstrap critical values.

5.4 Empirical Findings

Table 5.1 below reports the long-run findings of ARDL for the top ten countries. According to Table 5.1, the ECT is negative and statistically significant, for all estimations conducted, suggesting any disequilibrium expressed in the short run is corrected and that equilibrium is restored in the long run. The F-statistic is significant for all ten estimations, confirming the presence of cointegration. The CUSUM and CUSUMSQ results signify that the ARDL models are stable.

Table 5.1: Results of the Long-Run Estimations Based on the ARDL Model

Countries	**ECT**	**Constant**	**IQ**	**HC**	**FD**	**F-stat**	**CUSUM**	**CUSUMSQ**
Brazil	-0.2620***	4.0383***	0.2130***	-0.1133***	-0.0647***	15.9126***	Stable	Stable
Burma	-0.1079***	5.0051***	0.1626	-3.4289***	0.0784	4.6785***	Stable	Stable
Cote d'Ivoire	-0.1813***	4.3831***	0.2237	-1.0064***	-0.0161	12.572***	Stable	Stable
Egypt	-0.0871***	4.6308***	1.5346**	-2.2948***	0.0805	8.1344***	Stable	Stable
Ghana	-0.4409***	3.9909***	-0.0941	-0.6759***	0.0263	12.056***	Stable	Stable
Kenya	-0.4895***	3.6670***	0.6308***	0.0995	-0.0227	5.5483***	Stable	Stable
Pakistan	-0.2011*	3.4537***	0.1126	-0.1090	0.0398	4.1404**	Stable	Stable
Peru	-0.0572***	4.5312***	0.6661***	-0.4246	0.0558	6.0760***	Stable	Stable
Tanzania	-0.1693**	5.1060***	0.1848**	-2.1695***	-0.0497**	7.2194***	Stable	Stable
Thailand	-0.3721***	5.1175***	-0.1089	-0.4698***	-0.1718***	30.7417***	Stable	Stable

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Our findings, according to ARDL, indicate that poor institutional quality, reflected by a positive political corruption coefficient, leads to the expansion of the shadow economy for several of the countries assessed within our investigation. We also find greater human capital to assist the contraction of the informal economy magnitude for the majority of countries analyzed, as indicated by a negative long-run coefficient. The role of financial development aids the reduction of the informal economy for the emerging countries examined within our investigation, as the FD coefficient is found to be insignificant for all other countries.

We observe a positive IQ coefficient for the majority of countries within our analysis. The IQ coefficient is significant for Brazil, Egypt, Kenya, Peru, and Tanzania, suggesting that greater political corruption leads to the enlargement of their shadow economies. This finding aligns with existing studies analyzing the role of corruption within the shadow economy (Buehn and Schneider, 2009; Buehn and Schneider, 2012a; Goel and Saunoris, 2014). Berdiev, Goel, and Saunoris (2018) investigated the direction of the relationship between political corruption and the informal economy for a global study consisting of one hundred and four countries. They identified a unidirectional causal relationship from corruption to the shadow economy; and state that greater corruption provides the incentive for individuals to conduct shadow activities in order to evade exploitable opportunities with corrupt political officials.

The HC coefficient is negative for almost all estimations and significant for Brazil, Burma, Cote d'Ivoire, Egypt, Ghana, Tanzania, and Thailand. This finding implies that greater human capital reduces the size of their shadow economy. This is

consistent with previous studies investigating the relationship amongst human capital and the informal economy (Berrittella, 2015; Satrovic, 2019; Baklouti and Boujelbene, 2020b). A greater educational background strengthens an individual's chances to obtain employment within the formal sector reducing their incentive to participate within the informal sector, causing the shadow economy to decline in magnitude (Berrittella, 2015) for several low-income and emerging economies enlisted within our sample.

When turning our interest to our main variable of interest, financial development, we observe the effect to be significant for a few countries assessed within our study. For the case of Brazil, Tanzania, and Thailand, the FD coefficient is negative and significant. This suggests that further financial development leads to a reduction in the size of their shadow economy. Our finding is consistent with previous research investigating the role of financial development (Berdiev and Saunoris, 2016; Khan, Hamid, and Rehman, 2021). Moveover, Canh and Thanh (2020) found financial depth to assist the decline in the shadow economy's magnitude for their global sample of one hundred and fourteen economies.

For robustness, our sample of ten countries was also analyzed with Fourier ARDL. Table 5.2 reported below, displays the findings for the Fourier ARDL cointegration test. Within Table 5.2, we report the frequency of the breaks, the model's lag selection - according to Akaike Information Criteria (AIC), and the Fourier ARDL cointegration test statistics generated from the bootstrap replications (FA, t, and FB). According to the Fourier ARDL estimations, we find cointegration for the following seven countries; Brazil, Burma, Ghana, Kenya, Peru, Tanzania, and Thailand. The

presence of cointegration is determined when the bootstrap test statics are greater than the bootstrap critical values, resulting the rejection of the null hypothesis of no cointegration.

Table 5.2: Fourier ARDL Cointegration Tests Results

Countries	**Frequency**	**AIC**	**lags**	**F_A**	**t**	**F_B**	**Result**
Brazil	1.5000	-7.7334	1, 2, 0, 3	4.7087*	-3.7563**	4.9584*	Cointegration
Burma	1.5000	-7.4712	2, 0, 2, 0	5.7948*	-3.8765*	7.5610**	Cointegration
Cote d'Ivoire	0.5000	-8.7347	-	3.6818	-2.9409*	4.6588	No Cointegration
Egypt	0.6000	-7.5731	-	3.9273	-1.4871	5.0673*	No Cointegration
Ghana	1.5000	-8.1039	1, 1, 0, 0	5.7274***	-4.3711***	5.9263***	Cointegration
Kenya	3.5000	-9.2794	2, 2, 0, 0	6.8836*	-4.5880*	6.8663*	Cointegration
Pakistan	1.0000	-7.7533	-	1.9995	-1.8898	2.5209	No cointegration
Peru	1.2000	-9.5341	2, 2, 1, 1	2.9390*	-2.3729*	3.2674*	Cointegration
Tanzania	0.6000	-7.6069	1, 1, 0, 1	5.7889*	-3.7600*	4.9025*	Cointegration
Thailand	4.8000	-8.9262	2, 2, 3, 2	6.2217**	-3.5832*	5.6271*	Cointegration

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively. The number of bootstrap replications = 2000.

