A Greener Labor Market: Employment, Policies, and Economic Transformation

APRIL, 2022 WEO OUTREACH PRESENTATION

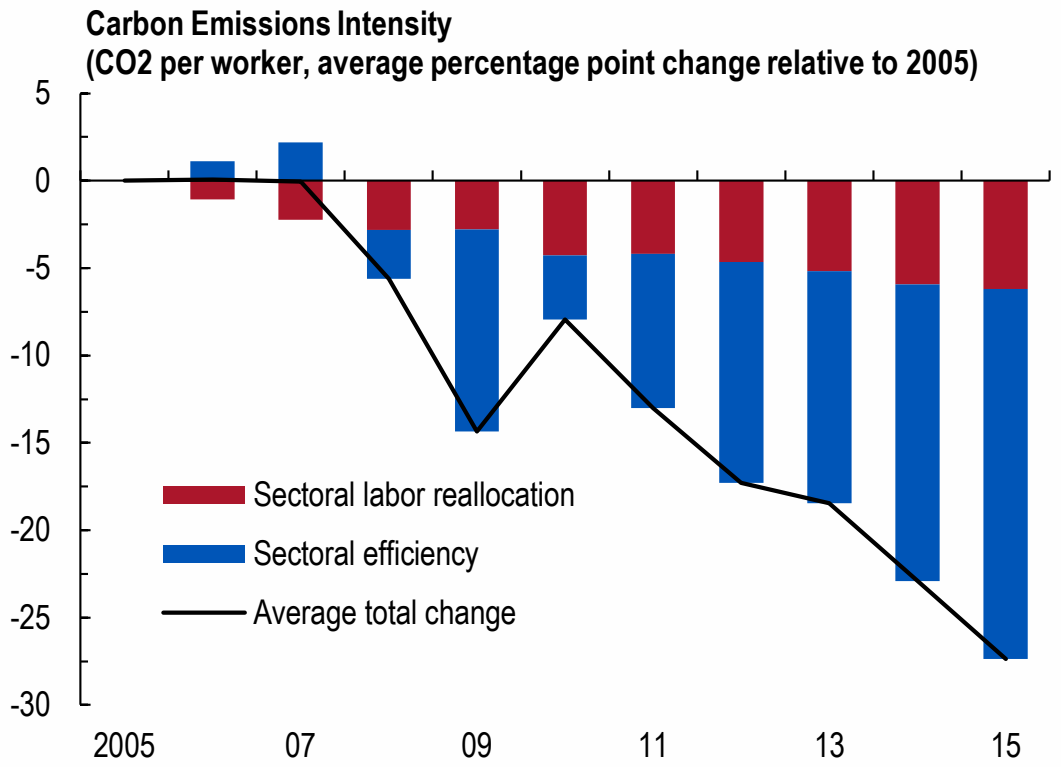
John Bluedorn, Niels-Jakob Hansen, Diaa Noureldin, Ippei Shibata, and Marina M. Tavares with support from Savannah Newman and Cynthia Nyakeri

Motivation

- Tackling human induced climate change is among the most pressing issues challenge facing policymakers and will require a transformation of the global economy.
- This green economic transformation will move workers away from carbon-intensive and environmentally destructive production processes and into jobs that help reduce greenhouse gas emissions.
- The COVID-19 pandemic has generated immense disruption and dislocations in economies and labor markets, but also presents an opportunity.
- How can the employment shifts needed for the green transformation best be facilitated? How can policy help?

Labor market reallocation has contributed to reduction in emissions

- Emissions intensity on a downward path for our analytical sample, with sectoral labor reallocation accounting for about 20 percent of the change.



Sources: ILOSTAT database; IMF Climate Change Indicators Dashboard; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: The chart shows the percentage point change in the cross-country average carbon emissions intensity relative to 2005. The sample includes AUT, BEL, CHE, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, IRL, ITA, LTU, LUX, LVA, SVK, SVN, SWE, and USA.

Key questions

- **How green is the labor market?**
  - How widespread are green- and pollution-intensive jobs, in the aggregate and across sectors?
  - How are they related to sectors' emissions intensities and how have they evolved over time?
  - What are the characteristics of these jobs and the workers that hold them?

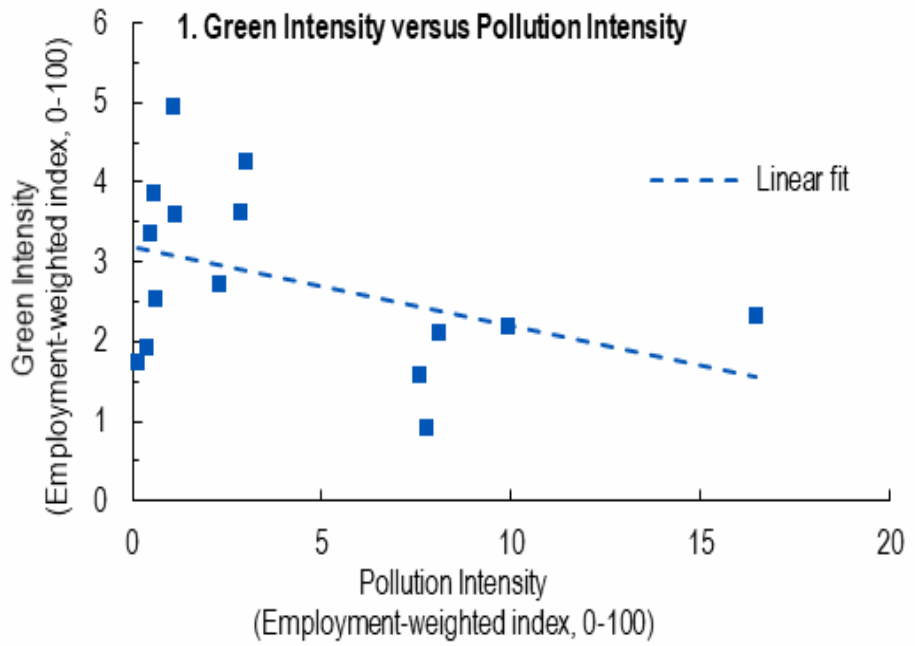
- **How easily do workers transition into greener jobs?**
  - What are the characteristics of workers that transition into greener jobs? Does a worker's past employment history affect their ability to change?

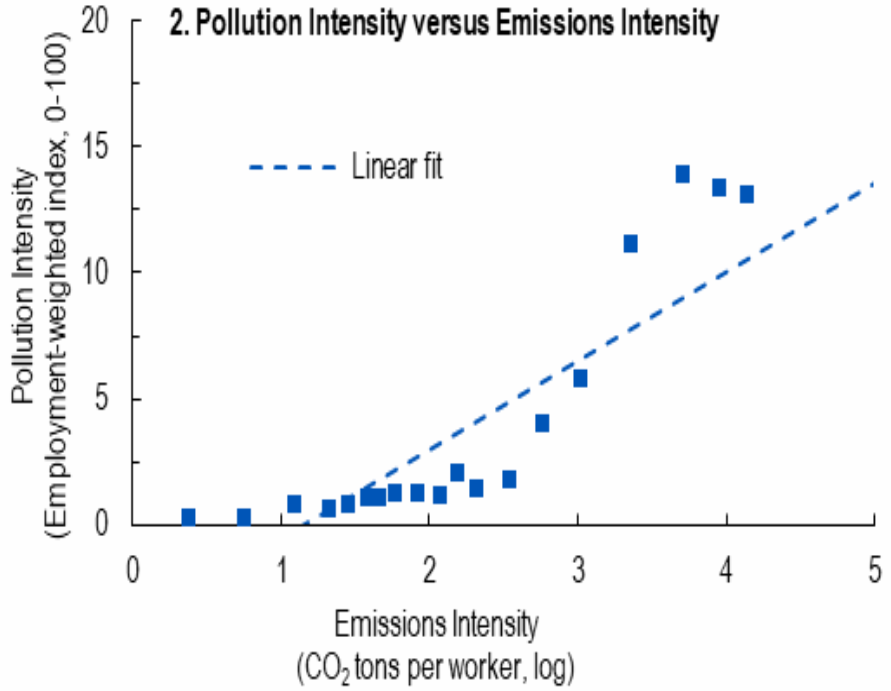
- **How do environmental policies impact the reallocation of workers into greener jobs?**
  - Can policies help to increase the share of green jobs in the economy?
  - Is the effectiveness of such policies affected by an economy's structural features/policies?

