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Identification and analysis of factors affecting the level of Kazakhstan's shadow economy

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ABSTRACT

The shadow economy in Kazakhstan accounted for 17.52% of GDP in 2023 and is projected to decline to 15% by 2025, highlighting the need for a deeper understanding of its driving factors. This study aims to identify and analyze the key macroeconomic determinants influencing the size of Kazakhstan's shadow economy, focusing on income, unemployment, and gross regional product (GRP). This quantitative study utilizes secondary panel data from Kazakhstan's 16 regions from 2013–2022. A fixed-effects panel regression model was employed to estimate the impact of economic variables on the shadow economy. The regression analysis reveals that a 1% increase in monetary income leads to a 0.65%–1.16% reduction in the shadow economy. In comparison, a 1% increase in unemployment is associated with a 1.38% decrease in informal economic activities. Conversely, a 1% rise in GRP correlates with a 0.55% increase in the shadow economy, suggesting that economic expansion alone does not curb informality but may create more opportunities for unregulated activities. This research contributes to the empirical literature on transition economies, providing a regionally disaggregated analysis of the shadow economy in Kazakhstan and offering valuable insights for policymakers aiming to improve economic formalization.

Contribution/ Originality: The study presents a novel approach for conducting regionally disaggregated analyses of the shadow economy in Kazakhstan. An unexpected connection has been established, in which economic growth corresponds with an increase in informal activity, contradicting conventional views.

1. INTRODUCTION

The shadow economy is closely related to the non-observed economy (NOE) concept, which encompasses all productive activities not included in the national accounts database (Adair, 2020, 2021). The shadow economy comprises various activities that operate outside official oversight for different reasons. Legal but concealed activities refer to economic transactions intentionally hidden from authorities to evade taxes, circumvent labor regulations, or avoid complex administrative procedures (Koufopoulou, Williams, Vozikis, & Souliotis, 2019). Legally, these activities are conducted, but they are often done loosely to reduce costs and minimize government oversight. Illegal actions, on the other hand, involve making or selling goods and services that are definitely against the law (Hale, 2024; Hardoy & Satterthwaite, 2022). This includes illegal businesses like drug dealing, running a business without permission, and

other unfair ways of making money. Another part of the shadow economy is household production for its end use. This occurs when individuals engage in illicit economic activities within their homes, such as subsistence farming or constructing dwellings, primarily for their use and not to generate income. Lastly, informal sector production encompasses small, unreported businesses that operate out of necessity rather than choice. These include temporary work, street vending, and other unregulated companies that offer opportunities to earn money in areas with limited formal job opportunities. Together, these types of illegal businesses add to the size and complexity of the shadow economy.

Kazakhstan transitioned from a controlled economy to a market economy, significantly altering how people generate income. Historically, wages were the primary source of income (Humphries & Weisdorf, 2019). These days, business activities and other sources of income are more critical than ever. While this was happening, hidden incomes, such as earnings from illegal or unofficial work, "envelope salaries," and legal but unreported income, also began to emerge. The fact that the shadow economy is a significant part of Kazakhstan's economy makes understanding it even more critical. The wholesale and retail trade sector comprised the most significant part of the shadow economy, accounting for 17.52% of the GDP (Kishwar, Bashir, Hussain, & Alam, 2023). However, trends from the past indicate that informal economic activity has been more prevalent, accounting for 38.88% of the total between 1991 and 2015. A significant amount of money is lost in the shadow economy because people fail to pay taxes, and workers are not adequately regulated. It impacts state revenues and keeps workers from obtaining legal rights and social benefits. Informal activities also influence market competition, making it more challenging to plan the economy and leading to less efficient resource utilization (Igwe, Odunukan, Rahman, Rugara, & Ochinanwata, 2020; Webb, Khoury, & Hitt, 2020).

There is a noticeable lack of research on the shadow economy in Kazakhstan despite its significant presence. Few empirical studies have investigated its causes at the regional level since most have concentrated on large-scale estimations at the national level or conducted theoretical assessments. Kazakhstan and other transition economies lack research on critical macroeconomic variables, including income, unemployment, and regional economic production. Ignoring the complex dynamics unique to post-Soviet republics, such linkages are often assumed to be linear or uniformly applied worldwide, even when they are addressed. For instance, given Kazakhstan's institutional setting, where social assistance and structural labor changes modify this connection, the commonly held hypothesis that increased unemployment leads to more informality may not hold. By conducting an empirical analysis using panel data from all sixteen regions of Kazakhstan from 2013 to 2022, this work fills a gap in the literature and addresses these inadequacies. The study employs a fixed-effects panel regression model to account for unobservable heterogeneity and capture variation within regions, thereby strengthening causal inference. It examines three theories on how GRP, unemployment, and household income affect the size of the shadow economy.

This research has three main contributions. For starters, it fills a gap in the literature by providing a regionally disaggregated empirical evaluation of Kazakhstan's shadow economy, a task that other studies have not yet accomplished. A second important point is that it presents evidence of a counterintuitive but statistically significant negative effect, which challenges traditional beliefs. One such assumption is the expected negative association between informality and unemployment. As a third point, it disproves the prevailing view that formal economic progress invariably results in less informality by showing that GRP-proxied economic growth may paradoxically strengthen informal activity. There are direct policy consequences of the results. The work offers specific recommendations for reducing informality through institutional changes, improved tax policies, and labor market reforms, identifying the macroeconomic factors that influence the shadow economy in various locations. In addition, other post-Soviet and developing economies confronting comparable transitional and structural issues can learn from the lessons shown by the Kazakhstan situation.

The amount of informal economic activity is influenced by various factors, including the unemployment rate, income, the number of rules and regulations, and tax compliance (Etim & Daramola, 2020; Williams, 2023). However,

despite its vital importance to the economy, there is a lack of real-world studies on what drives Kazakhstan's shadow economy. It is essential to understand these factors to develop policies that effectively curb illegal economic activities while promoting long-term growth. Many studies have been conducted on the causes of the shadow economy worldwide, but comparatively little research has been done on its operation in Kazakhstan. Recently, there have been no rigorous studies examining the impact of critical macroeconomic factors, such as income, unemployment, and regional economic growth, on Kazakhstan's informal economy. Existing studies typically provide rough estimates of the shadow economy's size but do not examine all its factors at the local level. Additionally, previous studies have not adequately explained the relationships in certain economies, such as the relationship between unemployment and informal economic activity, which may be negatively correlated. This study employed a panel data analysis of Kazakhstan's shadow economy from 2013 to 2022, spanning 16 regions, to address these gaps. Regression analysis is employed in a mathematical study to identify the most significant economic factors influencing the shadow economy. This helps us understand how different macroeconomic factors more complexly affect the continuation of illegal economic activities in the country.

To link the analysis with the results, the study tests the following hypotheses.

H_1: An increase in household income reduces the size of the shadow economy. Higher income levels improve financial security and reduce incentives for undeclared work.

H_2: Higher unemployment leads to an expansion of the shadow economy. Individuals who lose formal employment are more likely to engage in informal work.

H_3: Economic growth (measured by GRP) decreases the shadow economy. A growing formal economy should provide more opportunities for legal employment and business activities.

A panel data model will test these hypotheses by comparing regional differences in the shadow economy across Kazakhstan. This study contributes to the academic discourse on the "shadow economy" by providing new insights, prompting a reconsideration of the role of economic growth in informality, and offering policy-relevant information. First, it provides one of the first empirical studies that analyze the factors affecting Kazakhstan's shadow economy by region. It employs a fixed-effects panel data model to illustrate how conditions vary across different areas. Second, it closely examines the connection between gross regional product (GRP) and informality, questioning the common belief that as economies grow, shadow economies naturally shrink. Instead, the study shows how growth can sometimes lead to a more informal environment, leaving regulatory gaps and creating more opportunities for informal business. Lastly, the results are helpful for policymakers because they indicate which macroeconomic factors are most effective in reducing illegal business. This study offers policymakers valuable insights, focusing on reducing the size and impact of the shadow economy by strengthening state institutions, enhancing tax administration, and addressing labor market inefficiencies. This study enhances our understanding of Kazakhstan's shadow economy by integrating economic theory with empirical analysis. It also lays the groundwork for future research on informal economies in other transitioning countries.

2. LITERATURE REVIEW

The shadow economy consists of activities deliberately concealed from official statistics to evade financial obligations, regulatory constraints, or institutional scrutiny. The primary reasons people engage in the shadow economy can be categorized into three groups. For economic reasons, the primary goals are to minimize tax payments and social security contributions. Regulatory motivations are strategies designed to mitigate the costs and complexities associated with business registration, labor laws, and other official economic requirements (Peticca-Harris, Degama, & Ravishankar, 2020; Wilson, 2020). Weaknesses in institutional factors include laws that are not adhered to, ineffective political institutions, and the rule of law not being enforced properly. These factors can lead people and businesses to choose to operate outside the formal system.

The European Union has conducted several studies since the early 1990s to assess the magnitude and impact of the shadow economy (Baklouti & Boujelbene, 2020; Huynh, Nguyen, Nguyen, & Nguyen, 2020). These studies concur that shadow economies frequently evade detection by regulators and are not reported in tax returns or official statistics. Numerous studies have demonstrated that the global shadow economy is expanding (Chen, Sinha, Hu, & Shah, 2021; Dell'Anno, 2022; Estevão, Lopes, & Penela, 2022; Shah & Asghar, 2024). These studies demonstrate that high taxes, ineffective regulations, and weak institutions can all contribute to the growth of informal economic activity.

There is no single, agreed-upon definition of the shadow economy because it is a complex and multifaceted phenomenon with numerous causes. Different scholars have proposed various interpretations. The shadow economy is a vast, largely unreported area of business and income that remains unaccounted for (Reza & Bromfield, 2019). According to DeRock (2021), it is the part of the gross national product that official figures do not show. Both meanings focus on transactions involving money but exclude barter and other non-monetary activities. Schneider (1986) provided a more general definition of the shadow economy: "all economic transactions that contribute to value added and are subject to national accounting but are not currently reported by national measurement agencies." The shadow economy primarily comprises legal, productive activities that are kept secret from the government (Goel, Saunoris, & Schneider, 2019; Luque, 2022). This group does not include activities that involve illegal or criminal behavior, work performed without compensation, or charitable endeavors.