Table 5.3, presented below, displays the ECT, long-run coefficients, and stability (according to CUSUM and CUSUMSQ) for the Fourier ARDL model estimations. For the seven countries that are cointegrated, according to the Fourier bootstrap – where the bootstrap test statistics are greater than the critical values in absolute terms, we observe the ECT to be negative and significant. This signifies that any short-run disequilibrium experienced is corrected for, and equilibrium is restored within the long run. According to the CUSUM recursive stability test, all seven estimations are considered stable.

Results of Fourier ARDL indicated that poor institutional quality, illustrated by positive coefficients proxied by political corruption, leads to the expansion of the shadow economy for low-income countries with our analysis. This finding is consistent with previous studies focusing on low-income countries (Dreher and Schneider, 2010). Goel and Nelson (2016) study found better institutional quality to reduce the size of the shadow economy of thirty-four countries, which include Ghana, Kenya, Peru and Tanzania. Thus, our results support their findings. We observe greater human capital to display a contraction effect on the informal economy, as all long-run coefficients are negative and significant in our study. Regarding our main research question, the nature of the relationship between financial development and the shadow economy, we find a negative association. The Fourier ARDL results confirm the finding of ARDL further financial development results in a decline of the informal economy's magnitude for the sample of emerging countries (Peru and Thailand) within our sample of the top largest shadow economies.

Table 5.3: Results of the long-run estimations based on the Fourier ARDL model

Countries	**ECT**	**Constant**	**IQ**	**HC**	**FD**	**CUSUM**	**CUSUMSQ**
Brazil	-0.7932***	3.6897***	0.0308	-0.1886***	0.0149	Stable	Unstable
Burma	-0.2355***	5.3120***	0.0943	-3.6817***	0.0439	Stable	Stable
Cote d'Ivoire	-	-	-	-	-	-	-
Egypt	-	-	-	-	-	-	-
Ghana	-0.8623***	3.8889***	0.0959***	-0.2287***	-0.0039	Stable	Stable
Kenya	-0.7249***	-3.5062***	0.2518**	-2.9881**	-0.0051	Stable	Unstable
Pakistan	-	-	-	-	-	-	-
Peru	-0.4207***	4.8184***	0.0723*	-0.6037***	-0.0826***	Stable	Stable
Tanzania	-0.7375***	4.3489***	0.1179**	-0.6540*	-0.0229	Stable	Stable
Thailand	-0.7170***	5.2134***	-0.1223***	-0.4757***	-0.1854***	Stable	Stable

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

The IQ coefficient is found to be positive in all most all models. We observe a significant IQ coefficient for Ghana, Kenya, Peru, and Tanzania, when accounting for the presence of smooth and sharp breaks with the utilization of the Fourier function – confirming our findings obtained with ARDL. This result suggests that great political corruption causes their shadow economy to increase in size and is in line with previous studies (Goel and Saunoris, 2014; Berdiev, Goel, and Saunoris, 2018). In regards to HC, the coefficient is negative and significant for all cointegrating estimated models. This implies that more human capital aids the reduction of the shadow economy's magnitude for the seven previously mentioned countries; and supports the results of our ARDL estimations. Our results support the findings of Batrancea, Nichita, Batrancea, and Gaban (2018) who found greater human development to reduce the shadow economy for their sample of a hundred and ninety three countries and territories.

Regarding FD, the coefficient is negative for most estimations. Our findings indicate that financial development, when assessed at a country level, cannot combat the shadow economy for most countries enduring/suffering from the presence of a large shadow economy. We find the coefficient to be significant for Peru and Thailand. This observation suggests that further financial development, for the case of Peru and Thailand, decreases the size of their shadow economy specifically. Our finding is supported by Khan, Hamid, and Rehman (2021) who investigated the role of financial development for two individual samples of OIC and non-OIC countries. Their panel of non-OIC countries includes both Peru and Thailand. Their study concluded that financial development mitigates the shadow economy of non-OIC countries more profoundly when compared to their OIC countries sample. Our

results are also consistent with Canh and Thanh (2020) study, which found financial development to negatively impact the shadow economy for upper-middle countries (their sample includes Peru and Thailand in the panel).

5.5 Conclusion

This study investigates the potential drivers of the shadow economy for ten individual countries, consisting to have the largest shadow economy according to Medina and Schneider (2018), after excluding countries with data limitations and a GDP less than $50 billion to refrain from any estimation biases. This study is the first to analyze the role of financial development within the shadow economy using time series analysis for a sample of the top ten shadow economies, to the best of our knowledge. Another novelty of our research is that we estimate the long-run relationships between the variables using ARDL and Fourier ARDL. Fourier ARDL provides robustness and enables us to assess long-run coefficients while accounting for smooth breaks in the datasets by employing Fourier functions. For the most part, Fourier ARDL results confirm the findings of ARDL.

When assessing our results according to ARDL, we find that poor institutional quality, or greater political corruption, to induce the shadow economy for five of the ten countries investigated. When this relationship is examined with Fourier ARDL, robust estimates suggest that poor institutional quality increases the magnitude of the shadow economy for Ghana, Kenya, Peru, and Tanzania. For these countries, less political corruption would mitigate the informal economy. As a decline in political corruption would increase the costs associated with participating within the shadow economy, thus reducing the enticement in which to engage in informal economy activities. We suggest the utilization of political reforms to enhance political

democratization to reduce political corruption; in hopes of causing a decline in the shadow economy's size. Policies and regulations in place should promote economic freedom, as too restrictive regulations and policies will induce greater political corruption and ultimately lead to the enlargement of the shadow economy.

