Warsaw School of Economics

Collegium of Economic Analysis

The aggregate and redistributive effects of emigration

Małgorzata Walerych

Warsaw, 2020

MOTIVATION

After joining the European Union (EU) in May 2004, Poland and other Central and Eastern European (CEE) new member states (EU8[1]) have experienced significant migration outflows to the old member states that opened their labour markets for the new entrants[2]. As reported by Baas et al. (2010), the migrant population from EU8 more than doubled between 2003 and 2007. This scale of outflow has never been observed before in the post-war history of CEE countries.

Interestingly, the EU enlargement changed not only the scale but also the structure of emigration from CEE countries: migrants became younger and better educated. Increasing emigration rates (defined as the shares of the native population of the given country residing abroad) of individuals holding the tertiary degrees and falling fractions of older individuals (65+) in emigrants population reported by Arslan et al. (2015) clearly highlight the selective nature of these recent migration movements in terms of age and educational attainment. According to Arslan's et al. (2015) calculations based on DIOC (Database on Immigrants in OECD and non-OECD Countries), the biggest difference between total and high-skilled emigration rates in 2010 was observed in Poland. The population of emigrants from this country was also characterized by the lowest share of older individuals.

Post-accession migration dramatically affected labour markets in both host and sending countries and raised many concerns, especially in the context of demographics, long-term growth prospects, as well as inequality issues. Yet, we still know quite little about many potentially important effects of these recent migration flows on the sending economies, and much research is needed to fill this gap.

The empirical studies on source economies lack a general equilibrium dimension and therefore cannot assess all important macroeconomic effects, including welfare impact of outward migration movements. These empirical papers by construction have also little

---

[1]Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia.

[2]The freedom of movement of workers is one of the four fundamental freedoms guaranteed by the EU regulations. EU nationals can not only freely travel to other member states but also take up employment. The first old member states that opened their labour markets for the new entrants where Ireland, UK and Sweden. Other EU countries took advantage of so-called transition agreements, which postponed access to their labour markets. Two countries, Germany and Austria, decided to introduce the transitional period of 7 years, which was the maximum period allowed by the EU regulations.

to say about the long-term effects, which can be potentially very different from the effects observed just after lifting migration barriers. Moreover, the empirical investigation of effects of post-accession emigration is hindered by still relatively short period that has passed since the EU enlargement and the limited availability of data on emigration size and structure. As a result, many important questions can be addressed only using a theoretical framework. However, the existing structural models with labour mobility usually do not include all key dimensions of individual heterogeneity and hence cannot capture all potentially important redistribution effects of migration and its impact on economic inequality.

The goal of this dissertation is to overcome the shortcomings of the existing studies and analyse the aggregate, redistributive and welfare consequences of the increase in emigration from Poland following its EU accession, both in the short and in the long run.

RESEARCH HIPOTHESES

Based on the above research objective, I formulate the following hypotheses, which I verify in my dissertation:

1. *Migration significantly impacts macroeconomic aggregates of the source country, including output, production factors and net foreign assets.*

   The 2004 enlargement of the EU led to the substantial increase in emigration from Poland. Such a large scale of population outflow and its selectivity in terms of age and education might impact the short- and long-term macroeconomic outcomes. First, emigration might affect the labour supply and output since the population shrinks. Second, the impact on these aggregates might be further strengthened by changes in the demographic structure and more precisely by the falling share of working age population. Third, population outflow might alter country's international investment position since different age groups are characterized by different consumption and savings behaviour.

2. *Changes in the population structure due to post-accession emigration increase the*

wage differential between skilled and unskilled workers and lead to higher inequalities in the sending country.

Post-accession emigration from Poland is biased towards well-educated individuals. This selectivity affects the relative supplies of skilled and unskilled labour. Since skilled labour becomes relatively more scarce, its price should go up, thereby exacerbating differences in wages of both skill groups. Higher disproportions in earnings of skilled and unskilled agents can in turn escalate economic inequalities.

