REGIONAL POLICY IN UKRAINE – IMPORTANCE FOR POST-WAR RECONSTRUCTION

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Abstract. Our analysis sets out a methodology for evaluating the effectiveness of regional development programmes in Ukraine. Specifically, we investigate to what extent the Ukrainian approach to regional development policy resembles the successful approach taken by the EU programmes of Cohesion Policy in the post-2004 New Member States. In addition, drawing on initial versions of Ukrainian national and regional models, we illustrate how the bottom-up regional approach initiated in Ukraine needs to be co-ordinated with a top-down national perspective that identifies and distinguishes national development objectives from specifically regional objectives. Such methodologies, suitably adapted, will be required during post-war reconstruction.

Keywords: macroeconomic models, regional development, regional strategies.

Introduction

This paper arises out of a project commissioned by U-LEAD in mid-2021.[1] The task was initially specified in rather broad terms: to carry out research on how the impact and effectiveness of a proposed series of regional policy reforms and actions in the Ukrainian oblasts could be evaluated quantitatively. As we started to address this task, it became apparent that the scope of the work had to be extended to include a range of deeper related issues concerning the need to understand the structure and performance of the Ukrainian regional economies; the availability of appropriate data at the NUTS 2 (or oblast) level; the desirability of constructing simple regional models to form the basis of a methodology for quantitative policy impact evaluation; the content and logic of the regional development strategies being drawn up by the oblast administrations; and the specific selection of policy decisions that were proposed in action plans, the impacts of which needed to be evaluated.

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[1] U-LEAD with Europe: Ukraine – Local Empowerment, Accountability and Development Programme is a multi-donor action of the European Union and its member states Germany, Poland, Sweden, Denmark, Estonia, and Slovenia to support Ukraine on its path to strengthening local self-government.

The range of issues we had to address embraced many of the themes that include the fact that Ukraine is still in the process of transitioning from its old Soviet legacy to eventual EU membership; the role of economic development in preparing Ukraine and its regions for full exposure to competition in global and regional markets; addressing the spatial heterogeneity of levels of development and standards of living in the oblasts; and the internal and external dimensions of the development process.

The deadline for delivery of our work and its presentation to the staff of the Ministry of Territories and Communities Development of Ukraine (MinRegion) in Kyiv was set for early March 2022. However, after the Russian invasion commenced on February 24th, Ukraine was moved to a war footing. The plans of the Ukrainian State and of their regional administrations to develop and modernise their economies, improve infrastructure, educate, and train their people, and benefit from closer links to Europe, needed to be put on hold. In the specific perspective of economic development, the envisaged pre-war broad regional policy focus would first have to be replaced by emergency repair of war-damaged infrastructure, resumption of normal production and trading activities of enterprises and restoration of peaceful dealings with the rest of the world.

Although the analysis contained in the pre-war Ukrainian *Regional Development Strategies* (RDSs) and the improvements proposed in the *Regional Action Plans* (RAPs) have been overtaken by events, a strong case can be made for their continued relevance.[2] It would be reasonable to assume that large elements of the pre-war regional analysis and strategy will continue to be of use once the initial post-war reconstruction of basic infrastructure commences.

The main aim of our paper is to show the role that could be played by national and regional macroeconomic modelling in shaping regional policy in Ukraine after the war. It draws on our final report to U-LEAD and MinRegion and the paper is structured as follows.[3] Against the background presented in the literature review, we set out the research challenge that we faced as we developed tools for the quantitative evaluation of the impacts of regional policy actions in all the Ukrainian oblasts.[4] To the best of our knowledge, there had been no previous attempt to model the economies of the oblasts, so we were entering into new research territory.

In the methodology and data section, we briefly discuss the pre-war advances that were in the oblasts in developing regional development strategies and plans. The main data and the methodology, i.e. the HERMIN modelling framework, are subsequently presented.

In the Results section, we describe the preliminary analysis that we carried out of the likely impacts of the pre-war RAPs, based on applications of the new regional models.[5] Although these results only apply to a peaceful and orderly pre-war world that has now been brutally disrupted, nevertheless this is the kind of analysis that will be needed, in a revised form, when port-war reconstruction gets under way. Benefits from reformed regional policies will only be relevant after post-war basic reconstruction, but they will still be available as Ukraine recovers and peace is restored.

Then we discuss how the bottom-up regional approach initiated in Ukraine needs to be co-ordinated with a top-down national perspective that identifies and distinguishes national development objectives from specifically regional objectives. The successful reconciliation of these two perspec-

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[2] For more detail see: Council of Ministers (2020); Lviv Oblast Council (2020); Odesa Oblast Council (2020a, 2020b); Zakarpathia Oblast Council (2020); Cherkasy Oblast Council (2020a, 2020b); Chernigiv Oblast Council (2019a, 2019b); Zaporizhzhia Oblast Council (2019a, 2019b).

