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# Labor Market Tightness in Advanced Economies

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**ABSTRACT:** Two years after the onset of the COVID-19 pandemic, a puzzle has emerged in several advanced economies: unfilled job vacancies have increased sharply even though employment has yet to fully recover. This note sheds light on three contributing factors, namely barriers to returning to work, changing worker preferences away from certain types of jobs, and sectoral and occupational job mismatch. The note also assesses the impact of labor market tightness on wage growth, showing that it has so far been large for low-pay jobs but milder overall. Bringing disadvantaged groups of workers into the labor force, including by controlling the pandemic itself, would ease labor market pressures while amplifying the recovery and making it more inclusive.

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# Contents

# Executive Summary

Two years after the onset of the COVID-19 pandemic, employment and other measures of labor market slack have yet to fully recover, yet labor markets are tight in some advanced economies. If this a puzzle—what is driving it? And what are its consequences, including for labor market inequality, wage pressures, and public policies? This Staff Discussion Note sheds light on these questions, focusing on a selected group of countries.

Most labor markets in advanced economies are tighter than they were prior to COVID-19, particularly in English-speaking countries (Australia, Canada, United Kingdom, United States). Tightness can be seen in a sharp rise in vacancies and vacancies-to-unemployment ratios. Vacancies have risen across all sectors, including those with more contact-intensive, less-teleworkable, and lower-skilled jobs that were hit hard by the pandemic. Fears that COVID-19 might permanently destroy these jobs, including via automation, have not yet materialized.

Tight labor markets partly reflect reduced labor force participation, which has shrunk the pool of available job seekers and made it harder to fill vacancies. Disadvantaged groups—including the low-skilled, older workers, and women with young children, depending on the countries—have yet to fully return to the labor market. Looking through cross-country heterogeneity, in the median country, low-skilled workers accounted for more than two-thirds of the aggregate employment gap vis-à-vis its pre-COVID-19 trend by late 2021, while older workers—including low-skilled ones—contributed about one-third.

The pandemic itself partly explains why some workers have not fully come back. It has persistently pushed low-skilled and older workers out of employment in some countries, while in the United States, the adverse impact of the pandemic on school closures and childcare availability has kept women with young children home. In some cases, lower immigration also seems to have amplified labor shortages among low-pay jobs.

There are also signs that COVID-19 may have changed worker preferences, most clearly away from some low-pay jobs—a phenomenon sometimes labeled the “Great Resignation.” A growing share of workers with contact-intensive jobs have been moving into other jobs or left the labor force altogether, despite the concomitant rise in contact-intensive job vacancies. Likewise, voluntary quits have risen most in industries with larger shares of contact-intensive, physically strenuous or less flexible jobs, resulting in pockets of labor shortages.

Sectoral job mismatch also played a role, but it rose less, and less durably, than it did after the 2008–09 global financial crisis (GFC). By late 2021, the rise in mismatch accounted for less than one-tenth of the employment rate gap vis-à-vis pre-COVID-19 levels in the median country. This suggests that, at least so far, the pandemic has transformed labor markets less than was generally envisaged after the first wave.

Tightness has pushed up wage growth, especially among low-pay jobs, helping reduce wage inequality in some countries such as the United Kingdom or the United States. In low-pay industries, wages are more responsive to tightness, and tightness has increased more than in other industries. The impact on economy-wide wage pressures—at least 1.5 percentage points on annual wage growth as vacancies recovered—has been muted by the small overall share of low-pay jobs in firms’ total labor costs. In comparison, demands for compensation for recent price hikes and/or sustained higher inflation expectations among workers would entail larger inflationary risks.

To ease labor market pressures while making the recovery more inclusive, further wage increases will help by attracting more disadvantaged workers back into the labor force, but policies need to amplify market forces. Controlling the pandemic itself is paramount—it would enable seniors, workers in contact-intensive industries and women with young children (in the United States) to fully join back the labor force. Active labor market policies—including short-term training programs targeted at some of the professions that concentrate shortages—could also help. So could labor laws and regulations that facilitate telework, and a resumption of immigration.

# I. Introduction

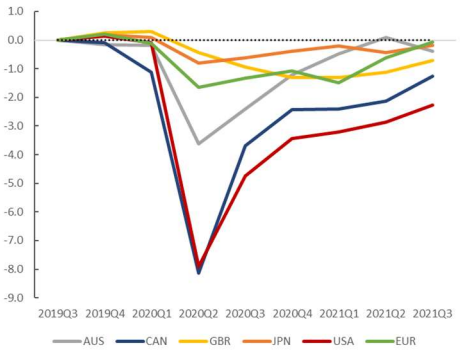
**Two years after the start of the COVID-19 pandemic, labor markets in a number of advanced economies are showing signs of tightness even though employment and average hours worked have yet to fully recover (Figure 1).** Under the latest IMF *World Economic Outlook* projections, while the ongoing labor market recovery should remain solid, employment would remain below pre-COVID levels by the end of 2022 in about one-third of advanced economies. Yet, even in some of these, labor markets have become tight, as indicated by a sharp rise in unfilled job vacancies and vacancy-to-unemployment ratios, alongside a pick-up in wage growth lately. This surprising coexistence of plentiful vacancies with incomplete labor market recoveries can be found in countries, such as the United States and the United Kingdom, whose government policies and employment trajectories varied widely during the pandemic. This suggests that, beyond the role of policies, other factors have likely been at play.

**This note sheds light on this puzzle and explores some of its consequences, including for labor market inequality, wage pressures and public policies.** Specifically, the note (1) reviews the current state of labor markets in advanced economies, documenting both tightness and remaining employment shortfalls vis-à-vis pre-COVID levels, as well as how these varies across types of industries, workers and jobs; (2) provides fresh evidence on factors that may account for the coexistence of plentiful jobs and scarce workers, including sectoral and occupational mismatch (between characteristics of job seekers and open vacancies), barriers to returning to work for certain demographic groups (such as the elderly or women with young children) amid a persistent pandemic, a decline in immigration, and changing job preferences among some workers generating a new type of mismatch between their aspirations and available jobs; (3) investigates the impact of current labor market tightness on wage growth, both in general and across different types of jobs—low-pay versus others; (4) draws implications regarding which policies in advanced economies could, at the same time, ease labor market tensions, amplify the labor market recovery, and sustain a much-needed reduction in wage and broader income inequality.

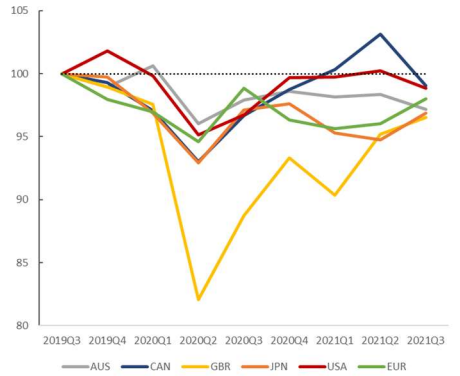
**Some of the key questions considered in this note are the following:**

Figure 1: Rising Vacancies, Incomplete Employment Recovery

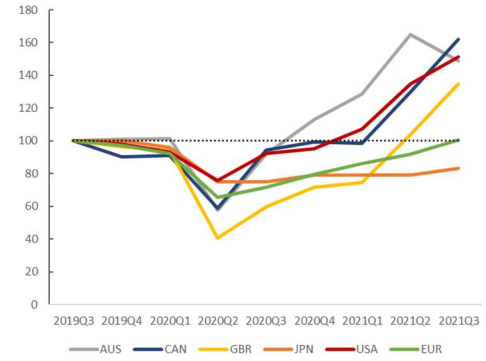
1. Employment Rates
*(Deviation from 2019Q3, percentage points)*




2. Average Hours Worked
*(Index 2019Q3 = 100)*




3. Vacancies
*(Index 2019Q3 = 100)*




Sources: Australian Bureau of Statistics (AUS); Japan Ministry of Health, Labour, and Welfare (JPN); Eurostat (EUR); Organisation for Economic Co-operation and Development (AUS, CAN, GBR, JPN, USA); Statistics Canada (CAN); UK Office for National Statistics (GBR); US Bureau of Labor Statistics (USA); and IMF staff calculations.
Note: The EUR group is calculated as the averages weighted by country employment and includes Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden.

- **How tight are labor markets across advanced economies?** Have unfilled vacancies shot up across the board, or do tensions vary depend on jobs' contact intensity, teleworkability, and required skill levels? To what extent are employment and labor force participation back to pre-COVID levels, and how does this vary across countries, sectors, and demographic groups?
- **Why are jobs plentiful while workers are still comparatively scarce?** To what extent has the pandemic increased (sectoral and occupational) mismatch between available jobs and (the backgrounds of actual and potential) job seekers, making it harder to fill out vacancies? Have the pandemic and policy responses (or lack thereof) persistently pushed certain groups of workers out of the labor force, and how likely are they to fully return soon? Has the fall in immigration during the pandemic amplified the decline of available workers? Are there signs, such as rising voluntary quits, that workers might have become more reluctant to take up certain jobs? Are workers who previously held more contact-intensive or less flexible jobs more likely to remain out of the labor force and be looking for different kinds of jobs?
- **What is the impact of increased labor market tightness on wages?** Is it larger for low-wage workers and industries? If so, could this help reduce wage inequality? How much has greater competition for fewer workers among firms contributed to a pick-up in overall wage inflation pressures, and will these last?
- **Which policies could help ensure that tightness remains a blessing, not a curse?** How can policymakers ease ongoing tensions, while at the same time amplifying income gains at the lower end of the pay scale and sustain an inclusive labor market recovery? How can they bring more people into the labor force?

**The main findings can be summarized as follows:**

- **Most labor markets are tighter that they were prior to COVID-19.** These include English-speaking (Australia, Canada, United Kingdom, United States) and several northern and western continental European economies, while Germany and Japan still show lower vacancy-to-unemployment ratios than in 2019. Vacancies have risen steadily across all sectors, including those with more contact-intensive, less-teleworkable, and/or lower-skilled jobs that were hit hard by the pandemic. Fears that COVID-19 might permanently destroy these jobs, including through automation, have not materialized so far.
- **Tight labor markets partly reflect reduced labor force participation, which has shrunk the pool of available job seekers.** The main reason why employment remains subdued, particularly compared to pre-crisis trends, is that disadvantaged groups—including, depending on countries, the low-skilled, older workers, or women with young children—have yet to fully return to the labor market. Looking through cross-country heterogeneity, in the median country, low-skilled workers—about one-fourth of whom are older workers— account for more than two-thirds of the aggregate employment gap vis-à-vis its pre-COVID-19 trend, while older workers as group contribute about one-third of the gap. In some cases, the decline in immigration also seems to have amplified labor shortages among low-skilled jobs.
- **The pandemic itself partly explains why some workers have remained out of the labor market.** Health concerns—and, in some cases, pension plan valuation gains amid booming financial markets until late 2021—contributed to older workers' labor force withdrawal, which accounted for one-third of the overall employment gap vis-à-vis pre-COVID levels in the United Kingdom and the United States by late 2021. Likewise, prolonged school closures and scarce childcare opportunities have kept women with young children home, explaining some 15 percent of the overall US employment shortfall by the fall of 2021.
- **There are also signs that COVID-19 may have changed worker preferences, most clearly away from some low-pay jobs.** A growing share of workers with contact-intensive jobs has been moving into other

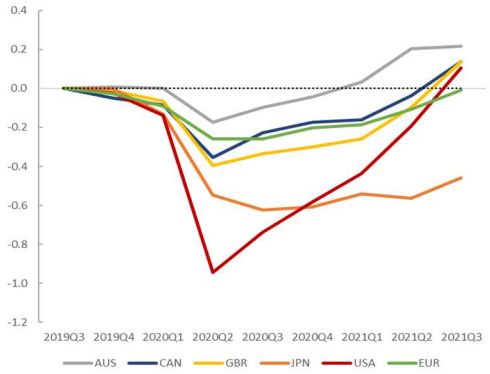
jobs or left the labor force altogether, despite the concomitant rise in contact-intensive job vacancies. Likewise, voluntary quits have risen most in industries with larger shares of contact-intensive, physically strenuous, or less flexible jobs, resulting in pockets of labor shortages.

- **Sectoral and occupational mismatch also some played a role, but it rose less, and less durably, than it did after the 2008–09 global financial crisis.** In most countries, mismatch spiked at the onset of the crisis, but then receded gradually as hard-hit industries recovered from the COVID-19 shock and hired back previously laid-off workers. By late 2021, the employment rate loss due to mismatch was less than 1 percentage point higher than it was prior to the crisis, with Spain being the exception among the countries covered. Overall, by late 2021, higher mismatch accounted for just one-tenth of the overall employment rate gap vis-à-vis pre-COVID-19 levels in the median advanced economy for which data are available.
- **Tightness has pushed up wage growth among low-pay jobs, helping reduce wage inequality in some countries.** In the United Kingdom and the United States, for example, wages are more than twice as responsive to tightness in low-pay industries, which have also seen larger increases in tightness, than other industries. For both reasons, the tighter labor market is estimated have raised the annual growth rate of nominal wages in low-pay industries by 4 to 6 percentage points between mid-2020 and late 2021.
- **The overall impact of increased tightness on wage inflation has been more muted so far.** The analysis in this note puts it at least at 1.5 percentage points in the United Kingdom and the United States between mid-2020 and late 2021, partly because of the small overall share of low-pay industries (and jobs) in total labor costs. Nonetheless, given persistent labor market tightness, overall nominal wage growth should remain solid going forward. Worker demands for compensation for recent price hikes and/or sustained higher inflation expectations would entail larger inflationary risks than tight labor markets *per se*.
- **To ease labor market pressures while making the recovery more inclusive, further wage increases will help by attracting more disadvantaged workers back into the labor force, but policies need to amplify market forces.** Measures to bring disadvantaged workers into the labor force are key. Controlling the pandemic through vaccines, tests and treatments will enable seniors, low-skilled workers in contact-intensive industries and—by enabling schools and daycare to stay open—women with young children (in the United States) to fully join back the labor force. Well-designed active labor market policies could speed up job matching, including through short-term training programs that help detached (and employed) lower-skilled workers build the skills required for new fast-growing occupations or more traditional jobs that have experienced acute shortages. To accommodate shifting worker preferences, labor laws and regulations also need to facilitate telework. Immigration, whose sharp reduction slightly amplified labor shortages in some cases, could also help "grease the wheels" of the labor market.
- **In the more distant future, mainstreaming the use of job retention schemes could help keep disadvantaged workers attached to the labor force after major temporary shocks.** Job retention schemes dampened initial job losses, labor force withdrawals, and subsequent increases in tightness in most European economies. It is important, however, that job retention support be temporary so as not to impede the eventual reallocation of workers after persistent shocks—such as the lingering pandemic.

