IN UNITY THERE IS STRENGTH: THE EFFECT OF DECENTRALIZATION REFORM ON LOCAL BUDGETS IN UKRAINE

by

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Abstract

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In 2014, a decentralization reform of unique design commenced in Ukraine. It launched voluntary amalgamation of village, town and city councils into so-called amalgamated territorial communities (ATCs), which now possess a wider administrative and financial authority, including a bigger tax base and more expenditure sources. In this manner a territorial amalgamation reform was combined with fiscal decentralization.

This thesis examines how amalgamations of local communities in Ukraine affected their local budgets, financial independence and local government size. The dataset covers four years before the reform (2012-2014) and two years after (2015-2016). The applied methodology is difference-in-differences (DiD) estimation with fixed effects in a panel context, which was additionally combined with propensity score matching.

Two years after the reform, its effect was found significant and positive for most budget expenditures. Among local budget revenues, the treatment effect on few local tax incomes was found significant.

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GLOSSARY

ATC. Amalgamated territorial community. A voluntary association of residents of several separate villages, towns or cities into one administrative center with a new council.

DiD. Difference-in-Differences estimation.

Own revenues. Own-source revenues. The revenue that a local government raises by collecting taxes or generating non-tax income, including proceeds from capital management transactions.

PIT. Personal Income Tax. A national tax, which is (1) levied on the income of the residents of Ukraine who receive their income from the sources of origin in Ukraine and abroad; (2) levied on the income of non-residents who receive their income from the sources of origin in Ukraine. Regulated in the articles 162-179 of the Tax Code of Ukraine.

Chapter 1

INTRODUCTION

In 2014, Ukraine has started a multi-tier decentralization reform, whose goal was proclaimed as "the formation of the efficient local government and territorial organization of power for the sake of creating and maintaining sufficient living environment for the citizens, providing them with high-quality and affordable public services, establishing institutes of direct democracy, complying the interests of the state with the ones of the territorial communities" (Cabinet of Ministers of Ukraine[1]). Finally, Ukraine joined the wave of amalgamations in Europe in the recent decades, as a resurgence of the respective post-war trend.

As suggested by its ambitious goal, the reform in Ukraine is multi-sided in itself, and includes three main components. First is territorial reform, namely the voluntary amalgamation of local communities, which is considered as a separate reform itself in policy evaluation literature, usually known under the name "municipal mergers". Initially, the government designed a plan to consolidate all local councils in Ukraine into bigger entities because most small rural councils have been inefficient in providing not only sufficient living standards for its residents but also basic public services. As of the end of 2019, which is 5 years after the start of the reform, 6,631 hromadas are left unamalgamated out of over 12,000, and they are to undergo compulsory amalgamation as the next stage. Hence, the empirical evidence on the lessons to be learnt from the voluntary amalgamation is necessary to complete the reform successfully.

[1] For more details, see: https://www.kmu.gov.ua/diyalnist/reformi/efektivne-vryaduvannya/reforma-decentralizaciyi.

The second dimension is financial, which represents classical decentralization reform from the literature with one nuance – it is conditional on the first component, i.e. amalgamations. Namely, amalgamated communities receive bigger financial resources not only due to new on-purpose government grants, which still represent a third of their incomes, but due to retaining a bigger number and scope of collected taxes in their budgets. Thus, local authorities will be prone to stimulate development of business activity in the ATC. The government reported about an increase in own revenues of local budgets by 200 billion UAH (or by 29%) from 2014 to 2018 being "a real instrument to make an impact and fulfil the expectations of a community" (Cabinet of Ministers of Ukraine). However, no rigorous empirical research was conducted to estimate the pure economic effect of the reform and support the above statement with more evidence than manipulations with absolute numbers.

The third reform component is administrative, which implies more economic development instruments available to local governments, such as external borrowing, independent selection of urban planning contractors, provision of more registration services on site, maintenance of general education schools, dispensaries and similar. Empirical evidence recognizing economic gains of decentralization are vital to identify if decentralization may be regarded as an effective tool to boost economic development in Ukrainian regions.

The main focus of this thesis is the first "amalgamation" component of the reform. The research question is, thus, defined as follows: how has amalgamation of local communities in Ukraine affected their local budgets? Due to the unique Ukrainian reform design, amalgamation reform is embedded into the decentralization reform. As the study of the two is inseparable in Ukrainian case, we also look at the financial decentralization component of the reform, namely how has amalgamation affected financial independence and local government size of local communities in Ukraine.

Decentralization theorem, formulated by Oates (1972), postulates that "from an efficiency perspective, fiscal responsibilities should always be decentralized as long as there are no cost savings to be gained from centralization…". The capacity to control local budgets and expenditures determines the ability to invest them into economic development of local communities, which in response incentivizes local citizens to be economically active and generate more local tax revenues. For these reasons, fiscal decentralization has been promoted as a primary tool for promoting economic growth by various development agencies and specialists. However, the literature on the nexus between decentralization and economic development is still in its infancy.

As for the amalgamation reform, the literature provides the following arguments in its favor: (1) costs of public services provision are reduced due to economies of scale (Belley 2012; Kushner & Siegel 2003); (2) smaller jurisdictions are "closer to people" and, thus, enable a more efficient choice of public services to better match preferences of local citizens (Oates 1972); (3) local governors are held more accountable for the local budgets' utilization due to increased transparency (Dollery et al. 2007).

Decentralization reform has a purpose to reach optimal allocation of local resources and maximize the benefits for the community via delegating authority and budgets to the grass-roots bodies (Despro[2]). Given the recency of the Ukrainian decentralization reform, the only way to estimate its economic effect so early is by looking at local budget revenues as the proxy for the community well-being, and the change in the local expenditures as the proxy for the optimal (or not) allocation of local resources. Hence, in my thesis I will look at the pure treatment effect of the reform on the change in local budget revenues and

[2] http://despro.org.ua/en/social-projects/decentralisation-reforms-in-ukraine/

expenditures per capita. Based on the literature, I expect no significant positive changes in local expenditures and bear in mind inconclusive evidence for the effect on local revenues. As for the change in financial independence or local government size as a result of amalgamations, these measures have not been examined in the literature.

This thesis represents a contribution to the literature because (1) the effect of the reform on all budget indicators is considered, both on the revenue and expenditure side, as well as on decentralization measures; (2) a rigorous matched DiD estimation is conducted, which is scarce in the analysis of amalgamations in Eastern European countries.

The data used in this research comprises local budget revenues and expenditures by type during the period of 2012-2017, collected for all village, town and city councils in Ukraine. This rich dataset is supplemented by the 50-SG form data on agriculture enterprises' revenues and costs as potential control variables for the change in the budgetary situation in local communities. For the estimation part I will consider difference-in-differences model in a panel context, combined with propensity score matching and placebo analysis for robustness checks.

The paper is organized as follows. Chapter 2 provides a literature review on the relationship between decentralization, amalgamations and budget performance as well as common research approaches. Chapter 3 gives a more detailed picture on Ukrainian decentralization reform, namely its pre-conditions, design and achievements. Chapter 4 presents Ukrainian local-level dataset. Chapter 5 describes the difference-in-differences methodology proposed to analyze the investigated relationship for Ukrainian country-specific context. Chapter 6 includes empirical results as well as discussion upon them. Chapter 7 describes robustness checks of the conducted estimation. Chapter 8 concludes.

Chapter 2

LITERATURE REVIEW

Amalgamation in a political or administrative context is a combination of two or more administrative entities (e.g. municipalities, counties) into a single unit. It is synonymous to consolidation, or municipal merger. Robert Bish (2001), who is one of the first researchers in the field, defines amalgamation as a reduction in the number of multi-purpose local government units through consolidation. This process can be either voluntary or mandatory, depending on the reform design, but is principally different from annexation when one local government unit (usually of larger size and greater resources) absorbs a part of another unit (Tavares 2018). Within the purpose of this research, amalgamation is viewed as a territorial and local government reform, which makes it principally different from annexation.

It is commonly acknowledged that despite the popularity of amalgamation reform, in particular in European countries, the design of most of the conducted municipal mergers was not supported by rigorous empirical research. The existing literature on municipal amalgamations primarily focuses on the following domains of the reform: (1) economic efficiency due to the economies of scale; (2) local government's managerial effectiveness related to the quality of public services provision, and (3) implications for democracy. An accompanying issue of interest is optimal size of a merger. Following Tavares (2018), this literature review is structured around three above mentioned dimensions of the reform.

2.1. Theoretical impacts of amalgamations

2.1.1. Economies of scale

Economies of scale may appear if amalgamated municipalities, which are larger in size, provide local public services at lower unit costs than before amalgamation. Denters et al. (2014) claim that economic planning in larger municipalities is more comprehensive, which is partially due to higher specialization and professionalism of their local governments. As a result, investments in local infrastructure are easier to attract because of their lower risk, which translates into better economic development.

From the consumer point of view, residents of an enlarged municipality benefit because the boundaries of the jurisdiction better match the catchment areas of services, which is the area from which a municipality attracts a population that uses its services (Swianiewicz 2010). Due to their larger size and increased capacity, local governments are able to address issues of bigger scope within their communities. In addition, residents of other less developed communities may also benefit, which is called interjurisdictional spillovers.

The expectations from the economy of scale to work are undermined by the following critics on the consequences of amalgamation reform. First, while the economies of scale are observed in capital-intensive industries, where fixed costs become spread across a bigger number of residents, they approach zero in labor-intensive sectors, where provision of services to a bigger number of residents requires more hiring, thus, neutralizing the economies of scale (Boyne 1992). Second, more hiring is usually needed in local government bodies in large municipalities (after a certain population threshold), since they serve a larger number of residents. A larger local government staff also creates excessive administrative burden. Altogether this results in diseconomies of scale (Dollery and

Fleming 2006). Holzer et al. (2009) provides evidence of the latter for jurisdictions of above 250,000 residents in the USA.

Therefore, achieving bigger economic efficiency due to the economies of scale is not a guaranteed consequence of amalgamation reform. Depending on the size of a consolidated unit, it often requires more costs to be maintained than are being saved.

2.1.2. Allocative efficiency

Another consequence of amalgamations, which is being questioned, is whether a better match to the needs and preferences of citizens-voters, who are consumers of public services in a community, is in place. A predominant argument is that local officials are better able to satisfy the consumer preferences of their citizens in smaller communities, which are homogeneous within a community and officials are "closer to the people". This means they possess better knowledge of both local preferences and cost conditions (Oates 1972).

In addition, with a bigger territorial fragmentation, residents have more choices among heterogeneous sets of public services, provided by their or neighboring communities. This creates competition among local governments and increases quality of public services provisions in non-amalgamated communities. Amalgamations, vice versa, decrease competition and result in higher bureaucratization with bigger uncontrollable spending. Information about price and quality are easier to hide. Swianiewicz (2010) also adds that "fragmentation supports experimentation and innovation", and their diffusion is more likely across fragmented jurisdictions.

In contrast, allocative efficiency in amalgamated communities may be achieved due to a higher quality, differentiation and specialization of public services that amalgamated communities are able to provide due to their increased capacity (Swianiewicz 2010). In total, local residents' satisfaction with public services will increase if a better coordination, professionalism and more resources of an amalgamated community outweigh a better knowledge and closer contact with the "client" that could have existed before amalgamations.

2.1.3. Implications for democracy

The smaller a jurisdiction is, the more accountable politicians are, because their contact with the voters is more frequent and closer. Both political and civil participation is higher in demographically and economically homogeneous communities, with smaller population size and smaller governments (Tavares 2018). Thus, Oliver (2001) concluded that people living in smaller cities were more likely to report voting in municipal elections and contact local officials.

As amalgamation occurs, political trust in local governments may decline (Denters et al. 2014). Highly diverse interests may be present in heterogenous amalgamated communities, which is more likely to create a conflict. However, if such conflict arises, bigger municipalities also have more resource to respond, for instance, by increasing political participation.

Amalgamation advocates argue that the absence of conflict might mean that larger-scale problems are simply off the agenda and are not addressed at all rather than addressed successfully (Tavares 2018). Among positive democratic expectations, the first is that bigger jurisdictions naturally result in increased political pluralism, which produces more fruitful political debates, and stronger civil society (Gill, Dahl

and Tufte 1973). Second, as population number increases, more political issues arise, which gets people more involved into politics and undertaking more large-scale political action. They create more organized community groups to lobby their interests, political parties, civil society organizations and media (Newton 1982). These groups not only demand bigger responsiveness from local governors but also produce leaders who represent political competitors to elected leaders (Gill, Dahl and Tufte 1973).

Finally, amalgamations can potentially reduce income inequalities between residents making social unrest less likely (Swianiewicz 2010).

To sum up, amalgamation enables a better quality of local democracy whereas smaller jurisdictions enable better political trust. Responsiveness to public needs may increase in both cases, either due to closer contact with citizen-voters or due to bigger political competition and capacity to address larger-scale issues.

With a spectrum of strong theoretical arguments both in favor and against amalgamation, it makes sense to look at empirical findings on the topic. Only amalgamations of multi-purpose government functions are considered, with post-amalgamation discussion.

2.2. Empirical studies on economic effects of amalgamations

According to Tavares (2018), who conducted a comprehensive literature review of 52 articles on amalgamations, the most diverse and technically advanced studies are detected on the amalgamation reform in Denmark in 2004. Apart from Denmark, the majority of studies explore territorial reforms in such developed countries as Sweden, the Netherlands, Germany, Canada, Australia, and Japan. Some of them are summarized in Table 1 below.

The most popular empirical method is difference-in-differences, usually combined with OLS regressions, fixed effects models in panel context, synthetic control method, or propensity score matching. Less sophisticated quantitative techniques include comparative analysis of financial indicators and principal component analysis. Also, qualitative methods include content analysis, case studies, and descriptive analysis of survey and interview responses (perception-based data).

Table 1. Empirical literature on the effects of amalgamation reforms (economies of scale) in developed countries

Authors	Country / Reform	Empirical method	Findings
Hanes, 2015	Sweden, 1952	OLS	Expenditures decreased in smaller amalgamated communities, with no significant change in bigger communities (by population).
Blom-Hansen et al., 2016	Denmark, 2004	Difference-in-differences method	No systematic effect on local government spending across 9 areas (day care, schools, elderly care, children with special needs, roads, culture, administration, labor market activities, total expenditures). Insignificant effect of the size of jurisdiction.
Moisio and Uusitalo, 2013	Finland, 1990-2014	Nearest-neighbor matching	10 years after the merger, per capita operating expenditure (mainly on education and healthcare) increased, expenditure on welfare did not change, spending on general administration decreased. No effect on either per capita taxable income or tax rates.
Bikker and Van der Linde, 2016	The Netherlands, 1990-2014	Quadratic spline regression function	Economies of scale were found at 17% around the mean with an optimum size of 48,200 inhabitants. Smaller municipalities experience bigger economies of scale than larger ones.

Most researchers conclude about no significant effect of municipal amalgamations on public expenditures, in particular after controlling for other factors. Notably, revenues are analyzed less frequently than expenditures. In other studies, a reduction of general administration spending is found, which is simultaneously

neutralized by diseconomies of scale in other expenditure areas. In addition, Swianiewicz (2018) highlights that almost all recent empirical studies have focused on compulsory, non-voluntary municipal mergers. This mandatory character could be one of the reasons for undetected economies of scale.

Among transition countries in Eastern Europe, apart from Ukraine, amalgamation reform has happened in Poland, Georgia (2006), Estonia (1996-2014), and Latvia (2009) recently. In Southern Europe, Macedonia (2002) and Albania (2015) have undergone amalgamations (Centre of Expertise for Local Government Reform, 2017). Surprisingly, empirical research on these amalgamations is scarce (Table 2 below). Only Swianiewicz et al. (2010; 2016; 2017) has conducted treatment effect estimation of the amalgamation reform in Poland and a qualitative research about Georgian territorial reform. Other studies bear descriptive and comparative nature.

Table 2. Empirical literature on the effects of amalgamation reforms in Central and Eastern Europe

Authors	Country / Reform	Empirical method	Findings
Swianiewicz et al., 2017	Poland,	Difference-in-differences, synthetic control analysis	Amalgamation resulted in increased spending on general administration; reduction in the operating budget surplus in the short run, but a neutral or positive effect in the long run; higher participation rate in local elections.
Swianiewicz and Mielczarek, 2010	Georgia, 2006	Surveys, in-depth interviews and document analysis	Financial decentralization was not conducted. The goal of reducing disparities among local governments was not achieved. Citizens have not acknowledged the reform as significant.

No empirical studies were found for amalgamations in Baltic counries, they are primarily descriptive in nature (Vanags and Vilka 2003; Kalev 2009). Only Reiljan et al. (2013) have analyzed the effects of mergers by examining the levels and

dynamics of factors of financial sustainability focusing on the revenue side. The financial impact of mergers varies greatly for different groups of municipalities.

In the case of Ukrainian reform, there is a vast array of policy papers of descriptive nature commenting on the increased own revenues as a result of the reform. Notably, there is a distinct focus on the revenue side in the case of Ukrainian decentralization reform. The only recent empirical study was conducted by Hamaniuk (2020), who discovered that incomes from single tax on individuals and legal entities increase more in smaller amalgamated communities than in large ones.

Thus, there is a significant gap in the literature on the voluntary amalgamation reforms, on its effect on local budget revenues and on territorial reforms in transition countries, including Ukraine, which I intend to fill with this thesis.

2.3. Decentralization measures in the literature

Various decentralization measures are analyzed in a vast array of literature on the impact of decentralization on economic development, the number of which are limited when it comes to the study of transition countries.

Woller & Phillips (1998) applied such direct decentralization measures as the ratio of local government revenues (and local government revenues less grants-in-aid separately) to total government revenues as well as the ratio of local government expenditures to total government expenditures.

The only detected comprehensive study on decentralization in transition countries by Rodríguez-Pose & Krøijer (2009) introduced the following fiscal decentralization measures: subnational expenditures as a share of total

expenditures; own tax revenue as a share of total subnational revenues; transfers from the central government as a share of total subnational revenues.

This thesis represents a contribution to the literature because it supplements a limited number of empirical studies on municipal amalgamations in transition economies, in particular in Eastern European countries.

Chapter 3

DECENTRALIZATION REFORM IN UKRAINE

In April 2014, the Cabinet of Ministers of Ukraine approved the Order No. 333-r. "On approval of the Concept of Reforming Local Self-Government and Territorial Organization of Power in Ukraine"[3]. This order commenced the decentralization reform in Ukraine, which had been anticipated for quite a long time.

3.1. Reform pre-conditions

Among the reform pre-conditions, the following key shortcomings of the former local government system in Ukraine should be highlighted:

1. Low effectiveness of small rural councils
   There used to be 12 thousand village council with an average population number of 1,500 residents, which were unable to provide basic public services of decent quality. As a result, rural communities were degrading, maintaining low standard of living, deteriorating demographic situation and poor investment climate (Reform Office at the Cabinet of Ministers of Ukraine[4]).
2. Ambiguous division of powers between regional governance levels, namely *oblast* and *rayon*
   Undefined role of sub regional government is considered as remnant of a highly centralized Soviet governance system. Because of high

[3] https://zakon.rada.gov.ua/laws/show/157-19

[4] https://rdo.in.ua/direction/decentralizaciya

> dependence on the central government and low efficiency of local authorities, only 6 regions in Ukraine were financially sufficient as of the beginning of 2014. Such regional disproportions preserved high corruption level and little trust in the government.

In addition, the political context in 2014 with dangerous separatist movements became a catalyst for restructuring center–periphery relations not through federalization, but through a consolidation of small communities (The Chatham House 2019).

3.2. Reform design

Voluntary amalgamations of local communities in Ukraine is the first key element of Ukrainian decentralization reform design. From 2014, local communities of cities, towns and villages (*hromadas)* have a right to amalgamate with other local councils and form an amalgamated territorial community (ATC).

Previously, Ukrainian territorial organization included three subnational tiers: 27 regions (oblast), close to 500 rayons and over 12,000 lowest-tier local government units (cities, towns and villages). Approximately 180 main cities have the status of cities of oblast significance, which means that they provide the functions of both the lowest-tier and the rayon tier. The powers of self-governing towns and villages have been very narrow, and in financial terms they are dependent on government transfers, which are allocated at the rayon and regional levels. As a result, only cities of oblast significance can be considered as real local self-governments with independent budgets (Centre of Expertise for Local Government Reform 2017).

The government has developed a consolidation plan for over 12,000 local councils. Certain political, administrative and financial competencies were reallocated from the subregional level to these merged and enlarged local communities, namely:

1. ATCs, alongside cities of regional importance and rayons, collect 60% of Personal Income Tax and 5% of Excise Tax, which are generated within its borders. Previously, this financial authority was inherent to the level of cities of oblast significance only. Later two more new tax types were added to this list. A detailed list of local budget revenue sources by local government tier may be found on the official website of Ukrainian decentralization reform[5].
2. ATCs and other local councils collect 100% of local taxes, as previously, and can set tax rates within the boundaries established in the Tax Code of Ukraine[6]. A full list of local taxes collected and maintained at the lowest tier of local government may be found in Appendix A.
3. The number of official transfers to ATCs has increased compared to non-amalgamated local communities (e.g. Education Subvention, Medical Subvention, Subvention for the Development of Infrastructure in ATCs etc.).
4. ATCs received a wider variety of economic development instruments, namely external borrowing, independent selection of institutions to service local budgets for development, the right to independently determine urban architecture policy and others.

5 Decentralization.gov.ua. Revenue Sources of Local Budgets [Джерела доходів місцевих бюджетів]. https://storage.decentralization.gov.ua/uploads/attachment/document/14/Джерела_доход_в_м_сцевих_бюджет_в.pdf

6 https://zakon.rada.gov.ua/go/2755-17

5. ATCs received broader powers and responsibilities to finance community expenditures compared to non-amalgamated village councils, especially education and healthcare expenditures. Namely, now they fully maintain general education schools and ambulance clinics. They also provide a wider variety of administrative services (registration, documents' legalization etc.) with a bigger number of operating administrative service centers (Reform Office at the Cabinet of Ministers of Ukraine).

3.3. Reform achievements

In 2015-2019, 4,330 Ukrainian hromadas amalgamated or started the process (Figure 1).