[3] The full report is downloadable at http://www.herminonline.net/index.php/news.

[4] The autonomous region of Crimea was excluded from our terms of reference. However, the oblasts of Luhansk and Donetsk, then only partially controlled by Russian dominated separatist forces since 2014, were included.

[5] Space restrictions prevent inclusion of model descriptions. However, full details are available in the final report (see footnote 3). Our focus in this paper is on the methodology of regional impact analysis.

tives will be a vital element of post-war Ukrainian nation building.

Finally, we present the main conclusions and set out some proposals that might be beneficial as Ukraine faces into the daunting task of post-war reconstruction and orients its economy towards full integration into the EU Single Market.

Literature review

When faced with the requirement to quantify the likely impacts of regional policy actions, an obvious question to pose is the following: Are economic data, analysis and models needed for policy impact analysis? Surely 'monitoring' fulfils much the same role, with no need for data and models? However, policy monitoring is very different from policy impact evaluation. Monitoring indicators can be used to show (for example) how many km of motorway have been constructed; how many people have been re-trained; or how much and what type of R&D has been carried out. In other words, monitoring addresses the question of whether the financial allocations were spent on the approved measures and mainly asks if programmes were delivered effectively and on time.[6]

Monitoring by itself cannot identify the role of road improvements in boosting the performance of a regional economy. In addition, the size and complexity of the Ukrainian RAPs (to be discussed below) means that models are needed to evaluate their impacts on the economy, in the short term as well in the longer term. Without models, one is unable to isolate the separate influences of RAPs from all the other internal and external factors that drive a small, open, Ukrainian regional economy. In addition, the financial injections in the RAPs can be so large that they generate macroeconomic consequences that affect all aspects of the economy, and not just the areas that are directly influenced by the investments. Examples would include sectoral output and productivity).

The body of literature about regional development in Ukraine is steadily growing. However, research studies applying quantitative methods, including macroeconomic modelling, to investigate the mechanisms underlying regional development or the policy impacts are rather scarce. This follows from the fact that Ukraine's regional economies are still in transition and, consequently, are experiencing major structural changes. As a result, any econometric inference is quite a challenge in these circumstances. We have identified a number of studies based on simple single-equation models. For example, Getzner and Moroz (2022), used panel data-based models to investigate the role of different aspect of territorial capital on regional development in Ukraine. Chugaievska et al. (2020) use a gravity growth model to simulate labour productivity trajectories across Polish and Ukrainian NUTS 2 regions. Other studies apply econometric methods to examine regional development in Ukraine, e.g., Nosova (2017) investigates the role of restructuring for regional development and Naumenko (2013) uses input-output models to analyse economic disparities in Ukraine.

Although there are numerous macroeconomic model-based studies produced by Ukraine's Central Bank and the Kyiv School of Economics, these focus on the national economy rather than on regional economies. As macroeconomic models allow for various channels through which public support may affect the regional economy, they are more likely to capture a greater spectrum of feedbacks and interlinks in the economic system due to the public intervention.[7] In consequence, one can explore different mechanisms through which development polices affect

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[6] Cost-benefit analysis of each individual project can be carried out as a form of 'micro' impact evaluation. But in practice this is extremely difficult to do and requires even more knowledge and data than the kind of macro-regional impact analysis that we are discussing (see Bradley et al., 2006).

[7] The drawbacks of the single-equation aggregate models, e.g., neoclassical-type growth models, are clearly shown in Rodrik (2005).

economic growth. Hence, macroeconomic modelling can become a crucial element of the analysis of the effects of public interventions.

Progress made in constructing harmonised national and regional Ukrainian databases opened up the opportunity to construct prototype national and regional models for Ukraine based on the first version of the databases.[8] The progression of work in Poland/EU, compared to the initial stages of the Ukrainian work, is illustrated in Figure 1.
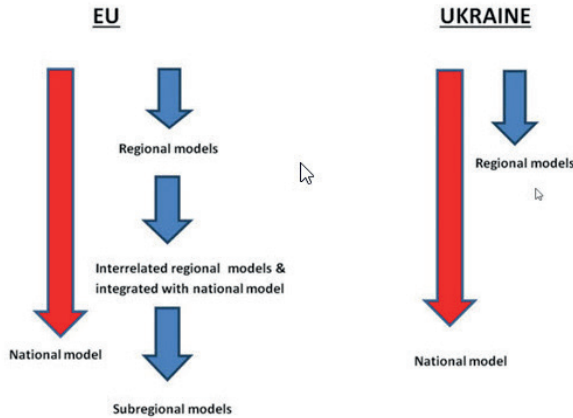

Figure 1. Tools for regional policy analysis

It must be stressed that the Polish research evolved over an extended period during which it was possible to develop models and analysis methodologies of increasing sophistication. The challenge in the Ukrainian project was to initiate this kind of research along the general lines of the early stages of the Polish policy research.