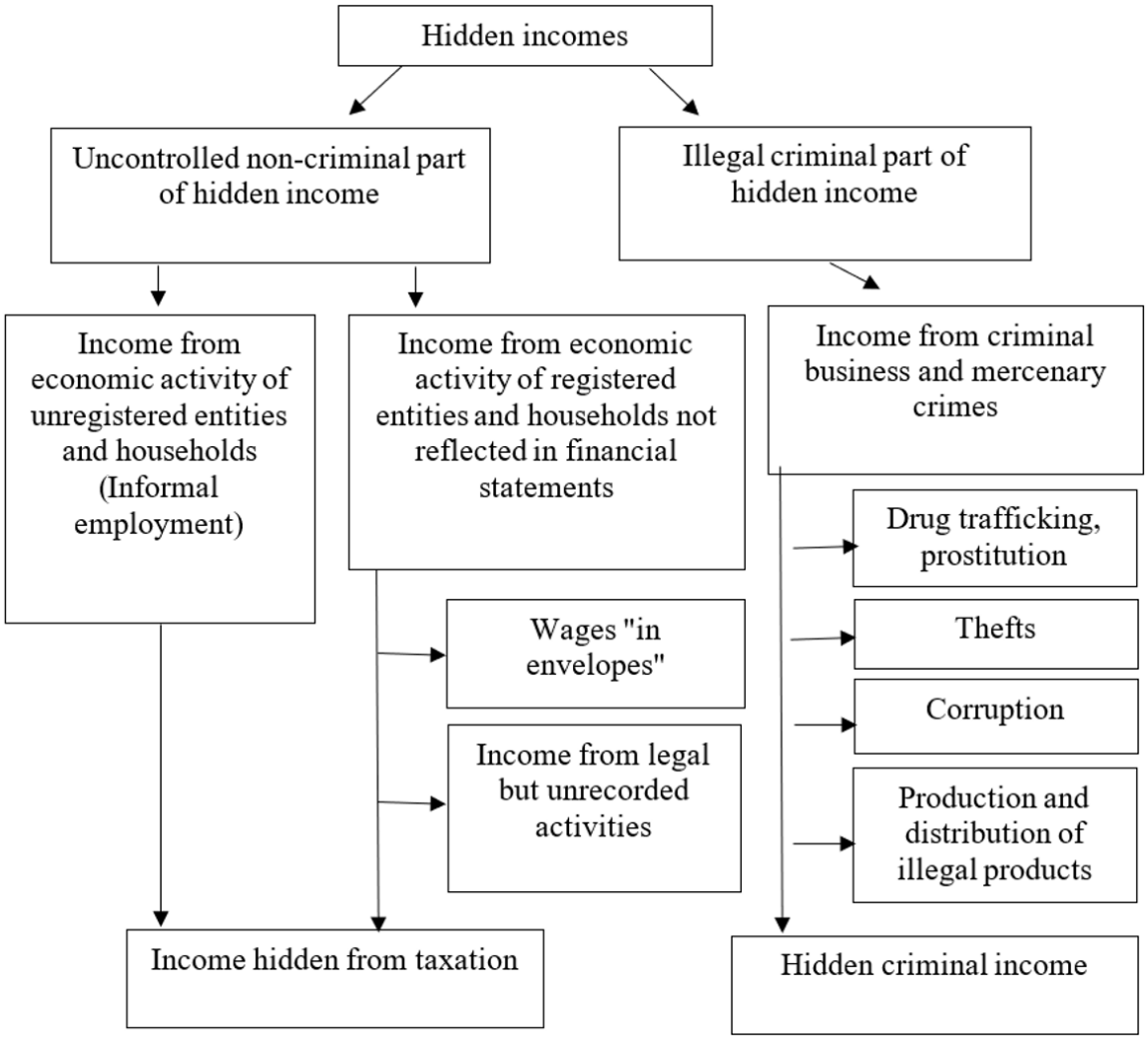

Figure 1. Formation of hidden incomes in the economy.
Source: Avdiysky and Bezdenezhnykh (2018).

Figure 1 illustrates the structure of hidden incomes in the economy. It thoroughly breaks down the shadow economy, separating hidden income from legal and illegal sources. This framework is essential for understanding the nature of illicit economic activities that evade taxation and avoid scrutiny by the law, thereby influencing economic policy and financial regulation. The diagram categorizes secret income into two main groups: the illegal part, which is not controlled, and the uncontrolled part. Each group contributes differently to the overall shadow economy. The uncontrolled non-criminal section includes money earned through illegal or illicit activities. This group has two primary sources: (1) Earnings from businesses and households not listed with the government. This includes wages outside official job markets without contracts or social security contributions. (2) Income from registered businesses and households not shown on financial statements. This includes wages paid "in envelopes" to avoid taxes, social contributions, and legal income that isn't reported, such as in small companies that do not report all of their earnings. Even though these types of secret incomes are not illegal, they do result in tax losses, distort economic data, and make it more challenging to make the economy more transparent. On the other hand, the illegal component of hidden income comprises money generated from illicit activities. This includes money made from drug trafficking, prostitution, theft, organized crime, and financial fraud, as well as money made from companies that hire criminals. Additionally, it encompasses the manufacture and sale of illicit goods, including counterfeit items, goods sold on the black market, and stolen goods. Unlike unofficial jobs or wages that aren't recorded, these activities contribute to economic unofficiality and pose a serious threat to government, social stability, and financial security.

2.1. Measurement Methods

Informal economic activities are challenging to measure because they are often conducted secretly. These methods can be roughly categorized into three groups: model-based approaches, direct measurement methods, and secondary measurement methods. Direct measurement methods depend on structured polls, self-reporting tools, and tax audits to gather firsthand information (Jetzek, Avital, & Bjørn-Andersen, 2019). Questionnaires and surveys are often used to determine the level of involvement of people and companies in casual activities (Voyer & van Leeuwen, 2019). These methods provide helpful information, but they are prone to social desirability bias, which means that people may exaggerate or underreport their involvement in the shadow economy due to fear of legal consequences. Another direct method is tax audits, in which tax officials attempt to determine the amount of unreported taxable income by verifying compliance and conducting audits.

Statistical gaps and financial indicators are used in indirect measurement methods to understand the shadow economy (Canh, Schinckus, & Dinh Thanh, 2021). One standard procedure is to examine national accounting data for discrepancies in the reporting of inflows and outflows in national accounts. If the overall number of people working remains relatively unchanged, another approach is to examine labor force statistics. The decline in formal employment is often used as a proxy for informal jobs (Shah, Serna, & Delgado, 2023; Younas, Qureshi, & Al-Faryan, 2022). Currency demand is one of the most important ways to examine money when determining the size of the shadow economy. This approach is based on the idea that cash is the most common method for people to conduct business without being detected. Researchers attempt to determine the prevalence of informal deals by examining an unexpected surge in cash demand that cannot be attributed to formal economic activity (Adams, 2019; Grilli, Latifi, & Mrkajic, 2019). Another indirect method is the energy consumption method, which suggests that the amount of electricity used is a reliable indicator of the economy's activity level. Researchers estimate the size of the shadow economy by examining changes in energy use that cannot be explained and comparing them to the growth rate of the official GDP (Ginevicius, Kliestik, Stasiukynas, & Suhajda, 2020).

Using model-based approaches is another way to gain insight into the shadow economy, as they examine various factors and indicators that can help explain the phenomenon. A popular model is the Multiple Indicators Multiple Causes (MIMIC) model. This statistical method examines the shadow economy as an unobservable variable influenced by factors such as tax rates, regulatory complexity, and the prevalence of cash transactions (Dybka,

Kowalczuk, Olesiński, Torój, & Rozkrut, 2019). This method enables a more comprehensive examination of the causes and effects of informality. However, the MIMIC model is sensitive to the data used, requires careful description, and has been criticized for possibly being model-dependent.

Another model used in the research is the Pissarides-Weber method, which aims to determine the amount of income that self-employed individuals fail to report (Slemrod, 2019). This approach is based on the idea that household surveys accurately report the amount of money people spend on food and that wage earners accurately report their earnings. There is no single way to obtain a perfect picture of the shadow economy. Instead, experts often use various methods to achieve a more accurate picture. There are two types of methods: direct and indirect. Direct methods provide exact data, but they only cover a small area. Indirect and model-based methods offer more accurate estimates but depend on assumptions and indirect proxies (Arrighi, Carraresi, & Castelli, 2022). The available data, the economic situation, and the study goals all affect the choice of method. This approach assumes that survey respondents accurately report their food expenditures and that wage earners are honest about their income.

2.2. Determinants of the Shadow Economy

Several key factors that influence the growth and size of the shadow economy have been identified through empirical studies. These factors include tax policies and regulatory systems, the overall economy, the functioning of the job market, and the growth of the financial sector. It is essential to understand these factors to develop policies that reduce informal economic activity and promote a more stable overall economy. The high cost of taxes and complex regulations are among the leading causes of the shadow economy (Early & Peksen, 2019). Businesses and individuals often do not participate in the formal economy due to high taxes and complex rules and regulations. Many small businesses and self-employed individuals work informally to avoid high taxes and regulations that can significantly impact their profits (Cieślik & van Stel, 2024). Additionally, excessive red tape and expensive business registration requirements create further obstacles, which in turn encourage more illicit economic activity. There are usually more shadow economies in countries with numerous regulations and taxes, as businesses attempt to avoid paying fees and dealing with government officials by remaining unlisted. Institutional quality, encompassing the effectiveness of the government, the rule of law, and the prevalence of crime, is another crucial factor. It's easy for illicit businesses to thrive in areas with weak institutions, poor governance, and corruption. Businesses and individuals may opt to conduct business informally with one another rather than through regulatory authorities when they believe that government structures are inefficient or corrupt (Bu, Luo, & Zhang, 2022). When legal and financial rules are not strictly enforced in a country, businesses may choose not to pay taxes or register because they are aware that the punishments for non-compliance are weak or applied inconsistently. People who don't trust government structures tend to act informally in the economy even more because they believe that government involvement is more harmful than helpful (Apriliyanti & Kristiansen, 2019; Shah & Asghar, 2024).

