

Amalgamation and Local Finance: A Case Study of Ukraine

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ABSTRACT

Purpose: The article aims to measure the impact of the voluntary amalgamation approach applied in Ukraine in the course of the decentralization reforms undertaken over a period of five years, and assess how much these reforms have been successful in improving the local government fiscal situation. Ukraine began a long-delayed decentralization process in 2015 through amalgamation based on a voluntary approach, with an emphasis on improving the fiscal resources of the amalgamated units. The decentralization reform was based on three pillars: (1) voluntary amalgamation of the territorial units, (2) enhanced financial resources through own source revenues and infrastructure grants, and (3) utilization of inter-municipal cooperation to support improved service delivery.

Methodology: A time series of fiscal data from amalgamated territorial communities in selected regions of Ukraine have been analysed to measure the impact of the amalgamation policy on the amalgamated territorial units.

Findings: The fiscal improvements anticipated by the amalgamated territorial units have not been demonstrated by the statistical data analysis and no significant improvement in local government finances appears to have been realized through the application of a voluntary merging ap-

proach. There have been significant regional and urban/rural variations based on the population segments and access to financial resources.

Academic contribution to the field: While there has been considerable research on the impact of merging or amalgamating local governments, there has been very little, if any, on the voluntary approach to amalgamation.

The study seeks to address this problem and present evidence of the advantage of utilizing a voluntary over a mandatory approach to amalgamation.

Significance: The study provides a unique opportunity to measure the impact of amalgamation process in Ukraine over a five-year period based on the voluntary approach to amalgamation and determine how much this approach and the accompanying policies have been successful in improving the local government fiscal situation.

Keywords: amalgamated territorial communities, fiscal decentralization, voluntary amalgamation, fiscal equalization

JEL: H70

1 Introduction

Ukraine began a long-delayed decentralization process in 2015 with amalgamation based on a voluntary approach, as well as an emphasis on improving the fiscal resources of the newly-established territorial units. In 2014, following the Revolution of Dignity, the political will for decentralization and local government reform materialized as one of the primary policy decisions of the newly reformed Ukrainian government. The policies chosen were to reduce the over 10,000 small communities into approximately 1,500 amalgamated territorial communities (ATC) by voluntary amalgamation, increase the fiscal resources through financial incentives and targeted infrastructure grants, and support the use of inter-municipal cooperation to promote service delivery and economic efficiency.

The key features of this reform rested on several policy pillars. First, the restructuring of the administrative-territorial composition to reduce the large number of local government units. Second, applying a bottom-up voluntary approach to amalgamation of these units through a defined criteria and local decision-making and negotiation. Third, some reassignment of functions, particularly in the health, education and social services areas. Fourth, the promotion of inter-municipal cooperation as a means to enhance the service delivery through economies of scale and fiscal resources to overcome capacity limitations. And, fifth, greatly increasing the fiscal resources through more own-source revenues, primarily the personal income tax, property tax, and other taxes and fees along with grants to promote infrastructure improvements in the ATCs.

This paper focuses on the neglected research areas of researching the impact of the amalgamation on the revenues of the merged units and those that voluntarily merged in 2016 in Ukraine. The analysis presents the changes in

the fiscal resources based on per capita and selected population segments within these voluntary merged units. The purpose is to test the hypothesis that amalgamation of local governments into larger units produce greater fiscal resources. There is practically no research as identified by Tavares (2018) that addresses the voluntary amalgamation approach and even the revenue side of the fiscal equation.

This research paper intends to shed light on the most anticipated result of the decentralization reform in Ukraine: the revenue impacts on voluntary amalgamated units over a period of five years based on the population classifications and rural/urban categories. This is to test the proposition that larger population units would have increased fiscal resources as a result of the amalgamation and these correlate to different population segments of the units.

The paper is structured into the following sections. In the introduction we present the general context of Ukrainian decentralization reform. We then deliver a short literature review in order to present recent studies on decentralization emphasizing developments in Ukrainian local government sector. The third section presents the methodology developed by the authors to produce some meaningful conclusions on trends in ATC regarding revenue endowment and budget spending. The fourth section presents the main results of the study. This is followed by a fifth section that discusses the results. In the sixth section the authors' vision of future development and possible policies which can be considered for further research.

2 Literature Review

Amalgamation of local government units has been one of the main political and policy options open to sub-national governments to improve locally provided services and enhance their fiscal resources. The large and significant amount of research addressing amalgamation for the various reasons and purposes has been well documented by Tavares (2018).

There have been a substantial number of researches focused on studying the impact of amalgamation of local governments on the efficiency and effectiveness of service delivery, municipal expenditure levels and fiscal sustainability. These studies have analysed several variations of the amalgamation process, including the mandatory and voluntary approaches. The studies have concentrated primarily on the European countries as this is where the largest number of amalgamations have occurred and the data and analytical capacity has been more pronounced for this research purpose.

While the efforts to implement decentralization and amalgamate the multitude of local government units were long delayed in Ukraine, the research and reports supporting these changes began at an early stage. As early as 1995, in a paper by Wright (1995), the outlines of the final local government reform policies were formed. This included the need to reduce the number of local government units, the use of inter-municipal cooperation, and enhanced local government own source revenues. Many Ukrainian students also formu-

lated similar proposals considering that the state of the public administration sector was excessively centralized over the past decade.

The decentralization process that started in 2015 in Ukraine launched a boom in decentralization studies. More recent studies have addressed the aggregate levels of fiscal resources and the effects of the changes from the amalgamation and local revenues (Hamaniuk and Palchuk, 2020; Newmaier et al., 2019; Romanova and Umland, 2019; Solodkyy et al., 2020).