Defining environmental properties of jobs

- Examine jobs through two complementary lenses:
  - **What workers do → their occupations**
    - *Green intensity of occupations* – building from Dierdorff and others (2009) and O*NET Center (2021) on share of green tasks by occupation
      - More green-intensive occupations include "water-resource specialists" and "'wind energy operations managers."
    - *Pollution intensity of occupations* – building from Vona and others (2018) on occupations specific to highly polluting sectors
      - More pollution-intensive occupations include "petroleum engineers" and "gas plant operators."
    - Neutral occupations are those which are neither green- nor pollution-intensive – this accounts for the vast bulk of work.
    - Crosswalk from US SOC occupational classifications to ISCO-08 encoding, linked to individual-level employment
  - **Where they work → the sectors in which they are employed**
    - *Average total carbon (CO2) emissions intensity (per worker) of sectors*
      - Higher emissions intensity sectors include utilities (electricity, gas, water supply), mining, and manufacturing.
    - Mapping total emissions (direct plus derived) to ISIC rev. 4 sectors, linked to individual-level employment
- For empirical analyses, data requirements lead to a **sample of 34 countries** (US, EU, Mexico, South Africa) spanning 2005-19, with exact coverage varying by analytical exercise.

Relationships between environmental properties of jobs



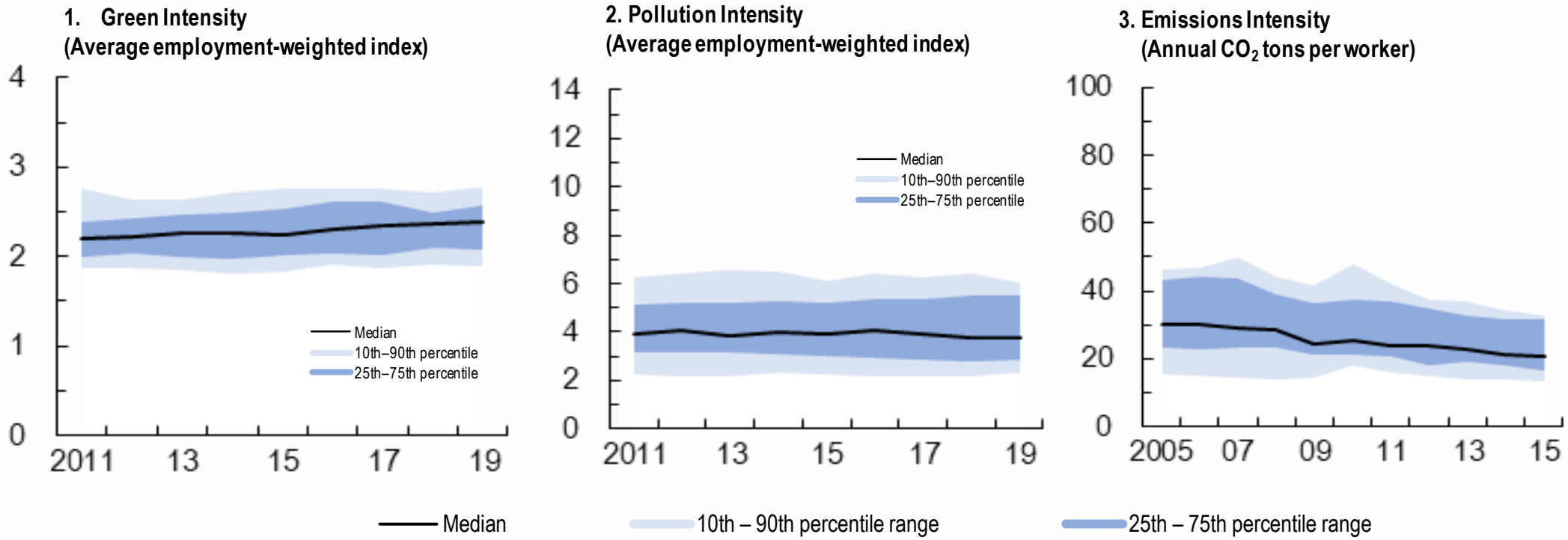


Sources: EU Labor Force Survey; ILOSTAT database; IMF Climate Change Indicators Dashboard; Mexico National Survey of Occupation and Employment; Occupational Information Network; Organisation for Economic Co-operation and Development; Statistics South Africa Quarterly Labour Force Survey; US Current Population Survey; Vona and others (2018); and IMF staff calculations.
Note: The panels show binned scatterplots (Chetty, Friedman, and Rockoff 2014) based on individual-level observations, with the sample constrained to be identical across charts to ensure comparability (covering 2008-15 due to data availability). Total carbon emissions (CO_2) per worker are presented on a log scale.

1. How green is the labor market?

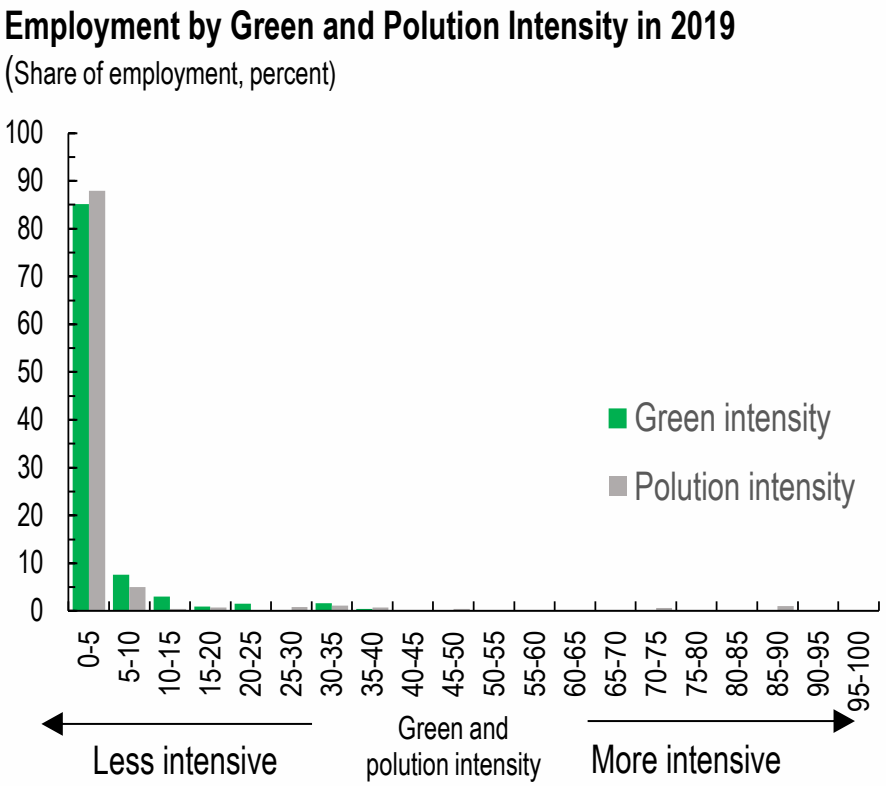
The labor market is slowly becoming greener