A significant aspect of how the shadow economy operates is its impact on the job market. Individuals who struggle to find formal employment often turn to informal work as an alternative means of earning a living in areas with high unemployment rates. Many unemployed individuals find employment in the informal sector, which offers flexible yet unregulated job opportunities (Benanav, 2019). However, the relationship between unemployment and the shadow economy is complex and varies depending on the state of the economy. People receiving unemployment benefits may be advised not to work in the informal sector, but in other situations, it may become their only option for staying financially afloat. Rahman, Faisal, and Ali (2023) found that the hidden economy tends to shrink as a country's economy expands. In this case, higher levels of development typically mean more job prospects, better institutions, and more effective tax administration. However, some studies show no direct link between economic growth and informality. When the economy grows, there is initially an increase in shadow economy activity, but it eventually levels off (Hoinaru, Buda, Borlea, Văidean, & Achim, 2020). In rapidly growing economies, new businesses may emerge without regulation, and they may only transition to the formal sector as government structures improve.

Lastly, the growth of the banking sector is another critical factor that affects the shadow economy. Access to banking services and financial infrastructure is crucial for reducing illicit trades. According to Demirgüç-Kunt, Klapper, Singer, Ansar, and Hess (2020), people and businesses gain better access to formal banking systems as financial growth continues. It facilitates the transition of economic activities into the formal economy. People depend less on cash transactions, which are often linked to illegal activities, as banking services are readily available to many. Businesses and individuals may be less inclined to operate outside the formal financial system if they have access to digital payment systems, mobile banking, and easier credit options. Overall, tax policies, the quality of institutions, the state of the job market, economic growth, and the ease of entry into the financial sector all affect the shadow economy. To address these issues, we require a comprehensive policy approach that not only simplifies rules and reduces taxes but also enhances government efficiency, facilitates access to financial resources for a broader range of people, and improves the job market.

2.3. Regional Focus: Kazakhstan

Kazakhstan's shadow economy remains a significant component of the country's economy. It creates jobs, generates revenue, and complicates economic policy and government decision-making. 17.52% of the country's GDP was comprised of the shadow economy in 2023, with the wholesale and retail trade sector accounting for the largest share. However, patterns in the past indicate that the unorganized sector was likely even more prominent. The shadow economy accounted for an average of 38.88% of Kazakhstan's GDP between 1991 and 2015. This illustrates the extent to which illegal economic activities are ingrained in the country. The shadow economy is shrinking, but it remains a significant challenge for policymakers. Recent efforts to modernize the economy and reform institutional practices have been beneficial. There are several key reasons why illicit economic activities persist in Kazakhstan. Small businesses are often discouraged from going official due to high tax rates and strict regulations. Many entrepreneurs and workers operate outside the law. The problem is exacerbated by the large number of people who work illegally, especially in low-wage and labor-intensive businesses. Because building, agriculture, and retail jobs are flexible but not regulated, many people who work in these fields remain outside the formal economy (Insebayeva & Beyssembayev, 2023). These trends will likely continue if no strong enforcement mechanisms exist and companies are willing to hire people informally.

The shadow economy in Kazakhstan is also caused by ineffective government regulations. There are numerous complex tax rules, government regulations, and high costs associated with running the official economy. The informal sector, on the other hand, allows businesses to operate with fewer regulations. Many small and medium-sized enterprises (SMEs) struggle to comply with government regulations, so some operate without being formally recognized. Additionally, businesses tend to interact less with official financial and regulatory institutions when they lack trust or believe them to be corrupt. This makes it easier for people to do business informally. Even with these challenges, the government has successfully halted illegal economic activities by digitizing financial transactions, reforming tax administration, and implementing effective policy changes for businesses. Electronic billing, easier tax filing for small businesses, and digital payment systems have helped create deals that were once more formal and conducted in cash. However, these steps have not fully resolved the issues that lead to people being unofficial, especially in rural and low-income areas where accessing financial services remains challenging.

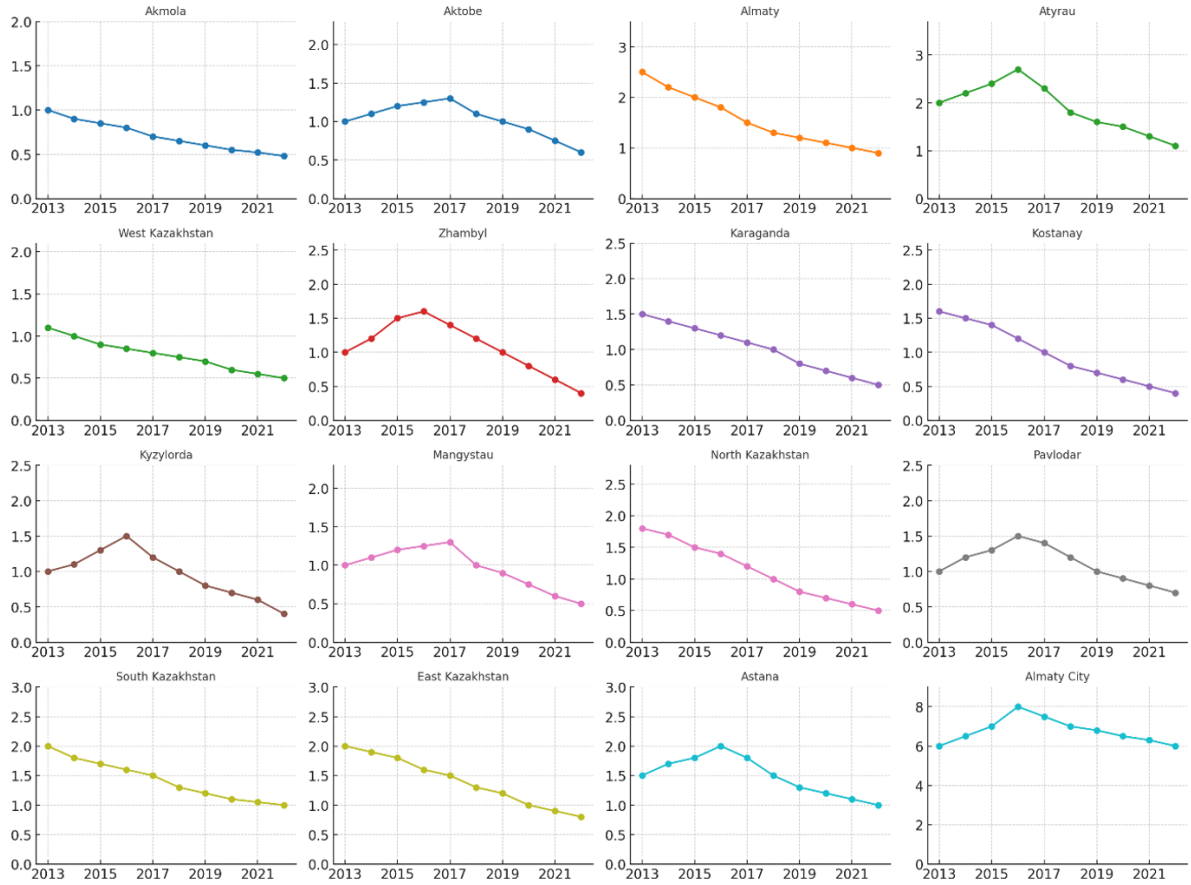

Figure 2. Trends in the shadow economy by region.

Figure 2 illustrates changes in Kazakhstan's shadow economy from 2013 to 2022 and reveals that informal economic activity varies across different areas. The shadow economy is steadily decreasing in many regions of Kazakhstan, including Akmola, Almaty, West Kazakhstan, Karaganda, Kostanay, North Kazakhstan, East Kazakhstan, and South Kazakhstan. This downward trend suggests that policy changes, increased formalization, and improved economic stability are effective in these areas. There may be a link between less informality and better tax compliance, governmental oversight, and financial modernization. However, in some areas, such as Aktobe, Atyrau, Zhambyl, Kyzylorda, Mangystau, and Pavlodar, shadow economy activity initially rose and then slowly decreased until 2016–2017. This trend suggests that shifts in the economy and government policies have contributed to the rise of informality. There were probably more unofficial jobs and unlisted businesses during the growth phases. Regulations later controlled these. Based on these results, private activity can increase when the economy is growing and then level off as the government's efforts improve.

Astana and Almaty, two major cities, continue to have substantial amounts of shadow economy activity. Although it has been gradually decreasing over the past few years, Almaty City still has the highest participation rate in the private sector, which peaked at nearly 8% in 2016. Similarly, Astana changed. It peaked between 2017 and 2018 before leveling off at about 1%. As economic and financial hubs, these cities attract companies that are not subject to regulation, individuals who avoid paying taxes, and tax avoidance schemes. Due to their high rates of informality, large cities are more likely to have shadow economies. Additionally, places like Atyrau, Mangystau, and Pavlodar, which are significant industrial or commercial hubs, exhibit varying levels of informality. This aligns with the study's conclusion that economic growth does not necessarily lead to a decline in the shadow economy. Instead, growth may create more opportunities for informal businesses, especially in fields where regulations are not strictly enforced. Overall, the results show that most areas have been able to lower their share of the shadow economy. However, large high-GRP towns and regions are still struggling with persistent informality. This highlights the importance of

policymakers continuing to focus on key areas, such as ensuring accurate tax payments, refining regulations, and providing incentives for businesses to become established.