3. *Allowing for labour mobility is on average beneficial for agents born in the source country. The welfare effects are, however, heterogenous across age and skill groups, with some individuals benefiting and some losing from the open borders.*

Opening the borders gives to all agents the possibility of emigrating to the country with higher wages. Therefore, it can be expected that allowing for free labour mobility is ex-ante on average beneficial for the citizens of the sending economy. Since emigration changes the education structure of labour supply, the skilled individuals might additionally benefit from the increase in wages in the home country, and hence they are likely to enjoy the largest welfare gains. From the ex-post perspective, some unskilled never-migrants, i.e. workers who never decide to emigrate, might lose from open borders as their wages in the home country drop.

4. *Accounting for the total factor productivity (TFP) convergence does not alter the conclusions about the short-term impact of emigration on income redistribution.*

The equalisation of productivity between source and destination countries diminishes the wage differential between both economies, thereby eliminating the long-term incentives to emigrate. However, since the process of economic convergence is gradual, it can be expected that opening up the borders can still generate the substantial population movements in the short run. The selective nature of emigration might lead then to changes in the skill structure of labour supply, and hence redistribute income from low-skilled to high-skilled workers.

5. *Remittances have important effects on disposable income of residents of the source economy and are sufficient to turn losers of emigration into winners.*

The increased migration in the post-accession period induced significant rise in transfers remitted to Poland by those who emigrated. These transfers from abroad improve welfare of those staying behind. Most importantly, it is possible that they can compensate the unskilled individuals for the drop in their wages resulting from the changes in the population skill structure. Hence, in presence of remittances, even the unskilled never-migrants can benefit from open borders.

6. *Accounting for the impact of emigration on the number of newborns is crucial to understanding the economic effects of population outflows.*

Labour mobility affects the demographic situation of the source country not only directly, through the outflow of population, but also through the lower number of individuals born in the economy. Accounting for this loss of emigrants' descendants seems to be key to reproducing the sending country' population age structure, and more precisely - correct evaluation of the impact of emigration on the population ageing process. Since age composition of population is crucial for many macroeconomic outcomes, it can be expected that neglecting this effect would lead to wrong conclusions about the impact of emigration on the evolution of macroeconomic aggregates.

RESEARCH METHOD

To verify the formulated research hypotheses, I construct a two-country general equilibrium model with idiosyncratic uncertainty (see, e.g. Aiyagari, 1994) and endogenous migration choice, and use it as a tool to assess the consequences of emigration from Poland following the EU enlargement.

The constructed model belongs to the class of overlapping generation (OLG) models. A standard OLG model, in which households are finitely lived and have deterministic income was first introduced to the economic literature by Auerbach and Kotlikoff

(1987). Their framework, in which households are allowed to live for many periods, was an extension of a non-stochastic two-cohort Diamond's model (1965). The deterministic OLG model was soon extended by Huggett (1996) by allowing for individual uncertainty about income (stochastic individual productivity) and lifespan (age-dependent probability of death). Since then, the Huggett's model (1996) has become the foundation for more sophisticated life-cycle models, which focus on the issues such as income inequalities, intergenerational wealth transfers or implications of fiscal and pension reforms. As shown by Lee (2018), such a framework can also be successfully employed in analysing the implications of mobility of people.

Individuals in my model economy are finitely-lived and heterogeneous with respect to their age, skills, productivity and how costly it is for each of them to change the country of their residence. The representative firms produce a homogeneous good using capital and labour. Capital moves freely between countries and labour is imperfectly mobile, i.e. individuals are allowed to change their location, but migration is costly. First, the individuals living in the foreign country suffer a utility cost which is introduced to the model to reflect the individual attachment to home location. Second, to capture the fact that the economic performance of immigrants tends to be lower than that of the natives (see, e.g. Büchel and Frick, 2005; Clark and Drinkwater, 2008), moving involves an individual productivity loss. In my model, population flows result from economic reasons, i.e. differences in wages which are the consequence of different TFP levels in both countries, and I consider only permanent relocation, meaning that no return migration is possible.