Methodology and data

The Ukrainian national economy consists of 25 regional economies at the NUTS 2 (oblast) level that are very diverse and differ greatly in their level of development and external orientation. We studied this diversity and the challenges that it posed to central government as it guided the Ukrainian economy increasingly towards closer integration with the EU. As part of the process of reforming central and local governance, over the years 2018-2021 MinRegion in Kyiv drew up a template for how regions could prepare for more systematic and cohesive development and invited each region to prepare a Regional Development Strategy (RDS) as a benchmark, followed by a Region Action Plan (RAP) that would set out specific programmes of investment to address identified barriers to growth.

We collated a complete set of Ukrainian *RDSs* covering the period 2021-2027, and RAPs for the period 2021-2023. Since the time allocated to the project was short, we selected six regions for initial detailed analysis and modelling. The six regions selected were: Lviv, Zakarpattia, Chernihiv, Zaporizhzhia, Odesa and Cherkasy. The logic behind this selection is as follows:
1. Two of the oblasts represent mountain regions: Zakarpattia and Lviv,
2. Two of the oblasts represent the Azov-Black Sea regions: Odesa and Zaporizhzhia,

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[8] Full details of the database construction is available in the complete report. Refer footnote 3.

3. Four of the oblasts represent border regions: Zakarpattia (bordering four countries: Hungary, Slovakia, Romania & Poland); Chernihiv (bordering two countries: Belarus and Russia); Lviv (bordering one country: Poland); and Odesa (bordering two countries: Moldova & Romania).
4. One of the oblasts is close to occupied zones (Zaporizhzhia), and specific references to the economic consequences of this location are made in the SWOT analysis of the Zaporizhzhia Regional Development Strategy (Zaporizhzhia Oblast Council, 2019b).
5. Three of the oblasts represent regions with significant urban agglomerations (Odesa, Lviv and Zaporizhzhia).
6. All six oblasts contain natural preservation areas and monuments which are elements of the 'emerald network' (Ukrainian Natura 2000).
7. All of the five 'macro-regions' (i.e., geographical groupings of regions in North, South, East, West and Central Ukraine) are represented.

The RDSs were prepared and approved during the years 2019 and 2020 and followed best practice and EU standards. There was an obvious coordination between strategies in that all of them followed a unified structure. However, they are not without the flaws. First, the RDSs have only a seven-year perspective. The practice from EU Cohesion Policy regions suggests the desirability of a longer perspective of 10 years and more. A longer timeframe seems to be more appropriate for the long-run vision of the regional development. Second, spatial analysis at the sub-oblast level was rare or missing. The RDSs do not identify functional areas and areas of strategic intervention inside the oblast, and they do not propose policy intervention addressed to such specifically identified areas, as it is described as place based approach. Third, a very limited effort was made to recognise the need to align strategies with adjoining regions. Nevertheless, the regional strategies provided a good starting point for the subsequent compilation of RAPs.

RAPs contain quantitative information on programmes to be implemented and finance to be allocated. Where financial allocations exist, they were extracted and re-classified into the following four economic categories:
1. physical infrastructure,
2. human resources,
3. direct assistance to productive sector
4. social and institution building allocations.

The basis for the structure and content of the RAP was derived from the prior RDS, including a regional SWOT analysis. In effect, the RAPs implement the regional strategy and are reasonably well structured programs following best practice and EU standards. In addition to containing broad programs, they also contain very detailed catalogues of individual projects and tasks.

The three-year duration of the RAPs over 2021-2023 is obviously too short a time for realization of any desired 'game changer' projects that would be likely to put the development of Ukrainian regions on radically new trajectories. The longer seven-year duration used in EU Structural Fund programmes is more likely to induce a fundamental shift in the development trajectories of assisted EU states and regions and future Ukrainian RAPs will probably move to that longer duration.

Unlike the case of the RDSs, where analysis was fairly uniform, there is far less coordination between the RAPs across oblasts. The RAPs also have differing standards of summary financial tables and treatment of the balance between regional to national financing of proposed investment programmes. There are also some inconsistencies in the financial tables, missing data, and lack of clarity with respect to the size and role of private and international support financing.