2.4. Research Gap and Justification

The global shadow economy has been studied extensively, but Kazakhstan has not been adequately examined. Some studies present broad data on the informal economy but do not explain how the country's socioeconomic and institutional elements influence it. Most studies of the shadow economy overlook regional or industry differences, as well as the impact of economic policies on the informal economy. This paucity of research makes it more challenging for policymakers to provide targeted solutions to Kazakhstan's informal sector. The relationship between economic growth and informality is a topic that has been poorly studied. According to traditional economic theory, the shadow economy is expected to shrink as countries develop, driven by the creation of more formal jobs and increased regulation. In some regions, economic expansion seems to increase shadow economy activity. This contradiction has not been extensively studied; therefore, further research is necessary to identify the causes of informality in Kazakhstan.

The shadow economy is also affected by income, unemployment, and laws. The effects of these issues on Kazakhstan's economy are unclear. Unemployment is critical, as some research suggests that higher unemployment rates are associated with decreased informal sector activity. Contrary to popular opinion, unemployment does not increase informal sector employment. Government social safety nets, informal job seekers, or errors in unemployment data may explain this, but these factors require further testing. This study examines Kazakhstan's shadow economy using a fixed-effects panel data model by region to address these research gaps. This study examines income, unemployment, and GDP growth to identify the factors that drive informal economic activity. Previous studies have primarily examined national data; this study, however, focuses on regional disparities to gain a deeper understanding of informality in Kazakhstan. This study also contributes to the discussion on transition economies by providing new insights that may benefit other post-Soviet countries and emerging markets with similar economic systems. This study aims to identify the conditions under which economic growth reduces or promotes informality, enabling policymakers to transition informal workers into the formal economy. It aims to align fiscal policy, labor market dynamics, and institutional growth.

3. RESEARCH METHODS

This study uses secondary data and quantitative research to examine the factors influencing Kazakhstan's shadow economy. The study employs panel data regression analysis to examine 16 areas over 10 years, from 2013 to 2022. The primary objective is to determine how various economic factors, such as income, unemployment rates, and gross regional product (GRP), influence the size of the shadow economy. Panel data regression models, which are more suitable for this work than cross-sectional or time-series models, are employed. Panel data considers both time and space, which increases the number of observations and makes statistical figures more accurate. This approach is particularly well-suited for studying the shadow economy as it effectively captures changes over time and across regions, surpassing the capabilities of cross-sectional or time-series techniques alone. There are other ways to examine the shadow economy, such as cross-sectional regression (which only analyzes one point in time and does not reveal changes over time) and time-series models (which do not account for differences between regions). However, these methods were considered less valuable because they could not account for differences between areas that were not seen. Panel data analysis was chosen as the most effective method to achieve the study's goals because informal economic activities are constantly evolving.

The selection of the 2013–2022 period is grounded in both methodological and data-driven considerations. Firstly, consistent and regionally disaggregated economic data for all 16 regions of Kazakhstan became more systematically available from 2013 onward, following statistical reforms by the National Bureau of Statistics. Secondly, the selected decade encompasses a complete economic cycle, including periods of oil price volatility,

currency devaluation, and fiscal modernization—factors that are likely to impact informality. The end year, 2022, represents the latest full calendar year with verified economic data, ensuring the timeliness and relevance of the findings.

This approach is particularly suitable for studying the shadow economy as it enables researchers to observe economic behavior over time and across diverse regional settings. Cross-sectional regressions cannot account for temporal changes, while time-series models overlook regional variation. Therefore, a panel data structure was chosen because it uniquely captures both temporal dynamics and spatial heterogeneity, which are essential when analyzing informal economic activity in a transitioning and regionally diverse country like Kazakhstan.

3.1. Data Collection

The study utilizes secondary data sources to construct a panel dataset containing economic indicators for 16 regions of Kazakhstan over the 2013–2022 period. The data were obtained from the National Bureau of Statistics of Kazakhstan, the International Monetary Fund (IMF), and other relevant governmental and financial institutions. The dataset includes key macroeconomic indicators necessary for assessing the determinants of the shadow economy. The choice of variables is theoretically and empirically justified. Population income, unemployment, and GRP are foundational indicators in shadow economy research, representing individual financial capacity, labor market pressures, and overall economic performance, respectively. Additional control variables—such as inflation, subsistence minimum, consumption income, and household expenditures—were selected based on their relevance in modeling informal behavior, as demonstrated in prior global and regional studies (e.g., (Dell'Anno, 2022; Etim & Daramola, 2020; Schneider, 1986). The variables included in the analysis, along with their descriptions, are presented in Table 1.

Table 1. Description of the selected variables for the model.

Variables	Description
TenE	Share of the shadow economy (% of GDP)
DOXOD	Population income
UNEMPL	Unemployment rate (%)
VRP	Gross regional product (GRP)
CONSINC	Population income used for consumption by region
UNDERPRMIN	Share of the population with income below the subsistence level
PRMIN	Subsistence minimum
RASXOD	Population expenditure
INFL	Inflation rate (%)

Before the analysis, the data underwent cleaning and normalization procedures to ensure consistency and reliability. This included addressing missing data points using interpolation techniques where possible and verifying extreme outliers against official sources. Monetary values were adjusted for inflation using constant prices to ensure comparability across years. To stabilize variance and improve the interpretability of the results, variables were converted into logarithmic form where appropriate.

3.2. Model Description

The study employs a panel data regression model to analyze the impact of economic factors on Kazakhstan's shadow economy. The dependent variable in the model is the share of the shadow economy (TenE), while the independent variables include income levels, unemployment, GRP, inflation, and other macroeconomic indicators.

The general functional form of the model is provided by.

$$Level\ of\ shadow\ economy\ = f(DOXOD, UNEMPL, VRP, CONSINC, UNDERPRMIN, PRMIN, RASXOD, INFL)$$

To improve estimation accuracy and mitigate potential nonstationarity in the data, the logarithmic form of the model was used.

$$log(TENEVAYA) = \beta_0 + \beta_1 log(DOXOD) + \beta_2 log(UNEMPL) + \beta_3 log(VRP) + + \beta_4 log(UNDERPRMIN) + \beta_5 RASXOD + \beta_6 CONSINC + \beta_7 INFL + \beta_8 PRMIN + \varepsilon$$

Where β_0 is the intercept, β_1, β_2,..., β_8 are the estimated coefficients, and ε is the error term.

3.3. Data Analysis

Panel regression models are employed in this study to investigate the factors that influenced the shadow economy in various regions of Kazakhstan from 2013 to 2022. Panel data analysis is an effective method for examining changes over time and across different regions. It helps us understand how economic and institutional factors affect informal economic actions more comprehensively. Three types of panel regression were examined to determine the model parameters. These were the pooled regression, fixed effects (FE), and random effects (RE) models. The pooled regression model assumes that all regions are the same and derives a single regression equation for all observations, but it does not consider differences that have not been observed. However, because Kazakhstan's regions have very different economies and government systems, this assumption is unlikely to be true. This makes pooled regression a less suitable method.

The fixed-effects model was selected based on the Hausman specification test, which confirmed the correlation between unobserved regional characteristics and the independent variables. The FE model allows each region to have its intercept, capturing unobserved heterogeneity such as governance quality, enforcement strength, and institutional infrastructure—factors that are stable over time but vary across regions. This makes the FE model the most appropriate choice for drawing causal inferences within this dataset.

The fixed effects (FE) model considers differences that cannot be observed by assigning each area its unique intercept (Shah, 2025). This model is ideal for examining changes within regions over time, as it accounts for factors that remain constant but can still impact the shadow economy, such as variations in government, economic systems, and regulations. The FE model helps separate the effects of economic factors, such as income, unemployment, and gross regional product (GRP), on informal economic activities by focusing on changes within a specific area. On the other hand, the random effects (RE) model posits that differences between regions are random and not linked to the factors that explain them. This makes it suitable for studying more prominent economic trends. The RE model may yield incorrect results if the unobserved regional differences are linked to factors that explain them. The Hausman test was employed to determine the optimal model for this study. This statistical test compares the FE and RE models to ascertain if the unobserved heterogeneity is associated with the explanatory factors. The alternative hypothesis supports the FE model, whereas the null hypothesis asserts that the RE model is correct. The Hausman test indicates that the fixed effects model is the most suitable option, as it accounts for the impact of regional differences on the shadow economy. This study employs a panel regression framework to provide substantial insights into the evolution of the shadow economy in Kazakhstan over time. This will help lawmakers develop more targeted ways to bring economic activities into the light and improve institutions.

4. RESULTS

This section presents the study's empirical findings, analyzing the relationship between macroeconomic factors and the shadow economy in Kazakhstan using a fixed-effects panel regression model. There is a need to choose between a fixed-effects and a random-effects model to create a panel data model. The Hausman test yields a $\chi 2$ statistic of 64.58 and a corresponding p-value of 0. This means that the idea that there is a significant difference between the values for the fixed-effects and random-effects models is not supported (Table 2). The null hypothesis, which states that the random-effects model is correct, can be rejected if the p-value is very low (less than 0.05). The Hausman test

indicates that a fixed-effects model is more suitable for the shadow economy. The random-effects model differs from the fixed-effects model and the general models. It uses the maximum likelihood principle instead of the least squares method. The theory suggests that we are interested in the population's behavior. This means that a conclusion is drawn about the traits of the whole population, and the results can be applied to more than just the sample used in the model.

Table 2. Correlated random effects, Hausman test.