Some differences in the findings of these studies became apparent. The research by Hamaniuk and Palchuk (2020) indicated that the smallest units with population under 5,000 had seen a higher increase in the per capita own source revenues than the larger ones. However, other research conducted under the Ukraine-Local Empowerment, Accountability and Development Programme (U-LEAD) project that sampled 15 amalgamated units of various population size indicated that the larger the amalgamated unit the greater the increase in the revenues (Zubenko et al., 2020). These studies were of a limited duration and number of units to provide a definitive analysis of the situation across all amalgamated units.

The latest and more definitive analysis of the success of the local government reform program that examined the voluntary versus mandatory impacts, the use of inter-municipal cooperation and the relationship of population size to revenues is provided by Wright and Slukhai (2021). This study indicated that the voluntary approach applied in Ukraine was not very successful and resulted in the use of the forced amalgamation of the local government units in 2020. It also concluded that the use of inter-municipal cooperation did not reach a critical mass across the regions to significantly impact the delivery of services. And, finally, the study addressed the fiscal resources changes based on the data for the ATCs with different population segments.

Ukrainian researchers on the ATC finances pointed out some flaws in the current approach associated with ignoring the fiscal sustainability criteria that might foster horizontal inequality, increase the gap between resources and expenditure needs and lead to stagnation of most small ATCs which appeared to remain non-sustainable after amalgamation (Ivanova and Ivanov, 2020; Vozniak and Zherybylo, 2020). Other researchers indicated that low fiscal viability of ATCs is predetermined by the fact that ATCs were formed under administrative pressure, with no regard to economic and fiscal criteria (Baranivskyi, 2017). Some studies with a macro-approach concluded that the ATC size does not correlate with the ATCs' per capita own revenues (Liutyi and Spasiv, 2019). The empirical studies carried out with data of some specific ATCs and regional samples concluded that in course of amalgamation a significant increase in ATC own revenues was observed (Hrynchyshyn, 2019; Spasiv, 2019; Vartsaba, 2018; Zakhidna et al., 2020). Some researchers outlined policies to measure (Blazhivska and Petrovskyi, 2020) and improve the ATC fiscal viability through fostering amalgamation that would involve big cities of regional significance on order to form agglomerations with high economic potential which would lead to increase in total revenues of territorial units

(Patytska, 2019). One of the recent empirical studies (Klyuchnik et al., 2020) emphasized the lack of link between infrastructure development and supporting the ATCs' competitive advantages.

As can be seen from this review, the researchers of Ukrainian decentralization process do not observe unequivocal developments in the local government sector and this makes a topical further study of trends in this field more essential.

3 Methodology and Data

The methodology of the research undertaken for this paper relies on a multi-prong macro and micro analysis of the available data on the fiscal resources of the amalgamated units beginning from 2016. The prior research done by donor organizations, primarily the U-LEAD project (2018, 2019), focused on the national level aggregated data that examined the overall national level trends in revenues and expenditures. This high level of aggregated data did not reveal many of the underlying trends and differences across the amalgamated units.

On performing the initial data analysis of the aggregated data for one year (Wright and Slukhai, 2020), it was determined that a further and deeper analysis would reveal possible trends in ATC performance over the years from 2016 to 2020. On this second level of analysis, the intent was to see if the different population segments may have significant differences in the growth of their revenues on a per capita basis. Additionally, it was considered that there may be regional differences as well and between urban and rural amalgamated units. The urban ATCs were defined as those which have more than 50 per cent of urban population to total population, the rural ATCs, respectively, were those which have more than 50 per cent of rural population to total population.

Four regions representing the different areas of Ukraine were selected (Dnipro, Poltava, Khmelnytsky and Ternopil) to determine if there were differences across the regions. These regions belonged to those which were at the top of Ukrainian regions regarding the number of ATCs formed in 2016. All amalgamated units that were formed in 2016 were tracked in these four regions over five years. The number of amalgamated units that fit to the requirements amounted to 72, approximately 5 per cent of the total units amalgamated, and included only those ATCs which did not change their composition (as some of ATCs formed in 2016 later expanded through inclusion of some new communities). The regional distribution of the sample is provided in the Table 1.

Table 1. Regions and populations segments of the sample selected

Region	>15,000	15,000-10,000	10,000-5,000	<5,000	Total number of units
Ternopil	4	3	7	11	25
Dnipro	3	3	2	6	14
Poltava	1	2	2	6	11
Khmelnytsky	6	3	11	2	22
Total	14	11	22	25	72

Source: The data from the yearly fiscal reports prepared by U-LEAD and published on the Decentralization website (www.decentralization.gov.ua).

Sixty-five per cent of the amalgamated units from our total sample have population of 10,000 or less. Approximately 35 per cent of the merged units have less than 5,000 in population and are considered the least fiscally viable units.

While there was a substantial amount of fiscal data available, the analysis mostly focused on the trends in the revenues, capital expenditures and the donations (transfers) of the ATCs over these years.

To identify insights that corresponds to the results of decentralization reform we constructed Machine Learning models based on a dataset of 72 ATC performance metrics on the period from 2016 to 2020. The features that formed the dataset are:

1. Binary: urban dominating ATC.
2. Nominal: region (Ternopil, Poltava, Dnipro, Khmelnytsky).
3. Continuous:
 - per capita own revenues;
 - ATC area;
 - ATC population;
 - the share of basic donation in total revenues (as target);
 - the share of expenditures for the government bodies in general revenues (as target);
 - per capita capital expenditures and own revenues (as target).