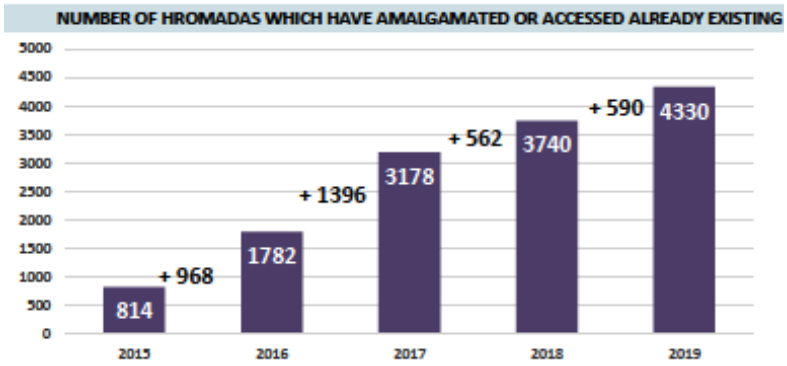

Figure 1. Dynamics of municipal amalgamations in Ukraine

Source: Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine. 2019. Monitoring of the Power Decentralisation Process and Local Self-Government Reform as on 10 August 2019.

This number of hromadas corresponds to 39,5 % of the total number of local councils as of 1 January, 2015, and 33% of the territory of Ukraine (not including

temporarily occupied territories). 936 ATCs were formed as of the end of 2019, which corresponds to 54% of the rural population and 26% of the total population of the country.

As a result of the reform, Ukraine has become one of the most decentralized countries in Europe. Local government revenues increased from 441 billion UAH to 569 billion UAH, which is a 29% increase after adjustment for inflation. They increased both as a share of GDP (from 14% to 16%) and as a share of total government revenues (from 34% to 41%). Own revenues of local communities also increased by 69% (from 42 billion UAH to 69 billion UAH), and there is some evidence that at least some local governments are making greater efforts to generate their own revenues (Levitas and Djikic 2019). See Figure 2 below for more details.

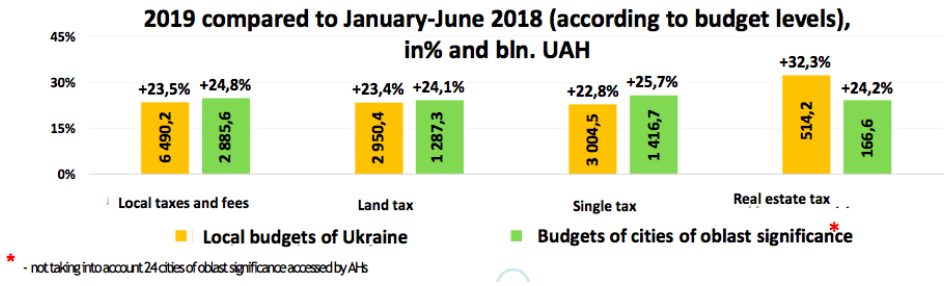

Figure 2. Growth rates of revenues from local taxes and fees in Ukraine in Jan-Jun 2019

Source: Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine. 2019. Monitoring of the Power Decentralization Process and Local Self-Government Reform as on 10 August 2019.

As for local expenditures, they are primarily consumption in nature, for the first five years of the reform. For example, local government maintenance represents the biggest share amounting to more than 80% of own revenues, when the recommended level is 20%. In general, funds are spent on repairing and building

roads, administrative service centers, ambulances and medical dispensaries, schools and kindergartens, stadiums and swimming pools, water supply and sewerage, street lighting and so on (Figure 3 below). These expenditure sources allow to quickly demonstrate positive change by creating ATC to its community citizens.

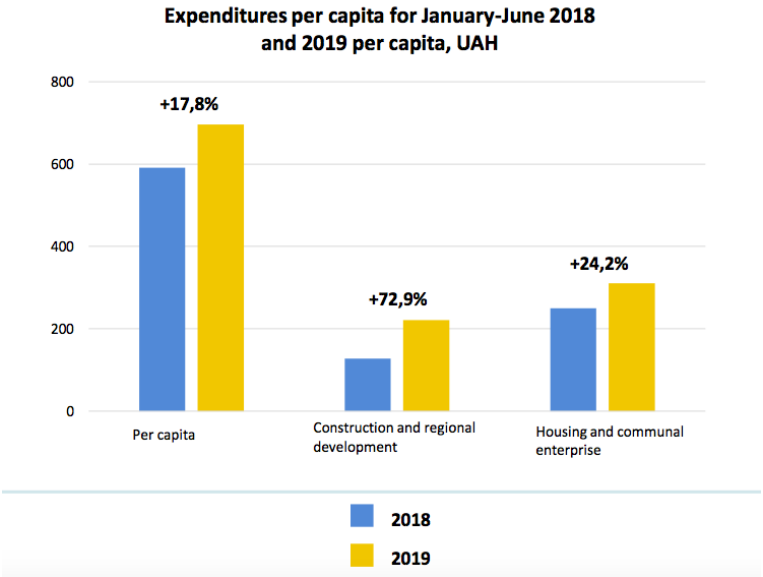

Figure 3. Growth rates of local expenditures in Ukraine in 2018-2019

Source: Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine. 2019. Monitoring of the Power Decentralisation Process and Local Self-Government Reform as on 10 August 2019.

Summarizing the effects of the decentralization reform five years after its commencement, policymakers conclude that financial self-sufficiency of Ukrainian local communities is impossible to achieve in the foreseeable future because of weak tax base and employment in most rural areas of Ukraine (Kaziuk et al. 2019). The primary goal for the amalgamations as of now is to make ATCs large enough to effectively provide public services. In the meanwhile, local government revenues

have largely increased due to subventions, which were primarily directed to oblasts and rayons.

Although the new equalization system is a very significant achievement, it now needs to be refined and better funded. More money needs to be poured into this system, as many ATCs simply do not have a sufficient tax base to generate revenue as a share of PIT, which is the basis of their finances (Zubko 2017). This is not entirely unexpected, given that most ATCs have been formed by merging poor rural areas with the nearest small towns.

Another disproportion that has arisen during the reform implementation is that in a small number of ATCs, PIT per capita is by many times higher than the national average. Another small group of ATCs receives income from rent and land taxes from legal entities at such a level that it brings them among the richest communities in the country. These ATCs were formed around particularly powerful industrial and agricultural agglomerations, but at the expense of poorer neighboring areas that were not merged (Romanova and Umland 2019). Here the shortcomings of voluntary amalgamations come into play, and they should be considered in the further stages of consolidation.

Chapter 4

DATA DESCRIPTION

The data represents yearly executed budget of local councils in Ukraine for six years, i.e. four years before the decentralization reform (2012-2015) and two (2016-2017) after. It comes from the World Bank BOOST-portal. The data for the later years was impossible to include because of different IDs for local councils, assigned by the State Treasury of Ukraine. The dataset includes both expenditures and revenues, which were kept at the lowest tier of administrative classification for the purposes of this research. This lowest tier includes the budgets of village councils, town councils, rayon subordinate city councils, and ATCs. Data preparation stage included combining two separate datasets on revenues and expenditures, removing duplicates, reshaping from long format to wide, setting panel structure of the data, and calculating aggregates.

4.1. Data on amalgamations

As the effects of the decentralization reform are of interest in this research, the further narrative in this chapter is based upon the descriptive comparison between amalgamated and non-amalgamated village and city councils in Ukraine. Local budgets dataset was merged with the list of Ukrainian settlements that have become a part of amalgamated territorial communities (ATCs) since the beginning of reform in 2015 up to the end of the year 2016. This list was manually composed by combining the Ministry of Finance data and the data on the official website of Ukrainian decentralization reform (decentralization.gov.ua). This allowed to create proxies of ATC budgets for the years 2012-2016, before the

reform, by aggregating the budgets of respective village and city councils. The latter are not reported after the reform, in 2016-2017, as they are incorporated into the budgets of real ATCs.

As a result, there are 3 types of local budget units in the dataset: 9,150 village and city budgets that have not amalgamated as of the end of 2016 (for the years 2012-2017); 366 ATC proxies' budgets (for 2012-2015); 159 real ATC and 207 ATC proxies (in 2016); 366 real ATC budgets (in 2017). The resulting unbalanced panel dataset size contains 56,800 observations (Table 3).

Table 3. Number of observations by the type of local budget units

	Real ATC & ATC proxies, by amalgamation year		non-ATC settlements		Total
Year	2015	2016	Rayon subordinate cities	Towns & villages	-
2012	159	207	8,950	178	9,494
2013	159	207	8,950	178	9,494
2014	159	207	8,949	178	9,493
2015	159	207	8,952	180	9,498
2016	159	207	8,854	178	9,398
2017	159	207	8,878	179	9,423
Total	954	1,242	53,533	1,071	56,800

The number of ATCs by the end of 2017 is represented in the Figure 4 below. No obvious regional patterns of ATC accumulation are inferred.

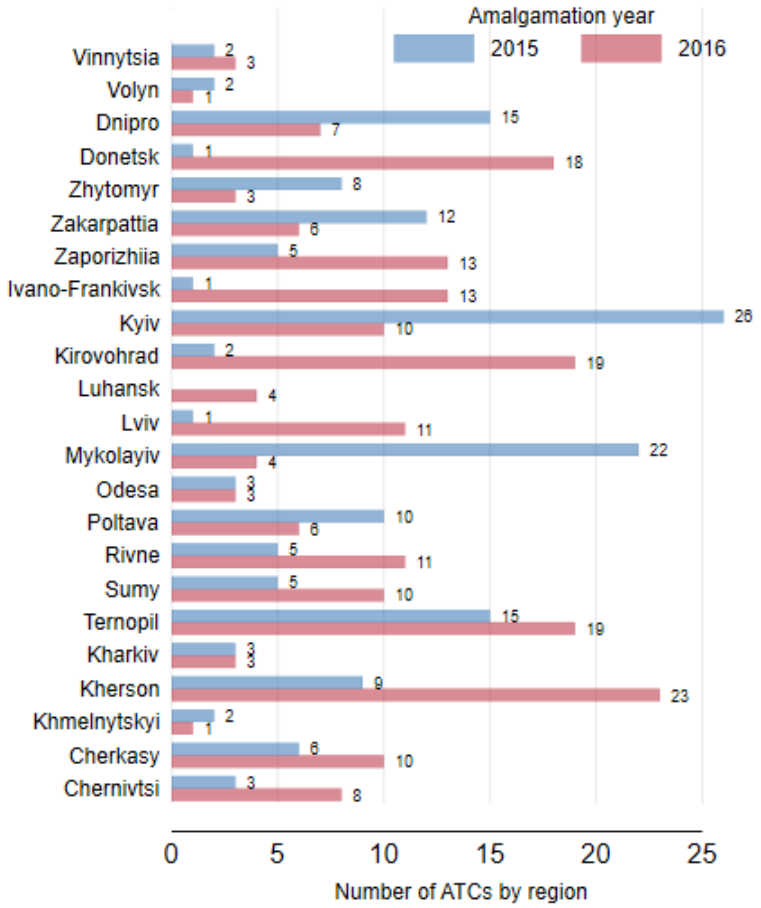

Figure 4. Number of amalgamated territorial communities (ATCs) by region as of the end of 2017

Certain data cleaning issues are worth mentioning because omitting them could have produced methodological issues. First, the budgets of settlements in the Autonomous Republic of Crimea were excluded from the dataset for two reasons: 1) there existed no possibility of them to become a part of an ATC, which is crucial in this research; 2) the data is available for the years 2012-2014 only. Second, for the same reasons, the budgets of temporarily uncontrolled settlements as well as settlements on the confrontation line in Donetsk and

Luhansk regions[7] are excluded from the dataset. Third, the budgets of the cities of regional importance were removed from the dataset because: 1) they have not amalgamated with other councils to become an ATC as of the end of 2016; 2) their budgets are normally 2-3 times larger than both non-amalgamated village councils and newly created ATCs.

4.2. Time-invariant characteristics of local communities

Some characteristics of local budget units that are constant over time are presented in the Table 4 below. The data on population was obtained from the Ministry of Finance, and the data on area comes from the StateGeoCadastre.

Table 4. Summary statistics on constant variables by ATC and non-ATC type of communities as of the beginning of the reform (2015)

	Population, people			Area, hectares		
	non-ATC	ATC	All	non-ATC	ATC	All
Share, %	81.79%	18.21%	100%	84.15%	15.85%	100%
Total, million	14.13	3.15	17.27	46.20	8.70	54.90
Mean	1,723.42	8,594.69	2,017.11	5,131.51	23,771.90	5,859.70
Max	39,540	86,352	86,352	77,509.9	201,085.2	201,085.2
Min	62	870	62	62.79	1,520	62.79
Standard deviation	2,459.21	8,001.65	3,232.75	4,001.75	20,377.57	6,679.23
No. of observations	8,197	366	8,563	9,003	366	9,369

Notably, non-amalgamated communities comprise 82% of population and 84% of the territory. However, the average number of population and average area are 2-3

[7] https://zakon.rada.gov.ua/laws/show/1085-2014-%D1%80

times larger across amalgamated communities. For this reason, population size of communities is introduced as a control variable into one of pooled regression specifications. In most specification, all variables of interest are presented in per capita terms, to normalize for the heterogeneity in size.

4.3. Local budgets' structure

Dependent variables are represented by various types of budget revenues and expenditures. Tax revenues amount to the largest share of budget revenues of Ukrainian local communities, which is around 70% for non-ATC settlements and 50% for ATCs (Figure 5).

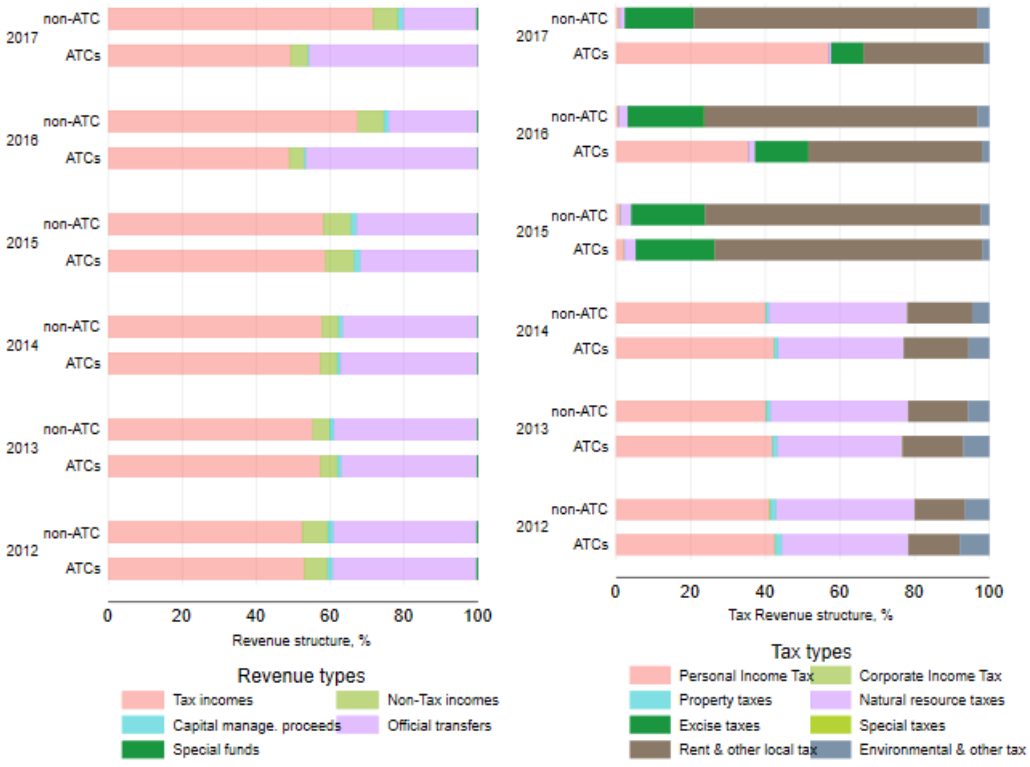

Figure 5. Structure of Total revenues and Tax revenues by year across ATC and non-ATC communities

The second largest source is Official transfers, with the share of roughly 30% for non-ATC and 50% for ATC communities. It is reasonable to investigate tax revenues more closely as they make up the majority of own revenues.

Main sources of Expenditures are Local Self-Government (20% for ATCs and around 40% for non-ATC communities), and Education (around 50% and 30% respectively) (Figure 6).

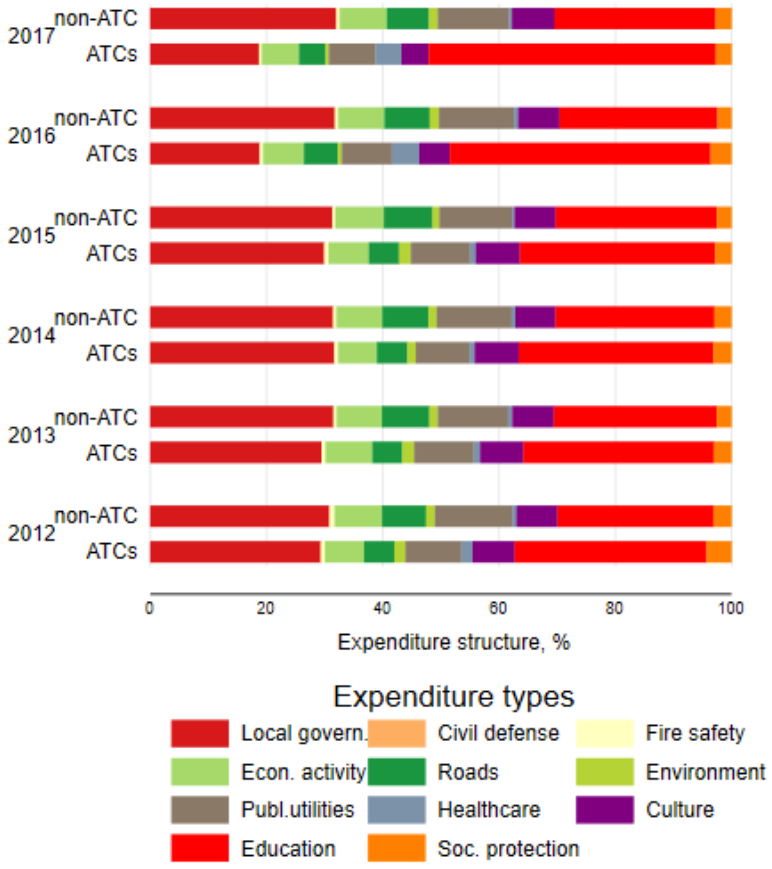

Figure 6. Structure of Total expenditures by year across ATC and non-ATC communities

Due to the amendments to the Budget Code, the volume and share of various types of tax revenues have been changing from year to year. Personal income tax and Rent for the use of natural resources have no longer been collected by village budgets since 2015 while simultaneously Excise taxes collection have been incorporated into the local budgets. Thus, the only tax incomes whose change may consistently be tracked across years are local taxes, whose share has substantially increased since 2015, as well as Corporate income tax, Taxes on environmental protection, Property tax, and Special taxes.

4.4. Local budget indicators affected by the reform

In order to define the budget revenues and expenditures of interest among 392 available, the Budget Code last revised before and after the decentralization reform (as of 26.10.2014[8] and 24.12.2017[9] respectively) was taken as a basis, namely the articles 64, 69, 86, 88-89, 91 and 93. Appendix A contains a summary of local budget items that have been collected by local communities consistently, regardless of the reform. The dynamics of their collection (or spending, for local expenditures) is depicted on Figures 7 and 8 below. These revenue and expenditure types become dependent variables in this research.