We find human capital to reduce the informal economy for the majority of the countries analyzed, according to ARDL. The results of Fourier ARDL support these findings, as we observe a significant negative coefficient for all countries investigated. Hence, greater education equips individuals with the understanding of the costs and risks associated with participating in the informal economy. Increased awareness concerning the pitfalls of engaging within the shadow economy decreases an individual's incentive to conduct shadow activities; and results in a contraction of the informal economy's size. Greater education - increased human capital - leads to a greater number of skilled workers and increases the wages offered in the formal economy, whilst increasing the risks and costs associated with conducting shadow activities (Berrittella, 2015). Moreover, policies promoting higher educational levels will increase productivity and innovation of the formal economy; likewise, decrease the desire to participate in shadow activities.

Turning our attention to the role of financial development, we observe financial development to display a negative association with the shadow economy for a few of the countries included in our analysis. According to ARDL, further financial development reduces the informal economy for Brazil, Tanzania, and Thailand. The findings of Fourier ARDL support this, as greater financial development decreases the informal economy in Peru and Thailand specifically. Thus, improving the

efficiency of financial institutions– within Thailand and Peru - will promote financial development, reducing financial risk and decreasing the magnitude of the shadow economy. We advocate the use of financial development policies, aimed at boosting economic development – by deepening financial markets and providing greater access to financial or credit markets; to shift economic activities from the informal economy to the formal economy in order to curb the size of the shadow economy for the case of Thailand and Peru.

Chapter 6

CONCLUDING REMARKS

The vast previous literature devoted to measuring and identifying the determinants of the shadow economy has documented its most prominent drivers. Recently, the literature has turned its interest to assessing the relationship between financial development and the shadow economy. Thus far, the research has provided mixed findings regarding the role of financial development. The majority of early studies have reported a negative relationship amongst financial development and the shadow economy (Blackburn, Bose, and Capasso, 2012; Bayar and Ozturk, 2016). This relation suggests that enhanced financial development assists in the reduction of the informal economy's magnitude. Whilst, a number of more recent studies examining the relationship between financial development and the shadow economy express that the relationship is of an inverted U-shape (Berdiev and Saunoris, 2016; Din, Habibullah, and Abdul Hamid, 2019; Canh and Thanh, 2020). Their findings imply that high levels of financial development are required in order for financial development to enable the contraction of the shadow economy's magnitude.

Given the newly demonstrated evidence of financial development's ability to contract the shadow economy size, this dissertation aims to address the implication of financial development on the shadow economy. To this aim, our first two empirical studies shed light on the role of financial development for countries of considerably low financial development, which has been overlooked by the literature

thus far. Our third study examines the nature of the relationship at a country-specific level, to empirically assess whether financial development assists in the reduction of the shadow economy for countries with considerably large informal economies.

Our first case study investigates the drivers of the shadow economy for the Baltic region. Where the informal economy is represented using the Baltic shadow economy index devised by Putniņš and Sauka's (2015) survey approach, in which the magnitude of the shadow economy is recorded as a percentage of GDP. Our main variable of interest, financial development, is represented using two proxies from the IMF's financial development database, namely, the financial development index and the financial institution index. We applied panel ARDL and obtained PMG estimators in order to assess the long-run coefficients for a panel of three Baltic countries (Estonia, Latvia, and Lithuania) for the period 2009 to 2019 inclusively due to data limitations. We incorporated several institutional quality measures and economic factors popularly utilized within the existing literature into our empirical models. Moreover, to ensure robustness we employ two financial development proxies as mentioned above.

Findings obtained from the first case study indicate that further financial development leads to the expansion of the shadow economy within the Baltic region. All eight estimated models display a significant positive relationship between the pair, demonstrating that greater financial development encourages the desire to participate in shadow activities. Results imply that the large tax burden, experienced within this region, escalates the motivation to engage within the informal economy. Lastly, we observe both institutional quality measures and economic factors to exert

a negative effect on the shadow economy's size within the Baltic region. Both improved institutional quality and increased trade openness decrease the necessity to participate in shadow economy practices for the case of Baltic states.

Our second study focuses on analyzing the determinants of the shadow economy for the case of the CESEE region. The study uses a panel dataset consisting of eleven CESEE countries for 2003 - 2019 period. This sample is chosen as these transition economies suffer from a relatively larger shadow economy compared to other European countries (Schneider, 2022). This study utilizes Schneider's (2022) new shadow economy size dataset, estimated using the MIMIC method, to represent the shadow economy. The role of financial development is assessed using three proxies: financial development, financial market development, and financial institution development, obtained from IMF's financial development database. Commonly employed control variables found within the existing literature are incorporated within our estimated models to avoid biased model misspecifications. Control variables include; gross domestic product, institutional quality, trade openness, economic freedom, and urbanization. FMOLS and DOLS panel estimation methods are applied to estimate the study's long-run coefficients. Toda Yamamoto's (1995) causality test is employed to test for possible causal relationships amongst the variables.

Our results suggest that greater financial development (in all forms - overall, market, and institutional development) increases the shadow economy's magnitude within the CESEE region. CESEE countries are considered to be of low financial development, and therefore their financial development cannot combat the size of the

informal economy present within this region (Berdiev and Saunoris, 2016; Canh and Thanh, 2020). Findings also imply that a large tax burden within the CESEE region stimulates the growth of the shadow economy. Whilst, greater institutional quality is associated with a reduction in the shadow economy's magnitude. Findings concerning our economic factors suggest that greater trade openness and economic freedom decrease the shadow economy within the CESEE region.