The two countries in my setup correspond to the biggest EU8 economy - Poland and to the rest of the EU. I extensively use both macro and microdata sets to calibrate the model, and ensure that it closely replicates the key features of those economies. In particular, similarly to Gourinchas and Parker (2002) or Krueger and Ludwig (2013), I allow for deterministic productivity life-cycle profiles which differ across educational groups. As in Kindermann and Krueger (2014) or Kolasa (2020), I introduce a skill-dependent individual productivity processes. Additionally, my model features stochastic life span with survival probabilities depending on age and skill level (see, e.g. Fehr et al., 2013). In my setup, all the above characteristics are allowed to differ between the two economies to capture

the region-specific features. According to my knowledge, this is the first study which uses a model with so many aspects of household heterogeneity to analyse the consequences of labour mobility for the sending country, and in particular to study the EU enlargement episode.

As the stock of Polish citizens living abroad in the pre-accession period was rather small[3] and the data on emigration structure is quite limited, for simplicity I first solve the non-migration stationary equilibrium, i.e. the stationary equilibrium in which agents are not allowed to change the country of their residence. Next, I solve the migration equilibrium, which reproduces the size and skill structure of emigration from Poland in the post-accession period, and calculate the transition path between both steady states. The model is solved using value function iteration (see, e.g. Stokey et al., 1989; Ljungqvist and Sargent, 2004; Heer and Maussner, 2009). To approximate the distribution of the autoregressive part of individual productivity, I use a method presented in Tauchen and Hussey (1991).

RELATED LITERATURE

Despite the great policy and economic relevance, the consequences of migration for the sending countries remain relatively underresearched (Zaiceva, 2014). Migration economics has so far focused mostly on impacts of immigration, trying to explain how the movement of people affect the economic situation of countries that receive migrants (see i.e. Borjas (1994), Dustmann et al. (2016), Kerr and Kerr (2011) or Okkerse (2008) for extensive immigration literature surveys).

The empirical studies about sending countries, such as Mishra (2007) or Elsner (2013a), focus mainly on migrants' characteristics and impact of migration flows on the local labour markets. Papers investigating the effect of emigration from Poland after joining the EU (see e.g. Fihel et al., 2006; Kaczmarczyk and Okólski, 2008; Kaczmarczyk et al., 2010; Barslund et al., 2014; Dustmann et al., 2015; White et al., 2018) emphasise the selectivity of emigration that manifest itself in the bias towards highly educated people and point out

---

[3] According to Poland's Population Survey from 2002, the number of Poles living abroad for more than 2 months amounted to 786 thousands, i.e. 2.05% of total population in Poland.

that, although the overall impact of the increased population outflow on the Polish labour market was rather moderate, changes in the skill composition of non-migrants' population affected the wage distribution between workers with different educational backgrounds. Since the above papers use purely statistical or econometric tools and abstract from general equilibrium aspects, they cannot assess all important macroeconomic effects. In my dissertation I overcome these problems by using a structural general equilibrium setup.

My thesis is also related to studies which use structural models to assess the labour market, output and welfare effects of migration from the perspective of the sending countries such as Klein and Ventura (2009), Elsner (2013b), Marchiori et al. (2013) or Aubry et al. (2016). Klein and Ventura (2009) use a two-region life-cycle model with endogenous migration and cross-country TFP differences and find the large gains in output, capital accumulation, and welfare from removing barriers to labour mobility. Elsner (2013b) calibrates a structural model of labour demand using the data from Lithuania to find a significant effect of emigration on the wage distribution between young and old workers. Marchiori et al. (2013) develop a multi-region general equilibrium model of the world economy characterized by overlapping-generations dynamics and argue that prevalent high-skilled emigration and brain drain can be very harmful for the sending countries. Aubry et al. (2016) use a multi-country model that accounts for the interactions between the labour market, fiscal, and market size effects of migration and quantify the effects of global migration on the welfare of non-migrant OECD citizens. My thesis differs from those studies by including all important dimensions of household heterogeneity. More specifically, neither of the above papers use the Aiyagari (1994) type model with uninsurable individual risk and hence cannot evaluate the impact of workers' movement on economic inequality.

