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Urban growth and agrarian dynamics: Evaluating the Kyiv agglomeration's economic landscape

Abstract. This study investigated the effects of rapid urban expansion on agricultural economic dynamics within the Kyiv agglomeration. The research analysed changes in land use, wage levels, enterprise output, and logistics infrastructure using a comprehensive dataset compiled from national land cadastre records, economic reports, and regional statistics prior to 2023. The results revealed significant pressure on agricultural territories: only 0.21% (0.18 thousand hectares) of land within the region was designated for agricultural use, compared to over 54% assigned to green zones and nearly 13% to residential categories. Concurrently, average monthly salaries in Kyiv's food-processing industry reached 16,500 UAH, while agricultural wages in surrounding areas lagged at 14,000 UAH, influencing labour migration from rural to urban sectors. Moreover, transport costs – ranging from 20 to 250 UAH per kilometre depending on location and vehicle type – further impacted enterprise viability and spatial decision-making. A notable discrepancy in land rental rates was also evident: land within the Kyiv metropolitan core commanded rents of up to 25 million UAH per hectare per year, compared to an average of 3,474 UAH in the region. These factors contributed to the encroachment of farmland for residential, commercial, and industrial use. The study concluded that effective urban-rural land-use governance – through zoning regulations, fiscal incentives, and sustainable planning – was essential to safeguard agricultural viability and ensure balanced regional development amid Kyiv's ongoing metropolitan growth. Findings from this research could inform strategic land-use planning, guide interventions to mitigate adverse impacts on agriculture and foster a more balanced urban-rural dynamic in rapidly evolving metropolitan regions

Keywords: urban expansion; agricultural economy; land-use change; metropolitan growth; socio-economic development; resource economics

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INTRODUCTION

Rapid urbanisation and the consequent spatial expansion of city boundaries increasingly influence agricultural land use and economic structures worldwide. As metropolitan areas grow in population and infrastructure, conflicts often arise between residential-industrial development and the preservation of agricultural resources. These conflicts are particularly evident in rapidly expanding urban centres, where diverse economic sectors converge and compete for limited land resources. In this context, the Kyiv agglomeration – encompassing the city of Kyiv and its surrounding territories – is a pertinent case study to analyse the consequences of such expansion on regional agriculture and allied industries.

The rapid intensification of urban development in metropolitan regions has emerged as a significant factor in reshaping land use and economic structures, particularly in agricultural systems. The competition for land between expanding residential, industrial, and infrastructural developments and traditional farming areas is becoming increasingly acute. This challenge is especially critical in regions undergoing swift spatial transformations, such as the Kyiv agglomeration (State Land Cadastre of Ukraine, n.d.). As Ukraine's administrative and economic core, Kyiv exerts substantial influence over surrounding territories, prompting substantial reallocation of land resources and labour flows (State Statistics Service of Ukraine, n.d.). These dynamics necessitate a comprehensive understanding of the consequences of urban expansion and its impact on agriculture, food security, and sustainable development (Open Data Portal of Ukraine, n.d.). Examining this intersection is essential for devising balanced territorial development strategies that align economic growth with ecological and socio-economic stability.

Academic contributions have explored the complex relationship between urbanisation and agricultural sustainability from various regional and disciplinary perspectives. For instance, the study by N. Vasylieva & H. James (2021) highlighted the dual nature of urban expansion, demonstrating that while it introduces infrastructural improvements and market access, it

simultaneously disrupts traditional agricultural zones and undermines the food security of peri-urban populations. V. Beckers *et al.* (2020) analysed land-use conflicts in Belgium, showing that agricultural productivity decreases significantly in areas subject to rapid urban encroachment due to fragmented landholdings and logistical inefficiencies.

Within the European context, W. Oueslati *et al.* (2019) evaluated the impact of urban growth on agricultural productivity across several metropolitan regions. The findings emphasised that regulatory policy gaps and uncontrolled real estate development accelerate the decline of cultivated areas and reduce ecological resilience. In a different regional setting, S.K. Patel *et al.* (2019) studied land-use changes in peri-urban India and concluded that shifts in land cover correlated directly with socio-economic transformations, labour redistribution, and altered investment patterns in agricultural enterprises.

Studies focusing on the Global South further reinforce the significance of this issue. A. Follmann *et al.* (2021) systematically reviewed how farmers in rapidly urbanizing areas of Latin America, Africa, and Asia adapt or withdraw from agriculture, depending on state support and infrastructural accessibility. Similarly, I. Duvernoy *et al.* (2018) explored the French city of Toulouse, where urban development at the city's fringe resulted in fragmented agricultural landscapes, land speculation, and a weakening of local agri-food systems. In the Ukrainian context, O. Kravchenko *et al.* (2020) examined socio-economic transformations affecting agriculture and underscored the importance of sustainable land-use practices amid ongoing demographic shifts and regional development challenges. The findings support the notion that strategic governance and modernisation of rural infrastructure are vital for maintaining the viability of agriculture in regions facing intense urbanisation, such as the Kyiv agglomeration.

Ukrainian scholars have also contributed to this field, offering region-specific insights. V. Nazarenko (2020) examined the economic implications of land-use transformation in the Kyiv metropolitan area, revealing the pressure

on agricultural enterprises caused by increasing rent values, shifting labour availability, and spatial dislocation. In a related study, V. Nazarenko (2021) analysed how food-processing enterprises in and around Kyiv adjust the production strategies in response to urbanisation, highlighting the role of spatial proximity to markets, transportation networks, and resource availability.

These scholarly works underscore that urbanisation – if not strategically managed – poses significant risks to agricultural sustainability, regional food systems, and balanced territorial development. The works also affirm the necessity of adopting adaptive, context-specific policy measures and land-use frameworks that recognise agricultural landscapes' economic, ecological, and social value, particularly in expanding metropolitan areas. The purpose of this study was to assess the spatial and economic effects of urban expansion on the agricultural sector within the Kyiv agglomeration by analysing empirical data on land use, enterprise activity, wage structures, and infrastructure to identify patterns and policy gaps that affect the viability of agriculture in metropolitan territories.