Our third study aims to provide a greater understanding regarding the nature of the association between financial development and the shadow economy. To this aim, the study investigates the determinants for ten individual countries that exhibit a large informal economy magnitude, according to Medina and Schneider (2018). We opt to incorporate both an institutional quality measure and human capital measure, in the form of political corruption and educational level, respectively, within our empirical model to refrain from omitted variable bias. Autoregressive Distributed Lag Model (ARDL) and Fourier Autoregressive Distributed Lag Model (Fourier ARDL) were applied to observe the long-run relationships between the variables.

Findings indicate that poor institutional quality, reflected by greater political corruption, leads to expanding the shadow economy for the low-income countries assessed within our sample. According to ARDL and Fourier ARDL, greater human capital enables the reduction of the shadow economy's magnitude for all top ten countries. Thus, improvements in education will aid the contraction of the informal economy for countries considered to suffer for a considerably large shadow economy. When investigating the role of financial development on the shadow economy, we observe its long-run coefficient as statistically insignificant in most

estimations. We find a negative association for the case of Peru and Thailand. This result suggests that financial development's ability to curb the shadow economy may be country specific.

Results obtained within our research propose several policy implications intended to necessitate the reduction of the shadow economy. Given the positive association observed between tax burden and the informal economy, in both case studies; we advise the utilization of tax policy reforms in order to alleviate the large tax burden present within both regions (Baltic and CESEE), with the aims of reducing the shadow economy size. Moreover, we suggest including redistributive fiscal policies within modified institutional reforms. This modification will generate greater transparency regarding the usage of public resources (tax contributions) and facilitate great trust in the government, thus, reducing the desire to engage in shadow economy activities with the aim of conducting tax evasion. Lastly, we recommend additional regulatory framework development; aimed at improving taxpayers' awareness concerning the trade-off associated between the benefits of tax evasion and the penalties for conducting such activities. Greater education regarding this trade-off should result in improved tax attractiveness and compliance and therefore reduce the motivation to participate within the informal economy.

Our findings, for all three empirical investigations, imply that greater institutional quality aids the contraction of the shadow economy. We advocate the pursuit of political reforms; intended to combat political polarization by promoting political inclusion and democracy in order to boost institutional quality. Furthermore, to decrease the likelihood of citizens participating within the informal economy, we

advise adopting a well-functioning law system. Greater supervision and tighter regulations should be endorsed as this will dwindle the desire to conduct shadow activities. Moreover, we suggest greater legal and regulatory transparency, indicating clearly the benefits of formal economy engagement and the associated costs of undertaking informal economy activities to diminish the incentive to engage within the shadow economy.

Findings concerning our economic factors suggest that greater trade openness and economic freedom decrease the shadow economy's magnitude within transition countries. Thus, we recommend fewer trade restrictions within this region, as fewer trade barriers will decrease the labor costs associated with operating in the formal economy, reduce the benefits of conducting shadow activities, discouraging participation within the informal economy. Likewise, we suggest the implementation of policies aimed at eradicating oppressive regulations. Such policies will enable greater economic freedom and dissuade engagement within the shadow economy. The resulting discouragement in which to conduct informal activities will cause a shift from the informal to formal sector, thus, diminishing the magnitude of the shadow economy within transition economies.

For our third study, we find human capital to aid the reduction of the shadow economy's size. Hence, greater education equips individuals with the understanding of the costs and risks associated with participating in the informal economy. Increased awareness concerning the pitfalls of engaging within the shadow economy decreases an individual's incentive to conduct shadow activities; and results in a contraction of the informal economy's size. Greater education - increased human

capital - leads to a greater number of skilled workers and increases the wages offered in the formal economy, whilst increasing the risks and costs associated with conducting shadow activities. Moreover, policies promoting higher educational levels will increase productivity and innovation of the formal economy; likewise, decrease the desire to participate in shadow activities.

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APPENDICES

Appendix A: Chapter 4 Results

Table 1: Pedroni Cointegration Test Statistics

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
Within statistics												
Panel v-Statistic	2.334***	2.544***	1.984**		2.315**	2.362***	2.807***		1.715**	1.940**	1.465*	
Panel rho-Statistic	2.768	3.458	4.311		3.938	4.294	4.462		2.636	3.537	4.237	
Panel PP-Statistic	-2.636***	-3.016***	-4.425***		1.024	0.818	-0.103		-1.410*	-2.889***	-3.037***	
Panel ADF-Statistic	-2.914***	-2.992***	-2.513***		-0.180	-0.070	-0.900		-1.855**	-2.270**	-3.083***	
Weighted statistics												
Panel v-Statistic	1.557*	0.569	-0.288		1.655**	0.397	0.0667		0.915	0.256	-0.337	
Panel rho-Statistic	2.885	3.762	4.531		3.493	4.070	4.573		2.844	3.783	4.432	
Panel PP-Statistic	-3.193***	-3.198***	-3.355***		-1.851**	-1.639*	-1.981**		-1.535*	-2.552***	-3.112***	
Panel ADF-Statistic	-3.249***	-3.063***	-2.931***		-2.444***	-1.752**	-2.129**		-1.608*	-1.903**	-2.753***	
Between statistics												
Group rho-Statistic	4.172	4.924	5.613		4.733	5.366	5.646		4.202	5.082	5.580	
Group PP-Statistic	-4.471***	-4.513***	-8.458***		-5.758***	-3.706***	-9.613***		-3.199***	-6.806***	-10.072***	
Group ADF-Statistic	-3.245***	-3.610***	-4.022***		-2.830***	-2.658***	-4.257***		-2.160**	-3.014***	-5.338***	

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Appendix B: Chapter 5 Results