[8] https://zakon.rada.gov.ua/laws/show/2456-17/ed20141026
[9] https://zakon.rada.gov.ua/laws/show/2456-17/ed20171224

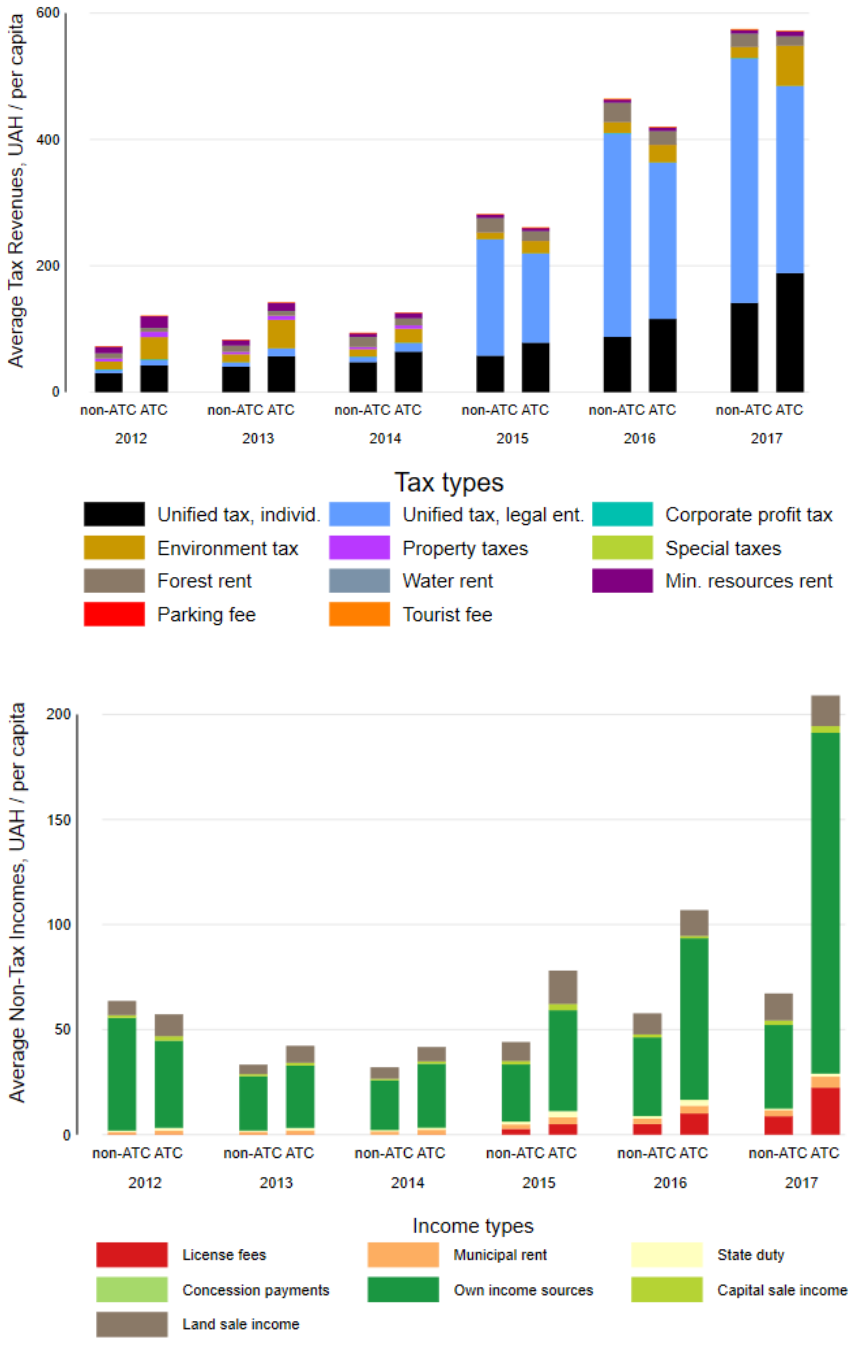

Figure 7. Average incomes per capita by year across ATC and non-ATC communities

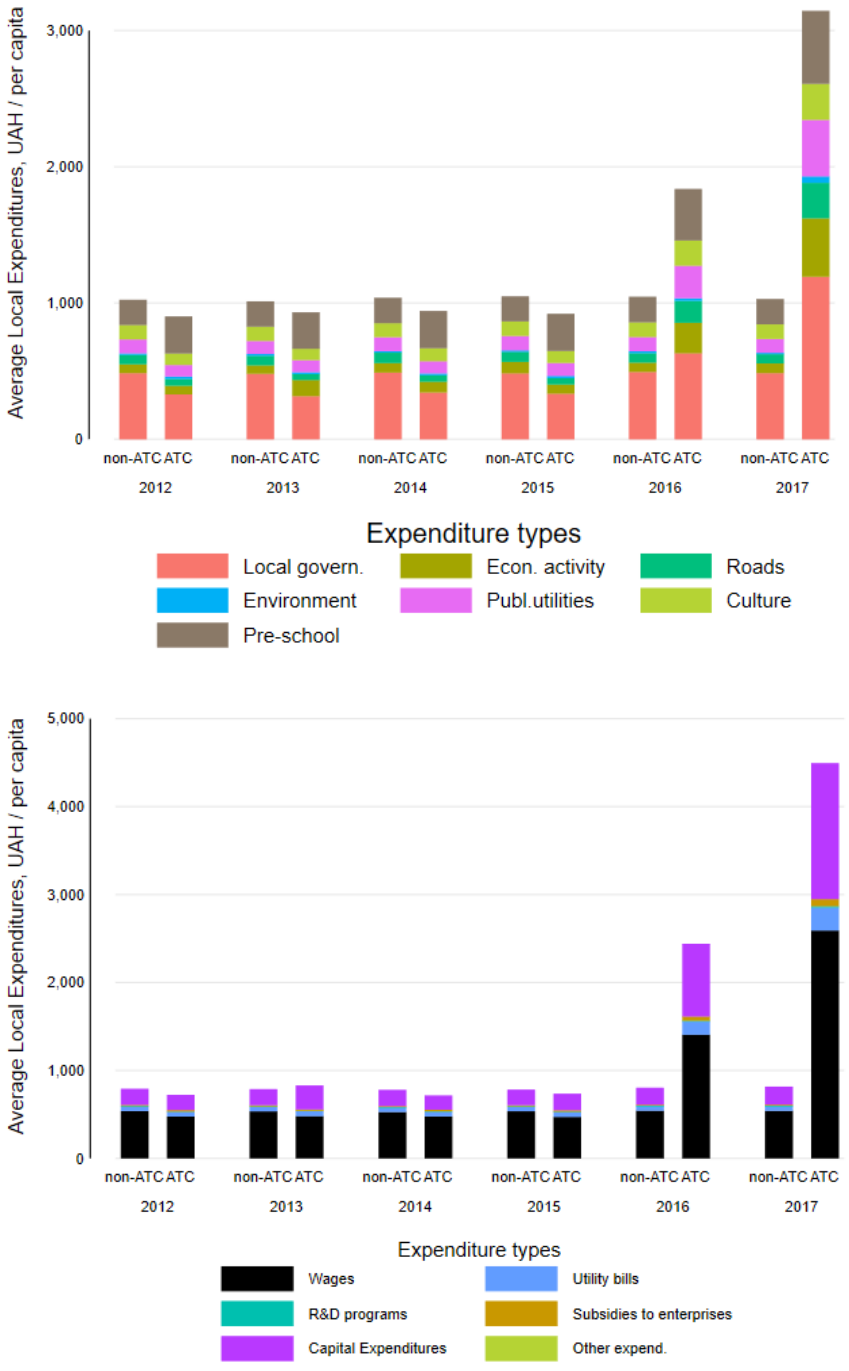

Figure 8. Average expenditures per capita by year across ATC and non-ATC communities

As can be observed, Single tax (here named "Unified tax") has been increasing both for ATCs and non-ATC gradually after 2015. The increase in average non-tax incomes has been more considerable in amalgamated rather than non-amalgamated communities, in particular after the year 2016.

Across expenditures of interest, all of them experienced a three- to five-fold increase in ATCs starting from the year 2016 (Figure 8). A positive trend that is worth pointing out is that not only current expenditures increased after the reform, but also Capital expenditures, and Subsidies and current transfers to enterprises and organizations.

Table 5. Summary statistics on Agriculture enterprises' revenues and costs

Variables (per capita)	Mean	Standard deviation	Min	Max
Non-Amalgamated settlements, no. of observations 19,130				
Land rental payments	2582.541	6799.929	0.020357	316426.2
Crop production value	16675.9	40573.75	0.1	1603912
Livestock production value	3935.965	30171.79	0.009783	2429062
Crop production revenues	20271.65	49844.03	0.1	1791190
Livestock production revenues	3596.532	25749.59	0.009783	1670124
Agriculture production revenues	24478.57	60344.23	0.1	1898102
Amalgamated settlements, no. of observations 1,720				
Land rental payments	1166.09	2283.59	0.0996056	35822.48
Crop production value	8428.681	14443.43	0.1	246079.4
Livestock production value	1778.499	5003.327	0.0042239	65259.45
Crop production revenues	9851.93	18530.36	0.1	265454.2
Livestock production revenues	1750.088	6101.302	0.0042239	103065.9
Agriculture production revenues	12227.18	21396.72	0.1	268033.9

Appendix B contains more detailed summary statistics of local budgets' indicators. Descriptive statistics on Agriculture enterprises' revenues and costs in local communities is presented in Table 5 above. This data comes from 50-SG accounting form data collected by the State Statistics Service of Ukraine. We may conclude that average agriculture production indicators are twice larger across non-amalgamated communities than across ATCs. The reasons for such a difference are not obvious, and may be related either to the prevalent urban type of ATC settlements or to the lack of reporting by agriculture firms located in ATCs.

A final data preparation procedure before testing the empirical model was deflating the values of various revenue and expenditure types by the CPI as of December of the previous year. The deflators are presented in Appendix C. All budget items are introduced in regressions in per capita terms and logarithmic form.

Chapter 5

METHODOLOGY

This thesis investigates the effect of local communities' consolidation on their budgets. On the basis of impact evaluation literature overview (e.g. Cunningham 2020), difference-in-differences method in a panel context was chosen as a primary estimation model. The basic model specification is the following:

$$Y_{it} = \delta_{0i} + \delta_1 ATC_i + \delta_2 post\_reform_t + \delta_3 (post\_reform * ATC)_{it} + \delta_4 control_{it} + \varepsilon_i \quad (1)$$

ATC_{it} is a dummy for the amalgamated communities, t and i are year and community identifiers, and $post\_reform_t$ is a dummy for the years after the amalgamation (2016 onward). *Diff-in-Diff,* which is Post_reform*ATC_{it}, is the treatment effect and the main variable of interest, i.e. a dummy variable for the amalgamated communities after the amalgamation. There is also a vector of control variables, and ε_{it} is the residual.

5.1. Difference-in-Differences strategy

According to Angrist and Pischke (2008), DiD is a type of fixed-effects estimation using aggregate data. Our dataset may be defined as conditionally split into Treatment group (TG=1), i.e. Ukrainian real ATC and ATC proxies, and Control group (TG=0), i.e. Ukrainian villages, towns and cities that have not undergone amalgamation. Following O'Grady (2020), the treatment effect that we would like to estimate is:

$$\delta_3 = E\,[Y_{i1}(1) - Y_{i1}(0) \mid TG_i=1] \quad (2)$$

Potential outcomes are defined as follows:

$Y_{i1}(1)$ – local budget indicator for community *i* in period *t* when amalgamated (TG=1)

$Y_{i1}(0)$ – local budget indicator for community *i* in period *t* when not amalgamated (TG=0)

Adding time periods, we obtain four potential outcomes (from equation 1, excluding estimates for control variables):

$$\begin{aligned} E\left[Y_{non_{ATC}}^{pre-reform}\right] &= \delta_{0i} & E\left[Y_{non_{ATC}}^{post-reform}\right] &= \delta_{0i}+\delta_{2it} \\ E\left[Y_{ATC}^{pre-reform}\right] &= \delta_{0i}+\delta_{1i} & E\left[Y_{ATC}^{post-reform}\right] &= \delta_{0i}+\delta_{1i}+\delta_{2it}+\delta_{3it} \end{aligned} \quad (3)$$

The unobserved differences between TG and CG are determined by the sum of a time-invariant effect of belonging to the amalgamated area, i.e. δ_{0i} from the equation, and a fixed time effect δ_{2it}, which is common across settlements:

$$E(Y_{it}|i,t) = \delta_1+\delta_2 \quad (4)$$

Thus, DiD may be manually derived in three steps.

Step 1. Take the difference over time in control group (TG=0):

$$E\left[Y_{non_{ATC}}^{post-reform}\right] - E\left[Y_{non_{ATC}}^{pre-reform}\right] = (\delta_{0i}+\delta_{2it}) - \delta_{0i} = \delta_{2it} \quad (5)$$

Step 2. Take the difference over time in treatment group (TG=1):

$$E\left[Y_{ATC}^{post-reform}\right] - E\left[Y_{ATC}^{pre-reform}\right] = (\delta_{0i} + \delta_{1i} + \delta_{2it} + \delta_{3it}) - (\delta_{0i} + \delta_{1i}) = \delta_{2it} + \delta_{3it} \quad (6)$$

Step 3. Subtract (5) from (6):

$$\delta_{3it} = (\delta_{2it} + \delta_{3it}) - \delta_{2it} \quad (7)$$

Many studies using DiD methodology, especially pioneering in the field such as Card and Krueger (1994), have an estimation setup of only one pre- and one post-treatment periods. However, like in our research, there is often a need to extend basic DiD setup to multiple geographical units and multiple time periods. In this case, the outcome variables become correlated not only within a village, town or city but also serially correlated. Therefore, the treatment effect is "contaminated" by time and fixed effects resulting in the standard errors being biased downward (Cunningham 2020). For this reason, fixed effects setup is the most appropriate in due to the presence of time-invariant unobservables.

As a result, in our research a basic DiD model is extended to a two-way fixed-effects model with six years and over 9,000 groups:

$$Y_{it} = \delta_{0i} + \delta_1 ATC_i + \delta_2 post\_reform_t + \delta_3 Diff\_in\_Diff_{it} + \delta_4 control_{it} + \sum_{i=2}^{9,000} \delta_5 ID_i + \sum_{i=2}^{6} \delta_6 year_t \quad (8)$$

Notably, during estimation, ATC_i and $post\_reform_t$ happen to be omitted because of collinearity with the respective fixed effects of ID_i and $year_t$. The treatment effect is still estimated with $Diff\_in\_Diff_{it}$, which is the interaction term between omitted ATC_i and $post\_reform_t$. The estimation is conducted following Torres-Reyna (2007).

5.2. Threats to validity

5.2.1. Parallel trends assumption

The parallel trends assumption for the outcome variable is the most challenging threat to internal validity for difference-in-differences estimation. It implies that in the absence of the treatment, the treated group would have followed the same trend for the outcome variable as the control group. This assumption enables the control group to serve as an over-time counterfactual for the treated group. In reality, though, this assumption is often likely to be violated because policy changes occur alongside many other exogenous changes influencing the outcome variable.

The main source of violation is time-varying confounders: something might have affected the treated group but not the control group, apart from the treatment itself, between pre-reform and post-reform period. For instance, there could be foreign investment inflow in some villages or towns that amalgamated, which resulted in higher tax revenues and distorted the pure effect of the decentralization reform. Notably, differences which are time-constant do not pose a threat to this assumption, as objects with similar initial characteristics are more likely to follow similar trends over time (O'Grady, 2020).

A partial solution to mitigate the influence of time-varying confounders is provided by the regression setup: by including time-varying group-level covariates. Especially those that are likely to have changed at the same time as the treatment we are interested in (O'Grady, 2020). For example, we could control for average wage in a village or town if such data were available.

A common case for many policy designs is that policy-makers select the treatment and control groups based on their initial changing attributes. For instance, selecting those communities to amalgamate first whose economic growth is rising (selection

issues). Another case is targeting poor rural communities whose position is getting worse as beneficiaries of the reform (targeting programs). In this case, pre-existing changing attributes are correlated with time-varying confounders, which practically guarantees the parallel trends assumption to be violated.

Since the amalgamation of local communities in Ukraine was initiated as voluntary, selection or targeting problems are not the case in our research. We assume that the treatment was applied in a random way.

Naturally, there is no counterfactual state of the world, which would be possible to observe in the absence of treatment and check if the treatment and control groups still follow the same trends. Hence, there are several approaches to test this assumption. The first one, which is visual, is discussed in the next section. Another one is placebo analysis, which aims to prove that the treatment effect doesn't exist where is should not (Cunningham, 2020). One way is to repeat the conducted analysis on a different part of a dataset, where no intervention occurred (for example, in the pre-reform period). This test was conducted in the robustness checks section (Chapter 7). Another test is to repeat the analysis for some alternative outcomes that are not supposed to be affected by the reform.

Finally, a common falsification test is conducted using an alternative control group, or, more precisely, distinguishing an additional control group from the treatment group. This is called triple differences (DDD), which is an extension of a DiD analysis. Unfortunately, this test is not possible in this research since it requires the existence of 2 qualification criteria to be selected for the treatment, namely to consolidate with other local communities, which is not implied in Ukrainian decentralization reform design.

5.2.2. Pre-estimation test 1

Since there are data on local budgets covering 4 years before the reform, we are able to depict graphically how treatment induces a deviation from the common parallel trend (Figure 9). We can see that average revenues were trending in the same way across all revenue groups. Hence, it is likely that communities that amalgamated in 2015 would have followed the pre-reform trend in the absence of the reform. The same applies to selected local expenditures (Figure 10). All graphical tests for the local budget items of interest are presented in Appendix D.

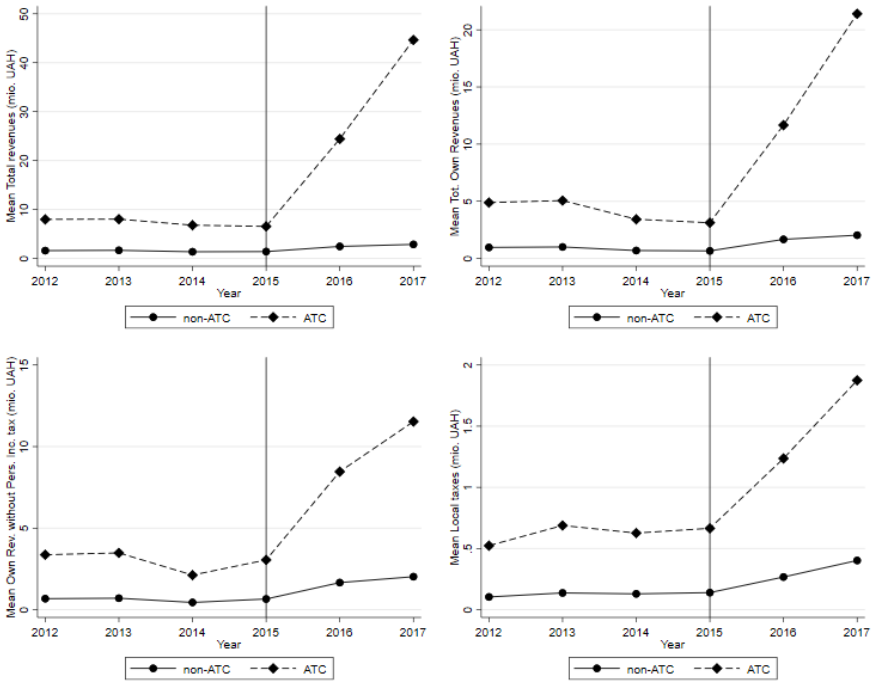

Figure 9. Parallel trends assumption – graphical test, aggregate local revenues

Four groups of local budget revenues of different levels of aggregation deserve a separate discussion. We can observe that the initial difference (in 2012) between

treatment and control groups was five-fold for all revenue groups. Although all revenue groups follow an upward trend, in the end (in 2017) amalgamated communities end up with a much higher average value experiencing a notable spike after 2015. However, the less aggregate the revenue group is, the smaller is the final difference between the average revenues in treatment and control groups. This difference varies from 9-fold for the most aggregate group, which is total revenues, to 4-fold in the least aggregate group on this picture – local tax revenues. This observation gives us a preliminary inference that the investigation of the treatment effect on the variables of high aggregation levels is rudimentary and may probably lead to biased estimates.

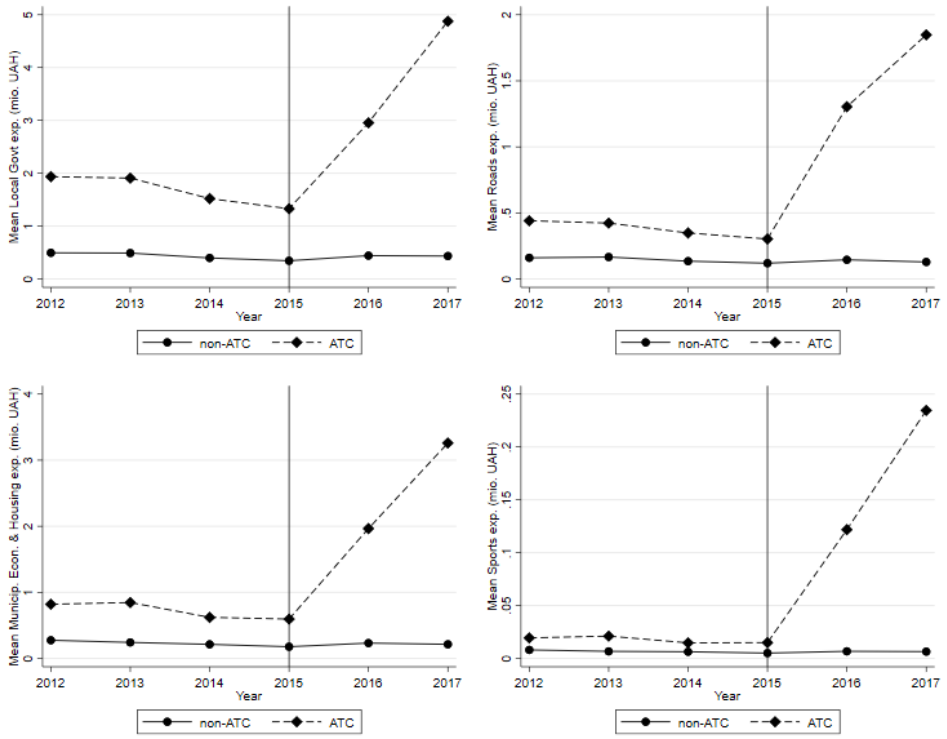

Figure 10. Parallel trends assumption – graphical test, selected local expenditures

However, for certain groups of non-tax revenues the parallel trends assumption is violated visually (Figure 11). We can observe that while average Municipal profit in non-amalgamated communities was constant across years, in ATC proxies it was following a downward trend from 2012 to 2014 before the policy and started rising from 2014, which is one year before the reform. Hence, a positive effect of the treatment on Municipal profit in ATC proxies is partially a continuation of the trend that began before the policy change. The violation also applies to the trends for average incomes from Property sale: there are spikes and drops for ATC proxies alongside a slight upward trend in non-amalgamated communities across years.

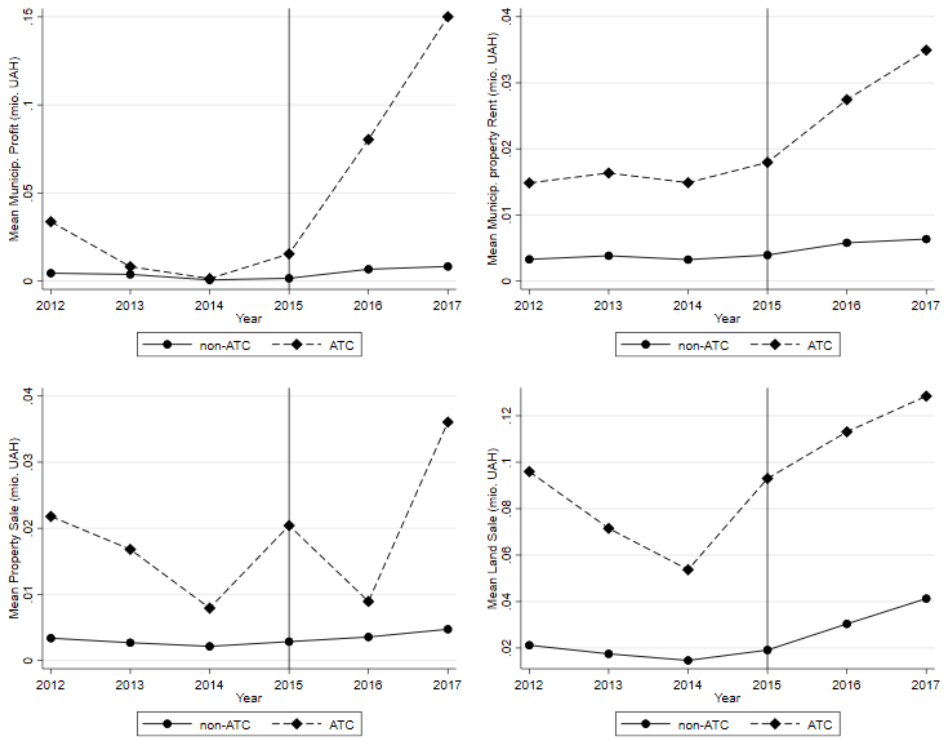

Figure 11. Parallel trends assumption – graphical test, selected non-tax revenues

The data from a source other than local budgets performance, i.e. revenues of agricultural enterprises and land rental payments, also demonstrates the validity of the parallel trends assumption in the pre-reform period (apart from average Livestock production revenues) (Figure 12).