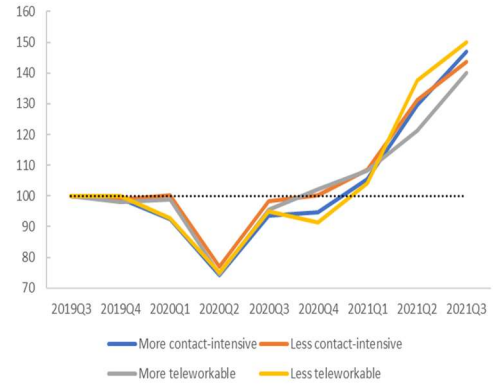
**Because of data limitations, these findings should be interpreted with caution.** Many of the key issues analyzed in this note require granular data that could be accessed and used for just a few advanced economies. Further, the impact of labor market tightness on wage growth is explored for the United Kingdom and the United States; it might be different—possibly weaker—in those other advanced economies, such as in continental Europe, with more stringent labor regulations—tighter job protection legislation, higher minimum wages—and more centralized collective bargaining arrangements.

Figure 2: Labor Markets Have Tightened across the Board

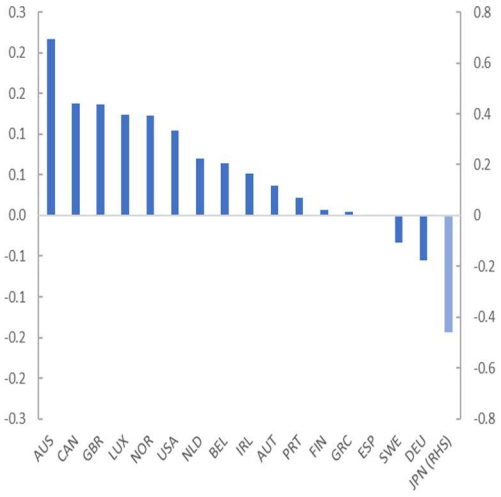
1. Vacancy-to-Unemployment Ratios
*(Deviation from 2019Q3, percentage points)*



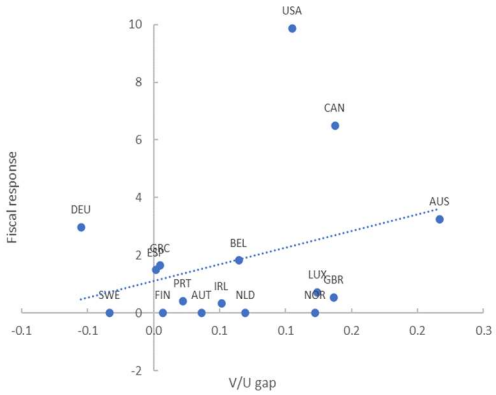

2. Vacancies
*(Index 2019Q3 = 100)*




3. Vacancy-to-Unemployment Ratios Gaps
*(Percentage points difference between 2019Q3 and 2021Q3)*




4. Vacancy-to-Unemployment Ratios and Fiscal Support to Households
*(Fiscal spending as a percent 2020 GDP)*




Sources: Australian Bureau of Statistics; Eurostat; Japan Ministry of Health, Labour, and Welfare; Japan Ministry of Internal Affairs and Communications; Organisation for Economic Co-operation and Development; Statistics Canada; UK Office for National Statistics; US Bureau of Labor Statistics; IMF staff calculations.
Note: The EUR group (panel 1) includes Austria, Belgium, Finland, Germany, Greece, Ireland, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden, and the values are calculated as the averages weighted by country employment. The country sample for panel 2 is similar but excludes Japan due to unavailability of sectoral vacancy-level data. Sectors are classified according to ISIC Revision 4 and grouped into more contact-intensive and more teleworkable sectors based on Kaplan, Moll, and Violante (2020). Country-level employment is used to aggregate by sector, and employment for each sub-sector is used to compute teleworkable and contact-intensive aggregates. In panel 4, "fiscal response" denotes fiscal support to households as featured in the October 2021 IMF *Fiscal Monitor* database of country fiscal measures in response to the COVID-19 pandemic. V/U gap is the gap vis-à-vis 2019Q3 levels.

# II. The Current State of Labor Markets in Advanced Economies

## II.1. Rising Vacancies

**Labor markets are tighter than they were prior to the pandemic,** as reflected in ratios of open vacancies to the number of unemployed that are at or above pre-pandemic levels in most advanced economies—most

strikingly in Australia, Canada, Luxemburg, Norway, the United Kingdom, and the United States, with Japan, Germany, and Sweden being the main exceptions (Figure 2, panels 1 and 3).[1] Tightness has increased sharply in countries that protected existing jobs through extensive job retention schemes throughout the pandemic—such as the United Kingdom, where the Coronavirus Job Retention Scheme covered almost a third of employment at its peak—and others that relied more on protecting workers through extended unemployment benefits—such as the United States, although the Paycheck Protection Program also saved jobs there. Across countries, the sharp rise in tightness also correlates positively with the magnitude of fiscal support given to households during the pandemic (Figure 2, panel 4). Within countries, it has been widely shared across sectors, although it has been slightly stronger in those with more contact-intensive and less-teleworkable jobs, which the pandemic hit harder (Figure 2, panel 2). It has also been particularly large for some low-pay jobs (Box 1).

## II.2 Incomplete Employment Recovery

**Despite plentiful job opportunities, the employment recovery remains incomplete, albeit with wide cross-country variation.** Employment across all sectors is still in the process of recovering to pre-pandemic levels. Hard-hit sectors with more contact-intensive and less teleworkable jobs are still lagging behind, although they have been catching up since the spring 2020 trough (Figure 3, panel 1). There are also significant differences across countries, with still significant employment shortfalls in Canada, the United Kingdom, or the United States, while employment is already above pre-pandemic trends in several European countries (Figure 3, panel 2). More broadly, employment fell less in Europe than in some other regions in the early phase of the crisis, owing in part to extensive reliance on job retention schemes (Ando and others, forthcoming; IMF 2021); even so, the employment rate remains slightly below its pre-pandemic trend, with some countries (such as Portugal and Sweden) falling significantly behind. In many countries, this employment gap is accompanied by a substantial labor force participation shortfall, as workers who left the labor market during the pandemic have not fully returned, such as in the United Kingdom and the United States, although tight labor markets are bringing workers back in some other countries, such as Norway and The Netherlands (Figure 3, panel 2). Overall, in the median country in the sample, the labor force participation rate gap accounts for half of the remaining employment gap vis-à-vis its pre-COVID-19 trend.

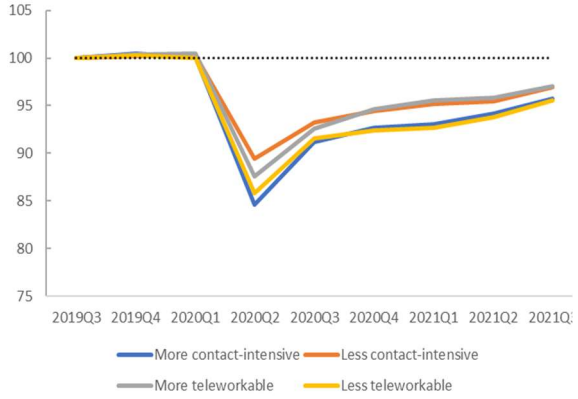
**Disadvantaged labor market groups are still facing employment scarring, shrinking the pool of available job seekers and contributing to labor market tightness.** Across demographic groups, low-skilled and older workers experienced the sharpest employment rate drops during the crisis, and they are still showing sizeable gaps vis-à-vis pre-pandemic levels (Figure 2, panel 3). Employment has not fully recovered for women either in the United States, and in fact in most other advanced economies as well once factoring in that female participation and employment rates would have likely increased in the absence of COVID-19; by late 2021, female participation was still generally below a linear projection based on the 2015–19 period, with notable exceptions such as The Netherlands and Norway that lifted the European average.

[1] Japan's sluggish recovery in the vacancy-to-unemployment ratio can be attributed to a combination of depressed vacancies amid persistent weak demand due to long-lasting health containment measures, together with rather stable unemployment throughout the pandemic owing to extensive use of job retention schemes (including the Employment Adjustment Subsidy).

Figure 3: Heterogenous Employment Recoveries

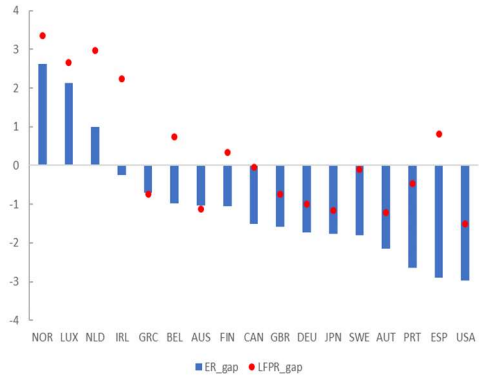
1. Employment Levels across Sectors

*(Deviation from 2019Q3, percent)*



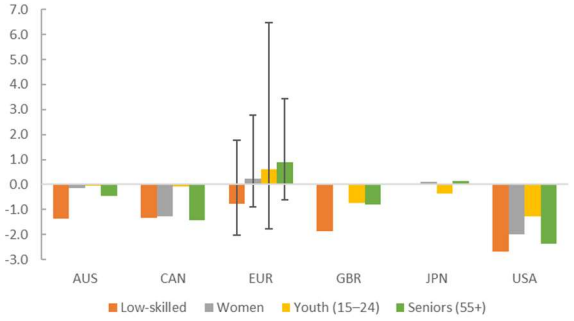

2. Employment and Labor Force Participation Rates

*(Deviation from 2021 trend projection, percentage points)*



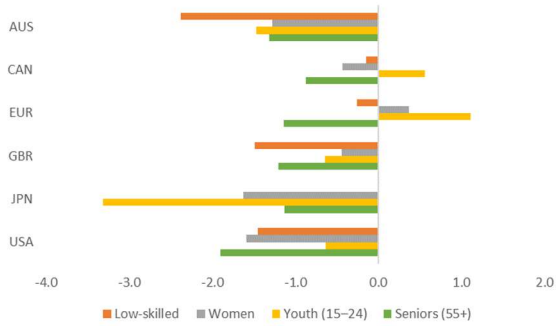

3. Employment Rates across Demographic Groups

*(Deviation from 2019Q3, percentage points)*




4. Participation Rates across Demographic Groups

*(Deviation from 2021 trend projection, percentage points)*




Sources: Australian Bureau of Statistics; Eurostat; International Labour Organization; Organisation for Economic Co-operation and Development; UK Office for National Statistics; and IMF staff calculations.
Note: Skill level is classified according to the ISCED 2011. Low-skilled = some college, associate degree or below; Youth = 15 to 24 years old; Seniors = 55 years and older. The country sample in panel 1 includes Australia, Canada, United Kingdom, United States, and the EUR group; it excludes Japan due to its unavailability of sectoral employment-level data. The EUR group is an employment-weighted average of 12 advanced European economies. Sectors are classified according to ISIC Revision 4 and grouped into more contact-intensive and more teleworkable sectors based on Kaplan, Moll, and Violante (2020). Teleworkable and contact-intensive sectors are weighted by sector and country employment levels. The whiskers in panel 3 indicate the 75$^{th}$ and 25$^{th}$ percentiles countries among European countries.

# III. Why Are Jobs Plentiful While Workers Are Still Scarce?

**There are three broad types of explanations for the seemingly puzzling coexistence of tight labor markets and employment slack—job mismatch, barriers to returning to work, and changing job preferences among workers.** This section provides evidence that all three have been at play, albeit to varying degrees and differing across countries. A fourth potential factor put forward in recent policy discussions is the adverse effect of generous public income support and excess savings during the pandemic on non-employed

workers' willingness to seek and take up jobs. However, preliminary evidence, including from the phasing out of the US federal unemployment insurance supplement in the second half of 2021, suggests the early removal of COVID-related unemployment benefits only had a modest effect on getting people back to work (Coombs and others 2021). Likewise, while households accumulated excess savings in advanced economies because of consumption restrictions and government support schemes, these were temporary, and tended to be concentrated among higher-income households (Bilbiie and others 2021; Armantier and others 2021; Attinasi, Bobasu, and Manu 2021). As such, while excess savings may have enabled some workers to take time off their job search to find better opportunities, they seem unlikely to durably suppress labor supply, particularly among low-income workers.

## III.1 Sectoral and Occupational Mismatch

**COVID-19 could create labor market mismatch and increase tightness.** COVID-19 may have triggered a wave of structural transformation, as some industries and firms shrink due to limited demand for their products or because they cannot fully operate during the pandemic, while others benefit from increased demand and their ability to telework. This could result in misalignment between the sectors and firms in which vacancies abound and those where most job seekers, displaced from their previous positions, either are looking for new employment or are qualified to get jobs. In turn, such sectoral and occupational mismatch could constrain job creation and increase labor market tightness, all else equal, as workers often take longer to find employment in new sectors and firms. Increased sectoral mismatch significantly slowed employment recoveries during past economic downturns, including after the GFC, when it may have accounted for up to one-third of the rise in US unemployment (Şahin and others 2014).

**Sectoral mismatch rose during the COVID-19 crisis, but generally receded as labor markets recovered (Figure 4, panel 1).**[2] At a basic level, the combination of rising vacancies and falling—rather than rising unemployment since the trough of the crisis suggests that mismatch is unlikely to have increased dramatically.[3] Detailed mismatch is computed following the methodology proposed by Şahin and others (2014), using granular vacancies and employment data at the sector and/or occupational level. In Australia, Spain, the United Kingdom, and the United States, mismatch rose markedly throughout 2020, which is consistent with heterogenous sectoral impacts of the COVID-19 shock. Jobs requiring in-person interactions, such as in restaurants, hotels, and entertainment, were hit hard while "teleworkable" jobs fared substantially better and yet others, such as delivery services, boomed. However, as hard-hit industries recovered and laid-off workers managed to transition to new jobs, mismatch generally receded. In the case of Australia, one of the hottest labor markets among advanced economies, estimated sectoral mismatch even fell below its late 2019 level by the end of 2021. In Canada, however, mismatch has been rising gradually since late 2020, standing 50 percent above its late 2019 level by mid-2021. While all countries covered here experienced at least some rise in mismatch, this was not the case in Japan, where it remained essentially flat.

[2] Annex 2 describes the computation of the mismatch index and employment losses due to mismatch. The raw value of the index reports the fraction of newly hired unemployed workers that is foregone due to mismatch in the allocation of vacancies and unemployment across sectors. Sector-level (pseudo) unemployment is computed using the sector in which unemployed workers report being last employed. The underlying assumption is that the unemployed search for jobs exclusively in the sector in which they previously worked. Mismatch estimates are robust to considering broader groups of job seekers, such as "marginally attached" workers; the short-term inactive, on-the-job searchers; and workers protected by the job retention scheme (for the United Kingdom); excluding temporarily laid-off workers (for the United States) and relaxing the assumption that workers search in their sector of previous employment. See Pizzinelli and Shibata (2022) for details.