Test cross-section random effects				
Test summary		**Chi-sq. statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random		26.566	8	0.001
Cross-section random effects test comparisons:				
Variable	**Fixed**	**Random**	**Var(Diff.)**	**Prob.**
DOXOD	-1.009	-0.795	0.022	0.146
INFL	0.0889	-0.091	0.005	0.011
CONSINC	0.935	1.051	0.850	0.900
UNEMPL	-1.362	-1.029	0.0245	0.033
VRP	0.538	0.570	0.005	0.656
UNDERPRMIN	-0.002	-0.026	0.001	0.178
PRMIN	-0.224	-0.624	0.0396	0.044
RASXOD	-0.820	-0.705	0.582	0.880

The results of the Hausman test, presented in Table 2, indicate a significant difference between the fixed-effects and random-effects models, supporting the selection of the fixed-effects model as the more appropriate choice for analyzing the shadow economy in Kazakhstan. The test yields a Chi-square value of 26.566 and a p-value of 0.0008, which is significantly lower than the 0.05 significance level. This means that the null hypothesis that the random-effects model is better is invalid. This indicates that differences between regions are probably not random but linked to factors that help explain them. When we examine the individual variables, we observe that the p-values for income (DOXOD), unemployment (UNEMPL), inflation (INFL), and subsistence minimum (PRMIN) are all less than 0.05. This indicates that significant changes exist between the fixed and random effects estimates of these factors. This makes the need for a fixed-effects method even more pronounced, as these variables change predictably across regions and cannot be ignored as random noise. Gross regional product (VRP), family consumption (CONSENT), and expenditure (RASXOD) have higher p-values, indicating less variation between the fixed and random models for these variables.

$$\log(TENEVAYA) = b_0 + b_1 \log(DOXOD) + b_2 \log(UNEMPL) + b_3 \log(VRP)$$

Table 3. Regression results of the full fixed-effects model.

Dependent variable: log (TENEVAYA)				
Method: Panel least squares				
Periods included: 10				
Cross-sections included: 16				
Total panel (Balanced) observations: 160				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
LOGDOXOD	-1.163	0.177	-6.551	0.000
LOGUNEMPL	-1.390	0.563	-2.469	0.015
LOGVRP	0.546	0.179	3.055	0.003
C	11.278	1.458	7.735	0.000
	Effects specification			
Cross-section fixed (Dummy variables)				
R-squared	0.925	Mean dependent var		0.176
Adjusted R-squared	0.916	S.D. dependent var		0.630
S.E. of regression	0.183	Akaike info criterion		-0.447
Sum squared resid	4.724	Schwarz criterion		-0.082
Log-likelihood	54.763	Hannan-Quinn criteria.		-0.299
F-statistic	96.806	Durbin-Watson stat		1.155

Table 3 presents the results of the panel regression model, which reveals strong correlations between certain macroeconomic factors and the size of Kazakhstan's shadow economy. The population income coefficient (log (DOXOD)) is -1.1626, and the p-value is 0.0000.

This means that there is a strong negative link between income and being unofficial. This suggests that a 1% increase in income is associated with a 1.16% decrease in the shadow economy. This illustrates the importance of maintaining stable finances to reduce illegal activities. Similarly, the unemployment rate (log (UNEMPL)) has a coefficient of -1.3901 and a p-value of 0.0148, indicating a statistically significant adverse effect on the shadow economy.

The results show that informal economic activity decreases as unemployment rises, which contradicts the common assumption that it would increase. Some possible reasons are that people are relying more on state welfare programs, there are stricter rules in the job market, or there are fewer informal jobs for the jobless. On the other hand, the gross regional product (GRP) has a positive coefficient of 0.5464 and a p-value of 0.0027, indicating a strong positive link between GRP and the shadow economy. It is not true that as GDP increases by 1%, informal economic activities increase by 0.55%.

This contradicts the notion that economic growth naturally reduces informality. With an R-squared value of 0.9251, the independent factors can explain 92.5% of the variation in the shadow economy. This is a strong indicator of explanatory power. The modified R-squared value (0.9156) remains close to the original, indicating that the model is stable. Overall, the F-statistic (96.806) and the corresponding likelihood indicate that the model is statistically significant. However, the Durbin-Watson figure (1.15), which suggests a small amount of positive serial correlation, needs to be considered when refining the results further.

Table 4. Evaluation of the impact of the selected factors on the level of the shadow economy.

A 1% increase in the factor causes:	Change in the level of the shadow economy
Population income used for consumption	- 1.16%
Unemployment rate	-1.39%
GRP	+0.55%

The results, as shown in Table 4, indicate that the shadow economy shrinks by 1.16% for every 1% increase in the amount of money people spend. This negative correlation suggests that as household incomes rise, people and businesses may have less reason to engage in illegal activities. The unemployment rate also has an opposite link with the shadow economy.

For every 1% rise in unemployment, there is a 1.39% drop in activity in the informal economy. People typically believe that higher unemployment would lead more individuals into the informal sector, but this finding contradicts that notion.

There could be several reasons, such as a greater reliance on government assistance programs, a lack of informal job opportunities, or the fact that informal employment is not accurately recorded in official unemployment statistics. On the other hand, the study shows that gross regional product (GRP) is beneficial for the shadow economy. For every 1% rise in GRP, there is a 0.55% rise in informality. The prevailing belief is that economic growth leads to a decrease in informal economic activity.

This result goes against that idea. Instead, it means that growth in the formal sector may open up new opportunities for the shadow economy to operate, either because regulators are not closely monitoring the situation or because more people are working informally in expanding businesses. These data illustrate the complexity of the shadow economy and suggest that economic growth alone may not be sufficient to reduce informality.

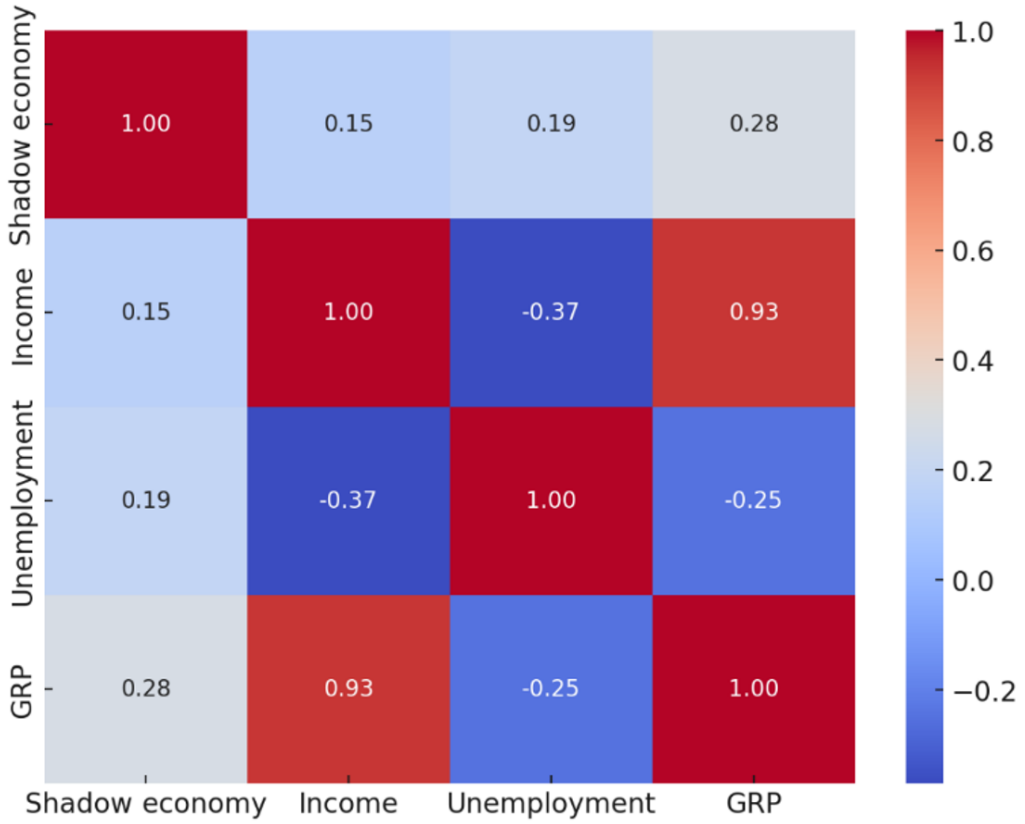

Figure 3. Correlation matrix.

The correlation matrix in Figure 3 illustrates the relationships between various economic factors. For example, income and GRP exhibit a strong positive correlation (r = 0.93), indicating that higher income levels are closely associated with higher GRP levels. A negative relationship exists between unemployment and income (-0.37) and GDP (-0.25). This means that as income and GDP rise, unemployment tends to fall. There are weak positive correlations between the shadow economy and GRP (0.28), income (0.15), and unemployment (0.19). The best model with a higher determination coefficient and statistically significant variables is obtained using the income factor (Table 5).

Table 5. Regression results of the simplified fixed-effects model (Excluding GRP).

Dependent variable: LOGTENEVAYA				
Method: Panel least squares				
Periods included: 10				
Cross-sections included: 16				
Total panel (Balanced) observations: 160				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
LOGUNEMPL	-1.378	0.579	-2.379	0.019
LOGDOXOD	-0.648	0.058	-11.245	0.000
C	9.760	1.410	6.920	0.000
	Effects specification			
Cross-section fixed (Dummy variables)				
R-squared	0.920	Mean dependent var		0.176
Adjusted R-squared	0.9106	S.D. dependent var		0.630
S.E. of regression	0.188	Akaike info criterion		-0.395
Sum squared resid	5.037	Schwarz criterion		-0.500
Log-likelihood	49.637	Hannan-Quinn criteria.		-0.255
F-statistic	96.302	Durbin-Watson stat		1.215
Prob(F-statistic)	0.000			

The updated fixed-effects panel regression model is shown in Table 6. Gross regional product (GRP) was excluded because it has a strong correlation with income. With a negative coefficient of -0.648, the results indicate that population income remains a significant factor in the shadow economy. This means that for every 1% rise in income, there is a 0.65% drop in informality. The unemployment rate remains negatively correlated with the shadow economy. For every 1% rise in unemployment, the shadow economy shrinks by 1.38 percentage points. This supports the surprising finding that higher unemployment does not always lead to more people working informally. This may be due to government assistance, changes in the job market, or the fact that official figures do not accurately reflect the amount of informal work.

Table 6. Assessment of the impact of the selected factors on the level of the shadow economy.

A 1% increase in the factor causes:	Change in the level of the shadow economy by
Population income used for consumption	- 0.65%
Unemployment rate	-1.38%

The level of the shadow economy is affected by several important factors. The unemployment rate (UNEMPL) and the amount of money people spend (DOXOD) are two key indicators. The shadow economy shrinks by 0.65% for every 1% increase in family income. This supports the idea that having more money means people are less likely to work illegally or avoid paying taxes. People and companies may stay in the formal economy as their incomes rise because it offers more financial security and easier access to social services.

