# Tax and social policy reforms to support developing retail market in Ukraine

by

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See you and good luck!

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## Abstract

The main objective of the research is to assess the tax, economic, behavioral, and social factors affecting informal employment in retail in Ukraine. Key behavioral factors are reputational risks for citizens, the level of corruption, the quality of state institutions, and the prevalence of bribery. The key economic factors are inflation, the tax burden, and the minimum wage level.

The model includes five blocks: the retail block, the tax and budget system block, the tax administration and state institutions block, the informal employment block, and the business climate block.

The block of retail calculates the main economic indicators of the model, the block of taxes calculates state finances, the block of state institutions, and the block of informal employment calculates the factors affecting informal employment in retail in Ukraine.

The relationship between the factors and informal employment is through effects based on the literature review and the author's assumptions.

The main policies are the introduction of tax reform, the improvement of anti-corruption policy, the strengthening of the government's social policy, and the minimum wage policy.

According to the simulations, informal employment shows an increase due to the war, but due to economic recovery and increased government efficiency, the amount of informal employment will decrease.

**Keywords:** informal employment, tax system, retail, exit capital tax, anti-corruption policy, social contract, minimum wage

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# Glossary

**Table 1. Key terms.**

| | |
|---|---|
| Informal employment | Informal employment — that is, work that in itself is legal but not declared to the authorities for tax, social security and/or labour law purposes (ESAP, 2023). |
| Retail | Retail is the activity of selling goods directly to citizens and other final consumers for their personal non-commercial use (DPS, 1995). |
| Wholesaling | Wholesale trade - the activity of purchasing and the corresponding transformation of goods for their subsequent sale to retail enterprises and other business entities (DPS, 1995). |
| Exit Capital Tax | Exit Capital Tax taxes only the amount that the company withdrew from its circulation, and not the entire profit (as it is in the corporate tax) |
| Corporate tax | Tax paid as a % of companies' profits. For 2023, the tax rate is 18% (MFU, 2021b). |
| Income tax | The tax paid by all hired employees in Ukraine is the main labor tax. For 2023, the tax rate is 18% (MFU, 2021b). |
| Value added tax | Tax paid by producers and sellers of products. It is the most important tax in the budget system of Ukraine. As of 2023, tax rate is 20% (Legalaid, 2023a). |
| Economic activity spending | This is a section of government spending that the state directs to stimulate various sectors of the economy. |
| UAH | Ukrainian hryvnia is the national currency of Ukraine. The exchange rate is 36.56 hryvnias to one dollar, as of June 1, 2023 (Minfin, 2023b). |

**Table 2. Key institutions.**

| | |
|---|---|
| Ukrstat | A state institution is responsible for collecting and publishing statistics on the economy, social segment, education, business, etc. |
| State Employment Service of Ukraine | The central state institution is responsible for providing employment assistance and assistance to the unemployed population of Ukraine. |
| Ministry of Finance of Ukraine | Ministry in the Ukrainian government is responsible for the development of the state budget, expenditure, and budget revenue planning. |
| National Agency of Ukraine for Civil Service (NADS) | State agency analyzes the situation with wages in state institutions. |
| State Treasury Service of Ukraine | The state institution is responsible for keeping accounts of the government of Ukraine. |
| International Labour Organization (ILO) | An international organization is responsible for analyzing the global labor market, the size of informal employment, and the labor force. |
| State Tax Service of Ukraine (DPS) | The central institution is responsible for assessment, collection of taxes, and publication of tax statistics. |

# 1. Introduction

The russian invasion of Ukraine exacerbated the problems of the Ukrainian economy and business. This led to the deterioration of business expectations, the mass migration crisis, and the growth of Ukraine's budget deficit, which in 2022 reached 30% of GDP (Danylyshyn, 2023).

The decrease in consumption and company income has led to layoffs and reduced tax revenues to the Ukrainian budget - about 5 million people in Ukraine will lose their jobs in 2022 (Berezhna, 2022).

At the same time, about 40% of business representatives in Ukraine state that the tax system in Ukraine is ineffective and prevents businesses from working (APPU, 2023). Among the main problems are a large number of inspections, corruption, and blocking of tax documents, which leads to losses for business (CID, 2023).

This creates an effect on informal employment (due to the business climate in the country and people's desire to avoid paying taxes and cooperating with the government). The growth of informal employment poses a threat to filling the state budget and increasing poverty in the country (OECD, 2009).

The research paper consists of an introduction, methodology, model description, validation, and calibration, description of model results, policy analysis, and conclusions. The document also includes appendices.

## 1.1 Problem Definition

The key problem of the research is the high level of informal employment in retail in Ukraine - the amount of informal employment was 41% of all employment in trade (retail and wholesaling) segment in 2021 (Ukrstat, 2021e). Data for 2022 is not published as of May 2023.

Informally employed workers do not pay taxes to the government and are socially vulnerable in the labor market (Alefari et al., 2020). This inhibits the economic growth of the country, because the informal sectors of the economy are mostly low-productivity and do not allow the government to provide basic services to the population (IMF, 2021).

This study focuses on the functioning of the tax system to ensure quality services for the population and comfortable conditions for doing business, which will make formal employment more attractive for employees.

After all, one of the reasons for informal employment is the lack of a social contract between the government and the population (Aleksynska & Wojcieszynski, 2022). The social contract includes what a citizen is ready to give to the government (taxes and other contributions) to ensure the needs of citizens (social support, quality services, and economic stability).

The problem of informal employment should be divided into key stakeholders in the employment system, business, and tax system. For policy development, it is important to determine the interests of all system participants (Table 3).

**Table 3. Stakeholders of research with their problems.**

| **Research stakeholders** | **Problem of stakeholder** |
|---|---|
| **Business** | Obsolescence of fixed assets, which negatively affects the productivity of companies |
| | The negative impact of interaction with the government (tax administration and other authorities) |
| | Lack of funds for investments to increase productivity, and therefore the income of companies. |
| **Government** | High level of informal employment |
| | Insufficient level of tax revenues to provide quality services to the population |

| | |
|---|---|
| | Corruption, which reduces the effectiveness of the government's policy of reducing informal employment in Ukraine. |
| **Population** | The negative impact of interaction with state authorities (corruption, bribes, low-quality services for the population) |
| | The high tax burden on employees |
| | Economic instability, which negatively affects people's desire to enter the formal sector. |
| **Others (business associations (1) and international partners of Ukraine (2))** | 1. High tax burden for association member companies<br>2. The instability of the functioning of the budget system in Ukraine, which does not allow the government to pay its debts and provide services to the population. |

So, the key issues for the government are employment, taxes, and the welfare of citizens. For business, it is the tax burden and sales volume, and for the population, it is the level of income and quality of life.

To analyze the relationships between tax revenues, informal employment, and the budget system of Ukraine, the retail market was chosen in this study for two reasons:

1. High level of informal employment in the retail sector in Ukraine.

2. Analysis of the system on the example of retail for further scaling to other sectors of the economy of Ukraine.

## 1.2 Research Questions

Brainstorming was used to determine the research question so that the research question was relevant, had rigour to the research methods, had and novelty (Mattick et al., 2018).

So, the main question of this research is:

*What economic and social factors affect informal employment in retail in Ukraine?*

1. Relevance. Informal employment in retail is still high, and the war has had a negative impact on the incomes of the population, which will lead to an increase in informal employment in the coming years.

2. The rigour of research on the appropriateness of research methods. System Dynamics make it possible to evaluate intersectoral relationships and consider the system as a whole (Lin et al., 2020). Using an approach that can handle dynamic complexity, the behavior of tax revenues and employment in the future was predicted. System Dynamics allows to assess the impact of tax changes on informal employment over a long period.

3. Novelty and innovation. The research examines policies that allow for stimulating business development in Ukraine stimulating the transition from informal employment to formal employment. This will ensure stable tax revenues, which will allow providing high-quality services to the population (as previously mentioned, this will affect the quality of the "social contract" between the government and the population).

At the same time, to satisfy the interests of all stakeholders in Ukraine (population, business, government), where each of the participants seeks to maximize their utility (Fu et al., 2016).

1. For business, utility maximization consists of comfortable conditions for doing business (macroeconomic stability, absence of corruption, low tax burden, and the ability to invest one's funds in production).
2. For the population, this means overcoming corruption, reducing the tax burden and poverty, and providing quality services to the government.
3. For the government, it is the maximization of tax revenue and employment and the minimization of poverty.

Additional questions of the research, which are given significant attention, are:

1. How can the government encourage businesses to invest in their development to increase sales?

2. How will the introduction of an exit capital tax or a reduction in tax rates affect retail investment and informal employment?

3. How does the business climate affect informal employment and the level of investment in companies?

4. What factors can increase or decrease the influence of corruption on informal employment in Ukraine?

5. How do economic conditions affect informal employment and how to assess them?

6. What potential policies should be implemented to reduce informal employment and to encourage businesses to invest their funds?

The plan for answering these questions is described in the 2.2 Research Outline.

In this research, the greatest emphasis is placed on tax revenues and the quality of state institutions. To increase tax revenues, two methods are considered:

1. An increase in official employment, which will lead to an increase in personal income tax revenues.

2. Improvement of business conditions and the fight against corruption, will lead to an increase in the volume of sales, which in turn will lead to an increase in value added tax value, which is the most important tax for the Ukrainian budget.

## 1.3 Research Objectives

The main objectives of this study are divided into 3 blocks (the economic block, the tax block, and the block of informal employment).

**Informal employment block**

To assess the factors affecting informal employment. Emphasis is on economic, social, reputational, and corruption factors.

Determine KPIs for reducing informal employment in Ukraine in retail.

*Consider the scenario without changes (scenario 1), restoration of economic stability, and the fight against corruption (scenarios 2-5, combinations of individual policies).*

**Economy block**

Assess how the capital exit tax can affect sales in retail.

Assess the potential of Ukrainian businesses to invest the funds that companies receive after the tax reform). (How much of the company's funds are ready to invest?)

**Tax system block**

Estimate tax revenues (VAT, corporate tax, personal income tax) from retail to the Ukrainian budget.

*Consider the base scenario (1), the introduction of the capital exit tax immediately (2), and the introduction of the exit capital tax by different years (scenarios 3-5)*

Estimate the number of jobs that can be created in the economy at the expense of government investments.

## 1.4 Behavior over time

During 2015-2021, there was a decrease in informal employment in the trade sector. In 2021, informal employment amounted to 470,000 people in the trade sector. The growth of informal employment in 2014 is due to the occupation of Donbas and Crimea, and the strengthening of the economic crisis in Ukraine in 2014-2015.

The reduction of informal employment during 2016-2021 (Figure 1) is due to the improvement of economic living conditions, improvement of the quality of social services, and successes in the fight against corruption.

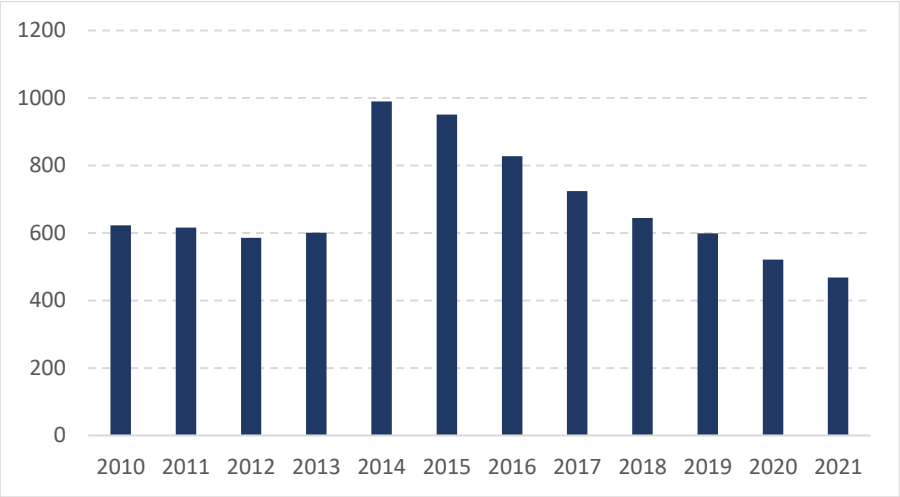


**Figure 1. Informal employment in the trade segment in Ukraine, thousands of persons, 2010-2021 years (author's calculations based on Ukrstat data (Ukrstat, 2021a))**

The reduction of informal employment in retail was accompanied by the improvement of conditions for doing business in Ukraine during 2015-2022. The implemented reforms included the automation of public services (reduction of tax discretion (Kapinus, 2017)), pension reform, deregulation of the economy, and integration with the European economic market.

Increasing government efficiency is one of the reasons for the reduction of informal employment during 2015-2022. Government effectiveness and the business environment affect citizens' willingness to work as unregistered workers (Estevão et al., 2022). The growth of Ukraine's position in the ranking of the rule of law testifies to the increase in the efficiency of the government.

But at the same time, Ukrainian business faces the problem of a lack of funds to invest in the development of production capacities. Depreciation of fixed assets in the trade sector

amounted to 39.2% in 2016 (Ukrstat, 2016), which emphasizes the importance of updating the capacities of companies in the retail market in Ukraine.

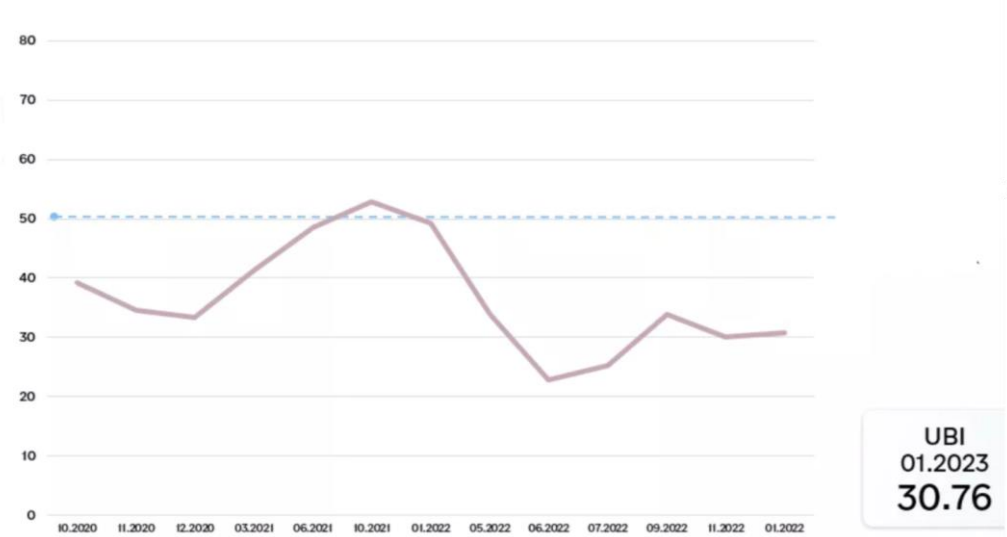


**Figure 2. Ukrainian business index, max=100, 2020-2023 years (CID, 2023).**

With the beginning of a full-scale russian invasion of Ukraine, 19% of enterprises are forced to relocate to safe regions of the country (AdvanterGroup, May 2023). The main obstacle to business is the lack of domestic demand and the lack of funds for investments in the development of enterprises. The business index showing business expectations is 30.76 at the beginning of 2023 (Figure 2).

To analyze the solution to this problem, changes in tax rates and the introduction of an exit capital tax were considered (included in the first block of the model). As mentioned earlier, the business climate and the economic situation affect informal employment.

## 2. Research Methodology

The methodology of this research includes literature analysis, analysis of state and international institutions, analysis of think tank projects, interview analysis, and analysis of social networks and media.

The analysis of the literature consists in determining the key cause-and-effect relationships between the blocks of research: informal employment, taxes, public services, and institutions.

Analysis of national and international institutions includes analysis of data sets that institutions publish on their websites. This allows to determine the key indicators for each organization in Ukraine, and the indicators that determine their policy.

Analysis of think tank research includes analytical reports on informal employment in Ukraine, an analysis of the tax system, and an analysis of the introduction of exit capital tax.

Interviews with specialists in the tax system of Ukraine, informal employment in Ukraine, and the budget system in Ukraine include verification of the results of the literature review and data collection.

Analysis of social networks and media is necessary to determine the position of business in relation to the fight against informal employment, the introduction of an exit capital tax, and how business evaluates the quality of public institutions.

I used EndNote to organize literature, social media, and other sources. In the EndNote, I used the segmentation of sources by type: literature, mass media, social networks, publications of state institutions, and publications of think tanks.

To adjust the work plan, I used Miro. For data storage, data analysis, and visualization, I used Excel, which allowed me to determine indicators for retail and create database with the main indicators of model.

## 2.1 System Dynamics Methodology

Using system dynamics includes building cross-sectoral linkages, identifying key policy variables, forecasting shocks, and scenario analysis.

The analysis of the problem of informal employment and the low level of investment in Ukraine will be carried out using a multisectoral analysis (employment, state, business, population). Model includes behavioral factors affecting employment in the economic system and related to other sectors.

Advantages of using system dynamics for this research include:

1. Analysis of complex systems using system dynamics (Azar, 2012).
2. Use of the model by the end user for optimization (Heijkoop & Cunningham, 2007) relative to their potential benefits.
3. The use of system dynamics for scenario analysis, which allows to determine the optimal values for government policy and better prepare business and the population for the introduction of new policies.
4. Disclosure of some indicators of the system as cumulative indicators (the company's funds, employment, for example), and others as non-cumulative indicators (sales, salary, taxes, etc.).

When constructing the model, the construction of cyclical loops with policy options was taken into account: introduction of exit capital tax (1), strengthening of the anti-corruption policy (2), and no changes (3).

## 2.2 Research Outline

The research was carried out in eight stages, starting from data collection, and ending with the analysis of policies that should be implemented in the future. It is extremely important to identify the research problem when building a plan (Tahan, 2022) and indicate the rationale for the study (Gelling & Engward, 2015).

The first stage includes data collection and a review of the literature on the situation in the retail market in Ukraine - analysis of key problems and data collection that allows reproducing the market in a historical context. This stage is described in detail in section 2.

The second stage consisted of the analysis of social networks, a means of mass information to determine the positions of society, business, and the population regarding informal employment, exit capital tax, and corruption in Ukraine. This stage is described in detail in section 2.

The third stage is that, after the data collection, I sent a request for interviews with representatives of trade associations, tax, and informal employment experts. This made it possible to verify the logic of identifying problems in the market and possible policies that should be implemented in the future. This stage is described in detail in section 2.

The fourth stage of the study includes the modeling of the business sector and the sector of the tax system of Ukraine.

After the completion of the development of these blocks, the block of employment and the block of social and economic causes of informal employment were added to the model.

The fifth stage includes re-verification with experts on the tax system and informal employment.

The sixth stage includes validation and testing of the model and adjustment of model indicators.

The seventh stage includes the analysis of potential policies that will reduce informal employment in Ukraine in retail.

The final part of the study is devoted to the conclusions and analysis of the continuation of the research in the future.

## 2.3 Data Collection

Data collection included the following sources: research by other scientists, publications and datasets of state and international organizations, reports of think tanks, conducting interviews with experts in the tax system and the informal economy, and research on social networks.

### 2.3.1 Literature Data

The literature review includes three stages: a collection of data on retail in Ukraine, tax and budget systems of Ukraine, and collection of data on factors affecting informal employment in Ukraine.

During the literature review, the key was to understand the formation of revenues and expenses for companies (Yefimenko, 2013), which later formed the basis for the first model block.

The second question was to understand how the tax system of Ukraine functions. It is also important to understand how economic and social factors affect informal employment in Ukraine (Anhelko, 2010).

The next stage of literature research included the study of informal employment. This stage included determining the key causes of informal employment in Ukraine.

1. Economic reasons (ILO, 2018).

2. Reputational reasons. The larger the group of people (in this research, informally employed workers), the smaller the reputational risks (Saeed et al., 2013).

3. Quality of state institutions and state services (Bologna, 2016; Ouédraogo, 2017; Wang, 2022).

All the above factors affect life satisfaction, which also affects informal employment.

### 2.3.2 Governmental and International Institution Data

A review of state and international institutions includes data collection of Ukrainian state institutions and analysis of international organizations (Table 4).

**Table 4. Institutions sources analysis.**

| Institution name | Datasets that were collected | Datasets that were used in the model |
|---|---|---|
| State Statistics Service of Ukraine (Ukrstat) | Company activity statistics<br>Balance of companies | Cost<br>Income |

| | | |
|---|---|---|
| | Financial results of companies (Ukrstat, 2021c)<br>The volume of informal employment (Ukrstat, 2021a)<br>The scope and dynamics of the education system (Ukrstat, 2021b) | Other expenses<br>Investments<br>The volume of informal employment<br>The scope and dynamics of the education system |
| State Tax Service of Ukraine (DPS) | Tax revenues by sectors and types of taxes (DPS, 2023)<br>Number of business checks (DPS, 2020) | Tax earnings from trade (after processing)<br>Number of checks |
| State Employment Service of Ukraine (DCZ) | Indicators of the labor market and unemployment (DCZ, 2023) | The number of unemployed, dismissed, those who received assistance, and those who found work |
| National Agency of Ukraine for Civil Service | Labor costs and salaries in the public sector (NADS, 2023) | Salaries and budgets of organizations in the tax system block. |
| National Anti-Corruption Bureau of Ukraine | Number of investigations and results (NABU, 2023) | Number of investigations and results |
| State Treasury Service of Ukraine | Government account balances at the beginning of the year (Minfin(newspaper), 2023) | Government account balances at the beginning of the year |
| Ministry of Finance of Ukraine | Government revenue and expenditure<br>Budgets of state institutions (Minfin, 2023) | Government revenue and expenditure<br>Budgets of state institutions |
| National Bank of Ukraine | Indicators of Turnover in Ukraine (NBU, 2023b)<br>Currency market data (NBU, 2023a) | Exchange rate |
| The World Bank | Commodity prices and forecasts (WB, 2023) | Commodity prices and forecasts |
| IMF | Forecast of economic development (IMF, 2023) | |
| International Labor Organization | Global Trends of informal employment (ILO, 2018b) | |

### 2.3.3 Think Tank Data

For the study, the research of think tanks was analyzed to determine the key factors affecting informal employment in Ukraine and the tax system in Ukraine. In Ukraine, during 2014-

2022, many studies on tax reform and the problem of informal employment were published in cooperation with international organizations.

The key sources of information in this section are the Ukrainian Institute of the Future (UIF, 2022), the Economic expert platform (EEP, 2021), Centre for Economic Studies (IER, 2017).

A comparison of the authors' positions is presented in section 2.3.

### 2.3.4 Interview Data

For the research, requests for interviews were sent to experts from Ukrainian analytical centers, the state tax service, and business representatives.

Two interviews were conducted (April 2023) with an expert on the tax system and an expert on the labor market in Ukraine.

The interview included open questions and was adjusted according to the expert's answers. This enabled a detailed consideration of the problems during the interview.

The first interview included the collection of data on the tax system in Ukraine - the key risks and advantages of the introduction of the exit capital tax, the main problems of the tax system in Ukraine and the definition of the algorithm for determining the effects of the tax reform (cycle of sales-income-profit-investment-fixed assets-sales). Detailed information about the interviews is provided in the appendices.

The second interview was conducted with an expert on the labor market in Ukraine, where the key topic was the factors influencing informal employment in Ukraine. During the interview, several factors that were in the first version of the model (gap in salaries in Ukraine and abroad) were rejected and new ones were added - the social system, which is part of the social contract between the population and the government (Aleksynska & Wojcieszynski, 2022). Detailed information about the interviews is provided in the appendices.

The main problem of the section was the lack of experts on the exit capital tax and representatives of business associations. Most representatives and associations did not respond to requests for comment.

### 2.3.5 Social Media Data

For the research, data was collected on the position of representatives of the business community on the exit capital tax and anti-corruption policy. (Facebook and YouTube channels).

This is necessary to understand the popularity (Wimmer & Dominick, 2009) of certain policies among businesses, population and the government.

For the study, data was also collected from the Retail Association of Ukraine and analytical portals about retail in Ukraine regarding the main problems of business in retail.

## 2.4 Data Analysis

Informal employment in Ukraine is determined by economic conditions - low incomes of the population and ineffective social policy. Among the social causes are corruption, a high level of bureaucracy and discretion in public authorities. Retail in Ukraine has problems, like other branches of the Ukrainian economy, obsolescence of fixed assets, lack of funds for investments, underdeveloped credit, and financial market. These factors limit the growth potential of companies, thereby affecting the willingness of businesses to hire informal workers.

The budget system of Ukraine consists of tax and non-tax revenues, but in 2022-2023 the situation has changed: most taxes are directed to the defense sector (KMU, 2023), and the government's social needs are provided with the funds of Ukraine's international allies (European countries and the USA).

The mechanism of the exit capital tax is that only the amount of profit withdrawn by the owners of the company is taxed. According to supporters of the exit capital tax, the new tax will encourage businesses to invest in their production (Dligach, 2023).

### 2.4.1 Literature Data Analysis

The main work on data analysis included the analysis of cash flow in the company (Yamaguchi, 2003).

To build a block of informal employment and its factors, a study on anti-corruption policy was analyzed using System Dynamics methods (Soto-Torres, 2007; Taylor et al., 2022).

### 2.4.2 Governmental and International Institution Data Analysis

After collecting data on all codes of economic activity, indicators of the entire Ukrainian economy, trade in general, and retail were sorted (Table 5).

**Table 5. Metrics analysis from governmental sources.**

| Metrics | Total | Total trade | Retail |
|---|---|---|---|
| Employment indicators | + | + | + |
| Indicators of the tax system | + | + | - |
| Indicators of informal employment | + | + | - |
| Indicators of corruption | + | - | - |
| Unemployment rates | + | + | - |
| Investment indicators | + | + | + |
| Financial results of companies | + | + | - |

| | | | |
|---|---|---|---|
| | | | (Ukrstat, 2021f) |

With the introduction of martial law, many data sets were closed for public viewing for national security purposes (for example, the tax map of Ukraine) (DPS, 2021a).

To correct the lack of data specifically for retail, the conversion coefficients of general trade indicators into retail indicators were applied. This assumption made it possible to determine the data for further modeling.

### 2.4.3 Think Tank Data Analysis

**Table 6. Think tank data and reports analysis.**

| **Where published** | **Date** | **Quote** |
|---|---|---|
| Ukrainian Institute of the Future | 2020 | *"The replacement of the income tax (hereafter PP) with the exit capital tax is one of the key decisions of the government, which will provide an incentive for the development of the economy in a short period:*<br>*$20-30 billion only of domestic investments in the real sector of the economy in the first 5 years, excluding foreign ones;*<br>*+$45-55 billion of additional nominal GDP created in 5 years;*<br>*+0.9-2.2% of additional real GDP growth per year (only the first 5 years);*<br>*4-5% real growth of the economy per year is a multiplier effect from investments in the perspective of 5 years."*<br>*(UIM, 2022)* |
| Ukrainian Business Council | 2021 | "*The results of econometric modeling indicate that in the short term, the introduction of an exit capital tax is expected to have a moderate effect on the economy, which will increase in the medium term due to the multiplier effect from the investment activity of enterprises, but fiscal losses will remain."*<br>(URB, 2021) |
| Economic Expert Council | 2021 | *"Based on the presented data, a stable positive effect of the exit capital tax on investment attraction can be traced, it was during its existence that several countries recorded record investment attraction indicators. We can talk about positive effects confirmed by the facts in the short- and medium-term perspective, at the same time, to assess the effects in the long-term perspective, further observations of the countries that have implemented the exit capital tax are necessary."*<br>*(Cherkashin, 2021a)* |
| IMF | 2018 | *«From a more technical point of view, we also have major doubts about the suggested advantages of the DDBCT (exit capital tax, put by the author's thesis). First, the DDBCT would incentivize shareholders to defer profit distribution or to find ways to disguise these through overpayments of other transactions, thereby avoiding taxation altogether since* |

| | | |
|---|---|---|
| | | *dividends are distributed at the discretion of shareholders. ...* *»* (Shymkiv, 2018) |

Table 6 shows that the analytical environment of Ukraine does not have a common vision of all the effects of the introduction of the exit capital tax. The system dynamic model includes a scenario analysis that includes testing different policies and implementation periods.

### 2.4.4 Interview Data Analysis

The analysis of the interview includes the segmentation of the expert's answers and the formation of key hypotheses for the system dynamics model.

**Key findings from the first interview.**

The main problems of business when interacting with the state are corruption, high discretion, blocking of tax invoices, lack of judicial reform, complexity of the reporting and tax payment system.

The main risks of introducing an exit capital tax are the withdrawal of funds instead of investment, the complication of tax administration, a decrease in tax revenues and an increase in the state deficit, the effect of the tax is poorly researched (a small sample of countries that have introduced an exit capital tax). The main solutions include digitization, the fight against corruption, reducing discretion, increasing control over the payment of taxes, fiscalization, but in dialogue with business.

**Key findings from the second interview.**

The need for a social contract to reduce informal employment in Ukraine. The growth of informal employment is caused by dissatisfaction with public services and the level of economic development.

### 2.4.5 Social and Mass Media Data Analysis

A key task of the analysis of media and social networks was to understand how many supporters of the capital outflow tax there are among business and government.

Among businesses, the majority of analyzed authors support the introduction of an exit capital tax. Among the government, former President Poroshenko and current President Zelenskyy supported the launch of an exit capital tax. However, this bill was not adopted in the Verkhovna Rada of Ukraine (Ukrainian parliament|) as of 2023 (Rada, 2018).

## 2.5 Research Ethics

The research was conducted in accordance with the rules of research ethics based on the recommendations of the Norwegian Ethics Committee (NESH, 2021).

During the analysis of social networks, the pages of public bloggers who publish their position on social issues on their page in the social network were used.

All conducted interviews did not include personal data of the participants, therefore there is no need to register in the RETTE system.

# 3. Model Description

The key goal of the model is the analysis of factors affecting informal employment in Ukraine. At the same time, I emphasize economic and behavioral factors. The model includes the following blocks (green variables is part of policies):

**1. Sales and formation of investments in retail in Ukraine.**

The model section includes the calculation of financial statements of all enterprises in retail in Ukraine. Potential policies: changing tax rates or introducing an exit capital tax. Tax reform reduces the tax base and leaves more money for companies.

**2. The budget system of Ukraine**

Calculation of tax payments: corporate tax, income tax and value added tax. The block also includes the formation of state revenues and expenditures of the budget of Ukraine. The block includes the government's policy, which includes investments in companies of the Ukrainian economy.

**3-4. Analysis of factors affecting informal employment in retail in Ukraine.**

Analysis of the factors of the economic situation, corruption, social and reputation factors.

1. *Economic factors are based on the first block of the model and inputs.*
2. *Social factors are based on the second model section.*
3. *Corruption factors include the second section of the model and input data (the number of court decisions, business inspections, digitization, etc.). Also, includes data from the first section of the model (inflation, salary, and sales).*

**4. Informal employment in Ukraine.**

Informal employment and total employment in retail includes a combination of factors from the third and fourth sections of the model. The block also includes the calculation of potential employment for retail in Ukraine.

**5. Formation of the business climate on the market in Ukraine.**

Using the social and economic factors from the previous blocks, the indicator of the business climate in Ukraine was calculated.

## 3.1 Dynamic Hypotheses

The model uses assumptions to describe the relationships between factors and the impact on informal employment.

The following hypotheses were also used:

1. Reducing the tax burden will stimulate business to invest funds.
2. Combining all social and economic conditions will reduce informal employment.
3. Investment growth will stimulate sales growth.
4. The increase in tax revenues will allow the government to spend more money on social policy and ensuring the activities of government institutions.

## 3.2 Causal-Loop Diagram Analysis

The diagram includes the system of public investments in Ukraine. The budget of Ukraine consists of tax and non-tax revenues. The main taxes in Ukraine are income tax, corporate tax and value added tax. Other taxes are not included in the model as separate variables, but all revenues are taken into account in the total budget receipts.

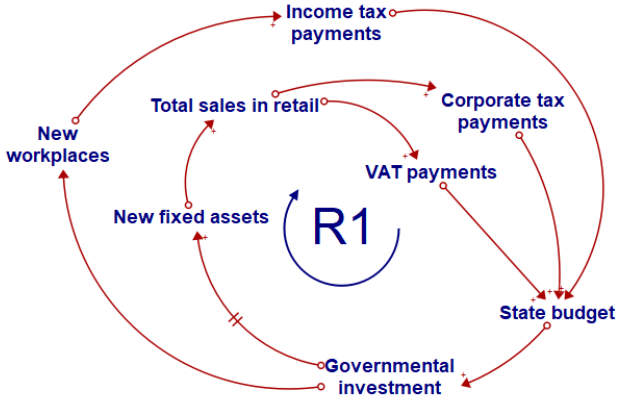


**Figure 3. State investment (CLD).**

The increase in government revenues allows the government to spend more money on investments to create jobs in the economy (Figure 3). The government also invests in the assets of private and state-owned companies. Obsolescence of fixed assets is one of the biggest problems of Ukrainian business (Kukhta, 2020).

Increased investment in the economy allows for an increase in employment (which leads to an increase in income tax) and an increase in company revenues (increase in value added tax and income tax). The increase in taxes increases the size of the Ukrainian budget, which allows the government to continue investing in the economy.