[3] The conventional framework used to analyze mismatch is the so-called Beveridge curve that links vacancies and unemployment. In this framework, a rise in mismatch shifts the curve outward, leading to *higher* unemployment for a given level of vacancies—such as that of late 2019, to which most advanced economies returned in the course of 2021. At the same time, booming aggregate demand moves the economy along the Beveridge curve, leading to both higher vacancies and lower unemployment. In principle, this negative effect on unemployment can dominate the positive effect of rising mismatch, in which higher vacancies and lower unemployment could still be observed *even* if mismatch is higher.

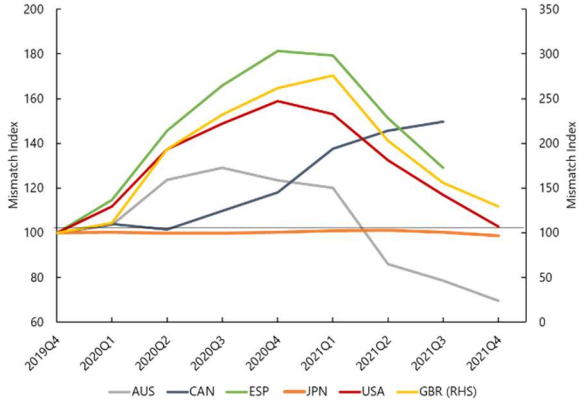
**Due to its temporary nature, the rise in sectoral mismatch generally accounts for a small fraction of the remaining employment shortfall at this point in the labor market recovery, consistent with a less transformative labor market impact of COVID-19 than envisaged earlier in the pandemic.** With the exception of Spain, in all countries mismatch accounted for no more than a fifth of the total employment rate contraction at its peak, and for a smaller fraction of remaining employment shortfalls vis-à-vis pre-crisis levels by late 2021—about 10 percent in the United Kingdom and the United States, and even less in the median country (Figure 4, panel 2). Overall, although most countries saw a rise in mismatch in the past two years, little evidence has surfaced of a persistent increase driven by major structural transformation. In fact, the estimated rise in mismatch has been smaller during the COVID-19 crisis than during the GFC. The GFC triggered a long-lasting contraction in, and job reallocation away from, industries such as construction and manufacturing. By contrast, during the pandemic, hard-hit industries recovered sharply from their initial drop, recruiting many of the workers who had lost their jobs in those same industries during the spring of 2020. Further, the use of job retention schemes on an unprecedented scale contained the total number of displaced workers who had to search for new jobs, thus limiting the scope for mismatch to affect a large fraction of the labor force.

## III.2 Barriers to Returning to Work

Figure 4: Mismatch and Employment Loss

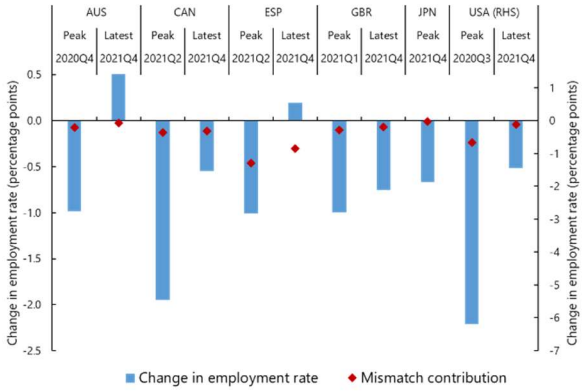
1. Mismatch Index

*(Fraction of hires foregone due to mismatch, index 2019Q4 = 100)*




2. Employment Rate Shortfall Due to Mismatch

*(Vis-à-vis 2019Q4 level, percentage points)*




Sources: Australian Bureau of Statistics (AUS); Statistics Canada, Indeed (CAN); Encuesta de Población Activa, Instituto Nacional de Estadística (ESP); Labour Force Survey, Office of National Statistics (GBR); Current Population Survey, Job Openings and Labor Turnover Survey (USA); and IMF staff calculations.

Note: Panel 1 plots (the 4-quarter moving average of) the labor mismatch index, calculated following Şahin and others (2014), which reports the fraction of new hires foregone because of mismatch between vacancies and unemployed workers across industries (occupations for Canada and Japan). Panel 2 reports for each country the employment rate decline (bar) and the associated contribution of mismatch (red dot) for two periods: the "peak" quarter, in which the contribution of rising mismatch to falling employment was largest during the COVID crisis, and the latest available period. Only one bar and dot are reported when the two periods coincide. The employment rate is computed as the ratio of employment to the sum of employment, unemployment, and inactivity.

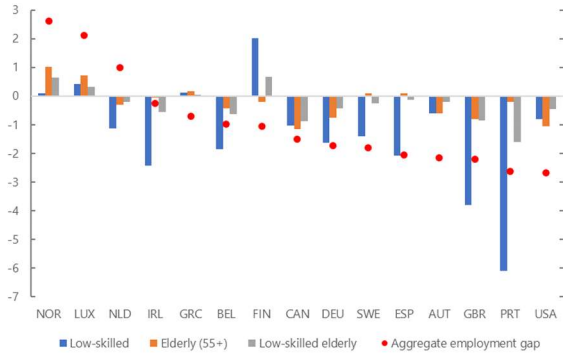
### *Barriers to returning to the labor force*

**Several demographic groups, particularly low-skilled workers, were hit harder at the onset of the pandemic and are still lagging behind for the recovery.** Low-skilled workers were hit particularly hard at the onset of the COVID-19 pandemic (Figure 5, panel 2), amplified in some countries by their over-representation in the most-affected contact-intensive sectors (right-hand set of bars in Figure 5, panel 2). Although their employment rates have risen steadily since then, they remain below pre-COVID-19 levels, despite the fact that

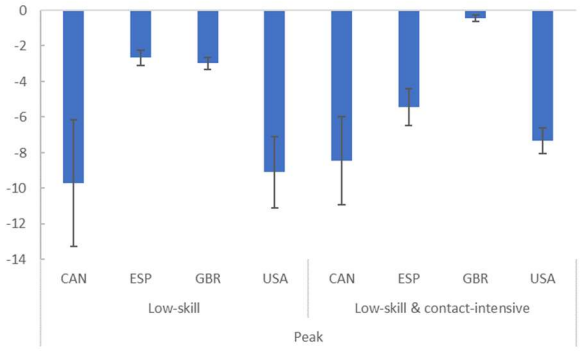
there is no longer any additional employment stigma from being previously employed in contact-intensive sectors, partly because these have been recovering (Figure 5, panel 3). Looking through cross-country

Figure 5: Employment Declines and Recoveries among the Low-Skilled, Older Workers and Mothers

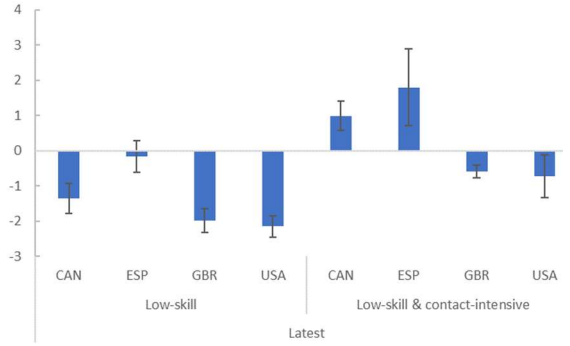
1. Low-Skilled and Seniors: Employment
*(Deviation from pre-COVID-19 trend as percent of total working-age population)*



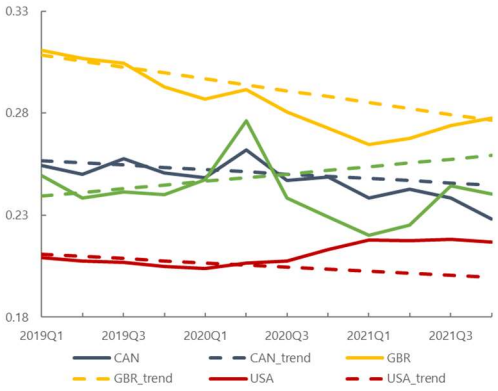

2. Low-Skilled: Employment Likelihood at the Peak of the Crisis
*(Percentage point deviation from pre-COVID-19 period)*




3. Low-skilled: Employment Likelihood by Late 2021
*(Percentage point deviation from pre-COVID-19 period)*




4. Mothers with Young Children: Inactivity Rate
*(Share of mothers with young children)*




Sources: Current Population Survey, Job Openings and Labor Turnover Survey (USA); Encuesta de Población Activa; Instituto Nacional de Estadística (ESP); Eurostat (EUR); Indeed (CAN); International Labour Organization (CAN, USA); Labour Force Survey, Office of National Statistics (GBR); Organisation for Economic Co-operation and Development (CAN, GBR, USA); Statistics Canada, and IMF staff calculations.
Note: Panel 1 shows the employment gaps of the low-skilled, seniors, and low-skilled seniors vis-à-vis their pre-COVID-19 (2015–19) trends, in percent of the total working-age population. The low-skilled employment gap (blue bars) exceeds the aggregate employment gap (red dots) in some countries because employment among other groups, such as youth, has more than fully recovered. Values shown are for 2021Q4 for CAN, ESP, GBR, and USA and 2021Q3 for the other countries. Panels 2 and 3 show the estimated employment probability of the low-skilled, in percentage point change relative to the pre-COVID period, for the peak of the crisis (latest available period), based on regression analysis on individual microeconomic data with 95 percent confidence intervals shown as whiskers. Low-skilled are defined here as those with less than a four-year college degree. "Low-skilled & contact-intensive" is the marginal employment probability difference for the low-skilled working in contact-intensive sectors. Peak quarters are 2020Q2 for CAN, ESP, USA and 2020Q3 for GBR. Latest available quarter is 2021Q4. Inactivity rate of mothers with young children in Panel 4 is defined as the share of mothers with young children aged 5 or younger who are not in labor force (inactive), while trends are estimated over 2015–19.

heterogeneity, in the median country, low-skilled workers accounted for more than two-thirds of the aggregate employment gap vis-à-vis its pre-COVID-19 trend by late 2021, of which almost one-fourth reflect under-employment of older low-skilled workers (Figure 5, panel 1).[4]

**The COVID-19 pandemic also durably pushed older workers into inactivity in a number of countries, with available evidence suggesting that health concerns played a bigger role than any wealth gains (Figure 5, Panel 1).** Labor force withdrawal has disproportionately affected low-skilled workers and renters, who are also less likely than high-skilled homeowners to hold retirement savings plans—and therefore to have benefited from booming financial markets until late 2021, particularly in countries with sizeable defined-contribution pension schemes. Overall, older workers' labor force withdrawal accounted for one-third of the overall employment gap vis-à-vis pre-COVID levels in the United Kingdom and the United States by late 2021 (Pizzinelli and Shibata 2022). This pattern also held true for the median advanced economy, albeit with wide cross-country heterogeneity.[5] Insofar as some of the rising inactivity among the elderly reflected early retirement, it could be largely irreversible and remain a drag on the labor market recovery for a while.

**While mothers with young children struggled at the onset of the COVID-19 in many countries, their under-employment remains an issue mainly in the United States.** School and daycare closures may have pushed many mothers with young children out of the labor force at the onset of the COVID-19 recession (such as in Canada, Spain, and the United States), a so-called "She-cession" (Alon and others 2021, Bluedorn and others 2021, Fabrizio and others 2021) (Figure 5, panel 4). By the fall of 2021, their inactivity rate remained above the pre-COVID trend only in the United States—accounting for some 15 percent of the overall US employment gap vis-à-vis pre-COVID levels—while the "she-cession" had dissipated in other countries (Bluedorn and others 2021). However, a resurgence in COVID-19 cases, such as that seen in late 2021 due to the Omicron variant, could push mothers with young children out of the labor force again.

**The sharp reduction in immigration seems to have amplified low-pay job shortages in some cases.** Unfilled vacancies have increased more in those low-pay sectors where the share of foreign workers has fallen more (Box 2). In the United Kingdom, for example, the pandemic may have accelerated a process already set in motion by "Brexit," speeding up the decline in the employment of foreigners and contributing to pockets of labor shortages in low-skilled professions, such as construction laborers, truck drivers, and workers in the hospitality and care sectors, as the economy recovered but immigrants did not fully return. In the United States, labor supply growth has been slightly reduced by lower immigration inflows—a trend that pre-dates, but was exacerbated by, the COVID-19 crisis. In Canada, after the pandemic forced immigration operations to shut down in 2020, the number of admitted immigrants fell well below the authorities' target—although this decline was followed by a very sharp rebound in 2021 to an immigration pace (of about 1 percent of the population) that is expected to last in the coming years and should help "grease the wheels" of the labor market.

## III.3 Shifting Worker Preferences

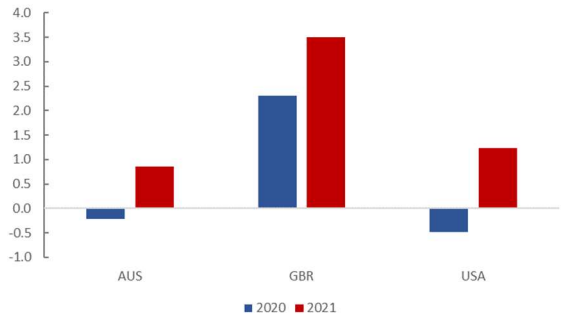
**COVID-19 may have changed workers' job preferences.** The crisis hit particularly hard contact-intensive jobs, such as in hotels, restaurants, and entertainment (Dingel and Nieman 2020, Kaplan and others 2020). While these sectors have been recovering, health concerns may be discouraging workers from keeping such jobs and job seekers from taking them up, leaving many vacancies unfilled. For vast categories of jobs, the

[4] The size of the contribution of the low-skilled to the aggregate employment gap was disproportionately higher than the 2019 average employment share of the low-skilled workers, which was 56 percent in a median country. Moreover, the contribution of low-skilled workers to the total aggregate (net) employment gap could be above 100 percent for some countries as some other demographic groups, such as young workers in some countries have fully recovered above the pre-COVID19 trend.
[5] Note that older workers include both high-skilled and low-skilled workers. Therefore, their contribution to the overall employment rate gap partly overlaps with that of low-skilled workers documented in the previous paragraph.

