Who is Most Vulnerable to the Transition Away from Coal? Ruda Śląska Residents’ Preferences Towards Jobs and Land Repurposing

Maddalena Honorati
Céline Ferré
Tomasz Gajderowicz
WHO IS MOST VULNERABLE TO THE TRANSITION AWAY FROM COAL?
RUDA ŚLĄSKA RESIDENTS’ PREFERENCES TOWARDS JOBS AND LAND REPURPOSING

Maddalena Honorati
Céline Ferré
Tomasz Gajderowicz
Who is most vulnerable to the transition away from coal?

Ruda Śląska residents’ preferences towards jobs and land repurposing

Maddalena Honorati, Céline Ferré and Tomasz Gajderowicz
The World Bank, Jobs Group
April 2023
MAIN FINDINGS

About 7k workers, or 21 percent of the workforce, is employed in coal-related activities in Ruda Śląska.

In addition to labor dependency on coal, one in three households reports to have more than 40 percent of their income dependent on the coal and broader fuel and energy sector.

The municipality has relatively good macroeconomic factors (low unemployment rates, wages and skills on par with regional averages, proximity to Katowice).

As with other workers likely to be highly affected by the transition away from coal, Ruda Śląska residents are reluctant to relocate and commute for work, and prefer job stability.

Unlike other coal-dependent municipalities in Silesia, Ruda Śląska residents care about fringe benefits and have a strong preference for jobs in the renewable energy (RE) sector.

This preference for the RE sector is confirmed by the preference for land repurposing: 48 percent of residents prefer options that foster job creation while preserving the environment and another 41 percent prefer post-mine land use for the development of RE.
TABLE OF CONTENTS

1 ONE IN FIVE JOBS IS RELATED TO COAL IN RUDA ŚLĄSKA’S ................................................................. 5
   1.1 SILESIA IS AT THE CORE OF THE POLISH TRANSITION OUT OF COAL ................................................... 5
   1.2 RUDA ŚLĄSKA IS ONE OF SILESIA’S POWIATS WITH THE LARGEST SHARE OF EMPLOYMENT IN COAL .... 6
   1.3 BUT RATHER GOOD MACROECONOMIC INDICATORS THAT SUGGEST POTENTIAL RESILIENCE TO THE GREEN TRANSITION… 9

2 ONE IN THREE HOUSEHOLDS ARE VULNERABLE TO THE TRANSITION ..................................................... 12
   2.1 COAL IS A SOURCE OF INCOME FOR A THIRD OF HOUSEHOLDS .......................................................... 13
   2.2 LOW PERCEIVED IMPACT OF THE TRANSITION ...................................................................................... 15

3 LABOR MARKET AND LAND REPURPOSING PREFERENCES ............................................................... 16
   3.1 LABOR MARKET PREFERENCES ................................................................................................................. 16
   3.2 PREFERENCES FOR LAND REPURPOSING ................................................................................................. 19

4 CONCLUSIONS ........................................................................................................................................ 23

FIGURES

FIGURE 1: FIVE POLISH COAL REGIONS APPROVED FOR TJTPS, INCLUDING SILESIA 5
FIGURE 2: RUDA ŚLĄSKA IS HIGHLY DEPENDENT ON COAL-RELATED LABOR 6
FIGURE 3: 21 PERCENT OF RUDA ŚLĄSKA’S EMPLOYMENT IS IN THE COAL-VALUE CHAIN 7
FIGURE 4: PGG EMPLOYEES ARE MOSTLY LOW-EDUCATED MEN WORKING UNDERGROUND 7
FIGURE 5: SUBCONTRACTORS GENERATE LIMITED EMPLOYMENT 8
FIGURE 6: ONE OF THE LOWEST UNEMPLOYMENT RATES IN THE REGION 9
FIGURE 7: WAGES ON PAR WITH NEIGHBORING POWIATS 10
FIGURE 8: THE SHARE OF EMPLOYMENT IN SERVICES IS INCREASING STEADILY 10
FIGURE 9: SKILLS AND PREFERENCE SURVEY SAMPLE 11
FIGURE 10: SKILLS ON PAR WITH REST OF POLAND AND SOMETIMES BETTER 12
FIGURE 11: HOUSEHOLDS’ VULNERABILITY TO THE OUT OF COAL TRANSITION, AS MEASURED BY 3 DIFFERENT INDICATORS 13
FIGURE 12: THE MAJORITY OF HOUSEHOLDS DERIVE LESS THAN 20 PERCENT OF THEIR INCOME FROM THE FUEL AND ENERGY SECTOR 14
FIGURE 13: RESIDENTS MOST DEPENDENT ON THE FUEL AND ENERGY SECTORS HAVE LOWER SKILLS 15
FIGURE 14: EXAMPLE OF A CHOICE CARD – LABOR MARKET PREFERENCES 17
FIGURE 15: DCE RESULTS – LABOR MARKET PREFERENCES 18
FIGURE 16: RUDA ŚLĄSKA RESIDENTS VALUE RENEWABLE ENERGY JOBS 19
FIGURE 17: EXAMPLE OF A CHOICE CARD – LAND REPURPOSING SCENARIOS 19
FIGURE 18: UTILITY MULTINOMIAL LOGIT MODEL – LAND REPURPOSING SCENARIOS 20
FIGURE 19: JOB CREATION WITH ENVIRONMENTAL PRESERVATION 21
FIGURE 20: CHARACTERISTICS OF INDIVIDUALS IN EACH LCA GROUP 22
FIGURE 21: DESCRIPTIVE STATISTICS OF SAMPLE 29
FIGURE 22: ONE IN THREE HOUSEHOLDS IS HIGHLY DEPENDENT ON THE FUEL AND ENERGY SECTOR 31
FIGURE 23: DCE RESULTS, RUDA ŚLĄSKA VERSUS SILESIAN MINERS 32
FIGURE 24: DCE RESULTS, RUDA ŚLĄSKA VERSUS OTHER COAL-DEPENDENT MUNICIPALITIES 33
FIGURE 25: DCE RESULTS, LABOR MARKET PREFERENCES BY INCOME DEPENDENCY 34
FIGURE 26: DCE RESULTS, LABOR MARKET PREFERENCES BY NUMBER OF WORKING MEMBERS IN COAL-RELATED SECTORS 35
One in five jobs is related to coal in Ruda Śląska’s

1.1 Silesia is at the core of the Polish transition out of coal

After Germany, Poland is the EU’s second largest coal producer and consumer. ¹ 96 percent of EU-27 hard coal production, or 54.4 million tons, is extracted in Poland (EURACOAL, 2020). In 2020, over 40 percent of the country’s total energy supply (TES) and 70 percent of its electricity generation come from coal and lignite (IEA, 2022), the highest rate in Europe. Coal in Poland also continues to employ about 88,000 people directly in the mines, down from about 444,000 in 1989. Europe’s commitment to stop its fossil fuel imports from Russia following Russia’s invasion of Ukraine is slowing down Poland’s coal phase-out to ensure energy security in Europe, ² but Poland remains committed to a complete coal mine closure by 2049.