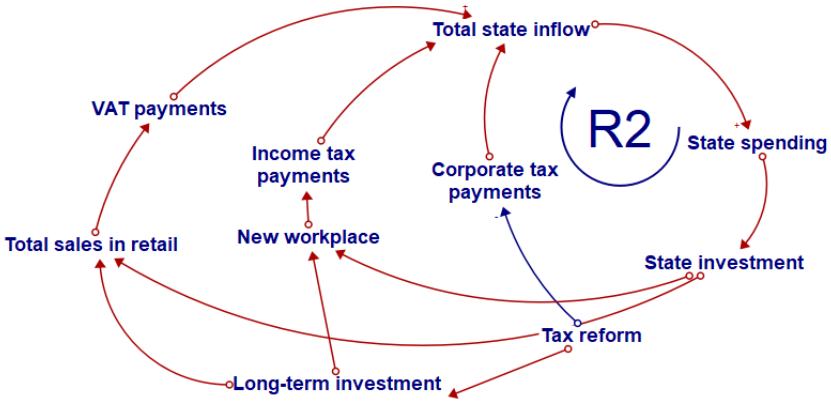


**Figure 4. Private investment (CLD).**

The company's sales, workforce, and income from tax revenues for the Ukrainian budget. In addition to state investments, companies invest their funds in their development.

In the model, the emphasis is on investment in fixed assets. Figure 4 shows how the tax reform (an exit capital tax) affects tax revenues. The reform has a negative effect on corporate tax revenues, but with a certain lag, the reform affects corporate investment, which leads to an increase in value added tax and income tax revenues.

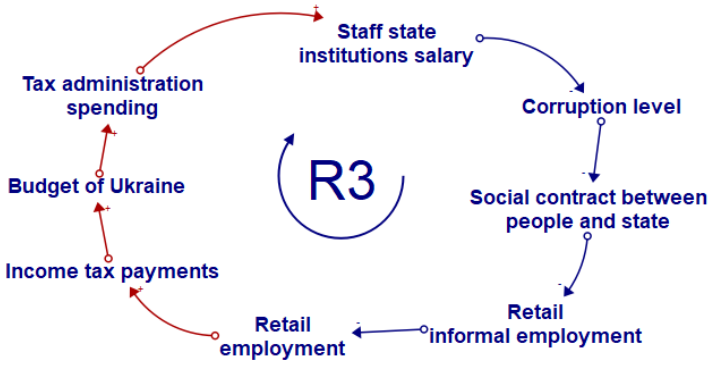


**Figure 5. Staff salaries and corruption level (CLD).**

One of the important reasons for corruption is the low wages of employees of state institutions (U4, 2009). The model shows the wage gap between employees in retail and employees of state institutions. The growing gap has a negative impact on the level of corruption, which leads to the depreciation of the social contract between the population and the government. The growth of corruption has a negative impact on the level of compliance with tax legislation (Uslaner, 2010). Consequently, the growth of corruption negatively affects informal employment (Figure 5).

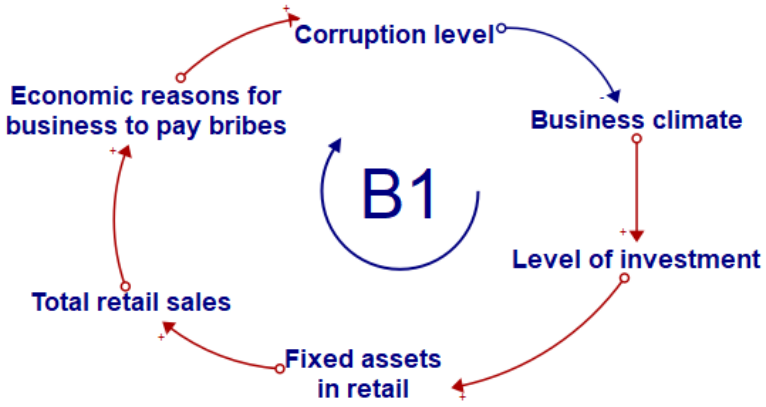


**Figure 6. Bribes and corruption (CLD).**

Macroeconomic stability, including inflation, affects real company revenues and employee wages. High inflation rates can increase economic instability in the country. The most

vulnerable group for corruption, in this case, are small companies and citizens with low incomes. Falling incomes increase the willingness to pay bribes to state institutions (Figure 6). Negative economic conditions encourage economic participants to use bribery as a means of survival (Nel, 2019).

The growth of corruption has a negative effect on the business climate, which has a negative effect on the investment of companies (the fifth block of the model).

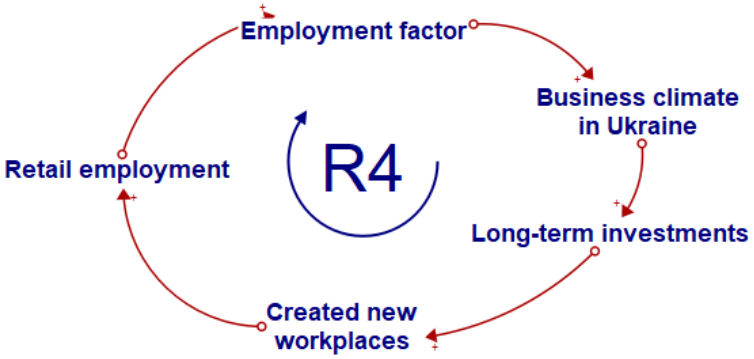


**Figure 7. Employment factor (CLD).**

The high level of unemployment has a negative impact on the business climate in Ukraine. Therefore, the growth of employment has a positive effect on the business climate, the business climate affects investments. Investments improve the business climate in the market (Figure 7), which affects company investments that create new jobs (increased employment).

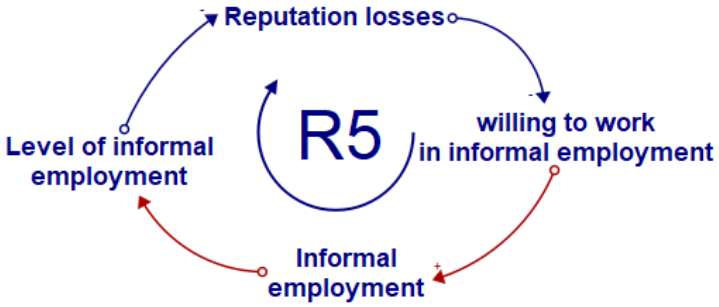


**Figure 8. Reputation losses for employees (CLD).**

Reputational losses affect the decision to work informally and not pay taxes. Population group size reinforces group identity (Saeed et al., 2013). In this model, the selected group is informal employment in retail (Figure 8). Therefore, the growth of informal employment reduces reputational losses for members of this group.

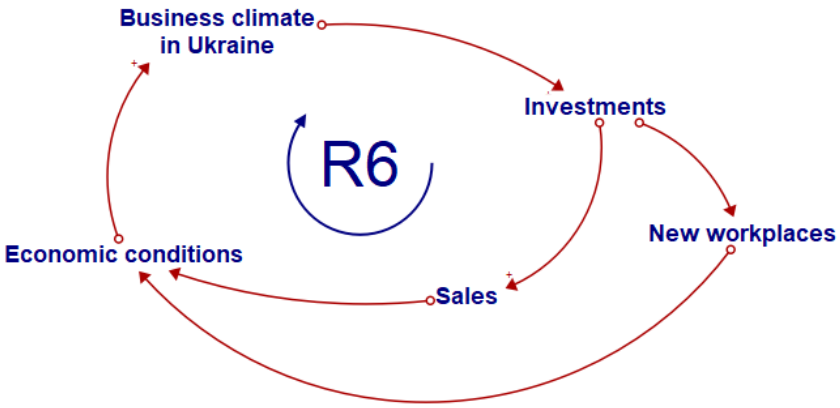


**Figure 9. Economic factors of business climate in Ukraine (CLD).**

Employment and investment affect the business climate (Figure 9), which affects the willingness of companies to invest their funds in capacity development. Factors of inflation, sales growth, introduction of tax reform are also included in the model (the fifth block of the model).

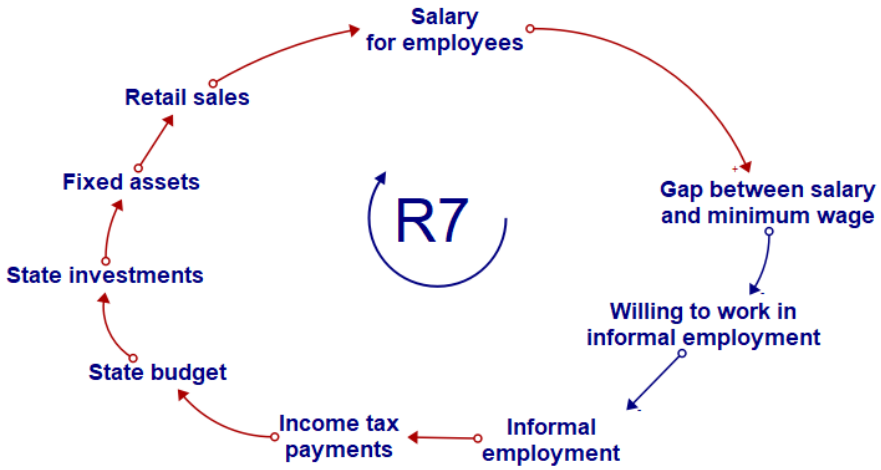


**Figure 10. Minimum wage and informal employment (CLD).**

Wage growth narrows the gap between the minimum wage and the average wage. This causes the growth of formal employment. A sharp increase in wages can cause an increase in informal employment (IMF, 2017).

Accordingly, the growth of informal employment negatively affects the budget of Ukraine, which causes a decrease in investments (Figure 10). The decline in investment is having a negative impact on retail wages.

## 3.3 Model Structure

### 3.3.1 First Block. Exit Capital Tax in Ukraine and Financial Flows in Retail in Ukraine

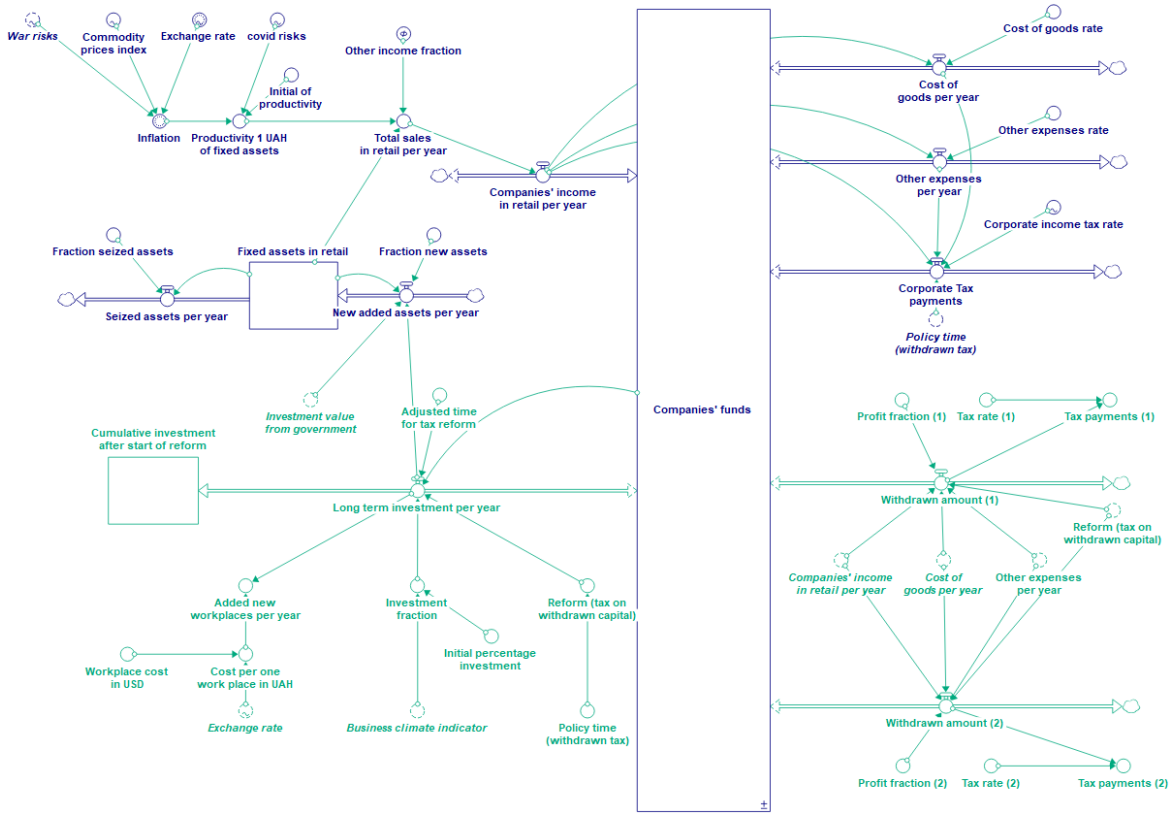


**Figure 11. Retail in Ukraine and exit capital tax reform.**

The main goal of the first block of the model is the reproduction of the retail market in Ukraine. The main element is the company's income, which is formed from the sales of companies on the market. Sales are affected by the availability of fixed assets, labor productivity and other company income. It is worth noting that other revenues include revenues other than the sale of products, based on historical data from 2010-2021 - companies receive an additional 4% not from the sale of goods - this is the provision of related goods and services.

Companies' expenses include costs, taxes, and other expenses. When choosing three elements of costs, the methodology of Ukrstat for collecting information about companies was taken into account. The percentage that calculates the cost price is an exogenous variable - 82% (based on historical data), which is explained by the fact that retail mostly resells goods, rather than manufacturing them. A similar situation is with the percentage, which calculates other expenses of the company.

Today, the income tax for enterprises in Ukraine is 18%, and the tax base is (income-cost-other expenses)*tax rate. For a potential policy, the replacement of income tax with capital outflow tax may occur in the future. According to business representatives, this will encourage businesses to invest in their development, which will increase investment in fixed assets, and this will, accordingly, increase sales of companies on the market (Cherkashin, 2021b).

Investments also create new jobs on the market. The cost of creating one workplace depends on the exchange rate of the national currency, because the cost in dollars is introduced exogenously and is adjusted to the exchange rate of the national currency. The growth of new jobs increases the amount of personal income tax.

**Table 7. Comparison of corporate taxes in Ukraine.**

| Corporate tax | Exit capital tax |
|---|---|
| (Income-cost-other expenses) * tax rate | The amount of funds that the owners of the company decided to withdraw from the company's accounts * the tax rate |
| Therefore, the tax base is the entire profit of the company | Therefore, the tax base is only the amount withdrawn from the company's account. |

After analyzing the proposal of the business community and calculating the effects of this reform on the state budget, I determined the potential percentage of the amount that the business will withdraw from its accounts - (11+23) % of the company's profit. 11% are capital withdrawal operations, 23% are operations equated to capital withdrawal operations.

Therefore, when calculating the impact of the introduction of exit capital tax, a comparison of the change in the tax base was applied (table above).

The volume of investments that companies will invest in their production depends on the amount that companies will have on their accounts (Stock Companies funds) and the business climate in Ukraine (the last block of the model). The starting point for the flow Companies funds are the current assets of the company as of 2010. Investments are directed to the company's fixed assets on the retail market in Ukraine. The growth of fixed assets

without the introduction of an exit capital tax is based on historical analysis - the amount of fixed assets put into operation and the amount of fixed assets withdrawn from operation.

When calculating the sales of companies, the volume of fixed assets and labor productivity are taken into account. Labor productivity is influenced by factors of inflation, military risks, and prices for raw materials in the world.

Also, in the first block of the model, the block of the population of Ukraine and the block of wages in the retail of Ukraine are calculated. The size of the population of Ukraine is influenced by the number of emigrants and immigrants from/to Ukraine. These figures are adjusted for historical data and estimates of the effect of war from 2014 and full-scale invasion and humanitarian crisis from 2022.

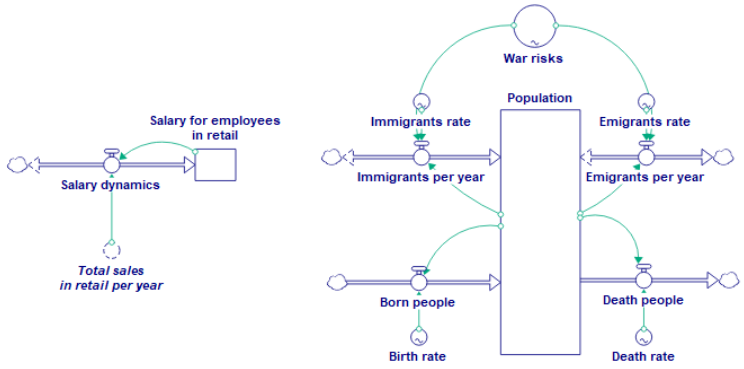


**Figure 12. Population of Ukraine sub-section.**

Birth and death rates in Ukraine have also been added to this block. In recent decades, Ukraine has been characterized by a high emigration of the population, an increase in mortality and a decrease in the birth rate. It is worth noting that the entire population of Ukraine, including the occupied territories of Ukraine - the Autonomous Republic of Crimea, part of Luhansk and Donetsk regions, is assessed in this section.

The size of the population of Ukraine affects the amount of unemployment (because the unemployment rate in this study is fixed) and the number of graduates who start working in the economy after graduation (the fourth block of the model).

The amount of wages in the retail market depends on the growth of sales of companies. I did a historical analysis that showed that companies spend a constant percentage on paying their employees - so in the model I assume that the company's revenue growth is equal to the growth in their employees' wages.

### 3.3.2 Second Block. Budget system in Ukraine. Aspects of Governmental Flows in Ukraine

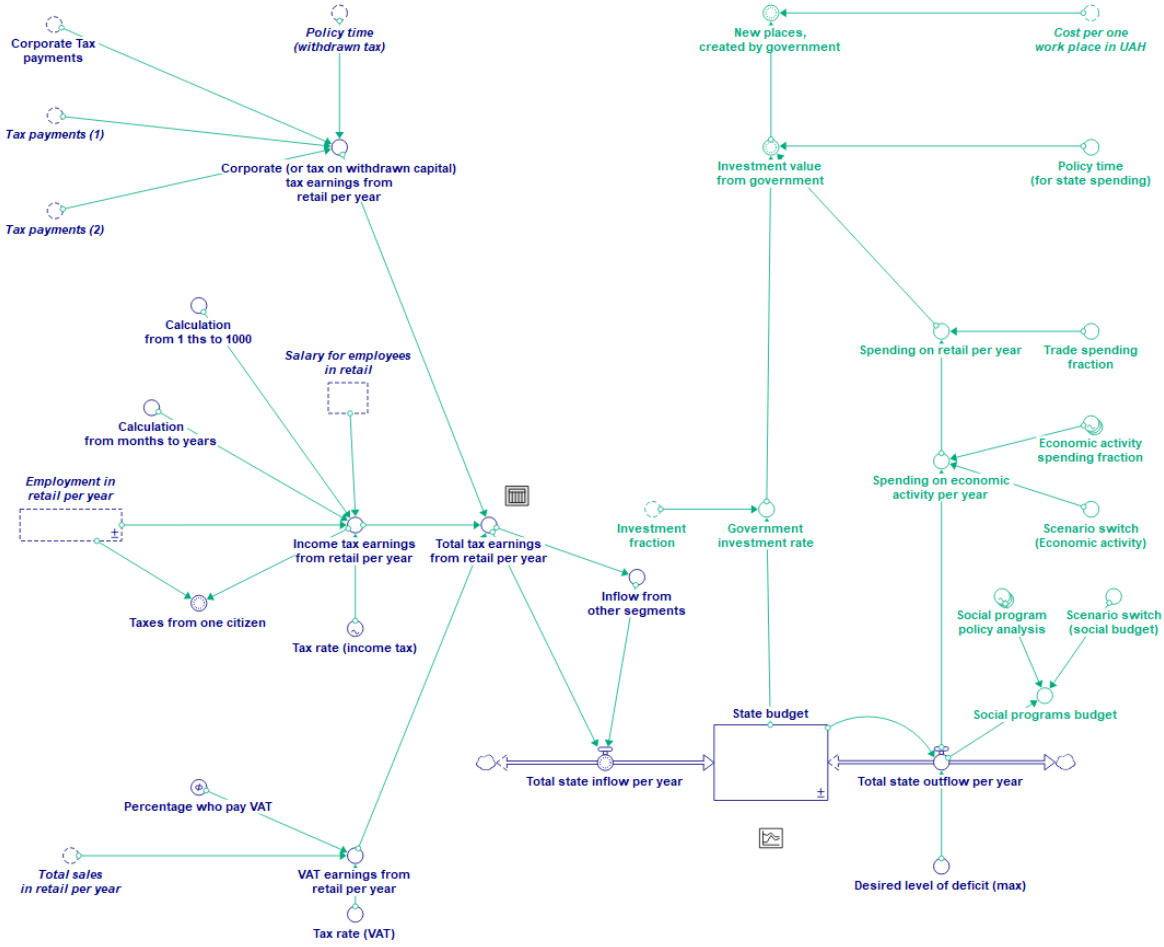


**Figure 13. Budget system in Ukraine.**

When developing this block, I analyzed the budget system of Ukraine to understand exactly which taxes fill the Ukrainian budget and how the expenses of the Ukrainian budget are formed.

The model considers three main taxes: corporate tax (paid by companies), value added tax (paid by companies), personal income tax (paid by employees) (Figure 13). The model does not include contributions to the pension system of Ukraine, which is called the single social contribution, because the analysis of the pension system of Ukraine is not the goal of this study.

Value added tax is calculated as the sum of all sales multiplied by the tax rate of 20% and multiplied by a factor of 0.08. This coefficient shows the share of the sales amount that should be taxed with value added tax in this study. Based on the historical analysis, I concluded that the retail industry has connections with other industries - this means that

some goods sold in retail, but VAT for these goods is paid by other companies from other areas of the economy, which are suppliers of goods and services for retail companies, which subsequently already sell these products on the retail market in Ukraine. Historical value added tax data was calculated by the author using a literature review.

Formation of tax revenues from income tax occurs in the first block of the model. The formation of tax revenues of the personal income tax is formed by multiplying the salary by the tax rate and by employment in the retail of Ukraine. Employment is calculated in the fourth block of the model – informal employment in retail in Ukraine.

In the event of the introduction of an exit capital tax, tax revenues will include exit capital tax, VAT, and personal income tax.

The next step in the model is the formation of the state budget, in the model I assume that revenues from other sectors will grow equally with the retail sector. This is necessary for the calculation of the general budget of Ukraine and construction of state budget expenditures. Revenues in the budget include the following sections: revenues from retail and revenues from other sectors of the economy.

The expenses of the Ukrainian budget include expenses for economic activity, according to the analysis of the methodology of Ukrstat, this section of expenses also includes investments in the economy. About 2% of the total amount for economic activity is invested by the government in the trade segment (which includes wholesale and retail). In the model, I assume that all these funds will be directed to create new jobs, which will increase employment in retail in Ukraine. Government expenses are divided with an emphasis on expenses for economic activity, expenses for the social block (for example, unemployment benefits) and expenses for State Tax Service of Ukraine.

So, this block of the model allows to assess the impact of the tax reform on the reduction of informal employment and on the volume of tax revenues to the Ukrainian budget. The volume of tax revenues allows the government to provide high-quality services to the population and ensure the high-quality functioning of state institutions (the next block of the model).

### 3.3.3 Third Block. Interaction with Government

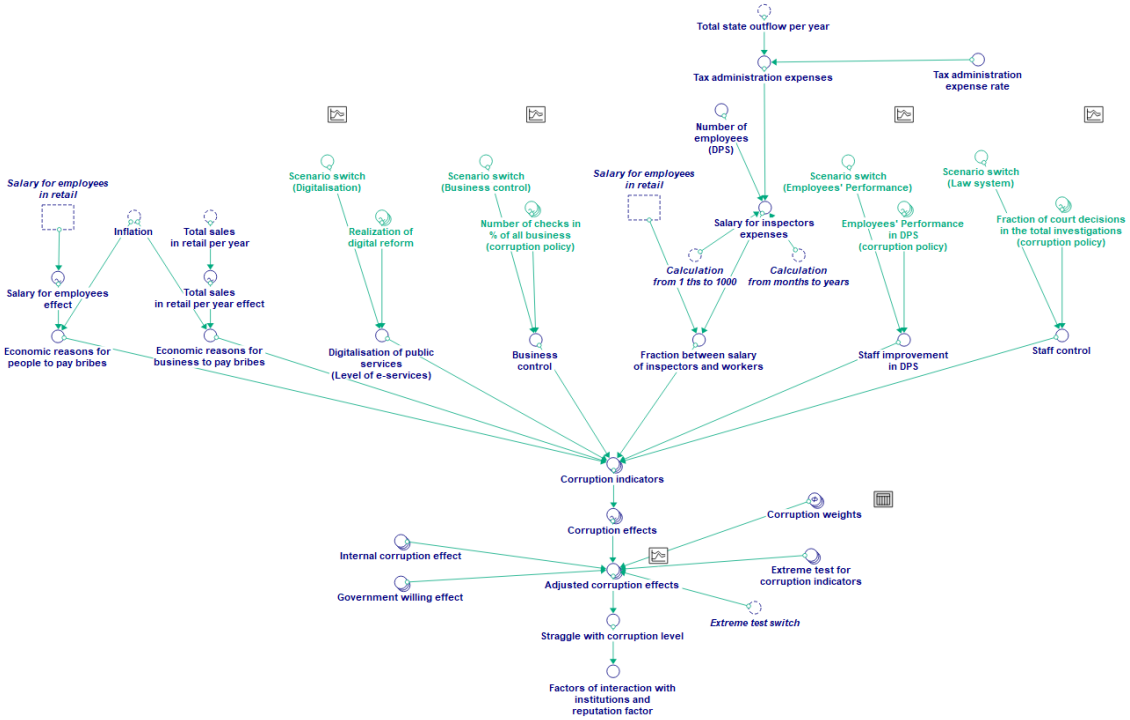


**Figure 14. Institutions block.**

The expenses of the Ukrainian budget form the budget of state institutions, including the State Tax Service of Ukraine, in 2021, the government of Ukraine allocated 0.6% to the budget of this organization. Part of these funds is directed to the salaries of service workers who make decisions about business and the population.

This block of the model calculates the effect of the interaction of business and the population with the state (part of the social contract) (Figure 14).

The formation of the anti-corruption section includes the economic and social causes of corruption.

The economic causes of corruption include the willingness of businesses to pay bribes, the willingness of the public to pay bribes, and the willingness of tax officials to offer bribes.

I assume that if the population faces economic hardships, this positively affects the willingness of the population to pay bribes. To measure the economic situation, wage growth rates and inflation indicators are used. When the prices of products rise faster than the wages of workers, this negatively affects the purchasing power of the population and reduces the real income of the population, which encourages the population to pay bribes to solve tax

issues. The situation is similar with the willingness of businesses to pay bribes - if inflation grows faster than sales, this negatively affects the real income of the business.

The increasing willingness of tax service representatives to offer bribes is determined by the ratio of wages of tax service employees and employees in the retail market. My guess is that if a tax representative's salary is lower than the market average, then the representative is more prone to bribes.

Social factors determining the level of corruption include improving the quality of tax service personnel, digitizing services, fighting corruption (law enforcement agencies) and reducing pressure on business (business inspections). In Ukraine, a large number of businesses complain about the large number of audits from tax authorities, which negatively affects the business environment in Ukraine. Increasing the number of inspections (pressure on business) could have the opposite effect that the government wants. This leads to an increase in corruption and the amount of bribes in the tax system of Ukraine.

Improving the quality of personnel has a positive effect on the quality of service provision, which negatively affects the level of corruption in state institutions. Digitalization allows to reduce the level of corruption and reduce discretion in making decisions regarding business and the population. One of the main factors of corruption is the fight against corruption - several anti-corruption institutes have been created in Ukraine. The efficiency of these institutions allows to reduce of corruption.

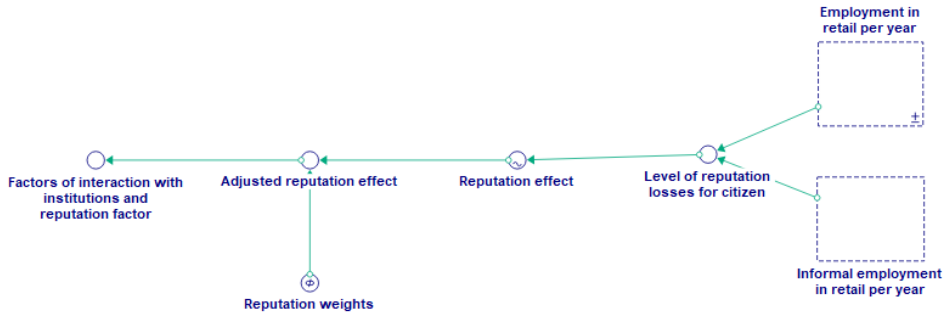


**Figure 15. Reputation factor of informal employment.**

An increase in the size of informal employment has a negative effect on reputational losses for an informal worker (the effect occurs through the effect adjusted for the weight of the factor).

### 3.3.4 Fourth Block. Business Climate Analysis

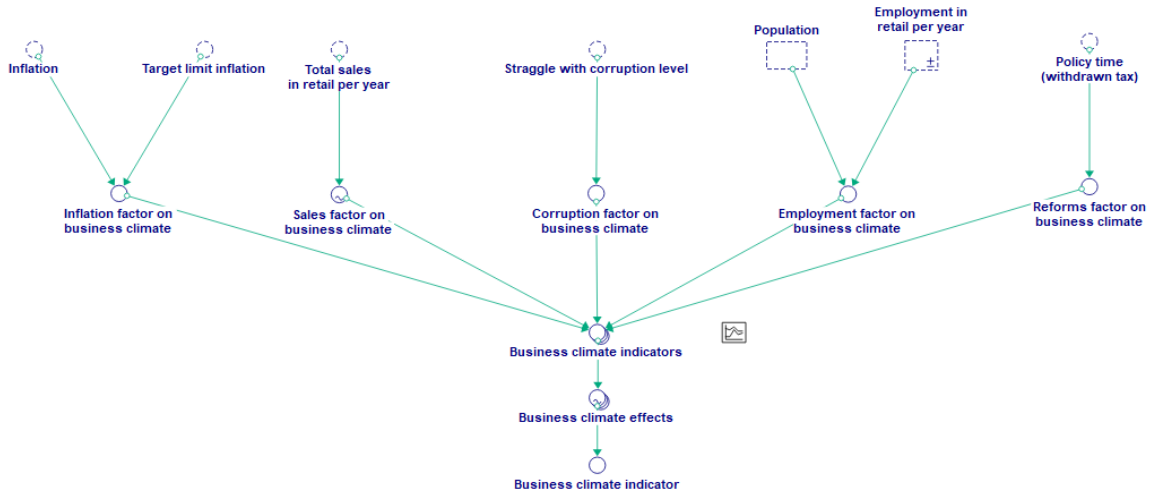


**Figure 16. Business climate in Ukraine.**

The business climate shapes the desire of businesses to invest in their production. The business climate in the study is determined by social and economic factors (Figure 16).

Economic factors include the dynamics of inflation and the dynamics of retail market development. The increase in sales has a positive effect on the business climate in Ukraine. This is due to the increase in positive business expectations regarding the development of the Ukrainian economy.

The inflation factor negatively affects the business climate in Ukraine. During 2014-2015 and 2022-2023, the highest inflation rates in recent decades were recorded. This is caused by the start of the war and the occupation of Ukrainian territories. To determine the impact of inflation, the gap between inflation and the targeted level of inflation was used. The targeted level of inflation is determined by the National Bank of Ukraine. Achieving the targeted level of inflation is one of the main policies of the national bank (NBU, 2023).

Among the social factors affecting the business climate is the level of employment, the fight against corruption and the introduction of reforms (exit capital tax).

The growth of employment has a positive effect on the level of well-being of the population, which has a positive effect on the business climate in Ukraine. The fight against corruption makes it easier for companies to do business.

The calculation of the general indicator of the business climate in Ukraine includes the use of effects for each factor.

### 3.3.5 Fifth Block. Informal Employment. Social and Economic Factors Analysis

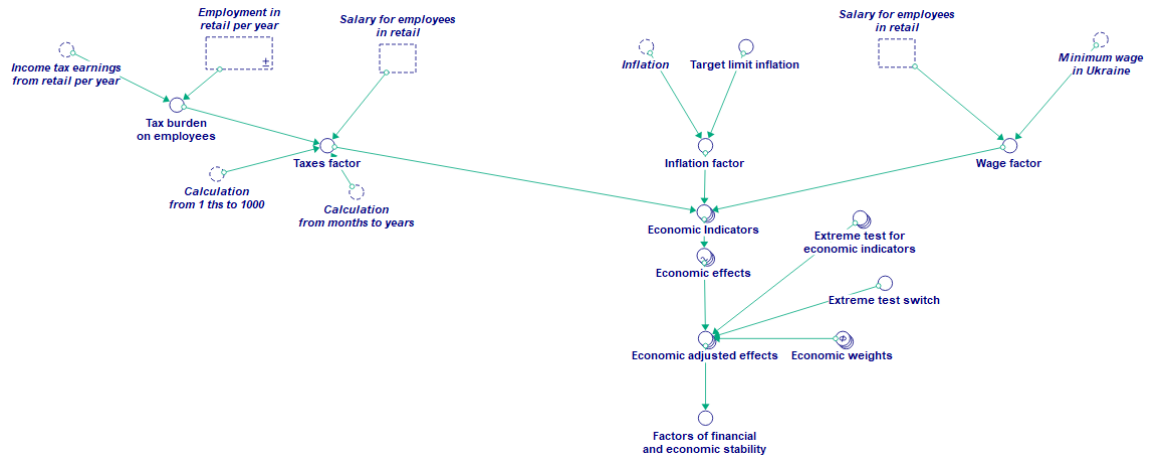


**Figure 17. Informal employment block in Ukraine.**

This block includes the calculation of economic factors (Figure 17) on informal employment and the impact of the government's social policy on informal employment. Factors from the block of interaction with the government and the reputation factor are also included.