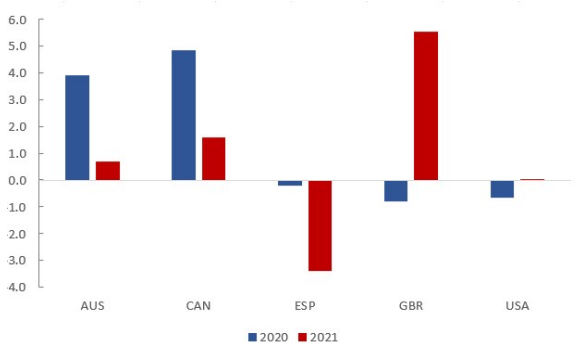
crisis also expanded telework opportunities and made work schedules more flexible, offering the prospect of improved work-life balance; this may have led workers to prioritize such jobs and discard others (Barrero, Bloom, and Davis 2021). To shed light on this issue, this section exploits recent data on job switches and separations (quits) and how they differ across industries and occupations depending on characteristics such as contact intensity. Further, Google trend series on internet search frequency of key words related to job characteristics are used to detect changing job search patterns.

Figure 6: Rising Transitions away from Contacting-Intensive Jobs

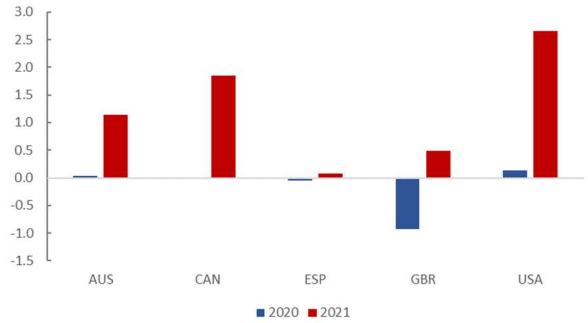
1. Share of Transitions from Contact-Intensive Jobs to Other Jobs
*(Percentage point deviation from 2015–19 average)*




2. Share of Transitions from Contact-Intensive Jobs to Outside of the Labor Force
*(Percentage point deviation from 2015–19 average)*




3. Vacancy-to-Employment Ratios in Contact-Intensive Sectors
*(Percentage point change relative to 2015–19 average)*




Sources: Australian Bureau of Statistics (AUS); Current Population Survey, Job Openings and Labor Turnover Survey (USA); Encuesta de Población Activa, Instituto Nacional de Estadística (ESP); Eurostat (NDL); Labour Force Survey, Office of National Statistics (GBR); LISS Panel, Statistics Canada, Indeed (CAN); and IMF staff calculations.
Note: Panel 1 plots percentage point deviations from the 2015–19 average, in the share of industry switchers who left contact-intensive industries via an on-the-job transition. Panel 2 plots percentage point deviations from the 2015–19 average in the share of those who separated from contact-intensive jobs into out-of-labor-force status. Panel 3 plots vacancy to employment ratios in contact-intensive sectors in 2020 and 2021 relative to 2015–19 average value. Note 2021 value is shown for Canada because of missing vacancy data for 2021Q2 and 2021Q3.

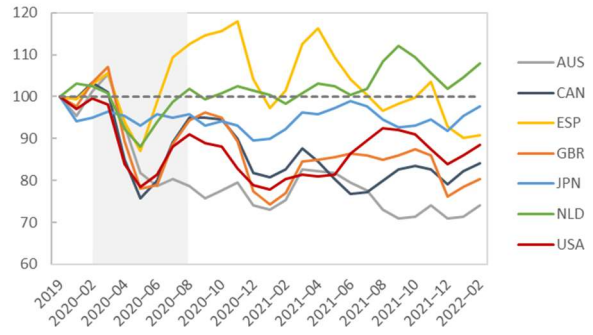
**A growing share of workers with contact-intensive jobs have been moving into other jobs or left the labor force altogether, despite the concomitant rise in contact-intensive job vacancies.** The share of industry switches that are accounted for by workers who previously held contact-intensive jobs has increased significantly in 2021 compared to the 2015–19 period (Figure 6, panel 1), even though contact-industries had largely recovered, as reflected in buoyant vacancies (Figure 6, panel 3). Likewise, the fraction of workers who separated from contact-intensive sectors to leave the labor force was significantly above its 2015–19 average during 2020—as would be expected from the magnitude of the initial COVID-19 shock—but, more surprisingly, given these industries' strong labor demand recovery, it also remained high in most countries during 2021 (Figure 6, panel 2). Taken together, these facts are consistent with workers being less willing to work in

contact-intensive sectors today than was the case prior to the pandemic. So is the rise in voluntary quits in the United Kingdom and the United States—the so-called "Great Resignation"—discussed in Box 3.

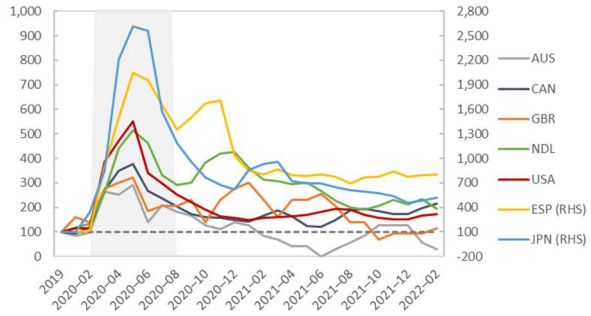
**Online job search data also point to growing interest in teleworkable jobs among job searchers.** Based on the number of google searches for "jobs," search intensity has declined relative to pre-COVID19 (January 2020) levels in most countries (Figure 7, panel 1). Yet search intensity for "telework" and "remote" has increased, remaining high in most cases even after its spring 2020 spike (Figure 7, panel 2). Taken together, these online job search patterns tentatively point to a preference shift toward teleworkable jobs.[6]

Figure 7: (Google) Search Intensity for Job and Telework

1. Aggregate Job Search Intensity
*(Google search, index = 100 in 2019 average)*




2. Teleworkable Job Search Intensity
*(Google search, index = 100 in 2019 average)*




Sources: Google search trends; and IMF staff calculations.
Note: Panel 1 plots job search intensity measured as the number of Google searches for the word "job" normalized to 100 for the 2019 average. Panel 2 plots job search intensity measured as the number of Google searches for the word "telework" (translated in local language where relevant) normalized to 100 for the 2019 average.

# IV. Labor Market Tightness and Wage Growth

## IV.1 Wage Developments

**Nominal wage growth is starting to pick up in many advanced economies.** In Japan, the United Kingdom, and the United States nominal wages are already growing faster than before the pandemic although, with the exception of Japan, these wage gains have so far been largely or fully eroded by the concomitant increase in price inflation (Figure 8, Panel 1). Micro-data evidence from the United Kingdom, and the United States offer further evidence of building wage pressures. In particular, new hires have been enjoying faster wage gains than incumbent workers lately (Figure 8, panels 2 and 3). Further, in the United States—where data allow for more granular analysis of wage patterns among new hires—this gap is being driven by workers hired from non-employment, rather than by on-the-job switchers. This points to stronger bargaining power of entrant workers in tight labor markets.

## IV.2 Labor Market Tightness and Wage Growth

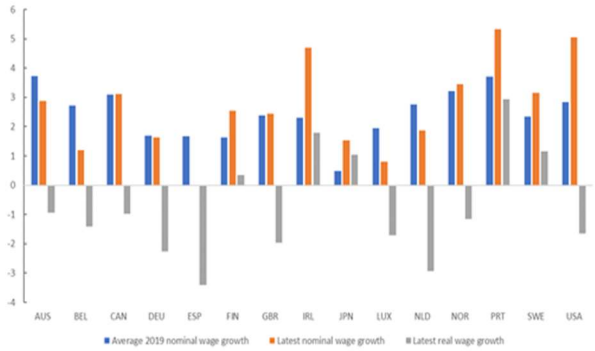
**Understanding the link between wage growth and tightness requires factoring in the wide heterogeneity in labor market developments across industries and groups of workers since the start of**

[6] Annex 2.3.2 explores Google search trends for "remote" and "part-time," also showing an increase since the onset of the pandemic.

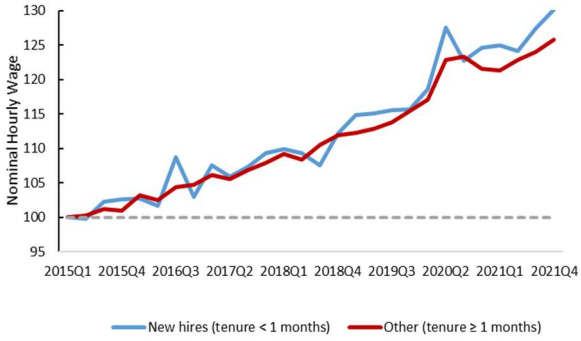
**the pandemic.** This link is often captured by so-called wage Phillips curves, which typically estimate the impact of low unemployment—and other factors, including inflation expectations—on wage growth. However, an aggregate wage Phillips curve fails to capture the sizeable existing heterogeneity across industries and groups of workers, in terms of both tightness dynamics and the responsiveness of wage growth to tightness. Such heterogeneity may be particularly relevant at the current juncture given prevailing asymmetries in the initial impact of, and subsequent recovery from, the COVID-19 shock, with potential implications for both wage inequality and overall wage inflation pressures.

Figure 8: Wage Growth Developments

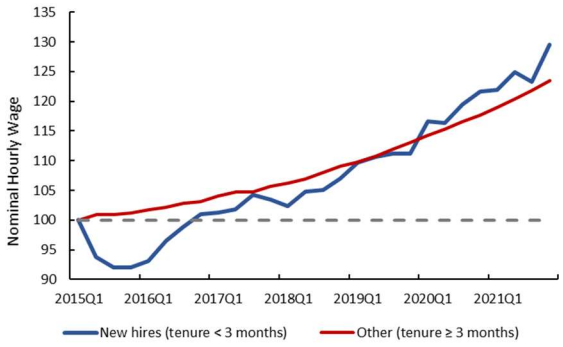
1. Nominal and Real Wage Growth
*(Annual growth rates, percent)*




2. Nominal Wages for New Hires vs. Incumbent Workers: United States
*(Index = 100 in 2015Q1)*




3. Nominal Wages for New Hires vs. Incumbent Workers: United Kingdom
*(Index = 100 in 2015Q1)*




Sources: Current Population Survey (USA); Labour Force Survey, Office of National Statistics (GBR); Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Panel 1 plots the annual growth rate of average nominal and real hourly earnings in the manufacturing sector. The series are constructed based on the OECD's Hourly Earnings (MEI) and CPI data sets. Latest available quarter is 2021Q2 for Australia, 2021Q4 for the United States, the United Kingdom, Japan, Norway, Portugal and The Netherlands, and 2021Q3 for other countries. Panel 2 reports the seasonally adjusted 3-month moving average of average nominal hourly wages for new hires (blue line) and job stayers (red line) in the United States. New hires are workers who transitioned to employment either from employment (on-the-job switchers) or from non-employment. Job stayers are those who did not change jobs between two consecutive months. Panel 3 reports the 4-quarter moving average of average nominal hourly wages for new hires (blue line) and job stayers (red line)—defined as those who did not change jobs between two consecutive quarters—in the United Kingdom.

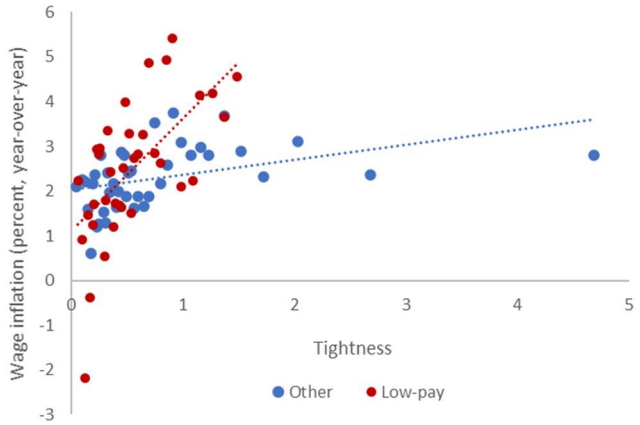
**Against this background, this section estimates empirically relationships between wage growth and tightness at the sector level for both the United Kingdom and the United States, also distinguishing between low- and high-pay sectors.** Specifically, for each country separately, quarterly wage growth at the industry level is regressed on labor market tightness—measured as the ratio of vacancies to unemployment—and various controls, including sector fixed effects, economy-wide inflation expectations and past wage growth and labor productivity growth (see Annex 3 for details). This specification is then extended to assess whether tightness has different effects on wage growth in low-pay versus other sectors.[7]

[7] Tightness is computed using (pseudo) unemployment at the industry level, using information on unemployed workers' previous industry. Annex 3 describes the empirical framework and results in detail.

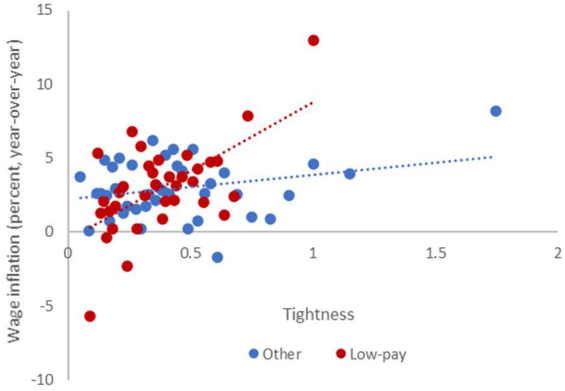
**Labor market tightness raises wage growth across the board, but more than twice as much in low-pay sectors than in others. In both the United Kingdom and the United States, the simple correlation between tightness and wage growth is strong, and stronger in low-pay sectors than in others (Figure 9, panels 1 and 2).** In-depth regression analysis confirms both facts. The estimates imply that a given rise in tightness has over twice as large an impact on wage growth in low-pay sectors than in the average industry in the United States, with an even larger difference in the United Kingdom. While the analysis could not be performed for other advanced economies for lack of granular data, it is possible that this gap in responsiveness between low-pay and other industries might be smaller in many continental European economies, reflecting binding and stickier statutory and collectively bargained minimum wages.

Figure 9: Labor Market Tightness and Wage Inflation: Low-Pay Versus Other Industries

1. Wage Growth and Tightness across Sectors: United States




2. Wage Growth and Tightness across Sectors: United Kingdom




Sources: Current Population Survey, Job Openings and Labor Turnover Survey (USA); Labour Force Survey, Office of National Statistics (GBR); and IMF staff calculations.
Note: Panel 1 plots the binned scatterplot between quarterly (year-over-year) nominal hourly wage inflation and tightness lagged one quarter between 2003Q1 and 2020Q1 for the United States. Each dot represents the mean of the *x*-axis and *y*-axis variables within each of the 40 equal-sized bins of the *x*-axis variable. The red dots report wage growth-tightness combinations for low-pay industries (accommodation and food services, retail trade, arts and entertainment) while the blue dots refer to the remaining industries. Panel 2 plots the binned scatterplot between quarterly (year-over-year) nominal hourly wage inflation and tightness lagged one quarter between 2001Q4 and 2020Q1 for the United Kingdom. The red dots report wage growth-tightness combinations for low-pay industries (accommodation and food services, wholesale, retail, repair of vehicles, arts, entertainment and recreation, administrative and support services).