Table 1: Descriptive statistics

Country	Variable	Obs	Mean	Std.Dev.	Min	Max
Brazil	LSE	29	3.575	0.041	3.508	3.660
	LIQ	29	-0.669	0.068	-0.734	-0.531
	LHC	29	0.803	0.172	0.540	1.105
	LFD	29	3.836	0.386	3.320	4.891
Burma	LSE	29	3.803	0.336	3.207	4.194
	LIQ	29	-0.254	0.243	-1.022	-0.126
	LHC	29	0.466	0.092	0.326	0.604
	LFD	29	2.129	0.613	1.144	3.344
Cote d'Ivoire	LSE	29	3.826	0.031	3.738	3.854
	LIQ	29	-0.485	0.090	-0.635	-0.338
	LHC	29	0.381	0.078	0.244	0.516
	LFD	29	2.633	0.425	2.164	3.588
Egypt	LSE	29	3.516	0.149	3.148	3.635
	LIQ	29	-0.203	0.063	-0.348	-0.165
	LHC	29	0.751	0.142	0.522	0.973
	LFD	29	3.534	0.305	3.053	3.956
Ghana	LSE	29	3.665	0.026	3.632	3.709
	LIQ	29	-0.405	0.065	-0.485	-0.247
	LHC	29	0.767	0.100	0.409	0.915
	LFD	29	2.368	0.486	1.297	2.869
Kenya	LSE	29	3.370	0.050	3.258	3.414
	LIQ	29	-0.238	0.116	-0.435	-0.121
	LHC	29	0.700	0.095	0.534	0.844
	LFD	29	3.230	0.179	2.918	3.601
Pakistan	LSE	29	3.526	0.027	3.478	3.589
	LIQ	29	-0.207	0.060	-0.357	-0.111
	LHC	29	0.493	0.103	0.306	0.588
	LFD	29	3.073	0.188	2.728	3.353
Peru	LSE	29	3.966	0.081	3.802	4.047
	LIQ	29	-0.438	0.099	-0.550	-0.277
	LHC	29	0.955	0.076	0.791	1.037
	LFD	29	3.078	0.470	1.939	3.782
Tanzania	LSE	29	3.998	0.119	3.752	4.137
	LIQ	29	-0.655	0.129	-0.910	-0.552
	LHC	29	0.419	0.076	0.271	0.533
	LFD	29	2.097	0.553	1.079	2.672
Thailand	LSE	29	3.890	0.065	3.799	4.067
	LIQ	29	-0.327	0.051	-0.465	-0.246
	LHC	29	0.863	0.096	0.716	1.020
	LFD	29	4.666	0.186	4.387	5.115

Table 2: Matrix of correlations

Country	Variables	LSE	LIQ	LHC	LFD
Brazil	LSE	1.000			
	LIQ	0.339*	1.000		
	LHC	0.919***	-0.267	1.000	
	LFD	-0.137	0.214	0.205	1.000
Burma	LSE	1.000			
	LIQ	0.829***	1.000		
	LHC	-0.973***	-0.707***	1.000	
	LFD	-0.479***	-0.775***	0.310	1.000
Cote d'Ivoire	LSE	1.000			
	LIQ	0.807***	1.000		
	LHC	-0.337*	-0.417**	1.000	
	LFD	-0.677***	-0.573***	-0.324*	1.000
Egypt	LSE	1.000			
	LIQ	0.738***	1.000		
	LHC	-0.864***	-0.681***	1.000	
	LFD	0.356*	0.405**	-0.010	1.000
Ghana	LSE	1.000			
	LIQ	0.631***	1.000		
	LHC	-0.827***	-0.759***	1.000	
	LFD	-0.847***	-0.790***	0.801***	1.000
Kenya	LSE	1.000			
	LIQ	0.962*	1.000		
	LHC	-0.821*	-0.820*	1.000	
	LFD	-0.744*	-0.790*	0.796*	1.000
Pakistan	LSE	1.000			
	LIQ	-0.377**	1.000		
	LHC	-0.898*	0.392**	1.000	
	LFD	0.550*	-0.177	-0.367**	1.000
Peru	LSE	1.000			
	LIQ	0.530*	1.000		
	LHC	-0.691*	-0.541*	1.000	
	LFD	-0.766*	-0.198	0.827*	1.000
Tanzania	LSE	1.000			
	LIQ	0.105	1.000		
	LHC	-0.857***	0.358*	1.000	
	LFD	-0.597***	-0.469**	0.314*	1.000
Thailand	LSE	1.000			
	LIQ	0.593**	1.000		
	LHC	-0.846***	-0.563***	1.000	
	LFD	-0.272	0.244	-0.112	1.000

Note: ***, **, and * signify 1%, 5%, and 10% significance, respectively.