The key machine learning methods that dominated in our approach were:

1. Gradient boosting, which is based on a step-by-step search for the optimal model. It starts with differential loss function initialization

$$F_0 = \arg \min_{\gamma} \sum_{i=1}^n L(y_i, F(x)) \quad [1]$$

and after each step improves model accuracy metrics by determination of the optimal multiplier to conduct the appropriate descent

$$F_m(x) = F_{m-1}(x) + \gamma_m h_m(x_i) [2].$$

2. Random Forrest and Extra Trees Regressor that combine decision tree framework and ensemble learning to randomly simulate decision trees and by mixing their results improve model accuracy metrics.

4 Research results

The revenue enhancements that would be made available to the ATCs were primarily greater collection effort for property taxes and other local taxes and fees. This was also to be enhanced by a grant fund that would be specifically targeted to the ATCs for infrastructure improvements. This State Fund of Regional Development would provide funds on a priority basis for regional development through competitive grants based on financial capacity of the units, cost-sharing of the projects and some social and economic considerations.

The amended Budget Code and Tax Code allowed for the ATCs to receive 60 per cent of the PIT, 5 per cent of the excise tax, 100 per cent of the small business tax, 100 per cent of CIT from the communal enterprises, 100 per cent of the property tax and 25 per cent of an ecological levy. These were intended, if effectively collected, to greatly increase the ATCs' local revenues.

The ATC own revenues (revenues excluding national government transfers) mostly consist of PIT and local taxes (including property tax) proceeds. As these types of revenue account for more than 80 per cent of revenues, it could be concluded that ATCs have quite low discretion over their own revenues because the tax base and tax rates for PIT and local levies are defined by the national legislation.

As is evident from Table 2, the local revenues did increase substantially in the early years of the merging process. However, since 2019 (when a drastic change in country's political landscape occurred that is associated with a newly-elected President Zelenskyii and forming a mono-coalition by his party in the parliament) a decrease is observed due to slowdown of the economy and re-shifting public revenues in favor of the central government. These data are highly aggregated across all the local government units and tend to show a slowing down of revenues in the later years.

Table 2. Total revenues of Ukrainian local governments including transfers, 2014-2020

	2014	2015	2016	2017	2018	2019	2020
Total revenues incl. transfers, bill. UAH	231,7	294,5	366,1	502,1	562,2	560,5	471,5
Increase, bill. UAH	n.a.	62,8	71,6	136	60,1	-1,7	-89,0
Per cent increase	n.a.	27,1	24,3	37,1	12,0	-0,3	-15,9

Source: own calculations based on data of the Ministry of Finance of Ukraine.

A significant drop in local total revenues experienced in 2020 must be attributed mostly to a cut of national government transfer payments towards local governments due to change in priorities of public expenditure policy. Despite that COVID-19 pandemic hit that year the Ukrainian economy, it had no significant consequences for the local finance. The authors of a U-LEAD report dedicated to this issue (Ventsel et al., 2021) came to the conclusion that COVID-19 pandemic caused some losses for local budgets, however they were overcompensated due to increase in minimal wage set by the government for 2020 (+15 per cent) and increase in average wage level (+10 per cent). As a result, the average budget execution rate for aggregated total local revenues in 2020 was 99.6 per cent with general budget fund revenue increase of 5.4 per cent in comparison to the level of 2019. This situation contrasts to that observed in most countries of Europe. The regional and local governments in Europe lost about 7.3 per cent of their revenues in comparison to the year 2019 (European Committee of the Regions, 2021). It could be assumed that some responsibility for such a phenomenon are the specifics of vertical public expenditure allocation in Ukraine, as well as a traditionally loose revenue forecasting that gives many possibilities to hide the revenues in order not to be subjected to revenue extraction by the national government.

Unlike other countries of the Western and Central European regions, Ukraine practiced a voluntary approach to the amalgamation. The voluntary approach had been attempted in several of the European countries, but in the end most of the countries had to resort to a mandatory approach to reducing the number of local government units (Swianiewicz, 2002).

The process of amalgamating these units began in earnest in 2015-2016 following the adoption of the respective Cabinet of Ministers regulations. It was driven by a bottom-up and voluntary method that allowed the local communities to determine how they wanted to merge. The process allowed for the initiation of the process through the local officials, primarily the mayor or local council, and the citizens.

The progress toward merging these units proceeded slowly over the years beginning in 2015 with 159 newly-established ATCs and ended up with 1,469 ATCs by the end of 2020. The voluntary amalgamation reached a peak in 2019 and further progress to merging the units was very difficult to achieve after 5 years of the voluntary approach. There were several reasons for this, but the most important appeared to be that there was substantial resistance from the larger and wealthier local governments to merge with their surrounding and less wealthy local governments (Udovychenko et al., 2017). These units didn't feel that they would benefit from increasing their population or territorial size and the revenues they collect would be spread over the revenue-tight communities merged with them. On the other side, in some regions the small rural local communities which were highly dependent on donations and decisions of district authorities were afraid to lose external sources of revenue in course of amalgamation and that was aggravated by situation of the compact dwelling areas of national minorities which were sensitive to maintaining their cultural identity (Vartsaba and Mulesa, 2018).

In addition to this resistance, the district governments still existed and, in some instances, overlapped or duplicated the area of the merged communities. The district administrations feared that they would be eliminated and not have the fiscal resources even though they still had services to deliver. So, district officials were very opposed to the merging of units in their areas of jurisdiction.