Summing up all influencing factors allows to determine the share of people who will move to the formal economy in retail in Ukraine. Each factor was previously multiplied by the weight of each factor (more details about the effects can be viewed in the appendix at the end of the document).

The calculation of the weight of each factor is based on a literature review and model calibration. During model calibration, weights for each factor were chosen to show results that reflect historical data.

I assume that the satisfaction of all factors (their maximum value) will cause informal employment to decrease to zero. Also, if all factors are maximally negative, then the entire employed population will move to the shadow sector.

Also, this block includes employment in retail and the potential labor force that can go into employment. The block of economic factors includes the factor of inflation, tax burden and gap between minimum and average wages (Figure 17).

The social system of Ukraine affects informal employment through the chain of assistance to the unemployed - coverage of the unemployed - the quality of social policy - the quality of the social contract between the population and the government (Figure 18).

The impact of the government's policy on the unemployed on the quality of social policy occurs through the effect. I assume that if all the unemployed receive public assistance and the value of social policy reaches a maximum value of one. After that, the indicator is multiplied by the weight of the social policy factor.

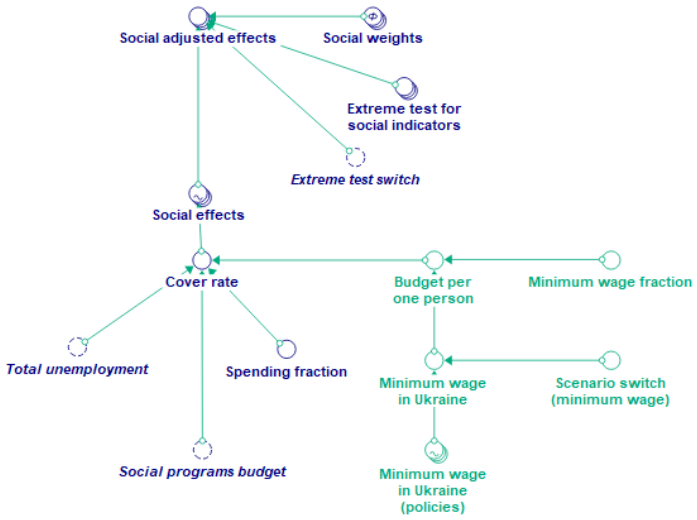


**Figure 18. Social system factor.**

The economic factor (Figure 17), the interaction factor with the government (Figure 14), and the social factor (Figure 18) determine the share of people who will move from informal employment to formal employment. The calculation takes place by adding all factors to the sum of the weights.

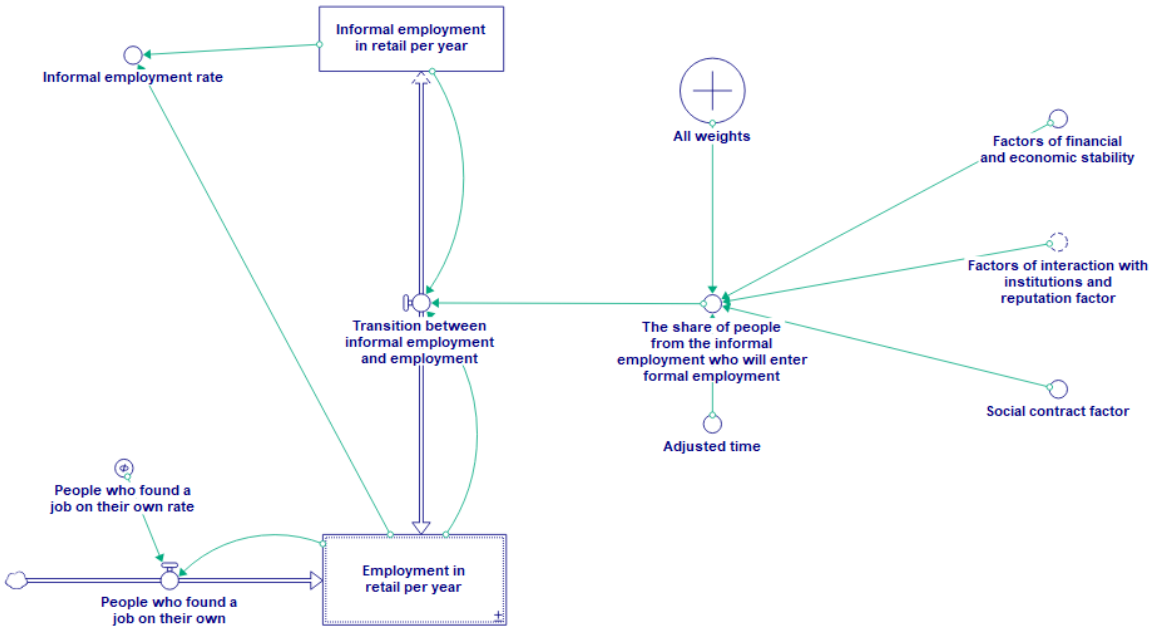


**Figure 19. Informal employment and employment block.**

Also, the model includes the number of people who independently found work in retail. Employment also includes the flows of fired and hired workers (Figure 20).

The employment transition rate includes three components: new jobs created (government), new jobs created (business), and people helped by the government to find work. The number of people the government helped find work is an exogenous variable and is based on historical data.

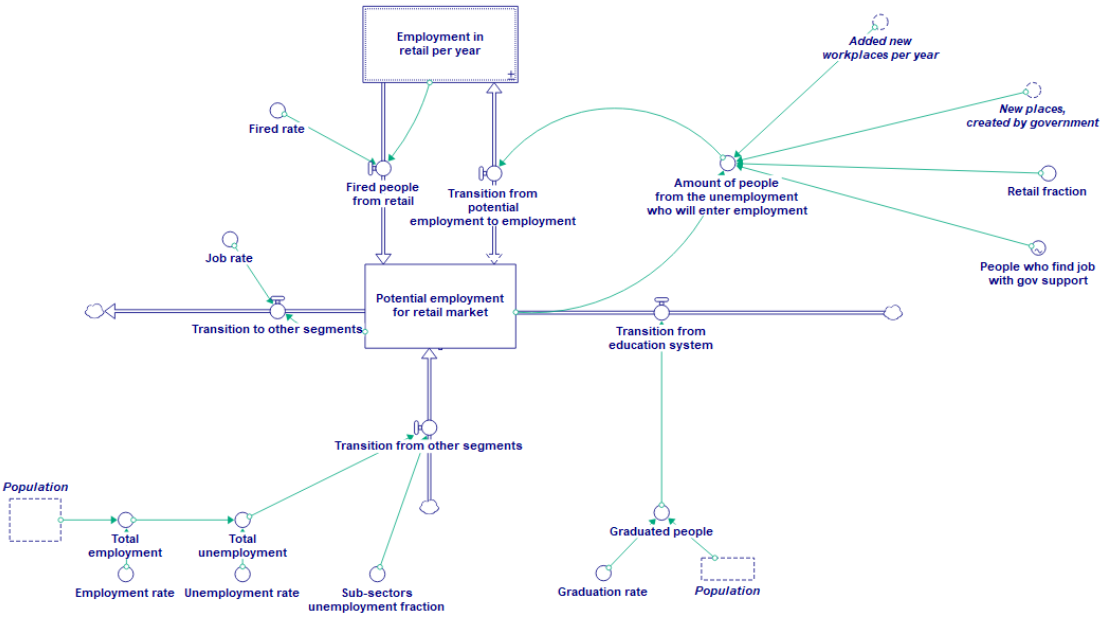


**Figure 20. Potential employment and employment block.**

The number of retail layoffs shows the number of people moving into potential employment.

Potential employment includes people who have completed their studies, the number of unemployed people in the entire trade sector of Ukraine. There is also an outflow of people who find work in other sectors of the Ukrainian economy.

## 3.4 Model Boundary

The main variables in the model are calculated during simulations and are not exogenous variables. Exogenous changes include shares, elements of anti-corruption policy (Table 8).

**Table 8. Variables comparison.**

| Excluded variables | Exogenous variables | Endogenous variables |
|---|---|---|
| Single tax | Commodity price | Sales |
| Single social contribution from the income of individuals | Exchange rate | Taxes |
| Credit system in Ukraine | Workplace cost | Spending |
| | Spending fractions | Factors of informal employment |
| | Anti-corruption indicators | Informal employment |
| | Minimum wage | Employment |
| | Target inflation | Population |
| | Weights | |

# 4. Model Validation and Testing

Model validation includes calibration, sensitivity analysis, and model testing using various methods.

Validation also includes verification of causal relationships based on interviews and literature review.

## 4.1 Model Calibration

The main model variables were calibrated so that the model data were realistic and replicated historical dynamics.

The calibration was based on the calibration methodology of the Stella Architect developers. During the calibration, emphasis was placed on the tax block, the block of informal employment and the activities of companies in the retail market in Ukraine.

## 4.2 Integration Error Tests

The model horizon from 2010 to 2035 was selected for model construction. The year 2010 allows covering a sufficient period of data, including the years 2010-2013, before the start of the war and the occupation of the territories.

Until 2035 allows covering a sufficient period of time to assess the effects of tax changes and reforms.

## 4.3 Unit Model Test

All variables in the model have their units of measurement, which coincide with real units of measurement. For some variables, additional converters have been created that convert thousands to units.

## 4.4 Parameter Model Test

Testing of the main parameters was carried out in comparison with historical data of 2010-2021. This is done for the model data to match the data generated by the model.

But it is worth noting that the correspondence to historical data is a weak argument for the validity of the model, the more important factor is the reflection of the behavior of the model (Langarudi & Radzicki, 2013).

## 4.5 Behavior Reproduction Tests

The simulation results demonstrate that the model represents the behavior of the main model variables. The model reflects the growth of informal employment in retail in 2014-2015,

albeit with a certain lag. The validation section describes testing using methods of unequal statistics.

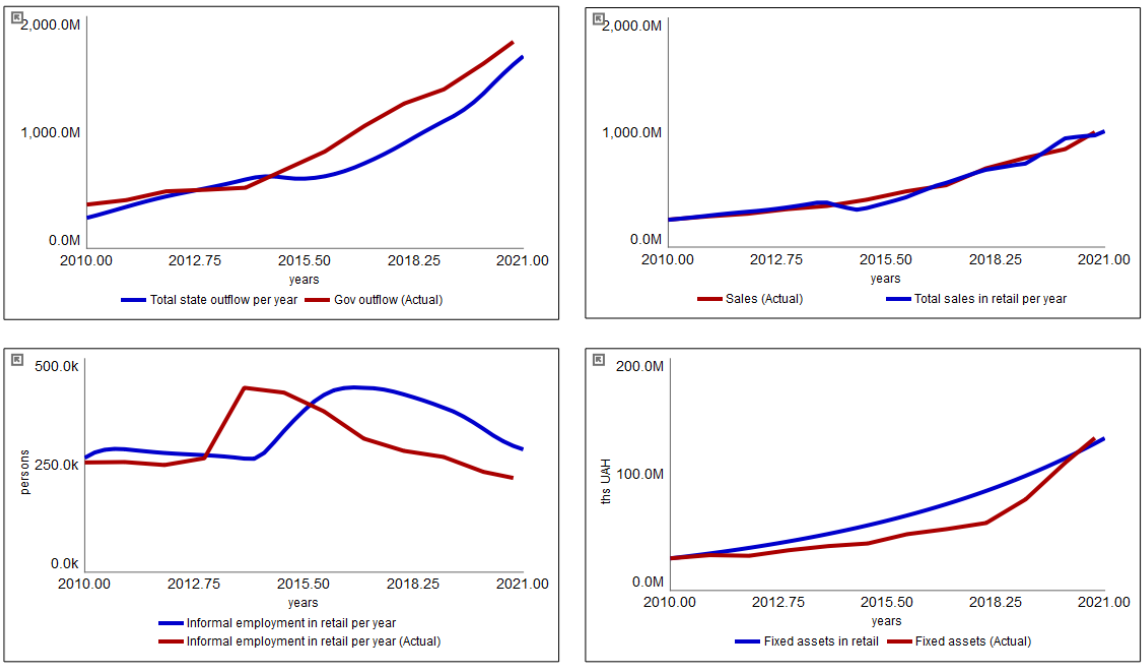


**Figure 21. History and simulated datasets.**

The costs, revenues and assets of the company reproduce the trend of historical data (Figure 21). Regarding the effect of the economic crisis of 2014-2015, the model reflects a drop in sales and business costs, but this is because labor productivity in the model depends on inflation.

So, I re-verified the data using methods of inequality statistics.

Also, the main variables were tested using methods of inequality statistics. The results of testing the main variables are shown in the table below.

**Table 9. Statistics analysis of main variables**

| | Total sales in retail per year | Employment in retail per year | Informal employment in retail per year | Total state inflow per year | Income tax earnings from retail per year |
|---|---|---|---|---|---|
| U | 0.085 | 0.089 | 0.295 | 0.173 | 0.169 |
| Um | 0.000 | 0.061 | 0.103 | 0.310 | 0.128 |
| Us | 0.056 | 0.062 | 0.003 | 0.054 | 0.002 |
| Uc | 0.944 | 0.877 | 0.894 | 0.636 | 0.870 |

Testing with methods of inequality statistics shows that the main variables reproduce the historical dynamics of the data (Table 9). Uc has the largest value among all U, demonstrating that the model reflects the behavior of the main variables.

Tax block variables showing high Um were also tested. This may be due to the following reasons, which cannot be taken into account in the model.

Calculations of historical VAT data are based on a combination of a literature review and the application of a coefficient to convert the indicator of all trade (which is published by the state tax service, and which is available in the literature) to the indicator of only retail.

Calculations of historical income tax data are based on multiples of the profits of all companies in the market by the tax rate, but the model does not take into account that companies understate their profits to avoid paying taxes. In case of losses, the company does not pay income tax.

But despite this, it is worth noting that the tests of all inputs show a high level of Uc, which demonstrates that the model reflects the behavior of the system (Sterman, 1983).

## 4.6 Extreme Conditions Model Test

For this test, I chose the maximum values for the input variables. Testing of the maximum values for factors influencing informal employment was also carried out, for this purpose an additional array was created, which allows checking the behavior of the model at the maximum values of factors influencing informal employment (Figure 22).

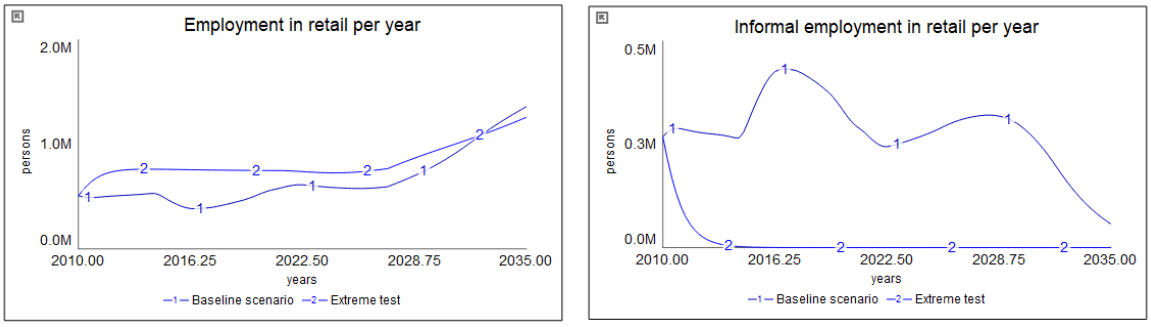


**Figure 22. Results of extreme test.**

## 4.7 Structural Model Test

The structure of the model was verified during interviews and literature review. All blocks are logically connected and have causal relationships in the model.

## 4.8 Sensitivity Model Testing

Sensitivity analysis allows to increase confidence in the model and choose the optimal parameters for the model that most closely match the real world (Breierova & Choudhari, 2001).

I tested each block of the model and examined the effect of changing the variables on the main variables of the model. The entire list of sets of sensitivity analyzes is given in the system dynamics model. The variables tested are listed in Table 10.

### 4.8.1 Sales and Investment

First, a change in the initial share that companies will invest in their production and the cost of creating one job in the retail market was tested.

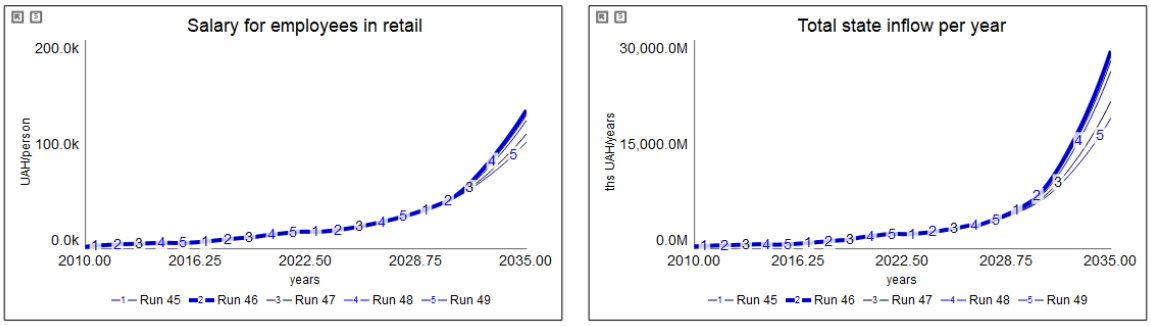


**Figure 23. Salary and total state inflow sensitivity analysis.**

The results of the sensitivity analysis show that the level of sales, wages and income of the company are weakly sensitive to changes in the cost of the workplace and the size of investments (Figure 23). This is because when the cost of a job changes, companies will still spend only a certain part on new jobs, that is, the increase in the cost will reduce the number of jobs created.

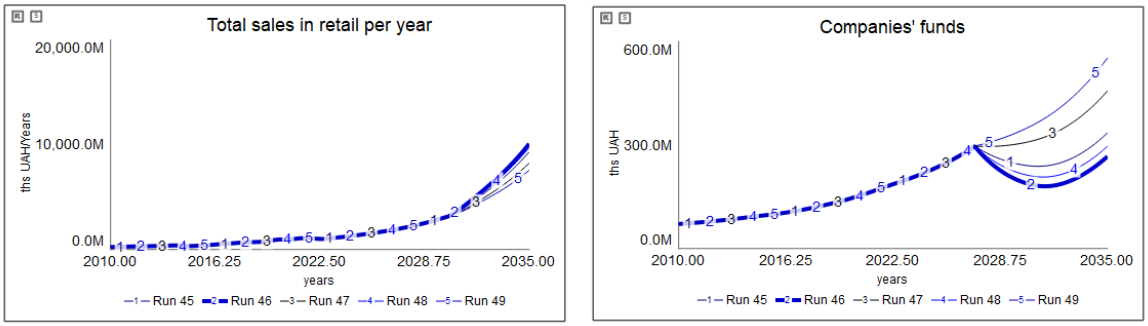


**Figure 24. Total sales and companies' funds sensitivity analysis.**

But the level of the company's funds is sensitive to changes in investment indicators and workplace costs (Figure 24).

This is primarily because the investments come from the company's funds. The model in this study considers only the investments made by the company.

### 4.8.2 Tax Payments from Retail Market

Analysis of changes in tax rates will allow to assess the effect on tax revenues and the amount of informal employment in Ukraine.

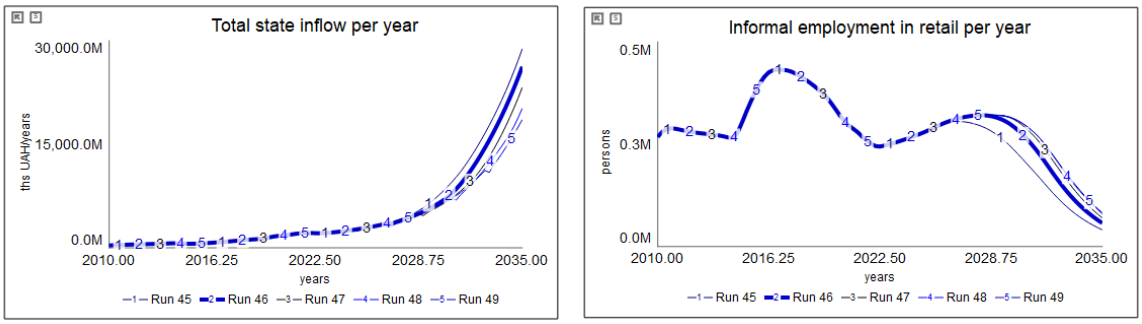


**Figure 25. Total state inflow and informal employment.**

Informal employment is sensitive to changes in tax rates (Figure 25). An increase in rates will lead to an increase in tax revenues in the event of the introduction of an exit capital tax.

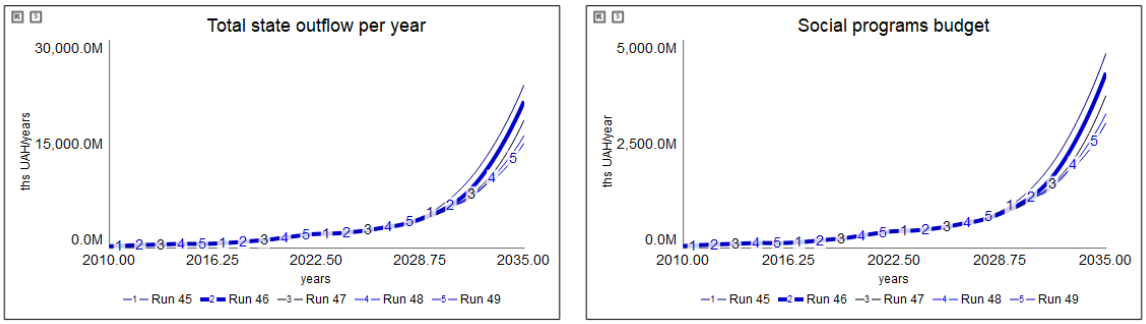


**Figure 26. Total state outflow and social programs budget.**

But it also has a negative impact on informal employment. This is due to the increase in business costs, and therefore staff costs and the willingness of businesses to pay bribes will increase. An increase in rates has a positive effect on tax revenues for the government (Figure 26).

### 4.8.3 State Spending

To analyze government spending, an analysis of the shares that the government spends on economic activity and on retail was used.

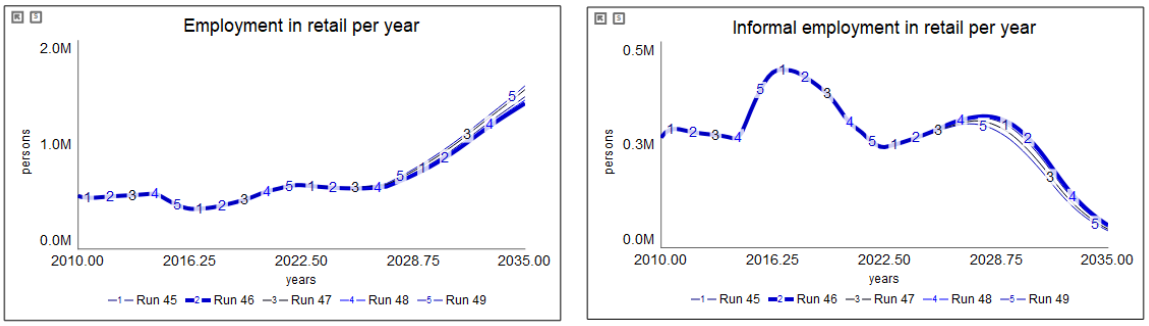


**Figure 27. Employment block sensitivity results (spending testing).**

An increase in government spending on retail will lead to an increase in tax revenue through increased retail employment.

But at the same time, indicators of informal employment are weakly sensitive to changes in government spending on trade (Figure 27).

### 4.8.4 Informal Employment

In the last sensitivity analysis, I took indicators from different blocks to demonstrate the overall effect on informal employment in retail in Ukraine.

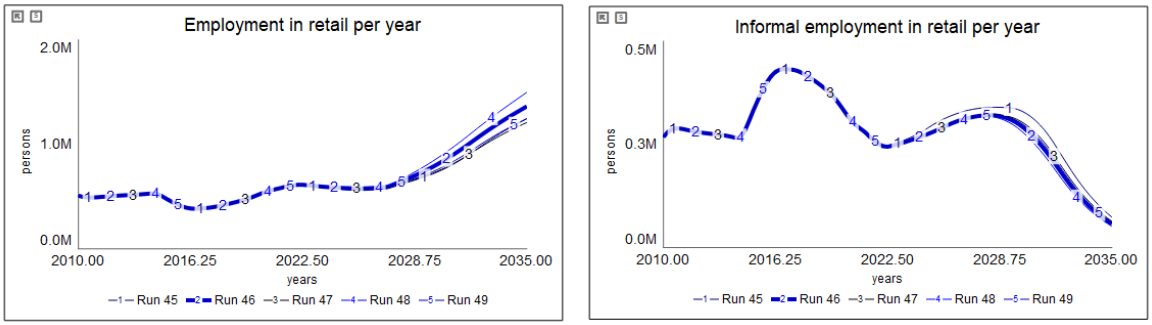


**Figure 28. Employment block sensitivity results.**

The increase in government spending on the tax system and the increase in the tax burden have a negative impact on informal employment in Ukraine. This impact is most negative during the peak values of informal employment (Figure 28).

**Table 10. Sensitivity analysis variables.**

| | | **Analysis variables** |
|---|---|---|
| **1** | **Variable** | Cost of workplace, initial investment |
| | **Range** | 20, 30, 40, 50, 60 (ths USD), 0-0.7 (%) |
| | **Type of distribution** | Ad-hoc, Uniform |
| | | |

| | | |
|---|---|---|
| **2** | **Variable** | Policy time, tax rate (1), tax rate (2) |
| | **Range** | 2025, 2027, 2029, 2031, 2033 years<br>0.1-0.4 (%), 0.1-0.4 (%) |
| | **Type of distribution** | Ad-hoc, Uniform |
| | | |
| **3** | **Variable** | Trade spending fraction |
| | **Range** | 0 – 0.2 (%) |
| | **Type of distribution** | Uniform |
| | | |
| **4** | **Variable** | Tax rate VAT, Tax administration rate, Workplace cost in USD |
| | **Range** | 0-1 (%), 0-0.2 (%), 10-50 (ths USD) |
| | **Type of distribution** | Uniform |

# 5. Model Behavior and Results

## 5.1 Retail in Ukraine

The base scenario demonstrates the growth of sales of companies and the further decrease of the population of Ukraine (Figure 29.A and 29.B). The reasons for the increase in sales are the increase in investment in fixed assets, which allows companies to increase their sales.

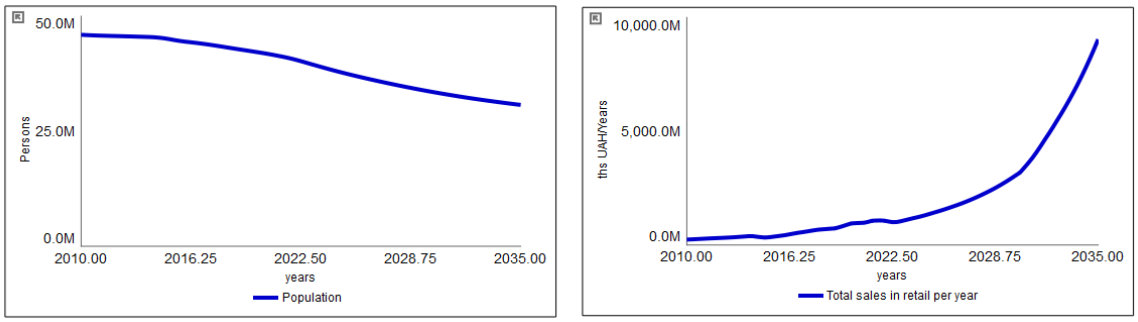


**Figure 29. Population (A) and total sales in retail (B).**

One of the factors that will stimulate sales growth is the gradual growth of fixed assets (the growth rate of new assets is higher than the rate of written off assets).

Among the reasons for the decrease in the population of Ukraine are high mortality, low birth rate and the continuation of the war, which caused the largest humanitarian crisis in Europe after the end of the Second World War.

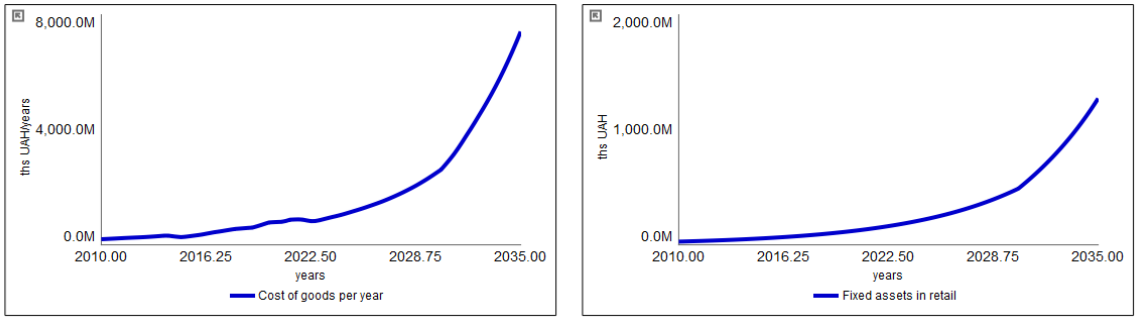


**Figure 30. Cost of goods (A) and fixed assets (B) in retail.**

The dynamics of the cost price and the cost of fixed assets of companies on the market also repeats the dynamics of sales of companies in the retail of Ukraine (Figure 30). Cost growth is driven by sales growth (cost costs are fixed in the model). During 2010-2021, company revenues increased 4.4 times (in national currency).

## 5.2 Budget and Tax Systems

In the baseline scenario, government revenues and expenditures will grow until 2035 (Figure 31). At the same time, the budget will continue to have a budget deficit.

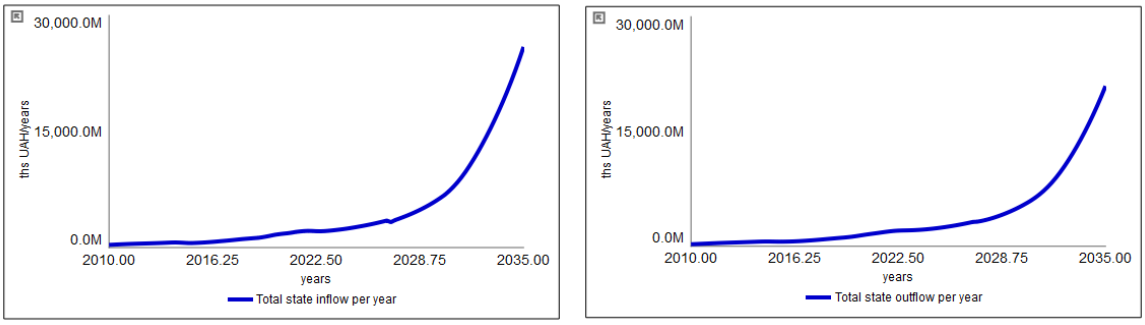


**Figure 31. State inflow (A) and outflow (B).**

Income growth increases the government's ability to provide quality services to the population: social policy, provision of services for the population, investments in the development of Ukrainian enterprises, etc. The base scenario does not include the introduction of an exit capital tax, and the scenario also includes the base scenario for all policies (the model presents five levels of each scenario).

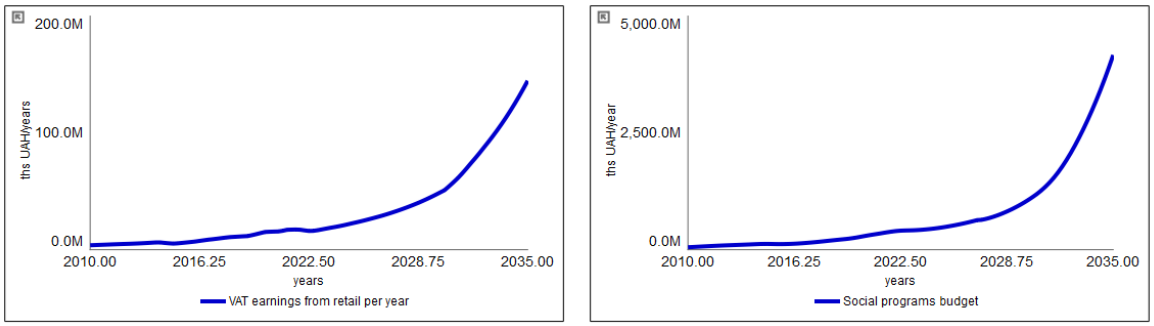


**Figure 32. VAT earning (A) and social program budget (B).**

The increase in budget revenues also allows the government to spend more money on helping the population during rising unemployment (Figure 32), which increases the quality of the social policy factor. The growth of budget revenues in the base scenario is provided by the following channels (Table 11):

| Income tax | Corporate tax | VAT |
|---|---|---|
| Employment ↑ | Sales ↑ | Sales ↑ |
| Salary ↑ | Fixed assets ↑ | Fixed assets ↑ |
| Informal employment ↓ | Investment ↑ | Investment ↑ |

**Table 11. Base scenario analysis.**

The basic scenario is confirmed by the fact that Ukrainian business gradually adapts to the war and changes its activities to increase its sales.