There were some very big differences in total financial allocations for the period 2021-2023, when expressed relative to the size of the oblast's GDP: ranging from 3.75% to more than 100% of GDP in different regions. Unlike the case of EU regional development programmes, where the EU finances the bulk of the investments with a fairly modest domestic co-finance element, in the Ukrainian RAPs the bulk of the finance would have to come from domestic national or regional budgets. So it became apparent that the RAPs were more like a wish list of desirable projects than a list of projects that could realistically be financed domestically.

Infrastructure investments dominated the RAP financial allocations, but the social and institutional building allocation is much higher than (say) in the Regional Operational Programs of EU Cohesion Policy. The proportions allocated to direct assistance to the enterprise sectors varied from high to very low, and there were mainly small allocations for human resources development.

Specific mechanisms to implement the RAPs had to be incorporated into the regional models and this is done in a way that mirrors well established methodologies used in EU Member States for the evaluation of EU regional development policies and draws of recent advances in growth theory.[9]

For the purpose of our research study, we constructed the first macroeconomic databases both at the national and regional level which can be used for a coherent and robust model-based analysis. These consists of annual time series of data covering the period 2000-2020. Where necessary, various data interpolation methods were used to fill the data gaps. Importantly, we examined a wide spectrum of databases, from international databanks such as the OECD database, the World Bank database, Eurostat, to data banks administered by Ukrainian public statistics (UKRSTAT) and its regional offices and the Central Bank of Ukraine and the Ministry of Finance of Ukraine. However, UKRSTAT was the most important source of data, as published in its online databanks and reports.

The methodology is as follows.

First, a time series of the total finance allocated to regional development is prepared. These data are taken from the *RAPs* for the period 2021-2023, but could easily be extended beyond 2023 when revised *RAPs* become available.

Second, using the administrative categories of financial allocations used in the *RAP,* the total finance allocation above is re-classified into the following four economic categories:

1. Physical infrastructure (roads, rail, communications, etc.)
2. Human resources (work-related training, re-training, etc.)
3. Direct support to enterprises (including support for research and development (R&D)
   Social and institutional building allocations

This re-classification of the administrative programme categories used in the *RAPs* is required so that expenditure can be converted into economic categories that are ameanable to impact analysis using macro-models.

Third, beneficial 'externality' (or spillover) effects associated with improved stocks of infrastructure, human capital and R&D are incorporated into the model to take account of the following mechanisms:

1. To capture the direct influence on manufacturing and market services output of the availability and use of an improved stock of physical infrastructure. The idea is that any improvement in the stock of infrastructure relative to a no-development policy baseline will generate an induced rise in output, by an amount that will depend on the size of a selected spillover elasticity. The size of the elasticity is a proxy measure for how well the investment is targeted at an identified barrier to increased growth potential.

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[9] See Aschauer (1989); Blanchard & Fischer (1990); Bajo-Rubio & Sosvilla-Rivero (1993); Krugman (1995); Sianesi & van Reenen (2002); Congressional Budget Office (2005) . Bradley & Untiedt (2012) show how the investments are incorporated into macro-models.

2. To capture the direct influence on manufacturing and market services output of the availability and use of improved human resources and R&D. Here, the idea is that any increase in the stock of human resources and of R&D relative to the no-development policy baseline will generate an induced rise in output, by an amount that will depend on the size of a selected spillover elasticity.

3. To capture the additional indirect influences of improved stocks of physical infrastructure, human resources and R&D on regional factor productivity in manufacturing and market services as it is increased by an amount that will depend on the size of a selected spillover elasticity.

The choice of a range of possible 'spillover elasticities' will be influenced by the economic structure of the region and by the types of investments contained in the RAPs. For example, using assistance to an enterprise sector in terminal decline will produce Keynesian-type impacts during 2021-2023, but nothing thereafter. Using the funding to target a small modern sector with future potential will produce some short-term impacts but increasing longer-term benefits if the sector grows as a result of the assistance (see Bradley & Untiedt, 2012).

For the purpose of our analysis, stand-alone macroeconomic models for the regional economies of Ukraine were constructed. These draw upon on the HERMIN modelling framework (Bradley & Untiedt, 2012). The HERMIN models include five sectors: manufacturing (mainly (externally) traded sectors, market services (mainly non-externally traded sectors), building and construction, agriculture, and government (or non-market) services. They combine conventional Keynesian mechanisms which are relevant only for the short-term behaviour, with many neoclassical features essential for longer-term results (more in Bradley & Untiedt, 2012). For the purpose of economic modelling, we applied WinSolve, i.e. a program for solving and simulating nonlinear deterministic and stochastic models and TSP, i.e. econometric software used for times series database construction and for the estimation of econometric models.