The initial analysis examined the level of per capita own revenues of the ATCs with the allocation of the personal income tax exclusively to the local units and the increase as a per cent to the average of the total sample tracked over the years from 2016 through 2020 in each of the population segments. These data are presented in Table 3.

Table 3. Per capita own revenues (total revenues without transfers) by population segments and years, per cent to average in four regions

ATCs by population size	2016	2017	2018	2019	2020
>15,000	87,8	91,3	92,4	91,0	92,5
10-15,000	152,6	151,6	132,6	130,3	134,8
5-10,000	94,8	93,5	91,9	92,2	94,5
<5,000	94,8	98,3	99,8	91,5	93,2

Source: Authors' calculation based on data published on the Decentralization website (www.decentralization.gov.ua).

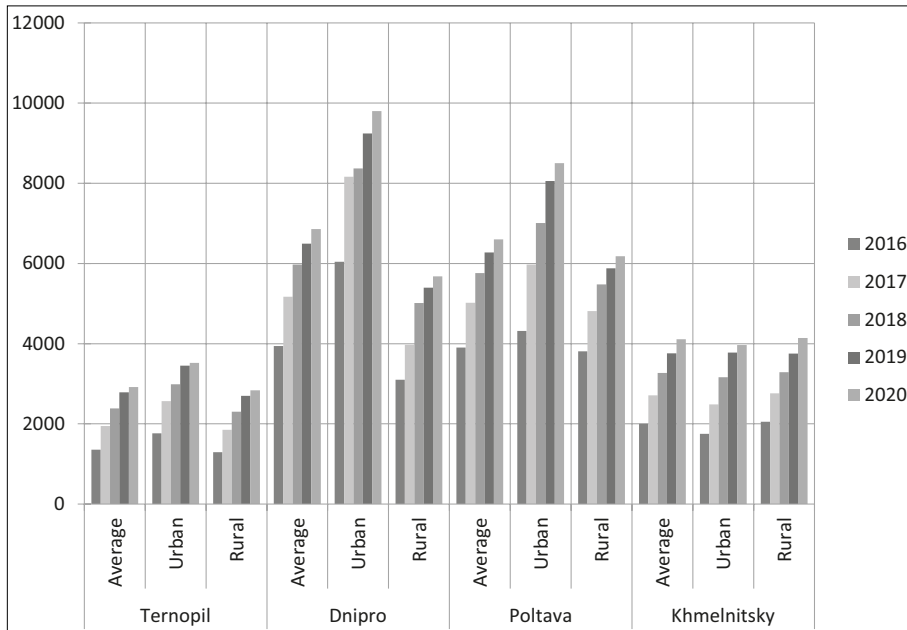
The data above indicate that the revenue variations across the ATCs is rather dramatic. The 10-15,000 population units had substantially more revenue over these years on a total revenue basis. The 5-10,000 and the larger than 15,000 units exhibited a relatively stable revenue base over these years. At the same time the less than 5,000 population and the 10-15,000 showed a decline in revenues over the same period. The most concerning situation is with regard to the 10-15,000 population which indicates a dramatic decline in revenues in 2018 and stays at a lower level for the last two years.

However, it also appeared that interregional differences concerning ATC fiscal endowment are quite substantial. The Figure 1 below provides a perspective of the differences over the years of the per capita revenue for each of the regions and urban/rural designation.

The data tends to indicate that the divergence between urban and rural units was the greatest in the Dnipro and Poltava regions, both in Eastern Ukraine. The difference between urban and rural units is the least for the Ternopil and Khmelnytsky regions (both Western Ukraine) and are at a much lower level than for the Dnipro and Poltava (Eastern and Central Ukraine) regions. The graph reveals that the ATC revenues, both in urban and rural locations did grow over the years in all of these regions. The differences across the regions with regard to total revenues correlate to the level of economy development

in each region: the most developed are Dnipro and Poltava (Eastern and Central Ukraine) which are more industrial and the less developed Khmelnytsky and Ternopil, (Western Ukraine) which are more agricultural based regions.

Figure 1. Per capita revenues by regions in urban/rural ATCs by years, UAH



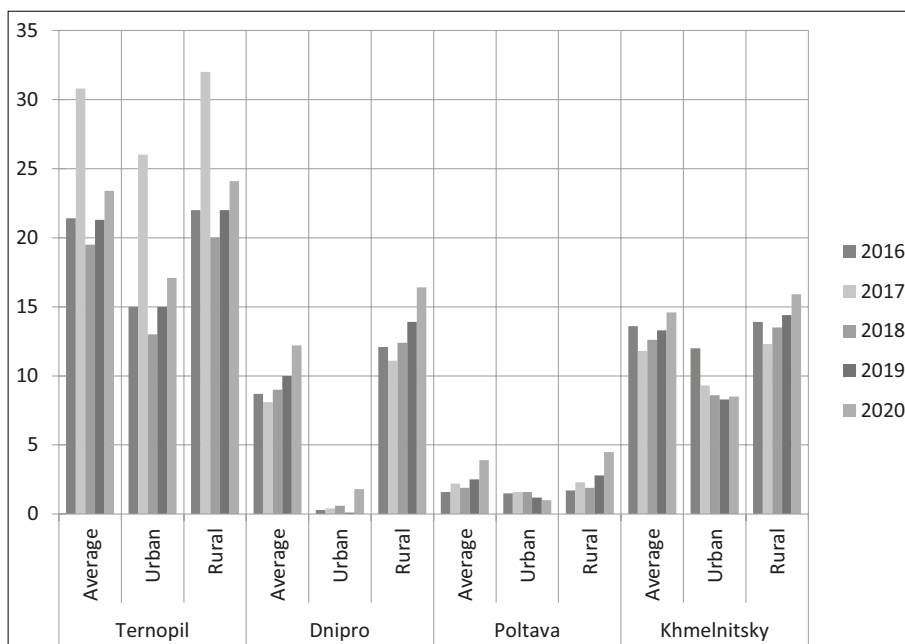
Source: Authors' calculation based on data published on the Decentralization website (www.decentralization.gov.ua).