## 5.3 Informal Employment

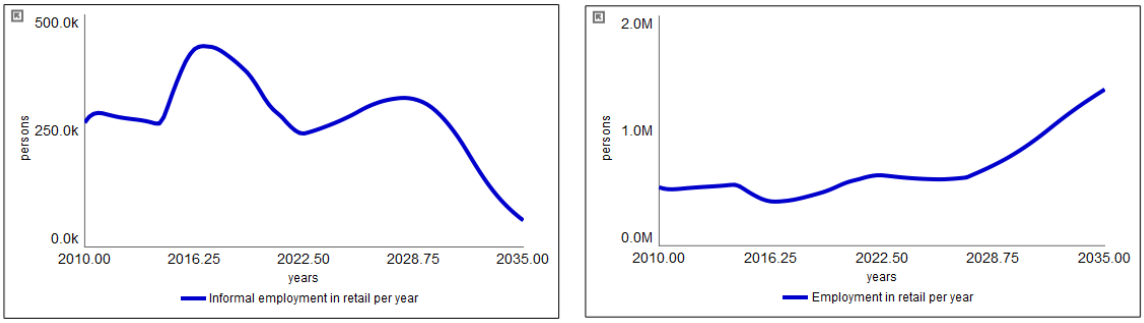


**Figure 33. Employment (A) and informal employment (B) dynamics.**

The growth of informal employment during 2014-2015 is caused by the deterioration of economic conditions in Ukraine (Figure 33). Population decline and mass emigration of the population are negative factors affecting the decline in employment in retail in Ukraine (Figure 33B).

The baseline scenario includes employment growth due to improved economic conditions and an increase in the quality of public institutions. (Figure 33B) In the scenarios, I assume that social policies, anti-corruption policies will be continued at the same pace as today.

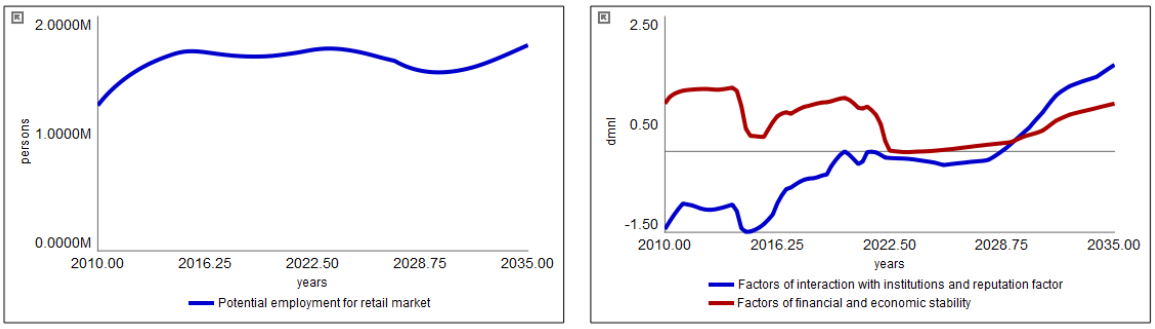


**Figure 34. Potential employment (A) and factors of informal employment (B).**

At the same time, potential employment for retail in Ukraine will grow during 2010-2035 (Figure 34).

## 5.4 Key Findings of Simulation Results

The simulation results reproduce the behavior of past periods and allow to assess the effectiveness of the government's tax and social policy.

Also, the results make it possible to assess the influence of social, behavioral, and economic factors on informal employment in retail in Ukraine.

So, the first block of the model forms the economic situation in Ukraine and the retail market in Ukraine.

The second block of the model includes the calculation of public finances, which allows to assess the government's ability to provide quality services and ensure the activities of government institutions.

Based on the first block, the influence of economic factors on informal employment is calculated in the fourth part of the model.

Based on the third block, the fourth block of the model calculates the impact of interaction factors with state institutions (corruption, bribery, reputational risks).

Also, the fourth block of the model includes the calculation of the influence of the government's social policy on informal employment in retail in Ukraine.

Modeling results show that government spending and revenue will continue to grow. This will improve the quality of public services and ensure the government's activities.

Informal employment tends to decrease, which is due to the improvement of government efficiency and the gradual recovery of the Ukrainian economy. But despite this, it is worth noting the growth of informal employment during 2014-2016, the growth was caused by the economic crisis in Ukraine and the specifics of retail (retail requires less qualified labor than technological sectors of the economy).

# 6. Policy Analysis

Some elements of sensitivity analysis were used to analyze the effects of policy implementation. The Ad-hoc method includes manual data selection, I chose the periods of policy implementation (exit capital tax) and the implementation of a certain scenario of each policy (Table 12). Detailed graphs and changeable variables I systemize in Sensitivity analysis window in Stella Architect.

**Table 12. Scenario list.**

| Tax policy | Spending policy | Anti-corruption policy | Wage policy |
|---|---|---|---|
| Tax reform 2024 | Highly pessimistic scenario (spending policy) | Highly pessimistic scenario | Highly pessimistic scenario (wage policy) |
| Tax reform 2026 | Pessimistic scenario (spending policy) | Base scenario | Pessimistic scenario (wage policy) |
| Tax reform 2028 | Base scenario (spending policy) | Highly optimistic scenario | Base scenario (wage policy) |
| Tax reform 2030 | Optimistic scenario (spending policy) | | Optimistic scenario (wage policy) |
| Tax reform 2032 | Highly optimistic scenario (spending policy) | | Highly optimistic scenario (wage policy) |
| Without reform | | | |

I defined the scenarios based on my assumptions about the development of the sectors of the model.

## 6.1 Exit Capital Tax

The introduction of an exit capital tax is a potential policy of the government in the tax sphere. Supporters of the reform claim that the introduction of an exit capital tax will lead to decrease of informal economy and the growth of investments in the economy.

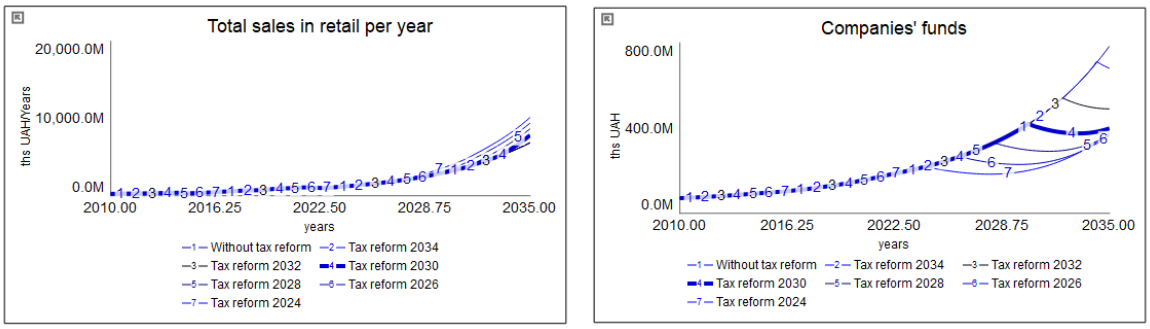


**Figure 35. Total sales in retail and companies' funds (exit capital tax policy).**

I compared different scenarios for the introduction of an exit capital tax (Figure 35). The analysis considered six scenarios based on the launch date of the new tax. The graph below shows the growth in sales and the growth of companies. The increase in sales is due to the increase in fixed assets and investments in retail.

At the same time, the introduction of the reform will have a positive effect on the growth of the share of people who want to work in the formal economy (Figure 36). This is due to the growth of the business climate and the improvement of economic conditions in the retail market in Ukraine.

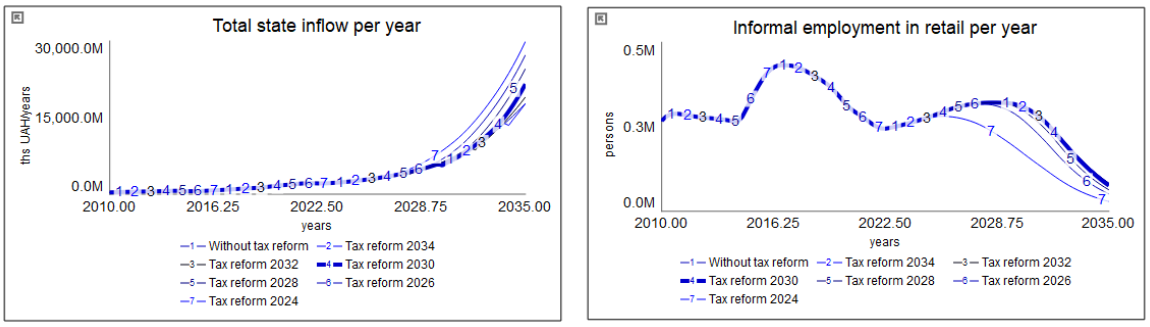


**Figure 36. Total state inflow (A) and informal employment (B) (exit capital tax policy).**

Growth in employment and sales can compensate for the loss of income tax revenues (Table 13).

**Table 13. Exit capital tax analysis.**

| **Income tax ↑** | **Corporate tax ↓** | **VAT ↑** |
|---|---|---|
| Employment ↑ | | Sales ↑ |
| Salary ↑ | | Fixed assets ↑ |
| Informal employment ↓ | | Investment ↑ |

But in this case, an important element is the amount of investment that companies are ready to invest in their production (and whether companies will invest these funds at all). I assume that with a good business climate, companies will invest 30% of their funds.

In the fifth block of the model, I define the business climate as a set of factors, and I define the final investment share as business climate (from 0 to 1)*base investment rate (30%).

Added policy results I provided in seventh appendix.

## 6.2 State Spending Policy

An increase in the share of spending on social services leads to a decrease in informal employment. This is due to the increase in the satisfaction of the population and the implementation of the social contract between the population and the government (Aleksynska & Wojcieszynski, 2022). But in this model, the influence of this factor is insignificant, because today most of the registered unemployed in Ukraine receive unemployment benefits and the social policy factor is the maximum in the model.

The lack of government social policy increases the opportunity cost of working outside of formal employment. Five scenarios were tested, including the growth and fall of spending on the social sphere (and maintaining today's level) (Figure 37).

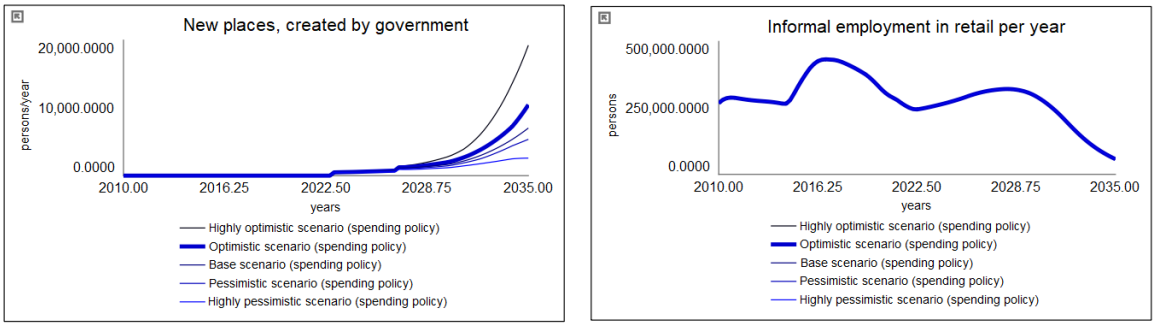


**Figure 37. New places that created by government (A) and informal employment (B) (spending policy).**

This policy also includes changing the government's spending on trade. 5 scenarios were tested (Appendix 4). The increase in trade costs allows the creation of new jobs (Figure 37A), but this amount is insignificant compared to the size of informal employment.

This shows the importance of making government more efficient and creating incentives for business, because the government does not have enough resources to provide all the jobs.

## 6.3 Anti-Corruption Policy

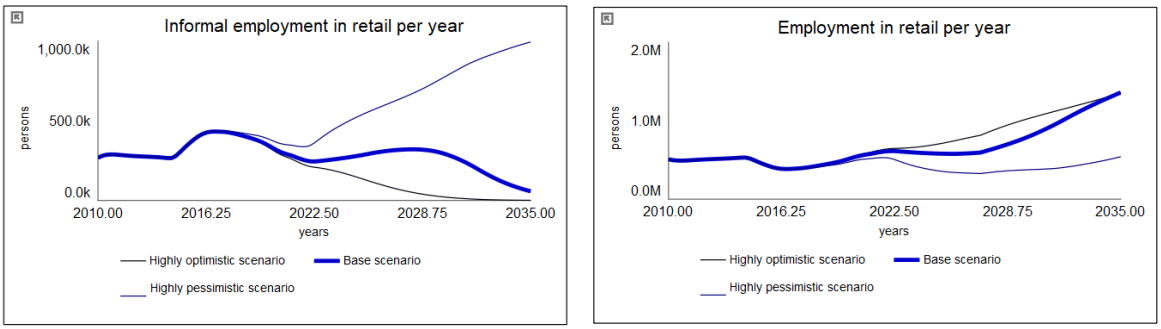


**Figure 38. Informal employment (A) and employment (B) in retail (anti-corruption policy).**

When applying the anti-corruption policy, various scenarios were tested for variables: the number of successful court decisions against corrupt individuals, the amount of funds invested in the staff of State Tax Service of Ukraine, the amount of business inspections and the pace of digitalization of public services in Ukraine (Figure 38).

Overcoming corruption makes it possible to improve the quality of the social contract between the government and the population.

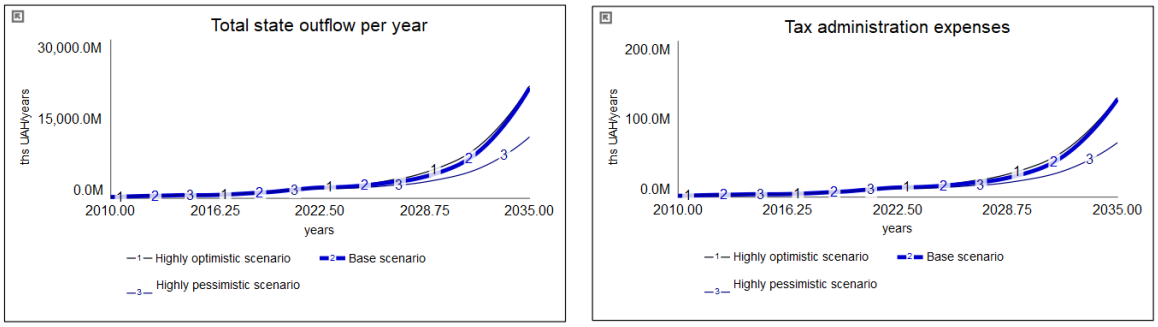


**Figure 39. Total state outflow (A) and tax administration expenses (B) (anti-corruption policy).**

An increase in employment leads to an increase in tax revenues, which allows the government to spend more and provide quality services to the population (Figure 39A). The increase in government revenues also allows more funds to be directed to reforming institutions and ensuring good wages for tax officials (Figure 39B).

## 6.4 Social Policy

The growth of the minimum wage in Ukraine, according to the literature, has two effects, including the growth of tax revenues and the growth of informal employment.

This is because an increase in the minimum wage increases the share of people receiving income below the minimum wage, so they are forced to work in informal employment (this effect is reflected in the model).

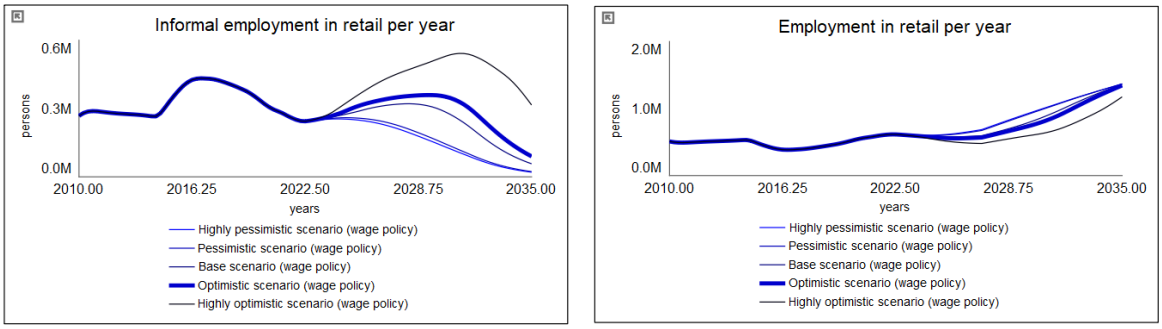


**Figure 40. Informal employment (A) and employment (B) in retail (wage policy).**

The increase in the minimum wage negatively affects the share of people who are ready to enter formal employment (Figure 40). But it is worth noting that the growth of wages in retail has a positive effect on the gap between wages and the minimum wage.

## 6.5 Key Policy Findings

I tested four policies from different sectors of the economy: taxation, investment, behavioral economics, and social policy. The introduction of an exit capital tax, for example, without an anti-corruption policy can minimize the positive effect of the tax reform (Figure 41).

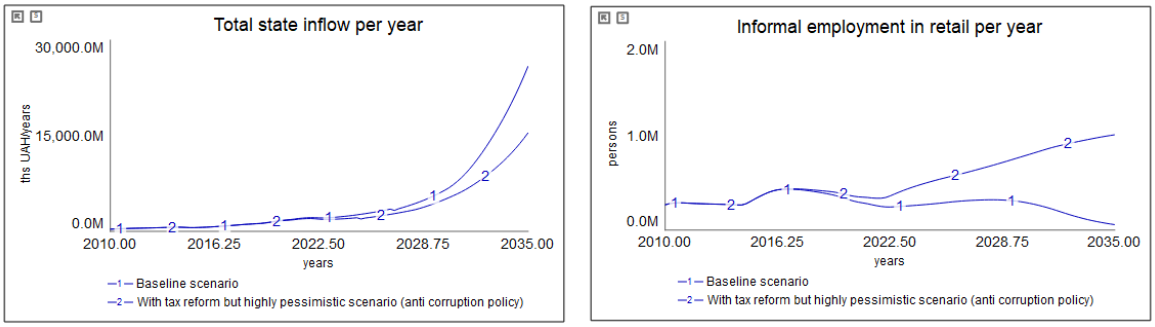


**Figure 41. Total state inflow (A) and informal employment (B).**

This is because a negative business climate and the growth of corruption will negatively affect the desire of businesses to invest their funds.

# 7. Discussion and Conclusion

## 7.1. Key Findings

The study of informal employment requires an analysis of economic, behavioral, and social factors. Economic factors affect the incomes of the population and companies, and the level of income affects the willingness to work in informal employment. Among the economic factors, the main role is played by the tax burden, price growth and the level of the minimum wage.

But it is worth noting that reducing the tax burden does not solve the problem of informal employment, because many developed countries with a high level of taxation have low indicators of informal employment (Norway, Sweden, Switzerland) (ILO, 2019).

But in developing countries, reducing the tax burden can be a stimulus for economic growth.

In addition to economic factors, informal employment is influenced by social factors, for example, how to provide quality services to the population, the professionalism of employees of public institutions, the level of corruption, the development of e-government, a fair law system, and the lack of high control of business. All these factors are part of the social contract between the population and the government. When the government fulfills its obligations, the government in return can demand that citizens work legally and pay taxes to the budget.

But it is worth noting the complexity of this system, because without paying taxes, quality governance and the provision of quality services to the population are impossible. So, in this situation, a certain compromise is needed between the government, business, and citizens.

The government can introduce an exit capital tax (or reduce tax rates), but at the same time increase efficiency (digitalization and increased control over employees of public institutions).

Improving efficiency and stimulating business will increase government revenues, thereby increasing the quality of services.

The reputation factor of citizens working in informal employment is also important. The size of the group affects its legitimization in society. But studies in recent years show that citizens in Ukraine positively assess the increase in the fight against tax evasion (UNIAN, 2019), but at the same time, the majority of citizens declare a high level of taxation in Ukraine (Finance.ua, 2019).

A combination of factors allows to minimize the volume of informal employment in Ukraine.

**Table 14. Informal employment factors**

| Economic factors | Social factor | Behavior factors |
|---|---|---|
| Inflation | Unemployment help | Bribes |
| Taxes | | State staff salary |
| Wages | | Staff control |
| | | Business control |
| | | Digitalization |
| | | Reputation |

The demonstrated policies in the model allow to assess the incentives to reduce informal employment in Ukraine. An exit capital tax is one of the incentives that can be introduced to stimulate investment and accelerate economic growth. The model shows that the growth of investments improves the economic situation, which positively affects the income of the population, and the population becomes less sensitive to economic problems. This has a positive effect on employment in retail.

Therefore, the main incentives for the transition to employment and paying taxes are economic, anti-corruption reforms and the continuation of the reform of government institutions.

Economic reforms include creating incentives for companies to invest in their production. Incentives may include reduced taxation, increased credit for businesses and attracting foreign investment.

The growth of sales in retail will have a positive effect on tax revenues to the Ukrainian budget, which will allow providing high-quality services for the population and business.

Among other incentives, it is the acceleration of the anti-corruption policy, which includes the following points:

1. Carrying out judicial reform and improving the quality of the judicial system of Ukraine. This will make it possible to prosecute corrupt officials and bribe takers in the government.

2. Reduction of business control. But at the same time, it is worth increasing the efficiency of tax collection. Today, many enterprises that pay taxes to the Ukrainian budget have many checks from state institutions.

Digitization, reducing the influence of the human factor in decision-making, and strengthening the control of employees will minimize the negative impact of reducing business control.

3. Digitization of services and state institutions. This will minimize corruption in state institutions and improve the quality of services for the population and businesses.

4. Ensuring a sufficient level of income for employees of state institutions. Currently, this problem does not exist in the tax administration, where salaries are higher than the average salary. But this factor is important in the context of the spread of populism because a sharp reduction in wages for employees in the government can contribute to the spread of corruption.

A combination of economic, social, and behavioral factors allows to reduce informal employment in Ukraine and ensure sustainable economic growth.

Therefore, during 2022-2035, the model demonstrates the growing influence of social and behavioral factors on informal employment. But if the war continues and economic problems intensify, economic problems can contribute to increasing informal employment.

The model shows the decline of informal employment in Ukraine after the end of the 201-2015 crisis, after the full-scale Russian invasion, millions of Ukrainians lost their jobs and had to look for new jobs. As of November 2022, about 31% of companies in Ukraine have ceased operations after the start of a full-scale invasion (AdvanterGroup, May 2023).

This caused the growth of informal employment, which is demonstrated in the model, but with a combination of reforms and economic recovery of Ukraine, informal employment will decrease until 2035. The growth of corruption and the decline in the quality of public services will lead to an increase in informal employment and a decrease in government tax revenues, which will cyclically increase the negative impact on the quality of the government and public institutions.

The key value of this study and model lies in the creation of a tool for analyzing potential policies in Ukraine. This allows to answer the key research question.

This tool can be applied to other sectors of the Ukrainian economy, but with a change in input data.

The model also covers the interests of stakeholder groups in Ukraine, namely business, society, employees of state institutions, the government, and international partners of Ukraine.

1. The business can use the model as a tool for analyzing financial flows, the effectiveness of tax policy, and forecasting its sales and investments.
2. State institutions can use it as an analysis of the effectiveness of state investments and assess risks from the introduction of tax reforms.
3. The population is included in the model as a group with its interests, which must be taken into account by business and government when making decisions.

So, in conclusion, it is worth noting that informal employment needs a comprehensive policy, which will include the factors presented in the model.

## 7.2. Limitation of Research

The main difficulties I encountered during the research are:

1. Lack of data specifically on retail, many indicators related to the entire trade. Most of the indicators for retail were calculated by me based on open data.
2. The difficulty of defining the concept of "informal employment".
3. Lack of data on taxes by types of taxes and areas of the economy. I calculated the tax flows based on the literature, assumptions, and my calculations.
4. Low response rate of experts for interviews. Two interviews allowed me to verify the general vision of the problem and identify key research points. But a larger number of interviews could help me reveal the problem even more.

The model has several limitations. These limitations can be addressed in future studies and projects.

1. The model is designed for retail use only. But when replacing historical data and inputs, it can be applied to other sectors of the economy.
2. The model is developed for the retail market in general (it does not have a division by company size). But for a detailed analysis of the company, can add a data array of (small/medium/large) companies. But this creates the problem of accounting for inputs and historical data for model validation.
3. The model considers all employees, regardless of gender.
4. The model was developed for all regions of Ukraine, without division into separate regions. In the future, the addition of regions will allow to evaluate the effectiveness of the policy, depending on the region.
5. The model does not take into account factors affecting informal employment: quality of jobs, protection of workers' rights, inspections from other institutions (except tax authorities).
6. Difficulty of calculating historical data.

All these limitations allow future research to be detailed for policymakers and specific stakeholders.

## 7.3. Further Research

Further research may include extending the model to other sectors of the economy or combining sectors using arrays in Stella Architect. Comparison with other sectors will allow for optimization of the selected policies, for example, an exit capital tax can be applied only to certain sectors of the economy.

A similar situation exists with the breakdown by size of companies and regions of Ukraine. As a result of the war, the eastern and southern regions of Ukraine suffered critical destruction. Therefore, tax incentives can be applied by region to speed up the recovery of destroyed regions.

The size of the company will allow to assess the effects on small businesses and separately on large companies in the market.

Further research could also involve involving experts, business, and government representatives to develop more detailed policies.

Digitization and open data policies in Ukraine create the potential to deepen future research using datasets not currently collected by government entities or closed due to national security concerns during wartime.

Regarding the tax block, further research may include the development of the pension system block, analysis of the legal features of taxation, etc.

All these points demonstrate that further research can be transformative depending on the problem and the potential stakeholder.

The model of this study does not include the above-mentioned items, because its task is to consider the system as a whole and evaluate the impact of the systems one on one.

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# Appendix 1. Model Documentation

In the document, theses of the sources are provided as citations for the systematization of the sources that were used in the work. In the model, the documentation is provided with links for ease of use.

| Total | Count | Including Array Elements |
|---|---|---|
| Variables | 191 | 279 |
| Sectors | 23 | |
| Stocks | 9 | 9 |
| Flows | 23 | 23 |
| Converters | 159 | 247 |
| Constants | 52 | 80 |
| Equations | 130 | 190 |
| Graphics | 46 | 86 |
| Macro Variables | 35 | |

| | Equation | Properties | Units | Documentation | Annotation |
|---|---|---|---|---|---|
| "\"1._BUSINESS_AND_EXIT_CAPITAL_TAX": | | | | | |
| Added_new_workplaces_per_year | Long_term_investment_per_year/Cost_per_one_work_place_in_UAH | | persons/year | The number of new jobs created in retail.<br><br>The indicator is calculated by dividing the total amount of investment by the cost of creating a workplace in Ukraine. | |
| Adjusted_time_for_tax_reform | 1 | | years | | |

| | | | | | |
|---|---|---|---|---|---|
| Birth_rate | GRAPH(TIME) Points: (2010.00, 10.8), (2011.00, 11.0), (2012.00, 11.4), (2013.00, 11.1), (2014.00, 10.8), (2015.00, 10.7), (2016.00, 10.3), (2017.00, 9.4), (2018.00, 8.7), (2019.00, 8.1), (2020.00, 7.8), (2021.00, 7.3) | | per year | The birth rate in Ukraine. Calculated by the author, based on Ukrstat data.<br><br>Future data is determined using the extrapolation function.<br><br>Used source:<br>(Ukrstat, 2021c) | |
| Born_people | Birth_rate/1000*Population | | Persons/years | The number of people born per year in Ukraine<br><br>Data were taken from Ukrstat:<br>(Ukrstat, 2021c) | UNIFLOW |
| Commodity_prices_index | GRAPH(TIME) Points: (2010.00, 100.0), (2011.00, 121.52), (2012.00, 114.29), (2013.00, 105.68), (2014.00, 101.88), (2015.00, 87.86), (2016.00, 87.45), (2017.00, 86.95), (2018.00, 86.56), (2019.00, 83.13), (2020.00, 87.08), (2021.00, 108.31), (2022.00, 122.75), (2023.00, 139.6), (2024.00, 139.6), (2025.00, 141.1), (2026.00, 142.6), (2027.00, 143.3), (2028.00, 144.1), (2029.00, 144.8), (2030.00, 144.8) | | dmnl | This indicator shows the dynamics of prices for raw materials on the world market.<br><br>The indicator is aggregated and includes the dynamics of metals, agriculture, and other raw materials.<br><br>Historical data are taken from the World Bank databases, forecast values are determined by the author and taken from the World Bank forecast.<br><br>Used sources:<br>(WB, 2023) | |
| Companies'_funds(t) | Companies'_funds(t - dt) + (Companies'_income_in_retail_per_year - Cost_of_goods_per_year - Other_expenses_per_year - Long_term_investment_per_year - Corporate_Tax_payments - "Withdrawn_amount_(1)" - "Withdrawn_amount_(2)") * dt | INIT Companies'_funds = 71091330 | ths UAH | The indicator shows the amount of funds that companies have at their accounts.<br><br>The indicator aggregates all companies in the retail market in Ukraine.<br><br>The primary value is data on the current assets of companies in retail for 2010.<br><br>Source:<br>(Ukrstat, 2021d) | |

| | | | | | |
|---|---|---|---|---|---|
| Companies'_income_in_retail_per_year | Total_sales_in_retail_per_year | | ths UAH/years | The indicator shows the volume of total sales in retail in Ukraine since 2010.<br><br>The indicator was taken from Ukrstat:<br>(Ukrstat, 2021d) | |
| Corporate_income_tax_rate | GRAPH(TIME) Points: (2010.00, 0.2500), (2011.00, 0.2500), (2012.00, 0.2100), (2013.00, 0.1900), (2014.00, 0.1800), (2015.00, 0.1800), (2016.00, 0.1800), (2017.00, 0.1800), (2018.00, 0.1800), (2019.00, 0.1800), (2020.00, 0.1800), (2021.00, 0.1800), (2022.00, 0.1800), (2023.00, 0.1800), (2024.00, 0.1800), (2025.00, 0.1800), (2026.00, 0.1800), (2027.00, 0.1800), (2028.00, 0.1800), (2029.00, 0.1800), (2030.00, 0.1800), (2031.00, 0.1800), (2032.00, 0.1800), (2033.00, 0.1800), (2034.00, 0.1800), (2035.00, 0.1800) | | dmnl | The income tax rate in Ukraine.<br><br>Source:<br>(MFU, 2021b) | |
| Corporate_Tax_payments | IF TIME<"Policy_time_(exit_capital_tax)" THEN (Companies'_income_in_retail_per_year-Other_expenses_per_year-Cost_of_goods_per_year)*Corporate_income_tax_rate ELSE 0 | INIT Corporate_Tax_payments = 28 | ths UAH/years | The indicator shows the income tax in the total income of companies.<br><br>The indicator was calculated by the author using data for all trade in Ukraine (category of companies G).<br><br>Financial statistics of all companies on the trade market in Ukraine from 2015 to 2021 were taken.<br><br>Source:<br>(Ukrstat, 2021d) | |

| | | | | | |
|---|---|---|---|---|---|
| Cost_of_goods_per_year | Cost_of_goods_rate*Companies'_income_in_retail_per_year | | ths UAH/years | The indicator shows the volume of the cost price in the total income of the companies.<br><br>The indicator was compared with historical data. Historical data was calculated by the author using financial statistics of all companies on the trade market in Ukraine from 2015 to 2021.<br><br>Source:<br>(Ukrstat, 2021d) | |
| Cost_of_goods_rate | 0.82 | | dmnl | The indicator shows the share of the cost price in the total revenues of companies.<br><br>The indicator was calculated by the author using data for all trade in Ukraine (category of companies G).<br><br>Financial statistics of all companies on the trade market in Ukraine from 2015 to 2021 were taken.<br><br>Source:<br>(Ukrstat, 2021d) | |
| Cost_per_one_work_place_in_UAH | Workplace_cost_in_USD*Exchange_rate | | ths UAH/par | The cost of creating a workplace in national currency. | |

| | | | | | |
|---|---|---|---|---|---|
| covid_risks | GRAPH(TIME) Points: (2010.00, 1.000), (2011.00, 1.000), (2012.00, 1.000), (2013.00, 1.000), (2014.00, 1.000), (2015.00, 1.000), (2016.00, 1.000), (2017.00, 1.000), (2018.00, 1.000), (2019.00, 1.088), (2020.00, 1.000), (2021.00, 1.000), (2022.00, 1.000), (2023.00, 1.000), (2024.00, 1.000), (2025.00, 1.000), (2026.00, 1.000), (2027.00, 1.000), (2028.00, 1.000), (2029.00, 1.000), (2030.00, 1.000), (2031.00, 1.000), (2032.00, 1.000), (2033.00, 1.000), (2034.00, 1.000), (2035.00, 1.000) | | dmnl | The indicator demonstrates the effect of coronavirus restrictions on the activities of companies in retail in Ukraine.<br><br>The graphic function was built by the author, based on the data of infections and the dynamics of deaths during the coronavirus pandemic.<br><br>Source:<br>(Worldometer, 2023) | |
| Cumulative_investment_after_start_of_reform(t) | Cumulative_investment_after_start_of_reform(t - dt) + (Long_term_investment_per_year) * dt | INIT | ths UAH | The cumulative volume of investments after the introduction of the exit capital tax in Ukraine | NON-NEGATIVE |
| Death_people | Population*Death_rate/1000 | OUTFLOW | Persons/years | The number of dead people per year in Ukraine<br><br>Data were taken from Ukrstat:<br>(Ukrstat, 2021c) | UNIFLOW |