Figure 1: Five Polish coal regions approved for TJTPs, including Silesia

On 5 December 2022, the European Commission approved the Territorial Just Transition Plans (TJTPs) for five Polish regions, including Silesia (see Figure 1). First, Silesia, with seven NUTS-3 sub-regions (Katowicki, Bielski, Tyski, Rybnicki, Gliwicki, Bytomski, Sosnowiecki, and Katowice municipality); second, Eastern Wielkopolska (Koniński sub-region, with the

1 Total (hard and brown) coal consumption in Poland amounts to 117.6 Mt in 2021 or 26.9 percent of the EU’s total (hard and brown) coal consumption (Eurostat, 2022). Most of it is for power generation and heating. Total (hard and brown) coal consumption in Germany is 153.8 Mt in 2021 (36.8 Mt hard coal (all imported) and 127 Mt brown coal).


2 Before Russia’s invasion of Ukraine on February 24, 2022, Poland’s coal phase-out was on an accelerating path, given the high cost of extraction and the challenge for Polish coal-fired power plants to provide electricity within politically acceptable price margins.
municipality of Konin relying on the mining and energy sectors); third, Western Małopolska, with one NUTS-3 sub-region (Oświęcimsk); fourth, Wałbrzyski sub-region (part of Lower Silesia) with its main town of Wałbrzych; and finally, Łódzkie (two NUTS-3 subregions: Piotrkowski and Sieradzki) with the main mining and energy-sector related town of Bełchatów).

**Poland’s coal extraction and employment are concentrated in Silesia.** 79 percent of Poland’s hard coal resources are located in Silesia, where about 400 coal seams are exploited. The mining sector also accounts for 5 percent of the region’s total employment (compared to about 1 percent in Lower Silesia and less than 1 percent in Wielkopolska), and 80 percent of Poland’s mining sector employees, or 72,000 people, are located in Silesia.

### 1.2 Ruda Śląska is one of Silesia’s powiats with the largest share of employment in coal

**Within Silesia, Ruda Śląska is one of the powiats where the mining sector plays a dominant role as an employer (see Figure 2).** In absolute terms, Ruda Śląska has the fifth largest number of workers employed in the coal value chain, or 6,875 persons, after the municipality of Katowice, Jastrzębie-Zdrój, Bieruńsko-Lędziński, and Rybnik. In relative terms, Ruda Śląska has the fourth largest share of workers employed in the coal value chain, after Bieruńsko-Lędziński, Jastrzębie-Zdrój, and Rybnik (Mazurkiewicz et al., 2022).

**Figure 2: Ruda Śląska is highly dependent on coal-related labor**

![Map showing employment in coal-related sector](image)

*Source: Authors’ own elaboration using data collected on mining conglomerates and subcontractors (Mazurkiewicz et al., 2022).*

**Indeed, 21 percent of Ruda Śląska’s employment is in the coal-value chain, almost entirely in one of two mining conglomerates (see Figure 3).** Most of the workforce at-risk of losing their job due to the transition away from coal are employed directly by the mining conglomerates: 19 percent of the workforce is directly employed in one of two mining conglomerates: respectively 2.7k and 2.4k employees in Halemba and Bielszowice mines (operated by PGG), and 1.2k employees in Pokój (dismantled by SRK) (IBS, 2022).
Subcontractors up the coal-value chain, or firms providing goods and services to the mining conglomerates, represent only 2 percent of the municipality’s workforce, or about 500 jobs.

Figure 3: 21 percent of Ruda Śląska’s employment is in the coal-value chain

Source: Authors’ own elaboration using data collected on mining conglomerates and subcontractors (Mazurkiewicz et al., 2022).

8 in 10 employees of PGG, the largest mining conglomerate in Ruda Śląska, work underground (see Figure 4a). As in most mining conglomerates, 92 percent of employees are men. Women are mostly employed overground, 55 percent of which in administrative positions and the other 45 percent in the coal processing plant. On the other hand, underground workers make up the vast majority of the workforce (79 percent), and of the male workforce (8 in 9 employees). The remaining 21 percent of employees work in administration and in the coal-processing plant (PGG administrative data related to year 2021).

Figure 4: PGG employees are mostly low-educated men working underground

Note: Overground plant workers corresponds to individuals working in coal-processing facilities. Source: Administrative data from PGG (as of 01.01.2022).
Most of PGG’s employees are blue-collars with upper-secondary education (see Figure 4b). The majority (84 percent) of PGG employees are blue-collars, while only 16 percent are technicians and engineers. Two thirds of blue-collar workers mostly graduated from upper-secondary general education (hence with no specialization), while a third graduated from secondary vocational curriculums. Underground engineers and technicians, who represent only 13 percent of PGG workforce, are highly specialized employees: they mostly graduated from university (46 percent) or post-secondary non-tertiary (21 percent) tracks. This high level of educational attainment results from the procedures required to be promoted.³

In Ruda Śląska, subcontractors of mining conglomerates generate limited employment (see Figure 5). An estimated 500 jobs among subcontracting firms are highly at-risk of being affected by the transition.⁴ These jobs are distributed among 30 companies located in the municipality, 40 percent of which have contracts with SRK only, and hence focus on the decommissioning of Pokój mine: they are mostly specialized in mining, machinery, demolition, and waste disposal.

Figure 5: Subcontractors generate limited employment

Source: Authors’ own elaboration using data collected on mining conglomerates and subcontractors (Mazurkiewicz et al., 2022).

³ Professional experience and exams approved by the President of the State Mining Authority (or is subordinate authorities) are required.

