



**Growing Inequality:**  
a Novel Integration of  
transformations research



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# Progress Report

## WP3 Digital Transformation: Impact on skills and inequality Milestone 6

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# Contents

1. Aim .....	4
2. Progress Reports on the individual tasks.....	5
Task 3.1: Firm-level technology adoption and the rise of Superstar Firms (UU, EUF) (Months: 4-38) .....	5
Content.....	5
Progress.....	6
Task 3.2: Worker resilience to technology shocks (UU) (Months: 4-38) .....	7
Content.....	7
Progress.....	8
Task 3.3: Incentive wage schemes and the increase of the gender wage gap (KRTK) (Months: 6-24) .....	9
Content.....	9
Progress.....	9
Task 3.4: What are the policy implications of the identified labour market transformations? (UU, KRTK, EUF) (Months: 20-28) .....	10
Content.....	10
Progress.....	10
Task 4.1: Quantifying the impact of international fragmentation of production on gender inequality .....	10
Content.....	10
Progress.....	10
Task 4.2: Worker mobility and the differential impact of occupation-specific import competition on labour market outcomes .....	11
Content.....	11
Progress.....	11
Task 4.3: Implications of offshoring for the labour market position of Bulgarian and Hungarian firms and workers .....	11
Content.....	11
Progress.....	11
Task 4.4: Policy implications of the international trade transformations? .....	12
Task 5.1: Inequality and international mobility and migration intentions.....	12
Task 5.2: Occupational sorting and migration in Hungary and Austria: the effect of outmigration on skill distribution, occupational mobility and wage inequality .....	12
Content.....	12
Progress.....	12
Task 5.3: Participation, segregation and labour mobility of native and immigrant groups in the EU labour market .....	12
Content.....	12
Progress.....	13
Task 5.4: New perspectives on the migration-inequality nexus.....	13
Content.....	13
Progress.....	13

# 1. Aim

This deliverable contains the proofs for the Milestone 6. We show where we are with the work and can report that the activities in WP3 are halfway.

WP 3 uses data on the microeconomic responses of workers and firms to technology shocks. The connection of individual employees to the company investments at firm firm-level is a novel approach. The data allows to understand how decisions are made at the firm-level. The focus is on distinguishing the different impact of cutting edge technologies, such as Industry 4.0, and older technologies. We allow explicitly for heterogeneity across firms. The WP starts at the investment-level and then focuses on the firm-level impacts on employment, wages and contracts. The analysis leads to informed policy choices. In particular, we aim to:

1. Investigate the impact of firms' investments into cutting-edge technologies on firm-level employment and occupational structures, as well as the role of new technologies (robotics, computer-aided design, computer-digital machine tools) in boosting firm-level productivity and creating "superstar firms";
2. Investigate the impact of technological change on workers' careers (employment, wages, mobility), the heterogeneity of these impacts, and which characteristics help workers to cope with the change;
3. Investigate the impact of technology-induced incentive wage schemes on within- and between-firm gender wage gaps;
4. Derive policy implications on how policy makers can respond to the challenges which that technological change poses for labour markets.

## 2. Progress Reports on the individual tasks

### Task 3.1: Firm-level technology adoption and the rise of Superstar Firms (UU, EUF) (Months: 4-38)

#### Content

To understand how and why firms invest in cutting-edge technologies and what the impact of these investments are on firm-level productivity, the emergence of superstar firms, employment and occupational structures, this task builds on two unique datasets: the first is the newly developed “IAB-ZEW Arbeitswelt 4.0” matched employer-employee dataset for Germany. This data combines German social security records with a firm survey, containing information, among others, on firms’ investments into cutting-edge technologies (“Industry 4.0”), further training measures, and workers’ administrative social security records. The second dataset comes from an annual firm-level survey in Spain spanning a 27-year period from 1990 to 2016. It includes firm-level information on the use of various technologies (e.g. robotics, computer-aided design, computer-digital machine tools) as well as various types of worker training (e.g. engineering and IT). The task consists of several analyses that will be conducted on the German and Spanish data:

- Analyse the role of firms’ technology choices for firm-level employment, wages and occupational structures. How do firms’ technology choices affect employment and wages? Which technologies require complementary investments into worker training, which don't? Which occupations and skills win, which lose due to new technologies?
- Decompose overall changes in employment and occupational structures into within- vs. between-firm effects: How much of overall employment and occupational changes can we explain through firms’ investment decisions?