The level of per capita revenues indicated that the worse-off ATCs must be supported by the transfers from the central government. However, it must be noted that amalgamation policy aimed to make the local units more fiscally viable, so it was plausible to expect that transfer dependence would get lower in amalgamated units in comparison to the pre-amalgamation period.

It has not been a surprise that our analysis (Figure 2) showed that the rural ATCs appeared to have higher transfer dependence over the urban areas during this period. The levels of donations generally grew over the years from 2018, but were nearly back at the same levels as at the beginning in 2016. Overall, the levels were rather stable over these years. The upward trend is observed from 2018 on both in the rural and urban areas of all the regions.

While the transfers show a rather stable (around 50 per cent to total revenues) and slightly upward trend in the aggregate, the analysis on a regional basis shows some significant differences.

Figure 2. Share of donation in the ATC budgets by years across the regions

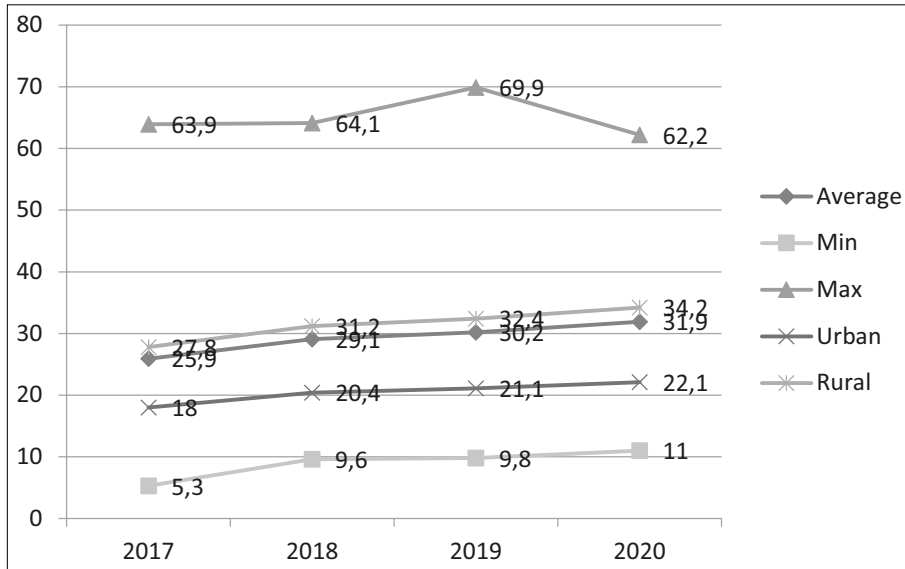


Source: Authors' calculation based on data published on the Decentralization website (www.decentralization.gov.ua).

There is a great variation across the regions in terms of the transfers received. The Ternopil region represents an interesting case in that both the rural and urban amalgamated units had a much higher transfer share over the years compared to the other regions. However, these transfer shares decline substantially after 2017. The Dnipro rural ATCs received much more transfers in the later years compared to earlier years. In the Poltava region the rural and urban ATCs had very low levels of transfers. Once again, Poltava and Dnipro regions, both in the Eastern and Central Ukraine, had much lower levels of transfers compared to the other regions because of having more generous sources of budget revenues due to higher economic development.

Another finding is a trend in expenses on the local government bodies observed since amalgamation started. Figure 3 below demonstrates that a share of ATC expenditure on local government bodies in the sample units amounted to 26 to 32 per cent on the average since amalgamation began. An upward increase was observed both in urban and rural ATCs. Such a trend in expenditure composition could indicate that new possibilities stemming from extended local revenues are compromised to some extent by a bias of local administrators to spend more local revenues on themselves, and are therefore missing in this way the opportunities to increase the level and quality of local public service delivery.

Figure 3. Expenditures for the local government bodies as per cent of general fund revenues (own revenues plus general transfers)

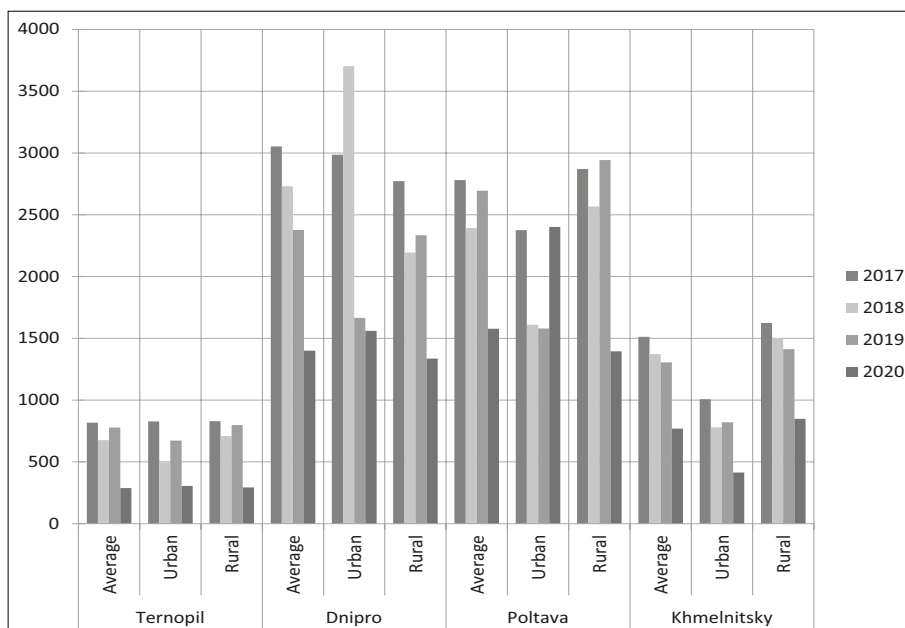


Source: Authors' calculation based on data published on the Decentralization website (www.decentralization.gov.ua).