MATERIALS AND METHODS

The methodological framework of this study was designed to comprehensively assess the economic and spatial transformations in the Kyiv agglomeration under the influence of urban growth, with a focus on the agricultural sector. A combination of qualitative and quantitative research methods was employed to achieve this. Legal and regulatory documents, including the Land Code of Ukraine (2001), Law of Ukraine No. 858-IV (2003), Law of Ukraine No. 3038-VI (2011), were referenced to contextualise land-use policies and zoning frameworks.

The primary method used was statistical analysis, which enabled the evaluation of socio-economic indicators such as land use distribution, wage structures, number of enterprises, production output, and transportation costs. Descriptive statistics (State Statistics Service of Ukraine, n.d.) were used to calculate collected data percentages, averages, and ratios. These methods were essential to identifying trends in

land conversion, shifts in economic activities, and regional development disparities.

The empirical data used in the study covered the period from 2000 to 2022 as the main research data, whereas for comparison, the data from 1995 and 2019 were used in the study (due to the importance of those periods to observe changes in the dynamics). Particular emphasis was placed on the post-2010 phase, during which the most significant shifts in land use and urban expansion were observed. This timeframe enabled the analysis of long-term trends in metropolitan development and the cumulative effects on agricultural economic indicators. The geographical focus of the research was the Kyiv agglomeration, which included the administrative territory of Kyiv city and the adjacent Kyiv region (oblast). The area encompassed the dense urban core and surrounding suburban and rural zones within a 50-kilometre radius of the capital. This territory was selected due to its strategic economic role, high population density, and pronounced land-use dynamics, making it an ideal case for studying the intersection of urbanisation and agricultural transformation.

The correlational analysis examined the relationships between urban development indicators (e.g., residential and industrial land area) and agricultural variables (e.g., land rent, enterprise revenue, employment). This approach helped determine how increased urban land occupation corresponded with decreases in agricultural land availability and rising land rental costs (Fig. 1). The cartographic method spatially visualised changes in land use, infrastructure distribution, and the geographical positioning of agricultural and food-processing enterprises. Particular attention was paid to distinguishing urban areas from adjacent territories, allowing for a comparative perspective on land occupation and socio-economic indicators in Kyiv versus peripheral locations (Table 1).

The comparative method was also applied to contrast urban and peri-urban zones regarding land price, rent, labour wages, and enterprise output. The factual material for this study was drawn from multiple official and publicly accessible sources (Kyiv Statistics Service, n.d.; State Statistics Service of Ukraine, n.d.).

Land use (areas)	Socio-economic data	Kyiv urban area
<ul style="list-style-type: none"> • residential • industrial • transport • agricultural • green zones 	<ul style="list-style-type: none"> • wage structures • number of enterprises • production output • transportation costs • population social data 	<ul style="list-style-type: none"> • Central business district • Kyiv city borders • Sub-urban areas • Enterprise placement

Figure 1. Article research data grouped by categories

Source: developed by the authors

Table 1. Research socio-economic indicators

Key socio-economic Indicators	Description
Land use structure	Percentage and total area (in thousand hectares) allocated to residential, industrial, transport, green, and agricultural zones.
Wage levels	Average monthly and annual wages across sectors (agriculture, food processing, construction, mining, etc.) in Kyiv and the surrounding region.
Enterprise distribution and output	Number of agricultural and food-processing enterprises, average number of employees, and average annual production output per enterprise.
Land market indicators	Average land sale price and rental rate per hectare in Kyiv vs. Kyiv region; total land area available for sale/lease.
Population demographics	Urban vs. rural population proportions, total population in the city and surrounding region, labour force distribution.
Transport and logistics costs	Average transportation costs per kilometre by vehicle type and product category (e.g., grain, milk, poultry).
Consumer spending	Average per capita food expenditure, including specific categories: meat, milk, bread.
Sectoral contribution to GDP	Share of agriculture and food processing in national GDP, export focus of large enterprises, and income distribution across enterprise sizes.
Housing and infrastructure indicators	Cost of rent and housing stock per capita, spatial expansion patterns of urban development.

Source: developed by the authors

Data cleaning and validation involved cross-referencing multiple official registries and published studies to minimise inconsistencies and measurement errors. Descriptive statistics were used to depict key parameters such as the percentage of land allocated to different categories and the corresponding total area in thousand hectares. Correlational analysis was subsequently performed to identify relationships between urban expansion indicators (e.g., increase in residential or industrial land) and agricultural performance measures (e.g., land availability, enterprise revenues, and wage levels). Where relevant, data were standardised for currency fluctuations and varying measurement scales, ensuring comparability across different sources. The resulting integrated approach facilitated a robust examination of

how metropolitan growth processes intersected with and reshaped the agricultural economy in the Kyiv agglomeration.

RESULTS AND DISCUSSION

Over the 20th century, the Kyiv metropolitan area has transformed from a relatively compact urban centre into a far-reaching agglomeration encompassing the capital of Ukraine and a constellation of surrounding towns and rural settlements. In the early 1900s, urban development was primarily concentrated within the city's historical core, and agricultural lands on the outskirts occupied approximately 70-75% of the broader region. However, socio-economic transformations – including industrialisation, infrastructure upgrades, and targeted development policies – catalysed steady population

growth and progressively integrated peripheral areas into the urban domain. For instance, between 1926 and 1989, Kyiv's population surged from around 513,000 to 2.57 million, reflecting the region's growing economic significance and drawing substantial in-migration (State Statistics Service of Ukraine, n.d.).

The Soviet-era (1922 to 1991) placed emphasis on centralised industrial growth, was pivotal in this expansion. Large production complexes and housing developments were systematically sited on former farmland, particularly in the 20-30 km zone outside the city centre. According to archival land-use records, by the 1980s, more than 25% of the agricultural land within that radius had been converted for industrial or residential use (State Land Cadastre of Ukraine, n.d.). Market liberalisation and private investments accelerated this trend in the post-Soviet period 1991 – present. From 2000 to 2020, official statistics indicate that an additional 14-16% of farmland near Kyiv was repurposed for commercial and residential construction (State Statistics Service of Ukraine, n.d.). As of 2022, the Kyiv agglomeration spanned roughly 2,600 square kilometres, housing over 4.7 million people – underscoring the area's ongoing expansionary pressures (Kyiv Statistics Service, n.d.).

