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NOTE

Seminars of the Big Data Knowledge Hub

Use of big data tools to support labour market (re)integration in the Swiss context

Notes of the online seminar promoted by the Big Data Knowledge Hub of the European Network on Regional Labour Market Monitoring (ENRLMM). February 23, 2023

The fourth of the Seminars of the Big Data Knowledge Hub took place on February 23, 2023. The aim of these series of seminars is to offer an opportunity to deepen the Network's knowledge on how to use Big Data for labour market research and consulting by presenting practical cases and demonstrations.

The Seminar included a presentation by **Professor Dominik Hangartner** (Immigration Policy Lab, ETH Zürich, Switzerland) who presented the project “Improving refugee integration through data-driven algorithmic assignment” and a presentation by **Martin Gasser** (SECO, Switzerland) who presented “Preliminary considerations of Risk Assessment Tools in the Public Employment Service- State of Work in Switzerland”. **Michel van Smoorenburg** (UWV, The Netherlands) commented on both experiences.

The open discussion counted with the participation of: **Christian Müller** (SECO, Switzerland), **Christa Larsen** (IWAK Goethe University Frankfurt am Main, Germany), **Moreno Baruffini** (USI, Switzerland), and **Dorit Griga** (SECO, Switzerland).

Introduction

Eugenia Atin (Speaker of the Big Data Working Group of the ENRLMM) after the initial greetings and thanks to the participants, contextualises this session in the work being done by the Big Data Working Group of the ENRLMM (European Network on Regional Labour Market Monitoring).

Christa Larsen (Founder and Coordinator of the ENRLMM), then presents the European Network on Regional Labour Market Monitoring (ENRLMM)



<http://regionallabourmarketmonitoring.net/>, that exists since 2007, and focuses on regional and local monitoring, especially on the demand side (the needs of companies).

The Big Data Working Group was born in 2016, to help the network members in the application of big data techniques in their monitoring projects. And then, 2 years ago, the Group designed the Big Data Knowledge Hub <https://bigdatahub.uvt.ro/> which is a collaborative platform for mutual exchange and learning. The Knowledge Hub is the place where all the members of the EN RLMM can look for guidance when aiming to use big data in their labour market monitoring projects. It is an easy accessible source of information on the techniques used by other reference labour market observatories for a particular topic or challenge. The "Seminars of the Big Data Knowledge Hub" are an initiative within this Hub, to make it more interactive.

Presentation by Professor Dominik Hangartner

The first presentation is about Improving refugee integration through a data-driven geographic assignment. Dominik Hangartner is professor of public policy at ETH Zurich and faculty co-director of the Immigration Policy Lab.

Professor Dominik Hangartner will give an update on some of the work that they have been doing these past years, particularly a pilot project that they have done in Switzerland and that they are also setting up in U.S., Canada and the Netherlands.

The basic idea is that for the refugees that arrive in European Countries (or others) and that are given permission to stay, to use big data in order to improve the geographic assignment.

Introduction

What does the Immigration Policy Lab do?

- We use data and statistics to evaluate (impact analysis) and to use machine learning to design policies surrounding the integration of immigrants, refugees, and asylum seekers worldwide
- Try to specialise in partnership with governments and immigrant service providers to implement evidence-based policies and conduct rigorous evaluations

Since immigration touches many dimension, we need an interdisciplinary team or researchers, data scientists and program managers at ETH Zurich and Stanford University.



We are trying to learn what are the policies that are most efficient and cost effective in facilitating successful integration into host countries' economies and societies. We intervene in that space with data-driven tools have the potential to deepen our understanding about drivers of migrant integration outcomes and serve as input for personalized policies that can further catalyse and boost integration. This can be a little abstract but we will give a concrete example with this GeoMatch algorithm.

When you think about refugee/immigrant integration you can very simply break it down in 3 main categories:

- Personal Characteristics (who you are, skills...)
- Geographic Location (neighbourhood, city) they all shape your future
- Synergies between the 2 (geography and personal characteristics), we will focus on this

For one refugee one place may be particularly promising because he/ she has a skill set that matches that place, while for another refugee the optimal place for economic integration might be another place. If you learn about these synergies, obviously you can steer the geographic assignment for these people.

