LISER
Luxembourg Institute of Socio-Economic Research

European Labor Market and Occupational Shifts

- Michal Burzynski, *Luxembourg Institute of Socio-Economic Research, Luxembourg*

Over the past two decades, Europe has undergone a profound transformation driven by automation. The growing use of machines, robots, and digital systems has allowed outsourcing tasks once carried out by people. This technological shift has redefined how goods and services are produced, has improved efficiency of work, but also has posed a crucial challenge for employees, whose skills have become less relevant. Some of them have already adapted (or will have to adapt) by retraining or moving into new occupations, while others have changed places of residence in search for better economic prospects. These transitions, occupational and spatial mobility of workers, play a crucial role in determining whether technological change benefits the society in broad terms or deepens divides between groups and local labor markets.

This study examines the way that technology-induced occupational shifts shape the European labor market and workers' remunerations. We are interested in a way that individual decision makers react and respond to changes on the labor market, as well as we want to quantify the economic consequences of such shocks. Within our model, we simulate a stylized scenario of increasing the demand for skills used in professional occupations – those types of jobs that include most complex and non-routine tasks and require high levels of education from employees. Such a scenario, even though it is purely mechanical within the logic of the model, closely resembles the ongoing dynamics of European labor markets. While, according to 2014-2018 Eurostat data, the relative importance of professional occupations in generating value added increased by 0.7 p.p. over four years across all production sectors and European NUTS1 regions, our scenario assumes a proportional increase in these shares by a further 1 p.p. on average taking the 2018 as a reference point.

By imposing this occupational shift, we induce changes in relative wages across different occupational groups. Such an imbalance rewards those individuals, who possess wanted skills, and puts a pressure on wages of incumbents in less complex occupations. Increasing demand for professional jobs, however, motivates some workers to move across occupations. In particular, those who have sufficiently high levels of required skills move to the professional occupations leaving other types of jobs. Although occupational switching is the easiest way of adjusting to the imposed skill demand shift, some workers prefer to migrate across European regions. The occupational shift shock, even though is uniform across regions, translates into uneven shifts in skill

Michal Burzynski, is a quantitative theoretical modeler focusing on causes and consequences of migration of people. He holds a Ph.D. in economics from Universite catholique de Louvain, Belgium and Poznan University of Economics, Poland. His research interests include: the impact of migration on labor markets, climate change and potential consequences for global growth and migration, immigration policies and interlinks between migration, trade, and other dimensions of globalization.

Contact:
michal.burzynski@liser.lu

demand as the latter are determined by initial intensity of occupational inputs in production, sectoral composition of firms and trade patterns that significantly differ across European NUTS1 regions. Thus, spatial inequality, which affects labor markets on top of within occupation and within-region inequality, generates incentives for changes in residences for some of the European workers. Overall, the imposed shock affects wage distributions of all types of workers across skill and occupation groups, the cost structure of all sorts of firms across sectors, trade and migration flows at NUTS1 regional level and the patterns of inequality. This policy brief displays the potential consequences of further skill-bias and complex-task-biased technological change, a scenario that is both credible and interesting from the policy perspective.

Brief Description of Methodology and Data

With a goal to measure the impact of occupational shift on workers' labor market outcomes, this study develops a large-scale spatial quantitative general equilibrium model that represents how workers and firms interact over the labor and goods markets across European regions. 31 European countries are divided into 100 NUTS1 regions, individuals sort across four broad occupational groups (managers, professionals, service workers, and elementary jobs), while firms operate in eight production sectors (manufacturing, construction, trade, transport, low-skilled, financial, professional, and public services). Each worker is characterized by a unique bundle of skills drawn from continuous distributions, allowing the model to capture how labor market shocks change wage inequality and job mobility. Firms differ in productivity, and their entry or exit is determined by profitability, which depends on available technology, labor costs, and demand for final goods and services. The model links three types of decisions: (1) firms choose how to combine labor and capital (including automation technologies) in production; (2) within each regional labor market workers decide which occupation to pursue based on their skills and expected wages and (3) additionally, workers have an option to migrate to another region if living standards there are higher. The model computes the allocation of workers across occupations, regions and sectors, occupation-specific wage distributions, migration follows between all pairs of European regions, trade flows of sectoral goods and services, as well as price levels, entry and exit of firms and income aggregates.