⁴ A bottom-up approach was followed to estimate the indirect impact of the mines closure. First, data on companies contracted out by mining conglomerates through public tenders between 07.01.2019 and 06.30.2021 was obtained through official reporting, data requests and data scrapping, resulting in a list of 1,097 entities for Silesia. Second, the list of subcontractors was restricted to companies with non-negligible business with the mining conglomerates, resulting in 936 entities for Silesia. When available, additional information on subcontracting companies (financial information, structure of labor, etc.) was merged from existing databases, websites, and reports: basic information on employment was retrieved for 52 percent of them, representing 91 percent of all contract value. Third, missing employment data for the remaining 48 percent of public tenders was imputed, in proportion to the tender amount. Fourth, information from the PGG’s structure of subcontracting was used to impute the number of individuals indirectly employed by mining conglomerates through small contracts that don’t need to go through public tendering (under EUR 443,000 in 2019 and EUR 428,000 in 2020). Finally, a last correction was applied to the total number of individuals indirectly affected by the mines closure, to only retain employees working on mining contracts. It was assumed that the share of workers likely to be affected by the transition away from coal within a subcontracting company was proportional to the share of revenue derived from the mining sector (see Christiaensen et al, 2022 for more details on the methodology).
The World Bank Skills and Preference Survey carried out among residents of Ruda Śląska (see Box 1) indicates that 1 in 3 households has at least one member employed in the coal sector. According to the World Bank Skills and Preference Survey - representative of residents of the Ruda Śląska municipality - 34 percent of the households have at least one individual employed in mining, or a sector dependent on fuel and energy. This number is larger than the incidence estimated through administrative data collected directly from the mining conglomerates and subcontractors, which indicates that 19 percent of Ruda Śląska workforce is directly employed by PGG or SRK, and an additional 2 percent work for subcontractors located in the municipality. The higher survey-based estimate possibly accounts for people working in companies located outside of Ruda Śląska municipality and companies in the broader fuel and energy (not just in subcontractors contracted through public procurement).

1.3 But rather good macroeconomic indicators that suggest potential resilience to the green transition

1.3.1 One of the lowest unemployment rates in the region

Unemployment rates in Ruda Śląska are lower than the national and regional averages (see Figure 6). Poland’s registered unemployment rates have been decreasing over the past decade to 5.8 percent in 2021. Silesia’s unemployment rates remained consistently lower and reached 4.3 percent in 2021, while Ruda Śląska consistently displayed even lower rates, reaching a 2.6 percent all-time low in 2021 (GUS, 2022).

Figure 6: One of the lowest unemployment rates in the region


1.3.2 Good employment benefits

At PLN 5,318 per month, the mean wage in Ruda Śląska is on par with neighboring powiats (see Figure 7). It is however slightly lower than what is recorded in Katowice, or the regional
and national averages, all above PLN 6,000 per month. In addition, 62 percent of those employed have an open-ended contract.

**Figure 7: Wages on par with neighboring powiats**


### 1.3.3 Proximity to Katowice economic center and labor market

**Ruda Śląska’s proximity to Katowice is an easy opening to the regional capital’s economic opportunities.** Commuting to the regional capital is short: the center of Katowice is an 11-minute drive from Ruda Śląska, and a 12-minute ride from Ruda Chełbie train station. Other municipalities are equally close: Ruda Śląska is located in the nexus of Silesian Industrial districts (Górnoshląski Okręg Przemysłowy), which is the most urbanized and industrial region in Poland.

**Figure 8: The share of employment in services is increasing steadily**


**Ruda Śląska and Silesia are moving away from high levels of employment in the primary and secondary sectors towards services (see Figure 8).** Most powiats are characterized by a high share of employment in industry and construction, but employment in services increased drastically between 2005 and 2021. This increase in Ruda Śląska was particularly sharp for
men: 38 percent now work in services (as compared to 23 percent in 2002). As for female residents, they are more likely to be employed in services than the regional average (respectively 81 and 75 percent).

**Box 1: Ruda Śląska Skills and Preference Survey (2022)**

A Skills and Preference Survey collected information among municipality residents to help shed light on Ruda Śląska’s readiness for the out of coal transition and aspirations for alternative land repurposing scenarios. The survey was fielded in November 2022 among a sample of 520 respondents (505 households) who were selected by a random walk. The survey consisted of three parts: (i) a skills and employment questionnaire, (ii) a Discrete Choice Experiment (DCE) regarding work preferences, and (iii) a DCE regarding post mine land repurposing. It measured a range of transversal hard and soft skills; and identified how respondents value different job characteristics, and land repurposing, through DCE. The questionnaires were field tested and fine-tuned accordingly. Figure 9 below shows simple descriptive statistics of the sample. Annex 1 provides details on survey design.

Due to the timing of the Skills and Preference Survey in Ruda Śląska, i.e. November 2022, the results presented in this report may be influenced by the energy crisis and the consequences of Russian invasion of Ukraine. Some of the differences between the municipality survey and prior results from other municipality surveys in Wielkopolska and Lower Silesia, or among PGG employees, may hence be driven by changes in perceptions and preferences since the onset of the war (all other Skills and Preferences surveys were carried out in 2021).

**Figure 9: Skills and Preference Survey sample**


1.3.4 Skills on par with rest of Poland and sometimes better

Ruda Śląska residents display on average similar skills to other Poles (see Figure 10). Overall, they score similarly to the rest of Poland, for most skills, but substantially higher for basic skills such as fluency in Polish (+0.3 points), resistance to stress (+0.3), assembly and repair of devices (+0.2), and willingness to travel (+0.2). On the other hand, they show lower ability in
advanced IT skills (-0.4 points), and simple calculus (-0.3). These results are in line with what was observed in previous skills surveys in municipalities highly dependent on coal mining.

**There are slight differences across gender and work status.** Ruda Śląska men display better skills than male national averages when it comes to basic skills such as fluency in Polish (+0.4 points) and resistance to stress (+0.3); while women have a clear advantage in assembly and repair of devices (+0.7). Working residents are better at handling stress (+03 points), while inactive have a clear advantage in assembly and repair of devices (+0.7).

**Finally, the majority of working residents have the skills required by their position.** A third of employees are adequately skilled, and 15 percent are overskilled for their job.

*Figure 10: Skills on par with rest of Poland and sometimes better*

---

2 **One in three households are vulnerable to the transition**

In addition to household members directly and indirectly employed in the coal sector, this section looks into two additional complementary measures of households’ vulnerability to the transition. As shown in the previous section, one in three households report to have at least one member employed in either the coal sector or in a sector related to fuel and energy based on the World Bank Skills and Preference Survey. This section looks at other two indicators of households’ vulnerability: (1) the reported share of household income stemming from the fuel and energy sector, and (2) households’ perceived dependency on the fuel and
energy sector. These indicators shed light on the contingent effect of the transition at the household-level: households with one breadwinner only, employed in the fuel and energy sector will be more vulnerable than those with multiple working members in more diversified sectors of activity. The household’s perceived impact of the transition allows to gain insight into household’s subjective perception of the impact of the transition away from coal on their lives (see Figure 11 for a summary of all indicators).

Figure 11: Households’ vulnerability to the out of coal transition, as measured by 3 different indicators

![Figure 11: Households’ vulnerability to the out of coal transition, as measured by 3 different indicators](image)


**Ruda Śląska households having at least one member employed in the coal sector (34 percent) display lower competences on average.** We consider these “employment-dependent” households vulnerable to the transition as at least one of their members is at risk of losing their job. When the person employed in the coal sector is the only breadwinner (4 percent of these “employment-dependent” households, about 1,000 households), the household is particularly vulnerable as it relies entirely on that job as source of labor income. On average these “employment-dependent” households are slightly younger than those with no link to the fuel and energy sector (the average respondent is respectively 40 and 44 years old), and 57 percent have children. The average competency of the main respondent from these households is slightly lower than the municipal average: they are worse at assembling and repairing technical devices, worse at advanced IT skills such as knowledge of specialized programs, worse at artistic and creative abilities, worse at coordinating the work of others, and less willing to travel. On the other hand, they display better abilities in Polish, and are slightly better at computer use.