Table 3: ZA unit root test results

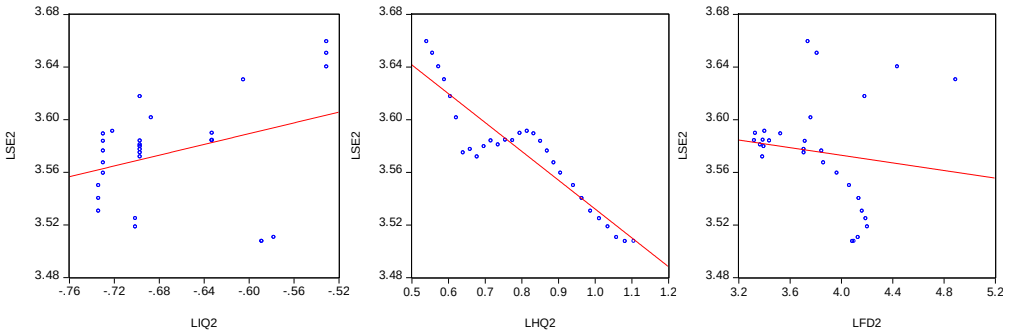
Country	Statistics (level)			Statistics (first difference)			
Brazil	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-2.604	-2.879	-3.359	5.112**	-2.957	-5.846***	**I(1)**
Break year	2011	2007	2002	1997	2000	1997	
Lag length	1	1	1	1	1	0	
LIQ2	-4.660	-4.671**	-3.087	-4.704	-4.033	-4.278	**Mixed**
Break year	2008	2012	2014	2005	1999	1996	
Lag length	2	2	0	2	2	0	
LHQ2	-5.210**	-3.773	-5.444***	-9.454***	-4.473***	-6.999***	**I(0)**
Break year	2011	2009	2011	2011	2014	2011	
Lag length	0	0	0	0	0	0	
LFD2	-3.837	-4.101	5.705***	-5.094**	-4.506**	-8.809***	**I(1)**
Break year	2015	2014	2007	2007	2009	2014	
Lag length	4	4	4	4	4	2	
	Statistics (level)			Statistics (first difference)			
Burma	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-4.469**	-3.901	-4.129	-4.253*	-3.171	-2.048	**Mixed**
Break year	2001	2002	2009	2009	2013	2008	
Lag length	2	2	2	2	2	2	
LIQ2	-4.393	-5.881***	-2.717	-7.282***	-4.969***	-6.614***	**I(1)**
Break year	2009	2011	2015	2011	2008	2011	
Lag length	1	1	4	1	1	1	
LHQ2	-3.671	-4.180***	-3.671	-4.988*	-3.625	-5.431***	**Mixed**
Break year	2006	2010	2006	2010	2007	2010	
Lag length	1	1	1	1	1	1	
LFD2	-5.187**	-3.399	-3.078	-5.050*	-4.362*	-5.276**	**I(1)**
Break year	2003	2009	2003	2009	2004	2009	
Lag length	1	1	0	0	0	0	
	Statistics (level)			Statistics (first difference)			
Cote d'Ivoire	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-3.267	-3.344	-1.691	-6.315***	-5.902****	-6.420***	**I(1)**
Break year	2012	2012	2014	2013	2012	2013	
Lag length	0	0	0	0	0	0	
LIQ2	-3.503	-3.199	-4.283	-8.889***	-7.626***	-6.873***	**I(1)**
Break year	1999	2000	2011	2011	2014	2014	
Lag length	0	0	0	0	0	0	
LHQ2	-2.871	-3.106	-2.759	-5.133**	-3.049	-5.010***	**I(1)**
Break year	2012	2010	2015	2001	2005	2011	
Lag length	1	1	1	0	0	0	
LFD2	-	-6.503***	-3.734	-7.325***	-7.577***	-4.925***	**Mixed**
Break year	-	1997	1996	2006	2006	2004	
Lag length	-	1	1	4	4	4	
	Statistics (level)			Statistics (first difference)			
Egypt	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-3.879	-1.646	-1.268	-5.041*	-3.358	-5.276***	**I(1)**
Break year	2007	2011	2000	2011	2004	2011	
Lag length	2	1	2	0	0	0	
LIQ2	-12.777***	-2.556	-7.328***	-7.341***	-6.176***	-6.456***	**I(0)**
Break year	2011	2002	2011	2011	2012	2013	
Lag length	0	0	0	0	0	0	
LHQ2	-3.347	-4.002	-2.359	-4.639	-4.893**	-3.294	**Mixed**
Break year	2014	2015	2005	2009	2010	2001	
Lag length	1	1	1	0	0	0	
LFD2	-3.637	-4.651**	-	-4.996*	-4.746**	-5.003***	**Mixed**
Break year	1998	2000	-	2014	2010	2013	
Lag length	0	0	-	0	0	0	

	Statistics (level)			Statistics (first difference)			
Ghana	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-2.997	-2.404	-1.966	-7.033***	-5.881***	-7.191***	**I(1)**
Break year	2007	2011	2013	2000	2008	2000	
Lag length	0	0	0	0	0	0	
LIQ2	-4.614	-	-2.699	-6.001***	-5.913***	-6.007***	**I(1)**
Break year	2002	-	2004	2002	2004	1997	
Lag length	0	-	0	1	1	1	
LHQ2	-3.272	-3.822	-1.982	-12.674***	13.136***	-4.584*	**I(1)**
Break year	2008	2009	2002	2004	2004	2011	
Lag length	4	4	4	0	0	4	
LFD2	-3.097	-2.749	-3.138	-4.424	-8.754***	-9.430***	**Mixed**
Break year	1997	2000	1997	2001	1998	2001	
Lag length	1	1	1	4	0	0	
	Statistics (level)			Statistics (first difference)			
Kenya	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-3.380	-3.519	-2.348	-5.093**	-5.014***	-4.505	**I(1)**
Break year	2003	2004	2008	2010	2013	2005	
Lag length	0	0	0	0	0	0	
LIQ2	-2.087	-	-2.881	-7.090***	-6.231***	-4.185	**I(1)**
Break year	2004	-	2010	2010	2014	2014	
Lag length	5	-	3	0	0	0	
LHQ2	-2.493	-2.549	-3.162	-6.203***	-2.878	-5.753***	**I(1)**
Break year	2007	2008	2011	2011	1997	2011	
Lag length	1	1	1	0	0	0	
LFD2	-4.365	-3.668	-4.487	-6.965***	-5.519***	-6.204***	**I(1)**
Break year	2006	2010	2014	2014	2014	2010	
Lag length	4	4	4	1	1	1	
	Statistics (level)			Statistics (first difference)			
Pakistan	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-3.781	-3.646	-4.079	-6.976*	-5.991*	-7.006*	**I(1)**
Break year	2011	1996	2004	1997	2013	1997	
Lag length	0	0	0	0	0	0	
LIQ2	-4.348	-2.985	-4.329	-5.376**	-4.429**	-5.435***	**I(1)**
Break year	2008	2000	2008	2002	2009	2002	
Lag length	1	1	1	0	0	0	
LHQ2	-7.565***	-4.351	-4.117	-5.949***	-2.349	-5.444***	**Mixed**
Break year	2001	2005	2001	2006	2002	2006	
Lag length	1	1	1	0	0	0	
LFD2	-3.781	-3.638	-3.953	-5.828***	-4.354*	-4.741*	**I(1)**
Break year	2003	2008	2002	2009	2012	2009	
Lag length	2	2	2	0	0	0	
	Statistics (level)			Statistics (first difference)			
Peru	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-3.739	-4.354*	-2.872	-1.730	1.684	-4.477*	**Mixed**
Break year	2000	2001	1998	2008	2013	2011	
Lag length	4	4	1	1	1	4	
LIQ2	-4.652	-2.812	-4.797*	-7.052***	-6.102***	-6.084***	**I(1)**
Break year	2001	2006	2001	2003	2002	1995	
Lag length	0	0	0	0	0	0	
LHQ2	-4.116	-3.969	-5.688***	-5.519***	-2.693	-3.315	**Mixed**
Break year	2006	2003	2006	2006	2009	2006	
Lag length	1	1	1	0	0	0	
LFD2	-5.249**	-4.214*	-5.162**	-7.075***	-6.261***	-6.587***	**I(0)**
Break year	2009	2012	2009	2005	2002	1999	
Lag length	4	4	4	0	0	0	