Similarly, the unemployment rate has an unexpectedly negative correlation with the shadow economy. For every 1% rise in unemployment, there is a 1.38% drop in activity in the informal economy. Typically, when unemployment is high, people seek work outside of their regular jobs. Some possible reasons include state programs that help people find work without requiring them to work illegally, changes in the job market structure, or reporting biases that exclude informal workers from official unemployment numbers. This finding highlights the importance of having a comprehensive understanding of how the labor market operates. It states that policies aimed at raising incomes, rather than just lowering unemployment, are needed to reduce informality.

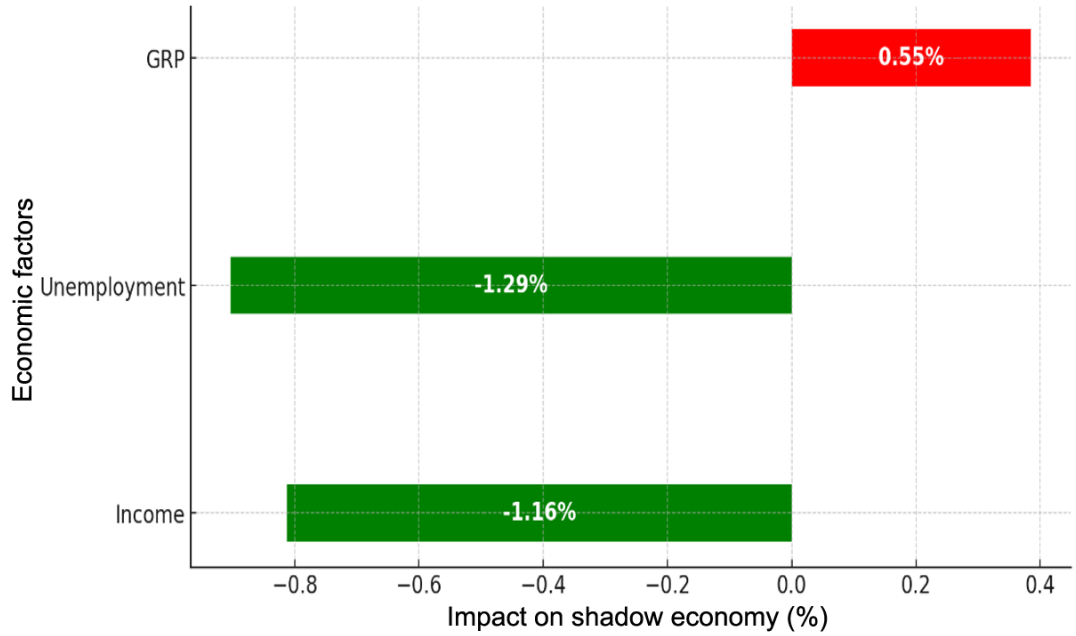

Figure 4. Impact of income, unemployment, and GDP on the shadow economy.

Figure 4 illustrates the impact of income, unemployment, and GDP on the shadow economy. It shows that income and unemployment have adverse effects, while GDP has positive effects. For example, a 1.16% and 1.29% drop in the shadow economy is linked to higher income and unemployment, suggesting that increased income and employment make informal activities less likely. On the other hand, a 0.55% rise in the shadow economy is associated with higher GDP, suggesting that economic growth may make it easier for people to engage in informal business. These results highlight the complexity of the relationship between economic factors and the shadow economy, underscoring the need for fair rules to regulate informal activities effectively.

4.1. Differences between the Full Model and the Simplified Two-Variable Model

Many factors in the original model contributed to explaining the phenomenon. These included population income (DOXOD), unemployment rate (UNEMPL), gross regional product (GRP), inflation, household consumption, population expenditure, subsistence minimum, and the proportion of the population living below the subsistence level. Using a fixed-effects panel regression model, the goal was to determine the extent of their impact on the shadow economy.

One significant issue with the model was the strong correlation ($r = 0.93$) between income and GRP, which suggested the possibility of multicollinearity. This meant that both variables yielded the same economic results, making it difficult to determine how each contributed to the shadow economy. To address this, the simplified model removed GRP, retaining only income and the unemployment rate as factors that could explain the relationship. The model retained a high level of explanatory power ($R^2 = 0.92$), only slightly lower than that of the full model ($R^2 = 0.925$). The main change was that income had a lesser effect on the model, decreasing from -1.16% in the full model to -0.65% in the simplified model. This indicates that GRP previously accounted for some of the variation in income. Unemployment had the same effect, which made the unexpected bad link between it and informality even stronger.

4.2. Confirmation of Research Hypotheses

The research hypotheses were tested and evaluated based on the empirical findings.

H1: Higher income reduces the shadow economy → Confirmed.

The results confirm that a 1% increase in income decreases the shadow economy by 0.65% to 1.16%, depending on the model. This indicates that higher household earnings reduce the need for informal employment and tax evasion. As people's financial stability improves, they are more likely to join the formal economy, benefiting from legal protection and access to credit.

H2: Higher unemployment increases the shadow economy → Rejected.

In contrast, studies show that when unemployment increases by 1%, private economic activity decreases by 1.38 to 1.39 percent. This surprising result suggests that jobless individuals may rely more heavily on government assistance than on informal work, or that informal workers are not accurately accounted for in official unemployment statistics. Another reason could be that when the economy is in a poor state, there are fewer opportunities for people to run their businesses, which causes the hidden economy to shrink.

H3: Higher GRP reduces the shadow economy → Rejected.

The results show that a 1% rise in GRP causes the shadow economy to grow by 0.55%. This contradicts the prevailing notion that economic growth reduces the size of the informal economy. This means that as economies grow, especially those that are still evolving, such as Kazakhstan's, there are likely to be more opportunities for small businesses to succeed. The results indicate that economic growth is insufficient to stop people from working without a license. Instead, specific policy interventions are necessary, such as simplifying the tax payment process and enforcing rules more strictly.

5. DISCUSSION

The main objective of this study was to identify and analyze the factors influencing the shadow economy in Kazakhstan using panel data regression models. The results show that the main factors affecting informal economic activity are income, unemployment rates, and gross regional product (GRP). The data indicate that higher incomes are associated with lower activity in the "shadow economy." This supports the notion that financial stability reduces the likelihood of engaging in illegal activities (Levi & Soudijn, 2020). However, contrary to what most people think, higher unemployment rates made the shadow economy smaller. This challenges the notion that unemployment leads to an increase in informal work. Additionally, GRP was positively associated with informality, indicating that economic growth does not necessarily reduce the shadow economy but may contribute to its expansion.

5.1. Income and the Shadow Economy

The results confirm a negative relationship between income levels and the shadow economy, indicating that a 1% rise in income leads to a 0.65–1.16% reduction in informal economic activity. This finding aligns with economic theory, which suggests that when individuals and businesses have sufficient financial resources, they are less likely to engage in the informal sector, opting instead for the formal sector when they are financially secure (Nguyen & Canh, 2021). A higher household income may also increase people's trust in the government, making them more likely to follow tax and business registration rules. Another reason for this trend is that more people are accessing money. Higher-income individuals are more likely to utilize formal financial tools, such as banks, digital payment systems, and formal financial instruments. This means they use cash less, which is a significant factor in what makes informal behavior possible. Additionally, as people's incomes rise, they tend to spend more in the formal economy. This makes more legally registered businesses necessary and lessens the demand for unregistered ones.

5.2. Unemployment and the Shadow Economy

This study found that when unemployment is high, the shadow economy tends to shrink. This contradicts the prevailing notion that people must work informally to make ends meet when unemployment rates rise. The reliance on social welfare programs could be one reason for this unexpected result. In Kazakhstan, jobless individuals may receive government assistance instead of seeking employment on their own. People looking for work may remain jobless if they can obtain sufficient financial support from social benefits instead of taking on hazardous and unregulated informal work. Strong social safety nets may reduce the likelihood of individuals engaging in illegal activities (Nguyen, Grote, Neubacher, Do, & Paudel, 2023). Another reason could be that informal workers are not adequately counted in official data. There may be differences in the data because unemployment is measured in a way that might not fully consider self-employed individuals or those who work informally.

The negative correlation could also be attributed to the fact that there are fewer informal jobs available during economic downturns. Both official and informal businesses often struggle when unemployment increases, as fewer people are willing to make purchases. If the economy slows down, it could impact informal businesses the most, as they typically serve low-income individuals. This could result in fewer jobs in the informal economy. Therefore, there may be a time when unemployment rises and fewer informal jobs become available. This goes against the common belief that people turn to informal work when they cannot find formal work. These results demonstrate the complexity of Kazakhstan's job market and suggest that economic informality does not always respond to unemployment in predictable ways.

5.3. GRP and the Shadow Economy

The research shows a link between the gross regional product (GRP) and the shadow economy. It indicates that for every 1% rise in GRP, there is a 0.55% rise in informality. People believed that economic growth would reduce shadow economy activity by creating more formal jobs and enhancing the capabilities of institutions. Instead, there

may be more than one reason why rising informality occurs simultaneously with economic growth. One reason is that there are more opportunities to conduct business without a license. As the economy grows, more people start their businesses, especially in areas where regulators do not closely monitor activities. Small and medium-sized enterprises (SMEs) often operate informally to minimize their tax obligations and administrative responsibilities. Another reason is that regulatory gaps and enforcement are not substantial. In rapidly growing economies, governing bodies may struggle to keep pace with the increasing number of new business activities. This can leave gaps that companies can exploit to their advantage.