### 2.1 Coal is a source of income for a third of households

**One in three households is highly income-dependent to the transition away from coal, i.e. the fuel and energy sector represents at least 40 percent of their earnings.** The majority of households (52 percent) declares that less than 20 percent of their income is dependent on the fuel and energy sector, 38 percent have between 21 and 60 of their income stemming
from the fuel and energy sector, and 11 percent display dependency with over 60 percent of their income related to that sector (see Figure 12).\(^5\) Less than 3 percent of all households have only one breadwinner employed in the fuel and energy sector. Among households with more than one breadwinner, the majority have diversified sources of income by having at least one other adult working in other sectors.

**Figure 12:** The majority of households derive less than 20 percent of their income from the fuel and energy sector

![Bar chart](image)

*Note: Low dependency = 0-20% of the household income depends on the fuel and energy sector; moderate = 21-40%; and high = above 41%.*

*Source: Ruda Śląska Skills and Preference Survey (2022) and BKL (2022).*

**High income-dependent households tend to have more members engaged in the coal-value chain.** Income dependent households (more than 40 percent of their income depends on the energy sector) are characterized by relatively higher labor force participation, higher work intensity (less than 8 percent of these households have only one breadwinner, as opposed to 39 percent in the least dependent), higher share of working-age adults engaged in the coal-value chain, and slightly younger individuals (41 years old on average, as opposed to 44 for the least income dependent families).

**One in ten households have highest vulnerability to the out of coal transition by deriving more than 60 percent of their income from the fuel and energy sector (see Figure 12).\(^6\)** 11 percent of households (about 8,000 households) have the highest income dependence, i.e. more than 60 percent of their income dependent on the coal sector. A large share of those households (81 percent) can rely on diversified sources of labor income, having at least one other working adult. However, these families may be vulnerable to the potential job losses due to mine closures as they are on average slightly larger, are more likely to have children (69 percent) and in almost a third of cases respondents (most likely mothers) declare to be inactive. The relative competency of the main respondent from these households is similar to those from Silesian miners: they are better than the average at assembling and repairing

\(^5\) The vast majority (72 percent) of households that derive more than 40 percent of their income from the fuel and energy sector are also households with at least one member in the mining sector or sector dependent on the fuel and energy sector.

\(^6\) Dependency on the fuel and energy sector was collected as a categorical variable, with the following 5 brackets: 0-20 percent, 21-40 percent, 41-60 percent, 61-80 percent, and 81-100 percent.
technical devices, group work, and coordinating the work of others, but they display worse abilities in Polish and computer use.

Individuals living in households with high income-dependency on coal mining over have slightly lower skills than the rest of Ruda Śląska residents. They are worse at advanced IT skills (such as knowledge of specialized programs), worse at assembling and repairing technical devices, worse at artistic and creative abilities, and worse at coordinating the work of others. On the other hand, they display better abilities in Polish, and are slightly better at computer use (see Figure 13).

Figure 13: Residents most dependent on the fuel and energy sectors have lower skills

Note: Low dependency = 0-20% of the household income depends on the fuel and energy sector; moderate = 21-40%; and high = above 41%. Skills for which residents with high dependency on the coal and energy sectors have better self-assessments than Polish averages are displayed in green; while skills for which residents with high dependency on the coal and energy sectors have worse self-assessments than Polish averages are displayed in red.

Source: Ruda Śląska Skills and Preference Survey (2022) and BKL (2022).

2.2 Low perceived impact of the transition

Relatively fewer households in Ruda Śląska perceive that the transition out of coal will impact their lives. 18 percent of the households declare that they will be highly affected by the transition, an additional 41 percent perceive they will be only moderately affected, and 42 percent will not be or just slightly affected by the transition (see Figure 11 above). This low perceived impact of the transition, compared to other coal-dependent municipalities in Eastern Wielkopolska and Lower Silesia could be explained by the distant prospect of the transition (compared to the imminence of the closure of ZE PAK in Wielkopolska), and by the proximity to Katowice labor market. Households whose income is highly dependent on the fuel and energy sector are more likely to perceive that the transition out of coal will strongly
impact their lives: 62 percent of those whose income is highly dependent expect this impact to be high, while respectively 21 and 7 percent of households whose income is moderately (21-40 percent) or marginally (0-20 percent) dependent expect this impact to be high.

3 Labor market and land repurposing preferences

Does limited mobility of the coal-related workforce identified through previous Skills and Preference Surveys in Wielkopolska, Silesia and Lower Silesia hold among residents of Ruda Śląska? Previous Skills and Preference Surveys carried out in 2021 among mining sector employees and municipalities highly dependent on coal in Wielkopolska, Silesia and Lower Silesia revealed that affected populations were reluctant to either commute or relocate; and placed a high value on mining-related jobs. Yet, whether workers in Ruda Śląska value mine related work and job opportunities locally to the same extent as has been observed so far is an empirical question, especially given the proximity of the municipality to Katowice. To inform policymakers and investors regarding the potential and desirability of different mine repurposing activities and economic diversification strategies, the skills profile and job aspirations of municipality residents of Ruda Śląska must be better understood.

3.1 Labor market preferences

The Discrete Choice Experiment (DCE) section of the Skills and Preference Survey on labor market preferences consisted of six choice sets, each of them offering two different job descriptions to choose from (see Figure 14). The two offers included detailed job characteristics or job attributes: alignment with educational specialization, type of contract, a monthly wage, wage increase over the first two years of work, benefit levels, and commuting time. The job attributes and their levels were based on the literature review and preliminary qualitative work, including previous skills and preference surveys done in Poland among population likely to be highly affected by the coal transition in Silesia, Lower Silesia and Wielkopolska. The choice experiment was divided into two designs (DCE 1 and DCE 2) with six attributes each, to prevent cognitive overload.

Similar to previous Skills and Preference surveys, Ruda Śląska residents display a reluctance to relocate and commute, though it is lower compared to other coal regions and among households with higher income dependence on coal. Ruda Śląska residents would require an additional PLN 3,634 to compensate for moving abroad. Moving to another Polish region would be less costly, and only necessitates a compensation of PLN 1,791. The inconvenience of relocating to another Polish region is close to that of commuting an hour (compensation estimated at PLN 1,387 on average). Compared to previous work carried out in municipalities in Wielkopolska and Lower Silesia or compared to average mine workers across Silesia, Ruda Śląska residents display lower reluctance to either commute or relocate, which could be explained by the proximity to Katowice, a mere 15-minute drive from the municipality.