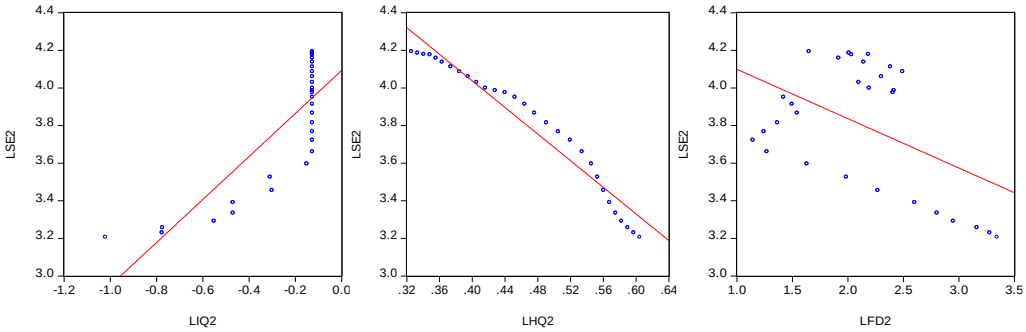
	Statistics (level)			Statistics (first difference)			
Tanzania	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-3.635	-10.440***	-3.802	-8.596***	-9.849***	-5.179***	**Mixed**
Break year	2014	1997	2004	2003	2002	1997	
Lag length	3	0	3	4	4	1	
LIQ2	-	-2.124	-2.445	-4.820***	-4.763***	-5.009***	**I(1)**
Break year	-	2014	1996	2008	1997	1998	
Lag length	-	0	0	0	0	0	
LHQ2	-4.342	-4.706***	-	-13.018***	-3.097	-12.358***	**Mixed**
Break year	1998	2000	-	2001	2004	2001	
Lag length	1	1	-	0	0	0	
LFD2	-7.337***	-7.587***	-7.063***	-7.226***	-8.132***	-5.408***	**I(0)**
Break year	2015	2015	2006	2004	2004	1999	
Lag length	4	4	4	4	4	4	
	Statistics (level)			Statistics (first difference)			
Thailand	ZA_B	ZA_T	ZA_I	ZA_B	ZA_T	ZA_I	Conclusion
LSE2	-6.268***	-6.257	-4.109	-5.588***	-6.490***	-5.420***	**Mixed**
Break year	2006	2011	1999	2005	2001	1997	
Lag length	2	2	1	4	4	0	
LIQ2	-3.788	-3.864	-4.666*	-5.958***	-5.596***	-6.145***	**Mixed**
Break year	2013	2014	2014	2014	1998	2014	
Lag length	0	0	0	1	1	1	
LHQ2	-	-3.374	-4.086	-5.647***	-2.807	-5.230**	**I(1)**
Break year	-	1997	2002	2001	2004	2001	
Lag length	-	1	4	0	0	0	
LFD2	-5.091***	-4.011	-4.967***	-4.383	-3.579	-4.415	**I(0)**
Break year	1998	2007	1999	1998	2000	1998	
Lag length	1	1	1	0	0	0	

ZA_B Represents the model with a break in both trend and intercept; ZA_T is the model with break in the trend; ZA_I is the model with intercept break. ***, **, and * denote the rejection of the null hypothesis at 1%, 5%, and 10%, respectively.