Technically, my model is closely related to the setup developed by Lee (2018). Yet, in contrast to my thesis, Lee (2018) looks at the migration from the perspective of a recipient country and studies the consequences of doubling the H-1B visa quota for the skilled immigration to the US. To my knowledge, my thesis is the first study using this kind of framework to investigate the consequences of migration for the country of origin.

MAIN FINDINGS AND CONCLUSIONS

My model simulations reveal that allowing for labour mobility leads to a substantial outflow of workers from the poorer country. Assuming the current productivity differential between Poland and the rest of the EU, in the long run more than 14% of agents born in Poland live abroad. Since emigration alters the size and composition of population in terms of age (emigrants are relatively younger than stayers), education (emigrants are relatively better educated) and individual labour productivity (emigrants are relatively less productive), it affects important macroeconomic variables. Indeed, the decrease in effective labour supply, accompanied by the outflow of capital, results in lower output per capita in the country of origin. Moreover, the rising share of elder agents boosts the supply of savings, thereby improving the net international investment position of the emigration country, which increases in the long run by 17.7% of output.

Outmigration shifts the skill composition of labour supply towards unskilled workers. This relative scarcity of skilled labour raises the wage difference between skill groups, thereby pushing inequalities up. The effects of the higher wage differential are, however, mitigated by the disproportionately high outflow of individuals from the lower end of individual productivity distribution and by the declining share of skilled agents, since this skill group is more differentiated in terms of labour income. Therefore, the overall impact of emigration on inequalities is rather limited.

Lifting migration barriers allows agents to work in the richer economy and therefore improves their welfare. Welfare effects calculated separately for different skill groups display considerable heterogeneity. Lifting labour mobility barriers turns out to be beneficial not only for people who move abroad, but also for skilled workers who never decide to relocate, while some unskilled never-migrants lose from open borders.

Moreover, I check the robustness of the main results by modifying three model assumptions. Firstly, I consider a scenario in which productivity in the emigration country gradually converges to the level observed in the destination economy. As this modification lowers the wage gap between both economies and hence limits the incentives to relocate, we observe no emigration flows in the long run. The analysis of

the transition path reveals, however, that in the short run part of the agents born in the home country decide to change the country of their residence. Hence, in this scenario migration turns out to be a transitory phenomenon, although lasting for several decades. The productivity convergence affects the skill premium as wages of skilled workers increase not only because of the rising efficiency of the economy, but also due to rising capital supply and the complementarity of skilled labour and capital in the aggregate production. This redistribution effect is in the short run additionally strengthened by the changes in the population education structure since emigration flows are from the very beginning biased towards skilled agents.

Secondly, I analyse a scenario in which emigrants send part of their income to their home country. Solving this model variant confirms that remittances have important effects on disposable income of residents of the sending economy. These transfers from abroad can, if uniformly distributed, offset the drop in wages of unskilled workers, and turn the unskilled never-migrants into winners of post-accession emigration from Poland. It also turns out that remittances more than offset the effects of increasing wage gap between the skill groups and therefore limit disproportions in disposable income.

Thirdly, I focus on the importance of the impact of emigration on source country's demographics. In the baseline model, outmigration leads to population ageing. On the contrary, in the analysed alternative scenario in which the growth rate of the first cohort is not determined endogenously but is fixed, the population in the migration equilibrium is younger than in the non-migration steady state. Since changes in the population age structure are crucial for the evolution of macroeconomic aggregates, the long run reactions of capital stock, output and labour supplies expressed in per capita terms, as well as international investment position to output ratio are completely different than in the baseline model. Hence, this part of my analysis reveals that accounting for the impact of emigration on the number of people born in the country is key to a proper understanding of the long-term effects of population outflows.