This continuing encroachment upon agricultural territories illustrates one of the most pressing issues facing the contemporary Kyiv

agglomeration: balancing rapid urbanisation with farmland's ecological and socio-economic value. Studies estimate that, compared to the 1960s, arable land in the region has diminished by approximately 35%, contributing to structural changes in local employment, disruptions in traditional food supply chains, and potential declines in soil fertility (Nazarenko, 2020; Kravchenko *et al.*, 2020). While the shift toward housing, commercial centres, and logistics hubs has helped modernise the regional economy, these developments also highlight the risks of overextending urban sprawl at the expense of strategic agricultural assets (Duvernoy *et al.*, 2018; Follmann *et al.*, 2021). The region's long-term resilience will hinge on implementing robust land-use governance, sustainable planning directives, and concerted efforts to reconcile future urban growth with the imperative to conserve vital farmland resources.

To better understand the specific dynamics of land transformation and agricultural displacement in the Kyiv agglomeration, this study conducted a detailed empirical assessment using spatial, economic, and demographic data collected from official statistical sources and open-access platforms. The following results represent the synthesised outcomes of this data-driven investigation, offering insights into how urbanisation has materially reshaped the agricultural landscape in and around Kyiv (Table 2).

Table 2. Kyiv region data (2022)

Land use, by category	Land occupied, % of total region	Total land area, thousand hectares
Total	100	82.64
Residential buildings	1.56	12.97
Private buildings	4.75	3.93
Industrial and production areas	7.99	6.61
Transport and infrastructure	7.45	6.16
Green zones	54.48	45.03
Water	7.33	6.06
Agricultural and faring	0.21	0.18

Source: developed by the authors based on Kyiv Statistics Service (n.d.), State Land Cadastre of Ukraine (n.d.)

An initial glance at Table 2 reveals that the Kyiv region's land-use structure is heavily skewed toward green zones, which occupy more than half of the total area (54.48%). By contrast, agricultural and farming land accounts for a

mere 0.21%, representing only 0.18 thousand hectares. This notable imbalance suggests that farmland has become increasingly marginal within the regional landscape and may be more susceptible to conversion under ongoing urban

expansion pressures. The relatively modest share of residential buildings (1.56% of total regional land, or 12.97 thousand hectares) compared to industrial and production areas (7.99%) might initially seem to indicate a limited footprint of housing-related development; however, the distinct category of “private buildings” (4.75%) and the significant “other” category (16.3%) indicate potentially diverse and unclassified uses that

could include emerging suburban settlements and mixed-use developments. These categories underscore the multifaceted nature of land-use change, with green areas, industrial zones, and private building plots competing for space – a trend likely to intensify as the region’s urbanisation accelerates. Table 3 delivers the economic data and offers a deeper look at possible drivers behind these land-use dynamics.

Table 3. Kyiv economic data (2022)

Data category	Kyiv	Kyiv area
Average monthly salary	16,186 UAH mining industry 44,405 UAH construction 8,311 UAH	8,000
Average rent for housing	22,500	13,500
Housing stock of the city	9.1 mln m ² 20.2 m ² per person	—
Average cost of renting a flat in Kyiv	\$9.4 per m ² \$263.2 per 28 m ² of flats	\$3.6
Number of business entities	294,458 companies	7,850
Number of full-time employees	1,149,074 people The average number of employees in one company was 16 people	370,000
Volume of products produced per one (medium-sized) enterprise	36,843.35 thousand UAH per year or 3,070.2 thousand UAH per month	23,500.00 thousand UAH per year
Total land area for sale/lease, hectare	2,812,100	
Land price per hectare	2,694	3,474
Land rent per hectare per year	25,000,000 UAH	—

Note: 1 US dollar = 28.48 UAH (2022), “—” means no data available

Source: calculated by the authors based on State Statistics Service of Ukraine (n.d.)

Within Kyiv, the average monthly salary stands at 16,186 UAH – substantially higher than many other regions of Ukraine – while the mining industry’s pay (44,405 UAH) far exceeds the local average (Table 3). This disparity indicates a strong economic pull toward industrial jobs within the metropolitan core. This effect may encourage further commercial and residential development in outlying areas with cheaper land. In addition, the construction sector’s average salary (8,311 UAH in Kyiv and 8,000 UAH in the surrounding zone) reinforces the notion that construction activities are robust in the city centre and the adjacent districts. Such a backdrop suggests a vigorous construction market that could drive more rapid conversion of farmland to real estate projects, whether residential, industrial, or commercial.

Another telling indicator is the average rent cost in Kyiv (9.4 USD per m²), contrasted with only 3.6 USD per m² in the surrounding area. This disparity creates substantial incentives for residents and businesses to relocate outside city limits. As the housing market pushes outward, formerly agricultural plots on the outskirts could yield higher profits if converted into residential or mixed-use complexes. Coupled with an abundant total land area available for sale or lease (over 2.8 million hectares in the broader region) and a land price per hectare ranging from 2,694 UAH in Kyiv to 3,474 UAH in the region, it appears there is ample opportunity for real estate development to encroach on farmland.

A key insight emerges when considering that the land rent per hectare per year in Kyiv is cited at 25,000,000 UAH – a figure that may appear

extraordinarily high compared to the per-hectare cost but could reflect prime urban parcels or specific commercial sites. Regardless of the precise breakdown, the strong financial returns from urban and industrial uses of land suggest that agricultural plots remain at risk for conversion if regulatory safeguards are lacking or farmland cannot generate comparable returns.

Collectively, these data hint at several hypotheses. First, the disproportionately low share of agricultural land (just 0.21%) raises questions about the long-term viability of farming in the Kyiv region if expansionary development trends continue unchecked. Second, the interplay between high salaries in specific urban industries and the increasing cost of housing suggests that population and businesses are apt to spill over into less expensive surrounding territories, thereby spurring more significant land-use change in suburban and rural zones. Third, the magnitude of green space (54.48%) might function as a buffer to some extent. However, if market pressures remain strong and strategic land-use policies are weak or poorly enforced, portions of these green zones could eventually face the same conversion pressures as farmland.