Lastly, the rise in informality may be attributed to the growth of specific sectors. Suppose most economic growth occurs in fields such as construction, agriculture, and retail, which have historically had high levels of informality. In that case, the shadow economy may continue to grow even as the formal GDP increases. These areas rely on temporary workers, businesses that are not registered, and methods to evade paying taxes, making them significant components of the informal economy. So, while GDP growth is typically viewed as a positive sign for the economy, it remains unclear how it will contribute to reducing informality. Instead, growth-driven informality may emerge, indicating that specific policy changes are necessary to ensure that economic growth leads to long-term formalization rather than the expansion of the shadow economy.

5.4. Comparison with Other Studies

The results of this study are similar to and differ from those of earlier studies in several important ways. They illustrate the complexity of the shadow economy in Kazakhstan. The negative link between income and informality aligns with Ulyssea (2020). According to him, higher incomes make people less dependent on informal jobs and more trusting of financial institutions. As people's incomes rise, they have less reason to participate in the black market. Instead, they work in the real economy, making safer financial deals with longer-term benefits. This makes the point even more potent: raising incomes can be a good way to reduce informality. Previous studies, such as Augustine (2019), have found that people who lose their jobs often turn to illegal work to make ends meet. On the other hand, this effect of unemployment on the shadow economy contradicts what one might initially think. There may be a difference in the results because Kazakhstan's job market and social safety nets are different from those in other economies. In Kazakhstan, stronger social assistance programs might make people less likely to work in the informal sector. When some businesses experience downturns, there may not be a strong informal labor market to hire people who are out of work. Additionally, the way unemployment is measured may not fully account for unofficial workers who do not report their employment status, making it more challenging to compare countries.

The surprising yet essential finding that GRP and the shadow economy are positively linked is in line with what Early and Peksen (2020) found: a non-linear relationship between economic growth and informality. When an economy is just starting to grow, informal activities may expand more rapidly than formalization processes. This pattern is significant in Kazakhstan because the country's economy is experiencing rapid growth in specific sectors, such as retail and construction, which can help small businesses and create new job opportunities. Even though the economy is improving, informal companies may still thrive due to lax government oversight and inefficient administration.

Similar trends have been observed in other post-Soviet and transition economies, where rapid economic growth has not necessarily led to a decline in illicit activities, as the institutions are not yet sufficiently robust. Countries undergoing economic transitions have demonstrated that growth alone cannot halt the shadow economy. Institutional strengthening, regulatory reforms, and targeted policy interventions are necessary to ensure that economic growth leads to increased formalization rather than more informality. These results demonstrate the importance of adopting a comprehensive policy approach that considers both economic development and the institutional context when addressing the challenges posed by the shadow economy.

5.5. Practical Implications of the Findings

To eliminate the shadow economy, we must examine it from multiple angles, including the economy, the job market, regulations, and the banking sector. Increasing financial openness by promoting digital payments, electronic billing, and simplified tax filing is an effective way to achieve this goal. Cash-based deals are a significant part of informality because they allow people and businesses to operate without government oversight. Tax evasion can be reduced, and people can be more accountable for their finances if governments encourage the use of digital payment systems and bring informal businesses into the formal banking system. Businesses may also be more likely to register and operate legally if tax compliance is made more straightforward and achieved through streamlined processes. Another crucial step is to improve labor market rules, making people less reliant on informal work. Workers can acquire the skills they need to transition to full-time jobs by taking advantage of expanded job training programs and workforce development initiatives. Providing tax breaks or other financial incentives to new businesses can also encourage them to formalize their workforce. Governments can gradually reduce informal work while maintaining economic stability by facilitating easier hiring for official jobs and making those positions more attractive.

To reduce informality, it is also essential to enhance regulatory oversight, particularly in high-risk sectors such as construction, agriculture, and retail. Many businesses in these areas operate loosely to avoid paying taxes and adhering to regulations. These businesses can be brought into the legal economy by implementing targeted enforcement measures, such as regular inspections, stricter licensing requirements, and enhanced monitoring of supply lines. On the other hand, eliminating bureaucratic hurdles to formalization, such as high license fees and complicated paperwork, can encourage businesses to join the formal sector on their own. Since increased GRP does not instantly reduce the shadow economy, we must finally discuss the effects of economic growth on this sector. Instead, governments should ensure that regulatory systems adapt to changes in the economy. As industries and companies grow, the way regulations are enforced must change to keep the informal sector from increasing at the same rate as the formal GDP. Building trust in state organizations means making it easier to collect taxes, providing better public services, and encouraging entrepreneurs to follow the law. By combining these tactics, policymakers can make the economy more stable, enabling growth and formalization to co-occur.

5.6. Research Limitations

Although this study provides us with helpful information, some issues need to be addressed. The work only includes information about Kazakhstan, so the results may not apply to other economies, as their labor markets and institutions differ. Because it is not easily defined and because estimates of it often rely on oblique approaches, the shadow economy is notoriously difficult to quantify. Corruption, informal sector production, and the efficiency of tax enforcement are some factors that can impact the shadow economy. However, they are not considered in this study.

5.7. Future Research

Further studies are needed to gain a deeper understanding of Kazakhstan's informal economy and address unanswered questions. One crucial area that requires further research is examining the impact of income on informality to determine if different types of income, such as wages, business gains, or remittances sent back to family, have distinct effects. The results of this study indicate that individuals with higher general incomes are less likely to engage in the shadow economy. However, further research is needed to determine whether different types of income facilitate the formalization of activities more or encourage them to occur informally. Another critical area of study is how digitalization can help reduce informality. As digital banking and financial technology continue to grow, it is essential to determine whether providing more straightforward access to digital financial tools, such as mobile banking, digital payments, and electronic tax filing, makes people less reliant on cash and unofficial business practices. Examining how quickly and effectively these technologies are adopted in various industries and locations can help us understand the impact of digitalization on the transition to formal economic engagement. Additionally, policy review

studies are necessary to determine the effectiveness of government efforts in reducing the shadow economy. Effect studies of tax changes, job market rules, and programs that encourage people to become employees can help determine which methods have the most significant effects. Determining which policies are most effective in preventing informality and which may have unintended consequences can help policymakers develop more targeted and practical measures. By examining these areas, future research can inform economic policies that foster growth and promote long-term formalization. This will make Kazakhstan's economy more stable and open to everyone.

6. CONCLUSION

This research provides real-world examples of the primary factors influencing Kazakhstan's shadow economy. It illustrates the intricate relationship between income, unemployment, and gross regional product (GRP). The results show that higher incomes lead to a smaller shadow economy, while higher unemployment rates surprisingly result in a smaller informal economy. Additionally, economic growth (as measured by GDP) appears to increase the size of the shadow economy, suggesting that illegal activities expand in tandem with official economic growth. These results highlight the importance of targeted policy measures to ensure that as the economy grows, efforts to formalize it are matched by a reduction in illegal activities rather than an increase in them.

To combat the shadow economy, the government should strengthen its rules and regulations, improve tax collection, and increase transparency in business dealings. Small and medium-sized enterprises (SMEs) should be able to conduct more formal business with less paperwork. Improving digital banking services can also help SMEs to conduct fewer cash-based transactions. Stronger institutional governance and anti-corruption measures are also crucial for building trust in the formal economy and ensuring that companies and individuals comply with the law and pay their taxes. In terms of business, companies should be encouraged to join the official economy by offering tax breaks for signing up, simplifying rules to follow, and providing them with access to financial aid programs. Construction, farming, and retail are all high-risk informal industries that should have structured ways for their businesses to transition into the official economy. Employers should also be rewarded for providing workers with written contracts and social security benefits to reduce informal work. Although this study provides us with vital information, further research is needed to understand the causes of the shadow economy. In the future, researchers should investigate how digitalization explicitly reduces illegal transactions, the effectiveness of government policies in combating illicit activity, and the variations in the shadow economy across different regions of Kazakhstan. Furthermore, a more thorough study of how various types of income affect informality might help policymakers make changes that will make the economy more open and accessible to everyone.

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REFERENCES

Adair, P. (2020). The non-observed economy vs. the shadow economy in the European Union: Concepts, measurements methods and estimates revisited. In *Research Handbook on Development and the Informal Economy* (pp. 45-78): Edward Elgar Publishing. https://doi.org/10.4337/9781788972802.00012.

Adair, P. (2021). Non-observed economy vs. shadow economy and informal employment in Poland: A range of mismatching estimates. In W. Andreff (Ed.), Comparative Economic Studies in Europe. In (pp. 249–278): Springer International Publishing. https://doi.org/10.1007/978-3-030-48295-4_13.

Adams, D. W. (2019). Taking a fresh look at informal finance. In *Informal finance in low-income countries* (pp. 5-23): Routledge. https://doi.org/10.4324/9780429034572-2.

Apriliyanti, I. D., & Kristiansen, S. O. (2019). The logics of political business in state-owned enterprises: The case of Indonesia. *International Journal of Emerging Markets*, *14*(5), 709-730. https://doi.org/10.1108/IJOEM-08-2018-0433

Arrighi, C., Carraresi, A., & Castelli, F. (2022). Resilience of art cities to flood risk: A quantitative model based on depth-idleness correlation. *Journal of Flood Risk Management*, *15*(2), e12794. https://doi.org/10.1111/jfr3.12794

Augustine, D. (2019). Working around the law: Navigating legal barriers to employment during reentry. *Law & Social Inquiry*, *44*(3), 726-751. https://doi.org/10.1017/lsi.2018.23

Avdiysky, V., & Bezdenezhnykh, V. (2018). The structure of financial flows in the shadow economy and methods of their assessment. *Ekonomika. Nalogi. Pravo= Economics, Taxes & Law*, *11*(5), 6-15.