| | | | | | |
|---|---|---|---|---|---|
| Death_rate | GRAPH(TIME) Points: (2010.00, 15.2), (2011.00, 14.5), (2012.00, 14.5), (2013.00, 14.6), (2014.00, 14.7), (2015.00, 14.9), (2016.00, 14.7), (2017.00, 14.5), (2018.00, 14.8), (2019.00, 14.7), (2020.00, 15.9), (2021.00, 18.5) | | per year | Mortality rate in Ukraine. The indicator shows how many people died per 1,000 people of the population of Ukraine.<br><br>Calculated by the author, based on Ukrstat data.<br><br>Future data is determined using the extrapolation function.<br><br>(Ukrstat, 2021c) | |
| Emigrants_per_year | War_risks*Population*Emigrants_rate | OUTFLOW | Persons/years | The volume of emigrants shows the influx of population to Ukraine.<br><br>Data taken from Ukrstat:<br>(Ukrstat, 2021c) | |
| Emigrants_rate | GRAPH(TIME) Points: (2010.00, 0.015), (2011.00, 0.014), (2012.00, 0.015), (2013.00, 0.014), (2014.00, 0.011), (2015.00, 0.012), (2016.00, 0.006), (2017.00, 0.01), (2018.00, 0.014), (2019.00, 0.013), (2020.00, 0.01), (2021.00, 0.011) | | per year | Rate of emigrants who left Ukraine. The indicator was calculated using Ukrstat data (number of emigrants)<br><br>(Ukrstat, 2021c) | |
| Exchange_rate | GRAPH(TIME) Points: (2010.00, 7.96), (2011.00, 7.98), (2012.00, 7.99), (2013.00, 7.99), (2014.00, 15.76), (2015.00, 24.0), (2016.00, 27.2), (2017.00, 28.0), (2018.00, 27.7), (2019.00, 23.7), (2020.00, 28.3), (2021.00, 27.27), (2022.00, 36.56), (2023.00, 40.0), (2024.00, 42.0), (2025.00, 44.0), (2026.00, 47.0), (2027.00, 50.0), (2028.00, 53.0), (2029.00, 56.0), (2030.00, 60.0) | | ths UAH/ths USD | The exchange rate of the national currency shows the ratio of the value of the national currency (hryvnia) to the US dollar.<br><br>Historical data was taken from the source:<br>(Finance.ua, 2023)<br><br>The following source was used for predictive sources:<br>(Monin, 2019) | |

| | | | | | |
|---|---|---|---|---|---|
| Fixed_assets_in_retail(t) | Fixed_assets_in_retail(t - dt) + (New_added_assets_per_year - Seized_assets_per_year) * dt | INIT Fixed_assets_in_retail = | ths UAH | The volume of fixed assets in retail in Ukraine.<br><br>Data for 2010 were taken as the base indicator.<br><br>Source:<br>(Ukrstat, 2021h) | NON-NEGATIVE |
| Fraction_new_assets | 0.19 | | per year | The share of newly created assets in retail.<br><br>The indicator was calculated by the author using data for 2010-2020.<br><br>Source:<br>(Ukrstat, 2021h) | |
| Fraction_seized_assets | 0.046 | | per year | Share of assets seized each year in retail.<br><br>The indicator was calculated by the author using data for 2010-2020.<br><br>Source:<br>(Ukrstat, 2021h) | |
| Immigrants_per_year | Population*Immigrants_rate*(1/War_risks) | | Persons/years | The volume of immigrants shows the influx of population to Ukraine.<br><br>Data taken from Ukrstat:<br>(Ukrstat, 2021c) | |
| Immigrants_rate | GRAPH(TIME) Points: (2010.00, 0.015), (2011.00, 0.015), (2012.00, 0.016), (2013.00, 0.015), (2014.00, 0.012), (2015.00, 0.012), (2016.00, 0.006), (2017.00, 0.01), (2018.00, 0.015), (2019.00, 0.014), (2020.00, 0.01), (2021.00, 0.011) | | per year | Rate of immigrants who entered Ukraine. The indicator was calculated using Ukrstat data. (number of immigrants)<br><br>(Ukrstat, 2021c) | |

| | | | | | |
|---|---|---|---|---|---|
| Inflation | ((SMTH1(DELAY(Commodity_prices_index/100, 1), 1, 1)+ DELAY(Exchange_rate/DELAY(Exchange_rate, 1), 1))+War_risks)/3 | | dmnl | Inflation shows the rise in prices in the economy. This indicator allows you to assess the state of the economic system and assess the situation in business and among the population.<br><br>The indicator is calculated based on world prices for raw materials (Ukraine has a large export of raw materials) and the exchange rate of the national currency (the exchange rate of the national currency reflects the impact of imported inflation).<br>Military risks are also included.<br><br>To verify the correctness of the generated data, a historical analysis was conducted based on the source:<br>(Minfin, 2023a) | |
| Initial_of_productivity | 8.24 | | per year | The indicator shows the return on fixed assets of retail in Ukraine.<br><br>The indicator was calculated by the author, based on the analysis of historical data. (Sales/fixed assets=productivity).<br><br>Primary data was taken from Ukrstat:<br>(Ukrstat, 2021d) | |
| Initial_percentage_investment | 0.3 | | dmnl | The indicator shows the share that should be invested in one's activity.<br><br>I assume that with a good business climate, companies will invest 30% of their s in their activities.<br><br>Source:<br>(FifthThirdBank, 2021) | |

| | | | | | |
|---|---|---|---|---|---|
| Investment_fraction | Initial_percentage_investment *Business_climate_indicator | | dmnl | This indicator includes the calculation of the amount that companies will invest in their activities.<br><br>The indicator is calculated as the multiplication of the basic investment share by the business climate in Ukraine.<br><br>I assume that at the maximum level of business climate, companies will invest 30%.<br><br>Source:<br>(FifthThirdBank, 2021) | |
| Long_term_investment_per_year | IF "Reform_(exit_capital_tax)"=1 THEN (Investment_fraction*Companies'_funds)/Adjusted_time_for_tax_reform ELSE 0 | | ths UAH/years | The volume of investments after the introduction of exit capital tax.<br><br>The indicator is calculated based on the volume of the company's funds and the desire to invest these funds.<br><br>The model also takes into account government investments in creating new jobs. | |
| New_added_assets_per_year | DELAY(Long_term_investment_per_year, 3)+DELAY(Investment_value_from_government, 3)+Fixed_assets_in_retail*Fraction_new_assets | | ths UAH/years | Volume of new assets in retail per year.<br><br>The indicator also includes investments from the introduction of tax reform with a three-year lag. Lag is necessary to demonstrate the time it takes to convert investments into fixed assets.<br><br>Historical figures were compared with historical data, source:<br>(Ukrstat, 2021h) | UNIFLOW |

| | | | | | |
|---|---|---|---|---|---|
| Other_expenses_per_year | Other_expenses_rate*Companies'_income_in_retail_per_year | | ths UAH/years | The indicator shows the volume of other expenses in the total income of companies.<br><br>The indicator was compared with historical data. Historical data was calculated by the author using financial statistics of all companies on the trade market in Ukraine from 2015 to 2021.<br><br>Source:<br>(Ukrstat, 2021d) | |
| Other_expenses_rate | 0.16 | | dmnl | The indicator shows the share of other expenses in the total revenues of companies.<br><br>The indicator was calculated by the author using data for all trade in Ukraine (category of companies G).<br><br>Financial statistics of all companies on the trade market in Ukraine from 2015 to 2021 were taken.<br><br>Source:<br>(Ukrstat, 2021d) | |
| Other_income_fraction | 0.035 | | dmnl | The indicator shows the share of revenues that companies receive from non-core activities, such as financial indicators.<br><br>The indicator was calculated by the author, based on the analysis of historical data. (Total revenue/revenue from product sales)<br><br>Primary data was taken from Ukrstat:<br>(Ukrstat, 2021d)<br><br>Also, the indicator has been calibrated to best reflect historical sales data. | |

| | | | | | |
|---|---|---|---|---|---|
| "Policy_time_(exit_capital_tax)" | 2045 | | years | Time for the introduction of the new tax policy - the exit capital tax (new policy). | |
| Population(t) | Population(t - dt) + (Immigrants_per_year + Born_people - Emigrants_per_year - Death_people) * dt | INIT Population = 45962947 | Persons | The population of Ukraine in persons<br><br>The author compared the data with historical data, based on the source:<br>(Ukrstat, 2021c) | NON-NEGATIVE |
| Productivity_1_UAH_of_fixed_assets | Initial_of_productivity*(1/covid_risks)*(1/Inflation) | | per year | The indicator shows the return on fixed assets in retail in Ukraine.<br><br>The indicator was compared with historical data calculated by the author.<br><br>Primary data was taken from Ukrstat:<br>(Ukrstat, 2021d) | |
| "Profit_fraction_(1)" | 0.111528239 | | dmnl | The indicator shows the share of profit that will be withdrawn from the company as operations for the withdrawal of funds. (withdrawal operations)<br><br>The indicator was calculated by the author using the source:<br><br>(ISET, 2017) | |

| | | | | | |
|---|---|---|---|---|---|
| "Profit_fraction_(2)" | 0.234418605 | | dmnl | The indicator shows the share of profit that will be withdrawn from the company as operations for the withdrawal of funds. (operations that will be treated as withdrawals)<br><br>The indicator was calculated by the author using the source:<br><br>(EEP, 2021) | |
| "Reform_(exit_capital_tax)" | IF TIME>"Policy_time_(exit_capital_tax)" THEN 1 ELSE 0 | | dmnl | The converter allows to activate of the policy of introducing an exit capital tax. | |
| Salary_dynamics | Salary_for_employees_in_retail*TREND(Total_sales_in_retail_per_year, 1, 1) | | UAH/(person*yea | Rates of wage growth in the trade sector of the Ukrainian economy. | |
| Salary_for_employees_in_retail(t) | Salary_for_employees_in_retail(t - dt) + (Salary_dynamics) * dt | INIT | UAH/person | Wage dynamics in the retail sector.<br><br>The salary is calculated in the national currency and per month per person.<br><br>The indicator was compared with historical data from Ukrstat:<br><br>(Ukrstat, 2021g) | NON-NEGATIVE |
| Seized_assets_per_year | Fraction_seized_assets*Fixed_assets_in_retail | | ths UAH/years | The volume of written-off assets in retail per year.<br><br>Historical figures were compared with historical data, source:<br>(Ukrstat, 2021h) | UNIFLOW |

| | | | | | |
|---|---|---|---|---|---|
| "Tax_payments_(1)" | "Tax_rate_(1)"*"Withdrawn_amount_(1)" | | ths UAH/years | The indicator shows the volume of the cost price in the total income of the companies.<br><br>The indicator was calculated by the author using data for all trade in Ukraine (category of companies G).<br><br>Financial statistics of all companies on the trade market in Ukraine from 2015 to 2021 were taken.<br><br>Source:<br>(Ukrstat, 2021d) | |
| "Tax_payments_(2)" | "Withdrawn_amount_(2)"*"Tax_rate_(2)" | | ths UAH/years | The indicator shows the volume of the cost price in the total income of the companies.<br><br>The indicator was calculated by the author using data for all trade in Ukraine (category of companies G).<br><br>Financial statistics of all companies on the trade market in Ukraine from 2015 to 2021 were taken.<br><br>Source:<br>(Ukrstat, 2021d) | |
| "Tax_rate_(1)" | 0.15 | | dmnl | The rate for withdrawal operations, source:<br><br>(ISET, 2017) | |
| "Tax_rate_(2)" | 0.2 | | dmnl | The rate for operations equated to withdrawal operations, source:<br><br>(ISET, 2017) | |
| Total_sales_in_retail_per_year | Fixed_assets_in_retail * Productivity_1_UAH_of_fixed_assets*(1+Other_income_fraction) | | ths UAH/Years | The indicator shows the volume of total sales in retail in Ukraine since 2010.<br><br>The indicator was taken from Ukrstat:<br>(Ukrstat, 2021d) | |

| | | | | | |
|---|---|---|---|---|---|
| War_risks | GRAPH(TIME) Points: (2010.00, 1.000), (2011.25, 1.000), (2012.50, 1.000), (2013.75, 1.000), (2015.00, 1.601), (2016.25, 1.465), (2017.50, 1.390), (2018.75, 1.351), (2020.00, 1.351), (2021.25, 1.355), (2022.50, 2.000), (2023.75, 1.978), (2025.00, 1.816), (2026.25, 1.728), (2027.50, 1.654), (2028.75, 1.579), (2030.00, 1.482), (2031.25, 1.404), (2032.50, 1.298), (2033.75, 1.241), (2035.00, 1.175) | | dmnl | This indicator determines the effect of the war in Ukraine on population flows from/to Ukraine.<br><br>The indicator takes on values from 1 to 2. 1 - no military threat, 2 - the highest level of military threat.<br><br>With the help of the indicator, the volume of graduates and the total volume of the workforce is determined.<br><br>The graphic function was built by the author after analyzing the literature:<br><br>(ACLED, 2022) | |
| "Withdrawn_amount_(1)" | IF "Reform_(exit_capital_tax)"=1 THEN (Companies'_income_in_retail_per_year-Cost_of_goods_per_year-Other_expenses_per_year)*"Profit_fraction_(1)" ELSE 0 | | ths UAH/years | The volume of withdrawal operations from company accounts for the year. | |
| "Withdrawn_amount_(2)" | IF "Reform_(exit_capital_tax)"=1 THEN (Companies'_income_in_retail_per_year-Cost_of_goods_per_year-Other_expenses_per_year)*"Profit_fraction_(2)" ELSE 0 | | ths UAH/years | The volume of operations is equivalent to operations for withdrawing funds from company accounts for the year. | |
| Workplace_cost_in_USD | 20 | | ths USD/person | The cost of creating one workplace in Ukraine is thousands of dollars.<br><br>Source:<br>(Golos, 2012) | |
| "2._TAXES_AND_BUDGET_SEGMENT": | | | | | |
| Calculation_from_1_ths_to_1000 | 1000 | | UAH/ths UAH | The indicator allows you to convert variables in hryvnias into variables in thousands of hryvnias. | |

| | | | | | |
|---|---|---|---|---|---|
| Calculation_from_months_to_years | 12 | | 1/years | The indicator allows to convert variables in months into annual variables. | |
| "Corporate_(or_exit_capital_tax)_tax_earnings_from_retail_per_year" | IF TIME<"Policy_time_(exit_capital_tax)" THEN Corporate_Tax_payments ELSE "Tax_payments_(2)"+"Tax_payments_(1)" | | ths UAH/years | The amount of tax revenues from companies. Today it is the income tax.<br><br>In the case of the introduction of exit capital tax, this converter will demonstrate the dynamics of exit capital tax<br><br>The data was compared to historical data using the author's calculations.<br><br>Used sources:<br>(Ukrstat, 2021d)<br>(Zvarich, 2013) | |
| "Desired_level_of_deficit_(max)" | 0.11 | | per year | The level of the budget deficit in Ukraine. Calculated by the author using data:<br>(MFU, 2021a) | |
| Economic_activity_spending_fraction[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1100), (2011.00, 0.1100), (2012.00, 0.1100), (2013.00, 0.1100), (2014.00, 0.1100), (2015.00, 0.1100), (2016.00, 0.1100), (2017.00, 0.1100), (2018.00, 0.1100), (2019.00, 0.1100), (2020.00, 0.1100), (2021.00, 0.1100), (2022.00, 0.1100), (2023.00, 0.1105), (2024.00, 0.1053), (2025.00, 0.1000), (2026.00, 0.0934), (2027.00, 0.0895), (2028.00, 0.0842), (2029.00, 0.0816), (2030.00, 0.0776), (2031.00, 0.0737), (2032.00, 0.0658), (2033.00, 0.0579), (2034.00, 0.0513), (2035.00, 0.0408) | | dmnl | The share of expenditures on economic activity in all government expenditures.<br><br>The indicator was calculated by the author, based on the following data:<br>(MFU, 2021a) | |

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|---|---|---|---|---|---|
| Economic_activity_spending_fraction[Pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1100), (2011.00, 0.1100), (2012.00, 0.1100), (2013.00, 0.1100), (2014.00, 0.1100), (2015.00, 0.1100), (2016.00, 0.1100), (2017.00, 0.1100), (2018.00, 0.1100), (2019.00, 0.1100), (2020.00, 0.1100), (2021.00, 0.1100), (2022.00, 0.1100), (2023.00, 0.1118), (2024.00, 0.1066), (2025.00, 0.1039), (2026.00, 0.1013), (2027.00, 0.1000), (2028.00, 0.0987), (2029.00, 0.0974), (2030.00, 0.0961), (2031.00, 0.0961), (2032.00, 0.0921), (2033.00, 0.0921), (2034.00, 0.0908), (2035.00, 0.0842) | | | | |
| Economic_activity_spending_fraction[Base_scenario] | GRAPH(TIME) Points: (2010.00, 0.1100), (2011.00, 0.1100), (2012.00, 0.1100), (2013.00, 0.1100), (2014.00, 0.1100), (2015.00, 0.1100), (2016.00, 0.1100), (2017.00, 0.1100), (2018.00, 0.1100), (2019.00, 0.1100), (2020.00, 0.1100), (2021.00, 0.1100), (2022.00, 0.1100), (2023.00, 0.1100), (2024.00, 0.1100), (2025.00, 0.1100), (2026.00, 0.1100), (2027.00, 0.1100), (2028.00, 0.1100), (2029.00, 0.1100), (2030.00, 0.1100), (2031.00, 0.1100), (2032.00, 0.1100), (2033.00, 0.1100), (2034.00, 0.1100), (2035.00, 0.1100) | | | | |

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|---|---|---|---|---|---|
| Economic_activity_spending_fraction[Optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1100), (2011.00, 0.1100), (2012.00, 0.1100), (2013.00, 0.1100), (2014.00, 0.1100), (2015.00, 0.1100), (2016.00, 0.1100), (2017.00, 0.1100), (2018.00, 0.1100), (2019.00, 0.1100), (2020.00, 0.1100), (2021.00, 0.1100), (2022.00, 0.1100), (2023.00, 0.1118), (2024.00, 0.1132), (2025.00, 0.1145), (2026.00, 0.1171), (2027.00, 0.1184), (2028.00, 0.1224), (2029.00, 0.1276), (2030.00, 0.1316), (2031.00, 0.1368), (2032.00, 0.1408), (2033.00, 0.1447), (2034.00, 0.1487), (2035.00, 0.1632) | | | | |
| Economic_activity_spending_fraction[Very_optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1100), (2011.00, 0.1100), (2012.00, 0.1100), (2013.00, 0.1100), (2014.00, 0.1100), (2015.00, 0.1100), (2016.00, 0.1100), (2017.00, 0.1100), (2018.00, 0.1100), (2019.00, 0.1100), (2020.00, 0.1100), (2021.00, 0.1100), (2022.00, 0.1100), (2023.00, 0.1145), (2024.00, 0.1171), (2025.00, 0.1171), (2026.00, 0.1224), (2027.00, 0.1355), (2028.00, 0.1487), (2029.00, 0.1658), (2030.00, 0.1842), (2031.00, 0.1987), (2032.00, 0.2237), (2033.00, 0.2513), (2034.00, 0.2776), (2035.00, 0.2974) | | | | |
| Government_investment_rate | IF TREND(State_budget, 1, 0.001)>0 THEN MAX(Investment_fraction, 0) ELSE 0 | | dmnl | I assume that the government spends the same share on investment (in terms of spending on economic activity) as business.<br><br>How government investments depend on the dynamics of Ukraine's budget. | |

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|---|---|---|---|---|---|
| Income_tax_earnings_from_retail_per_year | Employment_in_retail_per_year*Salary_for_employees_in_retail*Calculation_from_months_to_years*"Tax_rate_(income_tax)"/Calculation_from_1_ths_to_1000 | | ths UAH/years | Amount of tax revenue from income tax.<br><br>The data was compared to historical data using the author's calculations.<br><br>Used sources:<br>(Ukrstat, 2021d; Zvarich, 2013) | |
| Inflow_from_other_segments | Total_tax_earnings_from_retail_per_year*50 | | ths UAH/year | Amount of other revenues to the Ukrainian budget.<br><br>Calculated as a multiplication of revenues from retail by 50. (the share of revenues from retail in all budget revenues)<br><br>The share is calculated by the author. | |
| Investment_value_from_government | IF TIME<"Policy_time_(for_state_spending)" THEN 0 ELSE Spending_on_retail_per_year *Government_investment_rate | | ths UAH/years | The volume of government investment is directed at retail.<br><br>I assume that all government investment in trade will go into retail. | |
| "New_places,_created_by_government" | (Investment_value_from_government)/Cost_per_one_work_place_in_UAH | | persons/ year | Amount of jobs created by government investment. | |
| Percentage_who_pay_VAT | 0.07 | | dmnl | | |
| "Policy_time_(for_state_spending)" | 2023 | | years | The period for the introduction of the policy of increasing investment costs to create new jobs in Ukraine. | |
| "Scenario_switch_(Economic_activity)" | 3 | | dmnl | The switch allow activating the policy of increasing costs for economic activity in Ukraine. | |
| "Scenario_switch_(social_budget)" | 3 | | dmnl | The switch allows activating the policy of increasing spending on the social policy in Ukraine. | |

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|---|---|---|---|---|---|
| Social_program_policy_analysis[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1990), (2011.00, 0.1990), (2012.00, 0.1990), (2013.00, 0.1990), (2014.00, 0.1990), (2015.00, 0.1990), (2016.00, 0.1990), (2017.00, 0.1990), (2018.00, 0.1990), (2019.00, 0.1990), (2020.00, 0.1990), (2021.00, 0.1990), (2022.00, 0.1990), (2023.00, 0.1974), (2024.00, 0.1947), (2025.00, 0.1895), (2026.00, 0.1868), (2027.00, 0.1842), (2028.00, 0.1803), (2029.00, 0.1737), (2030.00, 0.1645), (2031.00, 0.1553), (2032.00, 0.1487), (2033.00, 0.1434), (2034.00, 0.1382), (2035.00, 0.1316) | | dmnl | The share of budget expenditures on the social sphere in Ukraine in all budget expenditures (introduction of the policy of adjustment of expenditures on the social sphere in Ukraine).<br><br>The indicator was calculated by the author, based on the following data:<br>(MFU, 2021a) | |
| Social_program_policy_analysis[Pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1990), (2011.00, 0.1990), (2012.00, 0.1990), (2013.00, 0.1990), (2014.00, 0.1990), (2015.00, 0.1990), (2016.00, 0.1990), (2017.00, 0.1990), (2018.00, 0.1990), (2019.00, 0.1990), (2020.00, 0.1990), (2021.00, 0.1990), (2022.00, 0.1990), (2023.00, 0.2000), (2024.00, 0.1934), (2025.00, 0.1882), (2026.00, 0.1855), (2027.00, 0.1816), (2028.00, 0.1789), (2029.00, 0.1750), (2030.00, 0.1724), (2031.00, 0.1697), (2032.00, 0.1658), (2033.00, 0.1605), (2034.00, 0.1566), (2035.00, 0.1513) | | | | |

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|---|---|---|---|---|---|
| Social_program_policy_analysis[Base_scenario] | GRAPH(TIME) Points: (2010.00, 0.1990), (2011.00, 0.1990), (2012.00, 0.1990), (2013.00, 0.1990), (2014.00, 0.1990), (2015.00, 0.1990), (2016.00, 0.1990), (2017.00, 0.1990), (2018.00, 0.1990), (2019.00, 0.1990), (2020.00, 0.1990), (2021.00, 0.1990), (2022.00, 0.1990), (2023.00, 0.1990), (2024.00, 0.1990), (2025.00, 0.1990), (2026.00, 0.1990), (2027.00, 0.1990), (2028.00, 0.1990), (2029.00, 0.1990), (2030.00, 0.1990), (2031.00, 0.1990), (2032.00, 0.1990), (2033.00, 0.1990), (2034.00, 0.1990), (2035.00, 0.1990) | | | | |
| Social_program_policy_analysis[Optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1990), (2011.00, 0.1990), (2012.00, 0.1990), (2013.00, 0.1990), (2014.00, 0.1990), (2015.00, 0.1990), (2016.00, 0.1990), (2017.00, 0.1990), (2018.00, 0.1990), (2019.00, 0.1990), (2020.00, 0.1990), (2021.00, 0.1990), (2022.00, 0.1990), (2023.00, 0.2013), (2024.00, 0.2066), (2025.00, 0.2066), (2026.00, 0.2105), (2027.00, 0.2158), (2028.00, 0.2184), (2029.00, 0.2211), (2030.00, 0.2211), (2031.00, 0.2211), (2032.00, 0.2211), (2033.00, 0.2224), (2034.00, 0.2237), (2035.00, 0.2316) | | | | |

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|---|---|---|---|---|---|
| Social_program_policy_analysis[Very_optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.1990), (2011.00, 0.1990), (2012.00, 0.1990), (2013.00, 0.1990), (2014.00, 0.1990), (2015.00, 0.1990), (2016.00, 0.1990), (2017.00, 0.1990), (2018.00, 0.1990), (2019.00, 0.1990), (2020.00, 0.1990), (2021.00, 0.1990), (2022.00, 0.1990), (2023.00, 0.2013), (2024.00, 0.2066), (2025.00, 0.2132), (2026.00, 0.2211), (2027.00, 0.2276), (2028.00, 0.2303), (2029.00, 0.2342), (2030.00, 0.2382), (2031.00, 0.2408), (2032.00, 0.2461), (2033.00, 0.2474), (2034.00, 0.2487), (2035.00, 0.2618) | | | | |
| Social_programs_budget | IF "Scenario_switch_(social_budget)"=1 THEN Total_state_outflow_per_year *Social_program_policy_analysis[Very_pessimistic_scenario] ELSE IF "Scenario_switch_(social_budget)"=2 THEN Total_state_outflow_per_year *Social_program_policy_analysis[Pessimistic_scenario] ELSE IF "Scenario_switch_(social_budget)"=3 THEN Total_state_outflow_per_year *Social_program_policy_analysis[Base_scenario] ELSE IF "Scenario_switch_(social_budget)"=4 THEN Total_state_outflow_per_year *Social_program_policy_analysis[Optimistic_scenario] ELSE IF "Scenario_switch_(social_budget)"=5 THEN Total_state_outflow_per_year *Social_program_policy_analysis[Very_optimistic_scenario] ELSE 0 | | ths UAH/year | The volume of budget expenditures for the social sphere in Ukraine. | |

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|---|---|---|---|---|---|
| Spending_on_economic_activity_per_year | IF "Scenario_switch_(Economic_activity)"=1 THEN Total_state_outflow_per_year *Economic_activity_spending_fraction[Very_pessimistic_scenario] ELSE IF "Scenario_switch_(Economic_activity)"=2 THEN Total_state_outflow_per_year *Economic_activity_spending_fraction[Pessimistic_scenario] ELSE IF "Scenario_switch_(Economic_activity)"=3 THEN Total_state_outflow_per_year *Economic_activity_spending_fraction[Base_scenario] ELSE IF "Scenario_switch_(Economic_activity)"=4 THEN Total_state_outflow_per_year *Economic_activity_spending_fraction[Optimistic_scenario] ELSE IF "Scenario_switch_(Economic_activity)"=5 THEN Total_state_outflow_per_year *Economic_activity_spending_fraction[Very_optimistic_scenario] ELSE 0 | INIT Spending_on_economic_activity_per_year = 2 | ths UAH/years | The volume of budget expenditures for economic activity.<br><br>Economic activity includes investments in the economy to improve the economic situation in Ukraine. | |
| Spending_on_retail_per_year | Spending_on_economic_activity_per_year *Trade_spending_fraction | | ths UAH/ye | The volume of budget expenditures on trade. Trade includes wholesale and retail. | |
| State_budget(t) | State_budget(t - dt) + (Total_state_inflow_per_year - Total_state_outflow_per_year) * dt | INIT State_budget | ths UAH | The volume of the Ukrainian budget.<br><br>The base indicator was the budget of Ukraine for 2009.<br><br>Source:<br>(CASE, 2022; MFU, 2021a) | |

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|---|---|---|---|---|---|
| "Tax_rate_(income_tax)" | GRAPH(TIME) Points: (2010.00, 0.150), (2011.00, 0.150), (2012.00, 0.150), (2013.00, 0.150), (2014.00, 0.150), (2015.00, 0.150), (2016.00, 0.180), (2017.00, 0.180), (2018.00, 0.180), (2019.00, 0.180), (2020.00, 0.180), (2021.00, 0.180), (2022.00, 0.180), (2023.00, 0.180), (2024.00, 0.180), (2025.00, 0.180), (2026.00, 0.180), (2027.00, 0.180), (2028.00, 0.180), (2029.00, 0.180), (2030.00, 0.180), (2031.00, 0.180), (2032.00, 0.180), (2033.00, 0.180), (2034.00, 0.180), (2035.00, 0.180) | | dmnl | The income tax rate for employees in Ukraine.<br><br>Source:<br>(MFU, 2021b) | |
| "Tax_rate_(VAT)" | 0.2 | | dmnl | The value-added tax rate in Ukraine.<br><br>Source:<br>(Legalaid, 2023a) | |
| Taxes_from_one_citizen | Income_tax_earnings_from_retail_per_year/Employment_in_retail_per_year | | ths ПДФО/рік | Amount of income tax per employee. | |
| Total_state_inflow_per_year | Total_tax_earnings_from_retail_per_year<br>+Inflow_from_other_segments | | ths ПДФО/рік | Amount of revenues to the Ukrainian budget. | |
| Total_state_outflow_per_year | State_budget<br>*(1+"Desired_level_of_deficit_(max)") | INIT | ths ПДФО/рік | The volume of expenditures of the Ukrainian budget. | |
| Total_tax_earnings_from_retail_per_year | "Corporate_(or_exit_capital_tax)_tax_earnings_from_retail_per_year"<br>+Income_tax_earnings_from_retail_per_year<br>+VAT_earnings_from_retail_per_year | | ths UAH/years | The volume of total tax revenues from companies in retail in Ukraine. | |

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|---|---|---|---|---|---|
| Trade_spending_fraction | 0.02 | | dmnl | The share of trade expenditures in all expenditures on economic activity.<br><br>The indicator was calculated by the author, based on the following data:<br>(MFU, 2021a) | |
| VAT_earnings_from_retail_per_year | "Tax_rate_(VAT)"*Total_sales_in_retail_per_year*Percentage_who_pay_VAT | | ths UAH/years | Amount of tax revenue from value-added tax.<br><br>The data was compared to historical data using the author's calculations.<br><br>Used sources:<br>(Ukrstat, 2021d)<br>(Zvarich, 2013) | |
| "3._TAX_ADMINISTATION": | | | | | |
| Adjusted_corruption_effects[Corruption_factors] | IF Extreme_test_switch=0 THEN Corruption_effects*Corruption_weights*Government_willing_effect*Internal_corruption_effect ELSE Extreme_test_for_corruption_indicators*Corruption_weights | | dmnl | Weight-adjusted effects of each fertility factor. | |
| Adjusted_reputation_effect | Reputation_effect*Reputation_weights | | dmnl | Adjusted effect for factor influence weight. | |

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|---|---|---|---|---|---|
| Business_control | IF "Scenario_switch_(Business_control)"=1 THEN "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Very_pessimistic_scenario]-0.01 ELSE IF "Scenario_switch_(Business_control)"=2 THEN "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Pessimistic_scenario]-0.01 ELSE IF "Scenario_switch_(Business_control)"=3 THEN "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Base_scenario]-0.01 ELSE IF "Scenario_switch_(Business_control)"=4 THEN "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Optimistic_scenario]-0.01 ELSE IF "Scenario_switch_(Business_control)"=5 THEN "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Very_optimistic_scenario]-0.01 ELSE 1 | | dmnl | The difference between the actual rate of checks and the critical level of checks. (selected scenario)<br><br>An indicator of 1% of all companies in Ukraine was chosen for the model.<br><br>Source:<br>(Schneider et al., 2010) | |

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|---|---|---|---|---|---|
| Corruption_effects[Economic_reasons_that_people_pay_pay_bribes] | GRAPH(Corruption_indicators) Points: (-0.500, -1.000), (-0.400, -0.9747), (-0.300, -0.9132), (-0.200, -0.7669), (-0.100, -0.4648), (0.000, 0.000), (0.100, 0.4648), (0.200, 0.7669), (0.300, 0.9132), (0.400, 0.9747), (0.500, 1.000) | | dmnl | 1. Growing poverty of the population stimulates the population to pay bribes<br>2. Instability of incomes and lack of macroeconomic stability encourages business to pay bribes.<br>3. Bureaucratization and high discretion in state institutions provoke the growth of corruption.<br>4. The increase in the number of business inspections has a negative effect on the level of corruption.<br>5. Reducing the gap between the salary of the taxman and workers in the market can lead to an increase in corruption.<br>6. The increase in the quality of personnel of state institutions has a positive effect on the fight against corruption.<br>7. An increased court decision and increased control over employees leads to a decrease in corruption. | |
| Corruption_effects[Economic_reasons_that_business_pay_bribes] | GRAPH(Corruption_indicators) Points: (-0.500, -1.000), (-0.400, -0.9747), (-0.300, -0.9132), (-0.200, -0.7669), (-0.100, -0.4648), (0.000, 0.000), (0.100, 0.4648), (0.200, 0.7669), (0.300, 0.9132), (0.400, 0.9747), (0.500, 1.000) | | | | |
| Corruption_effects[E_services_level] | GRAPH(Corruption_indicators) Points: (0.000, -1.000), (0.100, -0.6989), (0.200, -0.4265), (0.300, -0.180), (0.400, 0.04309), (0.500, 0.2449), (0.600, 0.4275), (0.700, 0.5928), (0.800, 0.7423), (0.900, 0.8776), (1.000, 1.000) | | | | |