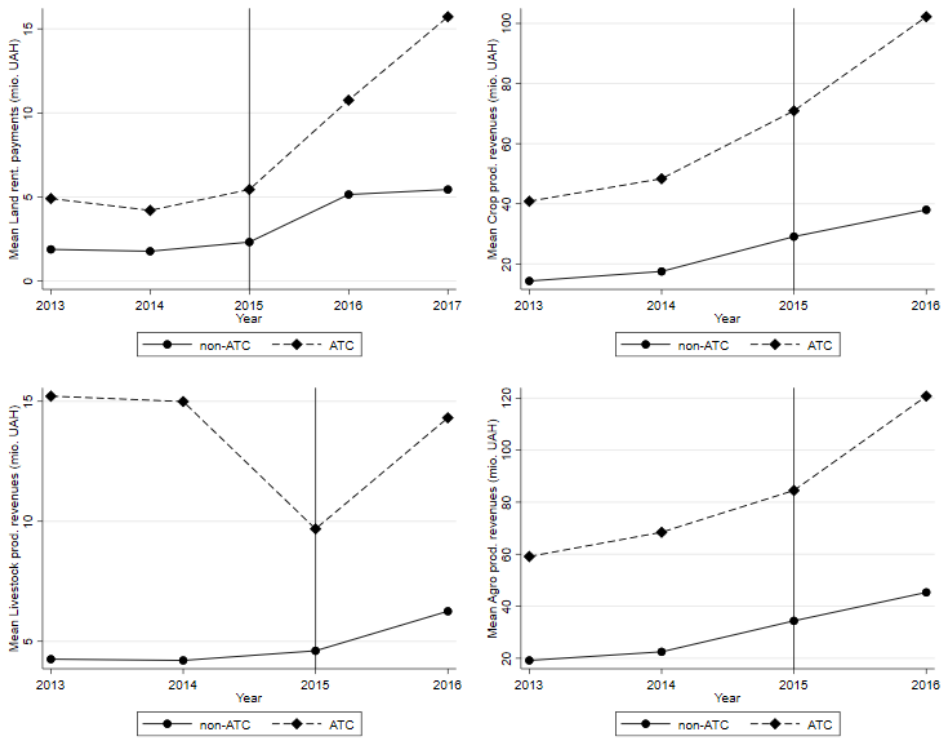

Figure 12. Parallel trends assumption – graphical test, agriculture enterprises' data

5.2.3. Selection bias

The issue of selection may arise if the treatment criterion, which is the decision to amalgamate, is correlated with the future changes in the budgetary situation. As discussed above, this may happen, for instance, if those communities amalgamated

which are currently experiencing either economic growth or decline. On the one hand, control variables treat a possible selection bias. Additionally, I decided to address its probability by a combination of DiD with propensity score matching, which is a popular method in policy evaluation studies.

5.2.4. Post-estimation test 2

One way to conclude about the possibility of the selection bias in the treatment effect is to check the baseline balance in covariates. If, at the baseline, the difference between average local budget items of interest among the treated and control groups is statistically significant, then the possibility of selection bias among them may not be eliminated.

Following CEGA Learning Guide (University of California, Berkeley), the conducted baseline test represents a two-sample t-test, which is adjusted specifically for the purposes of DID analysis. As observed in Table 6 below and in Appendix E, not all key covariates were reasonably balanced at the baseline, which is pre-reform period. The biggest imbalance by magnitude comes from disaggregated tax revenues, various types of official transfers and time-invariant covariates such as Total area. They will be included as control variables for the treatment effect.

Table 6. Baseline balance test in covariates of interest

Outcome Variables (per capita)	Mean non-ATC (1)	Mean ATC (2)	Diff. (2-1)	t	Pr (T>t)
Total own revenues	505.546	499.065	-6.482	0.180	0.860
Forest rent	12.726	8.205	-4.522	2.870	0.0041***
Mineral resource rent	6.727	9.960	3.233	1.020	0.310
Local taxes	49.690	63.041	13.351	4.990	0.0000***
Real Estate tax	0.472	0.413	-0.059	0.430	0.666
Parking fee	0.038	0.083	0.045	3.390	0.0007***

TABLE 6 – Continued

Outcome Variables (per capita)	Mean non-ATC (1)	Mean ATC (2)	Diff. (2-1)	t	Pr (T>t)
Tourist fee	0.427	0.384	-0.043	0.070	0.947
Single tax on legal entities	7.208	10.936	3.728	4.150	0.0000***
Single tax on individuals	41.545	51.226	9.680	5.430	0.0000***
Ecological taxes, all types	10.556	27.877	17.321	1.700	0.0892*
Municipal profit	0.835	1.533	0.698	1.510	0.130
Municipal property rent	1.564	2.044	0.480	2.440	0.0147**
Current expenditures	861.163	680.890	-180.273	4.860	0.0000***
Capital expenditures	176.376	176.425	0.049	0.000	0.998
Capital transfers to enterprises	8.329	9.734	1.404	0.280	0.779
Local government expenditures	377.667	222.706	-154.962	14.230	0.0000***
Base dotation	0.000	0.926	0.926	8.140	0.0000***
Subvention for infrastructure projects	5.624	4.026	-1.598	0.670	0.501
Subvention for medicine	0.000	0.403	0.403	4.710	0.0000***
Subvention for municipal economy	8.112	11.413	3.301	4.160	0.0000***
Land rental payments	1666.789	713.977	-952.812	7.630	0.0000***
Agriculture production revenues	20000.000	10000.000	-1.00e+04	6.300	0.0000***
Total area, ha per capita	5937.405	24000.000	18000.000	78.410	0.0000***
No. of Observations (baseline)	32,425	1,464	33,889	-	-

Notes: Mean coefficients. Two-sample t test
*** p<0.01; ** p<0.05; * p<0.1

5.3. Clustering standard errors

The most widely advised solution, which is employed in all estimation models within my research, is clustering standard errors at the group level. According to

McKenzie (2017), "if the treatment is assigned at the individual level, there is no need to cluster, unless you are using multiple time periods, and then you will want to cluster by individual, since the unit of randomization is individual, and not individual-time period". Since the source of variation comes from time-constant differences across villages, clustering at the village level is still applied with their fixed effects.

Two other solutions, which I employed for robustness checks of select models, include bootstrapping standard errors, and aggregating the data into one pre- and one post-period. The latter was possible because there was only one treatment date, which is the commencement of amalgamations in 2015.

Chapter 6

RESULTS

The effects of the decentralization reform on the changes in the budgetary situation in local communities is of interest in this research. The average *treatment effect* is estimated with is the coefficient on the DiD dummy variable, which the interaction term of the post-reform time period and the time-invariant dummy for amalgamated communities. All outcome variables are taken in per-capita terms to control for the initial imbalance in the population of the treated and control groups (average population number is 5 times larger in amalgamated communities compared to non-amalgamated). Additionally, logarithmic form of all outcome variables is used in estimation because statistical distribution of most of them is skewed to the left.

6.1. Unconditional treatment effect estimation

To begin with, the causal effect of amalgamation is estimated with the basic pooled regression specification, where there is baseline and one follow-up period, following Villa (2016). Although this estimate is unconditional because it does not account for possible time-variable confounders, this is a necessary starting point. Hence, it was estimated for all budget indicators of interest, the choice of which was discussed in Chapter 4.

As can be seen in Tables 7 and 8 below, and Appendix F, the treatment effect was found statistically significant at the 1% level and positive for most revenue and expenditure types. This means that as a result of the treatment, which is the decentralization reform, both local revenues and expenditures per capita increased.

However, there is a distinct pattern in the strength of the treatment effect, if looking at budget indicators by type.

Firstly, the treatment effect is the strongest for the most aggregate types of revenues and expenditures: from 0.913 for total revenues per capita to 1.326 for total expenditures per capita (Appendix F). This high magnitude is probably boosted by the nominal increase of the budget base of amalgamated communities, i.e. they receive more government transfers (the treatment effect for those is 1.702), they retain +60% of personal income tax added to pre-reform tax incomes, and they are responsible for a wider variety of local expenditures. Indeed, the bigger is disaggregation, the smaller treatment effect is found: 0.531 for total *own* revenues and 0.162 for own revenues excluding personal income tax. Thus, we should look closely at those tax incomes that have been consistently collected by local communities both before and after reform, because their increase is supposed to reflect the impact of the reform the most purely, being unaffected by any other factors in the time of the reform. These are local taxes.

The more disaggregated a revenue or expenditure type is, the smaller in magnitude and significance the treatment effect is found, as Table 7 demonstrates. Remembering about the correct interpretation of the coefficient on the binary DiD variable, which is $(e^{\beta} - 1)*100\%$, among all local taxes, the unconditional treatment effect is found significant only for real estate tax (+123%), single tax on legal entities (+40%), and tourist fee (+9%). It is also significant for special taxes (+15.1%), including advertisement tax (+2%) and municipal tax (+12.1%).

Among non-tax incomes of local communities, the effect is significant for municipal profit, administrative fines, contributions to the urban infrastructure development fund, and other municipal income (Appendix F). Notably, the third type of local revenues, which is Proceeds from capital management transactions,

demonstrates negative treatment effect of the reform: -0.159 for the aggregate budget item and -0.134 for land sale, both at the 10% significance level.

Table 7. DiD Estimation Results – pooled baseline and follow-up periods, selected local tax revenues

Outcome Variables (per capita)	Local taxes	Real estate tax	Parking fee	Tourist fee	Single tax on legal entities	Single tax on individuals
Diff-in-diff	0.0438	0.800***	-0.0126	0.0861***	0.336***	0.0672
	(0.0576)	(0.0633)	(0.0168)	(0.0306)	(0.109)	(0.0576)
Pre-reform t(0)						
non-ATC	3.309	-1.938	-2.279	-2.227	-0.316	3.171
ATC	3.872	0.0112	-2.229	-2.086	1.926	3.683
Diff t(0)	0.563	0.213	0.0630	0.0111	1.906	0.512
Post-reform t(1)						
non-ATC	4.217	-1.002	-2.264	-2.183	-0.778	4.052
ATC	4.824	-1.725	-2.201	-2.216	1.128	4.631
Diff t(1)	0.607	1.013	0.0504	0.0972	2.241	0.579
Observations	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.113	0.107	0.002	0.001	0.038	0.107

Notes:
Clustered standard errors in parentheses
Control group: 32,425 observations before treatment, 16,155 observations – after treatment
Treated group: 1,464 observations before treatment, 732 observations – after treatment
*** p<0.01; ** p<0.05; * p<0.1

Second, all types of local expenditures demonstrate a more significant and bigger treatment effect than local revenues. The reason may be that all of them were consistently born by local communities across years, having increased after reform. Positively enough, the effect is bigger for capital expenditures than for current expenditures (1.906 vs. 1.232). Such types of expenditures by economic classification as investments into capital acquisitions, capital renovation and reconstruction, capital transfers to enterprises, and similar development investments demonstrate a treatment effect from 1.226 to 2.172, which translates into 241% to 778% increase (Appendix F).

As for the expenditures by functional classification, the treatment effect is significant for all of them, being the most impressive in magnitude for expenditures on general schools (+51,649%), libraries and museums (+713%), and social assistance (+626.5%) (Table 8).

Table 8. DiD Estimation Results – pooled baseline and follow-up periods, selected local expenditures

Expenditures (per capita)	Local governm ent	Roads	Municipal economy	Sports	Libraries & museums	Pre-school	Social assistance
Diff-in-diff	0.727***	0.692***	1.303***	1.455***	2.096***	0.550***	1.983***
	(0.0309)	(0.138)	(0.118)	(0.0714)	(0.132)	(0.180)	(0.109)
Pre-reform t(0)							
non-ATC	5.689	1.216	2.666	-1.661	-0.222	1.917	0.270
ATC	5.300	3.384	4.768	0.266	2.070	5.354	2.818
Diff t(0)	-0.389	1.476	0.753	0.476	0.183	2.887	0.562
Post-reform t(1)							
non-ATC	5.715	1.205	2.712	-1.664	-0.209	1.895	0.272
ATC	6.053	2.681	3.418	-1.186	-0.0384	4.782	0.832
Diff t(1)	0.338	2.168	2.056	1.930	2.279	3.437	2.546
Observations	50,776	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.014	0.014	0.012	0.024	0.009	0.025	0.018

Notes:
Clustered standard errors in parentheses
Control group: 32,425 observations before treatment, 16,155 observations – after treatment
Treated group: 1,464 observations before treatment, 732 observations – after treatment
*** p<0.01; ** p<0.05; * p<0.1

Naturally, unconditional treatment effect has a descriptive nature and is likely to be "contaminated" by potential time-varying confounders influences budget indicators at the same time as the treatment. Let's see if our estimates change when controlling for them.

6.2. Local revenues: conditional treatment effect estimation

First, the inclusion of additional time-varying controls is reasonable because they make the parallel trends assumption more plausible. These control variables are supposed to be having a strong impact on the outcome variables. Local budgets are naturally influenced by economic activity of their residents and businesses, by people's wealth (tax incomes), by managerial skills of local governors to provide municipal property for rent to local businessmen (non-tax incomes) and to obtain foreign grants (official transfers from foreign institutions), by population number (government transfers and most types of local expenditures) and many similar factors that are usually not measured at the village level. Hence, the proxies for the listed confounding factors were found among present budget items, and the logic for their selection is explained hereby.

All budget items were roughly classified into the following groups reflecting economic environment of the community, depending on the types of tax payers and their calculation base, namely:

1. *Business taxes:* most tax incomes, including natural resource rent, special taxes (advertisement, municipal tax), real estate rent, single taxes paid by individuals and legal entities, all taxes on environmental protection (especially on air pollution which is usually conducted by larger businesses)

2. *Economic activity of residents, or "people" taxes*: parking fee, tourist fee, total tax incomes (including personal income tax), total local taxes, and state duty on various administrative services (among non-tax incomes of local budgets).

3. *Economic size or capacity of the community:* base dotation, stabilization dotation, and other types of government dotations and subventions; total revenues, total own revenues, total expenditures, current expenditures.

4. *Municipal property management, or "municipal incomes":* municipal profit, rent of municipal property and real estate, other types of municipal non-tax incomes; incomes from the sale of property and land, and proceeds from other types of capital management transactions.

5. *Quick demonstration of the monetary effect of ATC formation, or "fast" expenditures*: expenditures on roads management, municipal and housing economy (street lighting, sewage, water supply etc.), physical culture (stadiums and sports grounds), clubs, libraries, museums, arts exhibitions, other expenditures on culture maintenance etc.

6. *Support to the local business and organizations, or "business climate" expenditures*: current subsidies to enterprises, capital transfers to enterprises; total transfers to enterprises, institutions, and organizations.

7. *Local government size, or "toxic" expenditures*: expenditures on local government; expenditures on wages.

8. *Enlarged authority of local government as a result of the reform, or "targeted" expenditures*: expenditures on medicine, education, and social assistance.

These groups of local budget indicators were used as both outcome variables and control variables. Additionally, data on *agriculture enterprises revenues* and their *crop or livestock production value* were introduced as additional controls for local business activity. *Land rental payments* of these agriculture enterprises reflect the price of land in a community, which could be a proxy for wealth and economic capacity. The

strength of the relationships between all identified variables of interest was checked with pairwise correlations, which are presented in Appendix G.

Second, in the case of multiple time units and communities, it is critical to include year effects and community-specific time trends to eliminate their fixed effects (FE) and obtain the "pure" effect of the reform. With their inclusion, the dummy variables for the treated group and for the post-reform time periods are naturally omitted because of collinearity with the respective fixed effects, and only DiD estimator is represented in the regressions alongside control variables. The list of all control variables is presented in Appendix H.

Such control variables as Capital expenditures and Official transfers in the previous period are used for almost all revenue and expenditure types. Capital acquisitions, and Capital renovations and reconstruction are related to possible improvements in infrastructure, which may increase economic activity, and, thus, tax revenues due to the establishment of new enterprises and more people becoming sole entrepreneurs, as well as trust in the local government. Official transfers from the government, namely base dotation, stabilization dotation and various subventions, have a controversial effect: they are special-purpose, so they lead to increased expenditures in a specific area for which they are allocated. However, this on-purpose nature also discourages the local government from the efforts to increase own budget revenues.

Local tax incomes that are proxies for business activity are analyzed first. They are controlled with the proxies for the effort of local governors to stimulate business with subsidies, infrastructure development programs and economic capacity of the local community. As expected, the treatment effect was found significant but smaller in magnitude (Table 9). Namely, after decentralization reform, compared to non-amalgamated communities, the incomes from real estate tax increased by

+96.5% in amalgamated communities, +23.4% from single tax on legal entities, and +5.4% from single tax on individuals, which was additionally found significant with this model specification. Thus, the estimated conditional treatment effect is by 20-30% less than unconditional.

Table 9. DiD Estimation Results – fixed-effects panel model, selected local tax revenues

Outcome Variables (per capita)	Natural resource rent, all types	Local taxes	Real estate tax	Single tax on legal entities	Single tax on individuals	Ecological taxes, all types
Diff-in-Diff	0.0952	0.0301	0.6755***	0.2100**	0.0525*	0.0458
	(0.0665)	(0.0266)	(0.0746)	(0.0684)	(0.0264)	(0.0447)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.7787***	3.4351***	-1.5264***	-0.3788*	3.3133***	-0.9087***
	(0.1712)	(0.0898)	(0.1831)	(0.1811)	(0.0887)	(0.1295)
Observations	16839	16839	16839	16839	16839	16839
Adjusted R-squared	0.019	0.455	0.179	0.077	0.457	0.093

Notes: Dependent variables in per-capita terms and logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Next, we proceed with the types of local revenues defined as proxies for the economic activity of residents (Table 10). The decentralization led to an increase in tax incomes from tourist fees by +9.3%, which is almost the same in magnitude as unconditional treatment effect. Now, incomes from the state duty on administrative services are found significant at the 10% significance level, namely they decreased by 14.1% as a result of the reform. This is an unexpected result, considering that a wider variety of administrative services are provided in ATCs with a big number of functioning administrative centers.

Table 10. DiD Estimation Results – fixed-effects panel model, selected tax revenues

Outcome Variables (per capita)	Tax incomes	Parking fee	Tourist fee	State duty
Diff-in-Diff	0.5525***	-0.0083	0.0886***	-0.1518*
	(0.0328)	(0.0179)	(0.0244)	(0.0685)
FE – Year	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes
Constant	5.9031***	-2.2442***	-2.2325***	-1.6132***
	(0.0724)	(0.0240)	(0.0365)	(0.1603)
Observations	42303	42303	42303	42303
Adjusted R-squared	0.461	0.002	0.013	0.027

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The above estimations were also conducted with the bootstrapped standard errors for additional robustness checks and were found significant and about the same in magnitude for all tax types discussed above. The same applies to random effects specification (see both in Appendix I). Although Hausman test failed to reject random effects model, we decide to proceed with the fixed effects model because of the certain presence of time-invariant unobservable characteristics of local communities that are impossible to be controlled.

Interestingly enough, random-effects specification allows us to observe the effects on budget indicators for such time-invariant characteristics of local communities as urban-rural settlement type, the number of population of more than 5,000 residents, the total area of more than the average of 5,8 thousand hectares, and the fact of the first "wave" of amalgamations in 2015. We can observe that in cities and small towns ("smt") the incomes from natural resources rent and from

advertisement tax are smaller in urban settlements whereas larger for local tax types. The population larger than 5,000 people is associated with bigger local tax incomes. The effect of area being larger than the average is found mostly insignificant, but positive for natural resource rent, forest rent, single tax on legal entities and taxes on environment protection. The effect of earlier 2015 amalgamation is found statistically insignificant.

Proceeding to non-tax incomes of local communities, the treatment effect of the reform was found significant for aggregate non-tax incomes – they increased by 42.5%, and for other municipal income, which increased by 81.7% (Table 11). Hence, we may conclude that the reform did not result in the increase of non-tax incomes in local communities, which largely reflect the managerial capacities of local governors related to municipal property management.

Table 11. DiD Estimation Results – fixed-effects panel model, selected non-tax revenues

Outcome Variables (per capita)	Non-tax incomes	Municipal profit	Municipal property rent	Other municipal income	Property sale	Land sale
Diff-in-Diff	0.3544***	0.1726	-0.0550	0.5970***	-0.0956	-0.1991
	(0.0538)	(0.0955)	(0.0712)	(0.0555)	(0.1163)	(0.1254)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.4584***	-2.2388***	-1.2370***	2.2782***	-2.0515***	-1.5767***
	(0.1718)	(0.1279)	(0.1563)	(0.2078)	(0.1757)	(0.2058)
Observations	16839	16839	16839	16839	16839	16839
Adjusted R-squared	0.162	0.021	0.017	0.036	0.001	0.002

Notes: Dependent variables in per-capita terms and the logarithmic form. Clustered standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

Total tax incomes and expenditures indicate the economic capacity of local communities. Their estimated conditional treatment effects are lower in magnitude than unconditional, as expected (Table 12 below).