The data reveal a higher level of these expenditures as opposed to spending on public services over these years. The upward trend in expenses would indicate that these are taking more of the general fund budget relative to the other general fund expenses, such as the delivery of public services. The level of expenses on the local government bodies is much higher for the rural areas as opposed to the urban areas. The values for this expenditure share show that one of the goals of amalgamation – to keep administrative cost in ATCs at the level of 20 per cent to general revenue fund at maximum – is far from being achieved. Moreover, the growth trend here is obvious with the average value reaching over 30 per cent in 2020. This situation is a particular characteristic for the rural areas in the whole of Ukraine. This takes into consideration that most ATCs from our sample are rural. The Ministry of Finance of Ukraine latest data showed that in rural local governments the share of expenditures on local government bodies soared up to almost 40 per cent in 2020 (Ministry of Finance of Ukraine, 2021).

A very important indicator of forming the viable local communities is their investment activity as it supports local economy that in turn generates local revenues. So, it was logical to assess in what way the amalgamation process affected local public investments. Our major finding is the following one: there is an opposite trend in general budget revenues and the ATC per capita investment expenditures in nominal values and this tends to diminish from year to year in all the regions. This follows from data presented in Figure 4.

Figure 4. Per capita capital expenditures by regions urban/rural by years, UAH



Source: Authors' calculation based on data published on the Decentralization website (www.decentralization.gov.ua).

What is additionally evident here is that the Dnipro and Poltava regions (Eastern and Central Ukraine) have much higher levels of per capita capital expenditures over the years and with substantial variations from year to year. The greater convergence between the per capita capital expenditures between rural and urban areas is most noticeable in the Ternopil and Khmelnytsky regions (both Western Ukraine). The extent of the variations from year to year of the capital expenditures does not demonstrate a particularly stable or upward trend in the capital expenditures among these units. Generally, there was a downward trend in the per capita capital expenditures over these years with a significant decline in 2020.

Considering the key trends and relationships characterizing the process of amalgamation of territorial communities in Ukraine, surprisingly strong correlations between the following metrics were identified:

- High negative correlation (-.536) between the share of basic donation in total revenues and own revenue per capita. This result shows a natural connection that reflects the replenishment of transfers in regions with insufficient cash flow levels.
- Moderate negative correlation (-.322) between the share of expenditures for the government bodies in general revenues and the population of amalgamated territorial communities. Such a result arises as a scaling effect: the higher the population, the lower the share of administrative costs

per capita. More significant consolidation of the ATC groups may lead to a smaller percentage of these expenses to revenue generated by the community.

- A high positive correlation (.629) between capital expenditure and own revenues per capita. As a result of higher business activity in the region, investment in the area increases accordingly, demonstrating the most robust pairwise relationship.

The hypothesis tests were performed to conclude a significant linear relationship for described pairs of metrics with p-values lower than the .05 significance level. In addition, the performed correlation analysis confirms the hypotheses stated earlier.

Machine learning methods were used to describe the functional impact of individual components on the target performance metrics of the reform. Among the methods tested for explaining the share of donations, CatBoost Regression, the model of gradient boosting as an ensemble of decision trees on a transformed sample of data free of multicollinearity and with combined categorical variables, was singled out as the most accurate. In addition, the bootstrapping method was used to expand the data sample (see Table 4).

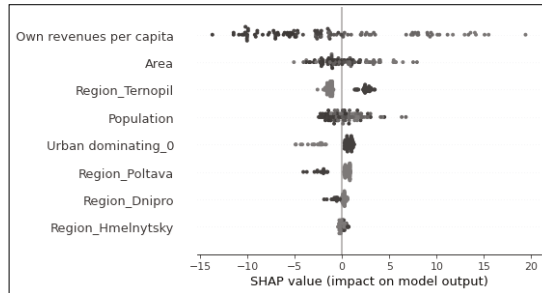
Table 4. Comparison of accuracy of Machine Learning models to explain basic donation in total revenues metric

Model	MAE	MSE	RMSE	R2
CatBoost Regressor	4.9094	49.7953	6.9067	0.7098
Extra Trees Regressor	4.7632	51.2661	6.9905	0.7094
Random Forest Regressor	5.2213	54.5084	7.2579	0.6866
Gradient Boosting Regressor	5.3972	56.6585	7.4068	0.6635
K Neighbors Regressor	5.4193	60.0295	7.6164	0.6553
Extreme Gradient Boosting	5.4377	61.5980	7.7341	0.6412
Linear Regression	6.4467	65.4230	8.0205	0.6267

Source: Authors' calculation.

Since gradient boosting is a complex algorithm for interpreting the influence of multiple independent variables on a target metric, we used the Shapley Additive Explanations algorithm, a sensitivity analysis-based method for explaining prediction models, to identify the character and strength of the influence of our variables (Figure 5).