These observations reinforce the notion that the region's agricultural sector stands on precarious ground as urbanisation gathers pace. It also underscores the importance of a nuanced, data-driven approach to land management in a rapidly evolving metropolitan environment like Kyiv's, where competing interests increasingly vie for the same finite resources.

According to State Land Cadastre of Ukraine (n.d.), Ukraine's total land area amounts to 60.4 million hectares, of which 42.4 million hectares are classified as agricultural land (roughly 32 million hectares cultivated annually). Built-up areas occupy approximately 2,550.4 thousand hectares, while industrial parcels – encompassing, among other sectors, the food industry – amount to 224.1 thousand hectares. At the national level, annual land-lease costs average 3,518 UAH per hectare. Region-specific data, however, show some variation: in Kyiv, lease rates stand at 2,694 UAH per thousand hectares, whereas in the surrounding Kyiv region – 3,474 UAH per thousand hectares. Taken together, until 2023, these leases collectively generated an estimated 195 million UAH annually in revenues for local budgets.

Table 4 provides a concise overview of Ukraine's agricultural landscape prior to 2023, highlighting both demographic and economic indicators that set the context for ongoing urbanisation trends and shifting land-use patterns. According to these data, nearly 69.41% of the population resides in urban areas, while only 30.59% remains rural. Of a total national land area of 60.4 million hectares, 42.4 million hectares are allocated to agriculture, although merely 224.1 thousand hectares are devoted to industrial activities – including food processing. The built-up portion of Ukraine's territory reaches 2,550.4 thousand hectares, illustrating its expansive infrastructural development alongside its substantial agricultural base.

Table 4. Ukraine agricultural profile data (2022)

Indicator	Value
Urban population	69.41%
Country (rural) population	30.59%
Total area of land plots (million hectares)	60.4
Agricultural land (million hectares)	42.4
Built-up land plots (thousand hectares)	2,550.4
Industry (incl. food processing) (thousand hectares)	224.1
Land rental price (UAH)	185,714,285
Annual salary of agricultural workers (UAH)	81,600
Monthly salary (UAH)	6,800
Land lease per year per hectare (UAH)	3,518
Monthly salary of agricultural workers (UAH)	14,000
Monthly salary in food processing (UAH)	16,500

Table 4, Continued

Indicator	Value
Revenue share of agricultural enterprises	~80%
Revenue share of small farm enterprises	12-13%
Revenue share of private farms	~20%
Food spending as share of total spending	46.6%
Expenditure on meat products per person per year (UAH)	5,487.4
Expenditure on milk per person per year (UAH)	2,746.4
Expenditure on bread per person per year (UAH)	3,750.08
Average per capita food spending in Kyiv (UAH)	25,439.46 (53%)
Average per capita food spending in Kyiv region (UAH)	27,803.04 (54.5%)
Agriculture's rank in national GDP	3 rd (~1.7%)
Gross wheat yields (c/ha)	40.2 (160% increase)
Gross barley collection (thousand tonnes)	770 (-8.5%)
Primary focus of large agricultural enterprises	Grain exports (corn, wheat)
Primary focus of households	Oats, millet, rye, buckwheat

Source: calculated by the authors based on State Statistics Service of Ukraine (n.d.)

Based on research and oversaturation, annual land lease rates average 3,518 UAH per hectare, a figure that both underscores the economic significance of farmland and signals its vulnerability to urban-driven increases in land values. Average annual salaries hover around 81,600 UAH, with monthly earnings at 6,800 UAH, although the agricultural sector and food processing industries record higher monthly wages (14,000 UAH and 16,500 UAH, respectively) (Kyiv Statistics Service, n.d.).

Large agricultural enterprises capture the majority of revenue – roughly 80% – mainly through grain exports (notably corn and wheat), while small farm enterprises account for 12-13% and private farms for around 20%. Spending on food constitutes 46.6% of total household expenditures, indicating the centrality of agriculture and food processing in the national economy. Agriculture ranks as the third most significant contributor to Ukraine's GDP, at approximately 1.7% (Kyiv Statistics Service, n.d.; State Statistics Service of Ukraine, n.d.).

Despite these robust indicators, the growing urban population continues to draw labour away from rural areas, compounded by the out-migration of approximately 2.5 million Ukrainian workers to neighbouring countries (Open Data Portal of Ukraine, n.d.). Nonetheless, foreign and domestic investment remains strong in and around Kyiv, with numerous companies and

international corporations establishing operations within a 50-kilometre radius of the capital. This intensifying economic focus in metropolitan and peri-urban zones exerts mounting pressure on surrounding farmlands – precisely those territories most prone to conversion as residential, industrial, and commercial developments expand outward. This tension between urban growth and agricultural preservation is central to understanding the current trajectory of land use in Ukraine and the evolving character of its agri-food sector.

Figure 2 illustrates Kyiv's population growth and median income levels in the agricultural and food processing industries. The data indicate a consistent upward trend in population size, coinciding with rising median incomes in both industries. Notably, incomes in the food processing sector (16,500 UAH monthly) consistently exceed those in agriculture (14,000 UAH monthly), reflecting greater economic incentives within urban industries. These income disparities likely contribute to labour migration trends from agricultural to urban sectors, emphasising the economic pressure driving urban expansion and land-use transformation within the Kyiv agglomeration. This demographic and economic intersection underscores the critical need for balanced urban-rural development policies to maintain agricultural viability amidst rapid urbanisation.

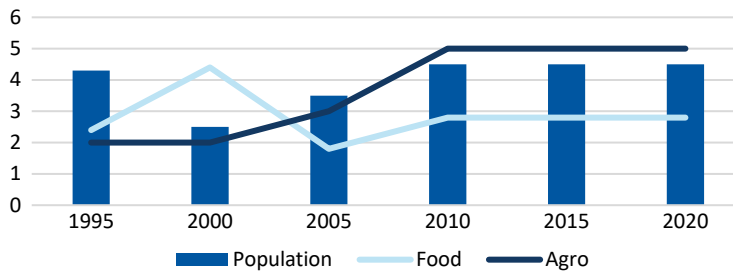


Figure 2. Kyiv population by year, median income (per agricultural, per food processing industries), thousand people and UAH

Source: developed by the authors based on Kyiv Statistics Service (n.d.), State Statistics Service of Ukraine (n.d.)