The analysis combines several major European data sources. Sizes of worker groups are computed from Eurostat's Labour Force Survey (LFS), allowing us to disaggregate them into occupation, education, and region of origin groups. Wage distributions are estimated from the Structure of Earnings Survey (SES), while EU-SILC provides data on wage differentials between natives and migrants. OECD and Eurostat migration statistics inform regional mobility patterns, and the OECD TiVA and JRC databases supply information on trade linkages across regions and sectors. Capital stocks and automation intensity are derived from the EUKLEMS dataset, while relative occupational inputs are computed using aggregate remuneration data from SES. The model is calibrated to match Europe's 2018 economic structure and then re-estimated for a "counterfactual" scenario by changing the occupational structure in each sector-region cell. The shock imposed to the system comprises in increasing the share of professional occupations by 5 percent, which on average increases these shares by 1 p.p. (since the average share of professional occupations is approximately 20 percent before the shock). Comparing both equilibria isolates the specific contribution of occupational shift to Europe's economic and migration outcomes.

Results of Simulation

Increasing the relative share of professional occupations across all sectors and regions is equivalent to increasing the demand for most complex and non-routine tasks. Therefore, this scenario generates a larger number of better-paid jobs at the expense of less paid jobs. By consequence, the overall gains for the European economy are positive, with the most urbanized and advanced regions leading in terms of overall economic growth, see Figure 1(a). While the gains in GDP are concentrated in areas with big cities, the change in total labor force (Figure 1(b)) does not follow the pattern of concentration. While the default is a positive relationship between these two variables, many a time, areas with high positive growth face lower number of active workers. The latter is caused by compositional change in the workforce: as the minority is better off, the majority faces wage reductions and decides to out-migrate. The higher initial share of professional occupations in a region, the stronger these contrasts are, and the greater the imbalance in net migration across different occupation groups. At the same time, the overall productivity gain, and consequential spillovers, allow to reap positive impacts on total economies. A similar story can be told in terms of task remuneration in Figure 1(c). Note that our model assumes that labor and capital are used together to fulfill tasks, thus this statistic blends these two types of inputs.

In general terms, tasks receive higher incomes, but the majority of the effect comes once again from the compositional change, as the structure of the labor markets is perturbed in favor of professional occupations. Although tasks are more expensive in majority of regions, the incentives for firms to enter the market are positive, and our scenario provides a sizable increase in firm entry, Figure 1(d). More firms means more consumption goods available for individuals, thus translates into lower price levels, inversely to the firm supply aggregate.

Tasks receive higher incomes, but the majority of the effect comes once again from the compositional change, as the structure of the labor markets is perturbed in favor of professional occupations. Although tasks are more expensive in majority of regions, the incentives for firms to enter the market are positive, and our scenario provides a sizable increase in firm entry