7 Four similar surveys were implemented (i) among ZE PAK employees in Wielkopolska, (ii) among PGG, SRK and Tauron employees in Silesia, (iii) among residents of the four most affected municipalities in Wielkopolska, and (iv) among residents of the two most affected municipalities in Lower Silesia.
In addition, the current survey shows that reluctance to commute decreases as household income becomes more dependent on the fuel and energy sector, and the most vulnerable expect less compensation for commuting. Similar to other coal regions, Ruda Śląska residents value job stability and the prospect of wage increase (see Figure 15).

Figure 14: Example of a choice card – labor market preferences

Moreover, as household income becomes more dependent on the fuel and energy sector, individuals become less demanding when considering possible job transitions. Residents who have at least one family member employed in mining, or those living in households with more than 40 percent of income dependent on the fuel and energy sector are the least reluctant to commute and/or relocate for another job (in Poland or abroad). They are also less concerned about job stability (as measured by open-ended contract), or job quality (i.e. a dangerous job). Individuals with the highest dependency on the fuel and energy sector would prefer jobs in the construction and renewable energy to jobs in mining, which is slightly different from individuals with the lowest dependency on the fuel and energy sector, who would rather go for position in industrial processing (and renewable energy, but to a lesser extent) (see Figures 24 and 25 in Annex 3).

Unlike in Wielkopolska and Lower Silesia, Ruda Śląska residents value fringe benefits. Respondents value more flexible working time (PLN 596), the opportunity to be reskilled or trained (PLN 762), the provision of transportation by the employer (PLN 501), as well as childcare services (PLN 494). In addition, residents do not show any significant preference regarding the compliance of work with their education, which differs from previous work. Śląska residents display different job preferences also compared to Silesian miners (see Figure 22 in Annex 3).
Figure 15: DCE results – labor market preferences

Note: The results of DCE1 and DC2 are combined into one graph. Values are displayed when the significance level is 5%.

In addition, and unlike respondents of previous surveys, Ruda Śląska residents display a strong preference for the Renewable Energy (RE) sector (see Figure 16). They value work in RE much more than opportunities in mining. They would be willing to take a pay cut of PLN 1,366 to switch from mining to RE, which is only slightly lower than the employees of ZE PAK in Wielkopolska. Individuals living in vulnerable households (with over 40 percent of income stemming from the fuel and energy sector) display a slightly lower preference for RE. These results contrast drastically with the preferences of Silesian miners, and to a lesser extent with residents of municipalities highly dependent on coal in Lower Silesia.
Figure 16: Ruda Śląska residents value Renewable Energy jobs


3.2 Preferences for land repurposing

The DCE on land repurposing preferences consisted of six choice sets, each of them offering two different development scenarios to choose from, and an opt out option (see Figure 17). These two scenarios included detailed land repurposing characteristics or attributes: land type, number of jobs created, average wage increase, and impact on pollution. The attributes and their levels were based on the literature review and preliminary qualitative work. In fact, the choice of different land type options stemmed from the land repurposing methodology developed by the World Bank, LURA, which optimizes land repurposing and post-mining spatial planning.8

Figure 17: Example of a choice card – land repurposing scenarios


In Ruda Śląska, the type of land repurposing scenario has a much bigger impact on residents’ satisfaction compared to other attributes (additional job position created, average wages

---

and impacts on pollution), with a stronger preference for renewable energy projects (see Figure 18). The bars in Figure 18 denote the relative strength of preferences towards the different land repurposing scenarios in the utility-space model. The first attribute (land type) was coded as discrete variables, while the average wage, pollution and the number of new jobs created were coded as continuous variables. Respondents would be most satisfied if post-mining areas were transformed into wind and solar power plants and industrial factories rather than forests and green areas. They have a positive attitude towards solutions that decrease environmental pollution. Finally, they are positive about solutions that would increase the average real wage and the number of jobs in the municipality, though these last factors have a much smaller impact on residents’ utility based on a multinomial logit model (see Annex 2).

Respondents value the improvement of environmental conditions more than the creation of new jobs. A 12.5 percentage point decrease in pollution (as proxied by the level of 2.5PM) provides them with almost 9 times more utility than 100 jobs created. The same decline in pollution yields more than seven times less utility than a 10 percentage points increase in real wages.

**Figure 18: Utility Multinomial Logit Model – land repurposing scenarios**

![Utility Multinomial Logit Model](image-url)

*Note: The numbers in the Utility model do not have a direct interpretation; they are simply used to interpret the sign and magnitude of the impact on utility compared to the base level. Changes in land types are discrete. Changes in average wages, number of jobs, and pollution are continuous: the unit of changes are respectively 10 pp increase in wages, 20 pp increase in PM 2.5 and 100 new jobs. Source: Ruda Śląska Skills and Preference Survey (2022).*

Based on their preferences, Ruda Śląska residents can be divided in three groups. Residents’ preferences were further investigated by a Latent Class Analysis (LCA) carried out on the same dataset based on the four attributes included in the DCE: land type, number of jobs created, average wage increase, impact on pollution (see Figure 19). The objective of the LCA was to divide Ruda Śląska residents into groups that had similar characteristics in terms of the chosen

---

9 The continuous variables refer to change in utility related to unit increase (that is why the numbers are so low for these attributes).
attributes and were as different as could be across groups. The optimization analysis led to the division of the population into 3 groups of individuals.10

Figure 19: Job creation with environmental preservation

The largest group, which represents almost half of the population11, is made of individuals who prefer the development of industrial factories or recreation facilities by the water body and are concerned about the environment. In this group, households are more likely to have at least a member working in hard coal mines and in an energy company, and individual net wages are above average. This group is made of individuals with less than upper-secondary education (basic, vocational or general secondary), with below-average seniority within their company, and who present lower skill sets than the municipality average, except soft skills such as the resistance to stress and the ability to organize oneself. Employed individuals in this group are more likely to work in the public sector, and households are more likely to count inactive members than in the two other groups (Figure 20).

Preferences for the RE sector may not be motivated by environmental concerns only, especially in the light of the energy crisis and the Russian invasion of Ukraine. The RE sector may be envisioned as a growing sector of activity, able to provide new jobs that will also contribute to an energy mix that is less dependent on coal. This is particularly true for respondents who belong to group 2, which represents 41 percent of all residents, who are more educated individuals than those of group 1, and who can transition to jobs provided by the RE sector more easily. Households with high income-dependency on coal, i.e. those with over 40 percent of their income depending on the fuel and energy sector, are more likely to belong to this group, as well as those who perceive that the transition will impact them the

10 The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) provide measures of model performance that account for model complexity. AIC and BIC combine a term reflecting how well the model fits the data with a term that penalizes the model in proportion to its number of parameters.