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|---|---|---|---|---|---|
| Corruption_effects[Control_business] | GRAPH(Corruption_indicators) Points: (-0.1000, 1.000), (-0.0700, 0.8776), (-0.0400, 0.7423), (-0.0100, 0.5928), (0.0200, 0.4275), (0.0500, 0.2449), (0.0800, 0.04309), (0.1100, -0.180), (0.1400, -0.4265), (0.1700, -0.6989), (0.2000, -1.000) | | | | |
| Corruption_effects[Salary_fraction] | GRAPH(Corruption_indicators) Points: (0.000, -1.000), (0.200, -0.6989), (0.400, -0.4265), (0.600, -0.180), (0.800, 0.04309), (1.000, 0.2449), (1.200, 0.4275), (1.400, 0.5928), (1.600, 0.7423), (1.800, 0.8776), (2.000, 1.000) | | | | |
| Corruption_effects[Expenses_on_personal] | GRAPH(Corruption_indicators) Points: (0.000, -1.000), (0.100, -0.6989), (0.200, -0.4265), (0.300, -0.180), (0.400, 0.04309), (0.500, 0.2449), (0.600, 0.4275), (0.700, 0.5928), (0.800, 0.7423), (0.900, 0.8776), (1.000, 1.000) | | | | |
| Corruption_effects[Control_staff] | GRAPH(Corruption_indicators) Points: (0, -1.000), (0.008, -0.6989), (0.016, -0.4265), (0.024, -0.180), (0.032, 0.04309), (0.04, 0.2449), (0.048, 0.4275), (0.056, 0.5928), (0.064, 0.7423), (0.072, 0.8776), (0.08, 1.000) | | | | |
| Corruption_indicators[Economic_reasons_that_people_pay_pay_bribes] | Economic_reasons_for_people_to_pay_bribes | | dmnl | An array of data was created from previous factors influencing corruption.<br><br>This is necessary for the analysis of effects and the calculation of the aggregated indicator of corruption. | |

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|---|---|---|---|---|---|
| Corruption_indicators[Economic_reasons_that_business_pay_bribes] | Economic_reasons_for_business_to_pay_bribes | | | | |
| Corruption_indicators[E_services_level] | "Digitalisation_of_public_services_(Level_of_e-services)" | | | | |
| Corruption_indicators[Control_business] | Business_control | | | | |
| Corruption_indicators[Salary_fraction] | Fraction_between_salary_of_inspectors_and_workers | | | | |
| Corruption_indicators[Expenses_on_personal] | Staff_improvement_in_DPS | | | | |
| Corruption_indicators[Control_staff] | Staff_control | | | | |
| Corruption_weights[Economic_reasons_that_people_pay_pay_bribes] | 0.40625 | | dmnl | Each factor has its weight, which makes it possible to assess the level of influence of the factor on the overall indicator of corruption.<br><br>Weights are calculated by the author based on model calibration so that the model reproduces historical data. | |
| Corruption_weights[Economic_reasons_that_business_pay_bribes] | 0.90625 | | | | |
| Corruption_weights[E_services_level] | 0.78125 | | | | |

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|---|---|---|---|---|---|
| Corruption_weights[Control_business] | 0.09375 | | | | |
| Corruption_weights[Salary_fraction] | 0.59375 | | | | |
| Corruption_weights[Expenses_on_personal] | 0.65625 | | | | |
| Corruption_weights[Control_staff] | 0.84375 | | | | |
| "Digitalisation_of_public_services_(Level_of_e-services)" | IF "Scenario_switch_(Digitalisation)"=1 THEN Realization_of_digital_reform[Very_pessimistic_scenario] ELSE IF "Scenario_switch_(Digitalisation)"=2 THEN Realization_of_digital_reform[Pessimistic_scenario] ELSE IF "Scenario_switch_(Digitalisation)"=3 THEN Realization_of_digital_reform[Base_scenario] ELSE IF "Scenario_switch_(Digitalisation)"=4 THEN Realization_of_digital_reform[Optimistic_scenario] ELSE IF "Scenario_switch_(Digitalisation)"=5 THEN Realization_of_digital_reform[Very_optimistic_scenario] ELSE 1 | | dmnl | Implementation of the digitalization reform of public services in Ukraine. (selected scenario)<br><br>Source:<br>(IFES, 2022) | |
| Economic_reasons_for_business_to_pay_bribes | Total_sales_in_retail_per_year_effect+1-Inflation | | dmnl | The difference between inflation and the rate of sales growth affects the real income of companies, which affects the willingness of companies to pay bribes.<br><br>Source:<br>(IRGlobal, 2022) | |

| | | | | | |
|---|---|---|---|---|---|
| Economic_reasons_for_people_to_pay_bribes | Salary_for_employees_effect+1-Inflation | | dmnl | The difference between inflation and the growth rate of wages affects the real income of the population, which affects the willingness of the population to pay bribes.<br><br>Source:<br>(Ward, 2023) | |
| "Employees'_Performance_in_DPS_(corruption_policy)"[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.034285714), (2011.00, 0.034285714), (2012.00, 0.034285714), (2013.00, 0.034285714), (2014.00, 0.034285714), (2015.00, 0.034285714), (2016.00, 0.034285714), (2017.00, 0.034285714), (2018.00, 0.034285714), (2019.00, 0.034285714), (2020.00, 0.034285714), (2021.00, 0.034285714), (2022.00, 0.034285714), (2023.00, 0.0974), (2024.00, 0.0895), (2025.00, 0.0816), (2026.00, 0.0750), (2027.00, 0.0658), (2028.00, 0.0592), (2029.00, 0.0526), (2030.00, 0.0474), (2031.00, 0.0421), (2032.00, 0.0342), (2033.00, 0.0289), (2034.00, 0.0237), (2035.00, 0.0197) | | dmnl | The share of employees attending advanced training courses in the tax service.<br><br>Source:<br>(Mocetti & Orlando, 2019) | |

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|---|---|---|---|---|---|
| "Employees'_Performance_in_DPS_(corruption_policy)" [Pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.034285714), (2011.00, 0.034285714), (2012.00, 0.034285714), (2013.00, 0.034285714), (2014.00, 0.034285714), (2015.00, 0.034285714), (2016.00, 0.034285714), (2017.00, 0.034285714), (2018.00, 0.034285714), (2019.00, 0.034285714), (2020.00, 0.034285714), (2021.00, 0.034285714), (2022.00, 0.034285714), (2023.00, 0.0974), (2024.00, 0.0934), (2025.00, 0.0868), (2026.00, 0.0829), (2027.00, 0.0763), (2028.00, 0.0684), (2029.00, 0.0645), (2030.00, 0.0632), (2031.00, 0.0605), (2032.00, 0.0605), (2033.00, 0.0579), (2034.00, 0.0539), (2035.00, 0.0461) | | | | |
| "Employees'_Performance_in_DPS_(corruption_policy)" [Base_scenario] | GRAPH(TIME) Points: (2010.00, 0.034285714), (2011.00, 0.034285714), (2012.00, 0.034285714), (2013.00, 0.034285714), (2014.00, 0.034285714), (2015.00, 0.034285714), (2016.00, 0.034285714), (2017.00, 0.034285714), (2018.00, 0.034285714), (2019.00, 0.034285714), (2020.00, 0.034285714), (2021.00, 0.034285714), (2022.00, 0.034285714), (2023.00, 0.1000), (2024.00, 0.1000), (2025.00, 0.1000), (2026.00, 0.1000), (2027.00, 0.1000), (2028.00, 0.1000), (2029.00, 0.1000), (2030.00, 0.1000), (2031.00, 0.1000), (2032.00, 0.1000), (2033.00, 0.1000), (2034.00, 0.1000), (2035.00, 0.1000) | | | | |

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| "Employees'_Performance_in_DPS_(corruption_policy)" [Optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.034285714), (2011.00, 0.034285714), (2012.00, 0.034285714), (2013.00, 0.034285714), (2014.00, 0.034285714), (2015.00, 0.034285714), (2016.00, 0.034285714), (2017.00, 0.034285714), (2018.00, 0.034285714), (2019.00, 0.034285714), (2020.00, 0.034285714), (2021.00, 0.034285714), (2022.00, 0.034285714), (2023.00, 0.1053), (2024.00, 0.1105), (2025.00, 0.1145), (2026.00, 0.1158), (2027.00, 0.1184), (2028.00, 0.1184), (2029.00, 0.1197), (2030.00, 0.1237), (2031.00, 0.1289), (2032.00, 0.1303), (2033.00, 0.1316), (2034.00, 0.1342), (2035.00, 0.1474) | | | | |
| "Employees'_Performance_in_DPS_(corruption_policy)" [Very_optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.034285714), (2011.00, 0.034285714), (2012.00, 0.034285714), (2013.00, 0.034285714), (2014.00, 0.034285714), (2015.00, 0.034285714), (2016.00, 0.034285714), (2017.00, 0.034285714), (2018.00, 0.034285714), (2019.00, 0.034285714), (2020.00, 0.034285714), (2021.00, 0.034285714), (2022.00, 0.034285714), (2023.00, 0.1013), (2024.00, 0.1053), (2025.00, 0.1079), (2026.00, 0.1132), (2027.00, 0.1184), (2028.00, 0.1224), (2029.00, 0.1250), (2030.00, 0.1303), (2031.00, 0.1355), (2032.00, 0.1421), (2033.00, 0.1461), (2034.00, 0.1566), (2035.00, 0.1724) | | | | |

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| Extreme_test_for_corruption_indicators[Corruption_factors] | 1 | | dmnl | A variable to check the model's maximum values. | |
| Factors_of_interaction_with_institutions_and_reputation_factor | Straggle_with_corruption_level+Adjusted_reputation_effect | | dmnl | Aggregate indicator of interaction between the population and the government (public services, corruption, reputation) | |
| Fraction_between_salary_of_inspectors_and_workers | Salary_for_inspectors_expenses/Salary_for_employees_in_retail | | dmnl | The salary gap between workers in the market and the employee of the tax service.<br><br>Source:<br>(U4, 2009) | |
| "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0), (2011.00, 0.01053), (2012.00, 0.0114), (2013.00, 0.01316), (2014.00, 0.01447), (2015.00, 0.01711), (2016.00, 0.01842), (2017.00, 0.02061), (2018.00, 0.02149), (2019.00, 0.02325), (2020.00, 0.025), (2021.00, 0.025), (2022.00, 0.025), (2023.00, 0.02368), (2024.00, 0.02281), (2025.00, 0.02061), (2026.00, 0.0193), (2027.00, 0.01579), (2028.00, 0.0136), (2029.00, 0.00921), (2030.00, 0.00526), (2031.00, 0.00263), (2032.00, 0.00044), (2033.00, 0), (2034.00, 0), (2035.00, 0) | | dmnl | Several successful convictions for all criminal investigations.<br><br>Source:<br>(Slovoidilo.ua, 2021)<br><br>(U4, 2018) | |

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| "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0), (2011.00, 0.01053), (2012.00, 0.0114), (2013.00, 0.01316), (2014.00, 0.01447), (2015.00, 0.01711), (2016.00, 0.01842), (2017.00, 0.02061), (2018.00, 0.02149), (2019.00, 0.02325), (2020.00, 0.025), (2021.00, 0.025), (2022.00, 0.025), (2023.00, 0.02368), (2024.00, 0.02281), (2025.00, 0.02149), (2026.00, 0.0193), (2027.00, 0.01711), (2028.00, 0.01535), (2029.00, 0.01316), (2030.00, 0.0114), (2031.00, 0.01053), (2032.00, 0.00965), (2033.00, 0.00921), (2034.00, 0.00877), (2035.00, 0.0057) | | | | |
| "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Base_scenario] | GRAPH(TIME) Points: (2010.00, 0), (2011.00, 0.01053), (2012.00, 0.0114), (2013.00, 0.01316), (2014.00, 0.01447), (2015.00, 0.01711), (2016.00, 0.01842), (2017.00, 0.02061), (2018.00, 0.02149), (2019.00, 0.02325), (2020.00, 0.025), (2021.00, 0.025), (2022.00, 0.02544), (2023.00, 0.02544), (2024.00, 0.02632), (2025.00, 0.02719), (2026.00, 0.02807), (2027.00, 0.02895), (2028.00, 0.02939), (2029.00, 0.02939), (2030.00, 0.03026), (2031.00, 0.03114), (2032.00, 0.03289), (2033.00, 0.03377), (2034.00, 0.03465), (2035.00, 0.03947) | | | | |

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| "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0), (2011.00, 0.01053), (2012.00, 0.0114), (2013.00, 0.01316), (2014.00, 0.01447), (2015.00, 0.01711), (2016.00, 0.01842), (2017.00, 0.02061), (2018.00, 0.02149), (2019.00, 0.02325), (2020.00, 0.025), (2021.00, 0.025), (2022.00, 0.02588), (2023.00, 0.02982), (2024.00, 0.03289), (2025.00, 0.03421), (2026.00, 0.03772), (2027.00, 0.03947), (2028.00, 0.0443), (2029.00, 0.04868), (2030.00, 0.05263), (2031.00, 0.05482), (2032.00, 0.05789), (2033.00, 0.05921), (2034.00, 0.06053), (2035.00, 0.07588) | | | | |
| "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Very_optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0), (2011.00, 0.01053), (2012.00, 0.0114), (2013.00, 0.01316), (2014.00, 0.01447), (2015.00, 0.01711), (2016.00, 0.01842), (2017.00, 0.02061), (2018.00, 0.02149), (2019.00, 0.02325), (2020.00, 0.025), (2021.00, 0.025), (2022.00, 0.02632), (2023.00, 0.03465), (2024.00, 0.04167), (2025.00, 0.04956), (2026.00, 0.05482), (2027.00, 0.06053), (2028.00, 0.06711), (2029.00, 0.07281), (2030.00, 0.07807), (2031.00, 0.08026), (2032.00, 0.08772), (2033.00, 0.09298), (2034.00, 0.09693), (2035.00, 0.1) | | | | |
| Government_willing_effect[Corruption_factors] | 1 | | dmnl | The government's willingness to reform the system is an important factor in the success of public sector reform.<br><br>Source: (TransparencyInternational, 2015) | |

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| Internal_corruption_effect[Corruption_factors] | 0.8 | | dmnl | The factor of influence of internal corruption in state institutions.<br><br>Internal corruption refers to corruption in the management of state organizations.<br><br>I assume that internal corruption in institutions can take 20% of the budget.<br><br>Source:<br>(GIACC, 2020) | |
| Level_of_reputation_losses_for_citizen | Informal_employment_in_retail_per_year/Employment_in_retail_per_year | | dmnl | The level of shadow employment in retail. | |
| "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.01383), (2011.00, 0.01317), (2012.00, 0.01242), (2013.00, 0.0115), (2014.00, 0.01075), (2015.00, 0.01008), (2016.00, 0.0095), (2017.00, 0.00908), (2018.00, 0.00867), (2019.00, 0.00817), (2020.00, 0.00767), (2021.00, 0.00917), (2022.00, 0.00992), (2023.00, 0.01058), (2024.00, 0.0115), (2025.00, 0.01225), (2026.00, 0.01317), (2027.00, 0.01383), (2028.00, 0.01467), (2029.00, 0.0155), (2030.00, 0.01625), (2031.00, 0.01692), (2032.00, 0.01767), (2033.00, 0.01817), (2034.00, 0.01883), (2035.00, 0.02) | | dmnl | The volume of inspections in the total number of companies in Ukraine.<br><br>Source:<br>(DPS, 2021b) | |

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| "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.01383), (2011.00, 0.01317), (2012.00, 0.01242), (2013.00, 0.0115), (2014.00, 0.01075), (2015.00, 0.01008), (2016.00, 0.0095), (2017.00, 0.00908), (2018.00, 0.00867), (2019.00, 0.00817), (2020.00, 0.00767), (2021.00, 0.008), (2022.00, 0.00842), (2023.00, 0.00883), (2024.00, 0.00917), (2025.00, 0.00967), (2026.00, 0.01008), (2027.00, 0.01033), (2028.00, 0.01075), (2029.00, 0.01117), (2030.00, 0.01167), (2031.00, 0.01208), (2032.00, 0.0125), (2033.00, 0.01308), (2034.00, 0.01383), (2035.00, 0.01483) | | | | |
| "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Base_scenario] | GRAPH(TIME) Points: (2010.00, 0.01383), (2011.00, 0.01317), (2012.00, 0.01242), (2013.00, 0.0115), (2014.00, 0.01075), (2015.00, 0.01008), (2016.00, 0.0095), (2017.00, 0.00908), (2018.00, 0.00867), (2019.00, 0.00817), (2020.00, 0.00775), (2021.00, 0.00742), (2022.00, 0.00717), (2023.00, 0.00692), (2024.00, 0.00658), (2025.00, 0.00642), (2026.00, 0.00617), (2027.00, 0.00608), (2028.00, 0.00592), (2029.00, 0.00583), (2030.00, 0.00558), (2031.00, 0.00533), (2032.00, 0.00525), (2033.00, 0.00517), (2034.00, 0.00508), (2035.00, 0.00483) | | | | |

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| "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.01383), (2011.00, 0.01317), (2012.00, 0.01242), (2013.00, 0.0115), (2014.00, 0.01075), (2015.00, 0.01008), (2016.00, 0.0095), (2017.00, 0.00908), (2018.00, 0.00867), (2019.00, 0.00817), (2020.00, 0.00758), (2021.00, 0.00708), (2022.00, 0.00667), (2023.00, 0.00642), (2024.00, 0.00608), (2025.00, 0.00575), (2026.00, 0.00533), (2027.00, 0.00492), (2028.00, 0.0045), (2029.00, 0.00408), (2030.00, 0.00375), (2031.00, 0.00342), (2032.00, 0.00317), (2033.00, 0.00283), (2034.00, 0.00233), (2035.00, 0.00142) | | | | |
| "Number_of_checks_in_%_of_all_business_(corruption_policy)"[Very_optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 0.01383), (2011.00, 0.01317), (2012.00, 0.01242), (2013.00, 0.0115), (2014.00, 0.01075), (2015.00, 0.01008), (2016.00, 0.0095), (2017.00, 0.00908), (2018.00, 0.00867), (2019.00, 0.00817), (2020.00, 0.00775), (2021.00, 0.00767), (2022.00, 0.00725), (2023.00, 0.00692), (2024.00, 0.0065), (2025.00, 0.00617), (2026.00, 0.00558), (2027.00, 0.00508), (2028.00, 0.00458), (2029.00, 0.00392), (2030.00, 0.00317), (2031.00, 0.0025), (2032.00, 0.00192), (2033.00, 0.00125), (2034.00, 0.00058), (2035.00, 0) | | | | |
| "Number_of_employees_(DPS)" | 1400 | | persons | The number of employees in the central office of the Tax Service of Ukraine<br><br>Source:<br>(NADS, 2021) | |

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| Realization_of_digital_reform[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2015.00, 0.000), (2017.00, 0.01263), (2019.00, 0.04341), (2021.00, 0.1165), (2023.00, 0.2676), (2025.00, 0.500), (2027.00, 0.7324), (2029.00, 0.8835), (2031.00, 0.9566), (2033.00, 0.9874), (2035.00, 1.000) | | dmnl | The policy demonstrates the digitization of public services. According to the baseline scenario, the Ukrainian government plans to digitize all public services by 2025.<br><br>Source:<br>(IFES, 2022)<br><br>(KMU, 2022)<br><br>(Khan et al., 2021) | |
| Realization_of_digital_reform[Pessimistic_scenario] | GRAPH(TIME) Points: (2015.00, 0.000), (2016.50, 0.01263), (2018.00, 0.04341), (2019.50, 0.1165), (2021.00, 0.2676), (2022.50, 0.500), (2024.00, 0.7324), (2025.50, 0.8835), (2027.00, 0.9566), (2028.50, 0.9874), (2030.00, 1.000) | | | | |
| Realization_of_digital_reform[Base_scenario] | GRAPH(TIME) Points: (2015.00, 0.000), (2016.00, 0.03187), (2017.00, 0.08744), (2018.00, 0.1809), (2019.00, 0.3221), (2020.00, 0.500), (2021.00, 0.6779), (2022.00, 0.8191), (2023.00, 0.9126), (2024.00, 0.9681), (2025.00, 1.000) | | | | |
| Realization_of_digital_reform[Optimistic_scenario] | GRAPH(TIME) Points: (2015.000, 0.000), (2015.900, 0.01263), (2016.800, 0.04341), (2017.700, 0.1165), (2018.600, 0.2676), (2019.500, 0.500), (2020.400, 0.7324), (2021.300, 0.8835), (2022.200, 0.9566), (2023.100, 0.9874), (2024.000, 1.000) | | | | |

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|---|---|---|---|---|---|
| Realization_of_digital_reform[Very_optimistic_scenario] | GRAPH(TIME) Points: (2015.000, 0.000), (2015.800, 0.01263), (2016.600, 0.04341), (2017.400, 0.1165), (2018.200, 0.2676), (2019.000, 0.500), (2019.800, 0.7324), (2020.600, 0.8835), (2021.400, 0.9566), (2022.200, 0.9874), (2023.000, 1.000) | | | | |
| Reputation_effect | GRAPH(Level_of_reputation_losses_for_citizen) Points: (0.0000, 1.000), (0.0500, 0.8776), (0.1000, 0.7423), (0.1500, 0.5928), (0.2000, 0.4275), (0.2500, 0.2449), (0.3000, 0.04309), (0.3500, -0.180), (0.4000, -0.4265), (0.4500, -0.6989), (0.5000, -1.000) | | dmnl | The effect demonstrates the relationship between the size of a certain group and the desire of members of that group to continue being a member of that group.<br><br>The smaller the group, the less desire to be part of it.<br><br>This effect shows the influence of the size of shadow employment on people's willingness to work in the shadow segment.<br><br>Source:<br>(Saeed et al., 2013) | |
| Reputation_weights | 0.09375 | | dmnl | The weight of reputational losses in the general causes of informal employment.<br><br>Weights are calculated by the author based on model calibration so that the model reproduces historical data. | |
| Salary_for_employees_effect | GRAPH(TREND(Salary_for_employees_in_retail, 1, 0.1)) Points: (-1.000, -1.000), (-0.800, -0.800), (-0.600, -0.600), (-0.400, -0.400), (-0.200, -0.200), (0.000, 0.000), (0.200, 0.200), (0.400, 0.400), (0.600, 0.600), (0.800, 0.800), (1.000, 1.000) | | dmnl | The graphical function shows the effect of changing the wages of employees. | |

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| Salary_for_inspectors_expenses | (Tax_administration_expenses*0.1/"Number_of_employees_(DPS)"/Calculation_from_months_to_years)*Calculation_from_1_ths_to_1000 | | UAH/person | Salary of employees in the tax administration. | |
| "Scenario_switch_(Business_control)" | 3 | | dmnl | The switch allows activating of the policy of reducing the number of business inspections in Ukraine. | |
| "Scenario_switch_(Digitalisation)" | 3 | | dmnl | The switch allows activation of the digitization policy in Ukraine. | |
| "Scenario_switch_(Employees'_Performance)" | 3 | | dmnl | The switch allows activating the policy of improving the quality of personnel in the tax service in Ukraine. | |
| "Scenario_switch_(Law_system)" | 3 | | dmnl | The switch allows activating the policy | |

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|---|---|---|---|---|---|
| Staff_control | IF "Scenario_switch_(Law_system)"=1 THEN "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Very_pessimistic_scenario] ELSE IF "Scenario_switch_(Law_system)"=2 THEN "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Pessimistic_scenario] ELSE IF "Scenario_switch_(Law_system)"=3 THEN "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Base_scenario] ELSE IF "Scenario_switch_(Law_system)"=4 THEN "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Optimistic_scenario] ELSE IF "Scenario_switch_(Law_system)"=5 THEN "Fraction_of_court_decisions_in_the_total_investigations_(corruption_policy)"[Very_optimistic_scenario] ELSE 1 | | dmnl | Several successful convictions for all criminal investigations. (selected scenario)<br><br>Source:<br>(U4, 2018) | |

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| Staff_improvement_in_DPS | IF "Scenario_switch_(Employees'_Performance)"=1 THEN "Employees'_Performance_in_DPS_(corruption_policy)"[Very_pessimistic_scenario] ELSE IF "Scenario_switch_(Employees'_Performance)"=2 THEN "Employees'_Performance_in_DPS_(corruption_policy)"[Pessimistic_scenario] ELSE IF "Scenario_switch_(Employees'_Performance)"=3 THEN "Employees'_Performance_in_DPS_(corruption_policy)"[Base_scenario] ELSE IF "Scenario_switch_(Employees'_Performance)"=4 THEN "Employees'_Performance_in_DPS_(corruption_policy)"[Optimistic_scenario] ELSE IF "Scenario_switch_(Employees'_Performance)"=5 THEN "Employees'_Performance_in_DPS_(corruption_policy)"[Very_optimistic_scenario] ELSE 1 | | dmnl | The share of employees attending advanced training courses in the tax service. (selected scenario)<br><br>Source:<br>(Mocetti & Orlando, 2019) | |
| Straggle_with_corruption_level | Adjusted_corruption_effects[Economic_reasons_that_people_pay_pay_bribes]+Adjusted_corruption_effects[Economic_reasons_that_business_pay_bribes]+Adjusted_corruption_effects[E_services_level]+Adjusted_corruption_effects[Control_business]+Adjusted_corruption_effects[Salary_fraction]+Adjusted_corruption_effects[Expenses_on_personal]+Adjusted_corruption_effects[Control_staff] | | dmnl | The aggregate factor of influence of corruption on the quality of state institutions.<br><br>Source:<br>(Buehn & Schneider, 2009) | |
| Tax_administration_expense_rate | 0.006 | | dmnl | The share of the budget spent on the tax service in Ukraine | |

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|---|---|---|---|---|---|
| Tax_administration_expenses | Total_state_outflow_per_year *Tax_administration_expense_rate | | ths UAH/yr | The volume of state expenditures on the state tax service | |
| Total_sales_in_retail_per_year_effect | GRAPH(TREND(Total_sales_in_retail_per_year, 1, 1)) Points: (-1.000, -1.000), (-0.800, -0.800), (-0.600, -0.600), (-0.400, -0.400), (-0.200, -0.200), (0.000, 0.000), (0.200, 0.200), (0.400, 0.400), (0.600, 0.600), (0.800, 0.800), (1.000, 1.000) | | dmnl | The graphical function demonstrates the effect of changes in sales of companies in retail. | |
| "4._EMPLOYMENT_SEGMENT": | | | | | |
| Adjusted_time | 1 | | years | | |
| All_weights | SUM(Social_weights[*]) + SUM(Economic_weights[*]) + SUM(Corruption_weights[*]) + Reputation_weights | | dmnl | The sum of all the weights of factors affecting informal employment in Ukraine. | SUMMINGCONVERTER |
| Amount_of_people_from_the_unemployment_who_will_enter_employment | IF Potential_employment_for_retail_market>0 THEN Added_new_workplaces_per_year+People_who_find_job_with_gov_support*Retail_fraction+"New_places,_created_by_government" ELSE 0 | | persons/year | The number of people who moved from potential employment (unemployment) to the employed population in retail in Ukraine. | |
| Budget_per_one_person | Minimum_wage_in_Ukraine* Minimum_wage_fraction*12 | | UAH/person | Amount of expenses per unemployed person per year. | |

| | | | | | |
|---|---|---|---|---|---|
| Cover_rate | MIN(((Social_programs_budget/Spending_fraction*1000)/Budget_per_one_person)/Total_unemployment, 1) | | ths ΠΔΗ/ΠΠ | The coverage ratio shows the share of unemployed people receiving public assistance. | |
| Economic_adjusted_effects[Economic_factors] | IF Extreme_test_switch=1 THEN Extreme_test_for_economic_indicators*Economic_weights ELSE Economic_effects*Economic_weights | | dmnl | Adjusted effects for the weight of the economic situation. | |
| Economic_effects[Taxes] | GRAPH(Economic_Indicators) Points: (0.0000, 1.000), (0.0500, 0.8776), (0.1000, 0.7423), (0.1500, 0.5928), (0.2000, 0.4275), (0.2500, 0.2449), (0.3000, 0.04309), (0.3500, -0.180), (0.4000, -0.4265), (0.4500, -0.6989), (0.5000, -1.000) | | dmnl | Economic effects affecting informal employment in Ukraine. | |
| Economic_effects[Inflation] | GRAPH(Economic_Indicators) Points: (0.0000, 1.000), (0.0300, 0.8776), (0.0600, 0.7423), (0.0900, 0.5928), (0.1200, 0.4275), (0.1500, 0.2449), (0.1800, 0.04309), (0.2100, -0.180), (0.2400, -0.4265), (0.2700, -0.6989), (0.3000, -1.000) | | | | |
| Economic_effects[Minimum_wage] | GRAPH(Economic_Indicators) Points: (0.1000, 1.000), (0.1900, 0.8776), (0.2800, 0.7423), (0.3700, 0.5928), (0.4600, 0.4275), (0.5500, 0.2449), (0.6400, 0.04309), (0.7300, -0.180), (0.8200, -0.4265), (0.9100, -0.6989), (1.0000, -1.000) | | | | |
| Economic_Indicators[Taxes] | Taxes_factor | | dmnl | An array of inflation, minimum wage and tax burden factors. | |
| Economic_Indicators[Inflation] | Inflation_factor | | | | |

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|---|---|---|---|---|---|
| Economic_Indicators[Minimum_wage] | Wage_factor | | | | |
| Economic_weights[Taxes] | 0.90625 | | dmnl | Each factor has its weight, which makes it possible to assess the level of influence of the factor on the general state of the economic system.<br><br>Weights are calculated by the author based on model calibration so that the model reproduces historical data. | |
| Economic_weights[Inflation] | 0.21875 | | | | |
| Economic_weights[Minimum_wage] | 0.21875 | | | | |
| Employment_in_retail_per_year(t) | Employment_in_retail_per_year(t - dt) + (Transition_between_informal_employment_and_employment + Transition_from_potential_employment_to_employment + People_who_found_a_job_on_their_own - Fired_people_from_retail) * dt | INIT | persons | The volume of employment in retail in Ukraine.<br><br>The base indicator includes data from 2010:<br>(Ukrstat, 2021a) | |
| Employment_rate | 0.375 | | dmnl | Share of the employed population.<br><br>Source:<br>(Ukrstat, 2021a) | |
| Extreme_test_for_economic_indicators[Taxes] | 1 | | dmnl | A variable to check the model's maximum values. | |
| Extreme_test_for_economic_indicators[Inflation] | 1 | | | | |

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|---|---|---|---|---|---|
| Extreme_test_for_economic_indicators[Minimum_wage] | 1 | | | | |
| Extreme_test_for_social_indicators[Unemployment_help] | 1 | | dmnl | A variable to check the model's maximum values. | |
| Extreme_test_switch | 0 | | dmnl | A variable to check the model's maximum values. | |
| Factors_of_financial_and_economic_stability | Economic_adjusted_effects[Taxes]+Economic_adjusted_effects[Inflation] +Economic_adjusted_effects[Minimum_wage] | | dmnl | Aggregate indicator of the state of the economic system. | |
| Fired_people_from_retail | Fired_rate*Employment_in_retail_per_year | | persons/year | The flow of laid-off labor. | UNIFLOW |
| Fired_rate | 0.34 | | per year | Share of people who were fired from retail companies in Ukraine.<br><br>Source:<br>(DCZ, 2023)<br>(Ukrstat, 2021g) | |
| Graduated_people | Population*Graduation_rate | | persons/year | The number of students who graduated from school. | |
| Graduation_rate | 0.0056 | | per year | The share of students finishing school in population.<br><br>Source:<br>(Ukrstat, 2021b) | |

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|---|---|---|---|---|---|
| Inflation_factor | Inflation-Target_limit_inflation | | dmnl | The gap between inflation and the targeted level of inflation shows the level of stability of the economic system.<br><br>The greater the gap, the greater the instability of the economic system.<br><br>Source:<br>(ILO, 2022) | |
| Informal_employment_in_retail_per_year(t) | Informal_employment_in_retail_per_year(t - dt) + ( - Transition_between_informal_employment_and_employment ) * dt | INIT | persons | The volume of informal employment in retail in Ukraine.<br><br>The basic indicator was calculated by the author, based on trade statistics in Ukraine.<br><br>Source:<br>(Ukrstat, 2021a) | NON-NEGATIVE |
| Informal_employment_rate | Informal_employment_in_retail_per_year/(Informal_employment_in_retail_per_year+Employment_in_retail_per_year) | | dmnl | The volume of informal employment relative to total employment in Ukraine. | |
| Job_rate | 0.32 | | per year | Share of people who found a job among the potential employment in Ukraine. | |
| Minimum_wage_fraction | 0.5 | | dmnl | Part of the minimum wage is paid as unemployment benefits.<br><br>Sources:<br>(Legalaid, 2023b) | |