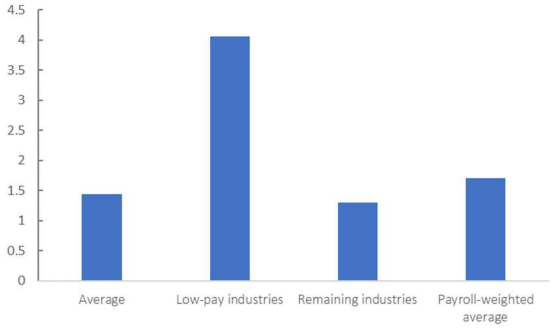
**Rising tightness since the summer of 2020 has fueled low-pay wage growth and contributed to the pick-up in aggregate wage growth in the United Kingdom and the United States.** Based on the aforementioned model estimates, a back-of-the-envelope calculation indicates that the sharp observed increase in tightness between 2020Q2 and 2021Q4 increased overall wage inflation by at least 1.5 percentage points in the United States (Figure 10, panel 1) and the United Kingdom—implying a material contribution of tightness to wage growth (in the United States mean hourly wage inflation was 3.5 percent year-over-year in 2021Q4, up from 2 percent on average prior to the pandemic, while in the United Kingdom it was 4 percent year-over-year in 2021Q4, up from 2.3 percent).[8] In the United States, higher tightness is also estimated to have increased wage growth among low-pay industries by at least 4 percentage points since 2020Q2, a finding that is consistent with the steeper recovery of hourly wage growth for individuals at the lower end of the wage

[8] These estimates should be seen as providing a lower bound because they do not factor in non-linearities, of which there is evidence in the data—further analysis (not reported here) finds statistically significant evidence that the impact of tightness on wage growth rises with the degree of tightness. Also, these estimates do not attempt to include indirect, second-round effects through the "wage-price spiral"—the impact of tightness-induced wage growth on price inflation and inflation expectations, which in turn can feed into higher wage claims by workers, and thereby higher wage growth.

distribution (Figure 10, panel 2). Likewise, the direct impact of tightness on wage growth was larger for low-pay industries in the United Kingdom—contributing at least 6 percentage points to higher low-pay-industry wage growth versus 1.3 percentage points for other industries.

Figure 10: Impact of Tightness on Wage Growth during COVID in the United States

1. Estimated Direct Contribution of Increased Tightness to Higher Wage Inflation during COVID-19
*(Over 2020Q2–2021Q4, percentage points)*




2. Wage Growth by Average Wage Quartile
*(12-month moving average, percent)*


Sources: Current Population Survey, Job Openings and Labor Turnover Survey, Bureau of Labor Statistics, Federal Reserve Bank of Atlanta (USA); and IMF staff calculations.
Note: In Panel 1, the bars report the estimated percentage point change in nominal hourly (year-over-year) wage inflation between 2020 Q2 and 2021Q4 for different industry groups due to the increase in tightness observed over the same period. The first bar is calculated from a regression specification that does not allow for different slope coefficients between low-pay and other industries. All other bars are calculated from a regression specification that allows for interaction effects between tightness and industry groups. The last bar reports the payroll-weighted impact and is derived as the weighted average of the direct impact of tightness on wage growth for low-pay and other industries, respectively, using income shares as weights. Panel 2 plots 12-month moving averages of monthly hourly wage growth from the Wage Growth Tracker of the Federal Reserve Bank of Atlanta for two categories of workers—the median worker of the average wage distribution (green line) and median worker of the lowest 25th percentile of the average wage distribution (blue line), where average wage distribution is computed based on the average of hourly wages in months *t* and *t* – 12.

**Nonetheless, the overall impact on economy-wide wage pressures of rising tightness among low-pay industries has been dampened by the small overall share of such industries—and low-pay jobs more broadly—in total labor costs.** When factoring in the larger increase in tightness, and the greater responsiveness of wage growth to a given rise in tightness among low-pay industries, the contribution of rising tightness to higher aggregate wage growth rises by just a few tenths of a percentage point, compared to an empirical framework that does not incorporate such cross-industry heterogeneity—as shown by the comparison of the "payroll-weighted average" and "average" bars in panel 1 of Figure 9.

**Current tightness should keep wage growth elevated for a while, particularly at the lower end of the wage distribution.** Barring a strong economic growth setback, ongoing labor market tightness is likely to persist and keep wage growth high in a number of advanced economies, such as the United Kingdom or the United States.[9] The empirical analysis above also suggests that low-wage jobs should keep enjoying above-average wage growth for some time in these countries, helping reduce wage inequality. The impact of faster wage growth at the bottom of the pay scale on price inflation could be significant in some low-skilled-labor-intensive industries although, as the empirical analysis above shows, this dynamics should on its own weigh

[9] The link between wage growth and tightness may differ across countries due to heterogeneity in labor market institutions. For example, it could be weaker in countries where wages are set through collective bargaining agreements, particularly when these involve multiyear contracts that tend to insulate wages from current labor market conditions. One such example is Australia, for which similar empirical analysis points to flatter sectoral wage Phillips curves than in the United Kingdom and the United States.

only to a limited extent on overall labor costs, and thereby on economy-wide price inflation. Comparatively more important for inflation dynamics going forward will be the extent to which recent inflation feeds into wage growth, and the extent to which higher wages are then passed onto prices. With price inflation largely or (more than) fully outpacing wage increases so far, including in those advanced economies where labor markets are tightest, this a material risk.

# V. Policy Implications

**Tighter labor markets should continue benefiting low-paid workers and reducing wage inequality, with a manageable direct impact on inflation.** In those advanced economies wherein unfilled vacancies are plentiful and wage growth has picked up among low-skilled workers, further wage increases will help attract others back into the labor force. Such pressures should have a manageable impact on overall wage and price inflation, even in the United Kingdom and the United States, where wages have accelerated the most in the past year; demands for compensation for recent price hikes and/or sustained higher inflation expectations among workers would have a comparatively larger impact as they might trigger wage-price spirals. Nonetheless, there is high uncertainty around how this process will unfold, and wage growth and inflation could turn out higher than expected. Against this background, central banks should continue to signal their strong determination to alleviate second-round effects from recent high inflation.

**However, active labor market policies can amplify the role of market forces, including to bring more people back into the labor force, fill out available vacancies and help workers get the kind of jobs they are looking for.** Those population groups most detached from the labor force may be less sensitive to market conditions, and long non-participation spells would damage their future employment prospects and earnings. Further, they may lack the skills to fill out existing vacancies for either fast-growing digital-intensive occupations (technology and e-commerce, for example) or more traditional jobs—sometimes even rather low-skilled ones—that have experienced more acute shortages (truck drivers or care economy workers, for example). Active labor market policies can help detached (and employed) lower-skilled workers build the skills required to get such jobs. These include short-term training programs, financed or subsidized by public employment agencies, targeted at professions that concentrate shortages and for which the required skills can be realistically acquired over a short timeframe. Returns from such policies may also be larger if targeting low-skilled youth.

**Labor laws and regulations also need to adapt to changing worker preferences by facilitating telework or remote work access.** These new laws and regulations should aim to make telework attractive to both workers and employers. This requires striking the right balance between their sometimes conflicting objectives, such as regarding working hours flexibility, the definition of office hours and the cost of resources used to work from home. Whenever the nature of the job allows, enhancing telework access should particularly support lower-skilled workers who favor working from home due to preferences or health reasons, thereby enhancing their labor force participation. Indeed, while low-skilled workers have been enjoying above-average wage growth in some advanced economies, they have benefitted less than others from the novel flexibility brought about by the pandemic—a potentially significant non-wage benefit.

**To bring other disadvantaged workers into the labor force—notably older workers and women with young children, fighting the pandemic remains paramount.** Vaccines, tests, and treatments remain essential to curb individual (and societal) risks from the virus. This, in turn, will enable seniors and lower-skilled workers in contact-intensive industries, who dropped out more than other groups during the pandemic, to join back the labor force. Likewise, supporting schools and daycare to stay open can help mothers of young children take up jobs—particularly in the United States where this has been an issue and female labor force

participation remains below pre-pandemic levels, unlike in most of Europe, for example. There is also a case for making these options affordable through greater public childcare spending and subsidies, and for paid family leave to help caregivers combine and work and family priorities—in general, but even more so importantly while the pandemic remains disruptive. These immediate actions could be envisaged as part of a broader, longer-term policy package to reduce gender-based tax and regulatory barriers to female labor force participation, which had already declined in the United States in the decade following the 2008–09 global financial crisis.

**A resumption of immigration could also slightly ease labor shortages in some cases.** This will vary across countries depending on the extent of the decline in immigration before and during the pandemic, the adequacy between unfilled jobs and potential immigrants' profiles, and the nature of the immigration system. For example, countries with predominantly employment- and skill-based immigration systems may wish to tailor their entry criteria more specifically to existing labor shortages. For those immigrants who stayed in their host country, but became non- or under-employed during the pandemic, access to the types of training programs mentioned above can facilitate return to work—over and above the pulling effect from improving health conditions and sustained market wage growth.

**In the more distant future, mainstreaming the use of job retention schemes could help keep disadvantaged workers attached to the labor force after major temporary shocks, thereby alleviating wide swings in labor market tightness.** Job retention schemes dampened initial job losses, labor force withdrawals and subsequent increases in tightness in most European economies. Together with their beneficial role—on a smaller scale—during the 2008–09 global financial crisis, this suggests that such schemes can be used to mitigate the labor market scars from future transitory shocks. It is important, however, that job retention support be temporary so as not to impede the eventual reallocation of workers after shocks that eventually prove to be more persistent—a relevant consideration at the current juncture, two years into the pandemic, as countries need to transition away from such schemes and instead facilitate workers' transitions away from struggling firms and industries toward expanding ones.

## Box 1: A Closer Look at Vacancies in Low-Wage Jobs[1]

While the low-skilled remain less likely to be employed than they were prior to the crisis in many advanced economies, job vacancies in low-wage occupations have sharply recovered in several countries and were well above their pre-pandemic levels by end-2021.[2] Connected to this, hiring difficulties have been widely reported in recent months for specific professions, such as construction workers, warehouse workers, truck drivers, or retail salespersons (for example, US Federal Reserve System 2021). Such labor shortages may reflect a strong demand amid persistent reluctance of workers to keep or take up such jobs at prevailing wage levels because of the contact intensity, lack of teleworkability, inflexibility in workings hours, and/or physical hardship involved. The purpose of this box is to document labor market tensions for these and other professions in the context of the broader rise of labor market tightness.

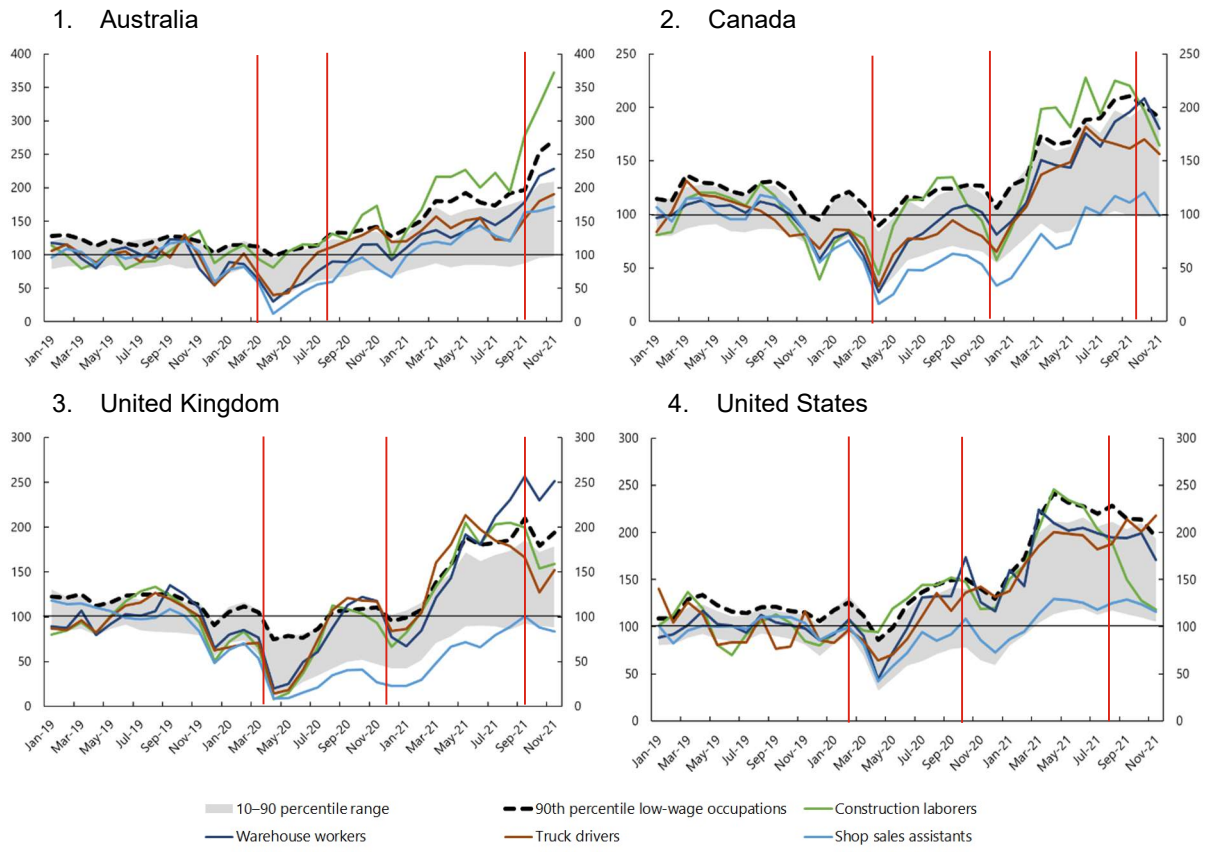
Vacancies data for detailed professions provided by Indeed, a large-scale job posting website, are used for Australia, Canada, the United Kingdom, and the United States. The Indeed database contains individual job postings, starting in January 2019, reporting the title of the advertised position and the day in which it was first posted. Between January 2019 and November 2021, the data set contains several millions of job posts in each country (approximately 100 million for the United States, for example). Using a series of advanced matching algorithms applied to the job titles, the postings are categorized according to the 4-digit level of the 2008 International Standard Classification of Occupations (ISCO-08). For each occupation, the average number of new job posts in the first four weeks of each month can then be computed.[3]

In Figure 1.1, the grey areas report the 10$^{th}$–90$^{th}$ percentile range of the distribution of vacancies by occupation. In the four countries, vacancies for almost all occupations fell sharply during the first wave of COVID-19 but began a steep recovering starting from mid-2020. This recovery was broad-based, with even the lower percentiles of the distribution eventually returning to pre-pandemic levels by 2021. Moreover, the various waves of the pandemic were associated with increasingly muted inflections in vacancies, as firms and workers learned how to cope with the virus and restrictions.