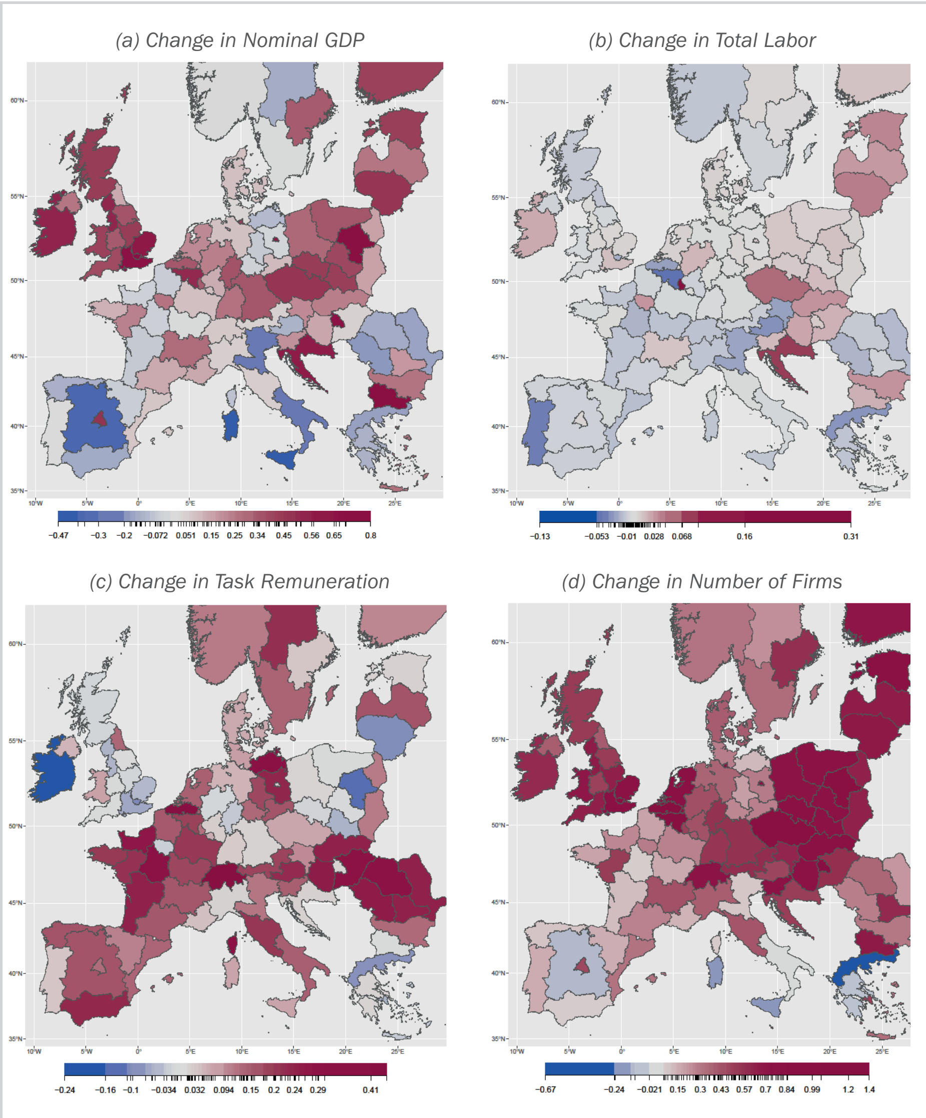

Figure 1: Aggregate effects of changing the relative productivity of professional occupations in Europe. (a) includes percent changes in nominal GDP per capita, (b) illustrates percent changes in total labor, (c) shows percent changes in payments for tasks, (d) depicts percent changes in number of firms. All results are summarized at a NUTS1 geographical level.

Source: own computations.

Figure 2 dives into the details of the above described effects and looks at sectors (in panel (a)), as well as individual types by education-occupation groups (remaining panels). As it is clear from Figure 2(a), the growth in all regions is driven by high-skilled intensive economic sectors: financial, professional and public services. The remaining sectors tend to lose slightly, as they do not use the professional occupations in an intensive way, thus do not profit from higher productivity shock. Higher relative productivity of professional occupations boosts output only in a fraction of local economies, and generates visible inequality depending on the production technology. Moreover, the overall effect on growth analyzed in Figure 1(a) is solely a function of the weights that each sector has across local markets: industry intensive regions of East Germany, Spain or Italy tend to be losing comparing to high-tech service-intensive regions of the UK, Benelux and Poland. As expected, in Figure 2(b), higher wages accrue to those who are active in professional occupations, as their relative productivity grows. However, one can observe spillover effects across occupations, especially those that are characterized by higher similarity to professionals that is managers on the one end and service occupations on the other. As workers tend to follow wage increases, they sort into professional occupations (see Figure 2(c)), while originating mainly from other service jobs. Lower supply of workers in managerial and service jobs, in consequence, raises the price for these skills and offers a tangible benefit for those who decide not to change their job instead of switching to more productive professional tasks. While this effect is mainly present for the high-skilled workers, less-educated employees, who cluster in elementary occupations, leave these jobs for inactivity, thus fully quitting the labor market. Importantly, the occupational reshuffling induced by the simulated shift has a crucial impact on who ends up in which type of job. According to Figure 2(d), the self-selection of workers within occupations is strongly affected with average skill levels decreasing in professional and increasing in other occupations. Necessarily, those workers, who switch into professional jobs are negatively self-selected from the perspective of both initial and final jobs. The least skilled in non-professional occupations are most likely to switch, as their outside option of remaining in their current job is the weakest. At the same time, the switchers, who join professional occupations are necessarily less skilled in these jobs comparing with incumbents. Thus, the double-sided negative self-selection strongly affects wage distributions and inequality, as the left tails of wage distributions are subject to cut (extended) in non-professional (in professional, respectively) occupations. The self-selection mechanism works in opposite way to the supply effect, as long as skills are sufficiently different. There exists however few counterexamples in which skill similarity between managerial and professional jobs is big enough to generate a positive self-selection of job switchers, e.g. in Hungary, Bulgaria and several regions in Germany. Average skill levels of managers reduce meaning that the best managers tend to switch to professional occupations.