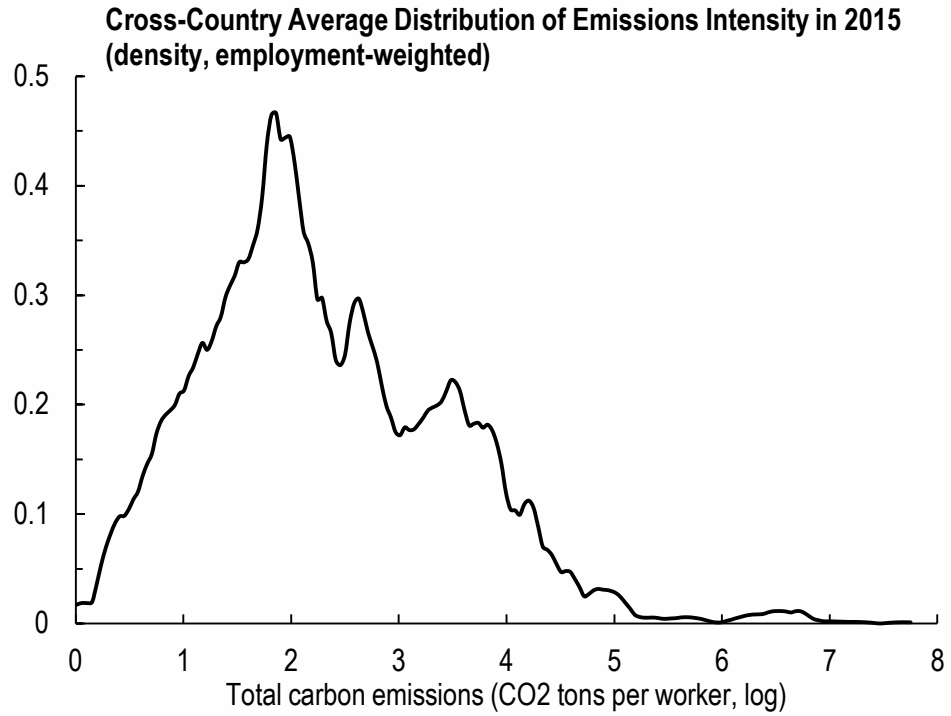
The Cross-Country Distribution and Evolution of Green- and Pollution-Intensive Occupations and Carbon Emissions Per Worker



Sources: EU Labor Force Survey; ILOSTAT database; IMF Climate Change Indicators Dashboard; Mexico National Survey of Occupations and Employment; Occupational Information Network; Organisation for Economic Co-operation and Development; Statistics South Africa Quarterly Labour Force Survey; US Current Population Survey; Vona and others (2018); and IMF staff calculations.
Note: Panels 1 and 2 are computed by the share of occupational tasks in the total economy that are green-intensive and the share of occupations that are pollution-intensive, respectively, weighted by employment for each country. Panel 3 exhibits carbon emissions intensity for the average worker in each country. Data are shown over the time periods for which they are available.

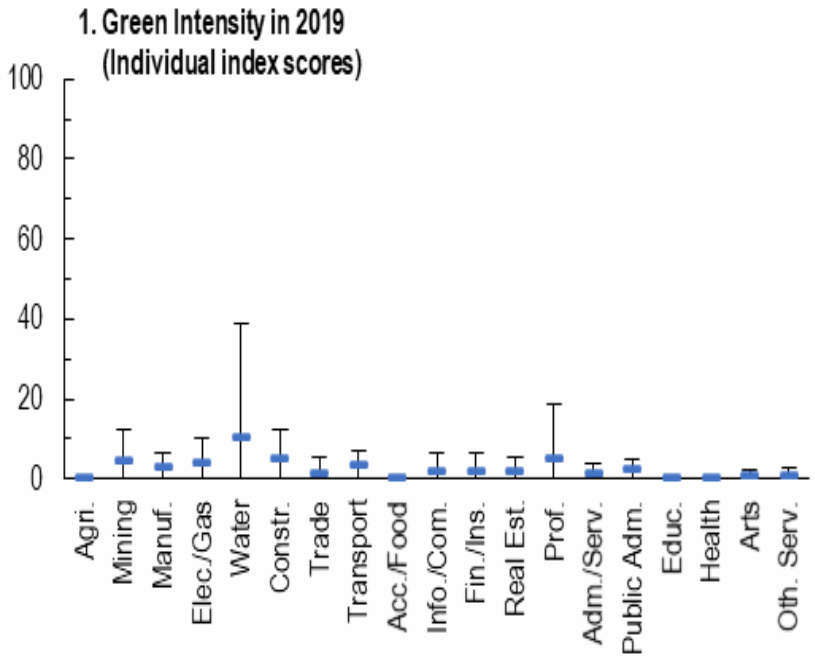
Green-intensive jobs are concentrated among a relatively small subset of workers

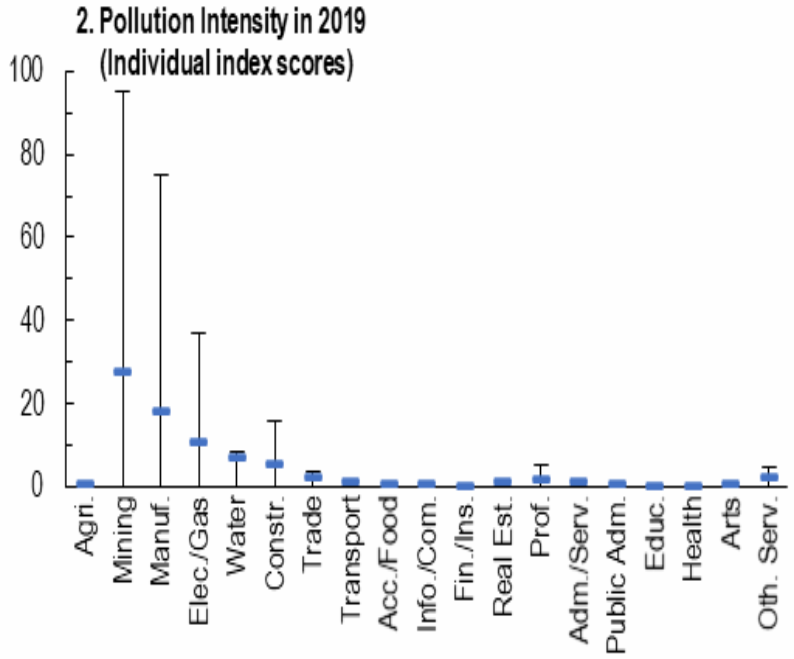


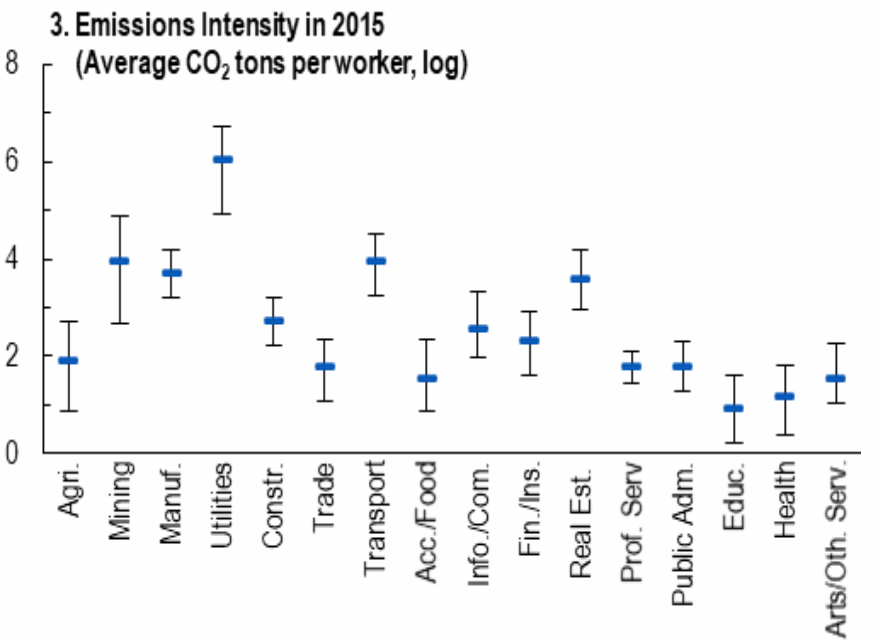


Sources: EU Labor Force Survey; Mexico National Survey of Occupations and Employment; Occupational Information Network; Statistics South Africa Quarterly Labour Force Survey; US Current Population Survey; IMF Climate Change Indicators Dashboard; Vona and others (2018); and IMF staff calculations.
Note: The left chart shows the average distribution of employment by green and pollution intensity across countries in the sample. The right chart shows the average distribution by emission intensities (direct and indirect) across countries in the sample.