My dissertation leaves a few doors open for further investigation. Firstly, to keep the model structure simple, my framework abstracts from the presence of a pension system. The outflow of young individuals can have, however, serious consequences for the

10

sustainability of the pension scheme. Investigating this issue is an interesting avenue for future research. Secondly, faced with migration, countries may choose to implement policies aimed at limiting population outflow or fostering returns, such as decreasing the tax wedge for the young, or providing tax cuts and cash payments for migrants coming back home. An OLG framework with labour mobility, like the one developed in this dissertation, is a perfect tool for studying the efficacy of such policies.

REFERENCES

Aiyagari, S. R. (1994). Uninsured Idiosyncratic Risk and Aggregate Saving. *The Quarterly Journal of Economics*, 109(3):659–684.

Arslan, C., Dumont, J.-C., Kone, Z., Moullan, Y., Ozden, C., Parsons, C., and Xenogiani, T. (2015). A New Profile of Migrants in the Aftermath of the Recent Economic Crisis. OECD Social, Employment and Migration Working Papers 160, OECD Publishing.

Aubry, A., Burzyński, M., and Docquier, F. (2016). The welfare impact of global migration in OECD countries. *Journal of International Economics*, 101(C):1–21.

Auerbach, A. J. and Kotlikoff, L. J. (1987). *Dynamic Fiscal Policy*. Cambridge University Press.

Baas, T., Brücker, H., and Hauptmann, A. (2010). Labor mobility in the enlarged eu: Who wins, who loses? In Kahanec, M. and Zimmermann, K. F., editors, *EU Labor Markets After Post-Enlargement Migration*, pages 47–70. Springer Berlin Heidelberg, Berlin, Heidelberg.

Barslund, M., Busse, M., Vargas-Silva, C., Kaczmarczyk, P., Baas, T., Peinado, M., Jimeno, J., Lacuesta, A., Galgóczi, B., and Leschke, J. (2014). Labour mobility in the EU: Dynamics, patterns and policies. *Intereconomics: Review of European Economic Policy*, 49(3):116–158.

Borjas, G. J. (1994). The Economics of Immigration. *Journal of Economic Literature*, 32(4):1667–1717.

Büchel, F. and Frick, J. R. (2005). Immigrants' economic performance across Europe – does immigration policy matter? *Population Research and Policy Review*, 24(2):175–212.

Clark, K. and Drinkwater, S. (2008). The labour-market performance of recent migrants. *Oxford Review of Economic Policy*, 24(3):495–516.

Diamond, P. A. (1965). National Debt in a Neoclassical Growth Model . *American Economic Review*, 55(5):1126–1150.

Dustmann, C., Frattini, T., and Rosso, A. (2015). The Effect of Emigration from Poland on Polish Wages. *Scandinavian Journal of Economics*, 117(2):522–564.

Dustmann, C., Schönberg, U., and Stuhler, J. (2016). The Impact of Immigration: Why Do Studies Reach Such Different Results? *Journal of Economic Perspectives*, 30(4):31–56.

Elsner, B. (2013a). Does emigration benefit the stayers? Evidence from EU enlargement. *Journal of Population Economics*, 26(2):531–553.

Elsner, B. (2013b). Emigration and wages: The EU enlargement experiment. *Journal of International Economics*, 91(1):154–163.

Fehr, H., Kallweit, M., and Kindermann, F. (2013). Should pensions be progressive? *European Economic Review*, 63(C):94–116.

Fihel, A., Kaczmarczyk, P., and Okólski, M. (2006). Labour mobility in the enlarged european union: International migration from the eu8 countries. CMR Working Papers 14/72, Warsaw.

Gourinchas, P.-O. and Parker, J. A. (2002). Consumption Over the Life Cycle. *Econometrica*, 70(1):47–89.

Heer, B. and Maussner, A. (2009). *Dynamic General Equilibrium Modeling. Computational Methods and Applications,*. Springer.

Hendricks, L. (2001). The economic performance of immigrants: A theory of assortative matching. *International Economic Review*, 42(2):417–449.

Huggett, M. (1996). Wealth distribution in life-cycle economies. *Journal of Monetary Economics*, 38(3):469 – 494.