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|---|---|---|---|---|---|
| Minimum_wage_in_Ukraine | IF "Scenario_switch_(minimum_wage)"=1 THEN "Minimum_wage_in_Ukraine_(policies)"[Very_pessimistic_scenario] ELSE IF "Scenario_switch_(minimum_wage)"=2 THEN "Minimum_wage_in_Ukraine_(policies)"[Pessimistic_scenario] ELSE IF "Scenario_switch_(minimum_wage)"=3 THEN "Minimum_wage_in_Ukraine_(policies)"[Base_scenario] ELSE IF "Scenario_switch_(minimum_wage)"=4 THEN "Minimum_wage_in_Ukraine_(policies)"[Optimistic_scenario] ELSE IF "Scenario_switch_(minimum_wage)"=5 THEN "Minimum_wage_in_Ukraine_(policies)"[Very_optimistic_scenario] ELSE 0 | | UAH/person | The minimum wage in Ukraine (selected scenario). | |
| "Minimum_wage_in_Ukraine_(policies)"[Very_pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 869), (2011.00, 941), (2012.00, 1073), (2013.00, 1218), (2014.00, 1218), (2015.00, 1218), (2016.00, 1378), (2017.00, 3200), (2018.00, 3723), (2019.00, 4173), (2020.00, 4723), (2021.00, 6000), (2022.00, 6700), (2023.00, 7000), (2024.00, 7000), (2025.00, 7200), (2026.00, 7600), (2027.00, 7900), (2028.00, 8200), (2029.00, 8500), (2030.00, 8700), (2031.00, 8800), (2032.00, 9100), (2033.00, 9100), (2034.00, 9100), (2035.00, 9500) | | UAH/person | The minimum wage in Ukraine.<br><br>Source: (Victorija.ua, 2022) | |

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|---|---|---|---|---|---|
| "Minimum_wage_in_Ukraine_(policies)"[Pessimistic_scenario] | GRAPH(TIME) Points: (2010.00, 869), (2011.00, 941), (2012.00, 1073), (2013.00, 1218), (2014.00, 1218), (2015.00, 1218), (2016.00, 1378), (2017.00, 3200), (2018.00, 3723), (2019.00, 4173), (2020.00, 4723), (2021.00, 6000), (2022.00, 6700), (2023.00, 7100), (2024.00, 7300), (2025.00, 7500), (2026.00, 7900), (2027.00, 8000), (2028.00, 8500), (2029.00, 8800), (2030.00, 9100), (2031.00, 9400), (2032.00, 9900), (2033.00, 10200), (2034.00, 10300), (2035.00, 10500) | | | | |
| "Minimum_wage_in_Ukraine_(policies)"[Base_scenario] | GRAPH(TIME) Points: (2010.00, 869), (2011.00, 941), (2012.00, 1073), (2013.00, 1218), (2014.00, 1218), (2015.00, 1218), (2016.00, 1378), (2017.00, 3200), (2018.00, 3723), (2019.00, 4173), (2020.00, 4723), (2021.00, 6000), (2022.00, 6900), (2023.00, 7200), (2024.00, 7700), (2025.00, 8500), (2026.00, 9300), (2027.00, 10000), (2028.00, 10700), (2029.00, 11500), (2030.00, 12300), (2031.00, 13200), (2032.00, 13800), (2033.00, 14700), (2034.00, 15700), (2035.00, 16300) | | | | |

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|---|---|---|---|---|---|
| "Minimum_wage_in_Ukraine_(policies)"[Optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 869), (2011.00, 941), (2012.00, 1073), (2013.00, 1218), (2014.00, 1218), (2015.00, 1218), (2016.00, 1378), (2017.00, 3200), (2018.00, 3723), (2019.00, 4173), (2020.00, 4723), (2021.00, 6000), (2022.00, 6800), (2023.00, 7500), (2024.00, 8200), (2025.00, 9300), (2026.00, 9700), (2027.00, 10900), (2028.00, 11700), (2029.00, 13000), (2030.00, 14900), (2031.00, 16200), (2032.00, 17900), (2033.00, 19600), (2034.00, 21500), (2035.00, 24800) | | | | |
| "Minimum_wage_in_Ukraine_(policies)"[Very_optimistic_scenario] | GRAPH(TIME) Points: (2010.00, 869), (2011.00, 941), (2012.00, 1073), (2013.00, 1218), (2014.00, 1218), (2015.00, 1218), (2016.00, 1378), (2017.00, 3200), (2018.00, 3723), (2019.00, 4173), (2020.00, 4723), (2021.00, 6000), (2022.00, 6800), (2023.00, 8000), (2024.00, 9700), (2025.00, 12400), (2026.00, 14500), (2027.00, 15600), (2028.00, 16600), (2029.00, 19200), (2030.00, 26000), (2031.00, 28700), (2032.00, 35100), (2033.00, 37900), (2034.00, 39800), (2035.00, 40000) | | | | |

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|---|---|---|---|---|---|
| Model_calibra | GRAPH(TIME) Points: (2010.00, 45.6), (2011.00, 55.7), (2012.00, 56.6), (2013.00, 57.5), (2014.00, 57.9333333333), (2015.00, 58.3666666667), (2016.00, 58.8), (2017.00, 59.2333333333), (2018.00, 59.6666666667), (2019.00, 60.1), (2020.00, 60.4), (2021.00, 60.7), (2022.00, 61.0), (2023.00, 61.4333333333), (2024.00, 61.8666666667), (2025.00, 62.3), (2026.00, 62.3), (2027.00, 62.3), (2028.00, 62.3), (2029.00, 62.3), (2030.00, 62.3), (2031.00, 62.3), (2032.00, 62.3), (2033.00, 62.4333333333), (2034.00, 62.5666666667), (2035.00, 62.7) | | persons | | |
| People_who_find_job_with_gov_support | GRAPH(TIME) Points: (2010.00, 327000), (2011.00, 332000), (2012.00, 337000), (2013.00, 343000), (2014.00, 349000), (2015.00, 357000), (2016.00, 362000), (2017.00, 370000), (2018.00, 378000), (2019.00, 381000), (2020.00, 385000), (2021.00, 390000), (2022.00, 247000), (2023.00, 247000), (2024.00, 361000), (2025.00, 489000), (2026.00, 662000), (2027.00, 676000), (2028.00, 716000), (2029.00, 745000), (2030.00, 773000), (2031.00, 799000), (2032.00, 819000), (2033.00, 841000), (2034.00, 850000), (2035.00, 850000) | | Persons/year | The number of people who found work with the help of government institutions.<br><br>Source:<br>(DCZ, 2023) | |

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|---|---|---|---|---|---|
| People_who_found_a_job_on_their_own | Employment_in_retail_per_year*People_who_found_a_job_on_their_own_rate | | persons/year | Several self-employed people in retail.<br><br>Defined by the author as the difference between the total number of new employees - the number of employees who were helped by the government to find work.<br><br>Source:<br>(DCZ, 2023) | UNIFLOW |
| People_who_found_a_job_on_their_own_rate | 0.267965051 | | per year | The share of self-employed people relative to the total employed population in retail.<br><br>Source:<br>(DCZ, 2023)<br>(Ukrstat, 2021g) | |
| Potential_employment_for_retail_market(t) | Potential_employment_for_retail_market(t - dt) + (Fired_people_from_retail + Transition_from_other_segments + Transition_from_education_system - Transition_from_potential_employment_to_employment - Transition_to_other_segments ) * dt | INIT | persons | Potential employment includes all graduates and all unemployed in the trade sector of the economy.<br><br>Also, potential employment includes laid-off workers.<br><br>There are two flows from potential employment: to retail and other sectors of the economy. | NON-NEGATIVE |
| Retail_fraction | 0.0711 | | dmnl | The share of retail in the total number of places that the government provided to citizens. (job search assistance)<br><br>Source: (DCZ, 2023) | |
| "Scenario_switch_(minimum_wage)" | 3 | | dmnl | The switch allows activating the policy of changing the minimum wage in Ukraine. | |
| Social_adjusted_effects[Social_factors] | IF Extreme_test_switch=1 THEN Extreme_test_for_social_indicators*Social_weights ELSE Social_effects*Social_weights | | dmnl | Adjusted effects for the weight of social policy. | |

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|---|---|---|---|---|---|
| Social_contract_factor | Social_adjusted_effects[Unemployment_help] | | dmnl | Aggregate indicator of the government's social policy | |
| Social_effects[Unemployment_help] | GRAPH(Cover_rate) Points: (0.000, -1.000), (0.100, -0.6989), (0.200, -0.4265), (0.300, -0.180), (0.400, 0.04309), (0.500, 0.2449), (0.600, 0.4275), (0.700, 0.5928), (0.800, 0.7423), (0.900, 0.8776), (1.000, 1.000) | | dmnl | The effect of social policy on informal employment.<br><br>Source:<br>(Anthesis, 2022) | |
| Social_weights[Unemployment_help] | 0.28125 | | dmnl | Each factor has its weight, which makes it possible to assess the level of influence of the factor on the government's social policy.<br><br>Weights are calculated by the author based on model calibration so that the model reproduces historical data. | |
| Spending_fraction | 6 | | dmnl | The share of social expenditures directed to help the unemployed. | |
| "Sub-sectors_unemployment_fraction" | 0.17 | | per year | Share of trade in total unemployment.<br><br>Source:<br>(Ukrstat, 2021d) | |
| Target_limit_inflation | 1.04 | | dmnl | Targeted level of inflation in Ukraine.<br><br>I apply a rate of 4% for the entire period of the model.<br><br>Source:<br>(NBU, 2023) | |
| Tax_burden_on_employees | (Income_tax_earnings_from_retail_per_year/12)/Employment_in_retail_per_year | | ths UAH/ye | The indicator shows the amount of tax burden per employee. | |

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|---|---|---|---|---|---|
| Taxes_factor | Tax_burden_on_employees*Calculation_from_1_ths_to_1000/(Salary_for_employees_in_retail*Calculation_from_months_to_years) | | dmnl | The tax burden shapes the impact on the economic factors of working as an informal worker.<br><br>Source:<br>(Araujo & Rodrigues, 2016) | |
| The_share_of_people_from_the_informal_employment_who_will_enter_formal_employment | ((Factors_of_financial_and_economic_stability+Factors_of_interaction_with_institutions_and_reputation_factor+Social_contract_factor)/All_weights)/Adjusted_time | | Per Year | The share of the informally employed population transitions to formal employment in retail in Ukraine.<br><br>The indicator includes the influence of the factors of corruption, reputation, the state of the economic system, and the quality of the social policy of the Ukrainian government. | |
| Total_employment | Employment_rate*Population | | Persons | The volume of the employed population in Ukraine | |
| Total_unemployment | Total_employment*Unemployment_rate | | Persons | The volume of unemployment in Ukraine | |
| Transition_between_informal_employment_and_employment | IF The_share_of_people_from_the_informal_employment_who_will_enter_formal_employment>0 THEN Informal_employment_in_retail_per_year *The_share_of_people_from_the_informal_employment_who_will_enter_formal_employment ELSE Employment_in_retail_per_year*The_share_of_people_from_the_informal_employment_who_will_enter_formal_employment | | persons/year | Labor flow between informal employment and retail employment in Ukraine. | |

| | | | | | |
|---|---|---|---|---|---|
| Transition_from_education_system | Graduated_people | | persons/year | The number of students who graduated from school. | UNIFLOW |
| Transition_from_other_segments | Total_unemployment*"Sub-sectors_unemployment_fraction" | | persons/year | The flow of the unemployed in the trade sector of the economy of Ukraine. | UNIFLOW |
| Transition_from_potential_employment_to_employment | Amount_of_people_from_the_unemployment_who_will_enter_employment | OUTFLOW | persons/year | Labor flow between unemployment and employment in retail. | |
| Transition_to_other_segments | Job_rate*Potential_employment_for_retail_market | OUTFLOW | persons/year | The number of people who found a job among the potential employment in Ukraine. | UNIFLOW |
| Unemployment_rate | 0.06 | | dmnl | Share of the unemployed population.<br><br>Source: https://www.ukrstat.gov.ua/operativ/menu/menu_u/dem/r_pr.htm | |
| Wage_factor | Minimum_wage_in_Ukraine/Salary_for_employees_in_retail | | dmnl | Reducing the gap between the minimum wage and the average wage can have a negative impact on informal employment.<br><br>Source: (WB, 2017) | |
| "5._BUSINESS_CLIMATE_INDICATOR": | | | | | |

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|---|---|---|---|---|---|
| Business_climate_effects[Inflation] | GRAPH(Business_climate_indicators) Points: (-1.000, 1.000), (-0.800, 0.9874), (-0.600, 0.9566), (-0.400, 0.8835), (-0.200, 0.7324), (0.000, 0.500), (0.200, 0.2676), (0.400, 0.1165), (0.600, 0.04341), (0.800, 0.01263), (1.000, 0.000) | | dmnl | Effects on the aggregate indicator of the business climate in Ukraine. | |
| Business_climate_effects[Sales] | GRAPH(Business_climate_indicators) Points: (-1.000, 0.000), (-0.800, 0.01263), (-0.600, 0.04341), (-0.400, 0.1165), (-0.200, 0.2676), (0.000, 0.500), (0.200, 0.7324), (0.400, 0.8835), (0.600, 0.9566), (0.800, 0.9874), (1.000, 1.000) | | | | |
| Business_climate_effects[Corruption] | GRAPH(Business_climate_indicators) Points: (-1.000, 0.000), (-0.800, 0.01263), (-0.600, 0.04341), (-0.400, 0.1165), (-0.200, 0.2676), (0.000, 0.500), (0.200, 0.7324), (0.400, 0.8835), (0.600, 0.9566), (0.800, 0.9874), (1.000, 1.000) | | | | |
| Business_climate_effects[Employment] | GRAPH(Business_climate_indicators) Points: (0.000, 0.000), (0.0909090909091, 0.01097), (0.181818181818, 0.0356), (0.272727272727, 0.09036), (0.363636363636, 0.2018), (0.454545454545, 0.3877), (0.545454545455, 0.6123), (0.636363636364, 0.7982), (0.727272727273, 0.9096), (0.818181818182, 0.9644), (0.909090909091, 0.989), (1.000, 1.000) | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Business_climate_effects[Reforms] | GRAPH(Business_climate_indicators) Points: (0.000, 0.000), (0.100, 0.01263), (0.200, 0.04341), (0.300, 0.1165), (0.400, 0.2676), (0.500, 0.500), (0.600, 0.7324), (0.700, 0.8835), (0.800, 0.9566), (0.900, 0.9874), (1.000, 1.000) | | | | |
| Business_climate_indicator | (Business_climate_effects[Inflation]+Business_climate_effects[Sales]+Business_climate_effects[Corruption]+Business_climate_effects[Employment]+Business_climate_effects[Reforms])/5 | | dmnl | Business aggregates economic and social indicators affecting business activity in Ukraine.<br><br>The index affects the willingness of businesses to reinvest their funds in production. | |
| Business_climate_indicators[Inflation] | Inflation_factor_on_business_climate | | dmnl | An array of factors on the business climate in Ukraine. | |
| Business_climate_indicators[Sales] | Sales_factor_on_business_climate | | | | |
| Business_climate_indicators[Corruption] | Corruption_factor_on_business_climate | | | | |
| Business_climate_indicators[Employment] | Employment_factor_on_business_climate | | | | |
| Business_climate_indicators[Reforms] | Reforms_factor_on_business_climate | | | | |
| Corruption_factor_on_business_climate | Straggle_with_corruption_level | | dmnl | The impact factor of reducing corruption on improving the business climate in Ukraine.<br><br>Source: (LaMarco, 2018) | |

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|---|---|---|---|---|---|
| Employment_factor_on_business_climate | Employment_in_retail_per_year/Population | | dmnl | The impact factor of unemployment reduction on the business climate in Ukraine.<br><br>Source: (WGU, 2019) | |
| Inflation_factor_on_business_climate | Inflation-Target_limit_inflation | | dmnl | The factor of influence of inflation on the business climate in Ukraine.<br><br>Source:<br>(Nelson, 2022) | |
| Reforms_factor_on_business_climate | IF "Policy_time_(exit_capital_tax)">TIME THEN 0 ELSE 1 | | dmnl | The impact factor of the tax reform on the business climate in Ukraine.<br><br>Source: (Glazkova, 2018) | |
| Sales_factor_on_business_climate | GRAPH(TREND(Total_sales_in_retail_per_year, 3, 0.01))<br>Points: (-1.000, -1.000), (-0.800, -0.800), (-0.600, -0.600), (-0.400, -0.400), (-0.200, -0.200), (0.000, 0.000), (0.200, 0.200), (0.400, 0.400), (0.600, 0.600), (0.800, 0.800), (1.000, 1.000) | | dmnl | The impact factor of sales growth in Ukraine on the business climate in Ukraine.<br><br>Джерело: (Investopedia, 2023) | |
| History_vs_real_data_analysis: | | | | | |
| History_vs_real_data_analysis_1: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| "Employment_in_retail_per_year_(Actual)" | GRAPH(TIME) Points: (2010.00, 501304.0), (2011.00, 510851.0), (2012.00, 499069.0), (2013.00, 501657.0), (2014.00, 433489.0), (2015.00, 397963.0), (2016.00, 415295.0), (2017.00, 419560.0), (2018.00, 448797.0), (2019.00, 474064.0), (2020.00, 483360.0), (2021.00, 512533.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | persons | For historical analysis | |
| "From_education_system_(Actual)" | GRAPH(TIME) Points: (2010.00, 364000.0), (2011.00, 215000.0), (2012.00, 329000.0), (2013.00, 304000.0), (2014.00, 247000.0), (2015.00, 229000.0), (2016.00, 211000.0), (2017.00, 203000.0), (2018.00, 195000.0), (2019.00, 198000.0), (2020.00, 222000.0), (2021.00, 229000.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | persons | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Informal_employment_in_retail_per_year_(Actual)" | GRAPH(TIME) Points: (2010.00, 257012.5356), (2011.00, 257988.6352), (2012.00, 251032.7688), (2013.00, 266863.7585), (2014.00, 431958.3417), (2015.00, 420558.5008), (2016.00, 376658.2346), (2017.00, 312877.6664), (2018.00, 284204.5284), (2019.00, 269966.3104), (2020.00, 235009.0169), (2021.00, 215903.5335), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | persons | For historical analysis | |
| History_vs_real_data_analysis_2: | | | | | |
| "Economic_activity_spending_(Actual)" | GRAPH(TIME) Points: (2010.00, 60122845.79), (2011.00, 66330295.85), (2012.00, 78360042.82), (2013.00, 80490534.11), (2014.00, 83240452.88), (2015.00, 108182035.86), (2016.00, 132998708.6), (2017.00, 168186956.84), (2018.00, 198931805.81), (2019.00, 218370241.52), (2020.00, 253861504.49), (2021.00, 293637300.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Gov_inflow_(Actual)" | GRAPH(TIME) Points: (2010.00, 314506300.0), (2011.00, 398553600.0), (2012.00, 445525300.0), (2013.00, 442788700.0), (2014.00, 456067300.0), (2015.00, 652031000.0), (2016.00, 782859500.0), (2017.00, 1016969500.0), (2018.00, 1184290800.0), (2019.00, 1289849200.0), (2020.00, 1376673800.0), (2021.00, 1662333600.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| "Gov_outflow_(Actual)" | GRAPH(TIME) Points: (2010.00, 377842800.0), (2011.00, 416853600.0), (2012.00, 492454700.0), (2013.00, 505843800.0), (2014.00, 523125700.0), (2015.00, 679871400.0), (2016.00, 835832100.0), (2017.00, 1056973100.0), (2018.00, 1250189500.0), (2019.00, 1372350600.0), (2020.00, 1595395900.0), (2021.00, 1845367400.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Personal_tax_earning_(Actual)" | GRAPH(TIME) Points: (2010.00, 2055185.98), (2011.00, 2616251.88), (2012.00, 2952611.98), (2013.00, 3303832.74), (2014.00, 3220060.33), (2015.00, 4033243.58), (2016.00, 5209992.06), (2017.00, 6915182.89), (2018.00, 9116668.74), (2019.00, 11053742.7), (2020.00, 11783338.48), (2021.00, 14931911.73), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| "Social_expenses_(Actual)" | GRAPH(TIME) Points: (2010.00, 75214977.74), (2011.00, 82980631.75), (2012.00, 98030104.84), (2013.00, 100695395.43), (2014.00, 104135603.17), (2015.00, 135338061.8), (2016.00, 166384255.03), (2017.00, 210405513.06), (2018.00, 248867982.7), (2019.00, 273185885.32), (2020.00, 317586221.32), (2021.00, 367346600.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Trade_spending_(Actual)" | GRAPH(TIME) Points: (2010.00, 898882.07), (2011.00, 991688.15), (2012.00, 1171541.98), (2013.00, 1203394.44), (2014.00, 1244507.81), (2015.00, 1617403.36), (2016.00, 1988431.41), (2017.00, 2514522.37), (2018.00, 2974181.14), (2019.00, 3264800.48), (2020.00, 3795421.74), (2021.00, 4390100.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| "VAT_earning_(Actual)" | GRAPH(TIME) Points: (2010.00, 3829565.83), (2011.00, 4285142.77), (2012.00, 4659112.94), (2013.00, 5298718.12), (2014.00, 5740543.24), (2015.00, 6613167.62), (2016.00, 7785778.33), (2017.00, 8634507.12), (2018.00, 10981860.83), (2019.00, 12457502.17), (2020.00, 13675618.21), (2021.00, 16823539.25), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| History_vs_real_data_analysis_3: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| "Corporate_tax_value_(Actual)" | GRAPH(TIME) Points: (2010.00, 921951.07), (2011.00, 1031629.21), (2012.00, 1024125.14), (2013.00, 1053792.04), (2014.00, 1081573.39), (2015.00, 1245984.19), (2016.00, 1466915.29), (2017.00, 1626823.94), (2018.00, 2069087.88), (2019.00, 2347112.86), (2020.00, 2576617.6), (2021.00, 3169716.11), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| "Cost_of_goods_(Actual)" | GRAPH(TIME) Points: (2010.00, 206845641.62), (2011.00, 231452636.03), (2012.00, 251651818.33), (2013.00, 286198696.54), (2014.00, 310062916.1), (2015.00, 357195817.82), (2016.00, 420531826.79), (2017.00, 466374060.43), (2018.00, 593161248.81), (2019.00, 672864795.41), (2020.00, 738658675.28), (2021.00, 908686761.18), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Fixed_assets_(Actual)" | GRAPH(TIME) Points: (2010.00, 27721369.09), (2011.00, 30493506.0), (2012.00, 29945855.0), (2013.00, 34730642.0), (2014.00, 38311461.0), (2015.00, 40561023.0), (2016.00, 48618501.0), (2017.00, 53000813.0), (2018.00, 58276221.0), (2019.00, 78712836.0), (2020.00, 110273123.0), (2021.00, 138672130.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH | For historical analysis | |
| "Inflation_(Actual)" | GRAPH(TIME) Points: (2010.00, 1.09), (2011.00, 1.08), (2012.00, 1.01), (2013.00, 1.0), (2014.00, 1.12), (2015.00, 1.49), (2016.00, 1.14), (2017.00, 1.14), (2018.00, 1.11), (2019.00, 1.08), (2020.00, 1.03), (2021.00, 1.09), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | dmnl | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Other_expenses_(Actual)" | GRAPH(TIME) Points: (2010.00, 39990585.6), (2011.00, 44747988.79), (2012.00, 48653205.86), (2013.00, 55332340.5), (2014.00, 59946139.02), (2015.00, 69058597.59), (2016.00, 81303690.45), (2017.00, 90166617.19), (2018.00, 114679069.42), (2019.00, 130088586.77), (2020.00, 142808873.09), (2021.00, 175681321.69), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| "Own_funds_value_(Actual)" | GRAPH(TIME) Points: (2010.00, 71091329.51), (2011.00, 85309595.42), (2012.00, 102371514.5), (2013.00, 122845817.4), (2014.00, 131253455.2), (2015.00, 164917527.4), (2016.00, 237757200.0), (2017.00, 247266356.9), (2018.00, 297723612.1), (2019.00, 346123220.4), (2020.00, 334131945.2), (2021.00, 380117560.6), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Population_(Actual)" | GRAPH(TIME) Points: (2010.00, 45962947.0), (2011.00, 45778534.0), (2012.00, 45633637.0), (2013.00, 45553047.0), (2014.00, 45426249.0), (2015.00, 42929298.0), (2016.00, 42760516.0), (2017.00, 42584542.0), (2018.00, 42386403.0), (2019.00, 42153201.0), (2020.00, 41902416.0), (2021.00, 41588354.0), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | person | For historical analysis | |
| "Salary_(Actual)" | GRAPH(TIME) Points: (2010.00, 1898.0), (2011.00, 2371.0), (2012.00, 2739.0), (2013.00, 3049.0), (2014.00, 3439.0), (2015.00, 4692.0), (2016.00, 5808.0), (2017.00, 7630.55), (2018.00, 9404.43), (2019.00, 10794.9), (2020.00, 11286.1), (2021.00, 13487.76), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | UAH/month | For historical analysis | |

| | | | | | |
|---|---|---|---|---|---|
| "Sales_(Actual)" | GRAPH(TIME) Points: (2010.00, 239347864.4), (2011.00, 267821423.3), (2012.00, 291194558.5), (2013.00, 331169882.4), (2014.00, 358783952.2), (2015.00, 413322976.0), (2016.00, 486611145.7), (2017.00, 539656695.2), (2018.00, 686366302.1), (2019.00, 778593885.5), (2020.00, 854726138.1), (2021.00, 1051471203.3), (2022.00, NaN), (2023.00, NaN), (2024.00, NaN), (2025.00, NaN), (2026.00, NaN), (2027.00, NaN), (2028.00, NaN), (2029.00, NaN), (2030.00, NaN), (2031.00, NaN), (2032.00, NaN), (2033.00, NaN), (2034.00, NaN), (2035.00, NaN) | | ths UAH/year | For historical analysis | |
| Model_results: | | | | | |
| Model_results_2: | | | | | |
| Model_results_3: | | | | | |
| Model_results_4: | | | | | |
| Policy_analysis_1: | | | | | |
| Policy_analysis_2: | | | | | |
| Policy_analysis_3: | | | | | |
| Policy_analysis_4: | | | | | |
| POLICY_SWITCHERS: | | | | | |
| Sensitivity_and_scenario_analysis: | | | | | |
| Sensitivity_and_scenario_analysis_1: | | | | | |
| Sensitivity_and_scenario_analysis_10: | | | | | |
| Sensitivity_and_scenario_analysis_2: | | | | | |
| Sensitivity_and_scenario_analysis_3: | | | | | |

| Run Specs | |
|---|---|
| Start Time | 2010 |
| Stop Time | 2035 |

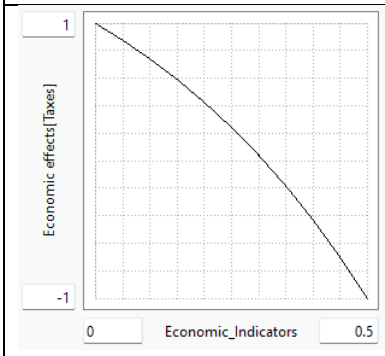
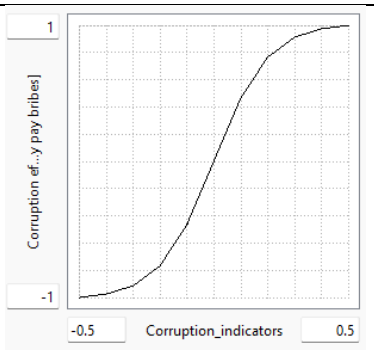
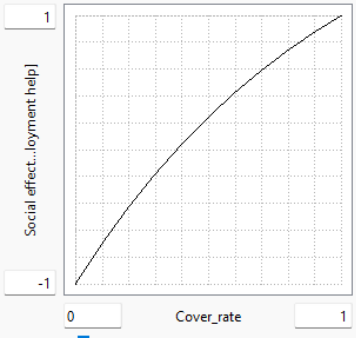
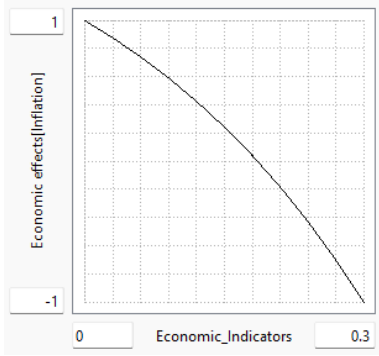
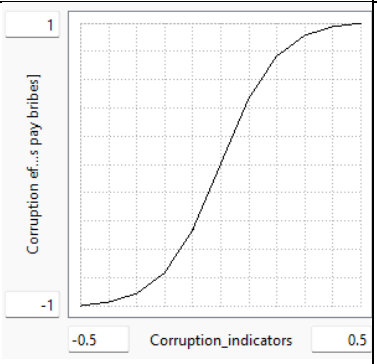
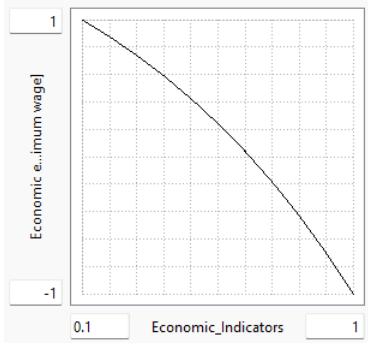
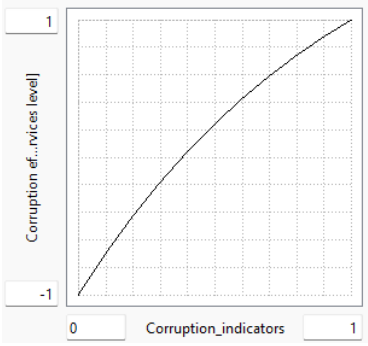
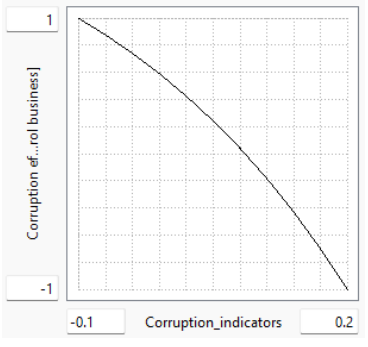
| | |
|---|---|
| DT | 1/4 |
| Fractional DT | True |
| Save Interval | 0.25 |
| Sim Duration | 3 |
| Time Units | years |
| Pause Interval | 0 |
| Integration Method | Euler |
| Keep all variable results | True |
| Run By | Run |
| Calculate loop dominance information | True |
| Exhaustive Search Threshold | 1000 |

| Array Dimension | Indexed by | Elements |
|---|---|---|
| Business_climate_factors | Label (5) | Inflation<br>Sales<br>Corruption<br>Employment<br>Reforms |
| Corruption_factors | Label (7) | Economic_reasons_that_people_pay_pay_bribes<br>Economic_reasons_that_business_pay_bribes<br>E_services_level<br>Control_business<br>Salary_fraction<br>Expenses_on_personal<br>Control_staff |
| Economic_factors | Label (3) | Taxes<br>Inflation<br>Minimum_wage |
| Policy_analysis | Label (5) | Very_pessimistic_scenario<br>Pessimistic_scenario<br>Base_scenario<br>Optimistic_scenario<br>Very_optimistic_scenario |
| Social_factors | Label (1) | Unemployment_help |

| Custom Unit | Aliases | Equation |
|---|---|---|
| kilowatt hours per day | | kWh/day |
| kilowatts | kilowatt | kW |

| | | |
|---|---|---|
| Dimensionless | dmnl<br>unitless | 1 |

# Appendix 2. Informal Employment Effects

| Economic factors | Corruption and reputation factors | Social factors |
|---|---|---|
|  |  |  |
|  |  | |
|  |  | |
| |  | |