Within and between sector reallocation of labor can contribute to the green transformation

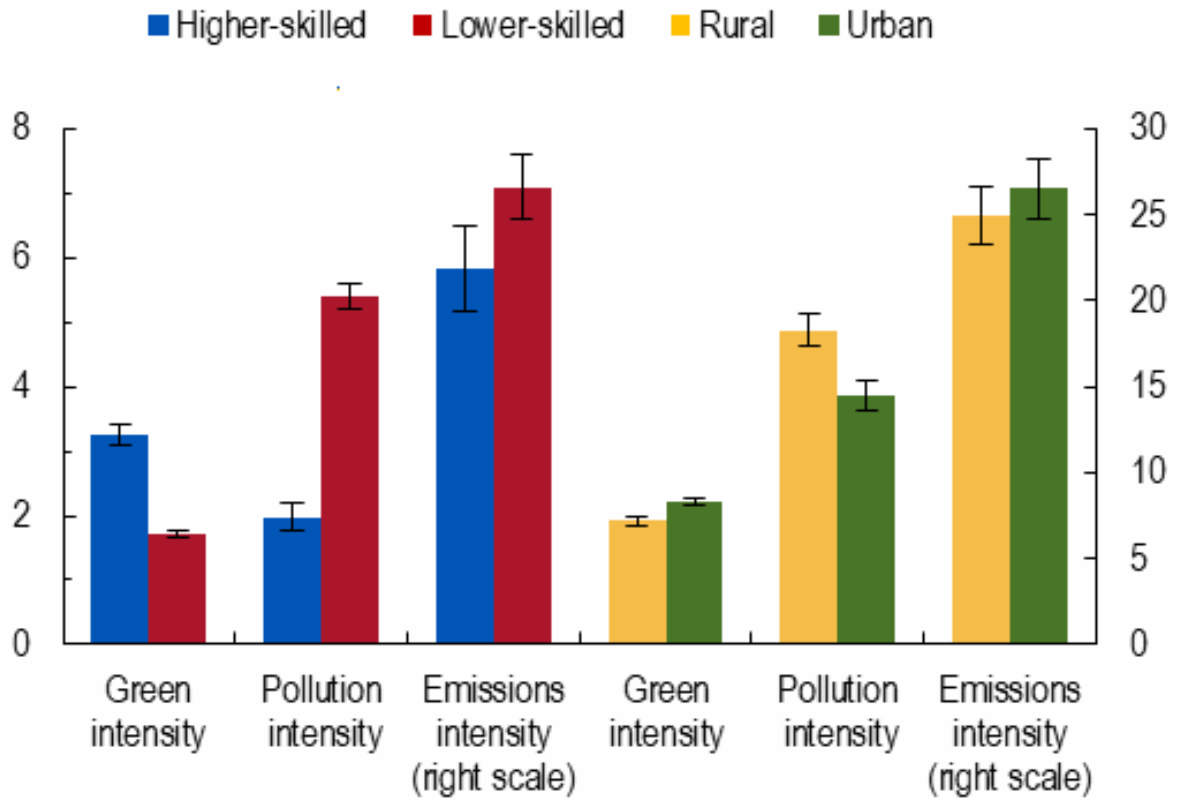






Sources: Sources: EU Labor Force Survey; ILOSTAT database; IMF Climate Change Indicators Dashboard; Mexico National Survey of Occupation and Employment; Occupational Information Network; Organisation for Economic Co-operation and Development; Statistics South Africa Quarterly Labour Force Survey; US Current Population Survey; Vona and others (2018); and IMF staff calculations.
Notes: Heavy bars represent the mean for the sector across individuals in the sample, while whiskers represent the 10th–90th percentile range. Sectors are classified according to ISIC Revision 4.

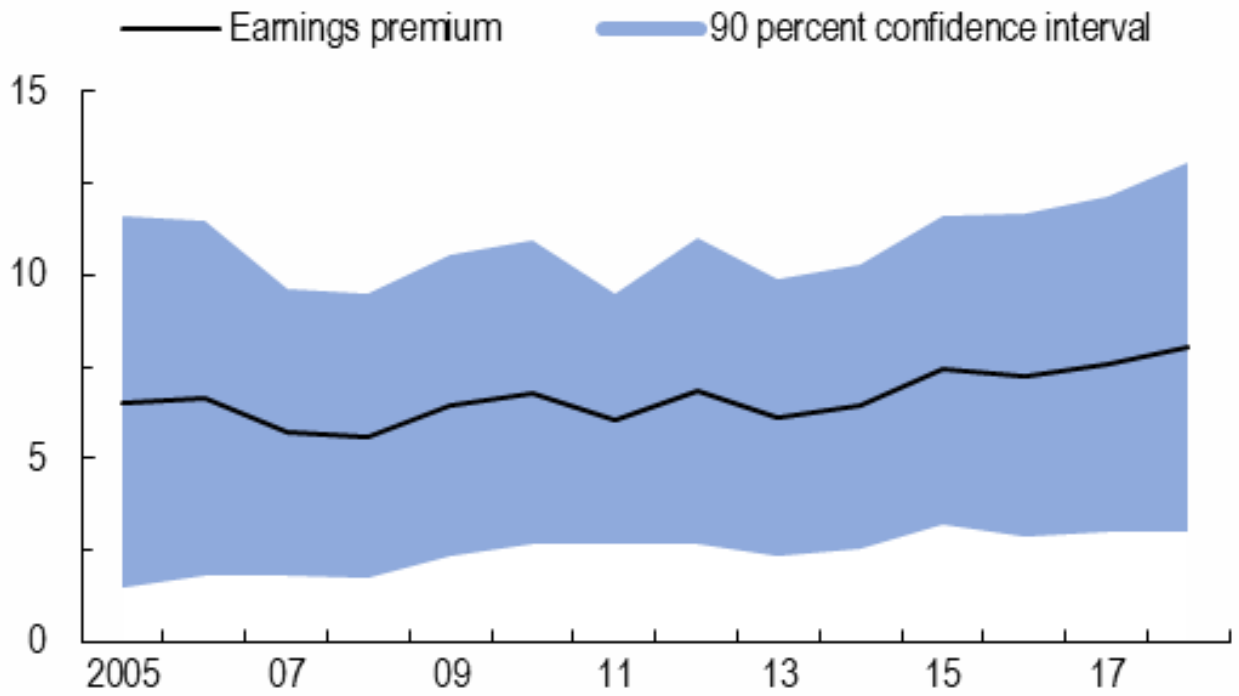
Higher-skilled workers, and workers in urban areas are more likely to possess greener jobs…



Sources: EU Labor Force Survey; Mexico National Survey of Occupation and Employment; IMF Climate Change Indicators Dashboard; Occupational Information Network; Organisation for Economic Co-operation and Development; South Africa Labor Force Survey; US Current Population Survey; Vona and others (2019); and IMF staff calculations.
Notes: Each bar is the estimated coefficient from a regression of the environmental property of employment of interest on the worker demographic characteristic indicated. Lower-skilled workers have at most secondary and non-tertiary education or below, while higher-skilled workers have above secondary education. The whiskers depict the 90 percent confidence interval around the estimated coefficient.

… which are also likely to command an earnings premium of about 7 percent on average

Earnings Premium of Greener Jobs Over Time (percent)



Sources: EU Labor Force Survey; Occupational Information Network; Organisation for Economic Co-operation and Development; US Current Population Survey; Vona and others (2018); and IMF staff calculations.
Notes: The chart shows earnings premium of green jobs relative to pollution intensive jobs after controlling for individual characteristics, evaluated at their respective means. The sample includes EU member states and the USA.

Summary of stylized facts

- Environmental properties of employment are multidimensional.
- Jobs are best described as *shades of green* rather than green and non-green
- Only a small share of employment in aggregate is green- or pollution-intensive, suggesting that only a small share of the work force would have their employment directly impacted by the green economic transformation.
- Wide dispersion of green, pollution, and emissions intensities in jobs across and within sectors, suggesting scope for emissions-lowering reallocation.
- Workers with green-intensive occupations tend to be higher-skilled and urban.
- Green-intensive jobs exhibit an earnings premium compared with pollution-intensive jobs.