Kaczmarczyk, P., Mioduszewska, M., and Żylicz, A. (2010). Impact of the post-accession migration on the polish labor market. In Kahanec, M. and Zimmermann, K. F., editors,

EU Labor Markets After Post-Enlargement Migration, pages 219–253. Springer Berlin Heidelberg, Berlin, Heidelberg.

Kaczmarczyk, P. and Okólski, M. (2008). Demographic and labour-market impacts of migration on Poland. *Oxford Review of Economic Policy*, 24(3):600–625.

Kerr, S. P. and Kerr, W. R. (2011). Economic Impacts of Immigration: A Survey. *Finnish Economic Papers*, 24(1):1–32.

Kindermann, F. and Krueger, D. (2014). High Marginal Tax Rates on the Top 1%? Lessons from a Life Cycle Model with Idiosyncratic Income Risk. NBER Working Papers 20601, National Bureau of Economic Research, Inc.

Klein, P. and Ventura, G. (2009). Productivity differences and the dynamic effects of labor movements. *Journal of Monetary Economics*, 56(8):1059–1073.

Kolasa, A. (2020). Macroeconomic consequences of the demographic and educational changes in poland after 1990. *Macroeconomic Dynamics*, pages 1–44.

Krueger, D. and Ludwig, A. (2013). Optimal Progressive Labor Income Taxation and Education Subsidies When Education Decisions and Intergenerational Transfers are Endogenous. *American Economic Review*, 103(3):496–501.

Lee, H. (2018). Quantitative Impact of Skilled Immigration Through the Lens of General Equilibrium: The Case of the US H-1B Visa. unpublished manuscript.

Ljungqvist, L. and Sargent, T. J. (2004). *Recursive macroeconomic theory*. MIT Press.

Marchiori, L., Shen, I.-L., and Docquier, F. (2013). Brain Drain In Globalization: A General Equilibrium Analysis From The Sending Countries' Perspective. *Economic Inquiry*, 51(2):1582–1602.

Mishra, P. (2007). Emigration and wages in source countries: Evidence from Mexico. *Journal of Development Economics*, 82(1):180–199.

Okkerse, L. (2008). How to measure labour market effects of immigration: a review. *Journal of Economic Surveys*, 22(1):1–30.

Stokey, N. L., Lucas, R. E., and Prescott, E. C. (1989). *Recursive methods in economic dynamics.* Harvard University Press.

Tauchen, G. and Hussey, R. (1991). Quadrature-based methods for obtaining approximate solutions to nonlinear asset pricing models. *Econometrica*, 59(2):371–396.

White, A., Grabowska, I., Kaczmarczyk, P., and Slany, K. (2018). *The Impact of Migration on Poland: EU Mobility and Social Change.* UCL Press.

Zaiceva, A. (2014). Post-enlargement emigration and new EU members' labor markets. *IZA World of Labor*, pages 1–40.

APPENDIX: RESEARCH AND ACADEMIC ACTIVITY

EDUCATION

1. M.A. with distinction, SGH Warsaw School of Economics, 10/2012–06/2014
   Faculty: Quantitative Methods in Economics and Information Systems
   Thesis title: Impact of labour market shocks on business cycle fluctuations in Poland
   Advisor: dr hab. Marcin Kolasa, prof. SGH

2. B.A. with distinction, SGH Warsaw School of Economics, 10/2009-06/2012
   Faculty: Quantitative Methods in Economics and Information Systems
   Thesis title: Analiza sytuacji na polskim rynku pracy z wykorzystaniem koncepcji rozszerzonej funkcji dopasowań (Analysis of the Polish labour market with the use of an augmented matching function)
   Advisor: dr hab. Marcin Kolasa, prof. SGH

3. Singapore Management University, student exchange programme, 08/2011–12/2011

RESEARCH VISITS

1. University of Chicago, Department of Economics, 01/2018–08/2018
   Advisor: prof. Robert Shimer

2. International Monetary Fund, Monetary and Capital Markets Department, 02/2017–05/2017

JOURNAL ARTICLES

1. *Do flexible working hours amplify or stabilize unemployment fluctuations?* (with M. Kolasa and M. Rubaszek), European Economic Review 131: 103605 (2021).

