BEAMM.Brussels: an online, open-access tax-benefit microsimulation model for Brussels

Key messages

1 Beamm.brussels is an online, open-access tax-benefit microsimulation model for the Brussels Capital Region.

2 The model runs on a fictitious but realistic synthetic dataset, based on both administrative and survey data, representing the population of the Brussels Capital Region.

3 The platform enables policy makers, civil society, media and citizens to assess in great detail the impact of fiscal or social reforms on the Brussels Capital Region and its population via the online interface www.beamm.brussels.

4 The platform presents a detailed analysis and visualization of the reform's impact on household income, inequality, poverty, state budget, tax burden, etc.

5 This model aims to contribute to evidence-based policy making and feed the democratic debate in the Brussels Capital Region.

Introduction

Taxes and social security contributions represent about 42,6% of GDP in Belgium in 2022 (OECD.stat, 2023). Taxes, social contributions and social benefits also tend to change the behavior of citizens, firms and organizations. Together, these two elements make that fiscal and social policy constitute an enormous lever for societal change. Moreover, taxes and social benefits are the key instrument for the redistribution of income, and the distribution of wealth in society. How incomes should be distributed is not a technical but a normative question and should be decided by democratic deliberation.

For all these reasons, a precise and reliable assessment of the impact of tax reforms in terms of their efficiency, effectiveness, and fairness is essential for the quality of our tax-benefit policies. The microsimulation model BEAMM aims to contribute to better policy making by allowing policy makers, civil society, media and citizens to simulate the effects on household income, inequality, poverty, state budget and tax burden of any hypothetical policy reform of the tax-benefit system in the Brussels Capital Region.

Methods, approaches and results/body

Beamm.brussels (for Belgian Arithmetic Microsimulation Model) is a detailed, online, open-access, tax-benefit microsimulation model for the Brussels Capital Region. The model aims to eventually be a comprehensive model of the tax-benefit system on the side of the households. The platform simulates the impact of fiscal or social policy reforms for each individual household or citizen in a dataset that is representative of the population of the Brussels Capital Region. By simulating all covered taxes and benefits for each citizen before and after a reform, Beamm.brussels analyses and visualizes ex ante how different types of households are impacted by a reform, but also, e.g., how poverty or inequality is affected, how the labor cost changes, and what the budgetary cost is for the state. The platform is available online on www.beamm.brussels.

Beamm.brussels is a long term project, and will keep on improving and becoming more complete over the coming years and decades. The present version of the platform accounts for little behavioral change by citizens or households. Several behavioral models with be integrated in the platform in the coming year(s) to account for behavioral change.

BEAMM runs on a synthetic micro-dataset that combines information from several administrative databases and surveys.

Machine learning techniques are used to merge these different existing data sources, into one single synthetic dataset, and then simulate a 100% fictitious but realistic dataset. No individual in the synthetic data corresponds to a real individual, but we create the sample of fictitious individuals in such a way that they together accurately represent the entire population.

Conclusions

Raising taxes and redistributing income are amongst the core activities of the state, and are important determinants of how society is functioning. As such, fiscal and social policies should be based on a solid democratic deliberation. Unfortunately, our fiscal and social security system is also legally, institutionally and economically very complex, and few (if any) people have all the necessary skills to fully assess the impact of a fiscal or social policy reform. The Beamm.brussels platform is conceived to become a digital twin for fiscal and social policies in the Brussels Capital Region.

Beamm.brussels is a comprehensive tax-benefit microsimulation model for the Brussels Capital Region and allows policy makers, civil society, media and citizens to simulate the impacts of any reform of the tax-benefit system on household income, inequality, poverty, state budget, tax burden etc.

Policy recommendations

A democratic debate about fiscal and social policies requires that all stakeholders share a common and profound understanding of the tax-benefit system and how potential policy changes will affect different actors in society. However, accurately assessing the impact of fiscal and social reforms is a complicated job. It requires a quite diverse skill set spanning legal, institutional, economic and data science expertise as well as access to the right data and tools. The Beamm.brussels project is a long term and relatively large scale effort to build a digital twin for fiscal and social policy assessment in the Brussels Capital Region, and to make a version of this instrument available online in open access, via the platform www.beamm.brussels.