The German dataset provides only a short term view on technology choices and their impacts. A structural framework is needed to quantify the causal effects of new technologies on productivity in order to identify the factors which are critical for new technologies to produce sizeable and positive productivity effects, including e.g. a suitably skilled workforce, access to foreign markets, and technological cooperation with other firms. The Spanish data allows such a framework because it covers a sufficiently long time period. The task assesses the extent to which new technologies widen the productivity gap between a few “superstar firms” and other firms, with crucial implications for the concentration of market power and the decline in the labour share.

## Progress

- Progress on the Spanish data:
  - The descriptive analysis part is finalised and will be subject to only minor changes going forward. The focus is on the evolution of the use of different technologies over time, as well as on heterogeneity across industries. Moreover, we inspect the pricing behaviour of different types of firms depending on their use of technology. This is important in the context of the analysis of the evolution of market power in connection with technology adoption.
  - We have adapted state-of-the-art mark-up estimation routines familiar from the literature to the needs of our analysis in order to investigate the evolution of mark-ups and market power over time. We pay special attention to the use of different technologies when estimating mark-ups. We have finalized a description of the routine that we use that will be subject to just minor changes going forward.
  - We have finalized the analysis of how mark-up evolve over time, duly paying attention to the distribution of mark-ups across firms.
  - We have developed an empirical framework to investigate the relationship between mark-ups and firm characteristics. We have applied this framework to our data and are now in the process of fine-tuning the estimation and describing and interpreting the results.
  - The period of analysis is currently being extended to include the years 2017 and 2018, so that the panel ends up covering a 29-year period from 1990 to 2018. This involves some more data preparation work, but allows us to bring the analysis closer to the more recent developments in the industry. This seems important in a modern economy that is subject to continuous change.
- With respect to the German data:
  - All data preparation and descriptive analyses have been successfully completed.
  - The association between firm characteristics and investment behaviour are finalised. The association between firms' investments and labour market outcomes are likewise finalised.
  - The decomposition of overall changes into within- and between-firm effects are completed.
  - The project team has run the regressions and is currently optimising additional regressions that provide deeper insights into the mediators of technology-driven occupational change within firms. In particular, the decomposition has revealed heterogeneity between firms in technology-driven occupational change. The team uses additional regressions to test theories that could explain this heterogeneity.

- The project team has prepared a first draft of the description of the German analysis and is currently polishing that draft. Once the first draft is completed, it will be sent to leading scholars in the field for feedback.
- Overall, the team is well on track concerning all analyses for Task 3.1 and expects to provide Deliverable 3.1 by the deadline (Month 38).
- 

## **Task 3.2: Worker resilience to technology shocks (UU) (Months: 4-38)**

### **Content**

This task focuses on the consequences of technology shocks for workers: their wages, careers, and mobility. We analyse the role of upskilling and mobility across labour markets as an instrument (insurance) to become more resilient to changes. We study in more detail how the network and clustering of tasks across occupations affects the labour market response to task-biased change from technological change. This task builds on access to Dutch and Portuguese micro-database from the Dutch Central Bureau for Statistics and the Portuguese Ministry of Employment.

- Create a descriptive analysis of the resilience of workers to shocks using the network of tasks across occupations (i.e., upskilling and mobility). This will be done on the bases of known occupation of the worker, which is mapped to the closest possible matching occupational database, e.g. ROME-v3, ESCO or O\*NET. How does this correlate with worker characteristics, in particular gender?
- Estimate heterogeneity in the link between ongoing technological change and the worker career trajectory. For this, we focus on the transition out of non-employment e.g. after a mass lay-off. We analyse heterogeneity in responses related to skills derived from previous working experience.
- We have received access to new data from the Public Employment Service of Flanders, VDAB. Because this dataset is superior for several reasons, this task will not make use of the alternatives. The Belgian data was not yet available at writing the GI-NI proposal phase. Now, we have compared the Belgian data with the Portuguese and Dutch data.

The Belgian dataset is derived from a combination of administrative records and worker profiles created on the online job platform of the public employment agency. The data has some unique qualities.

First, it allows the researcher to make a much more detailed and convincing task-competency profile. This is because past career (not just the last known occupation) is coded when job seekers register on the platform at a very granular level, more than in a standard administrative dataset. Moreover, the occupations are immediately merged with the very detailed task competencies related to this occupation, which is also shared with job seekers. In the alternative datasets, I would need to merge external occupational descriptions from e.g., O\*NET.