Figure 5. SHAP Values of factors explaining share of basic donation in total revenues in CatBoost Regression Model

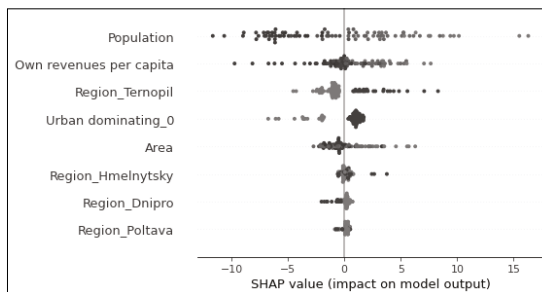


Source: Authors' calculation.

As we can see from the sensitivity analysis, per capita own revenues have the most decisive influence, while there is a robust negative relationship between this factor and the share of basic donation in total revenues. The area of the ATC plays the second most important place in the model, while the relationship also has a negative value. Another point that should be highlighted from the sensitivity analysis of the factors is that a larger share of subsidies is characteristic for ATCs of Ternopil region and those ATCs from other regions which have majority of the rural population. The situation is the opposite for Poltava and Dnipro regions.

Using a similar approach to illustrate the share of subsidies to the region we built a model that explains the percentage of expenditures for government bodies in the revenues. The model with the best characteristics was determined to be the Extra Trees Regressor model. This model has even a slightly lower level of Mean Absolute Error (4.24 p.p.) of expenditures for government bodies share and the coefficient of determination at the level of .739. The results are presented in Figure 6.

Figure 6. SHAP Values of factors explaining share of basic donation in total revenues in Extra Trees Regression Model



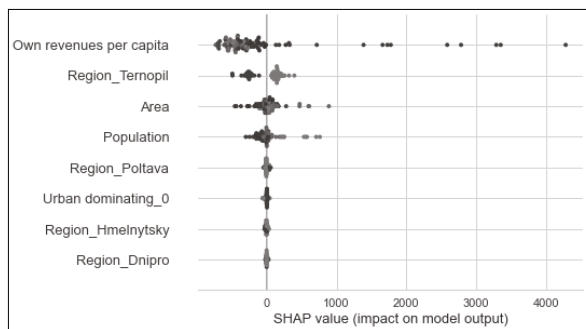
Source: Authors' calculation.

In the Extra Trees Regression model the population factor has a higher influence, demonstrating a certain positive scale effect of consolidation into a

single ATC. The relationship between the variables is negative, as predicted in the correlation analysis. The second most important factor – own revenue per capita, also shows a negative impact. The regional location and a share of the urban population have impact similar to the previous model, however we should emphasize a stronger and more pronounced negative effect for the Khmelnytsky region.

The Random Forest Regressor model was determined to be the most accurate model for the estimating factor for per capita capital expenditures, but the error rate for this variable is sufficiently high at 34 per cent Mean Absolute Percentage Error (Figure 7).

Figure 7. SHAP Values of factors explaining per capita capital expenditures in Random Forrest Regression Model



Source: Authors' calculation.

The highest positive impact on per capita capital expenditures has the amount of per capita own revenues, while other variables that have a strong effect can be defined as the binary metric of the Ternopil region and the metrics of ATC population and area.

5 Discussion

This research has examined the impact of a voluntary approach to amalgamation and accompanying policies of local government finance over a five-year period from 2016-2020. The intent was to see if there was a level of correlation or trend relationship across these years in terms of the population size to the fiscal resources and spending patterns. The assumption being that the greater the population the greater the level of fiscal resources and that these would rise as population levels of the amalgamated units increased. It was also assumed that after amalgamation ATCs would improve their expenditure composition and spend more money on investments.

While most studies of the impact of amalgamation have focused on the levels of expenditures, this research focused on the revenue sources related to own source revenues and transfers, capital expenditures and administrative expenses.

The research indicates that population size as a predictor of increased fiscal resources is not proven by the experience in Ukraine. The amalgamation approach of Ukraine of relying on voluntary amalgamation, use of inter-municipal cooperation and enhanced fiscal resources should have provided a high probability that larger units would demonstrate increased fiscal resources. Some studies carried out at the initial stage of decentralization put forward such result as an argument to amalgamate into larger ATCs (Kaziuk, 2016).

This correlation was not proven by the data analyzed in this research. This would suggest that concerns about fiscal viability of newly formed territorial units expressed by some students (Vozniak and Zherybylo, 2020) is sustained as our analysis shows. However, we do not suggest that population size is an inappropriate indicator for clustering the ATCs as some students claim (Liutyi and Spasiv, 2019). The problem with the absence of correlation among population and own revenues (as well as capital expenditures) could be rooted in institutional peculiarities of Ukrainian local governments system, especially with low elasticity of own local revenues with regard to the government size. And this is maybe a very significant weakness of Ukrainian decentralization reform because the world-wide experience of many countries demonstrated a high importance of fiscal incentives for local revenue collection (Jin et al., 2005).

Our research did indicate a significant level of differences between the fiscal capacity of urban and rural amalgamated units as might be expected. The rural areas had lower levels of fiscal resources, while urban areas, particularly those that include the large cities, had greater levels of fiscal resources. Whether this will remain true following the mandatory amalgamation implemented in 2020 will need to be further researched.

We suggest that an increase in ATCs own revenue observed through the time in our sample could be associated with some fiscal risks coming from a high (over 50 per cent) dependence on PIT. As some Ukrainian researchers emphasized, the PIT proceeds in smaller ATCs fall mostly on those who works for local budgetary institutions (school teachers, local council staff, etc.) and high reliance on PIT is in most cases associated with lower per capita own revenues (Hrynychshyn, 2019). This is an additional argument for changing ATC revenue composition in favor of truly own source revenues.