2. How easily do workers transition into greener jobs?

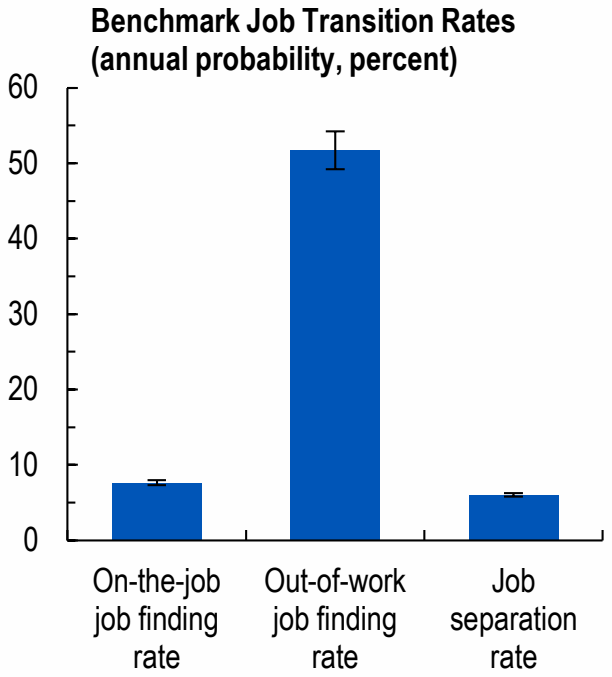
Empirical approach

- Linear probability model (LPM) of labor market transitions at the individual level (with weights):

$$Z_{i,c,t} = \alpha_c + \alpha_t + \beta' X_{i,c,t} + \boldsymbol{\gamma}' Y_{i,c,t-1} + \varepsilon_{i,c,t}$$

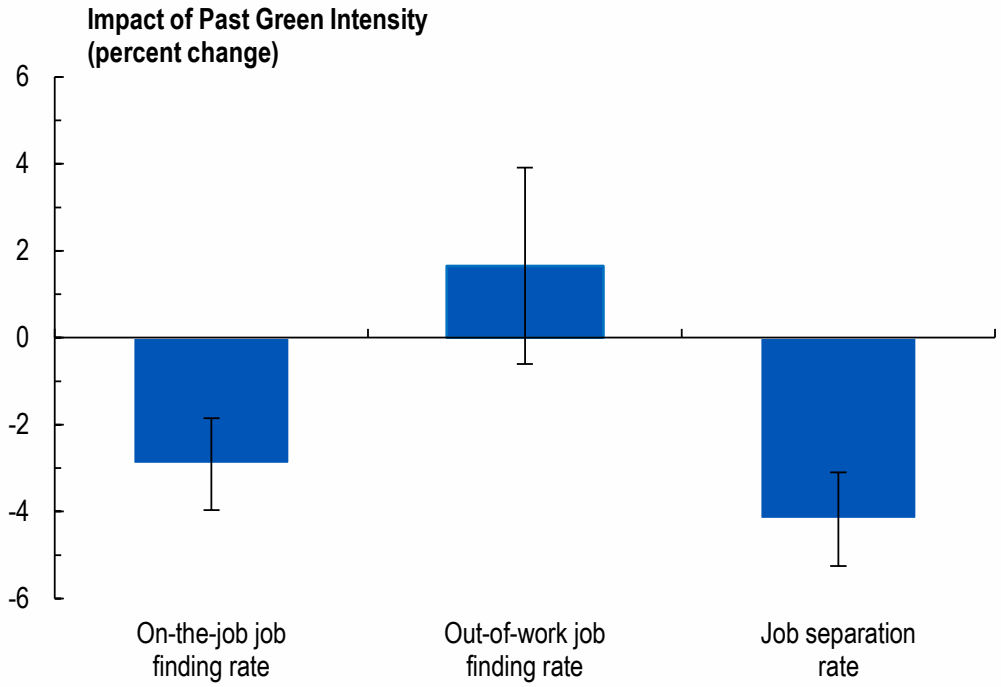
where $Z_{i,c,t}$ is a dummy for the job transition, $Y_{i,c,t-1}$ is the green/pollution intensity of their previous job, $X_{i,c,t}$ is a vector of individual characteristics, α_c and α_t are country and year fixed effects.

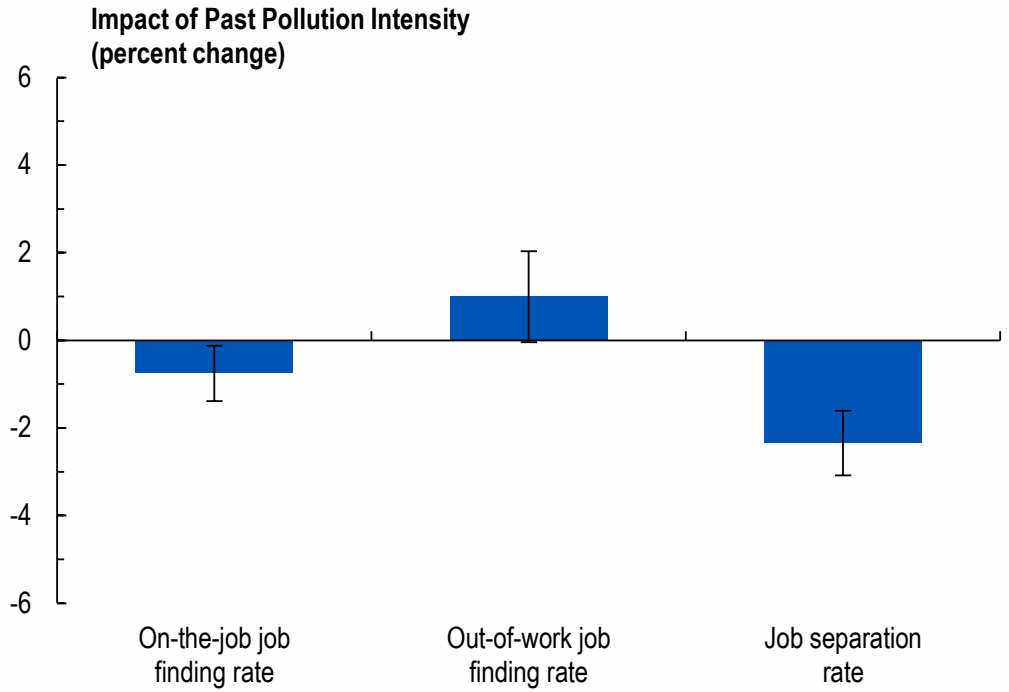
- Outcomes
  - On-the-job job finding: individuals who were employed last year and found a new job this year
  - Out-of-work job finding: individuals who were not employed last year and found a new job this year
  - Job separation: individuals who were employed last year and are unemployed this year



Sources: EU Statistics on Income and Living Conditions; US Current Population Survey; and IMF staff calculations.
Notes: The whiskers depict the 90 percent confidence interval around the estimated transition rate.