Second, the online platform also allows us to observe search effort (logins, clicks,...), a channel of adjustment that is so far, unexplored. This is also not something included in standard administrative records.

Finally, the policy change that will occur within the starting communication also provides us with a neat evaluation of a nudging design towards searching more online. This could also give us some clear policy insights into what tools could be useful for job seekers undergoing a structural change in the labour market. The Belgian dataset contains the complete inflow of unemployed job seekers that claim benefits and their job-finding rates within the next year. We observe a rich set of background variables and past career. Most importantly, these have been coded to very detailed occupations. Each of these occupations has been mapped to tasks on the basis of Rome-v3. This allows us to construct very detailed task-related competency profiles that will be used to predict differences in job-finding rates. The task-competency profiles will allow us to construct indices that capture exposure to automation by routine content, and the level of mobility. To measure their effect on unemployment, we will make use of duration analysis, similar to Goos et al. (2019). Second, we can observe their use of only search platform after introducing a stimulating policy. This is hypothesized to aid workers in re-orientating to the labour market (Belot et al., 2019).

## Progress

Progress for this task is on schedule.

The Flemish data have been processed and analysed:

- We have processed the sample of unemployed job seekers from the administrative data of the Public Employment Services (PES).
- We have created a novel instrument to measure the existence of similarity between job markets using the job descriptions from the PES. This allows us to create a structure of overlap between occupational labour markets which then predict mobility of job seekers.
- We have estimated a flexible matching function that takes into consideration the existence of similarity between job markets.
- We have analysed outcomes for workers that are exposed to different types of automation to understand whether the structure of overlapping markets can help understand why we find persistent negative effects from automation.
- We have developed two counterfactual simulations to understand how we might intervene to improve the situation.

We have progressed to having a written output:

- The results from this task have been presented at multiple outlets: The H2020 Pillars consortium conference in the summer of 2022, workshop and seminar at Utrecht School of Economics, seminar



presentation at the Technology and Policy Research Initiative at the Boston University – which is part of the research visit by Emilie Rademakers during Spring 2023.

- This project has received feedback in its form as a working paper. It is currently submitted at a high-ranking multidisciplinary journal.

Finally, we are also busy to analyse additional outcomes on the search effort of unemployed job seekers on the online platform and linking those to different forms of communication by the PES.

### **Task 3.3: Incentive wage schemes and the increase of the gender wage gap (KRTK) (Months: 6-24)**

#### **Content**

This task combines a firm-level survey on incentive wage schemes with Hungarian administrative social security data. We analyse how much incentive wage schemes contribute to the gender gap between and within firms. The task consists of several activities:

- Matching the Hungarian Structure of Earnings Survey to social security records on wages and to administrative revenue data of corporate income tax returns. Preparing and cleaning the data.
- Descriptive analysis on which types of firms choose incentive wage schemes. What type of workers do firms with incentive wages hire? Are there firm specific differences in hiring strategy?
- Decomposing the contribution of incentive wages to the gender wage gap between and within firms. Estimating within firm gender gap by occupational categories. E.g. do female managers gain less from incentive contracting than male managers?
- How does the career trajectory of men and women change after moving from a fixed wage firm to a firm with incentive wage scheme?

#### **Progress**

Deliverable 3.3 was due in Month 24 and has been submitted in time. Task 3.3 is completed.

### **Task 3.4: What are the policy implications of the identified labour market transformations? (UU, KRTK, EUF) (Months: 20-28)**

#### **Content**

This task consists of summarizing and bringing together the main contributions of this working package. Moreover, we derive broad policy implications to inform further analysis in WP6 (EU-analysis). What company policy or organisational elements form limits to change? For example, should policy focus on the re-skilling of workers within or across countries? How does the identification of jobs on the rise and on the decline inform convergence or divergence within and across European labour markets? This can be broken down in several activities:

- Summarize the main take-aways of the scientific contributions of this work package.
- Identify the challenges this poses for current (labour market) policy.
- Identify potential for improved data collection and analysis on a wider scale: What kind of data would be necessary to carry out the analyses of this WP in other countries?

#### **Progress**

The deadline for Deliverable 2.4 has been extended and is now July 2023.