Table 5 highlights the scale of Ukraine’s agricultural output across three core categories – meat, milk, and bread – and underscores the considerable volume that extends beyond domestic demand. The difference between total production and internal market sales indicates Ukraine’s capacity to meet its own needs and remain a key supplier in export markets. The study highlights that meat production stands at 53.6 million tonnes per year, of which 43.3 million tonnes are sold on local markets. This leads to the conclusion that more than

10 million tonnes are available for export or alternative channels. Milk and milk-product output is even more pronounced, at 200.5 million tonnes annually, with 141.95 million tonnes consumed within Ukraine, leaving nearly 60 million tonnes for potential external trade. The bread and sub-product segment is most striking: out of 97.6 million tonnes produced, just 20.34 million tonnes reach the domestic market. This gap underscores the importance of export-led production and the scale of processing industries that may add value before shipment abroad.

Table 5. Ukraine’s average annual agricultural and farming enterprise data

Production type	Produced, mln tonnes per year	Sold in internal market, mln tonnes per year
Meat and its products	53.6	43.3
Milk and its products	200.5	141.95
Bread and sub-products	97.6	20.34

Source: calculated by the authors based on State Statistics Service of Ukraine (n.d.)

In this study, such figures emphasise the critical need to preserve adequate farmland and maintain robust supply chains, especially in regions experiencing rapid urban expansion like the Kyiv agglomeration. As more agricultural parcels face pressure for residential, commercial, or industrial development, concerns arise about whether Ukraine can sustain these high production levels in the long term. Any significant reduction in arable land could disrupt internal food security and export earnings, particularly for staple goods such as bread, which already display a large surplus above domestic consumption.

The data further suggest that profitable industries – such as meat and milk production – may

intensify the operations to meet global demand. However, intensification usually requires more significant swaths of farmland, modernised infrastructure, and an available labour force – factors that can become constrained if urban sprawl continues unchecked. These points reinforce the article’s central premise: strategic land-use governance and balanced urban-rural planning are imperative to ensure Ukraine’s ongoing role as a major agricultural producer and to protect the viability of critical food sectors in the face of metropolitan growth.

In conducting the presented economic modelling of agricultural and food-processing enterprises in the Kyiv region, particular emphasis

is placed on the land market and associated operational costs. One critical variable is the average annual rent per hectare of land, depending on whether the enterprise is in an industrially zoned district or a more dispersed, rural settlement. In addition, the fact that many of these enterprises aggregate the production capacities in a single complex (i.e., a consolidated site encompassing processing, storage, and sometimes administrative facilities) makes the location decision even more pivotal. Proximity to key markets, labour pools, and infrastructure can substantially lower transportation expenditures and bolster overall profitability, albeit at higher land prices and rental rates.

Figure 3 illustrates the Kyiv metropolitan territory's economic division and pinpoints agricultural enterprise distribution. A noteworthy concentration of food industry facilities – 16 in total – resides within the administrative bounds of Kyiv. This high clustering reflects several regional advantages: enhanced access to urban consumer markets, established infrastructure networks, and better opportunities for technology transfer. However, these same advantages correspond to higher overhead, including elevated land and lease costs, relative to peripheral districts.

The data summarised in Table 6 offer more profound insight into the broader socio-economic environment shaping agricultural activities in the Kyiv region. Within Kyiv, the population is approximately 2.97 million, while an additional 1.78 million reside in the surrounding region. Crucially, about 86% of the total inhabitants in the administrative area around Kyiv are classified as urban, yet the region itself – encompassing 24 smaller villages – still reports 62% of its population living outside major city centres. This demographic structure hints at a potential labour divide: an urban workforce more inclined to seek higher-paying industrial or services-oriented jobs and a rural workforce more likely to engage in conventional or small-scale farming.

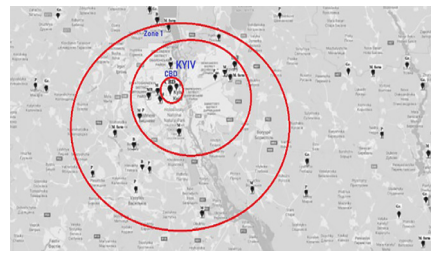


Figure 3. Kyiv economic territorial division map with agricultural enterprise locations
Source: developed by the authors

Table 6. Kyiv region's economic profile and agriculture enterprise data (2022)

Data	Kyiv city	Kyiv region
Population, Kyiv, thousand people	2,967	1,781
Urban population, % of total region	86	—
Non-urban population, % of total region	—	62 24 (small villages)
Average annual wage in agricultural companies, UAH	156,000	126,000
Average annual wage in food companies, UAH	204,000	156,000
Number of agricultural companies in Kyiv and region	16	1,470
Number of agricultural enterprises	6,568	

Note: “—” means no data available

Source: calculated by the authors based on data from Kyiv Statistics Service (n.d.), State Statistics Service of Ukraine (n.d.), State Land Cadastre of Ukraine (n.d.), Open Data Portal of Ukraine (n.d.)

The annual average wage in local agricultural companies is 156,000 UAH in Kyiv. However, it dips to 126,000 UAH in the broader region, reflecting regional cost-of-living variances

and differences in job specialisation. Notably, food industry salaries are higher on average – 204,000 UAH in the city and 156,000 UAH in the outlying area – mirroring the value-added

nature of processed goods and the need for technical expertise in these segments, despite the relatively small absolute number of agricultural companies operating directly in Kyiv (16), the surrounding region hosts as many as 1,470 such entities. Meanwhile, the total count of agricultural enterprises in the entire region surpasses 6,500 – reaffirming agriculture’s significance even amid intensifying urbanisation.