Both green- and pollution-intensive jobs see less churning than neutral jobs, with green most stable

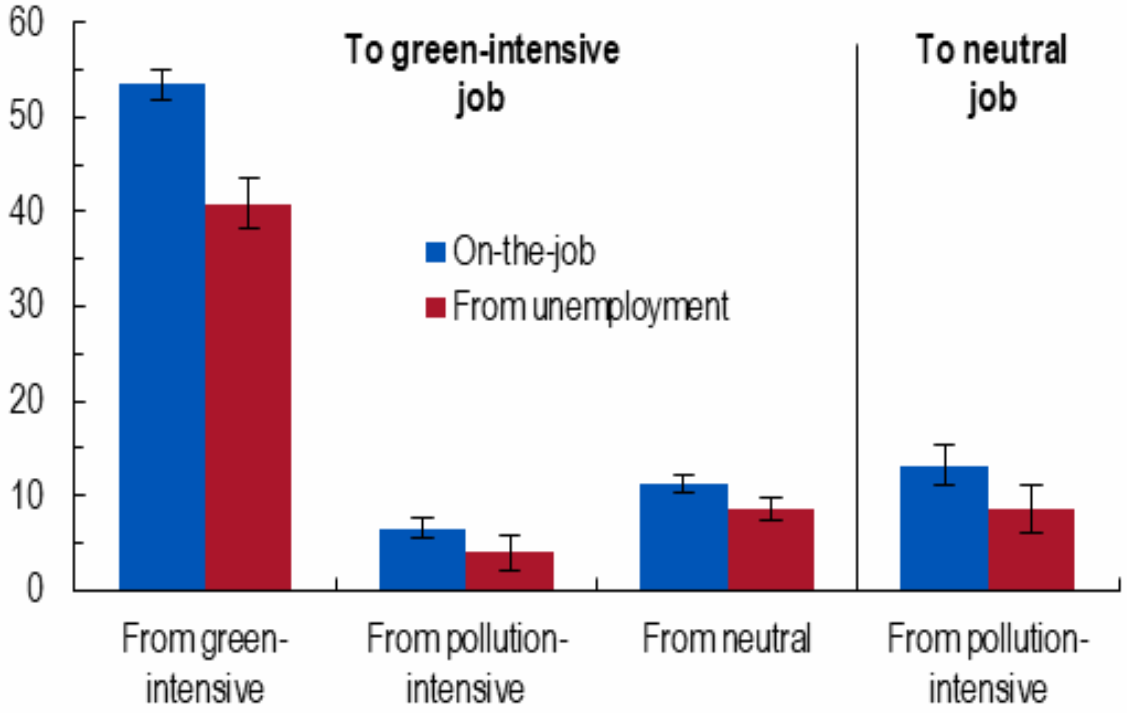




Sources: EU Statistics on Income and Living Conditions, US Current Population Survey; and IMF staff calculations.
Notes: The whiskers depict the 90 percent confidence interval around the estimated transition rate. The differences between more green- and pollution-intensive jobs are statistically significant for job-to-job finding and job separation rates

Workers from pollution-intensive jobs find it tough to switch to greener jobs

Probability of Transitioning into a Green-Intensive or Neutral Job among Job Switchers
(Annual Probability, Percent)



Sources: EU Statistics on Income and Living Conditions (EUSILC); Mexico National Survey of Occupation and Employment; Occupational Information Network; US Current Population Survey; Vona and others (2018); and IMF staff calculations.
Notes: Probabilities are calculated based on transitions across discretized version of green, pollution, and neutral intensity jobs, where job is defined to be green/pollution-intensive if green (pollution) intensity is above 0 and pollution (green)-intensity is zero, and a job is neutral if it is neither green nor pollution-intensive.

Environmental properties of jobs in transitions are sticky but not permanent.

- Green-intensive job holders tend to switch to other green-intensive jobs.
- Pollution-intensive and neutral job holders have a harder time moving into green-intensive jobs.
- Pollution-intensive job holders can also transition into neutral jobs, but still with low probability.

3. How do environmental policies impact the reallocation of workers into greener jobs?

Empirical strategy to estimate the effect of policies

- Extend the empirical models to analyze how environmental policies impact reallocation and the environmental properties of employment:

$$Outcome_{i,c,t} = \alpha_c + \alpha_t + \beta' X_{i,c,t} + \gamma' Y_{i,c,t-1} + \boldsymbol{\delta_0} P_{c,t} + \varepsilon_{i,s,c,t}$$

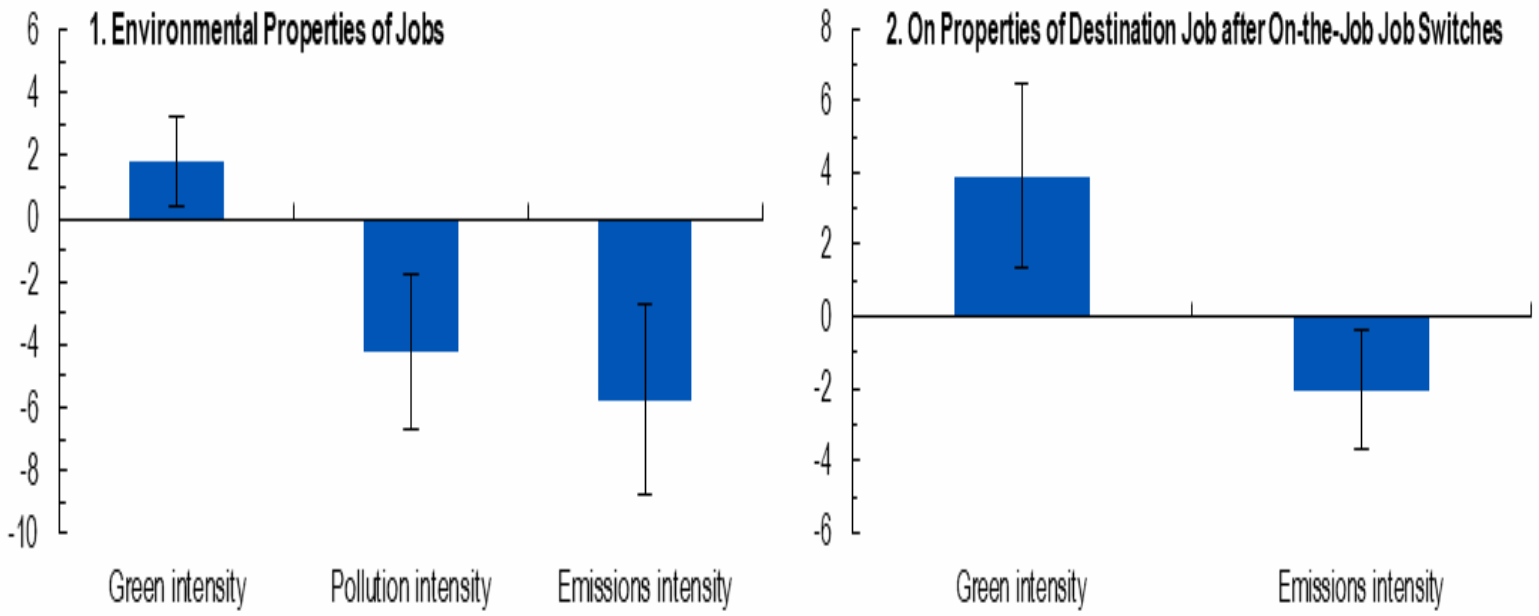
  where $P_{i,c,t}$ is an index of environmental policy stringency.

- How policy effects vary with labor market policies and structural features:

$$Outcome_{i,c,t} = \alpha_c + \alpha_t + \beta' X_{i,c,t} + \gamma' Y_{i,c,t-1} + \theta' W_{c,t} + \boldsymbol{\delta_1} P_{c,t} + \boldsymbol{\mu_1}' \left(P_{c,t} \cdot W_{c,t}\right) + \varepsilon_{i,s,c,t}$$

Identification assumptions: fixed effects control for any omitted macroeconomic factors and reverse causality to policy mitigated by focusing on outcome at the individual level

More stringent environmental policies associated with greener employment



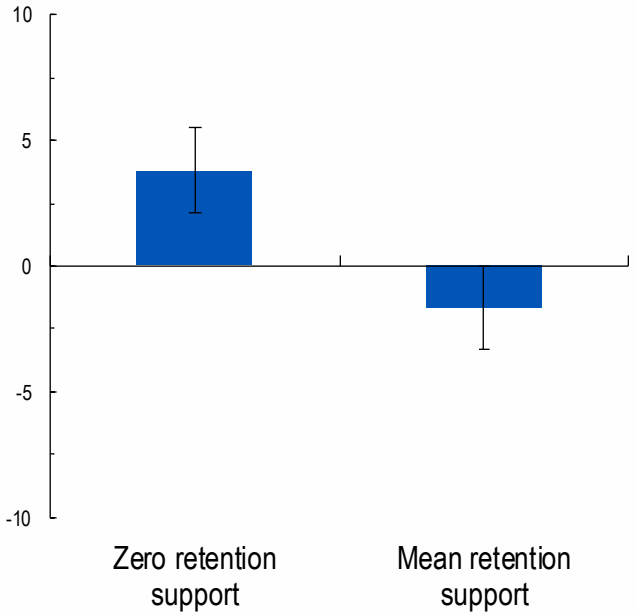
Sources: EU Labor Force Survey; EU Statistics on Income and Living Conditions; US Current Population Survey; and IMF staff calculations.
Note: The left panel shows the effect of Environmental Policy Stringency Index (EPSI) on environmental properties of jobs (currently employment) for changes in the EPSI from 25th to 75th percentile. The right panel shows the effect of the EPSI on environmental properties of destination jobs for on-the-job job changers (controlling for previous-job environmental property) for changes in the EPSI from 25th to 75th percentile. The whiskers depict the 90 percent confidence interval around the estimated transition rate.