11 48 percent.
most. The second group experiences a decrease in utility 52 times larger from a 20-p.p. drop in pollution than from a 100 new jobs increase, meaning that they are less concerned about environmental issues. The two groups responsible for the largest share of respondents clearly value the increase in their own real wages more than the increase in the number of jobs: in group 1, a 10-p.p. wage increase provides a utility 19 times higher than the creation of 100 additional jobs; in group 2, the utility from creating an additional 100 jobs was close to zero.

Finally, a small group (11 percent of residents) is made of individuals who favor job creation in known sectors of activity, with a preference for farmlands, business centers, housing and tourism, and who are less concerned about wage growth. This group is made of individuals with higher education, who are more likely to be women, who live in smaller households, have more seniority within their firm, are more likely to be employed in the private sector, and have the lowest income-dependence on the coal and energy sector (Figure 20).

Figure 20: Characteristics of individuals in each LCA group

These findings shed light on the acceptability of the recommendations from the LURA tool regarding optimal land use. Results from the Skills and Preference survey on the preferences and aspirations of Ruda Śląska residents complement the technical optimization of land repurposing based on the LURA assessment conducted by the World Bank. Pohl et al (2023) find that the optimal repurposing of the mining areas is split between energy production and light industry on the one hand, and business and residential development on the other hand: respectively 63 and 3 percent of land respectively in Bielszowice, 65 and 22 percent respectively in Halemba, and 81 and 16 percent respectively in Polska-Wirek. These results are broadly in line with the population’s revealed preference for business development and job creation while caring about environmental preservation. Less consistent are results for Pokój which point to 44 percent of land optimally used for energy production and light industry and 54 percent of land for business and residential development.
4 Conclusions

Coal-related jobs are at the forefront of the disruption brought about by the transition towards a low-carbon economy. Some displaced workers may be able to transition easily to new job opportunities, whereas many others may not. The resulting disruption to jobs and livelihoods may exacerbate the already challenging labor market environment in remote regions and traditional sectors that have not kept pace with broader economic modernization trends.

While the out-of-coal transition in Silesia is less advanced than in other regions, individuals working directly or indirectly in the coal mining sector will be gradually dismissed from the mining conglomerates. This paper zooms in on the labor market challenges regarding the out of coal transition in Ruda Śląska, a municipality located in the vicinity of Katowice where about one in five workers is employed in the coal value chain. The paper estimates the number of workers directly and indirectly affected. It further examines the affected people’s profile, their job perspectives and opportunities. It also probes local residents’ preference to various scenarios of post-mine land repurposing.

According to estimates from the World Bank Skills and Preference survey 2022, one in three households is vulnerable to the transition out of coal. Vulnerability is measured through three different metrics: (i) the dependence on the mining and energy sector as source of employment; (ii) the dependence on the mining and energy sector as source of household income; and (iii) the perceived impact of the transition on people’s lives. One in three households in Ruda Śląska have at least one member employed in the coal and energy sector: overall, 19 percent of employment is generated by the mining conglomerates and an additional 2 percent of the workforce works up the coal-value chain (subcontractors of the mining conglomerates). Similarly, one in three households reports to derive more than 40 percent of their income from the fuel and energy sector. Finally, 18 percent of the households feel that the transition will negatively affect their lives.

Ruda Śląska’s population most at risk of losing their jobs to the transition is the workforce employed in the coal-value chain. Most of those, however, are underground miners who are protected by the Social Agreement negotiated between the Trade Unions and the Polish government, and who will be dismissed gradually over the next 20 years.

Those who are most at risk of being left behind are individuals living in households highly dependent on the fuel and energy sector as a source of income and employment, who are left off from the Social Agreement packages. They are overall less skilled than other municipality residents, especially on technical skills (assembly and repair of technical devices and advanced IT), which probably explains why they are less demanding regarding labor market transitions (lower willingness to pay for relocating, commuting, job security, etc.). They are also more likely to display strong preference for the development of RE sector.

Finally, results show that almost half of the population in Ruda Śląska has a strong preference for post-mine land repurposing projects that are linked with the development of industrial factories and recreation facilities by the water body. Another 40 percent of the population has strong preferences for investments in the renewable energy (RE) sector. These results are
broadly in line with the recommendations from the World Bank LURA assessment, which identifies energy production and light industry on the one hand, and business and residential development on the other hand as the two optimal options for most of the land to be repurposed.
BIBLIOGRAPHY


ANNEXES

Annex 1: Skills and preference survey methodology

DCE methodology

To analyze preferences towards the workplace, a Discrete Choice Experiment (DCE) was applied. The concept of discrete choice methods is derived from the theory of economic value (Lancaster, 1966) and random utility theory (McFadden, 1974; McFadden, 2001). The utility refers to the level of satisfaction a person achieves from a particular consumption structure – here the consumed good is defined as the workplace.

In the discrete choice method, respondents select an alternative that seems to be more attractive to them or decide not to make a choice. This selection process is of probabilistic nature (McFadden, 1974). The choice is determined by a utility that depends on the observed characteristics (attributes), individual preferences regarding these attributes (men may choose different than women; mine workers may choose different than above ground personnel etc.) and unobserved idiosyncrasies. This process allows modeling worker's decision processes and extracting information about preferences (individual utility function parameters) based on pre-composed successive choices in a controlled environment.

The design of choice situations (composition of attributes) is based on an effective Bayesian method that allows obtaining the most accurate estimates with minimal respondents' choices (utility balance). The designing process is done using the simulation with obtained priors from the pilot study. Over the study, the design is optimized several times to minimize D-error (a scaled measure of the determinant of the Fisher Information Matrix, which summarizes how good a design is at extracting information about preferences).

The choice of attributes and levels was based on literature review and preliminary qualitative work. Prior pilot-testing enabled researchers to refine the attribute levels and their wording. To avoid cognitive overload resulting from too many attributes, two DCE designs with two overlapping attributes were prepared. To estimate the monetary equivalents of a change in job components a monetary attribute (monthly net salary) was included.

Econometric model

The choice is determined by a utility which depends on the observed characteristics (attributes) and unobserved idiosyncrasies and for individual, $i$, resulting from choosing an alternative, $j$, in the situation, $t$, can be expressed as:

$$ U_{ijt} = X_{ijt} \beta + e_{ijt}. $$

(1)

Where $X_{ijt}$ corresponds to observed job attributes with the vector of parameters, $\beta$, and $e_{ijt}$, refers to the stochastic component, standing for the unobservable factors. Assuming that the stochastic component ($e_{ijt}$) follows an independent and identical extreme value (type I) distribution, the probability of, $i$, respondent selecting an alternative, $j$, from set of, $J$, alternatives takes the form of conditional logistic regression:
which, depending on the selection and levels of attributes, enables to derive the maximum likelihood estimator of the utility function. As the respondents want to maximize their utility while making a choice, this probability represents an optimization problem. The designated formula 3 is known as the multinomial logit model (MNL).