A graph with Swiss data is shown, displaying the employment share on average of refugees 2 and a half years after arrival, across the 26 cantons of Switzerland (it is quite similar across all countries). Two striking features:

- 1) In all cantons there is room for improvement (even in the canton with the highest employment share, not even 50% of refugees have an employment after 2.5 years)
- 2) A lot of variation between cantons. Cantons have different policies and spend different budgets in integration (language, etc.)

Refugee population is quite similar across all countries because they are (by law) exogenously assigned across these cantons. The preference of refugees is not taken into account so much.

In the next slide, Professor Dominik Hangartner shows some correlation (not cause-effect) between the individual characteristics and the propensity to have a job 2.5 years after arrival. Gender and age matters, speaking French helps, and there are interaction between nationalities. If we look at these characteristics in the different countries, we can see that people from some origin countries have an easier time to find a job in some cantons than in others. So these are the synergies that we try to leverage in this project.

We do this in 2 stages:

- 1) Good administrative data in Switzerland, detailed information about every refugee, where they live and if they found a job and the whole trajectory. So we



use these data for the first stage, to model and predict employment probabilities for all cases at all locations

- 2) Use this model for newly arrived refugees to predict where they are more likely to find a job

There are of course many constraints and we operate within these constraints (families that belong together stay together, health issues, cantonal level: bigger cantons have to take more refugees, and we also have to take into account some balancing constraints).

We conducted a series of back tests (retrospective impact evaluation). With the GeoMatch algorithm we are optimistic that we can boost employment share by 30-70%. But this very much depends on the constraints.

We not only see average gains but also gains across groups. All groups seem to benefit but they do not benefit in the same way.

Based on these back tests we see that:

- There is quite a bit of potential for robust gains across diverse contexts.
- It is highly scalable, costefficient, and actionable for a large population.
- It is quite flexible in incorporating preferences of the refugees and outcome metrics
- We have to quite dynamically update the algorithm over time by adapting to new and recent synergies in the data

Professor Dominik Hangartner now explains one of the implementation studies. We do not focus on re-settled refugees but on asylum seekers who cross the Swiss border and arrive at a Reception and Processing Center to apply for asylum. After a few months they receive the decision and if it is positive they are relocated to an assigned canton to receive accommodations and, if applicable, access employment programs. It is pretty much a random relocation.

What we do is that we support the Ministry in this assignment. We built a dedicated software. When a new refugee comes in, the assignment officer manually inputs the characteristics of the refugee, and then generates a recommendation based on the GeoMatch algorithm. The case officer then reviews the recommendation and checks if it can be done or not (this is very important). If the case officer overwrites the recommendation, he/ she writes a note so that the algorithm can be further trained (continual learning of the algorithm).

A screenshot of the software which was co-designed with the Secretariat is also shown.



Since 2020 we have been piloting this with a randomized Control Trial so that we can see the benefits (and also the implications or consequences) of algorithmically supported placement versus random allocation (status quo). The pilot included 2,000 refugee families (half of them assigned using the algorithm and half of them without the algorithm). By summer 2023 the pilot will be finished, then we wait 2-3 years to collect the employment outcomes. The COVID-19 crisis was also in the middle of the piloting and this needs to be taken into consideration too.

Presentation by Martin Gasser

The second presentation is about preparing automated decision making or Risk Assessment Tools in the Public Employment Services.

Martin Gasser works for the Swiss Unemployment Insurance as a scientific advisor. His main tasks include statistical analyses and working on strategic projects. He is currently involved in designing a new strategy for PES in Switzerland. He won't show us a tool today, but rather where they stand in preparing potential tools.

Currently, the Swiss Public Employment Service (PES) are not using any fully-automated or semi-automated ("human-in-the-loop") decision-making (ADM).

What is changing now is that we have a new data protection law that allows the use of ADM and we are currently working out the new long term strategy for PES. So there is a lot of input to please use more ADM, more AI tools in PES. So we have to prepare for potential ADM uses.

What could be possible applications? Martin Gasser mentions some possibilities from an OECD study. You can use ADM to do profiling of unemployed people, you can do targeting, matching, fraud detection, monitoring... Many EU countries are ahead of us when using such tools.