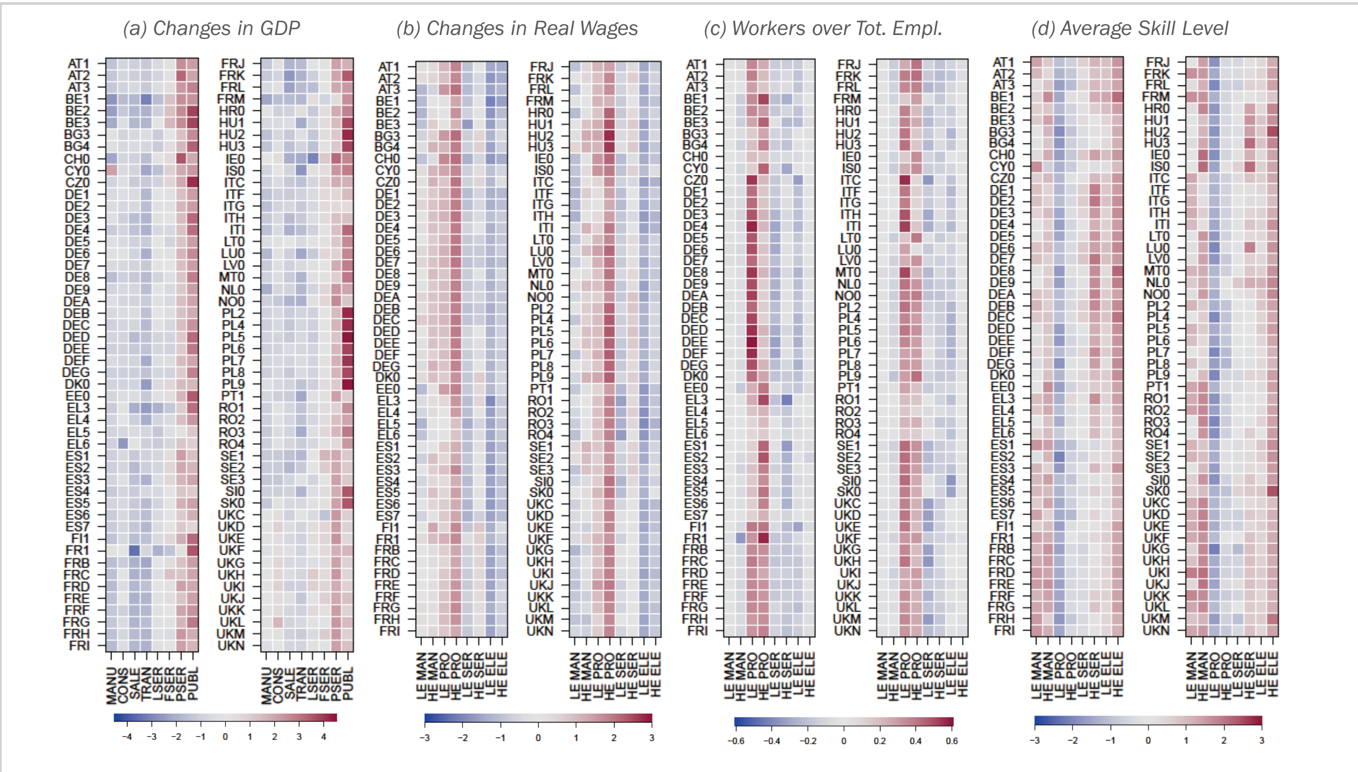

Figure 2: Effects of increasing the relative productivity of professional occupations in Europe, disaggregated by NUTS1 regions (rows) and sectors or individual types (columns). (a) depicts changes in nominal GDP, (b) illustrates changes in real wage rates (nominal wages divided by price index), (c) shows changes in employment, (d) depicts changes in average skill level of workers within labor market cells.