- More stringent environmental regulation is associated with higher green intensity and lower pollution /emission intensity in overall employment.
- A similar effect is seen in destination jobs for on-the-job job switchers.
- Policies can have a larger impact, particularly on the green intensity of newly created jobs.

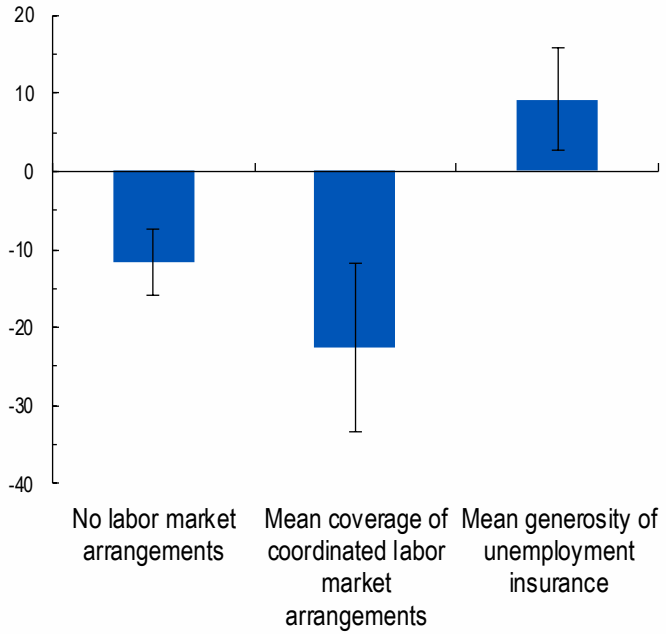
Features of the labor market impact the effectiveness of environmental policies

Estimated Effects of Environmental Policy Stringency Conditional on Labor Market Features
(Percent change)

1. On Green Intensity of Employment



2. On Pollution Intensity of Employment



Sources: EUSILC; USCPS; and IMF Staff Calculations.
Note: The marginal effect of environmental policy stringency (EPS index) on the environmental properties of jobs are expressed as percent of the mean intensity for changes in the EPS index from the 25th to 75th percentiles of the cross-country distribution. The whiskers depict the 90 percent confidence interval around the estimated transition rate.

- The positive impact of more stringent environmental policies on green intensity weakens with higher retention support measures.
- The negative impact of more stringent policies on pollution intensity strengthens as coordinated labor market and collective bargaining arrangements cover more of the work force.
- The negative impact on pollution intensity weakens with more generous unemployment insurance regimes, potentially inhibiting reallocation.

Model-based scenario analysis

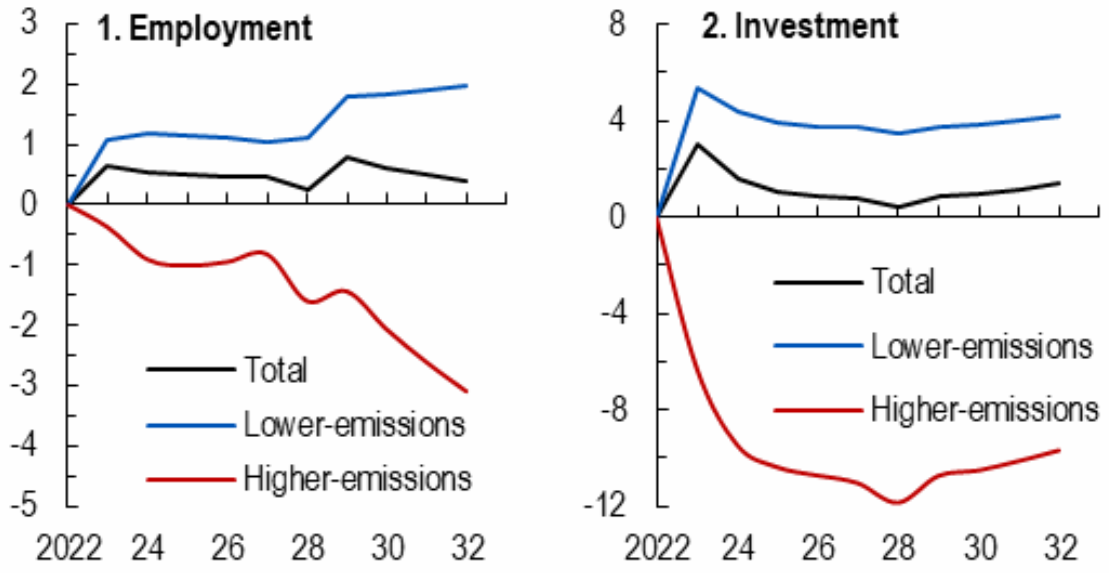
Use a newly developed model of labor markets, informed by empirical estimates, to examine how various policy interventions to achieve net zero emissions (NZE) by 2050 impact labor reallocation and workers' welfare.

- Task Model (Acemoglu and Restrepo 2018, 2021, Drozd, Taschereau-Dumouchel and Tavares 2021)
- To produce a good, a plant must complete a fixed set of tasks.
- Tasks are performed by capital, low-skilled, or high-skilled labor.
- Two Goods – higher emissions and lower emissions
- A carbon tax changes the relative price of higher emission goods to low emission goods impacting consumers' demand.
- Two representative economies – advanced and emerging market (today focus on advanced economies)

Labor and capital reallocation

- Package inspired by the WEO October 2020 analysis comprised:
  - Public infrastructure investment and R&D subsidies starting in 2023
  - Carbon tax that gradually phased in starting in 2023 with a sharper rate of increase from 2029
  - Targeted retraining to facilitate the transition of low-skilled workers starting in 2023
  - Targeted labor income tax reduction (EITC) to boost incomes and stimulate labor supply of low-skilled workers in 2029

Capital and Labor Reallocation
(percent change relative to the baseline)

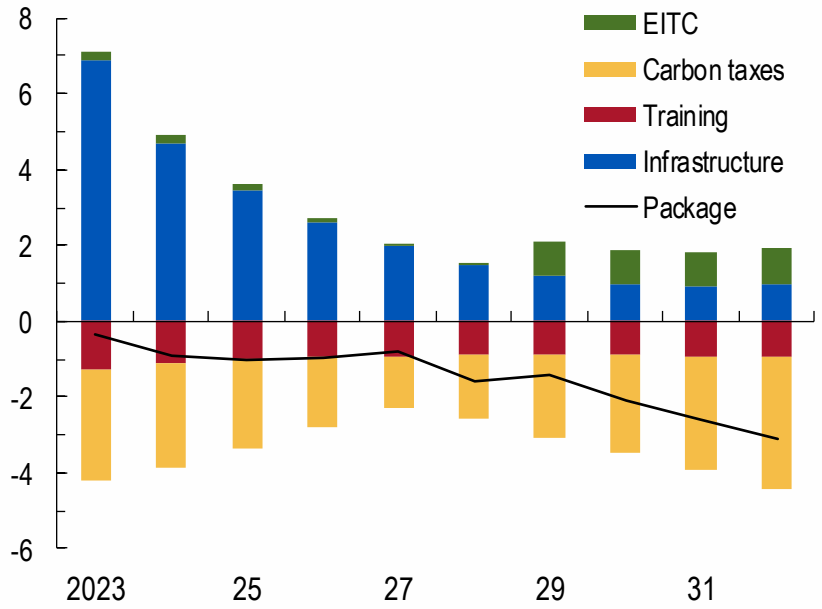


Source: IMF staff estimates.
Note: The simulations are run using the model calibrated to a typical "Advanced economy". The climate change mitigation policy package comprises (1) gradually rising carbon taxes, (2) a green fiscal stimulus consisting of green infrastructure investment and a subsidy for RD, (3) a training program, and (4) Earned income tax credit program (EITC). The figure also shows the effects of avoided damages from climate change resulting from the implementation of the package. See Online Annex 3.6 for details.