Table 12. DiD Estimation Results – fixed-effects panel model, aggregate revenues and expenditures

Outcome Variables (per capita)	Total revenues	Total expenditures	Total own revenues	Own revenues without PIT	Current expenditures	Wages expenditures
Diff-in-Diff	0.8242***	1.2298***	0.4777***	0.1224***	1.1578***	1.1544***
	(0.0267)	(0.0327)	(0.0204)	(0.0223)	(0.0289)	(0.0289)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.8895***	8.2486***	6.0252***	5.6206***	6.6380***	6.1591***
	(0.0554)	(0.0664)	(0.0703)	(0.0712)	(0.0685)	(0.0564)
Observations	16839	16839	16839	16836	16839	16839
Adjusted R-squared	0.645	0.249	0.677	0.737	0.249	0.331

Notes: Dependent variables in per-capita terms and logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The above discussion leads to the preliminary conclusion that decentralization reform led to the increase in certain types of local tax incomes, apart from aggregate local revenues and expenditures. This may indicate a positive reaction of local business and residents to consolidation with neighboring communities and to a bigger administrative power delegated to their local authorities.

6.3. Local expenditures: conditional treatment effect estimation

As for local expenditures, it is critically important to control them with base dotation and on-purpose state grants, which on average finance half of the public expenditures of local communities and this way boost the average treatment effect. We first analyze "fast" expenditures on local infrastructure, such as roads, street lighting, stadiums, cultural centers etc., which make the effect of the reform visible and attractive to the public eye. Also, another distinctive category of expenditures, which reflects the local government size, is expenditures on local government functioning and on the wages within municipal economy. These groups are tagged as "toxic" expenditures in our research, because their share in total expenditures often exceeds the recommended 20% by policy-makers (while the expenditures on wages are 80% in Ukraine) leading to inefficient allocation of local resources.

Amalgamated communities increased the per-capita expenditures on road management by +96%, on municipal economy by +212.5%, on sports facilities by +227.4%, on clubs by +81.5%, and on libraries and museums by +447.3%. "Toxic" expenditures on local government have increased by 88.9% in ATCs, and expenditures on wages in ATCs – by 178.9% (Table 13).

Table 13. DiD Estimation Results – fixed-effects panel model, selected local expenditures

Expenditures (per capita)	Local governm ent	Wages	Roads	Municipal economy	Sports	Clubs	Libraries & museums
Diff-in-Diff	0.6360***	1.0257***	0.6727***	1.1394***	1.1861***	0.5959***	1.6998***
	(0.0223)	(0.0297)	(0.1287)	(0.0731)	(0.0949)	(0.0588)	(0.1092)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 13 – Continued

Expenditures (per capita)	Local governm ent	Wages	Roads	Municipal economy	Sports	Clubs	Libraries & museums
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.7778***	6.3383***	1.7314***	3.2958***	-1.5102***	3.4187***	0.2092
	(0.0356)	(0.0318)	(0.2087)	(0.1369)	(0.0922)	(0.1362)	(0.1097)
Observations	20850	20850	20850	20850	20850	20850	20850
Adjusted R-squared	0.146	0.295	0.004	0.022	0.045	0.008	0.060

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The treatment effect estimates for local expenditures were additionally checked for robustness by applying one of the methods of dealing with multiple space and time units, namely with their serial and within correlation, proposed by Cunningham (2020). This method is about the aggregation of all years into two periods, baseline and follow-up, which leads to the simplified calculation of the DiD estimator with just 4 points. As can be seen in Appendix J, the treatment estimates came out generally more inflated than estimated in the panel context with fixed effects. For instance, this estimate says that expenditures on sports facilities increased by 2925% and by 104581% for the expenditures on libraries and museums, which sounds rather unreasonable. Hence, we may conclude that the choice of fixed effects method in a panel context provides more realistic estimates for the effect of the decentralization reform.

What is positive about the aggregation method is that it allows to conclude about the effect of time-invariant confounders on the budgetary situation. We can observe, as expected, that communities with a larger population number generally have larger public expenditures, and the same applies to the area of local community. Urban type of a community leads to larger expenditures on all

investigated budget items apart from expenditures on road management and community clubs, for which they are surprisingly smaller.

Next group of expenditures is strategic in terms of providing vital services to the people, the number of which has extended for ATCs as a result of the reform. Hence, the control variables for their estimation are provided in the Table 14 below, which are specific subventions targeted for the respective areas as well as base dotation.

Table 14. DiD Estimation Results – fixed-effects panel model, targeted local expenditures

Expenditures (per capita)	Pre-school	General school	Healthcare	Social assistance
Diff-in-Diff	0.5463***	5.7650***	1.3482***	1.8629***
	(0.0613)	(0.1423)	(0.1313)	(0.0797)
FE – Year	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes
Lagged Subvention for education	-0.0595*	0.0217		
	(0.0277)	(0.0427)		
Lagged Subvention for ATC	0.1066**	0.2242**	-0.2352***	0.0586*
	(0.0343)	(0.0718)	(0.0477)	(0.0241)
Lagged Subvention for medicine			0.3523***	
			(0.0412)	
Lagged Subvention for social assistance				-0.0969*
				(0.0485)
Constant	2.1426***	-1.4333***	-1.5906***	0.3862**
	(0.0389)	(0.0480)	(0.0867)	(0.1193)
Observations	42,303	42,303	42,303	42,303
Adjusted R-squared	0.003	0.357	0.145	0.019

Notes: Dependent variables in per-capita terms and the logarithmic form. Clustered standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

It can be seen that the effect of subventions as control variables is generally found statistically significant, which means they explain quite a large share of increase in these expenditures after the reform. Since the maintenance of general schools has become the full responsibility of ATCs, these expenditures increased by 31,794%. The expenditures on pre-school organizations have increased by 72.7%, on healthcare by 285%, and on social assistance by 544.2%.

Table 15. DiD Estimation Results – fixed-effects panel model, selected capital expenditures

Expenditures (per capita)	Capital expenditures	Development programs expenditures	Capital acquisitions	Capital renovation & reconstruction	Subsidies to enterprises	Capital transfers to enterprises
Diff-in-Diff	1.8108***	1.6575***	1.9074***	2.0543***	1.1192***	1.4416***
	(0.0725)	(0.1346)	(0.0885)	(0.1050)	(0.1082)	(0.1255)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.5539***	0.2002	1.5450***	1.5655***	-1.2193***	-1.4006***
	(0.3210)	(0.3813)	(0.3538)	(0.3877)	(0.2168)	(0.2157)
Observations	16,839	16,839	16,839	16,839	16,839	16,839
Adjusted R-squared	0.030	0.019	0.026	0.025	0.032	0.047

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Finally, capital expenditures represent the investments into infrastructure and into the improvement of business environment by providing transfers to local enterprises. These long-term investments are also largely financed by state grants and subventions, in particular a special subvention for the development of ATC

infrastructure. After controlling for the latter, the effect of the reform was found significant and positive for all types of capital expenditures (Table 15).

6.4. Treatment effect on the decentralization and efficiency measures

Among decentralization measures, suggested by the literature, the most common are the share of municipal expenditures financed by own revenues (financial independence measure), the share of local public revenues (or expenditures) in a country's GDP, the share of local public revenues (or expenditures) in the consolidated public revenues (or expenditures) of the central government, transfers from the central government as a percentage of local public revenues (NALAS, 2012). In our research, we investigate the following decentralization and efficiency measures, with the latter being suggested by the official methodology of communities' sustainability estimation, developed by the Ministry of the Development of Local Communities and Territories [10]:

1. *Financial decentralization measure*, which is the share of own revenues in total revenues
2. *Financial dependence measure*, which is the share of state transfers in total revenues
3. *Local Government size 1*, which is the share of local government expenditures in total expenditures
4. *Local Government size 2*, which is the share of expenditures on wages in total expenditures.

[10] For more details, see: https://www.minregion.gov.ua/napryamki-diyalnosti/regional-dev/rozvytok-mistsevoho-samovryaduvannya/dobrovil-ne/metodychni-rekomendatsiyi/metodichni-rekomendatsiyi-shhodo-otsinki-rivnya-spromozhnosti-teritorialnih-gromad/.

The same DiD estimation steps were applied to decentralization and efficiency measures, as described in the methodology section and followed in this Chapter. As can be seen in Appendix E, these measures were quite imbalanced in the beginning, with the decentralization measures being smaller for ATC proxies than for non-amalgamated communities. ATC proxies were less financially independent and more dependent on official government transfers.

Unfortunately, as a result of amalgamations, the financial dependence of ATCs only increased (Table 16). As have been discussed in Chapter 3, a large number of subventions are provided for all areas where the responsibilities of ATC authorities enlarged. An interesting issue for a further research would be to investigate if this fact actually disincentivizes local authorities from increases their own revenues and financial independence from government transfers.

Table 16. DiD Estimation Results – decentralization measures

Outcome variables	Share of Own revenues in Total revenues			Share of Official transfers in Total revenues		
Diff-in-diff	-0.179***	-0.157***	-0.1736***	0.203***	0.178***	0.1873***
	(0.00936)	(0.00983)	(0.0070)	(0.0102)	(0.0111)	(0.0082)
Covariates	No	Yes	Yes	No	Yes	Yes
Fixed effects	No	No	Yes	No	No	Yes
Model	Pooled without covariates	Pooled with covariates	Fixed effects model	Pooled without covariates	Pooled with covariates	Fixed effects model
Observations	55,213	42,289	16,834	55,213	42,289	16,834
R-squared	0.073	0.126	0.493	0.067	0.083	0.182

Notes: Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

As for the efficiency of local governments, before the reform ATC proxies spent less on local government and on wages relative to total expenditures. After the reform, these indicators decreased even more. The negative treatment effect is

found significant with all model specifications and of about the same magnitude from -5.5% to -4.1% for the share of wages in total expenditures, and from -11.8% to -10.7% for the share of local government expenditures (Table 17).

Table 17. DiD Estimation Results – measures of local government size

Outcome variables	Share of Wages expenditures in Total expenditures			Share of Local government expenditures in Total expenditures		
Diff-in-diff	-0.0563***	-0.0599***	-0.0415***	-0.126***	-0.114***	-0.1130***
	(0.0182)	(0.0200)	(0.0121)	(0.00978)	(0.0101)	(0.0057)
Covariates	No	Yes	Yes	No	Yes	Yes
Fixed effects	No	No	Yes	No	No	Yes
Model	Pooled without covariates	Pooled with covariates	Fixed effects model	Pooled without covariates	Pooled with covariates	Fixed effects model
Observations	55,224	42,298	16,836	55,224	42,298	16,836
R-squared	0.004	0.022	0.023	0.029	0.166	0.042

Notes: Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The drivers of such increased efficiency may be explained either by (1) the increase of the share of other expenditure types in total expenditures, or (2) a bigger effort of local governors to decrease the share of inefficient expenditures in their total spending. A closer investigation of the potential drivers is of particular interest in for further research.

Now let's look if the estimated treatment effects remain significant after robustness checks.

Chapter 7

ROBUSTNESS CHECKS

The robustness checks applied in this thesis are meant for two main purposes, which are (1) to check the validity of the obtained results, and (2) to test the credibility of the chosen model with its underlying assumption. The first test is placebo analysis, which is a more formal test of the parallel trends assumption than graphical analysis conducted in the pre-estimation test 1 section.

7.1. Placebo analysis

Placebo analysis is a type of falsification test that relies on the assumption that the treatment effect should be absent where it is supposed to be absent. It is common to test for its absence in the periods preceding the treatment, and I am doing the same. A subset of the dataset is taken up to the year 2015, and the same model specifications are re-estimated. If parallel trends assumption is satisfied, the DiD estimator is supposed to be statistically insignificant before the treatment occurred.

Table 18. DiD Placebo Analysis – selected local tax incomes

Outcome Variables (per capita)	Real estate tax	Single tax on legal entities	Single tax on individuals	Tax incomes	Tourist fee	State duty
Diff-in-Diff proxy	0.2985***	0.0135	0.0711**	-0.0430*	-0.0731**	0.0473
	(0.0512)	(0.0606)	(0.0256)	(0.0189)	(0.0237)	(0.0524)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.3025***	-0.7362***	3.0819***	6.0845***	-2.2257***	-1.6506***
	(0.0081)	(0.0111)	(0.0064)	(0.0853)	(0.0475)	(0.2129)

Table 18 – Continued

Outcome Variables (per capita)	Real estate tax	Single tax on legal entities	Single tax on individuals	Tax incomes	Tourist fee	State duty
Observations	33888	33888	33888	25416	25416	25416
Adjusted R-squared	0.107	0.001	0.029	0.054	0.003	0.034

Notes: Dependent variables in per-capita terms and the logarithmic form.
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The conducted placebo tests are partially successful in validating the obtained results. The parallel trends assumption was found violated for such local tax types as real estate tax per capita, single tax paid by individuals, total tax incomes, and tourist fee. Also, DiD estimator is significant for other municipal income, among non-tax incomes. Positively enough, the statistical significance is only at the 5% or 10% significance level (Table 18 above).

Notably, graphical analysis of these tax types does not indicate the violation graphically (except for the case of real estate tax and tourist fee, see Appendix D). Therefore, the placebo test is more accurate than a graphical one.

Table 19. DiD Placebo Analysis – selected local expenditures

Expenditures (per capita)	Local government	Roads	Municipal economy	Sports	Clubs	Libraries & museums
Diff-in-Diff proxy	0.0059	-0.0284	0.0189	-0.0569	0.0388	-0.0172
	(0.0168)	(0.1072)	(0.0725)	(0.0625)	(0.0522)	(0.0320)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.7097***	1.5421***	3.1763***	-1.5502***	3.5504***	0.1046
	(0.0493)	(0.2845)	(0.2107)	(0.1098)	(0.2181)	(0.1063)
Observations	12,729	12,729	12,729	12729	12729	12729
Adjusted R-squared	0.150	0.004	0.010	0.002	0.008	0.005

As for local expenditures and decentralization, and efficiency measures, the treatment effect on all of them was found insignificant (Tables 19-20 and Appendix J). This confirms the credibility of the parallel trends assumption in the conducted DiD estimation.

Table 20. DiD Placebo Analysis – decentralization measures

Outcome Variables	Share of Own revenues in Total revenues	Share of Official transfers in Total revenues	Share of Wages expenditures in Total expenditures	Share of Local government expenditures in Total expenditures	Wages expenditures
Diff-in-Diff proxy	0.0059	-0.0026	-0.0096	-0.0024	-0.0058
	(0.0051)	(0.0051)	(0.0098)	(0.0034)	(0.0086)
FE – Year	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Constant	0.6196***	0.3804***	0.6579***	0.4283***	6.2206***
	(0.0013)	(0.0013)	(0.0035)	(0.0011)	(0.0030)
Observations	36,867	36,867	36,869	36,869	33,888
Adjusted R-squared	0.260	0.044	-0.000	-0.000	0.231

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

7.2. Matched Difference-in-Differences

The biggest challenge posed by the difference-in-differences estimation method is the possibility of the selection bias. One of the most common methods to minimize selection bias in impact analysis is through propensity score matching, which I am incorporating as a supplement to the conducted analysis. Although the imbalance at the baseline was addressed with the balancing test, matching is still used to reduce

baseline heterogeneity, with Propensity Score Matching (PSM) being one of the more popular matching techniques.

Treated communities in the dataset, which are 366 ATCs, are matched with non-ATC communities from the control group. They are matched not by their initial observable characteristics but by similar probabilities of being selected in a treatment, which are called propensity scores. The latter are conditional on observables. Following CEGA Lecture notes, I conduct kernel PSM (gaussian type) with the common support condition, which implies that the propensity scores in the true treatment and control groups are within the same wide range, and is recognized as the most successful PSM.

Combination of PSM and DiD is conducted with the user-written command "Diff" in Stata, which conducts kernel PSM automatically and produces the DiD estimator on the matched treatment and control groups (Villa 2016). Thus, the outcome variables are the same as dependent variables in the main FE panel regression specification, and respective control variables are the matching criteria. Notably, we test only those outcome variables which demonstrated significant treatment effect with FE panel model specification.

Table 21. Matched Differences-in-Differences – selected local tax revenues

Outcome Variables (per capita)	Real estate tax	Single tax on legal entities	Single tax on individuals	Tourist fee	State duty
Diff-in-diff	0.796***	0.0866	0.0412	0.0847***	-0.155**
	(0.0810)	(0.0898)	(0.0339)	(0.0264)	(0.0719)
Observations	12,213	12,219	12,252	37,244	37,054
R-squared	0.192	0.080	0.188	0.003	0.032

Notes: Dependent variables in per-capita terms and the logarithmic form. Clustered standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

Comparing the treatment effect estimators from the matched DiD with the FE panel model, we may conclude that although the magnitude of estimates has hardly changed, more budget items demonstrated insignificant change. Among them there are single taxes on individuals and on legal entities, which have previously demonstrated increase in ATCs as a result of the reform (Table 21 above).

Table 22. Matched Differences-in-Differences – selected local expenditures by functional classification

Expenditures (per capita)	Local government	Wages	Roads	Municipal economy	Sports	Clubs	Libraries & museums
Diff-in-diff	0.787***	1.132***	0.465***	1.117***	1.390***	0.380***	1.901***
	(0.0373)	(0.0373)	(0.166)	(0.111)	(0.124)	(0.136)	(0.164)
Observations	12,273	13,039	12,876	13,077	12,953	12,815	12,974
R-squared	0.246	0.441	0.049	0.096	0.106	0.129	0.110

Notes: Dependent variables in per-capita terms and logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

In the case of matched DiD estimator for local expenditures, the magnitude has generally decreased, with a few exceptions, and was found insignificant for pre-school expenditures and general school expenditures (Tables 22-23).

Table 23. Matched Differences-in-Differences – selected targeted local expenditures

Expenditures (per capita)	Pre-school	General school	Social assistance
Diff-in-diff	1.737	-1.171	1.961***
	(1.258)	(0.963)	(0.0813)
Observations	33,000	36,000	38,586
R-squared	0.530	0.096	0.170

Notes: Dependent variables in per-capita terms and logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The magnitude of the matched DiD treatment effect for various types of capital expenditures has remained almost the same as estimated in the FE panel context (Table 24 below).

Table 24. Matched Differences-in-Differences – selected local expenditures by economic classification

Outcome Variables (per capita)	Capital acquisitions	Capital renovation & reconstruction	Subsidies to enterprises	Capital transfers to enterprises	Development programs expenditures
Diff-in-diff	1.937***	2.077***	1.101***	1.530***	1.693***
	(0.0950)	(0.117)	(0.118)	(0.127)	(0.126)
Observations	12,470	12,434	12,474	12,397	12,326
R-squared	0.253	0.277	0.077	0.113	0.144

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

The same slight change in the magnitude of the reform impact applies to decentralization and efficiency measures (Table 25 below).

Table 25. Matched Differences-in-Differences – decentralization measures

Outcome Variables	Share of Own revenues in Total revenues	Share of Official transfers in Total revenues	Share of Wages expenditures in Total expenditures	Share of Local government expenditures in Total expenditures
Diff-in-diff	-0.226***	0.183***	-0.0430***	-0.126***
	(0.00773)	(0.00893)	(0.0112)	(0.00704)
Observations	13,327	13,404	13,385	13,381
R-squared	0.117	0.115	0.021	0.164

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

After an elaborate cycle of estimations with several model specifications and robustness checks, we may conclude that decentralization reform in Ukraine resulted in the increase in the following budget indicators in amalgamated communities (matched DiD estimates):

- Real estate tax +121.7%
- Tourist fee +8.8%
- Expenditures on Local Government +120%
- Expenditures on Wages +210.2%
- Expenditures on Roads management +59.2%
- Expenditures on Municipal economy +205.6%
- Expenditures on Sports facilities +301.5%
- Expenditures on Clubs +46.2%
- Expenditures on Libraries and Museums +569.3%
- Expenditures on Social Assistance +610.6%
- Capital acquisitions +593.8%
- Capital renovation and reconstruction +698%
- Subsidies to enterprises +200.7%
- Capital transfers to enterprises +361.8%
- Expenditures on development programs +443.6%
- Share of Official transfers in Total revenues +20.1%.

Simultaneously, after decentralization a reduction has been detected in:

- State duty -14.4%
- Share of Own revenues in Total revenues -20.2%
- Share of Wages expenditures in Total expenditures -4.2%
- Share of Local government expenditures in Total expenditures -11.8%

While in the empirical literature on municipal amalgamations, no significant effect on public expenditures is normally detected, our research has found a significant positive effect. This may be explained by the fact that: (1) we conducted a research on the first two years after amalgamations, while most studies take up to 10 years after reform; (2) most literature examines compulsory amalgamations with prevalent diseconomies of scale, while Ukrainian case is about voluntary amalgamations. Local expenditures in Ukraine are likely to increase due to a larger authority of local self-government and increased transaction costs as potential reasons.

Chapter 8

CONCLUSIONS

Ukrainian decentralization reform was enacted in 2014 and commenced voluntary amalgamation of territorial communities in Ukraine. Newly formed consolidated communities are provided with broader financial and administrative responsibilities. Namely, they exercise a bigger authority in their expenditures, and have a larger tax collection base, now being equal to the cities of regional importance and "rayons" – counties in Ukrainian regions. It is of interest to estimate if local budgets have improved their performance not due to larger tax rates set in the law, but due to the accompanying economies of scale, better economic planning, and creating favorable investment climate for local businesses. These are the expected economic gains of the decentralization reform and municipal amalgamations largely investigated in the literature.

The average treatment effect of the decentralization reform in Ukraine was found statistically significant and positive for all aggregate types of local revenues and expenditures with all model specifications. This means that since the reform started in 2015, the communities affected by the decentralization reform in Ukraine have been growing both their revenues and expenditures faster than non-amalgamated communities. However, a rapid growth in total revenues and expenditures is most likely boosted by the nominally increased tax base and expenditure sources. Disaggregation of budget sections throughout our study leads to the deterioration of the effect of the decentralization reform. In the end, we may conclude that the amalgamations of local communities led to the increase of only a few types of local taxes, which are real estate tax, single business taxes on legal entities and individuals, and tourist fee.

Whether the increase in several local tax incomes is truly the success of the reform is hard to tell. The chosen DiD method is recognized successful in policy impact analysis in eliminating the potential impact of such factors that amalgamated communities could initially have been richer than average or maintained better business climate. After all, they were first to amalgamate in the entire country, which indicates they are likely progressive and tend to innovate, and we hope that this time-constant characteristic of theirs was eliminated econometrically. However, to be fully sure of this, such characteristics as wealth in a community or local elections participation rate could be introduced as control variables in the further research.