Land and labour costs must also be evaluated, along with logistics and transportation expenses, as these can significantly shape net operating margins. Regional data reveal that a 20-22-ton van costs about 27 UAH per kilometre outside Kyiv, whereas a 10-ton vehicle costs 20 UAH per kilometre. Within city limits, any capacity can result in a charge of roughly 250 UAH per kilometre, reflecting

congestion, higher wages, and administrative fees (Nazarenko, 2021).

Table 7 presents an overview of transport costs by product type and capacity. For instance, poultry farms typically employ refrigerated trucks ranging from 7 to 12 tonnes, while milk farms often use 8- to 10-ton vehicles that incur roughly 27-30 UAH per kilometre. Bread and grain producers, on the other hand, frequently rely on heavy vans (25 to 55 tonnes), with cost estimates at 2.3 to 2.8 UAH per kilometre for medium- or long-haul distances (21 UAH for every 100-200 km). Given that average transport within Kyiv requires about 1.5 hours over an 18.75 km distance, and enterprises located just outside the city typically lie around 18.25 km from the urban boundary, proximity to final markets and raw material sources can drastically influence operating budgets.

Table 7. Kyiv region’s economic profile and agriculture enterprise data (2022)

Production category	Transport capacity	Transportation price, per km. \$
Poultry	Refrigerators: 3 tonnes; 5 tonnes; 7 tonnes	1-1.2
Milk production	Refrigerators: 3.5 tonnes; 5 tonnes; 20 tonnes	\$9 for rent and \$1.3 per km
Grain production	Heavy transport vans: 25 tonnes; 55 tonnes	0.8

Source: calculated by the authors based on data from Kyiv Statistics Service (n.d.), State Statistics Service of Ukraine (n.d.), State Land Cadastre of Ukraine (n.d.), Open Data Portal of Ukraine (n.d.)

Figure 4 illustrates the annual agricultural production and consumption trends of key food products – meat, milk, and bread – in the Kyiv region. The graph highlights a consistent surplus in production over consumption, especially in the categories of milk and bread, underscoring the region’s potential as a key supplier for both domestic markets and export channels. However, the widening gap between production and internal consumption also signals growing pressure on infrastructure, distribution systems, and land resources, particularly as urban development reshapes regional agricultural capacity. The data presented in Figure 4 are

limited up to 2019. The study focuses on comparative historical data, emphasizing significant land use and economic shifts that occurred before and around that period. The authors selected this cutoff to identify long-term trends and patterns before more latter-day disruptions, including those from economic instability or geopolitical events after 2019. Thus, the chosen temporal limitation allows for a more precise, undisturbed analysis of agricultural production and consumption dynamics without the confounding influences of later events, ensuring accurate trend interpretation and policy recommendation formulation.

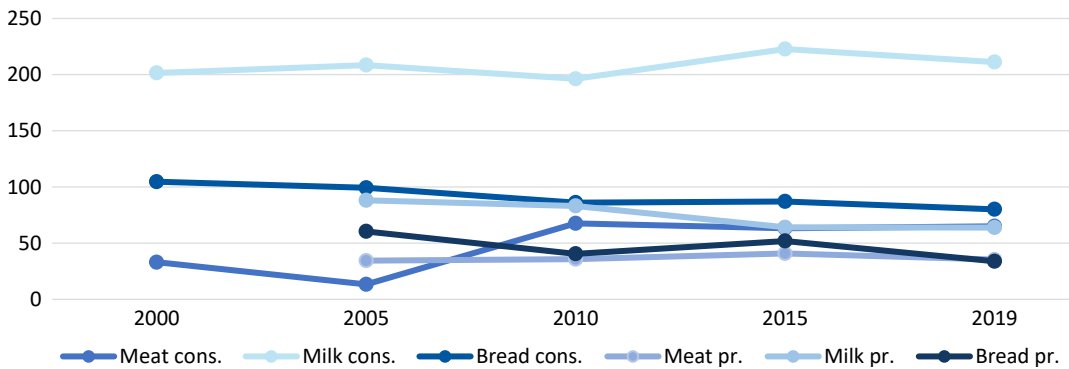


Figure 4. Agricultural production and derivative product consumption, per year (Kyiv)

Source: developed by the authors based on data from Kyiv Statistics Service (n.d.), State Statistics Service of Ukraine (n.d.)

Transportation expenses significantly shape the profitability of agricultural and food-processing operations. Depending on load capacity, per-kilometre charges can range from 20-30 UAH outside Kyiv to as high as 250 UAH per kilometre within city limits for certain vehicles. Grain producers typically pay 2.3-2.8 UAH/km for heavy carriers, whereas poultry and dairy sectors rely on refrigerated trucks, incurring up to 30 UAH/km. Given that the average distance from suburban enterprises to central Kyiv is roughly 18.25 km, these logistics costs can swiftly escalate. As farmland transitions to commercial or residential use, logistics corridors shift accordingly, implying further transportation patterns and expenditure adjustments over time (Nazarenko, 2021).

From an economic perspective, these cost differentials underscore how a strategic location – balancing lower land rent on the metropolitan periphery with proximity to logistical arteries – can substantially improve profitability. Enterprises engaged in high-value production, such as specialised food processing, may be able to absorb higher city-based rents in exchange for swifter access to urban consumer markets and skilled labour. Conversely, bulk commodity producers might find it more cost-effective to situate themselves in outlying districts where real estate is cheaper despite incurring additional transport charges.

The research revealed a significant and ongoing reduction in agricultural land within the Kyiv agglomeration, with agricultural areas

constituting only 0.21% of total regional land, while green zones dominate over 54%. High land rents in the metropolitan core – reaching up to 25 million UAH per hectare per year – and substantial wage disparities between urban and rural sectors are major drivers of land-use change and labour migration. Agricultural enterprises, especially in peri-urban zones, face rising operational costs due to logistical expenses and land competition, further threatening the viability. Despite these pressures, the region still supports over 6,500 agricultural enterprises, underscoring the sector's resilience. The findings confirm that without strategic land-use governance, zoning regulations, and supportive economic incentives, urban expansion will continue to erode agricultural capacity, posing risks to food security and balanced regional development. These outcomes highlight the need for integrated territorial planning to reconcile economic growth with the sustainable use of agricultural resources.