Policies to achieve NZE generate worker reallocation

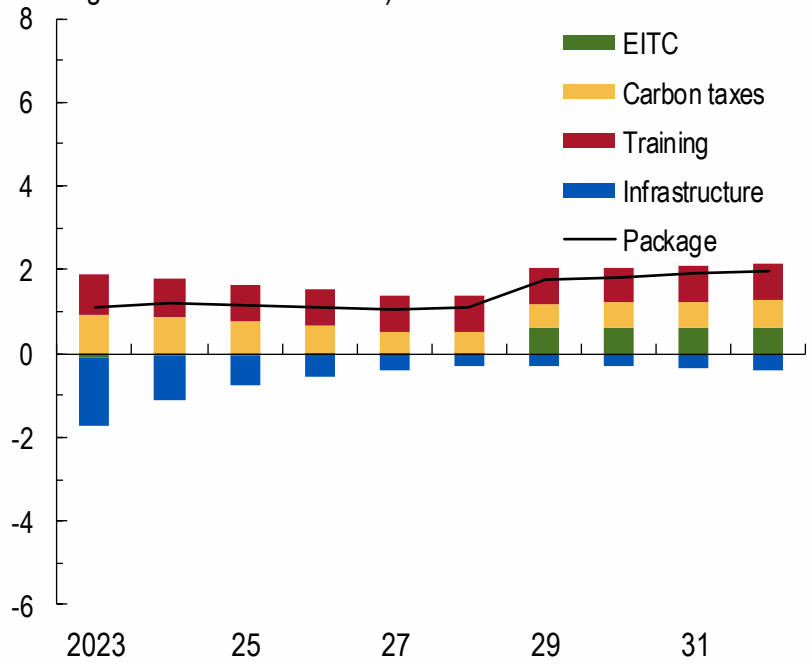
Workers in high emissions-intensive sector move to low emissions-intensive sector.

Employment Change Composition: Higher-Emissions-Intensive Sector
(percent change relative to the baseline)



Training helps ease reallocation and boost employment in low emissions-intensive sector.

Employment Change Composition: Lower- Emissions-Intensive Sector
(percent change relative to the baseline)

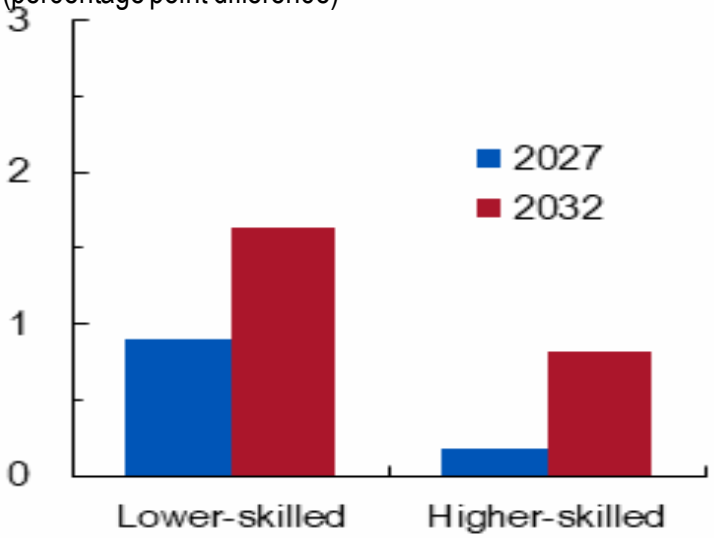


Source: IMF staff estimates.
Note: The simulations are run using the model calibrated to a typical "Advanced economy". The figures show the impact of each element of the policy package on employment relative to the baseline. The policy package comprises (1) gradually rising carbon taxes, (2) a green fiscal stimulus consisting of green infrastructure investment and a subsidy for RD, (3) a training program, and (4) Earned income tax credit program (EITC). The figure also shows the effects of avoided damages from climate change resulting from the implementation of the package. See Online Annex 3.6 for details.

Low-skilled need to reallocate more than high-skilled but will also benefit more from green transformation.

Low-skilled workers are more likely to need to change job.

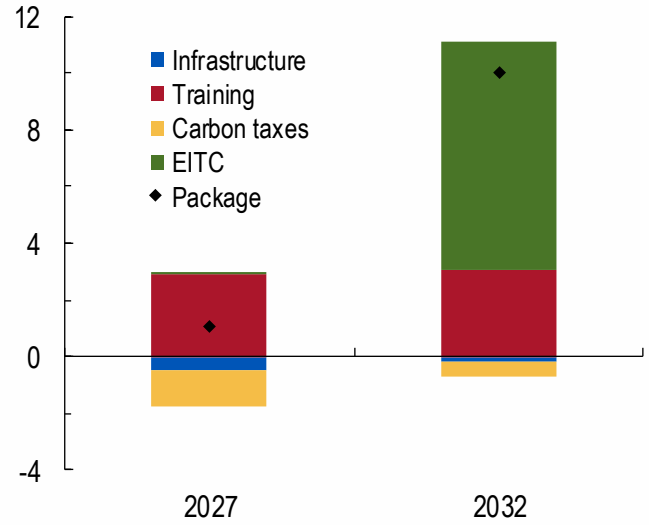
Employment in Lower Emissions-Intensive Sector
(percentage point difference)



Source: IMF staff estimates.
Note: The simulations are run using the Bluedorn and others (forthcoming) model calibrated to a typical "Advanced economy". The climate change mitigation policy package comprises (1) gradually rising carbon taxes, (2) a green fiscal stimulus consisting of green infrastructure investment and a subsidy for RD, (3) a training program, and (4) Earned income tax credit program (EITC). The figure also shows the effects of avoided damages from climate change resulting from the implementation of the package. The figure shows the impact of the policy package relative to the baseline on the employment share in in the low-emissions sector.

The right policy package can reduce inequality and improve low-skilled workers welfare.

Low-skilled Worker After-tax Income Change
(percent change relative to the baseline)



Source: IMF staff estimates.
Note: The simulations are run using the Bluedorn and others (forthcoming) model calibrated to a typical "Advanced economy". The figure shows the impact of each element of the policy package on low-skilled workers' after-tax income relative to the baseline. The policy package comprises (1) gradually rising carbon taxes, (2) a green fiscal stimulus consisting of green infrastructure investment and a subsidy for RD, (3) a training program, and (4) Earned income tax credit program (EITC). The figure also shows the effects of avoided damages from climate change resulting from the implementation of the package. See Online Annex 3.6 for details.

Key conclusions and findings

Key conclusions and findings

- **How green is the labor market?**
  - More green- and pollution-intensive jobs concentrated among subsets of workers
  - Jobs are best described as *shades of green* rather than green and non-green
  - Wide dispersion of green-, pollution-, and emission-intensities across and within sectors.

- **How easily do workers transition into greener jobs?**
  - Tough challenges in becoming greener for workers in polluting jobs
  - Higher skills can ease transition

- **How do policies impact the reallocation of workers into greener jobs?**
  - Environmental policies effective in greening employment, esp. if reallocation incentives not blunted.
  - Path for NZE achievable with right policy package
  - For a representative AE (EME) about 1.0 (2.5) percent of employment need to shift over next decade

World Economic Outlook
April 2022

THANK YOU!