The project team has developed a general structure for the policy brief and collected the state-of-the literature on the topic. The project team will write a first draft on the state of the literature, link it with the new insights from Tasks 3.1-3.3, and derive policy implications before the GI-NI Conference on May 25<sup>th</sup>. The project team will use input from the conference to optimize the policy brief and expects to submit it by the deadline in July 2023.

### **Task 4.1: Quantifying the impact of international fragmentation of production on gender inequality**

#### **Content**

This task quantifies the differential effects of changing GVCs on employment and income of male and female employees in various age groups and occupations, in EU countries and in major economies elsewhere in the world (2000-2014).

#### **Progress**

The report is uploaded on March 30<sup>th</sup> 2023.

## **Task 4.2: Worker mobility and the differential impact of occupation-specific import competition on labour market outcomes**

### **Content**

The objectives are:

- quantify the effects of the international fragmentation of production on employment of younger and older generations, of male and female workers and of workers with high and low levels of educational attainment
- analyse the material and immaterial repercussions of increased trade and outward FDI for those workers in relatively rich EU countries who decided to move into different occupations and/or different regions, upon facing the negative consequences of these transformations.

### **Progress**

The report is uploaded on March 30<sup>th</sup> 2023.

## **Task 4.3: Implications of offshoring for the labour market position of Bulgarian and Hungarian firms and workers**

### **Content**

The objectives are:

- analyse behaviour between firms that produce goods on their own account, versus firms that produce goods on behalf of a foreign firm;
- investigate how import product price shocks and foreign direct investment affects the behaviour of these Bulgarian and Hungarian establishments, how they specialize in certain tasks and how this functional specialisation shapes occupation-specific labour demand;
- analyse the responses of wages, employment, and inequality to these transformations

### **Progress**

The report is uploaded on March 30<sup>th</sup> 2023.

#### **Task 4.4: Policy implications of the international trade transformations?**

The deadline for Deliverable 4.4 is July 2023. A first version of the Policy Brief will be discussed during the Scientific Conference of May 25 2023.

#### **Task 5.1: Inequality and international mobility and migration intentions**

This report has been uploaded on July 31<sup>st</sup> 2022.

#### **Task 5.2: Occupational sorting and migration in Hungary and Austria: the effect of outmigration on skill distribution, occupational mobility and wage inequality**

##### **Content**

The objectives are:

- investigate the interaction of the source and the target countries of migration; investigate how the supply of workers in one side of the border affects vacancy creation on the other side of the border;
- estimate how the opening of specific vacancies on one side of the border affects migration and the wage inequality on both sides of the border.

##### **Progress**

This report is foreseen from 31<sup>st</sup> of July 2023 and onwards. The report is underway.

#### **Task 5.3: Participation, segregation and labour mobility of native and immigrant groups in the EU labour market**

##### **Content**

The objectives are:

- focuses on whether the inflow of the immigrant population, leads to unequal labour market opportunities between native and foreign-born workers: quantify the unequal distribution of different groups of workers in occupations,
- studying the occupational segregation with a double perspective: country of birth and gender; estimate the occupational mobility of natives with an econometric model;
- mobility tables created to study the labour trajectories of immigrants and also to analyse the wage assimilation of this group.

## Progress

This report is foreseen from 31<sup>st</sup> of July 2023 and onwards. The report is underway.

## Task 5.4: New perspectives on the migration-inequality nexus

### Content

The objectives are:

- comprehensive macroeconomic modelling framework; calculate aggregate migration flows detailed by labour market skills; and these flows help to quantify the impact of migration on wages of workers with different skills, as well as on returns to capital.
- Analyse implications for the European welfare states and estimate the effect of migration on tax revenues and pension payments.
- Analyse the microeconomic mechanisms underlying the migration-inequality nexus to propose a new channel through which immigration can reduce income inequality.

## Progress

This report is foreseen from 31<sup>st</sup> of July 2023 and onwards. The report is underway.

# GI-NI PROJECT IDENTITY

## **Project name**

Growing Inequality: a novel integration of transformations research — GI-NI

## **Coordinator**

Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek TNO,  
Netherlands

## **Consortium**

CNAM - CEET, Centre d`études de l`emploi et du travail (France)  
University of Groningen (Netherlands)  
Centre for European Policy Studies (Belgium)  
University of Adger (Norway)  
Centre for Economic and Regional Studies (Hungary)  
Utrecht University (Netherlands)  
Europa-Universität Flensburg (Germany)  
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2021 - 2025

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<https://www.gini-research.org>



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[www.gini-research.org](http://www.gini-research.org)