The hope that the economies of scale in the form of decreased local expenditures could work soon enough after the amalgamation happened is broken into pieces by rocketing rates of growth of expenditures in all areas, from capital investments to sports facilities. This result is in line with the literature on municipal amalgamations, where the effect of amalgamation was mainly found insignificant and almost never led to the decrease in local expenditures. Following the five-fold increase in the government transfers, Ukrainian local governors rushed to increase their investment in local infrastructure by the same rate or even bigger. Naturally, the next step in further research is to measure the quality of the provided public services – if they were actually a good value for money.

The decentralization reform is also meant to result in higher financial sustainability and reliance on the own revenues of local budgets. As defined in the SKL International/SIDA monitoring report on the success of Ukrainian decentralization reform, despite its achievements and positive vibe, the dream about full financial sustainability of Ukrainian hromadas will never come true because they are simply unable to generate so many revenues to cover all public expenditures. After the reform, the dependence of local communities on state

grants increased by 20% accompanied by a synchronous equivalent decrease in financial independence. Naturally, local authorities in ATCs do not have strong incentives to constrain their expenditures after the mergers, as the central government will always cover a solid share of their expenses. Therefore, Ukrainian policy makers are posed with a worthy dilemma and a challenge to create stimuli for local authorities to actually exercise the economies of scale, and increase savings.

The third important dimension of decentralization reform is the size of local government. Both in Ukrainian policy analysis by government agencies and in the literature about decentralization, the size of the local government is measured as the share of expenditures on local government in total expenditures and the share of expenditures on wages in total expenditures. Interestingly enough, as a result of the reform the size of local government decreased relative to total expenditures. Whether local authorities in amalgamated communities are indeed more efficient public administrators, or the negative effect is observed due to the increased share of other expenditure types is of particular interest for the further research.

Our results suggest that the first two years after the amalgamation are definitely not enough to observe the economies of scale in effect – the local authorities are rather overwhelmed on how to spend bigger state grants in the most remarkable way. However, an increase in several local tax revenues signify that local businesses and residents may be quite inspired both by the ability of local governors to impress them with new stadiums and better roads and by the fact that the taxes they pay could be largely executed in the place where they live and operate. Hence, we may expect that Ukrainian decentralization reform will reap even more positive effects in the years to come. During the next stage of the reform, local governments should focus on creating economic stimuli for the business, which are their most reliable own revenue source.

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APPENDIX A. LOCAL BUDGET SOURCES, ATC VS. NON-ATC

Table 26. Local budget revenues and expenditures in ATCs and non-ATC settlements, as of the end of 2014 (pre-reform) and 2017 (post-reform)

Settlement type	Village, town & city budgets		ATC budgets	
Local Budget Item / Timing	Pre-reform	Past-reform	Pre-reform	Past-reform
Revenues (general and special funds)				
Personal income tax (PIT)	25%	-	N/A	60%
Rent on special use of forest resources	100%	50%	N/A	50%
Rent on special use of water	100%	50%	N/A	50%
Rent on the use of national-significance subsurface resources	100%	50%	N/A	50%
Fees for the use of other natural resources	100%	50%	N/A	50%
State duty	100%	100%	N/A	100%
Tax on the profit of community-owned enterprises and financial institutions	100%	100%	N/A	100%
Land rent	100%	-	N/A	-
Other local taxes and fees	100%	100%	N/A	100%
Fixed agriculture tax	100%	-	N/A	-
Part of the net profit (income) of unitary community-owned enterprises	100%	100%	N/A	100%
Penalties and administrative fines imposed by local executive agencies	100%	100%	N/A	100%
Rental income and concession payments for the use of community-owned property	100%	100%	N/A	100%
Funds obtained from the successful bidder of a procurement contract	100%	100%	N/A	100%
Funds obtained by enterprises maintained by rayon-subordinated city, village, and settlement budgets	80%	100%	N/A	100%
Funds from the sale of ownerless and donated property	100%	100%	N/A	100%
Revenues of the development budget	100%	100%	N/A	100%
Fees for the registration of vehicles	50%	-	N/A	-
Funds from the compensation for losses of the agricultural and forestry production	60%	60%	N/A	75%

TABLE 26 – Continued

Settlement type	Village, town & city budgets		ATC budgets	
Local Budget Item / Timing	Pre-reform	Past-reform	Pre-reform	Past-reform
Penalties for the damage caused by violation of environmental protection legislation as a result of business and other activities	70%	50%	N/A	50%
Subvention for road management and other subventions	100%	-	N/A	-
Own revenues, revenues of special-purpose funds, and through international institutions' grants	100%	100%	N/A	100%
Environmental tax	25%	25%	N/A	25%
Targeted and voluntary contributions	100%	100%	N/A	100%
Repayment of loans	100%	100%	N/A	100%
Property tax	100%	100%	N/A	100%
Single tax	100%	100%	N/A	100%
Dividends accrued on the shares in corporations whose authorized capitals contain community-owned property	100%	100%	N/A	100%
Fee for issuing local guarantees	100%	100%	N/A	100%
Funds from the use of output owned by the state under production sharing agreements	1.5%	1.5%	N/A	-
Funds from the sale of non-agricultural land plots	55%	55%	N/A	-
Capital transfers from other budgets	100%	100%	N/A	100%
Excise tax on sales by retail trade economic entities of excisable goods	-	100%	N/A	100%
Parking fees	-	100%	N/A	100%
Tourism fees	-	100%	N/A	100%
License fees	-	100%	N/A	100%
Other administrative fees	-	100%	N/A	100%
Expenditures (consistent across years)				
Local self-government bodies	×	×	N/A	×
Local elections and referendum organization	×	×	N/A	×
Local debt service activity	×	×	N/A	×
Civil defense activities (local)	×	×	N/A	×
Fire safety and rescue service (local)	×	×	N/A	×
Physical culture and sports	×	×	N/A	×

TABLE 26 – Continued

Settlement type	Village, town & city budgets		ATC budgets	
Local Budget Item / Timing	Pre-reform	Past-reform	Pre-reform	Past-reform
Theatres, Artistic groups, concert/ entertainment organizations & Cinematography	×	×	N/A	×
Creative unions & Clubs	×	×	N/A	×
Natural reserves & monuments	×	×	N/A	×
Mass media organizations	×	×	N/A	×
Municipal economy	×	×	N/A	×
Municipal transport & road management system	×	×	N/A	×
Activities in the field of environment protection (local)	×	×	N/A	×
Housing economy (certain social groups)	×	×	N/A	×
Social protection & assistance, all social groups	×	×	N/A	×
Capital transfers to enterprises and other budgets	×	×	N/A	×
Preparing municipally-owned land or municipal plots for sale	×	×	N/A	×
Expenditures (inconsistent across years)				
Pre-school education system	×	-	N/A	×
General secondary education establishments & special boarding	×	-	N/A	×
Out-of-school education system	×	-	N/A	×
Vocational training system	-	-	N/A	×
Higher education of accreditation levels I-IV	-	-	N/A	×
Postgraduate education system	-	-	N/A	×
Healthcare (all)	-	-	N/A	×

Source: Budget Code of Ukraine

APPENDIX B. DESCRIPTIVE STATISTICS

Table 27. Summary statistics for dependent and control variables

Variables (per capita)	Mean	sd	Min	Max
Total revenues	1155.679	2468.344	0.1	251542.7
Total own revenues	1081.052	2278.68	40.15992	308130.9
Own revenues without PIT	735.8713	1931.09	0.1	220716.5
Tax incomes	767.7974	1909.323	0.1	227911.1
Non-tax incomes	54.00911	333.4791	0.0000347	26056.18
Proceeds from capital management transactions	9.333378	140.855	0.00000709	16516.38
Special funds	5.339858	91.15817	0.0000449	11850.44
Official transfers	319.3526	739.7027	0.0226225	128787.5
Natural resource rent, all types	23.43165	141.4134	0.00000621	11011.74
Forest rent	16.63814	85.66874	0.00000891	5709.65
Mineral resource rent	6.206714	109.0233	0.000002	11006.51
Other natural resources rent	0.7814652	22.24305	0.0000223	1913.806
Special taxes	0.1016843	0.0922997	0.000000325	15.69909
Advertisement tax	0.1001692	0.0188166	0.0000239	2.668361
Municipal tax	0.1016415	0.0900949	0.000000325	15.69909
Local taxes	78.44336	152.774	0.0003663	11173.67
Real estate tax	1.43856	17.82872	0.000011	2294.59
Parking fee	0.1361301	0.6487705	0.00000678	84.69355
Tourist fee	0.6474443	30.26675	0.0000394	3744.844
Single tax on legal entities	10.8073	43.79558	0.00000552	2552.34
Single tax on individuals	65.72032	108.843	0.0003663	4406.099
Ecological taxes, all types	12.89603	450.847	0.00000436	51236.34
Ecological tax – air pollution	7.151653	427.3751	0.00000436	50393.09
Municipal profit	1.486958	27.18147	0.00000258	2403.831
Administrative fines	0.2958804	1.41603	0.000046	121.3184
Compensation for losses in agriculture	3.313799	73.58417	0.00000169	6430.101
Municipal property rent	2.071595	10.91345	0.0000349	703.533

TABLE 27 – Continued

Variables (per capita)	mean	sd	min	max
State duty	0.872341	4.370341	0.000053	327.5511
Environment protection funds	1.04698	12.71532	0.00000331	1495.217
Infrastructure development funds	3.100391	50.70414	0.0001143	4670.525
Other municipal income	35.3044	304.9609	0.0001043	25486.63
Property sale	1.475187	16.85215	0.00000709	1237.402
Land sale	7.87579	139.4977	0.0000788	16501.87
Current expenditures	888.9193	1498.778	37.25092	173067.9
Capital expenditures	194.3286	1211.636	0.0202429	215280
Wages expenditures	538.8806	551.4709	31.1159	54879.72
Local government expenditures	377.5101	419.8619	20.64195	32577.47
Fire safety & civil defense expenditures	5.835688	33.24927	0.0062345	2372.791
Roads expenditures	70.79056	288.8347	0.0085644	17006.29
Agriculture production expenditures	5.253738	33.32848	0.0001748	3610.623
Construction expenditures	4.15111	25.12404	0.0000342	1118.096
Other economic activities expenditures	61.43547	637.1268	0.00000536	112160.3
Environment protection expenditures	11.33266	169.9122	0.0021672	16316.55
Municipal economy expenditures	101.247	430.6239	0.0017321	47274.33
Healthcare expenditures	1.665804	27.25324	0.1	1395.938
Sports expenditures	3.475597	125.4886	0.0047873	16023.52
Clubs expenditures	82.04843	193.9935	0.00000493	20656.87
Libraries & museums expenditures	16.55747	29.67749	0.0066021	1036.244
Other culture expenditures	1.964133	14.21291	0.0014473	1014.396
Pre-school expenditures	185.29	241.8729	0.0011364	5338.023
General school expenditures	37.25017	332.8047	0.1	26851.11
Social assistance expenditures	13.50005	55.84424	0.0007911	4534.629
Utilities bills expenditures	48.67664	101.7513	0.0010645	11395.91

TABLE 27 – Continued

Variables (per capita)	mean	sd	min	max
Development programs expenditures	20.04641	70.98927	0.0047393	5515.416
Subsidies to enterprises	12.61211	185.6318	0.0313972	24454.49
Capital transfers to enterprises	10.2337	267.1577	0.020724	44075.43
Capital acquisitions	64.24608	622.1199	0.00000376	108663.3
Capital renovation & reconstruction	103.6232	446.6945	0.0001403	62153.66
Base dotation	2.561467	29.94543	0.1	911.0484
Stabilization dotation	6.152124	23.01631	0.0230029	529.8193
Other subsidies	32.67865	117.0279	0.0147658	3818.265
Subvention for infrastructure projects	5.732332	84.69626	0.1	6650.175
Subvention for social assistance	0.3312689	12.46943	0.1	1267.982
Subvention for utilities' bills	0.1633541	8.154571	0.1	1313.897
Subvention for ATC	5.940957	66.30049	0.1	3490.937
Subvention for education	12.2212	126.2877	0.1	3773.997
Subvention for medicine	1.724518	28.08112	0.0000202	2534.85
Subvention for municipal economy	8.214439	27.72919	0.0001002	2925.035
Subvention for socio-economic development	20.33064	547.0988	0.1	117387.9
Other subventions	114.8008	297.3117	0.0000149	15037.99
Land rental payments	2465.692	6557.914	0.020357	316426.2
Crop production value	15995.55	39150.57	0.1	1603912
Livestock production value	3757.987	28942.23	0.0042239	2429062
Crop production revenues	19395	48089.79	0.1	1791190
Livestock production revenues	3441.184	24711.27	0.0042239	1670124
Agriculture production revenues	23447.82	58181.61	0.1	1898102

Notes: Number of observations 50,775

APPENDIX C. DEFLATORS

Table 28. Consumer Price Indices in 2013-2017

Year	Yearly
2013	100.5
2014[2]	124.9
2015[3]	143.3
2016[3]	112.4
2017[3]	113.7

Notes:
1 – December to December of the previous year.
2 – Data does not include the temporarily occupied territory of the Autonomous Republic of Crimea and the city of Sevastopol.
3 – Data does not include the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in Donetsk and Luhansk regions.

Source:
Consumer Price Index in 1991-2019 [Індекси споживчих цін у 1991-2019 pp.].http://www.ukrstat.gov.ua/operativ/operativ2006/ct/cn_rik/isc/isc_u/isc_m_u.htm

APPENDIX D. PARALLEL TRENDS ASSUMPTION TESTS

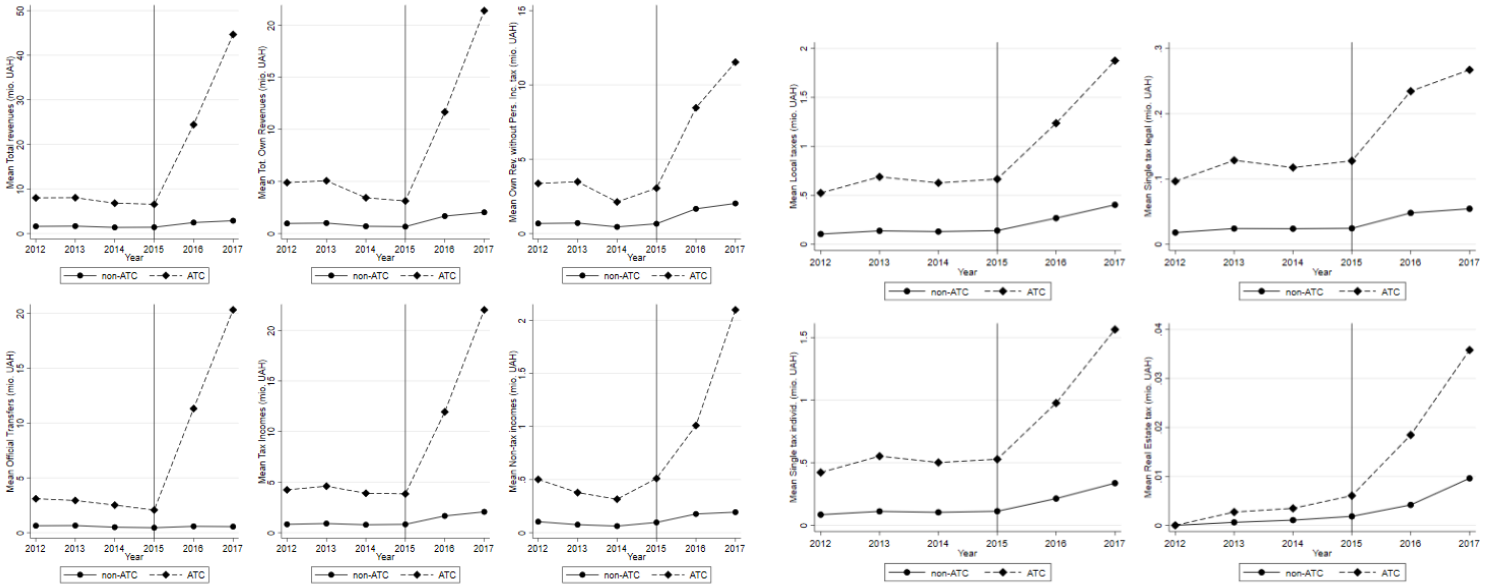

Figure 13. Parallel trends assumption – graphical test, selected tax revenues

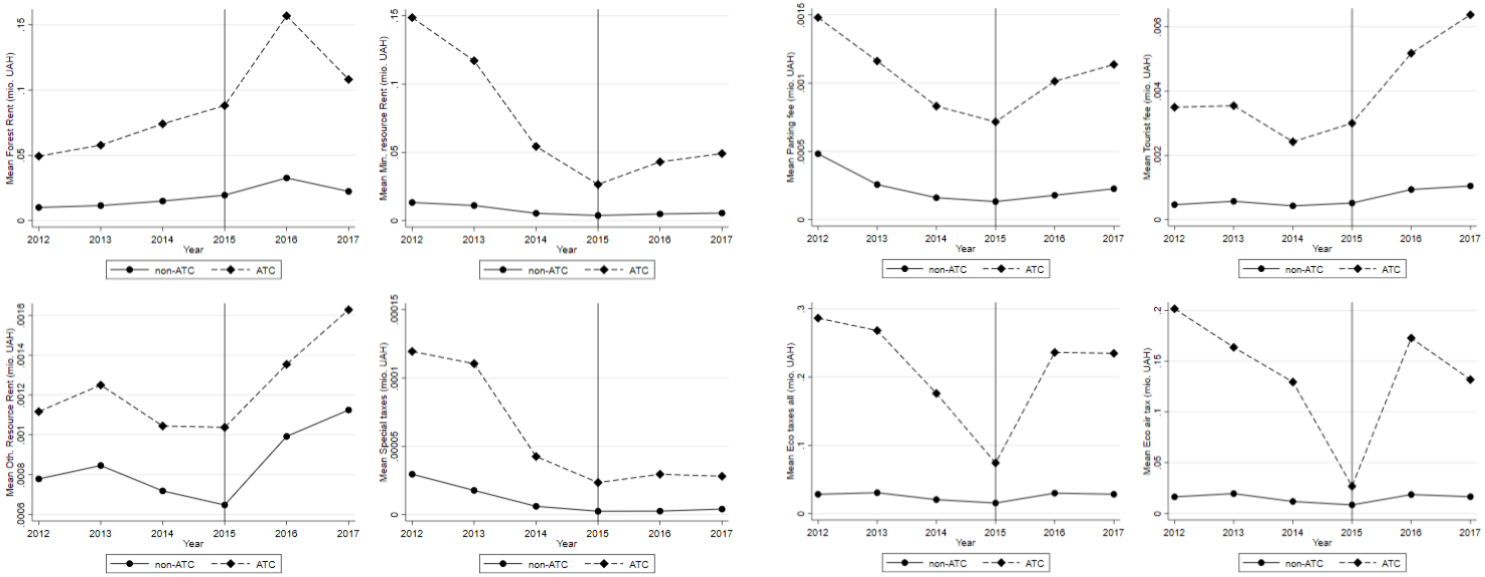

Figure 14. Parallel trends assumption – graphical test, selected local tax revenues

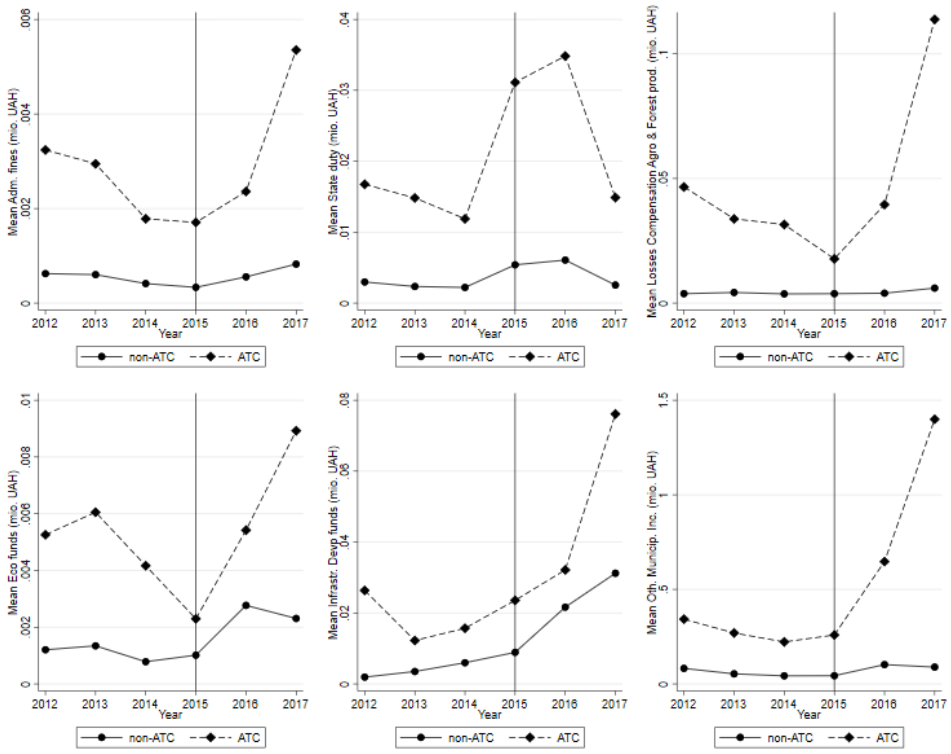

Figure 15. Parallel trends assumption – graphical test, selected non-tax revenues