Results

In this section we illustrate some of the results produced when the models for the six selected Ukrainian regions were used to estimate the likely impacts of the RAPs. Once again, considering the dramatically changed circumstances in which this analysis was delivered, we show a limited range of results, and focus only on a few options. The methodology is more important than the numerical results.

For each region we derived total annual financial allocations proposed in the RAPs for the years 2021 to 2023.[10] We then show the percentage financial allocations made under the four 'economic' classes previously discussed: physical infrastructure (**IF**RDS), human resources (**HR**RDS), direct assistance to production branches (**AP**RDS) and allocations to social and institutional building (**SO**RDS). Of the total allocations to production branches (**AP**RDS), we derived the percentage allocations to industry (**TAP**RDS), to market services (**MAP**RDS) and to agriculture (**AAP**RDS).[11] Finally, we derived the percentage of APRDS allocated to research and development (**APRD**RDS).

Among the six RAPs analysed, the percentage allocations to physical infrastructure (**IF**RDS) ranged from a high of 87.0% (Zaporizhzhia) to a low of 53.6% (Zakarpattia). The percentage allocations for human resources (**HR**RDS) ranged from a high of 8.7% (Chernihiv) to a low of 0.8% (Lviv).

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[10] The most recent RAPs covered a three-year period, starting in 2021, but in early 2022 proposals were in train to extend the programme period to seven years, emulating the EU budget cycle duration.

[11] No aid allocations were made to the Construction sector, but that sector would be heavily engaged in and benefit from physical infrastructure activities.

The percentage allocations for direct assistance to producer branches ranged from a high of 33.1% (Lviv) to a low of 4.5% (Chernihiv). Finally, the percentage allocations to social and institutional building ranged from a high of 26.5% (Chernihiv) to a low of 2.6% (Zaporizhzhia).

By the standards of the distribution of financial allocations under the EU Cohesion Policy system, the variation in the inter-regional allocations of the Ukrainian RAPs to the four 'economic' categories is rather large. In some cases, this will reflect the development requirements identified in the individual RDSs. But in other cases, it may reflect a lack of central guidelines and EC oversight that tend to operate in the case of EU Cohesion Policy.

Table 1 shows the RAP data for the case of the Lviv oblast.

Table 1. RAP financial allocations for Lviv Regional Action Plan

	2021	**2022**	**2023**	**Total**
RAP (hryvna mill)	21851.1	22313.0	18510.3	63384.9
Percentage allocations across four economic categories				
IFRDS	68.76	59.30	52.70	60.56
HRRDS	0.61	0.49	1.53	0.84
APRDS	25.31	34.50	40.24	33.08
SORDS	5.32	5.71	5.53	5.53
Branch allocations (percentage APRDS)				
TAPRDS	85.13	93.24	94.60	91.95
MAPRDS	12.91	5.40	3.91	6.54
AAPRDS	1.96	1.36	1.49	1.51
Percentage of APRDS assigned to R&D				
APRDRDS	82.01	91.25	93.51	89.72

In Table 2 we present an example of the first results from the model simulations that were carried out to analyse the likely impacts of the RAP for Lviv. The simulation started in 2019, the last year for which complete official data on the regional economies was available and was projected out to the year 2030. In the case of regional development policies, whose impacts are expected to endure into the medium term, we cannot stop the analysis on December 31st, 2023, the final year of the current RAPs. So, we develop a conjectural baseline projection from 2019 to 2030. If the RAP impact analysis was being carried out in more normal times, considerable care and attention would be given to ensure that the baseline projection was prepared in as realistic a way as possible to emulate how the regional economy would be likely to evolve in the absence of any RAP investments. In the present case we have set up a projection using simple extrapolation of current policies (i.e., no change in real terms) and crude assumptions about the external/global environment.

Having simulated a baseline projection where no RAP actions were taken, we now enter the RAP financial allocations into the model and simulate a 'with RAP' case. The likely impact of the RAP is derived by comparing the 'with RAP' results and the 'no RAP' results. A crucial assumption made in the 'with RAP' simulation is that the so-called 'spillover elasticities' discussed in the next section are all imposed at rather low values. In other words, for the purposes of exposition, we are simulating what resembles a kind of worst-case RAP, where the selection of policies has not yet been optimally targeted. In subsequent simulations we could relax this restrictive assumption and examine how better targeting (implying higher 'spillover elasticities') would produce higher impacts on the economy.