Baklouti, N., & Boujelbene, Y. (2020). Shadow economy, corruption, and economic growth: An empirical analysis. *The Review of Black Political Economy*, *47*(3), 276-294. https://doi.org/10.1177/0034644619885349

Benanav, A. (2019). The origins of informality: The ILO at the limit of the concept of unemployment. *Journal of Global History*, *14*(1), 107-125. https://doi.org/10.1017/S1740022818000372

Bu, J., Luo, Y., & Zhang, H. (2022). The dark side of informal institutions: How crime, corruption, and informality influence foreign firms' commitment. *Global Strategy Journal*, *12*(2), 209-244. https://doi.org/10.1002/gsj.1417

Canh, P. N., Schinckus, C., & Dinh Thanh, S. (2021). What are the drivers of shadow economy? A further evidence of economic integration and institutional quality. *The Journal of International Trade & Economic Development*, *30*(1), 47-67. https://doi.org/10.1080/09638199.2020.1799428

Chen, M., Sinha, A., Hu, K., & Shah, M. I. (2021). Impact of technological innovation on energy efficiency in industry 4.0 era: Moderation of shadow economy in sustainable development. *Technological Forecasting and Social Change*, *164*, 120521. https://doi.org/10.1016/j.techfore.2020.120521

Cieślik, J., & van Stel, A. (2024). Solo self-employment—Key policy challenges. *Journal of Economic Surveys*, *38*(3), 759-792. https://doi.org/10.1111/joes.12559

Dell'Anno, R. (2022). Theories and definitions of the informal economy: A survey. *Journal of Economic Surveys*, *36*(5), 1610-1643. https://doi.org/10.1111/joes.12487

Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2020). The Global Findex Database 2017: Measuring financial inclusion and opportunities to expand access to and use of financial services. *The World Bank Economic Review*, *34*(Supplement_1), S2-S8. https://doi.org/10.1093/wber/lhz013

DeRock, D. (2021). Hidden in plain sight: Unpaid household services and the politics of GDP measurement. *New Political Economy*, *26*(1), 20-35. https://doi.org/10.1080/13563467.2019.1680964

Dybka, P., Kowalczuk, M., Olesiński, B., Torój, A., & Rozkrut, M. (2019). Currency demand and MIMIC models: Towards a structured hybrid method of measuring the shadow economy. *International Tax and Public Finance*, *26*(1), 4-40. https://doi.org/10.1007/s10797-018-9504-5

Early, B., & Peksen, D. (2019). Searching in the shadows: The impact of economic sanctions on informal economies. *Political Research Quarterly*, *72*(4), 821-834. https://doi.org/10.1177/1065912918806412

Early, B. R., & Peksen, D. (2020). Shadow economies and the success of economic sanctions: Explaining why democratic targets are disadvantaged. *Foreign Policy Analysis*, *16*(3), 353-372. https://doi.org/10.1093/fpa/oraa005

Estevão, J., Lopes, J. D., & Penela, D. (2022). The importance of the business environment for the informal economy: Evidence from the Doing Business ranking. *Technological Forecasting and Social Change*, *174*, 121288. https://doi.org/10.1016/j.techfore.2021.121288

Etim, E., & Daramola, O. (2020). The informal sector and economic growth of South Africa and Nigeria: A comparative systematic review. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), 134. https://doi.org/10.3390/joitmc6040134

Ginevicius, R., Kliestik, T., Stasiukynas, A., & Suhajda, K. (2020). The impact of national economic development on the shadow economy. *Journal of Competitiveness*, *12*(4), 39.

Goel, R. K., Saunoris, J. W., & Schneider, F. (2019). Growth in the shadows: Effect of the shadow economy on US economic growth over more than a century. *Contemporary Economic Policy*, *37*(1), 50-67. https://doi.org/10.1111/coep.12288

Grilli, L., Latifi, G., & Mrkajic, B. (2019). Institutional determinants of venture capital activity: An empirically driven literature review and a research agenda. *Journal of Economic Surveys*, *33*(4), 1094-1122. https://doi.org/10.1111/joes.12319

Hale, R. L. (2024). Bargaining, duress, and economic liberty. In *Law and Economics Vol 1* (pp. 339-364): Routledge. https://doi.org/10.4324/9781003550150-17.

Hardoy, J., & Satterthwaite, D. (2022). The legal and the illegal city. In *Shelter, Settlement & Development* (pp. 304-338): Routledge. https://doi.org/10.4324/9781003271529-17.

Hoinaru, R., Buda, D., Borlea, S. N., Văidean, V. L., & Achim, M. V. (2020). The impact of corruption and shadow economy on the economic and sustainable development. Do they "sand the wheels" or "grease the wheels"? *Sustainability*, *12*(2), 481. https://doi.org/10.3390/su12020481

Humphries, J., & Weisdorf, J. (2019). Unreal wages? Real income and economic growth in England, 1260–1850. *The Economic Journal*, *129*(623), 2867-2887. https://doi.org/10.1093/ej/uez017

Huynh, C. M., Nguyen, V. H. T., Nguyen, H. B., & Nguyen, P. C. (2020). One-way effect or multiple-way causality: foreign direct investment, institutional quality and shadow economy? *International Economics and Economic Policy*, *17*(1), 219-239. https://doi.org/10.1007/s10368-019-00454-1

Igwe, P. A., Odunukan, K., Rahman, M., Rugara, D. G., & Ochinanwata, C. (2020). How entrepreneurship ecosystem influences the development of frugal innovation and informal entrepreneurship. *Thunderbird International Business Review*, *62*(5), 475-488.

Insebayeva, S., & Beyssembayev, S. (2023). Digital platform employment in Kazakhstan: Can new technologies solve old problems in the labor market? *International Labor and Working-Class History*, *103*, 62-80. https://doi.org/10.1017/S0147547923000200

Jetzek, T., Avital, M., & Bjørn-Andersen, N. (2019). The sustainable value of open government data. *Journal of the Association for Information Systems*, *20*(6), 702-734. https://doi.org/10.17705/1jais.00549

Kishwar, S., Bashir, S., Hussain, A., & Alam, K. (2023). Informal employment and catastrophic health expenditures: evidence from Pakistan. *The International Journal of Health Planning and Management*, *38*(4), 999-1014. https://doi.org/10.1002/hpm.3643

Koufopoulou, P., Williams, C. C., Vozikis, A., & Souliotis, K. (2019). Shadow economy: Definitions, terms & theoretical considerations. *Advances in Management and Applied Economics*, *9*(5), 35-57.

Levi, M., & Soudijn, M. (2020). Understanding the laundering of organized crime money. *Crime and Justice*, *49*(1), 579-631. https://doi.org/10.1086/708047

Luque, A. (2022). Analysis of the concept of informal economy through 102 definitions: Legality or necessity. *Open Research Europe*, *1*, 134. https://doi.org/10.12688/openreseurope.13990.2

Nguyen, B., & Canh, N. P. (2021). Formal and informal financing decisions of small businesses. *Small Business Economics*, *57*(3), 1545-1567. https://doi.org/10.1007/s11187-020-00361-9

Nguyen, T. T., Grote, U., Neubacher, F., Do, M. H., & Paudel, G. P. (2023). Security risks from climate change and environmental degradation: Implications for sustainable land use transformation in the Global South. *Current Opinion in Environmental Sustainability*, *63*, 101322. https://doi.org/10.1016/j.cosust.2023.101322

Peticca-Harris, A., Degama, N., & Ravishankar, M. (2020). Postcapitalist precarious work and those in the 'drivers' seat: Exploring the motivations and lived experiences of Uber drivers in Canada. *Organization*, *27*(1), 36-59. https://doi.org/10.1177/1350508418757332

Rahman, S. U., Faisal, F., & Ali, A. (2023). Financial development and shadow economy: A bibliometric analysis using the Scopus database (1985–2021). *Journal of the Knowledge Economy*, *14*(3), 2238-2265. https://doi.org/10.1007/s13132-022-00980-5

Reza, M. H., & Bromfield, N. F. (2019). Human rights violations against street children working in the informal economy in Bangladesh: Findings from a qualitative study. *Journal of Human Rights and Social Work*, *4*, 201-212. https://doi.org/10.1007/s41134-019-00098-w

Schneider, F. (1986). Estimating the size of the Danish shadow economy using the currency demand approach: An attempt. *The Scandinavian Journal of Economics*, *88*(4), 643-668. https://www.jstor.org/stable/3440435

Shah, S. S. (2025). Culture and individual attitudes towards responsible consumption. *Journal of Islamic Marketing*. https://doi.org/10.1108/JIMA-06-2023-0185

Shah, S. S., & Asghar, Z. (2024). Individual attitudes towards environmentally friendly choices: A comprehensive analysis of the role of legal rules, religion, and confidence in government. *Journal of Environmental Studies and Sciences*, *14*(4), 629-651. https://doi.org/10.1007/s13412-024-00913-5

Shah, S. S., Serna, R.-J., & Delgado, O. S. (2023). Modelling the influence of social learning on responsible consumption through directed graphs. *Electronic Research Archive*, *31*(9), 5161-5206. https://doi.org/10.3934/era.2023264

Slemrod, J. (2019). Tax compliance and enforcement. *Journal of Economic Literature*, *57*(4), 904-954. https://doi.org/10.1257/jel.20181437

Ulyssea, G. (2020). Informality: Causes and consequences for development. *Annual Review of Economics*, *12*(1), 525-546. https://doi.org/10.1146/annurev-economics-082119-121914

Voyer, M., & van Leeuwen, J. (2019). 'Social license to operate'in the Blue Economy. *Resources Policy*, *62*, 102-113. https://doi.org/10.1016/j.resourpol.2019.02.020

Webb, J. W., Khoury, T. A., & Hitt, M. A. (2020). The influence of formal and informal institutional voids on entrepreneurship. *Entrepreneurship Theory and Practice*, *44*(3), 504-526. https://doi.org/10.1177/1042258719830310

Williams, C. C. (2023). *Formalization of the informal economy: an e-government approach*: Springer Nature. https://doi.org/10.1007/978-3-031-37928-4.

Wilson, J. Q. (2020). The politics of regulation. In T. Ferguson & J. Rogers (Eds.), The political economy: Readings in the politics and economics of American public policy In (pp. 82-103): Routledge. https://doi.org/10.4324/9781315495811-9.

Younas, Z. I., Qureshi, A., & Al-Faryan, M. A. S. (2022). Financial inclusion, the shadow economy and economic growth in developing economies. *Structural Change and Economic Dynamics*, *62*, 613-621. https://doi.org/10.1016/j.strueco.2022.03.011