DISCUSSION

The results of this study confirm the intensifying competition between urban development and agricultural sustainability in the Kyiv agglomeration. The analysis of land-use data, wage differentials, and enterprise structure revealed a distinct trend: agricultural land is being rapidly marginalised due to increasing land rents, urban infrastructure expansion, and labour migration toward more profitable urban sectors. These conclusions align with findings from several international and national studies, which

emphasise similar pressures across different urbanised regions.

For instance, N. Vasylieva & H. James (2021) demonstrated that urban growth in Ukraine leads to physical and functional restructuring of agricultural territories. The authors found that food production systems near urban centres experience higher risks of displacement unless supported by clear spatial policies. This observation is consistent with this study's findings regarding the drastic reduction of agricultural land to just 0.21% of the Kyiv region and the increasingly high rent of 25 million UAH per hectare in central urban zones. Both studies underline the need for proactive territorial governance.

Research by V. Beckers *et al.* (2020) on Belgian peri-urban areas identified that urban encroachment causes land fragmentation and logistical inefficiencies, reducing farm productivity. This directly mirrors the observed situation in Kyiv, where smaller farms in suburban zones face elevated transport costs and infrastructural bottlenecks. However, unlike Belgium, where compensation mechanisms partially offset these effects, similar mitigation policies were not found to be effectively implemented in Ukraine, highlighting a key divergence.

W. Oueslati *et al.* (2019) examined urban pressures in European cities and found that agricultural land values rise faster than the productive output, leading to land abandonment or conversion. This economic mismatch was also evident in the Kyiv region, where the average enterprise revenue (30.7 million UAH annually) could not compete with speculative land development profits. The comparison reinforces the economic drivers behind farmland conversion.

In the U.S. context, S. Rogus & C. Dimi-tri (2015) emphasised the persistence of peri-urban agriculture supported by institutional frameworks and local food networks. The work showed that policy-driven support can enable farming to coexist with metropolitan functions even under urban pressure. This contrasts with the Kyiv agglomeration, where no comparable institutional support exists, leaving small and medium agricultural enterprises vulnerable. While both regions face spatial challenges, the U.S. case study offers policy models potentially applicable to the Ukrainian context.

Researchers B.A. Willaarts *et al.* (2013) analysed Brazil's urban expansion, noting how demographic and dietary shifts amplify the pressure on productive land. The work highlighted environmental degradation as a side effect of uncontrolled urban sprawl. Although the present study did not directly evaluate environmental factors, it revealed similar socio-economic drivers – such as rising population densities and infrastructural investments – that threaten land sustainability. The studies share a standard view of the multidimensionality of urban growth impacts.

O. Kravchenko *et al.* (2020) investigated Ukraine's socio-economic transformation in the context of sustainable agricultural development. The authors found that rural underinvestment and population decline compromise agricultural resilience. This aligns with the current findings on the wage disparities and workforce shifts from agriculture to urban industries. While O. Kravchenko *et al.* focused on broader national patterns, the present study provides a focused regional case study that confirms and elaborates on the conclusions. V. Nazarenko (2021) examined the spatial reconfiguration of food-processing enterprises in Kyiv and showed how logistics, rent, and labour availability drive location decisions. These findings correspond closely with this study's empirical results, particularly the clustering of 16 food industry enterprises within Kyiv city borders, where access to urban markets and infrastructure offsets higher rental costs. Both studies demonstrate the selective spatial advantages urban agribusinesses enjoy compared to peripheral producers.

Research A. Kucher (2017) argued that rational land-use planning is a cornerstone of rural development in Ukraine. The author proposed integrating agriculture into regional planning frameworks, a strategy not yet evident in the Kyiv agglomeration. This study's data suggest that without such integration, urban expansion continues to consume productive land without consideration for long-term agri-economic sustainability. The alignment between A. Kucher recommendations and the current study's findings underscores the gap between academic proposals and policy implementation. While F. Martellozzo *et al.* (2018) modelled future land-use change in Italy and predicted severe

agricultural land losses under current policies, the authors also emphasised that strong urban containment strategies can reverse the trend. The model-based approach complements the empirical approach of this study, offering a forward-looking perspective that echoes the conclusions drawn from the Kyiv region's latest historical land transformation.

S. Tripathi & C. Rani (2017) examined the mutual influence between agriculture and urbanisation in India, emphasizing how urban expansion can shape and reshape agricultural activity. The study highlights policy implications for balanced regional development and land use planning. G.F. Winfield (1973) offers a foundational perspective on the impacts of urbanisation on agricultural processes, focusing on land conversion, labour shifts, and market access. Although dated, the article remains relevant as a theoretical framework for understanding long-term urban-agricultural transitions. D. Satterthwaite *et al.* (2010) comprehensively review urbanisation's global implications for food and farming, particularly in developing countries. The authors emphasise that urban growth can disrupt rural food systems while creating opportunities for innovation in urban agriculture and food distribution.

I.E. Okoli *et al.* (2016) explored the economic effects of urbanisation on sustainable food production in sub-Saharan Africa. The study identifies key threats to food security and agricultural land due to urban sprawl and stresses the need for integrated urban-rural policy strategies. D. La Rosa *et al.* (2014) proposed a methodological framework for sustainable urban agriculture planning, focusing on integrating agricultural functions into urban landscapes. The work supports the idea of multifunctional land use and the potential of urban agriculture to contribute to food security, ecological resilience, and social inclusion.

Studies reinforce the observed dynamics of land use and urban transformation in the Kyiv agglomeration. For instance, S. Sakhniuk *et al.* (2023) conducted a geospatial analysis using Landsat satellite imagery to calculate impervious surface indices, revealing a steady expansion of urbanised zones in Kyiv over the last two decades. The findings confirm the growing

pressure on surrounding agricultural and green spaces, consistent with the land-use reductions identified in this study. From an ecological and policy standpoint, O. Kramarov (2019) and L. Moldavan *et al.* (2023) emphasised the importance of adapting Ukraine's agricultural sector to contemporary challenges, including climate change and urban encroachment. The authors advocate for integrated sustainable development strategies that combine environmental resilience with socio-economic planning – an approach that aligns with the urgent need to protect agricultural land in metropolitan regions. Moreover, P. Saik *et al.* (2024) proposed a structured ecosystem-based land-use planning framework to achieve land degradation neutrality (LDN) across Ukraine. The research underlines the necessity of balancing development with long-term soil and landscape sustainability, particularly in regions facing accelerated urbanisation. These perspectives support this study's conclusion that policy interventions must go beyond economic zoning to incorporate ecological value assessments and spatial regulation mechanisms.