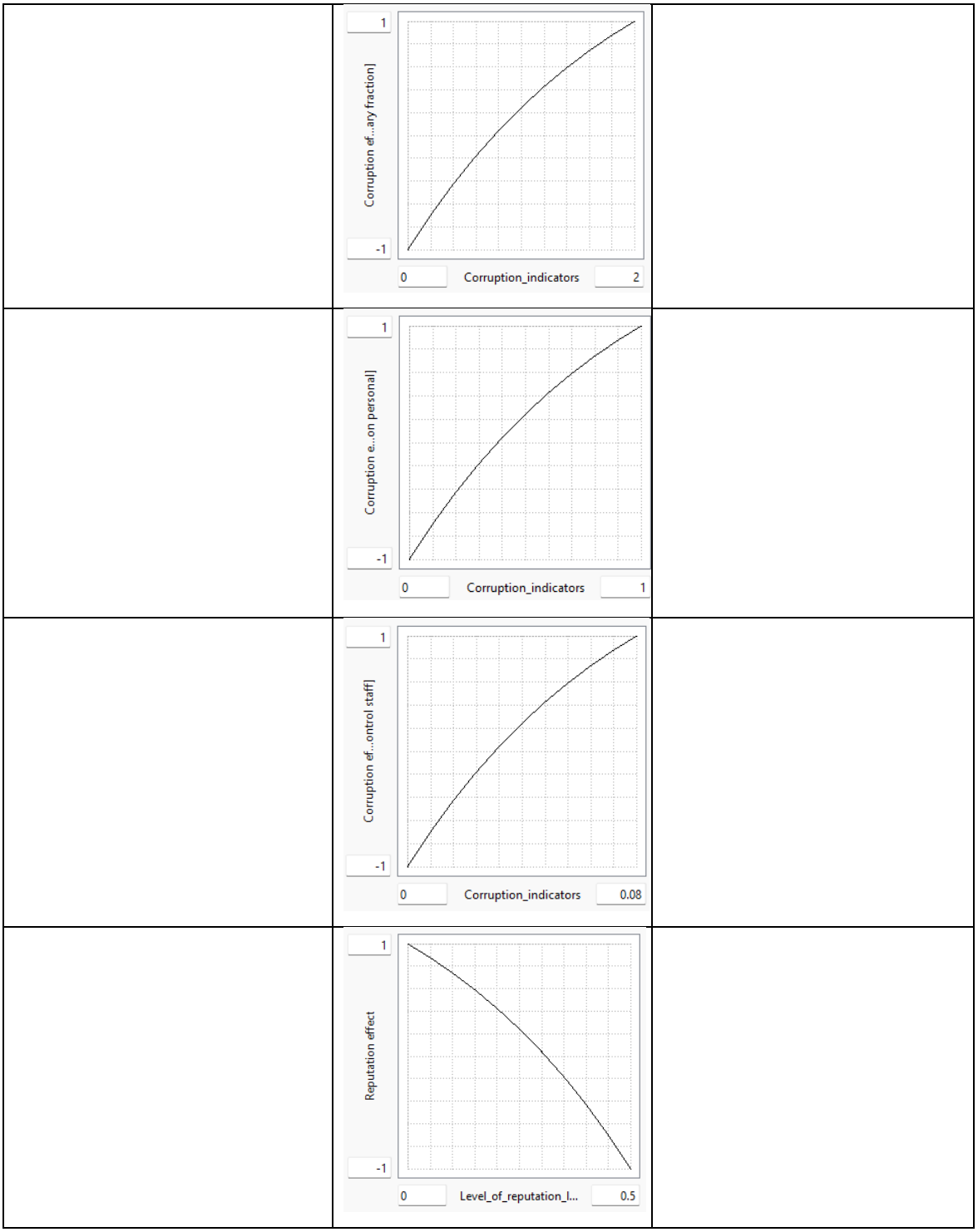
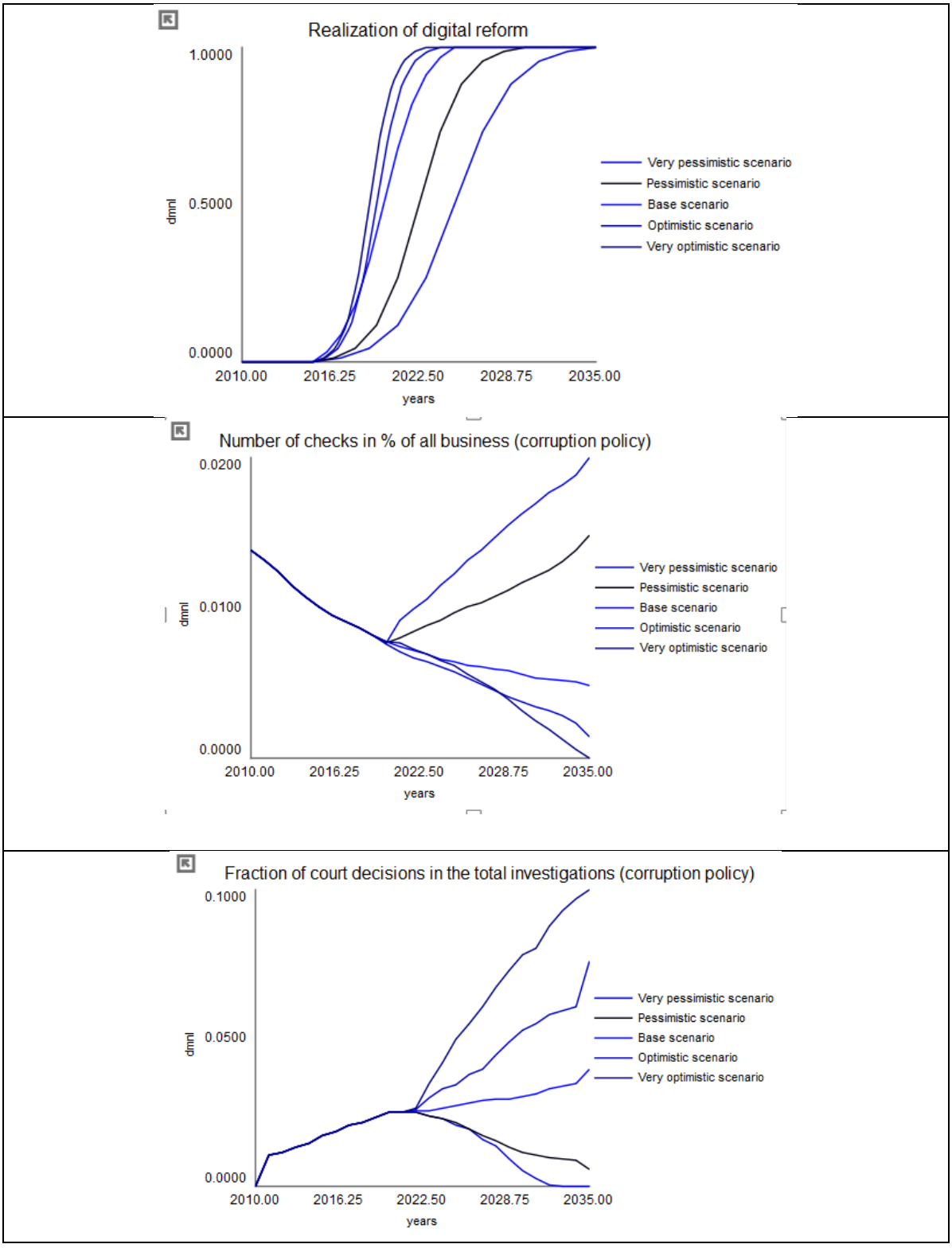



**Figure 42. Informal Employment Effects**

# Appendix 3. Scenario Combinations



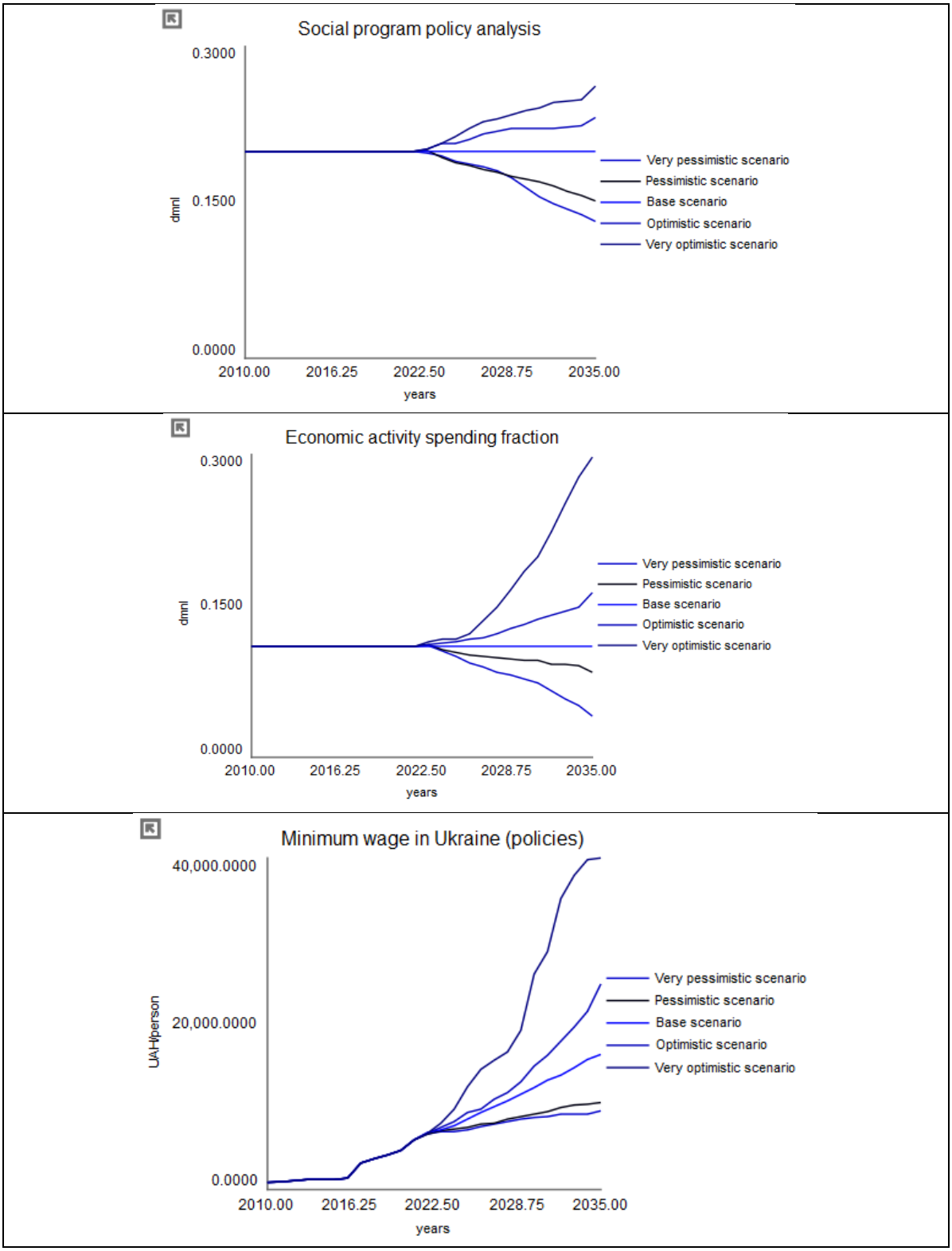



**Figure 43. Scenarios for Policies**

# Appendix 4. Thesis Model

## First block. Retail and Exit Capital Tax.

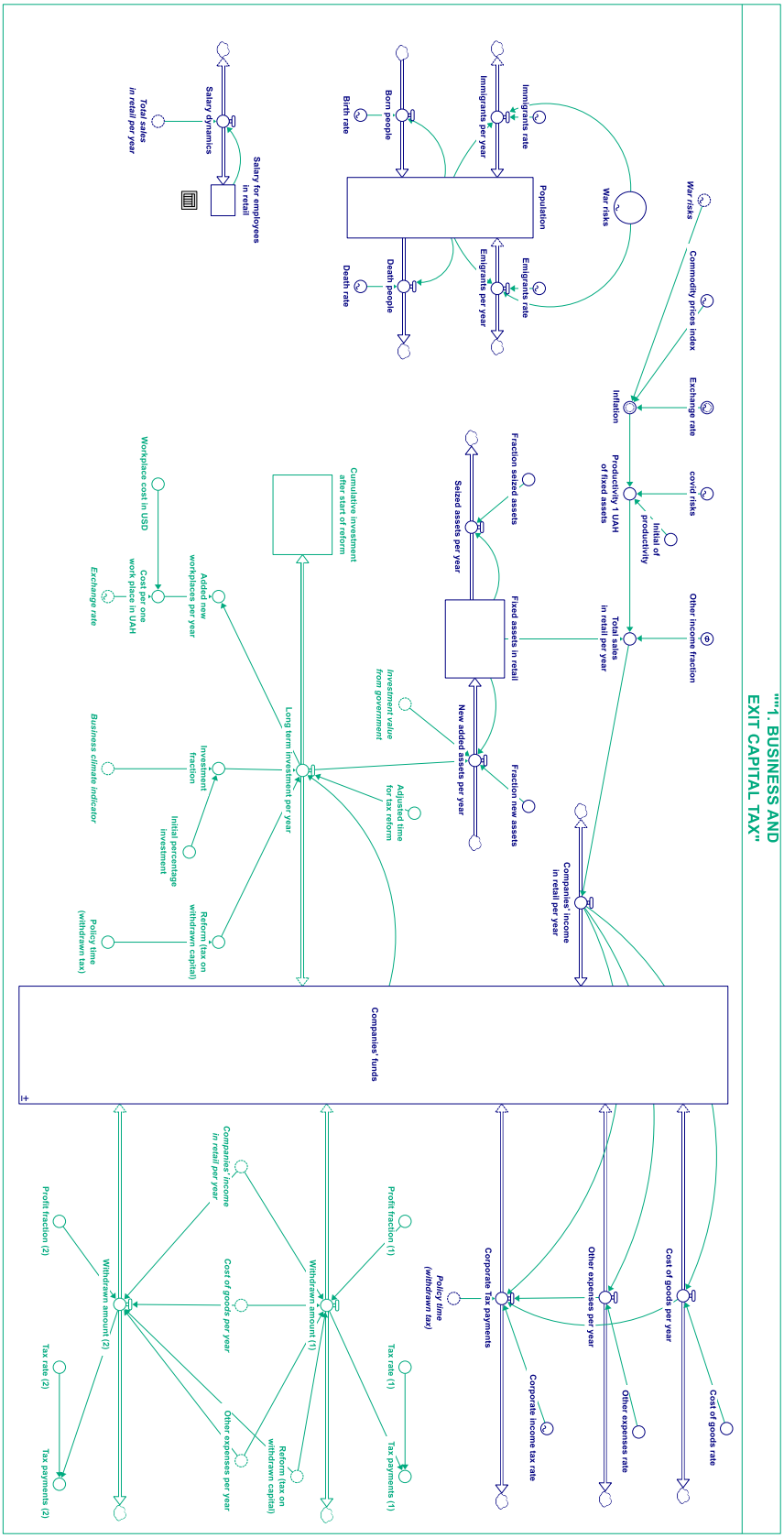



**Figure 44. First Model Block**

## Second block. Budget System and Taxes in Ukraine

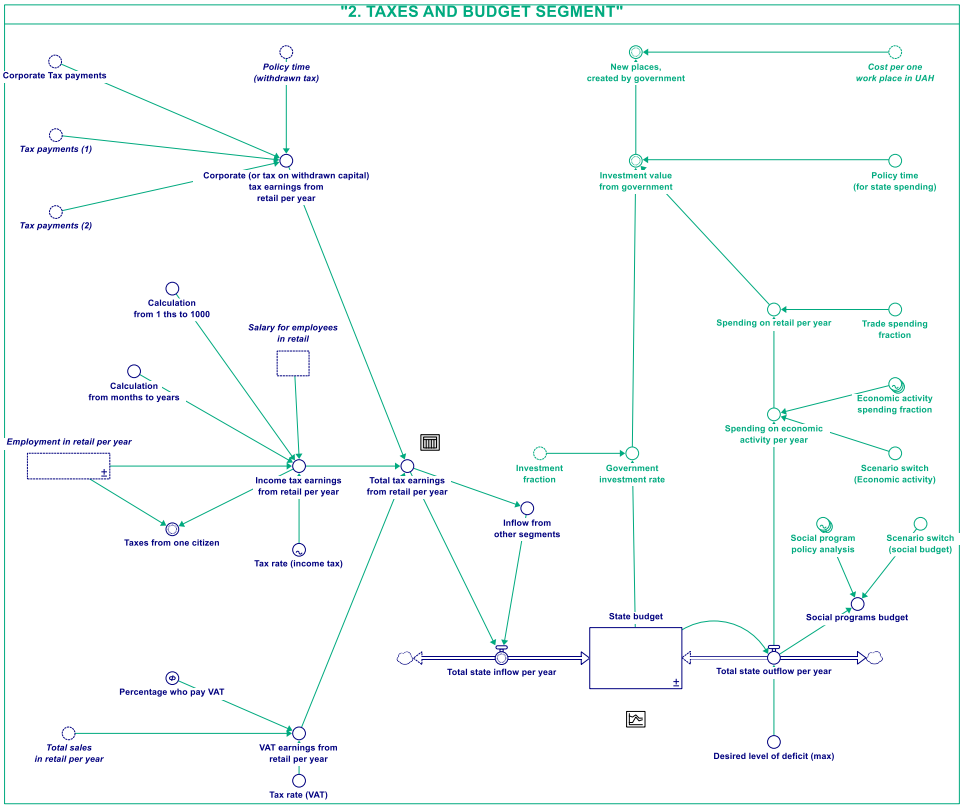



**Figure 45. Second Model block**

## Third block. Social and Behavioral Factors of Informal Employment

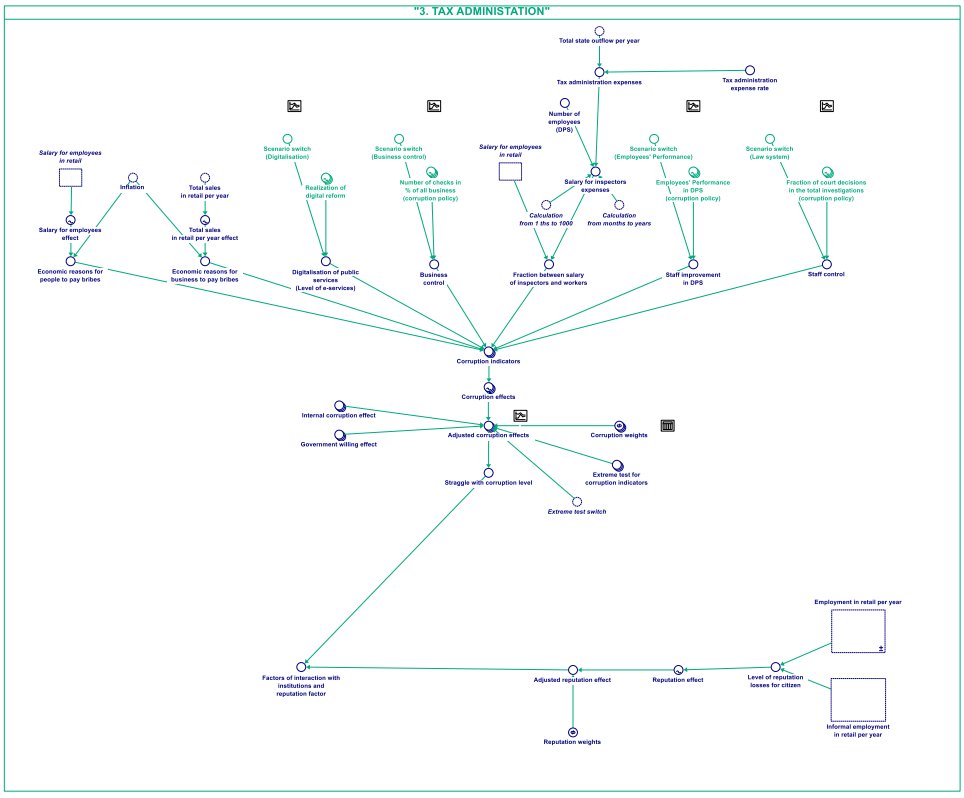



**Figure 46. Third Model Block**

# Fourth block. Economic Factors and Informal Employment

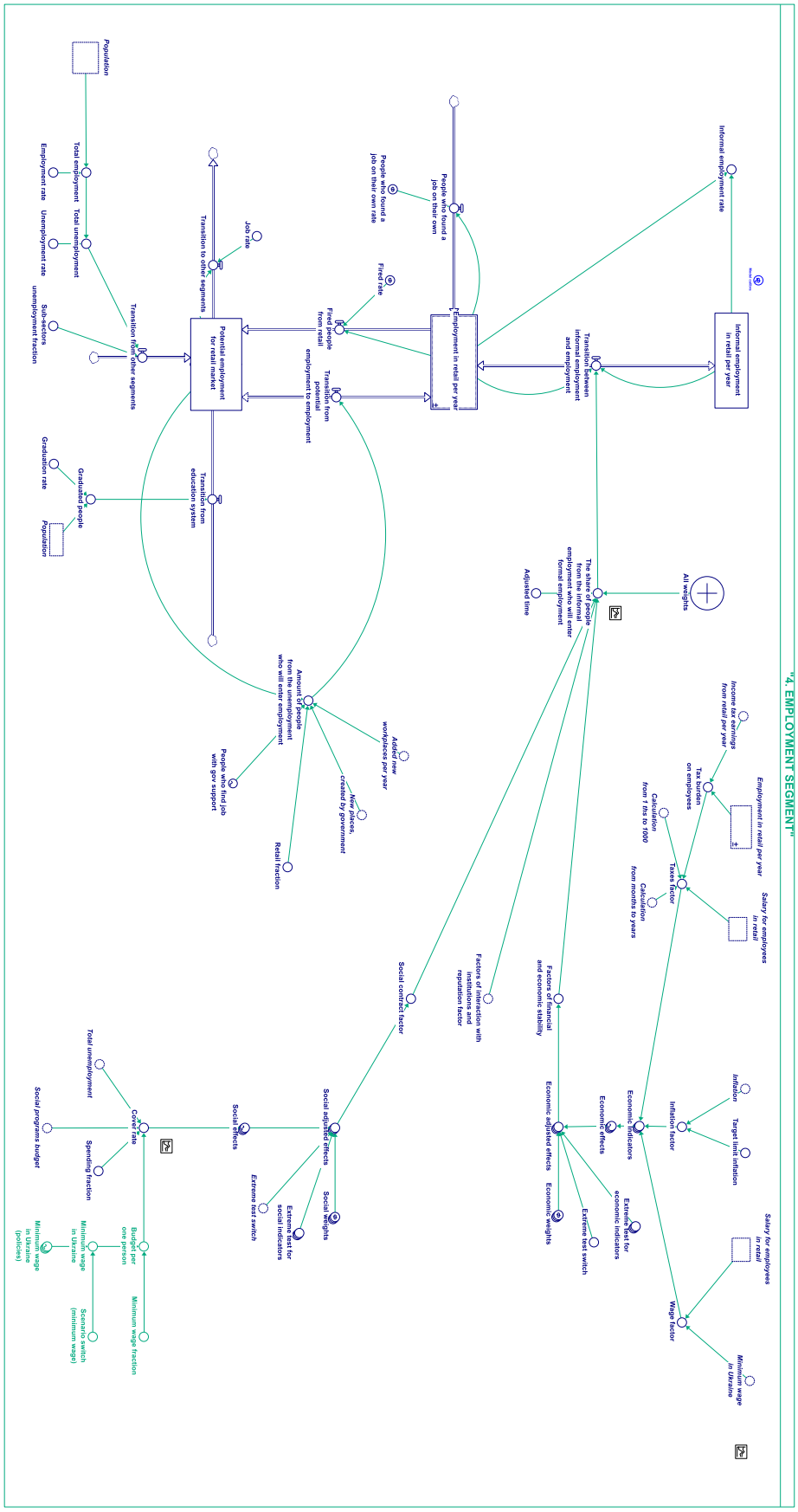



**Figure 47. Fourth Model Block**

## Fifth block. Business Climate Calculations

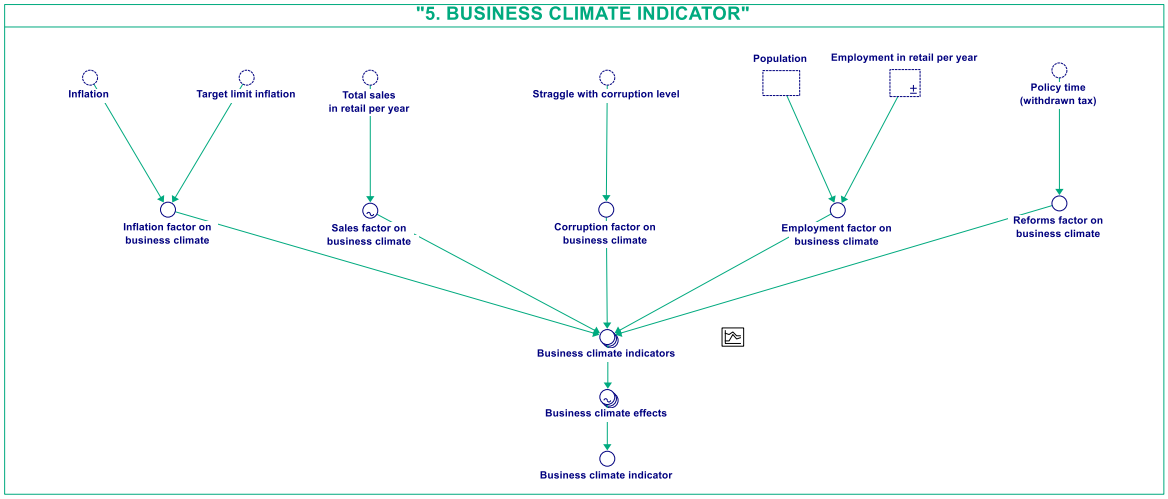



**Figure 48. Business Climate Model Block**

## Added block. Switchers for Policies

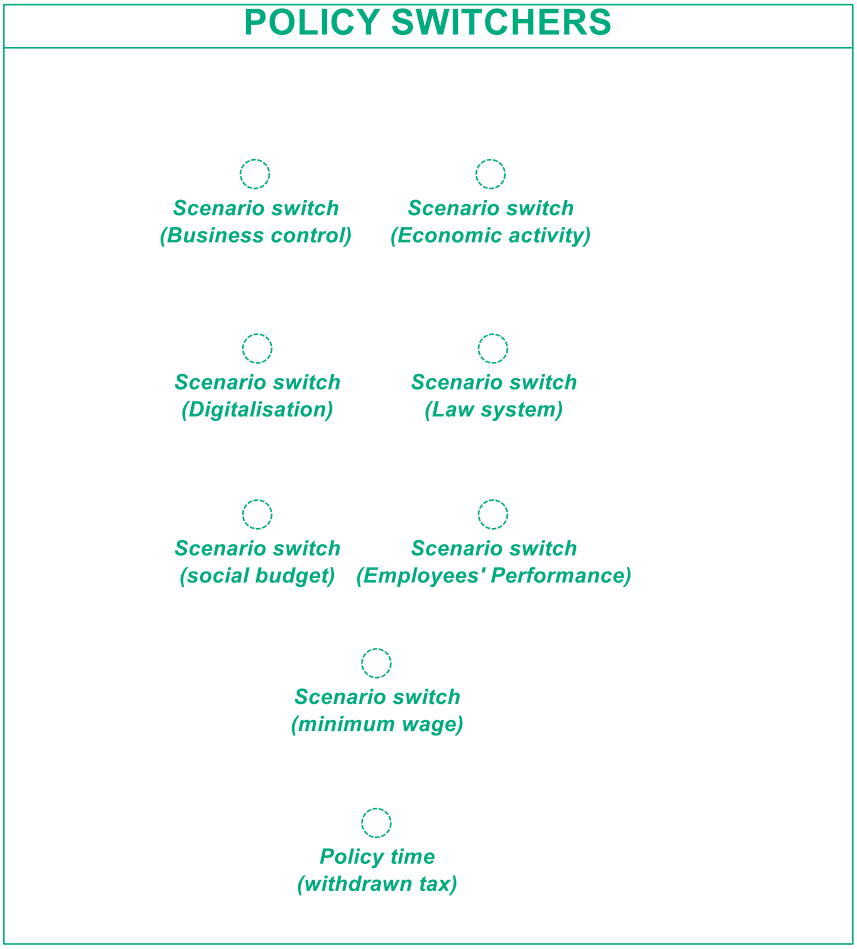



**Figure 49. Switchers Model Block**

# Appendix 5. Interview 1. Questions

**The tax system in Ukraine and exit capital tax.**

1. Exit capital tax

1. What are the key advantages of introducing an exit capital tax?
2. What are the arguments for the fact that companies will increase investments?
3. What are the successful cases of policy implementation?
4. How can predict the behavior of companies after the reform?
5. What is the impact on the budget system of Ukraine?

2. Tax Administration

1. What are the key problems of business related to state institutions?
2. What are the main areas of corruption in the activities of tax institutions?
3. Which sectors have the greatest impact on the tax system?

3. Solutions

1. What key changes need to be made in state institutions?
2. What policies should be implemented to increase tax payments?
3. What are the causes of corruption in state institutions?

# Appendix 6. Interview 2. Questions

**The labor market in Ukraine and informal employment**

1. Labor market in Ukraine

1. What are the key reasons for informal employment in Ukraine?
2. What factors should be taken into account when analyzing informal employment?
3. Should factors affecting the economic situation in other countries be taken into account?
4. How do immigrant flows affect the labor market?
5. What are the key risks of increased control over the labor market?

2. Retail features

1. What are the peculiarities of the retail market in Ukraine?
2. What factors increase informal employment in retail?

3. Solutions

1. What policies should the government implement to reduce informal employment?
2. How to reduce the opportunity cost of work legally?
3. How to improve the quality of state institutions?

# Appendix 6. Exit Capital Tax Policy Analysis

Testing by initial investment value in %:

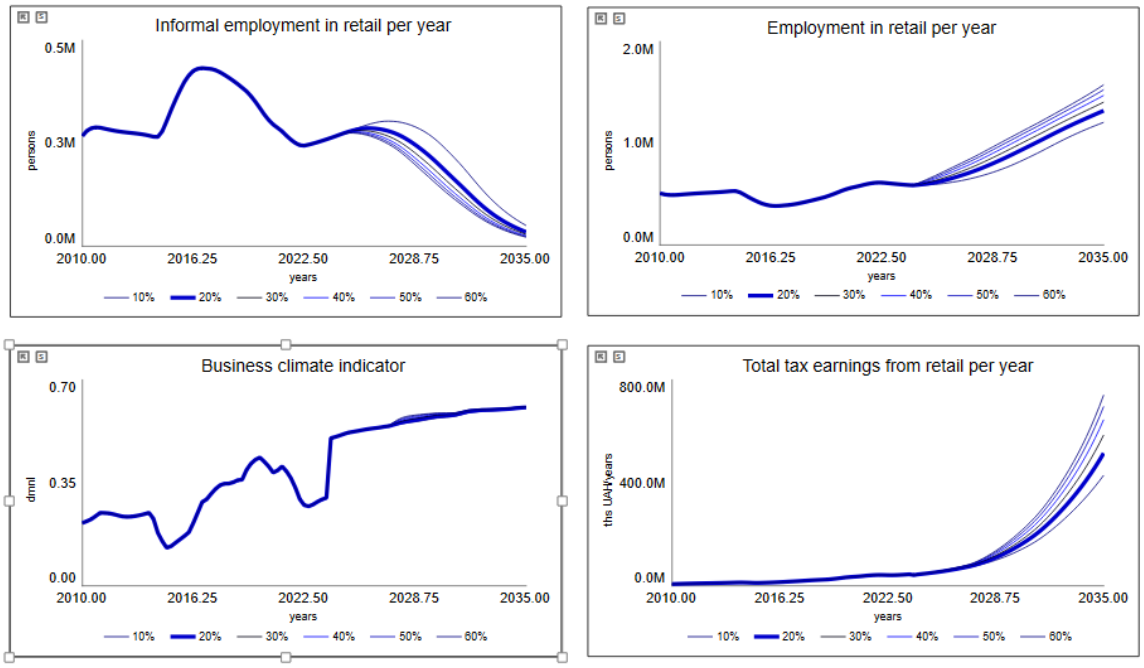



**Figure 50. Exit Tax Reform Analysis by initial investment rate.**

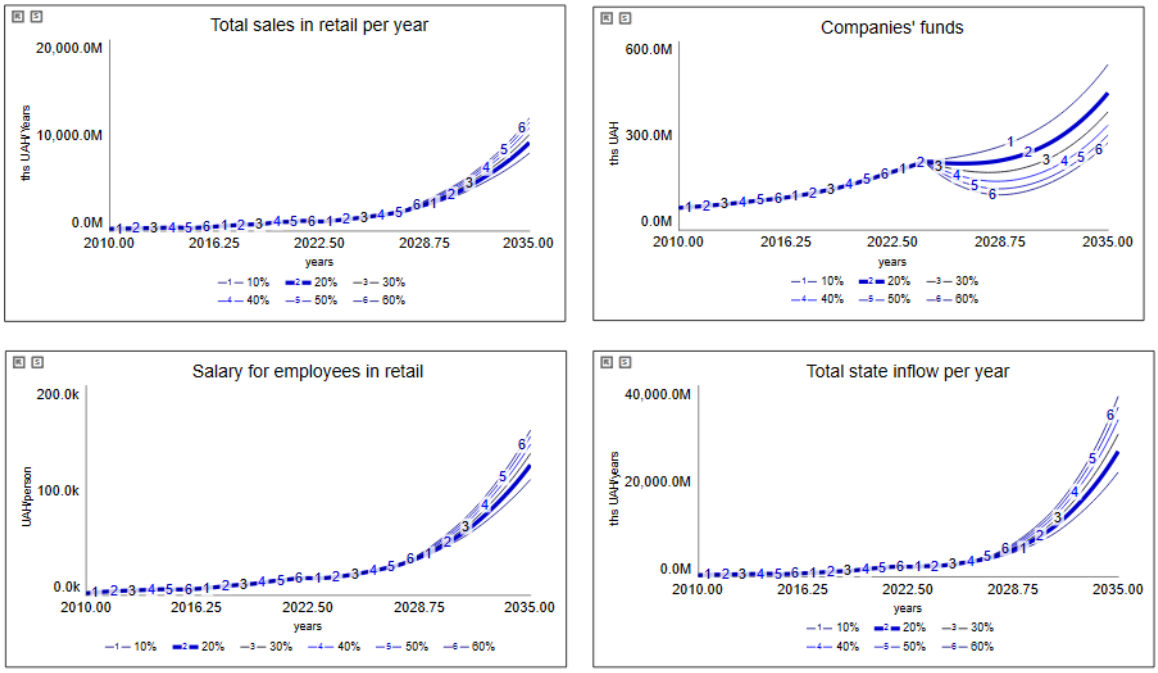



**Figure 51. Exit Capital Tax Analysis (2) by initial investment rate.**