Figure 1.1. also confirms the growing labor shortages for specific, mostly low-paying professions, as well as falling opportunities for jobs that were durably hit by the pandemic. The dashed black line reports the 90$^{th}$ percentile of the distribution for vacancies in low-wage occupations only. In all countries, this line lies above the grey areas in late 2021, indicating that a larger fraction of low-wage occupations has experienced a steep rise in vacancies in the post-COVID recovery compared to medium- and high-paying ones. This can be seen, for example, from the individual series for construction laborers, warehouse workers, and truck drivers, which are plotted separately against the rest of the distribution. In all countries, the first three occupations have experienced bouts of exceptional tensions, being often in the top 10 percent of occupations whose vacancies have risen the most vis-à-vis pre-pandemic levels. By contrast, vacancies for shop sales assistants are consistently in the bottom quarter of the distribution, indicating a sharp drop in vacancies compared to other occupations, in Canada, the United Kingdom, and the United States. Since the absolute value is still close to or above the 2019 average, this need not imply a permanent shrinking of the labor force employed in the shop sales sector, but rather a change in the nature of these jobs—reflecting lower consumer demand for in-person shopping and perhaps growing appetite for e-commerce.

## Figure 1.1: Vacancies in Selected Low-Wage Occupations

*(Average 2019 = 100)*




Sources: Indeed; and IMF staff calculations.
Note: The figure plots the distribution of vacancies at the 4-digit ISCO-08 occupation level, normalized to their average 2019 values. The grey area reports the 10th–90th range of the distribution of all occupations. The dashed black line reports the 90th percentile of the distribution for low-wage occupations, defined as the occupations with the lowest hourly wages (comprising one-third of total employment in 2019 in the United Kingdom). The individual lines report the series for shop sales assistants, construction laborers, warehouse workers, and truck drivers. The red vertical lines report months in which the COVID-19 pandemic approximately reached a peak in new daily deaths.

[1] Prepared by Carlo Pizzinelli and Alessandra Sozzi.

[2] For detailed analysis on the United States and the United Kingdom prepared for this note, see Pizzinelli and Shibata (2022).

[3] Annex 2 describes in detail the matching methodology, the construction of the monthly series, and the definition of low-wage occupations.

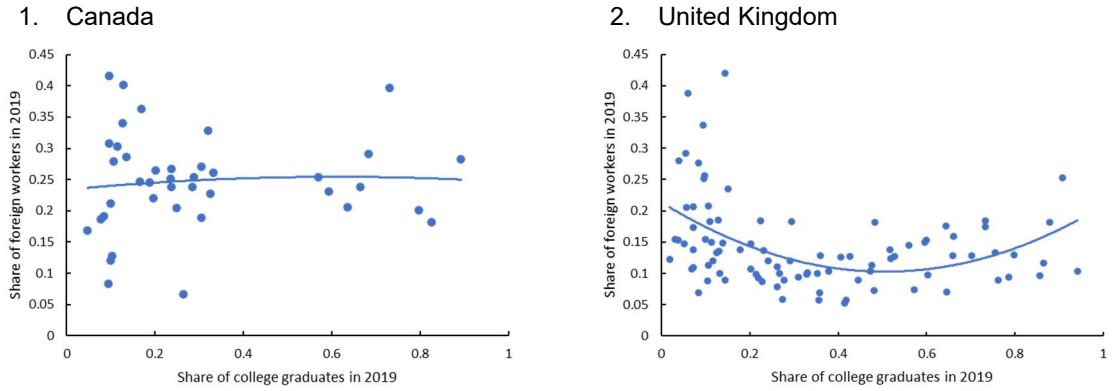
## Box 2: Receding Immigration and Rising Vacancies in Canada and the United Kingdom[1]

During the pandemic, governments imposed travel restrictions and applied changes to their immigration policies that limited workers' mobility across national borders, while foreign workers faced new concerns that may have led them to relocate or return to their home countries. This Box provides evidence that, in the case of Canada and the United Kingdom, the resulting drop in immigration likely amplified the rise in labor market tightness among low-pay jobs.

Because foreign workers often specialize in specific types of jobs, a reduction of immigration should not affect the labor market homogenously but rather induce shortages in a narrow set of industries and occupations. In the United Kingdom, for example, foreign workers are concentrated in occupations with very high and very low shares of college workers (Figure 2.1, panel 2).[2] Instead, in Canada, the relationship between skills and immigration is flat, as several low-skill occupations (in construction, agriculture, natural resources) are predominantly covered by domestic workers.

In both countries, the fall in immigration during the pandemic affected predominantly low-skill occupations. Occupations with fewer university graduates (blue dots in Figure 2.2) saw falling shares of foreign workers between 2019 and 2021, while most occupations with more university-educated workers (red diamonds) saw rising shares of immigrants. Furthermore, Figure 2.2 shows a negative correlation across low-skill occupations between the change in the foreign worker share and the growth of unfilled vacancies vis-à-vis pre-pandemic levels, while this relationship is positive for high-skill jobs. This suggests that the reduction in immigration was one factor contributing to low-pay job shortages.

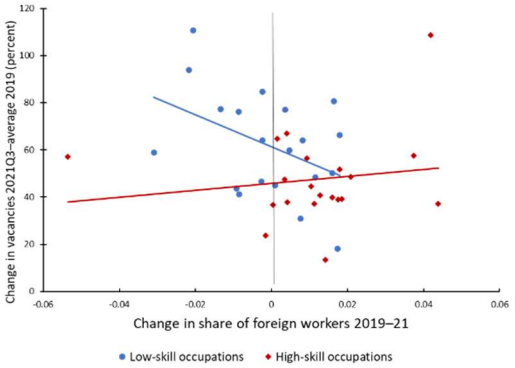
Figure 2.1: Share of Foreign and College Educated Workers by Occupation



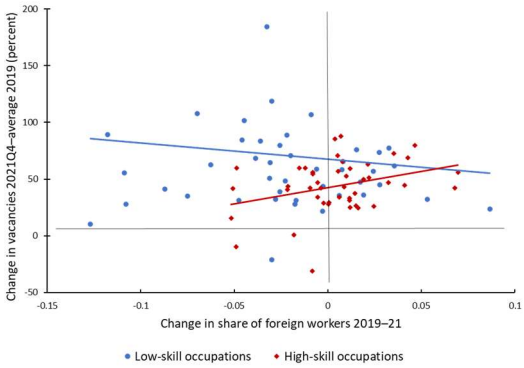

Sources: Labour Force Survey, Statistics Canada (CAN); Labour Force Survey, Office of National Statistics (GBR), and IMF staff calculations.
Note: Panels 1 and 2 plot the shares of college workers and foreign workers in each occupation in 2019 for Canada and the United Kingdom, respectively. The solid lines report a quadratic polynomial fit. For Canada, occupations are classified according to the 2-digit aggregation of the National Occupational Classification. For the United Kingdom, occupations are grouped at the 3-digit level of the 2010 Standard Occupation Classification.

Figure 2.2: Growth of Vacancies and Change in the Share of Foreign Workers by Occupation

1. Canada




2. United Kingdom




Sources: Indeed; Labour Force Survey, Statistics Canada (CAN); Labour Force Survey, Office of National Statistics (GBR); and IMF staff calculations.
Note: Panels 1 and 2 plot the change in the share of foreign workers against the percent growth in vacancies since 2019 college workers and the share of foreign workers in each occupation in 2019 for Canada and the United Kingdom, respectively, and divided by low-skill and high-skill occupations. The change in the foreign worker share of employment is computed on annual averages, using the first three quarters of 2021. The growth rate of vacancies is computed using the 2021Q3 against the average of 2019. The solid lines report a linear fit. For Canada, occupations are classified according to the 2-digit aggregation of the National Occupational Classification. For the United Kingdom, occupations are grouped at the 3-digit level of the 2010 Standard Occupation Classification. For each country, the occupations with the lowest share of university-educated workers in 2019 comprising 50 percent of employment are classified as low-skill.

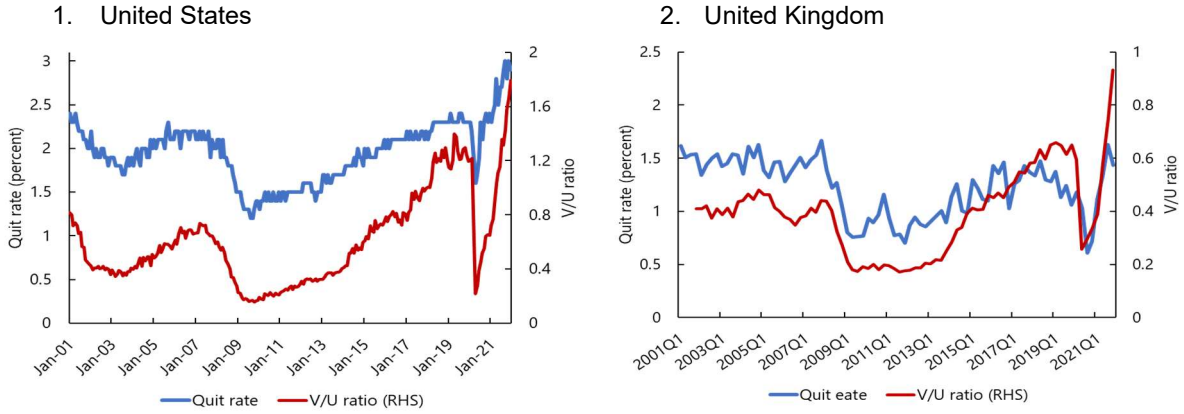
[1] Box prepared by Longji Li and Carlo Pizzinelli.
[2] Annex 5 provides details on the data sources, the occupational categories used, and the definition of low-skill occupations.

## Box 3: The Great Resignation[1]

Joint with the sharp increase in labor market tightness since the spring of 2021, both the United Kingdom and the United States have recorded historically high rates of job quits, defined as shares of workers who voluntarily leave their positions (Figure 3.1).[2] This phenomenon, sometimes labelled the "Great Resignation," could reflect many potential factors that have yet to be elucidated. One could be growing job dissatisfaction among workers, who then separate from jobs they feel do not offer satisfactory working conditions (including not just remuneration but also flexibility, safety, or a sense of purpose). While this explanation has received growing attention lately, another one could be that workers, rather than being dissatisfied, are simply taking advantage of a hot labor market to seize new opportunities. In this sense, high quit rates could reflect a well-functioning labor market where workers are able to progress along the job ladder.

Figure 3.1: Employment Quit Rate and Labor Market Tightness

*(Quit rate in percent and V/U ratio in level)*




Sources: Current Population Survey, Job Openings and Labor Turnover Survey (USA); Labour Force Survey, Office of National Statistics (GBR); and IMF staff calculations.

Note: The blue line reports the employment quit rate, computed as ratio of the number of workers who voluntarily quit their jobs in a given period, to move to either a new job or non-employment, to the employment level in the previous period. The ratio is computed at monthly frequency for the United States and quarterly for the United Kingdom. The red line reports the vacancies-to-unemployment ratio, for which higher values indicate greater labor market tightness.

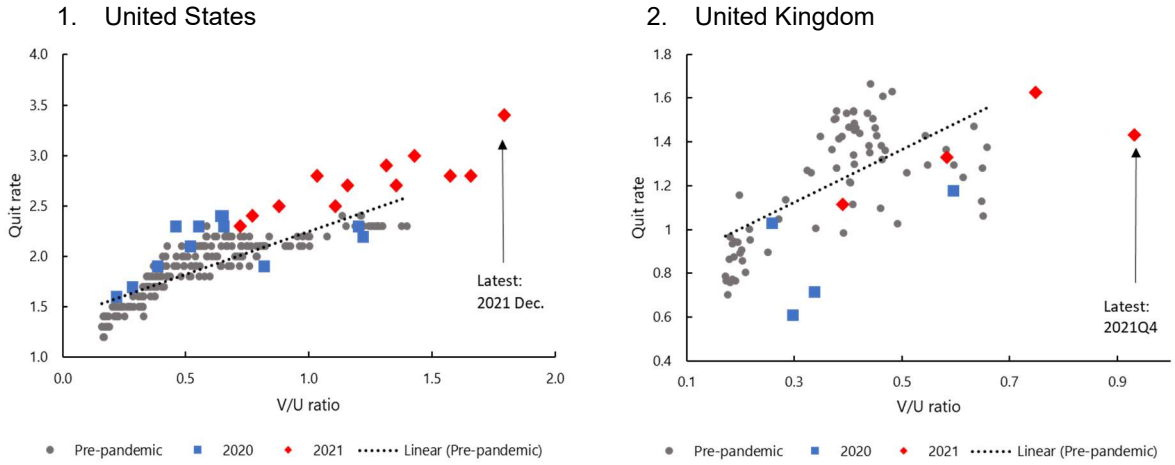
Under the latter explanation, quit rates are typically higher when the labor market is tighter, as workers more easily find better jobs and face lower risks of long non-employment spells. While this relationship between quits and overall labor market tightness has indeed held up well in the past, by late 2021 quit rates were well beyond what this historical relationship would suggest in the United States—albeit not in the United Kingdom (Figure 3.2). "Excess quits" tentatively suggest a strengthening of workers' bargaining powers in their search for better working conditions, and an increase in their reservation wages—the wage levels below which they would not consider taking up jobs, particularly those that do not meet their expectations, such as regarding telework or working hours flexibility, for example.

More detailed analysis of quits by type of industry further suggests that concerns regarding health and working conditions are driving some of the Great Resignation. In the United States, the five industries with the largest increases in quits relative to 2019 are (1) retail trade, (2) accommodation and food services, (3) nondurable goods manufacturing, (4) durable goods manufacturing, and (5) wholesale trade (Figure 3.3, panel 2). In the United Kingdom, the top five industries are (1) accommodation and food

services, (2) real estate, (3) transportation and storage, (4) wholesale and retail trade, and (5) construction (Figure 3.3, panel 2). In both countries, several of these sectors are contact-intensive and/or low-pay. Furthermore, quit rates have risen the least in industries that are less contact-intensive and/or high-pay, such as finance and insurance and educational services (United States), public administration services and defense (United Kingdom), and mining and quarrying (both countries).