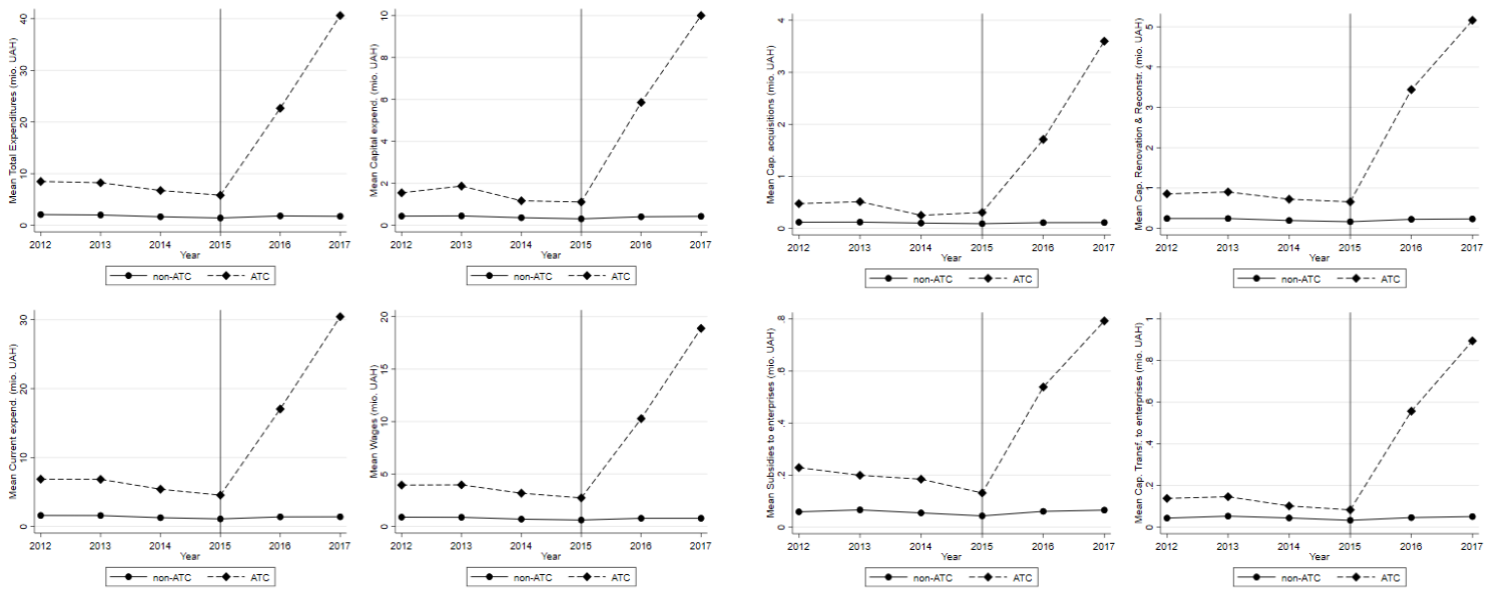

Figure 16. Parallel trends assumption – graphical test, selected expenditures by economic classification

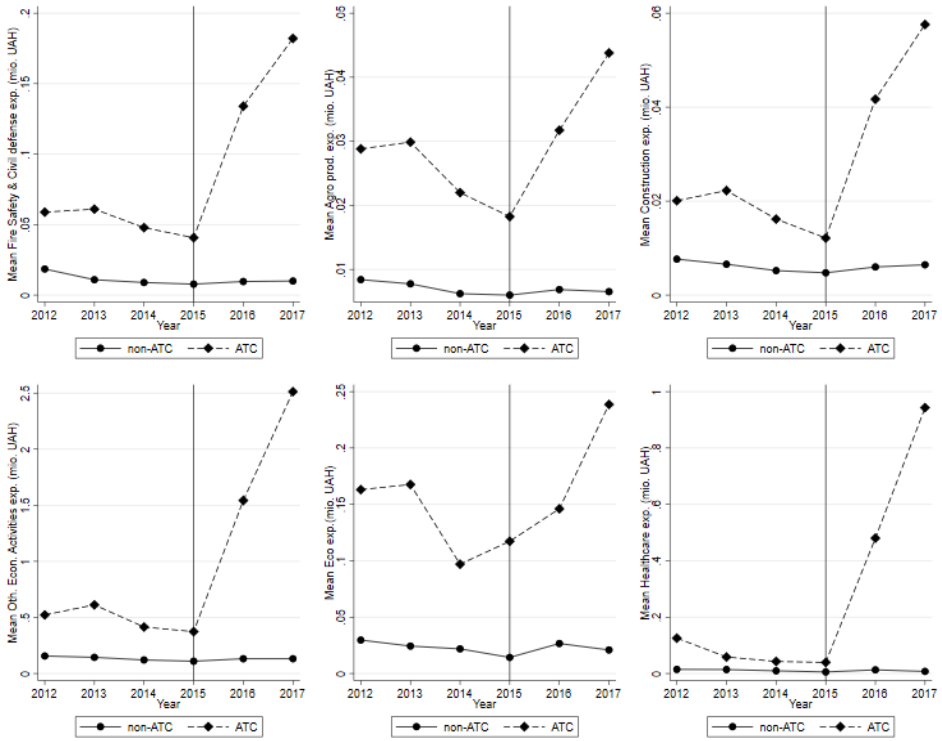

Figure 17. Parallel trends assumption – graphical test, selected expenditures by functional classification

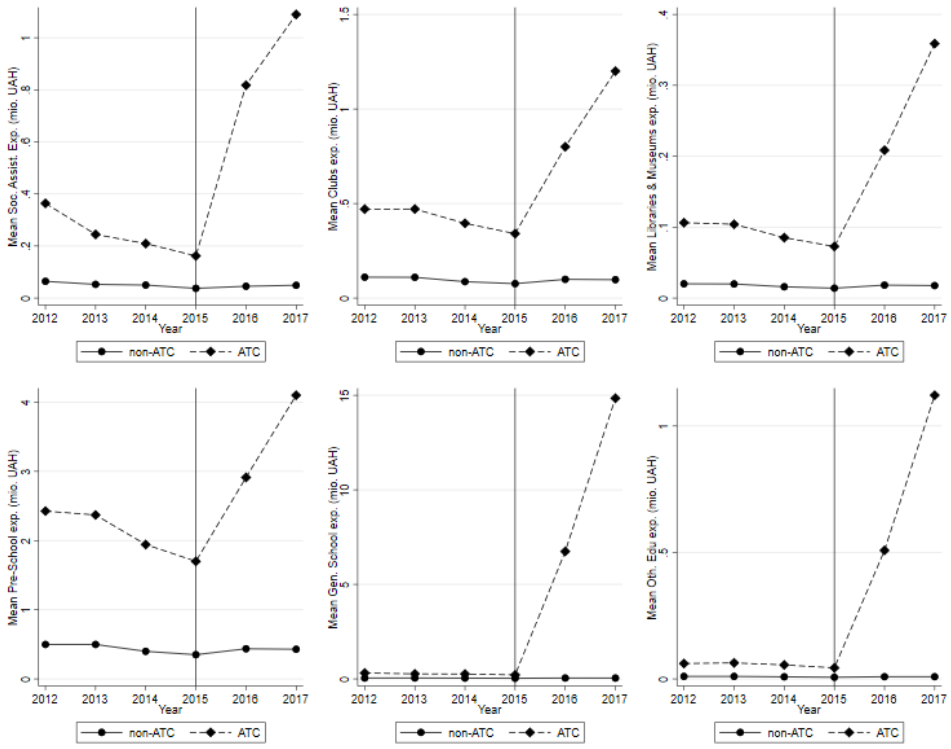

Figure 18. Parallel trends assumption – graphical test, selected expenditures on social assistance, culture and education

APPENDIX E. BASELINE BALANCE TESTS

Table 29. Baseline balance test in covariates

Outcome Variables (per capita)	Mean non-ATC (1)	Mean ATC (2)	Diff. (2-1)	t	Pr (T>t)
Total revenues	873.096	871.416	-1.680	0.030	0.975
Total own revenues	505.546	499.065	-6.482	0.180	0.860
Own revenues without PIT	413.162	383.094	-30.068	0.850	0.394
Tax incomes	522.310	498.124	-24.186	0.730	0.466
Non-tax incomes	44.384	56.739	12.355	1.480	0.139
Proceeds from capital management transactions	7.226	10.321	3.095	0.840	0.403
Special funds	3.900	3.258	-0.642	0.310	0.755
Official transfers	295.276	302.973	7.697	0.360	0.722
Natural resource rent, all types	20.071	18.402	-1.669	0.460	0.643
Forest rent	12.726	8.205	-4.522	2.870	0.0041***
Mineral resource rent	6.727	9.960	3.233	1.020	0.310
Other natural resources rent	0.618	0.237	-0.380	0.750	0.455
Special taxes	0.005	0.008	0.003	0.850	0.393
Advertisement tax	0.000	0.001	0.001	1.310	0.192
Municipal tax	0.005	0.006	0.002	0.550	0.580
Local taxes	49.690	63.041	13.351	4.990	0.0000***
Real estate tax	0.472	0.413	-0.059	0.430	0.666
Parking fee	0.038	0.083	0.045	3.390	0.0007***
Tourist fee	0.427	0.384	-0.043	0.070	0.947
Single tax on legal entities	7.208	10.936	3.728	4.150	0.0000***
Single tax on individuals	41.545	51.226	9.680	5.430	0.0000***
Ecological taxes, all types	10.556	27.877	17.321	1.700	0.0892*
Ecological tax – air pollution	5.992	8.082	2.090	0.220	0.827
Municipal profit	0.835	1.533	0.698	1.510	0.130
Administrative fines	0.204	0.265	0.061	2.300	0.0213**
Compensation for losses in agriculture & forest production	2.474	6.216	3.741	2.560	0.0105**
Municipal property rent	1.564	2.044	0.480	2.440	0.0147**
State duty	0.757	1.365	0.608	6.060	0.0000***
Environment protection funds	0.723	0.562	-0.161	0.920	0.356
Infrastructure development funds	1.187	2.830	1.643	2.580	0.0100**

TABLE 29 – Continued

Outcome Variables (per capita)	Mean non-ATC (1)	Mean ATC (2)	Diff. (2-1)	t	Pr (T>t)
Other municipal income	32.670	32.131	-0.539	0.070	0.945
Property sale	1.175	1.642	0.467	1.390	0.165
Land sale	5.935	8.639	2.704	0.740	0.461
Total expenditures	1041.230	853.754	-187.476	3.080	0.0021***
Current expenditures	861.163	680.890	-180.273	4.860	0.0000***
Wages expenditures	520.621	416.023	-104.599	8.060	0.0000***
Utilities bills expenditures	46.517	47.769	1.252	0.490	0.623
Development programs expenditures	18.842	11.921	-6.921	3.910	0.0001***
Capital expenditures	176.376	176.425	0.049	0.000	0.998
Transfers to enterprises	19.870	23.750	3.881	0.400	0.688
Subsidies to enterprises	11.540	14.017	2.477	0.490	0.626
Capital transfers to enterprises	8.329	9.734	1.404	0.280	0.779
Capital acquisitions	57.604	59.607	2.003	0.180	0.855
Capital renovation & reconstruction	94.435	91.650	-2.784	0.300	0.765
Local government expenditures	377.667	222.706	-154.962	14.230	0.0000***
Fire safety & civil defense expenditures	5.483	6.965	1.482	1.640	0.101
Roads expenditures	70.770	40.225	-30.545	3.790	0.0001***
Agriculture production expenditures	5.328	3.308	-2.020	2.140	0.0325**
Construction expenditures	4.177	2.097	-2.080	2.960	0.0031***
Other economic activities expenditures	57.273	67.933	10.660	0.550	0.581
Environment protection expenditures	10.902	13.522	2.619	0.550	0.582
Municipal economy expenditures	98.234	78.012	-20.222	1.910	0.0555*
Healthcare expenditures	0.460	3.050	2.590	6.870	0.0000***
Sports expenditures	3.329	1.699	-1.630	0.480	0.632
Clubs expenditures	80.701	60.974	-19.727	4.140	0.0000***
Libraries & museums expenditures	16.236	12.164	-4.072	5.240	0.0000***
Other culture expenditures	1.787	1.586	-0.201	0.570	0.566
Pre-school expenditures	179.730	236.085	56.355	8.800	0.0000***
General school expenditures	17.951	21.562	3.611	0.520	0.602
Social assistance expenditures	12.749	10.676	-2.073	1.510	0.130
Share of Own revenues in Total revenues	0.561	0.548	-0.013	2.290	0.0222**

TABLE 29 – Continued

Outcome Variables (per capita)	Mean non-ATC (1)	Mean ATC (2)	Diff. (2-1)	t	Pr (T>t)
Share of Official transfers in Total revenues	0.354	0.369	0.015	2.380	0.0171**
Share of Wages expenditures in Total expenditures	0.663	0.560	-0.103	9.780	0.0000***
Share of Local government expenditures in Total expenditures	0.435	0.301	-0.134	23.760	0.0000***
Base dotation	0.000	0.926	0.926	8.140	0.0000***
Stabilization dotation	5.821	7.931	2.110	3.510	0.0005***
Other subsidies	33.362	28.796	-4.566	1.440	0.149
Subvention for infrastructure projects	5.624	4.026	-1.598	0.670	0.501
Subvention for social assistance	0.144	2.237	2.093	7.060	0.0000***
Subvention for utilities' bills	0.000	0.464	0.464	8.240	0.0000***
Subvention for ATC	0.000	0.000	0.000	.	.
Subvention for education	0.586	0.470	-0.115	0.190	0.848
Subvention for medicine	0.000	0.403	0.403	4.710	0.0000***
Subvention for municipal economy	8.112	11.413	3.301	4.160	0.0000***
Subvention for socio-economic development	20.184	13.029	-7.155	0.410	0.684
Other subventions	114.176	109.711	-4.465	0.550	0.584
Land rental payments	1666.789	713.977	-952.812	7.630	0.0000***
Crop production value	13000.000	6219.047	-6400.000	5.870	0.0000***
Livestock production value	2922.467	1461.522	-1500.000	3.050	0.0023***
Crop production revenues	17000.000	8187.085	-8500.000	6.480	0.0000***
Livestock production revenues	3192.786	1657.429	-1500.000	2.370	0.0177**
Agriculture production revenues	20000.000	10000.000	-1.00e+04	6.300	0.0000***
Population	1712.282	8610.585	6898.303	89.070	0.0000***
Total area, ha per capita	5937.405	24000.000	18000.000	78.410	0.0000***
No. of Observations (baseline)	32,425	1,464	33,889	-	-

Notes: *** p<0.01; ** p<0.05; * p<0.1

APPENDIX F. BASIC DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Table 30. DiD Estimation Results – pooled baseline and follow-up periods, all budget indicators

Outcome Variables (per capita)	Total revenues	Total own revenues	Own revenues without PIT	Tax incomes	Non-tax incomes	Proceeds from capital sale	Special funds	Official transfers	Total expenditures	Current expenditures	Capital expenditures	Wages expenditures
Diff-in-diff	0.913***	0.531***	0.162***	0.559***	0.633***	-0.159*	0.0546	1.702***	1.326***	1.232***	1.906***	1.224***
	(0.0304)	(0.0396)	(0.0412)	(0.0454)	(0.0719)	(0.0901)	(0.0863)	(0.0677)	(0.0323)	(0.0305)	(0.127)	(0.0269)
Pre-reform t(0)												
non-ATC	6.547	5.871	5.619	6.722	3.047	-1.501	-1.330	5.061	6.659	6.541	3.053	6.106
ATC	6.602	5.943	6.875	5.947	3.305	-0.0765	-1.104	5.424	7.942	6.408	6.293	5.944
Diff t(0)	0.0553	0.0729	0.0186	0.0506	0.663	1.425	0.225	0.363	-0.0684	-0.106	1.334	-0.133
Post-reform t(1)												
non-ATC	7.136	6.695	6.695	5.896	2.641	-1.449	-1.346	5.090	6.685	6.513	3.038	6.077
ATC	8.104	7.298	5.638	7.332	4.344	-0.183	-1.066	7.155	6.590	7.667	4.373	7.197
Diff t(1)	0.968	0.604	0.180	0.609	1.296	1.266	0.280	2.065	1.257	1.126	3.240	1.092
Observations	50,776	50,776	50,769	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.189	0.183	0.247	0.147	0.031	0.020	0.001	0.029	0.046	0.042	0.025	0.052

Notes: Dependent variables in per-capita terms and logarithmic form
Standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 31. DiD Estimation Results – pooled baseline and follow-up perids, all tax revenues

Outcome Variables (per capita)	Natural resource rent, all types	Forest rent	Mineral resource rent	Other natural resources rent	Special taxes	Advertise ment tax	Municipal tax	Ecologica l taxes, all types	Ecologica l tax – air pollution	Municipal profit	Administr ative fines
Diff-in-diff	-0.0303	0.0508	-0.0289	0.0167	0.141***	0.0199***	0.114***	0.0485	0.101	0.245***	0.155***
	(0.122)	(0.118)	(0.0546)	(0.0179)	(0.0192)	(0.00683)	(0.0161)	(0.101)	(0.0949)	(0.0399)	(0.0475)
Pre-reform t(0)											
non-ATC	-0.394	-0.141	-2.127	-2.286	-2.312	-2.303	-2.325	-1.372	-1.676	-2.164	-2.018
ATC	0.243	-0.263	-1.684	-2.304	-2.507	-2.308	-2.332	-0.0916	-1.008	-2.047	-2.031
Diff t(0)	0.637	0.310	0.472	-0.0179	-0.170	-0.0250	-0.141	1.280	0.978	0.148	-0.167
Post-reform t(1)											
non-ATC	-0.0154	-0.573	-2.071	-2.283	-2.337	-2.307	-2.305	-1.142	-1.986	-2.195	-2.104
ATC	0.591	0.220	-1.599	-2.285	-2.341	-2.332	-2.466	0.187	-0.596	-1.771	-2.271
Diff t(1)	0.607	0.361	0.443	-0.00127	-0.0288	-0.00517	-0.0270	1.329	1.079	0.393	-0.0127
Observations	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.007	0.007	0.007	0.000	0.006	0.001	0.006	0.017	0.015	0.004	0.003

Notes: Dependent variables in per-capita terms and the logarithmic form
Standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 32. DiD Estimation Results – pooled baseline and follow-up periods, all non-tax revenues

Outcome variables	Municipal property rent	State duty	Environment protection funds	Infrastructure development funds	Other municipal income	Property sale	Land sale	Compensation for losses in agriculture & forest production
Diff-in-diff	-0.0910	-0.126	0.0469	0.619***	1.186***	-0.0558	-0.134*	0.0109
	(0.0900)	(0.0863)	(0.0608)	(0.0514)	(0.0998)	(0.0514)	(0.0806)	(0.0481)
Pre-reform t(0)								
non-ATC	-1.342	-1.851	-1.855	-1.839	1.709	-2.045	-1.657	-2.111
ATC	-0.741	-1.192	-1.574	-0.965	2.822	-1.698	-0.487	-1.788
Diff t(0)	0.692	0.718	0.0781	0.254	0.832	0.344	1.304	0.310
Post-reform t(1)								
non-ATC	-1.521	-1.910	-1.699	-2.166	1.991	-2.042	-1.721	-2.099
ATC	-0.829	-1.258	-1.777	-1.911	3.727	-1.757	-0.417	-1.789
Diff t(1)	0.601	0.593	0.125	0.874	2.018	0.288	1.169	0.321
Observations	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.007	0.006	0.003	0.032	0.018	0.004	0.021	0.004

Notes: Dependent variables in per-capita terms and the logarithmic form
Standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 33. DiD Estimation Results – pooled baseline and follow-up periods, local expenditures by functional classification

Outcome variables (per capita)	Fire safety & civil defense expenditures	Agriculture production expenditures	Construction expenditures	Other economic activities expenditures	Environment protection expenditures	Healthcare expenditures	Clubs expenditures	Other culture expenditures	General school expenditures
Diff-in-diff	0.722***	-0.0279	0.528***	1.787***	0.0496	1.530***	0.673***	1.003***	6.249***
	(0.0794)	(0.0935)	(0.0711)	(0.140)	(0.0868)	(0.0251)	(0.123)	(0.0676)	(0.0659)
Pre-reform t(0)									
non-ATC	-1.773	-1.234	-1.886	-0.253	-1.444	-2.285	2.915	-1.747	-2.092
ATC	-0.787	-0.372	-1.043	1.752	-0.102	-2.182	3.746	-1.323	-1.483
Diff t(0)	0.986	0.853	0.315	2.056	1.270	0.103	0.831	0.444	0.610
Post-reform t(1)									
non-ATC	-1.777	-1.226	-1.877	-0.304	-1.422	-2.286	2.949	-1.767	-2.093
ATC	-0.0700	-0.409	-1.562	3.590	-0.174	-0.653	4.453	-0.300	4.767
Diff t(1)	1.707	0.825	0.843	3.843	1.320	1.633	1.504	1.447	6.858
Observations	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.022	0.007	0.005	0.034	0.019	0.115	0.007	0.016	0.250

Notes: Dependent variables in per-capita terms and the logarithmic form
Standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 34. DiD Estimation Results – pooled baseline and follow-up periods, local expenditures by economic classification

Outcome variables (per capita)	Economic activity expenditures	Transfers to enterprises	Subsidies to enterprises	Capital transfers to enterprises	Capital acquisitions	Capital renovation & reconstruction	Utilities bills expenditures	Development programs expenditures
Diff-in-diff	1.511***	1.650***	1.244***	1.519***	2.037***	2.172***	1.226***	1.849***
	(0.133)	(0.103)	(0.0914)	(0.0757)	(0.128)	(0.155)	(0.0531)	(0.125)
Post-reform t(0)								
non-ATC	2.495	-1.413	-1.637	-1.863	1.309	0.869	3.298	-0.0663
ATC	5.305	0.317	-0.335	0.812	2.760	5.554	4.889	0.781
Diff t(0)	1.287	1.759	1.302	1.148	1.445	2.501	0.341	0.847
Post-reform t(1)								
non-ATC	2.506	-1.442	-1.610	-1.855	1.315	0.881	3.322	-0.0659
ATC	3.782	1.996	0.937	-0.715	4.791	3.370	3.639	2.630
Diff t(1)	2.799	3.409	2.546	2.667	3.483	4.673	1.567	2.695
Observations	50,776	50,776	50,776	50,776	50,776	50,776	50,776	50,776
R-squared	0.018	0.047	0.034	0.048	0.029	0.041	0.028	0.016

Notes: Dependent variables in per-capita terms and the logarithmic form
Standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

APPENDIX G. CORRELATIONS TABLE

Table 35. Pairwise Correlations between selected dependent variables and main lagged control variables