These findings validate the patterns observed in the Kyiv region and highlight a broader need for integrated, forward-looking planning that can ensure food security, environmental stability, and sustainable urban-rural coexistence. Across these works, several common themes emerge: the spatial displacement of agriculture under urban pressure, the inadequacy of regulatory frameworks, the economic disadvantages of farming compared to industrial sectors, and the sociodemographic shifts favouring urban employment. This study contributes to this body of knowledge by offering a data-rich regional case study and highlighting the direct financial, spatial, and labour-market mechanisms driving agricultural marginalisation. However, differences also appear. Unlike contexts such as Belgium or the United States, where policy instruments partially protect peri-urban agriculture, the Ukrainian case demonstrates a relative policy vacuum. Moreover, while some studies emphasise environmental degradation, the current work focused primarily on economic and spatial parameters, suggesting a potential area for future research.

CONCLUSIONS

The findings of this study emphasise the urgent need for policymakers to adopt a proactive and balanced approach to land-use regulation in the Kyiv agglomeration. The intensifying pressure from urban development on agricultural territories threatens the economic sustainability of local farming enterprises but also the long-term food security of the region. Effective spatial planning, zoning policies, and targeted economic incentives – such as tax benefits, infrastructure support, and land preservation programs – are essential to mitigate land conversion trends and sustain a viable agricultural sector amid continued metropolitan growth.

Contrary to earlier views, the Kyiv agglomeration contains large tracts of farmland, representing the primary urban expansion reserve. Of Ukraine's 60.4 million hectares, 42.4 million are agricultural, with 32 million cultivated yearly; in the Kyiv region alone, 1,470 agricultural companies operate in suburban areas. Given that average land rent (3,474 UAH/ha) is lower outside prime urban zones, farmland conversion incentives remain strong. Meanwhile, agricultural wages (126,000-156,000 UAH yearly) lag food-processing salaries (156,000-204,000 UAH), prompting rural-to-urban migration. Lower labour productivity, suboptimal rural living conditions, and the ongoing security crisis intensify this exodus, undermining agriculture's labour pool and competitiveness.

A cluster of 16 major food-industry enterprises located in the city of Kyiv benefits from agglomeration economies such as immediate access to a market of nearly three million residents, robust infrastructure, and proximity to financial institutions. These advantages help offset elevated land rents, which can reach tens of millions of hryvnias per hectare in premium

urban zones. By contrast, peripheral farming enterprises – numbering over 6,500 in the wider region – may enjoy lower land costs but face comparative disadvantages in marketing, distribution, and professional workforce recruitment. As the region's population now exceeds 4.7 million (2.97 million in the city plus 1.78 million in outlying areas), the allure of the metropolitan core is likely to deepen, further widening the economic rift between urban and rural ventures.

In conclusion, the results of this study reinforce and expand upon existing academic literature regarding urbanisation's impact on agriculture. The results also underscore the urgency of establishing targeted land-use policies, transport infrastructure support, and economic incentives to sustain agricultural viability in metropolitan environments. The comparative analysis confirms the global nature of the challenges while emphasising region-specific nuances that must be addressed through localised policy design and implementation. Future research could explore land-price elasticity using econometric models and examine how farms adapt through higher-value production, technology adoption, or income diversification. It may also assess farmland resilience under urbanisation pressures and identify policy tools – such as zoning regulations and economic incentives – to support and sustain local agriculture.

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CONFLICT OF INTEREST

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Розвиток міст та аграрна динаміка: оцінка економічного ландшафту Київської агломерації

Анотація. У дослідженні проаналізовано вплив швидкої експансії міст на економічну динаміку сільського господарства в межах Київської агломерації. Авторами було проаналізовано зміни у землекористуванні, рівень заробітної плати, обсягах діяльності підприємств та логістичній інфраструктурі з використанням комплексного набору даних, зібраного з записів національного земельного кадастру, економічних звітів та регіональної статистики до 2023 року. Результати засвідчили про значний тиск на сільськогосподарські території: лише 0,21 % (0,18 тис. га) земель у регіоні станом на лютий 2022 було відведено для сільськогосподарського використання, порівняно з понад 54 % відведено до зелених зон та майже 13 % до житлових категорій. Водночас середньомісячна заробітна плата в харчовій промисловості Києва сягала 16 500 грн, тоді як заробітна плата в сільському господарстві прилеглих районів встановлена на рівні 14 000 грн, що впливає на трудову міграцію з сільського до міського секторів. Крім того, транспортні витрати – від 20 до 250 грн за кілометр залежно від місця розташування та типу транспортного засобу – ще більше впливають на життєздатність підприємства та прийняття просторових рішень. Також помітна розбіжність у ставках орендної плати за землю: за землю в межах столичного ядра Києва орендна плата становила до 25 млн грн за гектар на рік, тоді як у середньому по області – 3 474 грн. Ці фактори сприяють зазіханням на сільськогосподарські угіддя для житлового, комерційного та промислового використання. У дослідженні зроблено висновок, що ефективне управління міським і сільським землекористуванням – за допомогою регулювань зонування, фіскальних стимулів та сталого планування – має важливе значення для забезпечення життєздатності сільського господарства та забезпечення збалансованого регіонального розвитку в умовах постійного зростання столичної інфраструктури Києва. Результати цього дослідження можуть стати основою для стратегічного планування землекористування, спрямовувати заходи для пом'якшення негативного впливу на сільське господарство та сприяти збалансованій динаміці між містом та сільською місцевістю в мегаполісах, що швидко розвиваються

Ключові слова: розширення меж міст; аграрна економіка; зміна землекористування; зростання метрополій; соціально-економічний розвиток; економіка ресурсів