However, it is clear that despite growing own source revenues, the amalgamation in its present form did not make ATCs more fiscally independent. The dependence on equalization transfers did not change greatly over time, but with some slight growth trend. This observation supports a claim by Lunina that local governments in Ukraine still have no fiscal instruments to adjust their own revenues to own expenditures (Lunina, 2014). The initial situation where around 80 per cent of ATCs received the equalization transfers (Baranivskiy, 2017) did not actually change. However, as our correlation analysis suggested, the growth in own revenues must lead to decrease in transfer dependence. The problems is that governmental policy should be more directed at increasing local fiscal autonomy.

Our study of expenditure patterns related to ATC revenue development revealed some problems with spending efficiency. This fact is not a unique one, as some studies documented no influence of amalgamation on local government spending efficiency (Afonso and Venancio, 2020). It could also be related to the complex interaction between elected politicians and bureaucrats at the local level (Peters, 2020). Our findings concerning growing share of expenses on local government bodies may indicate some institutional issues in local governance that are still present in the Ukrainian subnational public sector. These results are similar to those reported by Blesse and Baskaran (2014) in their examination of differences between voluntary and mandatory merged units in the German federal state of Brandenburg which found that in mandatory merged units there was a greater and more immediate reductions in administrative expenditures, while in the voluntary merged units there was much less reduction in these expenditures. Another study found that in course of amalgamation there is no economy of scale observed as concerns expenditures for local government bodies (Matejova et al., 2017). So, we can suggest that Ukrainian voluntarily amalgamation resulted in less efficient resource usage that could be explained to some extent by decreasing accountability backed by insufficient budget transparency and slow development of own revenue sources. The fact of low local budget transparency in ATCs is documented in a study by Slukhai et al. (2019). Low accountability relates to low citizen participation in local government budget decisions, as recent studies of some countries showed (Ebinger et al., 2019). However, the correlation analysis demonstrated that in general, growing own revenues may lead to decreasing share of this part of expenditures with regard to revenues.

Our analysis of local public capital expenditures in the four regions revealed their downsizing. This observation is consistent with trends observed in some other regions of Ukraine (Melnyk et al., 2019). However, our correlation analysis showed that per capita capital expenditures might increase with growing local revenues.

We also revealed great interregional variation and year-by-year fluctuations of per capita capital expenditures. This maybe caused to a great extent by the inconsistent governmental policy concerning supporting ATCs investments. As the audit by the Accounting Chamber of Ukraine on spending of state subvention for forming the ATC physical infrastructure showed, there have been no explicit principles of subvention accumulation and allocation formulated which have led to its mostly inefficient usage (Rakhunkova Palata Ukrainy, 2019). As this infrastructure subvention is a significant part of ATC capital budget, it would be no surprise that they have no consistent investment policy with resulting observed fluctuations. The empirical studies also showed insufficient influence of local investments on local economic development (Klyuchnik et al., 2020) that could be related to the issues with the state local investment support.

6 Conclusions

Based on the analysis in this paper it was revealed some substantial differences on a regional basis from the decentralization reform. The ATCs in the Eastern and Central Ukraine (regions of Dnipro and Poltava) had more own source fiscal resources and had much less transfer dependence. The opposite was true for the Western Ukraine (regions of Ternopil and Khmelnytsky) with lower levels of own fiscal resources available and higher levels of dependence on transfers. This may indicate significant differences in the economic situation in the regions as well as the capacity of these units to collect revenues and manage fiscal resources.

There may be other explanations for why our basic hypothesis was not fully proven in this decentralization reform. The data may not reflect the different economic situations of the merged units, the different capacities of the local government to collect revenue, and that the policy decisions related to enhanced revenue sources were not sufficient to have a noticeable impact on the fiscal situations.

It is clear that some changes in the current approach to decentralization (amalgamation) should be introduced. First of all there is the need for a broader range of truly local own source revenues. The local governments have to enjoy much higher autonomy in local taxation and that this must extend also to property taxation. In order to enhance local public investments, the amount of investment subsidy also must be increased and its incentive component significantly improved.

It is clear that these improvements could be introduced only after the victory of Ukraine in a war unleashed by Russia on February 24, 2022. Despite the mass destruction of the economy and severe issues with public institutions functioning caused by the aggression, the Ukrainian after-reform local government sector has proven its institutional sustainability.

In any case, the national government should look for reshaping its decentralization policy in some very important constituents. Then the recent amalgamation efforts might bring an expected outcome – getting a fiscally viable and sustainable local government system. This may require a more detailed examination of the own source revenues and the use of additional incentives to spur greater revenue collections. It should also address the potential inequities in the transfers and the use of performance-based grants to increase the willingness of local government units to voluntarily merge. Additional attention needs to be directed toward supporting more intensive inter-municipal cooperation in those instances where voluntary amalgamation is not a politically viable approach.

Since the Government of Ukraine mandated a compulsory amalgamation of all local government units in 2020, effectively ending the voluntary approach, our study may provide a basis for future research in terms of analyzing the differences in comparable units that were once merged voluntarily to those

that were mandated. There has been little research in this particular aspect of decentralization and the debate over whether voluntary or mandatory amalgamation will produce better results needs to be addressed. This study may also provide a basis for assessing the deficiencies of utilizing the voluntary approach and lead to identification of amalgamation policies that provide greater incentives for local governments units to merge on a voluntary basis.

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