### Figure 3.2: Historical Relationship between Tightness and Job Quits

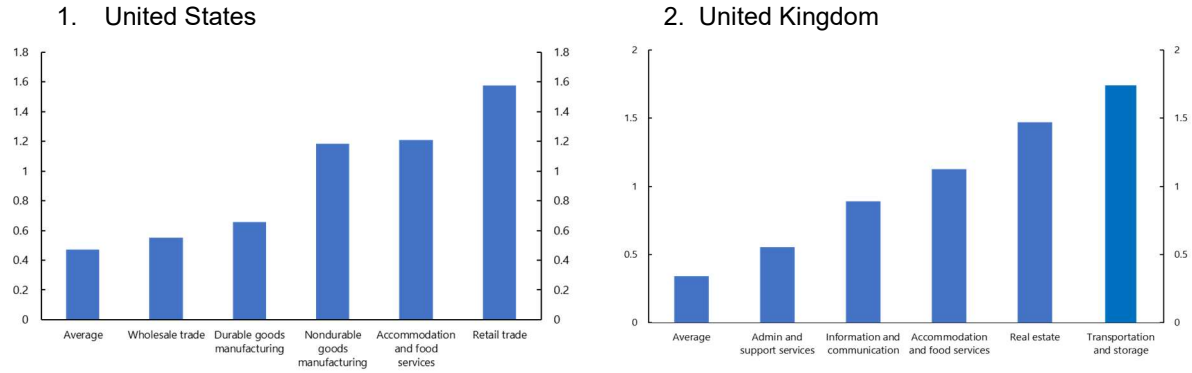
*(Quit rate in percent and V/U ratio in level)*




Sources: Current Population Survey, Job Openings and Labor Turnover Survey, (USA); Labour Force Survey, Office of National Statistics (GBR); and IMF staff calculations.
Note: In each panel, the *y*-axis reports the aggregate job quit rate while the *x*-axis shows the aggregate labor market tightness, measured by the vacancy to unemployment ratios. The series are plotted at a monthly frequency for the United States and quarterly for the United Kingdom. "Linear" trend shows the historical linear relationship between the two series for the pre-pandemic period.

### Figure 3.3: Top Five Industries with Biggest Rise in Job Quits during the Pandemic

*(Percentage point change relative to 2019 average)*




Sources: Job Openings and Labor Turnover Survey (USA); Labour Force Survey (GBR); and IMF staff calculations.
Note: The left panel reports the percentage point change in monthly job quits at the industry level between the 2019 average and the latest available period (December 2021) for the United States. The right panel reports the percentage point change in quarterly job quits at the industry level between the 2019 average and the period with the peak quit rate in 2021 (2021Q4) for the United Kingdom.

[1] Prepared by Carlo Pizzinelli and Ippei Shibata.
[2] Annex 6 provides details on the data sources used and the computation of the quit rates.

# Annex 1. Data Sources, Sample Coverage, and Variable Definitions

## 1. Descriptive Charts – Aggregate Data

Data sources used for the descriptive charts in Sections I and II are listed in Annex 1 Table 1.1. These charts cover 17 advanced economies. The latest observation is 2021Q3 for most of the countries considered in these two sections.

**Annex 1 Table 1.1. Data Sources for Stylized Facts**

| Indicators | Sources | Economies |
|---|---|---|
| Employment rates (Figure 1.1) | Eurostat (EUR group); Organisation for Economic Co-operation and Development (Non-EUR group) | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, Japan, United Kingdom, and United States |
| Average actual hours worked (Figure 1.2) | Australian Bureau of Statistics (AUS); Eurostat (EUR group); International Labour Organization (CAN, JPN, and USA): Office for National Statistics (GBR); Statistics Canada (CAN) | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, Japan, United Kingdom, and United States |
| Vacancy level (Figure 1.3) | Australian Bureau of Statistics (AUS); Ministry of Health, Labour, and Welfare (JPN); Eurostat (EUR group); Statistics Canada (CAN); Office for National Statistics (GBR); Bureau of Labor Statistics (USA) | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, Japan, United Kingdom, and United States |
| Vacancy-to-unemployment ratios (Figures 2.1 & 2.3) | Eurostat (Unemployment level data for EUR group); Organisation for Economic Co-operation and Development (Unemployment level data for non-EUR group); Same vacancy level data sources as shown in Figure 1.3 | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, Japan, United Kingdom, and United States |
| Sectoral vacancy level (Figure 2.2) | Australian Bureau of Statistics (AUS); Eurostat (EUR group); Statistics Canada (CAN); Office for National Statistics (GBR); Bureau of Labor Statistics (USA) | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, United Kingdom, and United States |

| | | |
|---|---|---|
| Sectoral employment level (Figure 3.1) | Australian Bureau of Statistics (AUS); Eurostat (EUR group); Statistics Canada (CAN); Office for National Statistics (GBR); Bureau of Labor Statistics (USA) | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, United Kingdom, and United States |
| Employment rates and labor force participation (LFP) rates (Figure 3.2) | Same employment and LFP data sources as shown in Figure 1.1 | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, Japan, United Kingdom, and United States |
| Employment rates and LFP rates by demographics (Figure 3.3 & 3.4) | Low skilled: Australian Bureau of Statistics (AUS); Eurostat (EUR group); International Labour Organization (CAN, USA); No United Kingdom and Japan due to data unavailability<br>Other demographic groups: Organisation for Economic Co-operation and Development; Eurostat (EUR group) | EUR group: Austria, Belgium, Finland, Germany, Ireland, Greece, Luxemburg, The Netherlands, Norway, Portugal, Spain, and Sweden<br>Non-EUR countries: Australia, Canada, Japan, United Kingdom, and United States |

Source: IMF staff compilation.
Note: Due to limited availability of aggregate vacancy level (B-S sectors) data in Eurostat, only a subset of developed European countries are included and grouped together under the EUR label.

## 2. Microdata

### 2.1 Canada Labor Force Survey

For Canada, the note uses the microdata from Statistics Canada (Labour Force Survey: Public Use Microdata File). The monthly dataset is available going back to 1976, but the note considers the period from 2015M1 to 2021M11. Relevant microdata variables considered for Canada include labor force status, duration of joblessness, gender, age, age of the youngest child, education, and industry (NAICS classification with 21 sectors). Sectoral vacancy data for Canada are not available for 2020Q2 and 2020Q3 from Statistics Canada. These two quarters are complemented with Indeed data.

### 2.2 Spain Labor Force Survey and Vacancy Data

For Spain, this note collects quarterly data from the Spanish Statistical Office (INE, Instituto Nacional de Estadística), from two sources of surveys: Economically Active Population Survey (Encuesta de población activa) and Quarterly Labor Cost Survey (Encuesta trimestral de coste laboral). Data for Spain span from 2013Q1 until the latest available quarter (2021Q4), but more historical data could be extended and explored.

Employment-related variables are calculated using the Spanish economically active population survey. These include employment, unemployment, inactivity, hires, and separations, at both aggregate and granular levels. Building on the rich microdata at worker level, this note also looks at these same variables by individual characteristics (gender, age, education, has children or not) and industry (CNAE-09 classification, 10 sectors). Job vacancy data are collected from labor cost surveys by industry (CNAE-09, 18 sectors).

### 2.3 UK Labor Force Survey and Vacancy Data

For the United Kingdom, the note uses two data sources both produced by the Office of National Statistics: the quarterly Labour Force Survey (UK LFS) and the VACS02 data set. The UK LFS is the nationally representative worker-level survey used to compute official labor market statistics such as employment, unemployment, and inactivity. It is available either in a cross-sectional format or, thanks to its rotating panel structure, in a two-quarter longitudinal format in which workers can be followed over two consecutive periods. The longitudinal version is used to compute flows across labor market states, including hires and quits. The stock of unemployed workers by industry is computed using reported information on the workers' industry of previous employment. Industries are defined using the 21 sectors of the UK's 2007 Standard Industry Classification (SIC 2007).

The VACS02 data set contains vacancies for 19 industries, using the SIC 2007, at monthly frequency, reported in 3-month moving averages since mid-2001. The three absent industries are agriculture, households as employers, and extra-territorial organizations. Only observations corresponding to full quarters (Jan–Mar, Apr–Jun, Jul–Sep, Oct–Dec) are used to be consistent with the periods of the UK LFS.

### 2.4 US Labor Force Survey and Vacancy Data

For the United States, the note uses two data sources: the Current Population Survey (CPS) issue jointly by the US Census Bureau and the US Bureau of Labor Statistics (US BLS), and the Job Openings and Labor Turnover Survey (JOLTS) issue by US BLS. CPS is a nationally representative monthly survey for the United States. The note calculates the stock of employed workers, unemployed, and those not in the labor force by the industry as well as flows between these labor force statuses at a monthly frequency between January 2000 and October 2021. The note uses vacancies (in levels), hires (in levels), and quit rates for the aggregate US economy and 17 industries based on the North American Industry Classification System (NAICS) between December 2000 and November 2021.

### 2.5 Australia Data

For Australia, the note uses publicly available monthly series produced by the Australian Bureau of Statistics. Labor force statistics, including employment and unemployment by demographic characteristics and industry, are constructed from the monthly Labour Force Survey (AUS LFS). Vacancies by sector are produced through the monthly Job Vacancies Survey (JVS).

## 3. Variable Definitions

Annex 1 Table 1.2 shows sectors' classification into contact-intensive and teleworkable sectors used in the note's Sections I and II.

## Annex 1 Table 1.2. Sectoral Classification Based on ISIC Rev. 4

| Sector Code | Sector Description | Sector Abbreviation | More Contact-Intensive | More Teleworkable |
|---|---|---|---|---|
| A | Agriculture, forestry, and fishing | Agri. | | |
| B | Mining and quarrying | Mining | | |
| C | Manufacturing | Manuf. | | |
| D | Electricity, gas, steam, and air conditioning supply | | | |
| E | Water supply; sewerage, waste management, and remediation activities | | | |
| F | Construction | Constr. | √ | |
| G | Wholesale and retail trade; repair of motor vehicles and motorcycles | Trade | √ | |
| H | Transportation and storage | Transport | √ | |
| I | Accommodation and food service activities | Acc./Food | √ | |
| J | Information and communication | Info./Con. | | √ |
| K | Financial and insurance activities | Fin./Ins. | | √ |
| L | Real estate activities | Real Est. | | |
| M | Professional, scientific, and technical activities | | | √ |
| N | Administrative and support service activities | | | √ |
| O | Public administration and defense; compulsory social security | Public Ad. | | |
| P | Education | Educ. | √ | √ |
| Q | Human health and social work activities | Health | √ | √ |
| R | Arts, entertainment, and recreation | | √ | |
| S | Other service activities | | √ | |
| T | Activities of households as employers; undifferentiated goods and services-producing activities of households for own use | | | |
| U | Activities of extraterritorial organizations and bodies | | | |
| *More aggregated sectors | | | | |
| B, D & E | Min./Ener. | | | |
| D & E | Utilities | | | |
| G, H & I | Trade/Acc. | | √ | |
| M &N | Pro. Serv. | | | √ |
| O, P & Q | Edu./Heal. | | √ | |
| R & S | Arts/Serv. | | √ | |

Sources: Dingel and Nieman (2020); Kaplan, Moll, and Violante (2020); and IMF staff calculations

# Annex 2. Mismatch, Barriers to Returning to Work, and Shifting Worker Preference

## 1. Mismatch Analysis

The analysis of mismatch follows the matching-function approach by Şahin and others (2014), which is described in detail in the original paper. Below is a brief overview of the framework (for further details on the analysis carried out for this note, see Pizzinelli and Shibata 2022). Given the difficulty of estimating sector-level matching efficiencies for several countries, requiring data on new hires by sector, the results from this note are based on estimates of mismatch not adjusted for heterogeneity in matching efficiency across sectors.

The discrete-time economy is formed by a finite number of sectors (industries or occupations) indexed by $i = 1, \dots, I$. In each period $t$, a unit mass of workers is either employed in a sector ($e_{it}$), or unemployed and searching for work exclusively in the sector ($u_{it}$). Firms in each sector post vacancies ($v_{it}$), which can be filled with job seekers through a frictional process. The number of hires ($h_{it}$) resulting from the matching of vacancies and searchers is determined by the matching function $h_{it} = \phi\, \mathrm{m}(\mathrm{v}_{\mathrm{it}}, u_{it}) = \phi\, v^{\eta} u^{1-\eta}$, where $\eta \in (0, 1)$ is the elasticity of new hires with respect to vacancies and $\phi$ is the "matching efficiency." Total hires across all sectors are $h_t = \sum_I h_{it}$.

For a given allocation of vacancies across sectors $\{v_{it}\}_{i=0}^{I}$, mismatch represent the percent shortfall in total hires between the outcome given by the empirical allocation of unemployment $\{u_{it}\}_{i=0}^{I}$ and the optimal allocation that would be chosen by a "benevolent social planner" $\{u_{it}^{*}\}_{i=0}^{I}$. The social planner's optimal solution maximizes total hires $(h_t^{*})$ by allocating job seekers across sectors to equalize their marginal contribution to total hires. Assuming a constant matching efficiency across sectors, the optimal solution simply requires equalizing the vacancies-to-unemployment ratio across sectors:

$$\frac{v_{1t}}{u_{1t}^{*}} = \cdots \frac{v_{it}}{u_{it}^{*}} = \cdots = \frac{v_{It}}{u_{It}^{*}}.$$

Given allocations $\{u_{it}\}_{i=0}^{I}$, $\{u_{it}^{*}\}_{i=0}^{I}$, and $\{v_{it}\}_{i=0}^{I}$, mismatch $\boldsymbol{M}_t$ can be quantified as the fraction of hires that are lost due to misallocation relative to $h_t^{*}$:

$$\boldsymbol{M}_t = 1 - \frac{h_t}{h_t^{*}} = 1 - \left(\frac{\phi}{\overline{\phi}}\right) \sum_{i=0}^{I} \left(\frac{v_{it}}{v_t}\right)^{\eta} \left(\frac{u_{it}}{u_t}\right)^{1-\eta},$$

where $v_t$ and $u_t$ represent aggregate vacancies and unemployment, respectively, and $\overline{\phi} = \phi \left(\sum_I \frac{v_{it}}{v_t}\right)^{\eta}$. The mismatch index $\boldsymbol{M}_t$ is displayed in Figure 4, panel 1 as a 4-quarter moving average and normalized to its value in the fourth quarter of 2019 to ease cross-country comparison.