2. *The economic effects of emigration: a literature review*, Nierówności Społeczne a Wzrost Gospodarczy 62: 121–135 (2020).

3. *Transmission of monetary policy and exchange rate shocks under foreign currency lending,*, Post-Communist Economies 30(4): 506-525 (2018).

4. *What drives the labour wedge? A comparison between CEE countries and the Euro Area*, Economic Modelling 56: 148–161 (2016).

5. *Impact of labour market shocks on business cycle fluctuations in Poland*, Bank i Kredyt 46(1): 1–40 (2015).

WORKING PAPERS

1. *When the Fed sneezes, the whole world catches the cold, when the ECB - only Europe* (with G.Wesołowski), MPRA Paper 100899 (2020).

2. *Monetary policy transmission mechanism in Poland. What do we know in 2019?* (with T. Chmielewski, A. Kocięcki, T. Łyziak, J. Przystupa, E. Stanisławska and E. Wróbel), NBP Working Papers 329 (2020).

HONORS AND AWARDS

1. Foundation for Polish Science (FNP) START Scholarship, 2020

2. Fulbright Junior Research Award, 2018

3. Award in the Competition for the Best Article Published in the Bank i Kredyt Scientific Journal, 2016

4. Best Paper Award, 3rd prize, Augustin Cournot Doctoral Days, 2015

5. Doctoral Scholarship, SGH Warsaw School of Economics, 2015–2018

6. Scholarship for Outstanding Academic Performance, SGH Warsaw School of Economics, 2015–2018

7. Scholarship for the Best Ph.D. Students, SGH Warsaw School of Economics, 2015–2020

8. Rector's scholarship for exceptional master and bachelor students, SGH Warsaw School of Economics, 2009–2014

9. Winner of the nationwide competition Practice of Financial Engineering, 2013

GRANTS

1. Polish National Science Centre research grant PRELUDIUM for financing the project *Analysis of short-term and long-term consequences of post-accession migration from Poland with the use of a heterogeneous agent model*, principal investigator, 2017–2022

2. Polish National Science Centre research grant OPUS for financing the project *Endogenous choice of mortgage loans portfolio in general equilibrium*, research assistant, 2015–2017

3. Research grant for young economists and Ph.D. students for financing the project *What drives the labour wedge? A comparison between CEE countries and the Euro Area*, principal investigator, 2015–2016

PRESENTATIONS AT CONFERENCES

Dynare (2019), AIEL (2019, 2015), EcoMod (2019, 2015), ECEE (2019), Macromodels (2018), ACDD (2015), Barcelona GSE Summer School (2015), IBS Workshop New Developments in Labour Markets (2015), University of Łódź Doctoral Workshop in Econometrics and Statistics (2015), WIEM (2015), seminars at NBP, SGH and INE PAN

REFEREEING FOR JOURNALS

Economic Modelling (2x), Post-Communist Economies, Gospodarka Narodowa, Bank of Lithuania Working Paper Series

PROFFESIONAL COURSES ATTENDED

1. R Modelling, Bank of England, 2019 (1 week)

2. Economic modelling and forecasting, Bank of England, 2016 (2 weeks)

3. Tools for Macroeconomists: Advanced Tools, London School of Economics, 2016 (1 week)

4. Labor Market Outcomes, Barcelona Graduate School of Economics, 2015 (1 week)

5. Bayesian Time Series Methods, Barcelona Graduate School of Economics, 2015 (1 week)

TEACHING EXPERIENCE

1. Econometrics (Fall 2017/2018, 2018/2019, in Polish)

2. Principle of Microeconomics (Fall 2015/2016, 2016/2017, in Polish)

3. Intermediate Microeconomics (Fall 2015/16, in Polish)

4. Principle of Microeconomics (Fall 2014/2015, in English)