Variables (per capita)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Natural resource rent, all types	1.000										
(2) Forest rent	0.931*	1.000									
(3) Mineral resource rent	0.319*	0.028*	1.000								
(4) Other natural resources rent	0.104*	-0.007	0.011*	1.000							
(5) Special taxes	0.001	0.005	-0.018*	0.021*	1.000						
(6) Advertisement tax	0.006	0.011*	-0.005	0.008	0.273*	1.000					
(7) Municipal tax	-0.007	-0.004	-0.019*	0.020*	0.826*	0.049*	1.000				
(8) Local taxes	0.042*	0.031*	0.049*	0.002	-0.050*	-0.019*	-0.036*	1.000			
(9) Real estate tax	0.054*	0.052*	0.020*	0.015*	-0.002	0.006	0.009*	0.328*	1.000		
(10) Parking fee	0.016*	-0.000	0.058*	-0.004	-0.081*	-0.034*	-0.062*	0.477*	0.207*	1.000	
(11) Tourist fee	0.035*	0.024*	0.045*	0.004	-0.047*	-0.018*	-0.034*	0.958*	0.285*	0.326*	1.000
(12) Single tax on legal entities	0.011*	-0.029*	0.108*	0.044*	-0.050*	-0.020*	-0.034*	0.193*	0.133*	0.191*	0.178*
(13) Single tax on individuals	0.039*	-0.002	0.112*	0.045*	-0.046*	-0.019*	-0.030*	0.172*	0.133*	0.164*	0.156*
(14) Total own revenues	-0.063*	-0.088*	0.068*	0.023*	-0.018*	-0.003	-0.013*	0.254*	0.163*	0.149*	0.233*

TABLE 35 – Continued

Variables (per capita)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(15) Own revenues without PIT	-0.050*	-0.071*	0.064*	0.015*	-0.003	0.003	-0.002	0.280*	0.182*	0.138*	0.261*
(16) Total revenues	-0.042*	-0.062*	0.059*	0.020*	-0.015*	-0.004	-0.011*	0.252*	0.171*	0.155*	0.231*
(17) Total expenditures	-0.066*	-0.086*	0.050*	0.018*	-0.020*	-0.005	-0.013*	0.092*	0.074*	0.106*	0.074*
(18) Current expenditures	-0.073*	-0.088*	0.040*	0.009	-0.010*	0.005	-0.010*	0.036*	0.039*	0.047*	0.021*
(19) Wages expenditures	-0.054*	-0.059*	0.012*	-0.011*	0.014*	0.011*	0.008	-0.064*	-0.026*	-0.050*	-0.074*
(20) Official transfers	0.019*	0.016*	0.011*	-0.005	-0.007	-0.006	-0.008	0.060*	0.001	0.046*	0.059*
(21) Local government expenditures	-0.026*	-0.023*	-0.004	-0.005	0.060*	0.019*	0.042*	-0.166*	-0.074*	-0.184*	-0.174*
(22) Transfers to enterprises	-0.060*	-0.083*	0.048*	-0.012*	-0.108*	-0.030*	-0.081*	0.222*	0.154*	0.298*	0.208*
(23) Transfers to enterprises	-0.061*	-0.082*	0.047*	-0.016*	-0.115*	-0.036*	-0.085*	0.211*	0.157*	0.287*	0.197*
(24) Subsidies to enterprises	-0.051*	-0.070*	0.033*	-0.010*	-0.100*	-0.029*	-0.074*	0.191*	0.129*	0.255*	0.181*
(25) Capital transfers to enterprises	-0.019*	-0.041*	0.066*	0.021*	-0.041*	-0.010*	-0.033*	0.258*	0.112*	0.229*	0.247*
(26) Roads expenditures	0.017*	0.002	0.051*	0.032*	-0.039*	-0.006	-0.029*	0.197*	0.112*	0.179*	0.189*
(27) Capital acquisitions	-0.031*	-0.045*	0.044*	0.011*	-0.033*	-0.009	-0.027*	0.172*	0.082*	0.180*	0.160*
(28) Capital renovation & reconstruction	0.024*	0.000	0.078*	0.027*	-0.049*	-0.013*	-0.039*	0.259*	0.137*	0.266*	0.247*
(29) Development programs expenditures	0.046*	0.027*	0.061*	0.032*	-0.027*	0.001	-0.029*	0.114*	0.093*	0.115*	0.105*

TABLE 35 – Continued

Variables (per capita)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(30) Utilities bills expenditures	-0.079*	-0.100*	0.052*	0.012*	-0.042*	-0.013*	-0.030*	0.172*	0.095*	0.176*	0.163*
(31) Base dotation	0.012*	0.008	0.018*	-0.002	-0.001	0.003	-0.008	0.045*	0.061*	0.048*	0.045*
(32) Stabilization dotation	0.011*	0.014*	-0.010*	-0.008	-0.009	-0.000	-0.010*	-0.016*	0.001	0.017*	-0.018*
(33) Crop production value	-0.145*	-0.149*	-0.027*	0.017*	0.035*	0.009	0.034*	-0.058*	-0.029*	-0.136*	-0.048*
(34) Livestock production value	0.020*	0.025*	-0.001	-0.016*	-0.018*	0.005	-0.012	0.018*	0.062*	-0.018*	0.016*
(35) Agriculture production revenues	-0.148*	-0.152*	-0.029*	0.018*	0.035*	0.010	0.034*	-0.050*	-0.024*	-0.133*	-0.040*

Notes: Variables 1-13 are in the logarithmic form,
variables 14-35 are in the lagged logarithmic form
* $p < 0.05$

APPENDIX H. DESCRIPTION OF DEPENDENT AND CONTROL VARIABLES IN FIXED-EFFECTS REGRESSIONS

Table 36. List of dependent and control variables in fixed-effects regressions

Dependent variables	Control Variables
1. Proxies for business activity: Natural resource rent, all types (UAH per capita) Local taxes (UAH per capita) Real estate tax (UAH per capita) Single tax on legal entities (UAH per capita) Single tax on individuals (UAH per capita) Ecological taxes, all types (UAH per capita)	Lagged Subsidies to enterprises (UAH per capita) Lagged Capital transfers to enterprises (UAH per capita) Lagged Capital renovation & reconstruction (UAH per capita) Lagged Capital acquisitions (UAH per capita) Lagged Local government expenditures (UAH per capita) Lagged Development programs expenditures (UAH per capita) Lagged Municipal economy expenditures (UAH per capita) Lagged Base dotation (UAH per capita) Lagged Subvention for socio-economic development (UAH per capita) Lagged Land rental payments (UAH per capita)
2. Proxies for economic activity of residents: Tax incomes (UAH per capita) Parking fee (UAH per capita) Tourist fee (UAH per capita) State duty (UAH per capita)	Lagged Capital renovation & reconstruction (UAH per capita) Lagged Single tax on individuals (UAH per capita) Lagged Current expenditures (UAH per capita) Lagged Official transfers (UAH per capita) Lagged Local government expenditures (UAH per capita) Lagged Roads expenditures (UAH per capita) Lagged Municipal economy expenditures (UAH per capita) Lagged Sports expenditures (UAH per capita) Lagged Social assistance expenditures (UAH per capita)
3. Proxies for economic size or capacity: Total revenues (UAH per capita) Total expenditures (UAH per capita) Total own revenues (UAH per capita) Own revenues without PIT (UAH per capita) Current expenditures (UAH per capita) Wages expenditures (UAH per capita)	Lagged Official transfers (UAH per capita) Lagged Local government expenditures (UAH per capita) Lagged Capital expenditures (UAH per capita) Lagged Base dotation (UAH per capita) Lagged Subvention for ATC (UAH per capita) Lagged Mineral resource rent (UAH per capita) Lagged Land rental payments (UAH per capita)
4. Proxies for municipal property management: Non-tax incomes (UAH per capita)	Lagged Official transfers (UAH per capita) Lagged Local government expenditures (UAH per capita)

Municipal profit (UAH per capita) Municipal property rent (UAH per capita) Other municipal income (UAH per capita) Property sale (UAH per capita) Land sale (UAH per capita)	Lagged Subvention for ATC (UAH per capita) Lagged Base dotation (UAH per capita) Lagged Stabilization dotation (UAH per capita) Lagged Other subsidies (UAH per capita) Lagged Subvention for socio-economic development (UAH per capita) Lagged Land rental payments (UAH per capita) Lagged Local taxes (UAH per capita)
5. Quick demonstration of the monetary effect of ATC formation, or "PR" expenditures: Roads expenditures (UAH per capita) Municipal economy expenditures (UAH per capita) Sports expenditures (UAH per capita) Clubs expenditures (UAH per capita) Libraries & museums expenditures (UAH per capita)	Lagged Subvention for municipal economy (UAH per capita) Lagged Base dotation (UAH per capita) Lagged Stabilization dotation (UAH per capita) Lagged Subvention for ATC (UAH per capita) Lagged Subvention for infrastructure projects (UAH per capita) Lagged Subvention for socio-economic development (UAH per capita) Lagged Other subsidies (UAH per capita) Lagged Other subventions (UAH per capita)
6. Proxies for local government size, or "toxic" expenditures: Local government expenditures (UAH per capita) Wages expenditures (UAH per capita)	Lagged Local taxes (UAH per capita) Lagged Capital renovation & reconstruction (UAH per capita) Crop production value (UAH per capita) Livestock production value (UAH per capita)
7. Proxies for the support to the local business and organizations: Capital expenditures (UAH per capita) Development programs expenditures (UAH per capita) Capital acquisitions (UAH per capita) Capital renovation & reconstruction (UAH per capita) Subsidies to enterprises (UAH per capita) Capital transfers to enterprises (UAH per capita)	Lagged Local government expenditures (UAH per capita) Lagged Base dotation (UAH per capita) Lagged Subvention for ATC (UAH per capita) Lagged Subvention for infrastructure projects (UAH per capita) Lagged Subvention for socio-economic development (UAH per capita) Lagged Other subsidies (UAH per capita) Lagged Local taxes (UAH per capita) Lagged Land rent. payments (UAH per capita)
8. Healthcare expenditures (UAH per capita)	Lagged Base dotation (UAH per capita) Lagged Subvention for ATC (UAH per capita) Lagged Subvention for medicine (UAH per capita)
9. Expenditures on education: Pre-school expenditures (UAH per capita) General school expenditures (UAH per capita)	Lagged Subvention for education (UAH per capita) Lagged Base dotation (UAH per capita) Lagged Subvention for ATC (UAH per capita)
10. Social assistance expenditures (UAH per capita)	Lagged Base dotation (UAH per capita) Lagged Subvention for ATC (UAH per capita) Lagged Subvention for social assistance (UAH per capita)

APPENDIX I. ADDITIONAL ROBUSTNESS CHECKS

Table 37. DiD Estimation with Bootstrapped Standard Errors – fixed-effects panel model, selected local tax revenues

Outcome Variables (per capita)	Natural resource rent, all types	Forest rent	Mineral resource rent	Special taxes	Advertisement tax	Municipal tax	Local taxes	Real estate tax	Single tax on legal entities	Single tax on individuals	Ecological taxes, all types
Diff-in-Diff	0.0341	0.0904	0.0065	0.0368	0.0007	0.036	0.0386	0.6920***	0.2868***	0.0620**	0.0472
	-0.1664	-0.0869	-0.1057	-0.0216	-0.0037	-0.0232	-0.02	-0.0384	-0.0625	-0.0232	-0.0293
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-1.1104***	-1.0160***	-2.5351***	-2.3130***	-2.2965***	-2.3282***	3.3631***	-2.0589***	-0.7530***	3.2257***	-1.1177***
	-0.1164	-0.1572	-0.1103	-0.0172	-0.0043	-0.0181	-0.1142	-0.1752	-0.2132	-0.0668	-0.0878
Observations	42296	42296	42296	42296	42296	42296	42296	42296	42296	42296	42296
Adjusted R-squared	0.034	0.048	0.007	0.002	0	0.002	0.409	0.187	0.048	0.407	0.059

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 38. DiD Estimation – random-effects panel model, selected local tax revenues

Outcome Variables (per capita)	Natural resource rent, all types	Forest rent	Mineral resource rent	Special taxes	Advertisement tax	Municipal tax	Local taxes	Real estate tax	Single tax on legal entities	Single tax on individuals
Diff-in-Diff	0.0636	0.1051	0.0368	0.0530*	0.0024	0.0332	0.0370	0.6627***	0.2978***	0.0589*
	(0.0673)	(0.0604)	(0.0568)	(0.0255)	(0.0064)	(0.0218)	(0.0248)	(0.0732)	(0.0666)	(0.0249)
FE – Year & Local Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urban-type settlement		-0.4269***	-0.5065***	0.0294	-0.0701***	-0.0063	-0.0311**	0.5090***	0.2756***	1.3344***
	(0.1205)	(0.1154)	(0.0629)	(0.0150)	(0.0046)	(0.0109)	(0.0407)	(0.0633)	(0.1058)	(0.0390)
Population > 5K people	-0.0596	-0.0887	0.1236	-0.1197***	-0.0089	-0.0693***	0.5325***	0.3647***	1.8008***	0.4998***
	(0.1301)	(0.1243)	(0.0695)	(0.0198)	(0.0059)	(0.0135)	(0.0480)	(0.0654)	(0.1085)	(0.0460)
Area > average 5.8K ha	0.5819***	0.6501***	-0.0473*	0.0045	0.0029*	0.0050	-0.0099	-0.0869**	0.2697***	-0.0131
	(0.0629)	(0.0612)	(0.0233)	(0.0051)	(0.0013)	(0.0036)	(0.0228)	(0.0271)	(0.0466)	(0.0228)
Amalgam. in 2015	0.3165	0.0354	0.3474**	0.0457	-0.0086	0.0178	-0.0790	-0.0619	-0.1523	-0.0786
	(0.1985)	(0.1896)	(0.1255)	(0.0253)	(0.0086)	(0.0208)	(0.0606)	(0.0752)	(0.1544)	(0.0584)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.7657***	-0.6939***	-2.5135***	-2.3328***	-2.3027***	-2.3519***	2.9695***	-2.5154***	-1.4935***	2.9725***
	(0.1505)	(0.1446)	(0.0752)	(0.0230)	(0.0064)	(0.0197)	(0.0811)	(0.1193)	(0.1450)	(0.0793)
Observations	42,296	42,296	42,296	42,296	42,296	42,296	42,296	42,296	42,296	42,296

Notes: Dependent variables in per-capita terms and the logarithmic form. Clustered standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

Table 39. DiD Estimation – two aggregate pre- and post-reform periods, selected local expenditures

Expenditures (per capita)	Local government	Wages	Roads	Municipal economy	Sports	Clubs	Libraries & museums	Other culture
Diff-in-Diff	0.8298***	1.4313***	1.8354***	1.6414***	3.4095***	1.2533***	6.9535***	2.6382***
	(0.0192)	(0.0263)	(0.2091)	(0.0953)	(0.3026)	(0.0738)	(0.3660)	(0.2995)
ATC	0.3449***	0.0550*	-0.4358**	-0.8021***	0.0410	1.5082***	1.0013*	-1.0326**
	(0.0224)	(0.0217)	(0.1369)	(0.1028)	(0.3558)	(0.2018)	(0.4447)	(0.3568)
Post-reform period	-0.0114	-0.0012	-1.4634***	-0.3944***	-0.6368***	-0.5168***	-0.2499***	-0.4800***
	(0.0066)	(0.0050)	(0.0767)	(0.0400)	(0.0559)	(0.0426)	(0.0309)	(0.0506)
Log Population	0.3202***	0.5260***	1.3220***	0.3828***	2.1552***	-0.0687	-1.7475***	1.0575***
	(0.0181)	(0.0210)	(0.1213)	(0.0844)	(0.1873)	(0.1230)	(0.2220)	(0.1631)
Log Area	0.1256***	0.1230***	-0.3843***	0.6608***	-0.4805***	0.9817***	0.8582***	0.3396**
	(0.0092)	(0.0105)	(0.0730)	(0.0561)	(0.1201)	(0.1009)	(0.1440)	(0.1121)
Urban-type settlement	0.2284***	0.2835***	-0.4258**	1.1031***	-0.1557	-2.8077***	-0.1768	2.3442***
	(0.0248)	(0.0261)	(0.1454)	(0.0881)	(0.3149)	(0.2557)	(0.3566)	(0.3217)
Lagged Subvention for municipal economy	0.0019	0.0021	0.1045***	-0.0228**	-0.0036	-0.0063	0.1440***	0.0058
	(0.0012)	(0.0015)	(0.0154)	(0.0075)	(0.0168)	(0.0118)	(0.0227)	(0.0173)
Lagged Base dotation	0.0687***	0.0640***	-0.0176	0.0720***	0.2498***	-0.0702***	0.4013***	0.3615***
	(0.0019)	(0.0020)	(0.0146)	(0.0088)	(0.0248)	(0.0159)	(0.0310)	(0.0258)
Lagged Stabilization dotation	-0.0091***	0.0050***	-0.0371***	-0.0686***	-0.0131	-0.0036	-0.0918***	-0.0012
	(0.0009)	(0.0010)	(0.0083)	(0.0063)	(0.0121)	(0.0088)	(0.0169)	(0.0123)
Lagged Subvention for infrastructure projects	0.0011	0.0027	-0.0578***	0.0238***	0.0353	0.0098	-0.2204***	0.0196

TABLE 39 – Continued

Expenditures (per capita)	Local government	Wages	Roads	Municipal economy	Sports	Clubs	Libraries & museums	Other culture
Lagged Subvention for socio-economic development	-0.0001	0.0022*	0.0003	-0.0061	0.0101	-0.0027	0.0276	0.0062
	(0.0009)	(0.0010)	(0.0078)	(0.0050)	(0.0122)	(0.0089)	(0.0164)	(0.0122)
Lagged Other subsidies	0.0003	0.0095***	-0.0227**	-0.0191***	-0.0383***	0.0467***	0.0352*	-0.0193
	(0.0008)	(0.0009)	(0.0076)	(0.0049)	(0.0105)	(0.0078)	(0.0146)	(0.0106)
Lagged Other subventions	0.0022*	0.0218***	0.0029	0.0296***	-0.0034	0.1154***	0.1485***	0.0285*
	(0.0010)	(0.0012)	(0.0110)	(0.0074)	(0.0130)	(0.0115)	(0.0192)	(0.0125)
Lagged Local taxes	0.0630***	0.0551***	0.4465***	0.3801***	0.1047	-0.1203*	0.3880***	0.2084**
	(0.0081)	(0.0089)	(0.0656)	(0.0456)	(0.0805)	(0.0493)	(0.1117)	(0.0697)
Lagged Capital renovation & reconstruction	0.0058***	0.0023*	0.0901***	0.0530***	0.0657***	0.0331***	-0.0037	-0.0021
	(0.0010)	(0.0011)	(0.0124)	(0.0075)	(0.0116)	(0.0094)	(0.0198)	(0.0125)
Lagged Crop production value	0.0097***	0.0101***	0.0073	0.0499***	-0.0613***	0.0102	0.0941***	0.0582***
	(0.0013)	(0.0015)	(0.0105)	(0.0092)	(0.0171)	(0.0134)	(0.0203)	(0.0151)
Lagged Livestock production value	-0.0014*	0.0005	0.0035	0.0011	-0.0025	0.0018	0.0068	-0.0024
	(0.0006)	(0.0006)	(0.0057)	(0.0036)	(0.0077)	(0.0056)	(0.0111)	(0.0078)
Constant	8.8202***	7.6433***	-3.0433***	-2.5080***	-10.3097***	2.4851**	1.3566	-12.5197***
	(0.0752)	(0.0857)	(0.7202)	(0.5343)	(1.0090)	(0.8071)	(1.3829)	(1.0333)
Observations	9053	9053	9053	9053	9053	9053	9053	9053
Adjusted R-squared	0.751	0.847	0.252	0.332	0.228	0.164	0.102	0.177

Notes: Dependent variables in logarithmic form. Clustered standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

APPENDIX J. PLACEBO ANALYSIS

Table 40. DiD Placebo Analysis – aggregate local revenues and expenditures

Outcome Variables (per capita)	Total revenues	Total own revenues	Own revenues without PIT	Other municipal income	Total expenditures	Current expenditures
Diff-in-Diff proxy	-0.0365*	-0.0375*	-0.0260	0.2893***	0.0131	0.0024
	(0.0151)	(0.0177)	(0.0184)	(0.0415)	(0.0159)	(0.0120)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.5949***	6.0132***	5.6910***	2.6610***	6.8071***	6.6597***
	(0.0036)	(0.0041)	(0.0043)	(0.0127)	(0.0045)	(0.0039)
Observations	33888	33888	33881	33888	33888	33888
Adjusted R-squared	0.050	0.258	0.235	0.146	0.120	0.157

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 41. DiD Placebo Analysis – selected capital expenditures

Expenditures (per capita)	Capital expenditures	Capital acquisitions	Capital renovation & reconstruction	Development programs expenditures	Roads	Subsidies to enterprises	Capital transfers to enterprises
Diff-in-Diff proxy	-0.0873	-0.0708	-0.1557	-0.0535	-0.1273	0.0299	-0.1071
	(0.0561)	(0.0696)	(0.0882)	(0.1046)	(0.0766)	(0.0587)	(0.0762)
FE – Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.2191***	1.4909***	1.0413***	0.0600*	1.3538***	-1.5740***	-1.8077***
	(0.0220)	(0.0231)	(0.0250)	(0.0238)	(0.0241)	(0.0101)	(0.0101)
Observations	33888	33888	33888	33888	33888	33888	33888
Adjusted R-squared	0.005	0.004	0.002	0.001	0.002	0.000	0.000

Notes: Dependent variables in per-capita terms and the logarithmic form
Clustered standard errors in parentheses
*** p<0.01; ** p<0.05; * p<0.1

Table 42. DiD Placebo Analysis – selected targeted expenditures

Expenditures (per capita)	Pre-school	General school	Healthcare	Social assistance
Diff-in-Diff proxy	-0.0365	0.1299	0.0108	0.0593
	(0.0695)	(0.0794)	(0.0423)	(0.0823)
FE – Year	Yes	Yes	Yes	Yes
FE – Local Community	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes
Constant	1.5050***	-1.8605***	16.2362***	0.3053*
	(0.3365)	(0.3274)	(3.7900)	(0.1553)
Observations	25416	25416	25416	25416
Adjusted R-squared	0.004	0.000	-0.000	0.004

Notes: Dependent variables in per-capita terms and the logarithmic form. Clustered standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1