Our main challenge now basically is having guidelines ready, under what conditions are we willing to deploy ADM? We are in the process of discussing these 7 guidelines:

1. Technology and risk assessment: required pre-development with relevant stakeholders, users and developers
2. Privacy impact assessment: legally required previous to any development
3. Data quality: Data are contextualized together with stakeholders and PES (e.g. data quality, expressiveness, and proxy outcomes)
4. Sufficient precision: necessary accuracy/performance is defined with stakeholders and independently evaluated (e.g. on test data)



5. Non-discrimination: statistical measure(s) of discrimination are defined with stakeholders and regularly evaluated
6. Transparency and reproducibility: automated decisions are recognizable as such, researchers can study the model (no black box)
7. Interpretability and explainability: model class as a whole should be interpretable, individual decisions can be reliably explained

The requirements are standard, but we struggle with making these guidelines concrete enough for application.

An additional challenge, specific to Switzerland: PES in Switzerland are organized regionally, so regional authorities have large room for manoeuvre, but also the same ADM will be used differently according to region. This means that that language and quality of data vary by region.

The challenges we face right now are:

- There are templates for technology and risk assessments, transparency rules, and privacy impact assessments; as well as established measures of accuracy
- Explainability is a practical issue (you know it when you use it)
- However, non-discrimination and interpretability are active and contentious areas of research
- Moreover, these areas of research are often highly technical. But in practice, we would have to discuss these matters with non-technical stakeholders
- Technical and ethical trade-offs have to be resolved beforehand because any ADM will fail on some criteria

An Estonian tool is also used to showcase the explainability. This is an empirical issue, it has to be decided with the case workers. If the case worker says it's helpful then that's it.

To be more concrete, we try to look at how would it look in practice. There is not a system being developed, but as a hypothetical case, a tool to predict long-term unemployment at the beginning of unemployment, so that you know who is at high risk of becoming a long term unemployed. Ideally, you would have to work with the stakeholders (non-technical too) so that it is democratically legitimised.

A simple approach to a statistical fairness evaluation would be as follows. Stakeholders would have to decide on:

1. (smallish) set of protected attributes and their mode of interaction (intersectionality)
2. an appropriate definition of non-discrimination
3. a measure of discrimination



4. an “acceptable” threshold for discrimination

This means that we would need to think about the attributes that we need to protect, that could be gender, age, migrational background, political orientation... So we would sit with trade unions and employer associations for example, and talk about technical issues.

So the biggest question is how did other countries do this? How did they bridge the gap between the technical literature and actually talking to people about these definitions.

They have done a dry run with a toy model to get a sense of how this could look. They wanted to predict long-term unemployment. The accuracy of the model was moderate : 0.78 (as measured by the area under the ROC curve or AUC). The model assumed that the stakeholders choose age as a protected attribute (the model was trained without access to age), and we choose separation as a criterion (all age groups should have equal error rates any decision thresholds), and we choose expected risk difference as a measure and are willing to accept a value ≤ 0.1 . Then, the proposed model would fail the non-discrimination audit.

Martin Gasser poses some open questions for other countries to explain how they did it.

- Do stakeholders understand/accept technical definitions of non-discrimination that rely on statistical independence?
- How do we navigate conflicting definitions of discrimination in practice? We lack real-world best practice cases
- How do we deal with multiple protected attributes, each with an appropriate definition of fairness? There is little research
- Should we test for full non-discrimination or measure discrimination. There is surprisingly little research on measuring discrimination in an interpretable way
- Can we really expect a model to be fully fair and, if not, how would we determine “acceptable levels” for a measure?

So basically how to bridge these technical issues in the non discrimination area with actually talking with stakeholders. Martin Gasser would be interested in experiences or best practices from other countries.

To finish, we are aware that the use of non- discriminatory measure is not enough, it doesn't mean that it is fair or even legitimate to use such an ADM.

We had two early attempts in 2005 and 2015 and they both failed because they were rejected by PES workers. This is why it is so important to include the stakeholders from the very beginning.



Comments by Michel van Smoorenburg

Michel van Smoorenburg is an International Labour Market Analyst working at the UWV – Public Employment Services Netherlands in the Department of Labour Market Information and Advice.