Table 2. RAP multiplier analysis for Lviv oblast

Date	RDSR	%del GDPM	CumRSRD	Cum%del GDPM	CumMult
2019	0.00	0.00	0.00	0.00	0.00
2020	0.00	0.00	0.00	0.00	0.00
2021	7.71	8.54	7.71	8.54	1.11
2022	7.51	9.25	15.22	17.79	1.17
2023	6.07	8.24	21.29	26.02	1.22
2024	0.00	1.88	21.29	27.90	1.31
2025	0.00	1.68	21.29	29.58	1.39
2026	0.00	1.55	21.29	31.14	1.46
2027	0.00	1.44	21.29	32.58	1.53
2028	0.00	1.33	21.29	33.91	1.59
2029	0.00	1.24	21.29	35.15	1.65
2030	0.00	1.15	21.29	36.30	1.70

The explanation of the notation in the simulation presented in Table 2 is as follows.

RDSR shows the size of the total RAP financial injection as a percentage of regional GDP, as generated by the projection out to the year 2030:

- **%del GDPM** shows the percentage increase in regional GDP in the 'with RAP' case relative to the 'no RAP' baseline case;
- **CumRDSR** represents the accumulation of the RAP injections, expressed as a share of regional GDP;
- **Cum%del GDPM** represents the accumulation of the percentage increases in regional GDP in the 'with RAP' case relative to the 'no RAP' baseline case;
- **CumMult** is the 'cumulative multiplier' and is calculated as **Cum%del GDP** divided by **CumRDSR**.

The cumulative multiplier, **CumMult**, represents the best indicator of the likely impact of the RAP on regional GDP and has the advantage of being scale independent. In other words, it is possible to compare cumulative multipliers across different regions since the absolute magnitude of the RAP financial injections have been normalised. So, the results for a region which used a small RAP financial injection relative to the size of its GDP can be compared with a region that used a large RAP financial injection relative to the size of its GDP.

What this shows is that the Lviv RAP proposed financial allocations of about 7% of regional GDP for each of the three years 2021-2023. The low initial cumulative multipliers gradually built up as externalities generated additional benefits in later years. By the year 2030, the aggregate financial allocation of 21.29% of GDP during the three implementation years produced a cumulative multiplier of 1.7, but this would gradually taper off as depreciation eroded the increases in stocks of physical infrastructure, human capital, and R&D.

For the six selected oblasts the long-term cumulative multipliers differ from region to region, from a high of 2.11 (Zaporizhzhia) to a low of 0.7 (Chernihiv). There are many possible explanations for these different cumulative multiplier impact results. But first, it should be stressed that the size of the RAP financial injection for a region relative to the size of the region's GDP is not a factor. For example, although the RAP injection over 2021-2023 amounts to over 30% of GDP in the case of Zaporizhzhia and is only 6% in the case of Chernihiv, their cumulative multipliers can be compared since they show impacts per unit of accumulated RAP finance. The explanation for the higher cumulative multipliers in Zaporizhzhia compared to Chernihiv must be sought elsewhere by examining the specific structure of the RAP and the structural characteristics of the Zaporizhzhia economy.

For example, the allocation of RAP finance to physical infrastructure by Zaporizhzhia was the highest of the six regions (87%), and the spill over elasticities from improved physical infrastructure tend to be higher than is the case for human resources and R&D. Furthermore, Zaporizhzhia also had the lowest allocation of RAP finance to social and institution building (2.6%), and however socially beneficial such allocations are, they are initially assumed to have very low spill over elasticities. Other factors would include the branch structure of the regional economy since beneficial RAP-related spill overs arise only in industry and marketed services. For example, in Zaporizhzhia, the region with the highest cumulative multiplier, the total share of manufacturing and market services in GDP is 73%, while in Chernihiv, the region with the lowest cumulative multiplier, the share is much lower (53%).

Since the selection of the sizes of the spill over elasticities in at present rather conjectural, in is of interest to explore the effect of gradually increasing their size. We use the Cherkasy oblast as a test case and the results are shown in Figure 2.[12]
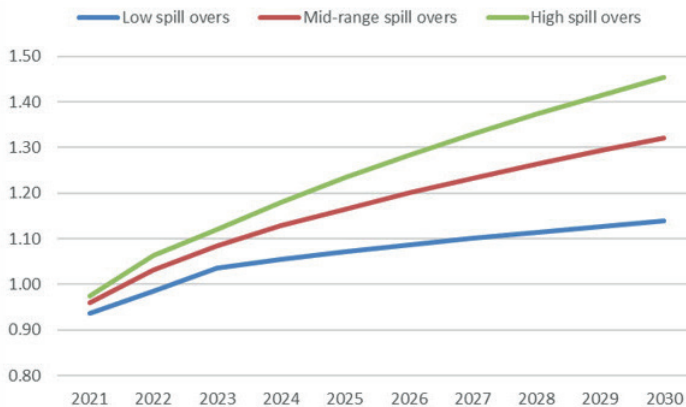

Figure 2. Cumulative multipliers for Cherkasy Oblast – sensitivity analysis

As expected, when the size of the spillover elasticities is increased, the magnitude of the cumulative multipliers also increases. With low spill overs, the multiplier is 1.14; for mid-range spill overs, it increases rises to 1.32; for high spill overs, it reaches 1.45. The interpretation of these results is as follows. For low spillover elasticities, in the medium term an injection of one unit of GDP by way of RAP investment finance generates 1.14 units of increase in regional GDP, i.e., a return of 14% by the year 2030. However, with an optimised RAP that was targeted accurately at the development needs of Cherkasy (and therefore was associated with high spill overs), the return by the year 2030 would increase to 45%.