Train (2003) proved that choice behavior logit models have several limitations. Namely, MNL express the preference variation that relates to observed characteristics of the decision-maker – this is called systematic taste variation as opposed to random taste variation. The second limitation is that the logit cannot handle situations where unobserved factors are internally correlated over time.

One of the ways to relax these restrictions is to allow for preference heterogeneity and, possibly, correlations between the alternatives and choices across time. This can be done by including the individual-specific parameters, $\beta$, which leads to more general models. (McFadden and Train, 2000).

To account for these limitations in addition to the MNL the data will be analyzed with a random parameter logistic regression called the mixed logit model (RPL or MIXL). Mixed logit is expressed as the integrals of standard logit probabilities over a density of parameters, where $n$ is an individual and $i$ is an alternative.

$$P_m = \int \frac{e^{\beta X_{ni}}}{\sum_j e^{\beta X_{nj}}} \phi(\beta | \Omega) \, d\beta$$

Here in the random parameter model, we will use the panel specification formulated by Revelt and Train (1998).

In the baseline assumption all non-price coefficients will be assumed to follow a normal distribution but the coefficients related to income will be assumed to follow a log-normal distribution. In this case, assuming lognormal distribution for the income coefficient is plausible from a behavioral perspective and the model accountability. Assuming log-normal distribution restricts respondents to have positive income sensitivity, in addition, this assumption guarantees that the resulting distributions of WTP are useful and meaningful i.e., have finite moments (Daly et al., 2012).

Given above it is convenient to introduce modification of the basic utility function defined above which is to use the so-called estimation in WTP space (Train and Weeks, 2005):
where $e_{ijt}$ is the stochastic component, $p$ is the time attribute, and the vector of parameters $\beta$ is a vector of implicit prices for the non-monetary attributes $Y_{ijt}$. In the survey, respondents were asked to choose between two hypothetical alternative job offers described by several attributes or decide not to make a choice. This selection process is of probabilistic nature (McFadden, 1974). The choice of an alternative that seems to be more attractive to respondents is determined by a utility that depends on individuals’ observed characteristics and unobserved idiosyncrasies. This process allows modeling workers’ decision processes and extracting information about preferences (individual utility function parameters) based on pre-composed successive choices in a controlled environment.

Annex 2

Table 1: MNL estimation results

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference level: Forests, green areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmlands</td>
<td>0.8492***</td>
<td>0.15440</td>
</tr>
<tr>
<td>Industrial factories</td>
<td>1.6013***</td>
<td>0.27198</td>
</tr>
<tr>
<td>Wind and solar power plants</td>
<td>1.9866***</td>
<td>0.15415</td>
</tr>
<tr>
<td>Business centers, housing, tourism</td>
<td>0.5703***</td>
<td>0.21598</td>
</tr>
<tr>
<td>Recreation facility by a water body</td>
<td>1.0879***</td>
<td>0.11754</td>
</tr>
<tr>
<td>Average increase in real wages as a result of investment</td>
<td>0.0138***</td>
<td>0.00409</td>
</tr>
<tr>
<td>Impact on environmental pollution (12.5% decrease in PM 2.5)</td>
<td>0.1877***</td>
<td>0.05114</td>
</tr>
<tr>
<td>Number of new jobs created in the municipality</td>
<td>0.0002***</td>
<td>0.00003</td>
</tr>
</tbody>
</table>
Annex 3: Additional tables and graphs

Figure 21: Descriptive statistics of sample

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>49.23</td>
<td>50.77</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment status</th>
<th>employed</th>
<th>unemployed</th>
<th>inactive</th>
<th>employed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>71%</td>
<td>2%</td>
<td>27%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment status by age groups</th>
<th>unemployed</th>
<th>inactive</th>
<th>employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>38.46</td>
<td>9.22</td>
<td>8.65</td>
</tr>
<tr>
<td>25-34</td>
<td>0</td>
<td>9.22</td>
<td>25.95</td>
</tr>
<tr>
<td>35-44</td>
<td>38.46</td>
<td>7.09</td>
<td>33.24</td>
</tr>
<tr>
<td>45-54</td>
<td>15.38</td>
<td>11.35</td>
<td>23.51</td>
</tr>
<tr>
<td>55-65</td>
<td>7.69</td>
<td>63.12</td>
<td>8.65</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment status by gender</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployed</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Inactive</td>
<td>32%</td>
<td>22%</td>
</tr>
<tr>
<td>Employed</td>
<td>64%</td>
<td>77%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocational</td>
<td>26%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary (high school or technical school)</td>
<td>37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-secondary</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher (Bachelor's degree)</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher (Master's degree)</td>
<td>18%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher, with at least a PhD degree</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income dependency on fuel and energy sector</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20%</td>
<td>51.6%</td>
<td></td>
</tr>
<tr>
<td>21-40%</td>
<td>16.3%</td>
<td></td>
</tr>
<tr>
<td>41-60%</td>
<td>21.7%</td>
<td></td>
</tr>
<tr>
<td>61-80%</td>
<td>8.9%</td>
<td></td>
</tr>
<tr>
<td>81-100%</td>
<td>1.6%</td>
<td></td>
</tr>
</tbody>
</table>
### Income dependency by employment status

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20%</td>
<td>50%</td>
<td>58%</td>
<td>49%</td>
</tr>
<tr>
<td>21-40%</td>
<td>8%</td>
<td>14%</td>
<td>17%</td>
</tr>
<tr>
<td>41-60%</td>
<td>0%</td>
<td>17%</td>
<td>24%</td>
</tr>
<tr>
<td>61-80%</td>
<td>42%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>81-100%</td>
<td>0%</td>
<td>3%</td>
<td>1%</td>
</tr>
</tbody>
</table>

### Income dependency by education level

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>23%</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>Vocational</td>
<td>23%</td>
<td>36%</td>
<td>23%</td>
</tr>
<tr>
<td>Secondary (high school or technical school)</td>
<td>54%</td>
<td>34%</td>
<td>38%</td>
</tr>
<tr>
<td>Post-secondary</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Higher (Bachelor's degree)</td>
<td>0%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Higher (Master's degree)</td>
<td>0%</td>
<td>12%</td>
<td>21%</td>
</tr>
<tr>
<td>Higher, with at least a PhD degree</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
</tr>
</tbody>
</table>

### To what extent will the transition affect your life?

<table>
<thead>
<tr>
<th>Extent</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A lot</td>
<td>16%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately</td>
<td>41%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A bit</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### To what extent will the transition affect your life?