Source: own computations.

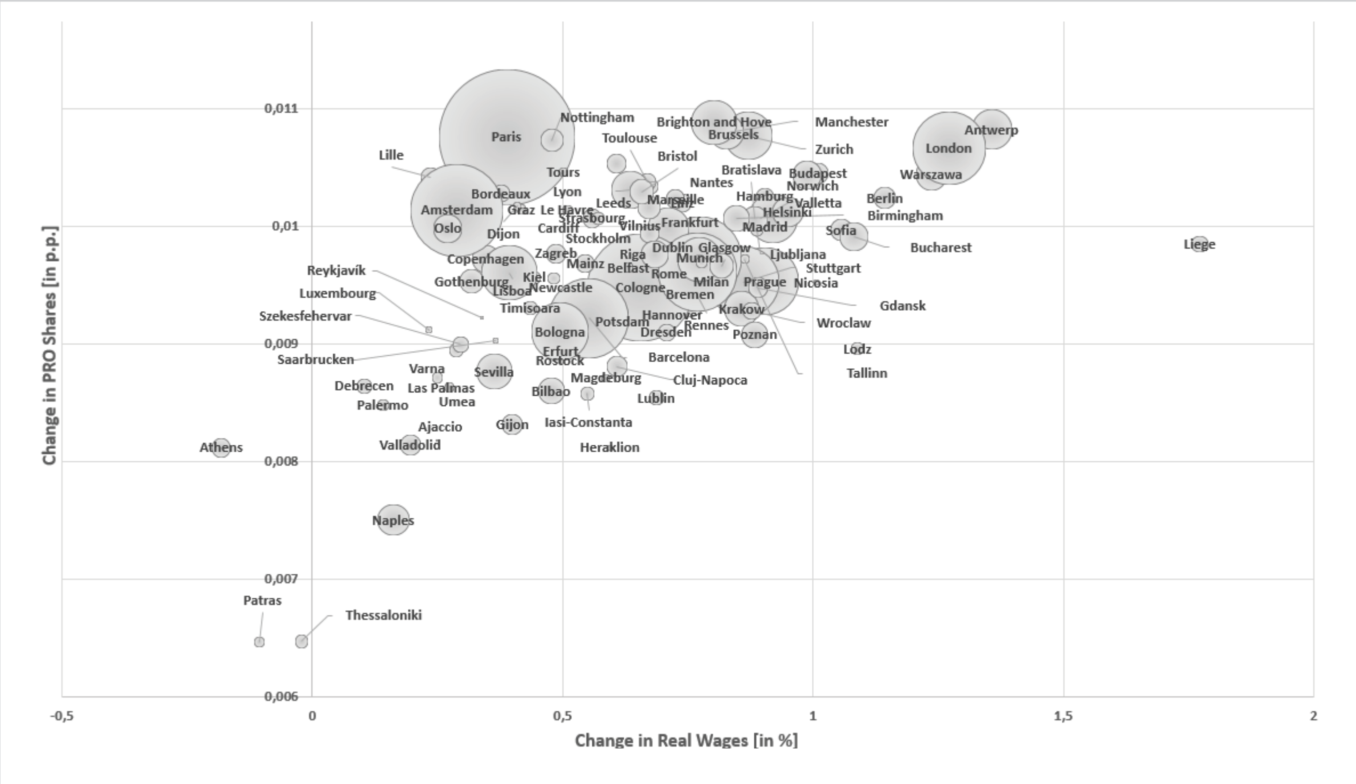

Figure 3: Welfare effects of increasing the relative productivity of professional occupations across NUTS1 regions in Europe. The horizontal axis illustrates percent changes in real wages to an average employee in each region, while the vertical axis shows the magnitudes of the imposed shocks in the counterfactual scenario: percentage point changes in professional occupation shares. The size of each bubble is proportional to region's population.

Source: own computations.