In the analysis above we have focused purely on the RAP impacts on total regional GDP. Of course, the model simulations produce results for every economic indicator contained in the model. We could examine the impacts on branch GDP, on branch employment, on the rate of unemployment, on household consumption, on the net trade balance of the region, etc. If a model-based regional policy impact analysis system was being implemented in a realistic situation, one could prepare a table automatically showing the impacts on any list of required indicators.

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[12] The spillover assumptions are available in the computer readable material submitted with the original report. Here we wish to illustrate the effects of varying the spill over elasticities rather than defining them with region-specific precision.

Discussion

A common pattern in the new EU Member States as they start to engage with the EU on regional development aid through Structural Funds is that the initial focus is on the national economy, with the spatial allocation of funds determined in large part by central government. This usually takes the form of national programmes concerning physical infrastructure, human resources and R&D which are designed at the centre, but actually implemented, of course, across the national territory. When the major national priorities are identified and addressed, attention turns to place-based policy and regional administrations play increasingly important roles alongside national government.

The curious aspect of the Ukrainian experience was that it started off with a process of very decentralised regional analysis and policy formulation, albeit using guidelines drawn up by central government, but in the absence of any clearly articulated national development strategy. Part of the explanation was that there was an urgent need to reform regional government administrative systems and to bring them into line with EU norms. Another factor was that the regional development planning exercise had many aspects of a trial run rather than being policies that were destined to be actually implemented. This was clear from the way the division of financial provisions as between central government budgets and regional budgets was not treated in any detail or clarified.

Previous research on Poland suggested that analysis of national development priorities needed to be treated first (Zaleski et al., 2014). It was essential to make a clear division between development policies that would be designed at the centre and applied uniformly across the nation (e.g., education and training, enterprise investment aids, policies of R&D), and policies that by their nature were region specific (mainly physical infrastructure, both internal to regions and linking regions). Reconciliation of national and regional priorities presents many political challenges since there is often a conflict between the desire to invest in advanced regions where the returns tend to be highest and the goal of investing in less advanced regions in a way that ensures long-term regional equity. But a good way of addressing this challenge is to base decisions on research that tries to quantify the complex returns to regional development policy as an input to the political process.

In addition to the need to reconcile national and regional development priorities, there is a need to reconcile inter-regional priorities. Although the analysis contained in the individual Ukrainian regional strategy documents was of a very high standard, there was only a very limited effort made to recognise the need to align strategies with adjoining regions as well as with their own sub-regions. For example, should regional policy makers opt to develop the existing metropolitan hubs, and rely on trickle-down to spill over the benefits to peripheral locations within the region? Or should they devote financial resources to integrate the peripheral regions into the already relatively prosperous metropolitan hubs? These kinds of questions remain to be addressed in Ukraine.

Conclusions

At the time of completing our analysis (March 2022), Ukraine was at peace. The current war raging in Ukraine makes and detailed analysis based on pre-war performance data less relevant considering the destruction of physical and economic infrastructure and the massive displacements of regional populations. Early estimates caried out by the Kyiv School of Economics showed that total economic losses in the three months since the beginning of the war were estimated at $564-600 billion).[13] However, the regional modelling and analysis methodological

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[13] See KSE (2022, May 27) for more details.

research reported in this paper retains relevance, in particular the computerised national/regional Ukrainian databases; the operational data processing/regional analysis system; and the lessons learned and suggestions for improving the regional data system and for addressing regional policy modelling and forecasting challenges.

Using the macroeconomic model framework for Ukraine's NUTS 2 regions, we demonstrated that modelling has a vital role to play in all stages of regional and national policy making, such as:

1. preliminary investigations into structural and other barriers to growth,
2. constructing the appropriate supporting databases,
3. evolving the model design to explain and illuminate economic mechanisms and policy choices,
4. using simulations as tools of exploration rather than as forecasts,
5. formalising policy impact analysis, ex-ante, mid-term and ex-post,
6. communicating results back to policy makers in useful, credible and effective ways.