<table>
<thead>
<tr>
<th>Extent</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely</td>
<td>8.33</td>
<td>2.9</td>
<td>1.65</td>
</tr>
<tr>
<td>A lot</td>
<td>25</td>
<td>17.39</td>
<td>15.11</td>
</tr>
<tr>
<td>Moderately</td>
<td>33.33</td>
<td>37.68</td>
<td>42.31</td>
</tr>
<tr>
<td>A bit</td>
<td>16.67</td>
<td>21.01</td>
<td>26.1</td>
</tr>
<tr>
<td>Not at all</td>
<td>16.67</td>
<td>21.01</td>
<td>14.84</td>
</tr>
</tbody>
</table>
Figure 22: One in three households is highly dependent on the fuel and energy sector

<table>
<thead>
<tr>
<th></th>
<th>Low dependency</th>
<th>Moderate dependency</th>
<th>High dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of households</td>
<td>52</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Share of households with 1 breadwinner only</td>
<td>39</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>Share of households with no HH member employed in the coal and energy sector (across groups)</td>
<td>73</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Share of households with at least 1 HH member in the coal and energy sector (across dependency groups)</td>
<td>9</td>
<td>21</td>
<td>70</td>
</tr>
<tr>
<td>Share of households with 1 breadwinner working in the coal and energy sector (across dependency groups)</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

*Individual-level data (main respondent in the HH)*

<table>
<thead>
<tr>
<th></th>
<th>Low dependency</th>
<th>Moderate dependency</th>
<th>High dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>68</td>
<td>75</td>
<td>73</td>
</tr>
<tr>
<td>Unemployed</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Inactive</td>
<td>30</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Average age</td>
<td>44</td>
<td>44</td>
<td>41</td>
</tr>
<tr>
<td>Share of female</td>
<td>48</td>
<td>48</td>
<td>52</td>
</tr>
</tbody>
</table>

*Note: Low dependency = 0-20% of the household income depends on the fuel and energy sector; moderate = 21-40%; and high = above 41%.*
Figure 23: DCE results, Ruda Śląska versus Silesian miners

* PGG, Tauron and SRK only.  
Note: The results of DCE1 and DC2 are combined into one graph. Values are displayed when the significance level is 5%.  
Figure 24: DCE results, Ruda Śląska versus other coal-dependent municipalities

Note: The results of DCE1 and DC2 are combined into one graph. Values are displayed when the significance level is 5%.

Figure 25: DCE results, labor market preferences by income dependency

Willingness to pay in PLN

-6000 -4000 -2000 0 2000 4000 6000

<table>
<thead>
<tr>
<th>Location (baseline = same location)</th>
<th>Elsewhere in Poland</th>
<th>Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous</td>
<td>-1183</td>
<td>-155</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of company (baseline = self-employed)</th>
<th>Public sector</th>
<th>Private sector</th>
<th>NGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous</td>
<td>-1654</td>
<td>-515</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector of activity (baseline = mining)</th>
<th>Construction</th>
<th>Industrial processing</th>
<th>Renewable energy (RE)</th>
<th>Agriculture</th>
<th>Transport services, repairs, communication</th>
<th>Other services (gastronomy, tourism, etc.)</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous</td>
<td>-1277</td>
<td>656</td>
<td>722</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location (baseline = same location)</th>
<th>Elsewhere in Poland</th>
<th>Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerously</td>
<td>-1986</td>
<td>656</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company size</th>
<th>-4802</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Additional benefits</th>
<th>Travel time to work</th>
<th>Flexible working time</th>
<th>Certified professional courses</th>
<th>Transport provided to and from work by bus</th>
<th>Private medical care</th>
<th>Childcare services</th>
<th>Mobile phone or computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous</td>
<td>-1467</td>
<td>722</td>
<td>710</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Salary progression</th>
<th>20% increase from initial salary</th>
<th>40% increase from initial salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous</td>
<td>-1638</td>
<td>722</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contract (baseline = open-ended)</th>
<th>Fixed-term employment</th>
<th>Temporary (contract of mandate)</th>
<th>Apprenticeship / internship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous</td>
<td>-1169</td>
<td>521</td>
<td>360</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location (baseline = same location)</th>
<th>Elsewhere in Poland</th>
<th>Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerously</td>
<td>-521</td>
<td>360</td>
</tr>
</tbody>
</table>

Note: Low dependency = 0-20% of the household income depends on the fuel and energy sector; moderate = 21-40%; and high = above 41%. The results of DCE1 and DC2 are combined into one graph. Values are displayed when the significance level is 5%.
Figure 26: DCE results, labor market preferences by number of working members in coal-related sectors

Note: The results of DCE1 and DC2 are combined into one graph. Values are displayed when the significance level is 5%.
Most Recent Jobs Working Papers:

73. **Does Agricultural Intensification Pay?** [2023]
Ghislain Aihounton and Luc Christiaensen.

72. **Cost-Effectiveness of Jobs Projects in Conflict and Forced Displacement Contexts—Annexes.** [2022]
Virginia Barberis, Laura Brouwer, Jan Von Der Goltz, Timothy Hobden, Mira Saidi, Kirsten Schuettler and Karin Seyfert.

72. **Cost-Effectiveness of Jobs Projects in Conflict and Forced Displacement Contexts.** [2022]
Virginia Barberis, Laura Brouwer, Jan Von Der Goltz, Timothy Hobden, Mira Saidi, Kirsten Schuettler and Karin Seyfert.

71. **Towards a Just Coal Transition Labor Market Challenges and People’s Perspectives from Wielkopolska.** [2022]
Luc Christiaensen, Céline Ferré, Maddalena Honorati, Tomasz Janusz Gajderowicz and Sylwia Michałina Wrona.

70. **Towards a Just Coal Transition Labor Market Challenges and People’s Perspectives from Silesia.** [2022]
Luc Christiaensen, Céline Ferré, Tomasz Gajderowicz and Sylwia Wrona.

69. **Towards a Just Coal Transition Labor Market Challenges and People’s Perspectives from Lower Silesia.** [2022]
Luc Christiaensen, Céline Ferré, Tomasz Gajderowicz and Sylwia Wrona.

68. **A Tale of Two Countries: Labor Market Profiles of Youth in Urban and Rural Cameroon.** [2022]
Ioana Botea and Mitja Del Bono

Michael Baxter, Christopher Brian Delgado, Jose Romero and David Ian Walker.

66. **Rural Employment in Africa: Trends and Challenges.** [2022]
Luc Christiaensen and Miet Maertens

65. **Understanding and Predicting Job Losses Due to Covid-19: Empirical Evidence from Middle-Income Countries.** [2021]
Maho Hatayama, Yiruo Li, and Theresa Osborne

[Click here for full Jobs Paper Series]
Address: 1776 G St, NW, Washington, DC 20006
Website: http://www.worldbank.org/en/topic/jobsanddevelopment
Twitter: @WBG_Jobs