Overall, however, the average workers across European labor markets experience a significant increase in real wages (nominal wages corrected by changes in prices), as indicated in Figure 3. The gains reveal high correlation with the magnitude of the shock, which is larger in those regions where the initial importance of professionals in generating value added was high. While the bigger regions, represented by the diameter of each bubble proportional to the total population, tend to cluster in the middle of the distribution of gains, large and innovative cities lead the standings, while workers in small and more rural areas in Europe experience attenuated (but still positive) consequences from the implemented scenario. Nevertheless, even though benefits from the increasing intensity of professional occupations are generically strongly heterogeneous and concentrated in specific labor market and spatial cells, the knowledge of the actual effects, its distribution across space and individual types, as well as potential spillover effects allows to construct a fair redistribution scheme that could propagate the gains in a more uniform and inclusive way.

The next decades are bound to induce unprecedented changes to labor markets. Digital technologies, data science and Artificial Intelligence will very likely outsource a significant chunk of tasks currently performed by humans. Studying the economic effects of these rapid changes is undoubtedly a necessary input for policy decisions. However, focusing on their impacts on inequality, occupational mobility and migration provides crucial insights into real world consequences of unequal distribution of gains and losses for even better people-centered policies.

Region	City	Region	City	Region	City	Region	City
AT1	Vienna	**DEF**	Kiel	**FRJ**	Toulouse	**PL7**	Lodz
AT2	Graz	**DEG**	Erfurt	**FRK**	Lyon	**PL8**	Lublin
AT3	Linz	**DK0**	Copenhagen	**FRL**	Marseille	**PL9**	Warszawa
BE1	Brussels	**EE0**	Tallinn	**FRM**	Ajaccio	**PT1**	Lisboa
BE2	Antwerp	**EL3**	Athens	**HR0**	Zagreb	**RO1**	Cluj-Napoca
BE3	Liege	**EL4**	Heraklion	**HU1**	Budapest	**RO2**	Timisoara
BG3	Varna	**EL5**	Thessaloniki	**HU2**	Szekesfehervar	**RO3**	Bucharest
BG4	Sofia	**EL6**	Patras	**HU3**	Debrecen	**RO4**	Iasi-Constanta
CH0	Zurich	**ES1**	Gijon	**IE0**	Dublin	**SE1**	Stockholm
CY0	Nicosia	**ES2**	Bilbao	**IS0**	Reykjavík	**SE2**	Gothenburg
CZ0	Prague	**ES3**	Madrid	**ITC**	Milan	**SE3**	Umea
DE1	Stuttgart	**ES4**	Valladolid	**ITF**	Naples	**SI0**	Ljubljana
DE2	Munich	**ES5**	Barcelona	**ITG**	Palermo	**SK0**	Bratislava
DE3	Berlin	**ES6**	Sevilla	**ITH**	Bologna	**UKC**	Newcastle
DE4	Potsdam	**ES7**	Las Palmas	**ITI**	Rome	**UKD**	Manchester
DE5	Bremen	**FI1**	Helsinki	**LT0**	Vilnius	**UKE**	Leeds
DE6	Hamburg	**FR1**	Paris	**LU0**	Luxembourg	**UKF**	Nottingham
DE7	Frankfurt	**FRB**	Tours	**LV0**	Riga	**UKG**	Birmingham
DE8	Rostock	**FRC**	Dijon	**MT0**	Valletta	**UKH**	Norwich
DE9	Hannover	**FRD**	Le Havre	**NL0**	Amsterdam	**UKI**	London
DEA	Cologne	**FRE**	Lille	**NO0**	Oslo	**UKJ**	Brighton
DEB	Mainz	**FRF**	Strasbourg	**PL2**	Krakow	**UKK**	Bristol
DEC	Saarbrucken	**FRG**	Nantes	**PL4**	Poznan	**UKL**	Cardiff
DED	Dresden	**FRH**	Rennes	**PL5**	Wroclaw	**UKM**	Glasgow
DEE	Magdeburg	**FRI**	Bordeaux	**PL6**	Gdansk	**UKN**	Belfast

Table 1: Index of NUTS1 regions in Europe: ISO codes and main cities

Acknowledgement:

This research is part of the the LaMaM project supported by the Luxembourg 'Fonds National de la Recherche' (contract C20/SC/14787979).

Luxembourg National Research Fund