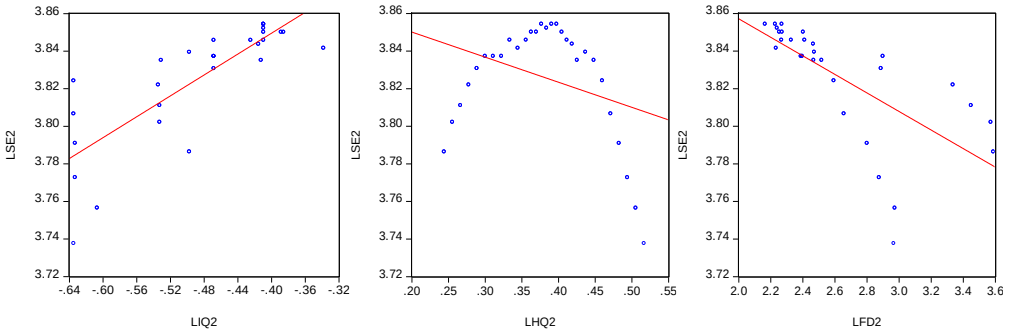
BRAZIL



BURMA



COTE D'IVOIRE



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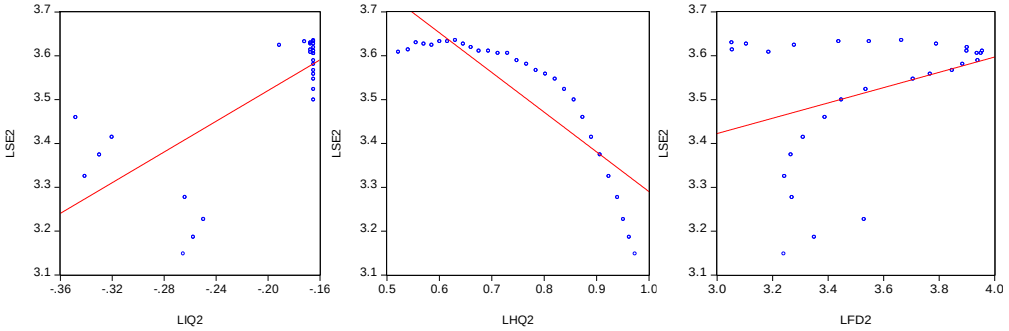
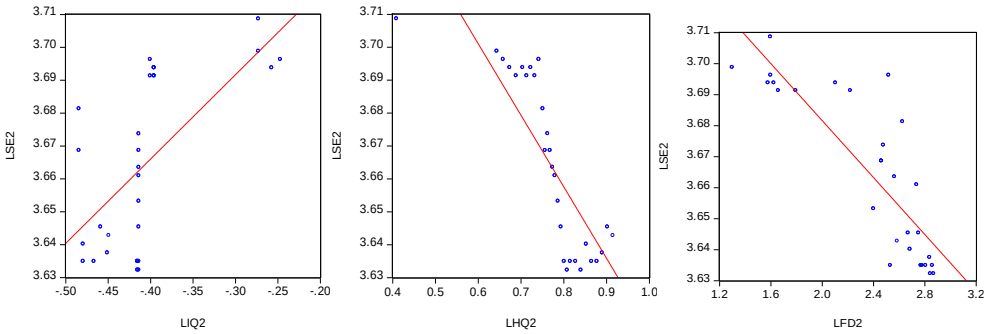


GHANA



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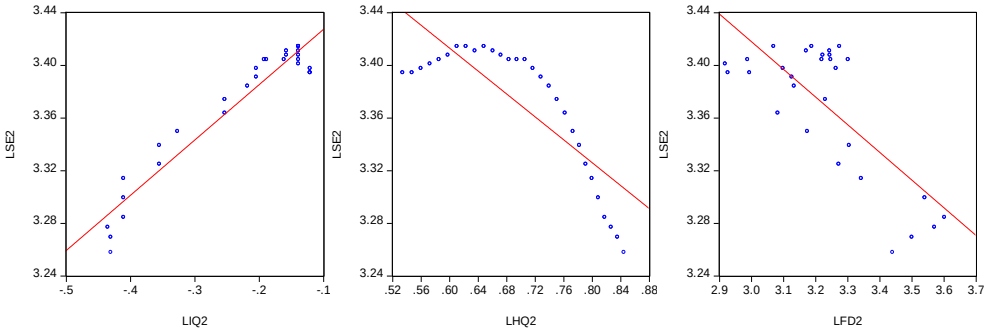

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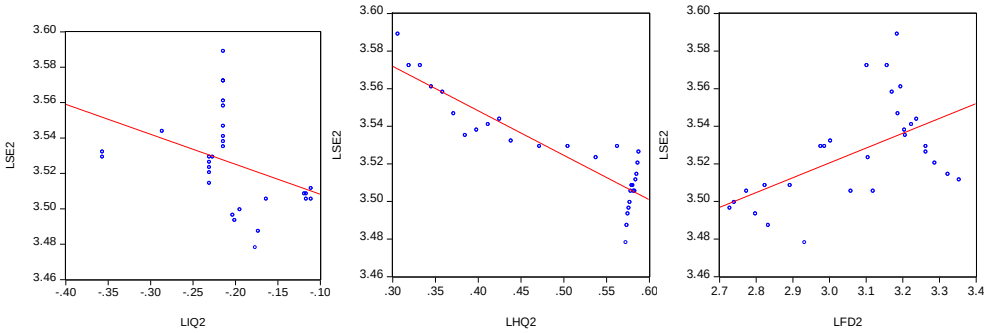

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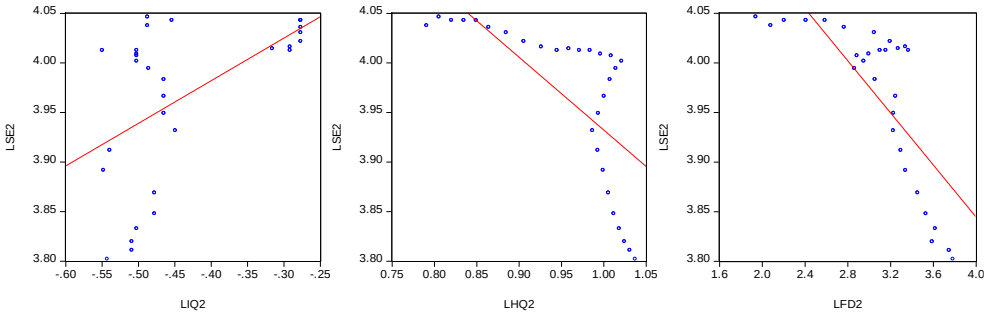

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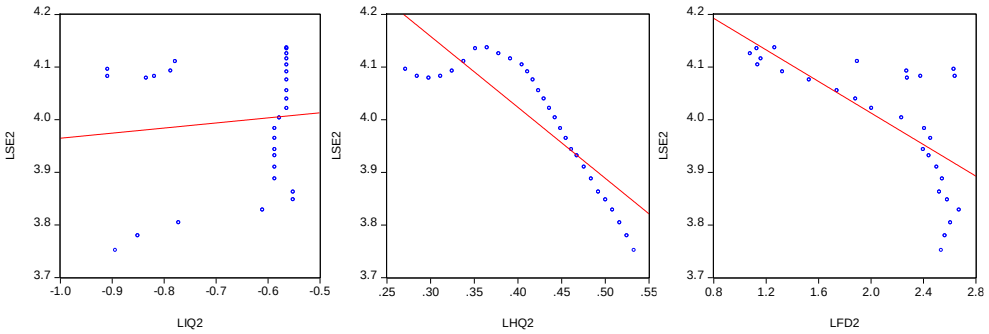

THAILAND