Over the past 4 years, we have laid the foundations of this project, and have built a first functioning version of this platform. Over the coming years, we will keep on developing and improving this platform. This platform is meant to serve a wide range of different users: politicians, policy makers, civil society, media, citizens etc. All these users can formulate their own research questions by defining their own fiscal and social policy reforms, specify these in the online interface of Beamm.brussels, click the simulate button and inspect the impact of their policy reform from far more viewpoints and in far more detail than can realistically be represented in a research paper. The platform will gradually include a series of videos in which different relevant policy reforms are simulated, and in which the results are interpreted and discussed.

This means that the beamm.brussels platform is and will remain a constant work-in-progress for the coming years and decades. The platform will be in permanent evolution, and will always become more complete and precise. Our own research projects will be one important driver of these permanent improvements, but our main recommendation in this report is also an invitation. We have built Beamm.brussels to support public policy making in the Brussels Capital Region, and we invite all policy makers and civil society to a dialogue to further improve the platform. We welcome all interaction to learn about the needs and policy questions of the policy makers and civil society in Brussels. We want to tailor the analysis and visualization as well as the capabilities of the Beamm.brussels platform to the needs of the Brussels Capital Region, and invite the public administrations and civil society actors in Brussels to engage in a joint process of co-creation for the further development of www.beamm.brussels.

A crucial element in the further development of Beamm.brussels is our own use of the back-end of the platform for scientific research and policy support. Our team of at present two dozens of researchers uses the Beamm.brussels platform in its full flexibility (i.e., the code, independent of the online interface) for scientific research on a broad variety of research questions: from road transport, public transport in Brussels, labor market policy in Brussels, tax design, child poverty, the impact of fiscal policy on intra-household behavior, housing, climate change etc. The results of all this beamm-based research will be published as research papers (in scientific journals, but also on beamm.brussels platform).

Policy recommendations

But the insights and code generated by this scientific research will also systematically be integrated in the beamm.brussels platform. As such, this research activity will allow us to keep perfecting, correcting and refining the online platform. The back-end of the platform will also be available to our team in order to assist the various policy makers and stakeholders in Brussels in dealing with specific policy questions and by providing detailed reports on particular reform scenarios.

Beamm.brussels is at present already a unique platform in both a national and international context, but it is still far from perfect or complete. This is an intrinsic characteristic of such a model: it will never be perfect or complete, neither next year, nor in a decade or two. A model is by definition a simplification of reality. Yet, the platform will keep on improving and become more complete and more precise in the coming months, years and decades. It is and will become a unique tool for policy makers to assess ex ante the impact of fiscal and social policy reforms, and will in the long run even extend beyond this scope. Therefore, the end of this Prospective Research for Brussels is not the end of a project, it is merely the end of the beginning.

List of publications

www.beamm.brussels

Annoye, Hugues, Beretta, Alessandro and Heuchenne, Cédric (2024), "*Statistical matching using kernel canonical correlation analysis and super-organizing map",* Expert Systems With Applications, forthcoming.

Annoye, Hugues, Beretta, Alessandro and Heuchenne, Cédric, Jensen, Ida-Marie (2024), *"Statistical Matching using Autoencoders-Canonical Correlation Analysis, Kernel Canonical Correlation Analysis and Multi-output Multilayer Perceptron",* mimeo.

Green, Rory and Sonnewald, David (2024), *"Marginal Personal Income Tax Changes: Tax Revenue, Welfare, and Labour Supply Responses"*, mimeo.

Sonnewald, David (2024), *" Trends and cross-regional differences in the Belgian labour market",* mimeo.

Sonnewald, David (2024), *" Country of birth and wage differentials Evidence from Belgium",* mimeo.

Sonnewald, David and Truyts, Tom (2023), *" Beamm.brussels: an online, open-access tax-benefit microsimulation model for the Brussels Capital Region"*, mimeo.

The author& project

Tom Truyts is a professor of public economics at the UCLouvain Saint-Louis Bruxelles and coordinator of the Beamm project.

The Beamm project is a collective research project building an online open-access tax-benefit microsimulation platform, which involves at present about 25 researchers, and is entirely organized at the Center for Applied Public Economics (CAPE) at UCLouvain Saint-Louis Bruxelles. CAPE is an interdisciplinary research center that focuses on public policy evaluation.

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Prospective research

Through the Prospective Research program, the Brussels-Capital Region is hoping to fund research projects from a dual perspective: to provide a solid regional pro-spective vision; to build solutions to

the specific challenges it will face in the years to come. The solutions proposed by the funded projects must take into account Brussels' urban complexity as well as the Region's environmental, social and economic transition objectives. The program targets researchers in human science as much as researchers in exact or applied science

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