Another use of regional models could be to compare the projections before war damage to infrastructure to projections that took account of the war damage. This could assist in the estimation at a regional level of consequences of war damage. In particular, some regions are being dramatically and directly hit by war (Zaporizhzhia and Chirnihiv in our sample selection of six regions) and some regions only indirectly (at present) like Zakarpattia. The regional models and simulations carried out for pre-war development scenarios and post-war development scenarios could be useful tools for estimation of loses in production capacity due to war at an oblast level involving damages and direct loses in social and technical infrastructure and production facilities. More importantly, they can also show a series of indirect macroeconomic consequences of these loses.

In the post-war period, Ukraine and its regions will face enormous reconstruction challenges. There has been massive destruction to physical infrastructure and the business fabric as well as major demographic turmoil. Therefore, the economic future of the most seriously affected oblasts will have to be written almost from a new baseline. Since the continuity of macroeconomic trends shown in the databases is likely to be severely disrupted, if not completely broken, it will not be possible to use historical databases for any econometric analysis. Nevertheless, we see the usefulness of the regional modelling framework in generating different post-war development paths that can potentially be followed by regional administrations in a variety of external circumstances. This, in turn, will effectively inform both national and regional authorities how to calibrate public intervention to achieve the best economic outcomes from reconstruction. Paradoxically, the severe war-driven disruptions might give rise to the break of path-dependency of several Ukrainian regions. New development scenarios will need to be explored. Again, its potential consequences might be thoroughly investigated through a scenario model-based analysis. The simulation outputs can, in turn, show the most effective directions for policymaking.

Ideally, it would be desirable to set up an exercise within MinRegion that used the 25 regional models to analyse the RAPs. In its initial stages, such an exercise would assist in ensuring greater uniformity between the diverse RAPs and would address issues concerning the consequences of different kinds of funding (e.g., region own resources, central government, external, private). It would also assist with making the transition from the SWOT-based analysis of the RDSs and the policy decisions contained in the RAPs.

This exercise could be extended beyond the analysis of RAPs and take into account all central government post-war reconstruction activities related to the relevant oblast area, giving an estimation of the impact of reconstruction and development of the region. It should be stressed that such modelling predictions could be relatively accurate for oblasts with a low level of destroyed infra-

structure (Zakarpattia), moderate for oblasts with visible impacts of the war damages in infrastructure by bombing (Odesa, Lviv), but rough and conjectural for regions which were/are battlefields and were heavily destroyed (Zaporizhzhia, Chirnihiv).

The role played by the regional/oblast administrations in recent years in the design and evolution of regional development strategies and regional action plans was significant. The central government drew up guidelines for preparing these strategies, but the execution was carried out by the oblast administrations, usually in consultation with lower levels of regional government as well as with the enterprise sector and civil society. The regional strategies and regional action plans have been evolving rapidly and include much interesting material that addresses the requirements of place-based strategy. This regional analysis was in the process of being fed back to central government before the whole process was interrupted by the Russian invasion.

Since Ukraine is now a candidate EU Member State, with prospects of full membership within, say, the next decade, the future financing of regional development strategies would eventually fall under EU Structural Fund and Cohesion Policy programmes. However, this timetable may be unrealistic. So financial assistance, other than for post-war reconstruction, is likely to be national and local for the foreseeable future. So, current and future RAPs are conjectural and should be looked upon as part of a learning process where regional strategies and actions are coordinated by national oversight, in much the same way as takes place within the EU Structural Fund process. Given the structural differences between EU member states' regions and Ukrainian oblasts, a straightforward transposition of EU strategic goals and tools to Ukrainian documents carries inherent risks. The significance of the model for programming regional policy in the EU needs to be emphasized, however. This model involves combining universal goals that do not require regionalization and can be implemented by central authorities with goals that necessitate a place-based approach, taking into account the specific potential and challenges of individual regions. Therefore, it is crucial to incorporate into the regional development strategy a spatial perspective that goes beyond the level of regional disaggregation provided by oblasts.

Finally, the differences in war damage between oblasts cause even greater heterogeneity of development than in the pre-war period. This, in turn, should require paying special attention to the regional level of Ukraine's development strategy. However, this regional approach is likely to be overlooked in post-war recovery, as a top-down approach to shaping development may prove to be a more effective way of aligning opinions between institutions such as the World Bank, the EU and the Ukrainian government. Therefore, it is of great importance to inform policymaking on both sides of the negotiating table about the role of development programming at the regional level.

In future research, it is useful to broaden the scope by encompassing all regions, ensuring a comprehensive understanding of the subject matter. Additionally, a thorough analysis of post-war development programs implemented in various countries, particularly at the regional level, should be undertaken to glean valuable insights and potentially identify adaptable strategies for sustainable development in Ukraine.

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