Michel van Smoorenburg says the first presentation was very interesting because it addresses a topic that is usually not covered. He is rather surprised by the differences in the employment rates of the refugees between the cantons and he would like to know the reasons for this. Are the employment programmes in the cantons different? We could then measure the effectiveness in the employment programmes. Do we spot the same differences in the employment rates for non-refugees? He would then suggest to calculate the difference between the employment rates of refugees and non-refugees and see this is a dependent variable. Professor Dominik Hangartner says that there are many factors affecting these differences across cantons. The key driver for those difference is the policies that regulate labour market access for refugees which are decided at a cantonal level.

Michel van Smoorenburg says the second presentation addresses a very important issue. He doesn't think that there are many "standard" ADM tools in the EU, he thinks that they differ a lot from country to country, but it is true that many PES already have ADM tools. In the Netherlands, for example, we have profiling, we have fraud detection, methods to measure the effectiveness of active labour market policy, or providing information to experimental groups. He would like to ask Martin Gasser about the toy model which uses 78 predictors, it seems like a lot. There is a strong correlation between independent variables, and he is wondering if he uses theory or hypothesis to put the predictors into the model. To avoid the discussion of discrimination, it is important the empirical but also the theoretical background. In what way do you implement the background and theory in these models? Martin Gasser explains that for this toy model they used an off-the shelf algorithm which is completely theory free. So they did not think about what would affect what, they just told the algorithm to predict the outcome. The model is basically a black box. We could use a theory based approach and choose some factors that resolve the variables and you build a simple model. You can still have discrimination using an statistical model but if we have a set of "if then" rules then the practitioners can understand and we get rid of many of the problems.



OPEN DISCUSSION

Christian Müller (SECO) has a question for Professor Dominik Hangartner about the balancing factors. How strongly weighted are they? Professor Dominik Hangartner says that in Switzerland they have to balance the top origin countries and this is unusual and has a huge impact. These balancing constraints can change annually but they mean that the top 10 origin countries have to be balanced across the country at the end of the year. This is tricky and this is why the range of improvement of our algorithm is so wide. The costs are not cheap.

Christa Larsen (IWAK Goethe University Frankfurt am Main, Germany) would like to ask Martin Gasser a question about quality criteria. For many years, PES use data for decision making so we should have already some quality criteria developed. Martin Gasser respond that yes, the standards exist, it is nothing new. What has changed now is that there is more awareness: ethical AI or non discriminatory AI. The issues have long been known but we are now more aware.

And a question for Professor Dominik Hangartner: some factors of the constraints could have an impact on the integration process. If you present this work to decision makers or to organisations working with refugees, what are their reactions? Professor Dominik Hangartner responds that in 2017 there was not the same level of awareness, it was almost up to us (researchers) to reflect and decide about the tool. There is an status QUO policy, and the only issue is that we cannot perform worse than the status QUO. We judge this project for the improvements to the current situation (and since it is so “bad” everybody welcomes such a project).

Moreno Baruffini (USI) thanks the speakers for their presentations and would like to know if when talking about employment if also self-employment is taking into account. Professor Dominik Hangartner says that they consider both types of employment but that the vast majority of people are dependently employed (this is a reality in Switzerland). There are not many entrepreneur refugees although it is changing and growing.

Dorit Griga (SECO) would like to know if or how the differences in infrastructure in the different cantons was taken into account. Also, the educational level and skills of refugees. Are these assumed to be constant across the cantons? Are there any differences? Professor Dominik Hangartner answers that the infrastructural question is not so relevant for how we designed the algorithm. We look at the interactions of the cantons with the characteristics. We also supplement these with information about



vacancies but it is not very helpful because the time of assignment is not the time of getting a job (it can take 2-3 years). Regarding the question about educational background and skills set, there have been debates for more than a decade. At the time of the start of the project, the data was not available so that's why it is not taken into account. But it would certainly improve the algorithm. Soft skills are very important and they are currently working on a platform to match refugees and potential employers, there is a lot of potential here.

More information will be circulated as always through the Network's newsletter. Also, if you are interested in sharing your experiences with the Network, please do so through the Knowledge Hub <https://bigdatahub.uvt.ro/> and contact Eugenia Atin if you wish to present your project through a Seminar.

Bilbao, March 2023

References

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