Once the mismatch is computed, counterfactual series for the job finding rate of unemployed workers $(f_t^{*})$, the employment rate $(e_t^{*})$ and the unemployment rate $(u_t^{*})$ are derived. The construction of these series is an iterative process where in the first period $e_0^{*}$ and $u_0^{*}$ are set equal to the historical employment and

unemployment rates $e_0$ and $u_0$. After that, they are computed forward using standard laws of motion, the historical job separation rate, and the counterfactual job finding rate

$$f_t^* = f_t \frac{1}{1-M_t} \left(\frac{u_t}{u_t^*}\right)^{\eta}.$$

## 2. Barriers to Returning to Work

### 2.1 Employment dynamics for low-skilled workers

Using the microdata labor force survey from Canada, Spain, the United Kingdom, and the United States, the note runs a simple linear probability model to estimate the employment likelihood among the low-skilled workers during the "peak" of the COVID-19 recession and for the "latest" available period. The regression specification is as follows:

$$y_{it} = \alpha + \gamma D_{Post} + \epsilon_{it}$$

where $y_{it}$ is a dummy equal to 1 if individual *i* in period *t* is employed and 0 otherwise, $D_{Post}$ is the dummy equal to one if the observation is in the period of *post* (peak or latest available period). The sample is restricted to low-skilled workers (below college degree) and two quarters: pre-COVID19 quarter (quarter in 2019) and "post" (peak or latest available). Peak is 2020Q2 for Canada, Spain, and the United States and 2020Q4 for the United Kingdom. The latest available quarter is 2020Q3 for Spain and the United Kingdom, and 2020Q4 for Canada and the United States. Pre-COVID19 quarter is defined to be the same quarter one year before the "peak" quarter and two years before the "latest" quarter for the countries considered. This is to avoid seasonal factors affecting the regression results. Standard errors are clustered at period (quarterly for the Spain and the United Kingdom and monthly for Canada and the United States). Bars titled "low-skill" in Figure 5 panel 1 plots coefficient $\gamma$ multiplied by 100, which captures the difference in the employment probability of low-skilled workers between pre-COVID19 and post COVID19 periods.

To assess how much being in contact-intensive sector affects low-skilled workers' employment likelihood, the following regression is run:

$$y_{it} = \alpha + \beta ConInt_{it} + \theta D_{Post} + \gamma D_{Post} \times ConInt_{it} + \epsilon_{it}$$

where $ConInt_{it}$ is a dummy equal to one if a worker was working in a contact-intensive industry and 0 otherwise (as defined in Annex 1 Table 2.1). The sample is restricted to low-skilled workers and the same two quarters as before (peak and latest). "Low-Skilled & Contact-Intensive" in Figure 5 panel 2 plots coefficient $\gamma$ multiplied by 100, which captures the additional impact on the employment probability of low-skilled workers from working in a contact-intensive sector.

### 2.2 Declining participations of elderly and mothers with young children

Using labor force survey data from Canada, Spain, the United Kingdom, and the United States, Figure 5 panel 2 plots the inactivity (out of the labor force) rate for women with young children, where young children are defined to be age five years or younger, as well as for the elderly, defined to be between age 55 and 74. Rate is calculated as a share of sub-group's population. The trend is a linear trend based on 2015–19 data.

# 3. Shifting Worker Preferences

## 3.1 Transitions away from contact-intensive jobs

For this analysis, the note uses the labor force surveys from Australia (AUS), Canada (CAN), Spain (ESP), the United Kingdom (GBR), and the United States (USA). The share of transitions from contact-intensive jobs to other jobs are calculated as the total flow of workers who remain employed for two consecutive periods (EE) and change jobs from a contact-intensive industry in period *t–1* into a different industry in period *t,* divided by the total flow of workers who remain employed for two consecutive periods and changed industries (without restricting the original industry to be contact-intensive industry) between period *t–1* and *t*. Because of data requirements on industry information for both the previous period *t–1 and* the current period *t*, this statistics is calculated only for Australia, the United Kingdom, and the United States. The share of transitions from contact-intensive jobs to outside of the labor force is calculated as total job separations from a contact-intensive sector into out of the labor force (that is, flows from employment in a contact-intensive sector to out of the labor force), divided by all job separations (from any industry) to out of the labor force. These statistics are calculated for 2015–19, 2020, and 2021 averages, and the percentage point difference is calculated as differences between different periods.

## 3.2 Vacancy-to-employment ratios in contact-intensive sectors

To measure how easy it has been to get a contact-intensive job relative to pre-pandemic periods, the note computes the ratio of the total number of vacancies in contact-intensive industries to total employment in contact-intensive industries for 2020 and 2021, and then for each period calculates the percentage point deviation relative to the 2015–19 average. The data used to calculate this ratio are from the sources listed in Annex 1 Table 1.1. The 2020 value for Canada is missing due to the unavailability of sectoral vacancy data for 2020Q2 and 2020Q3.

## 3.3 Search intensity for job and telework (Google trends)

To glance at worker preference shifts on a near real-time basis, this note explores Google Trends data as a potential indicator of workers' behavior changes. Similar exercises leveraging Google Trends in economic and policy research can be found, for example, in Woloszko (2020) and Borup and Montes Schütte (2020).

Google powers Google Trends to analyze the popularity of search queries across regions and time. Data are available in terms of search volume intensity (0–100, depicting a number of searches for specific keywords over total searches), given different keywords, frequencies (month/week/day), and geographical locations. To access the data, one can directly download the information online or bulk download through open-source APIs such as PyTrends.

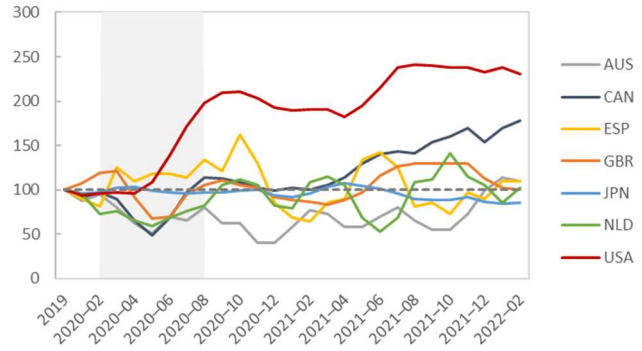
This section uses different keywords to capture recent trends for job search preferences, with a focus on job types and remote work opportunities. Specifically, search intensities for “jobs.” “telework,” “part-time jobs,” and “remote jobs” are collected for each country in the local language (see Annex 2 Table 1.1). For example, for Australia, Canada, the United Kingdom, and the United States, the word “jobs” is used to proxy job search activities. And correspondingly, for Japan, The Netherlands, and Spain, keywords “仕事,” “baan” and “empleo” are used to conduct searches. Trends for “part-time jobs” and “remote jobs” are shown in Annex 2 Figure 1, panels 1 and 2.

**Annex 2 Table 1.1. Keywords for Jobs and Telework**

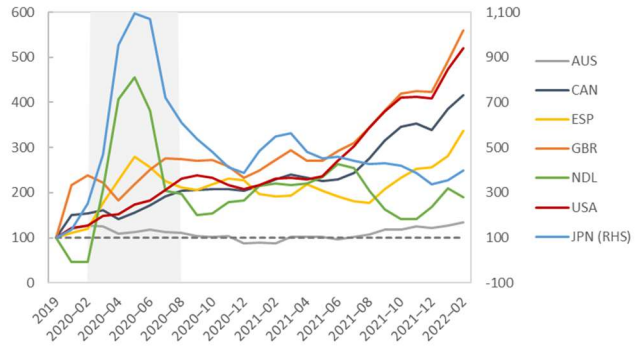
| Country | AUS | CAN | JPN | NLD | ESP | GBR | USA |
|---|---|---|---|---|---|---|---|
| **Jobs** | jobs | jobs | 仕事 | baan | empleo | jobs | jobs |
| **Telework** | telework | telework | テレワーク | telewerken | teletrabajo | telework | telework |
| **Part-time jobs** | part-time jobs | part-time jobs | アルバイト | parttime banen | trabajo a tiempo parcial | part-time jobs | part-time jobs |
| **Remote jobs** | remote jobs | remote jobs | リモートワーク | werken op afstand | trabajo remoto | remote jobs | remote jobs |

## Annex 2 Figure 1. Google Search Intensity for Part-Time and Remote Jobs

**1. Part-Time Job Search Intensity**
*(Index = 100 in 2019 average)*




**2. Remote Job Search intensity**
*(Index = 100 in 2019 average)*




Sources: Google search trends; and IMF staff calculations.
Note: Panel 1 plots job search intensity measured as the number of Google searches for the word "part-time jobs," normalized to 100 for the 2019 average. Panel 2 plots job search intensity measured as the number of Google searches for the word "remote jobs" (translated in local language where relevant), normalized to 100 for the 2019 average.

One caveat of Google Trends search data is interpretability. Google added two layers of normalization on the raw search volume: (1) rescale searches for any given keyword over total search-volume across the website, and (2) rescale based on each keyword's historical trends and labeled its peak value as 100. This section normalizes each keyword's search intensity to its 2019 average levels to compare countries and recent trends.

# Annex 3. Labor Market Tightness and Wage Growth

The conceptual framework used to analyze the link between labor market tightness and wage growth dynamics is the wage Phillips curve (WPC), whereby wage growth is regressed on labor market slack and various other controls, including measures of inflation expectations, past wage growth, and labor productivity growth. The framework presented in Section IV.2 closely follows previous literature, as in Galí (2011), Nickel and others (2020), and Byrne and Zekaite (2018). The WPC is estimated at the industry level for the United Kingdom and the United States separately. Specifically, for each country, the estimated specification is as follows:

$$\pi_{i,t}^{wage} = \mathrm{c} + \beta\pi_{i,t-12}^{wage} + \gamma\vartheta_{i,t-1} + \delta\pi_t^e + \zeta\mathrm{prod}_{t-1} + \eta_i + \epsilon_{i,t},$$

where $\pi_{i,t}^{wage}$ is nominal hourly (year-on-year) wage inflation in industry $\mathrm{i}$, $\vartheta_{i,t}$ is labor market tightness in industry $\mathrm{i}$, $\pi_t^e$ is a measure of economy-wide inflation expectations, $\mathrm{prod}_t$ is a measure of aggregate labor productivity growth (measured as output per hour growth) and $\eta_i$ captures industry fixed effects.

Robustness checks for both the United States and United Kingdom are conducted using several inflation expectations proxies, including (1) one-year-ahead and five-years-ahead inflation expectations from Consensus Economics forecasts on CPI inflation, (2) past realized price inflation, measured as the four-quarter moving average of the headline and core CPI inflation rates, and (3) linear combinations of the two aforementioned measures to control simultaneously for the forward-and backward-looking components of inflation expectations. All these robustness checks yield quantitatively similar estimates of the impact of tightness on wage inflation, which is the focus of Section IV.2. Further analysis (not reported here) also finds some indication of mild non-linearity in Wage Phillips curves. There is statistically significant evidence that the coefficient ($\gamma$) of labor market tightness gets larger for higher levels of tightness. However, this non-linearity does not appear to be large enough to materially affect the estimate, presented in the main text, of the quantitative impact the increase in labor market tightness observed since the trough of Spring 2020 has had on annual wage growth.

The panel regression above is estimated at the one-digit industry level, where one-digit industries are defined according to the NAICS classification for the United States and the SIC-2007 classification for the United Kingdom. The industry-level approach overcomes several challenges of the standard approach, which is to estimate the WPC at the country level using aggregate data, including omitted variable bias at the country level—some unobserved factors affect wage dynamics and tightness simultaneously. Estimating the relationship at the sector level enables us to control for several of these unobserved factors. Further, in the current context, the preferred measure to assess labor market conditions is tightness rather than the unemployment rate or the unemployment rate gap, which are typically used in the literature. Tightness (measured as the ratio of vacancies to unemployment) might better capture demand-side pressures on the labor market than the unemployment rate alone. However, as shown below, results are robust to using (pseudo) unemployment rates at the industry level instead. Standard errors are clustered at the industry level.

To explore the heterogenous impact of tightness on wage inflation across industries, an alternative specification is estimated where the impact of tightness is allowed to differ between low-pay and other sectors. Specifically, we extend the previous model as follows:

$$\pi_{i,t}^{wage} = \mathrm{c} + \beta\pi_{i,t-12}^{wage} + \gamma_1\vartheta_{i,t-1} + \gamma_2 lp_i * \vartheta_{i,t-1} + \delta\pi_t^e + \zeta prod_{t-1} + \eta_i + \epsilon_{i,t},$$

where $lp_i$ is a dummy for low-pay sectors. Low-pay sectors are defined as those in which employed individuals ranked among the lowest 25 to 30 percent in the distribution of average wages in 2019. In practice, the $lp_i$ dummy is equal to one for the accommodation and food services, retail trade, and arts and entertainment industries in the case of the United States, and for the accommodation and food services, wholesale and retail, and repair of vehicles services, arts and entertainment, and administrative and support services industries in the case of the United Kingdom.

The results are presented in Annex 3 Tables 1 and 2. Both tables have the same structure. Table 1 displays regressions results from the baseline specification for the United States, while Table 2 displays the regressions results for the United Kingdom. Columns (1)–(2) present the results from using lagged tightness as a proxy for labor market slack. Columns (3)–(4) present robustness checks from the analogous WPC that employs a more "standard" measure of labor market slack—unemployment. Specifically, the measure employed is a lagged pseudo unemployment rate, defined as the ratio of the unemployed who worked previously in the sector considered to total employment and unemployment in that sector. Columns (2) and (4) present regression results from the extended model that allows also for interaction effects between the labor market slack measure and the low-pay sector dummy. Both sets of results indicate that higher tightness is associated with higher wage growth, and that this association is relatively stronger for low-pay sectors. The WPCs that use our pseudo unemployment rate yield comparable results. Results are also robust to alternative estimation methods (ordinary least squares or Arellano-Bond method to address lagged dependent variable bias). Additionally, for both countries, the statistical significance of the tightness coefficient is robust to considering the full sample (running from the early 2000s until 2021Q4 for the United States and until 2021Q3 for the United Kingdom) rather than just the pre-pandemic sample—with some evidence that the impact of tightness may even have strengthened in the United States during the pandemic, consistent with a possible rise in reservation wages.

## Annex 4 Table 1. Wage Phillips Curve Estimation for the United States

| Dependent Variable: Nominal Hourly (percent, year-over-year) Wage Inflation | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Nominal hourly (%yoy) wage inflation *t–12* | -0.400*** | -0.407*** | -0.397*** | -0.402*** |
| | (0.036) | (0.029) | (0.035) | (0.029) |
| Tightness *t–1* | 0.836** | 0.712*** | | |
| | (0.319) | (0.182) | | |
| (Tightness * low-pay) *t–1* | | 2.514*** | | |
| | | (0.747) | | |
| 1-year-ahead CPI inflation Consensus Forecast *t* | 2.268*** | 2.163*** | 1.828*** | 1.808*** |
| | (0.390) | (0.386) | (0.595) | (0.432) |
| Labor productivity growth *t–1* | 0.137** | 0.137*** | 0.141** | 0.139*** |
| | (0.052) | (0.040) | (0.052) | (0.041) |
| Unemployment rate (%) *t–1* | | | -0.206** | -0.165*** |
| | | | (0.080) | (0.052) |
| (Unemployment rate(%) * low-pay) *t–1* | | | | -0.259** |
| | | | | (0.113) |
| Constant | -2.407*** | -2.303*** | 0.324 | 0.502 |
| | (0.814) | (0.813) | (1.706) | (1.102) |
| Observations | 1,037 | 1,037 | 1,037 | 1,037 |
| *R*-squared | 0.212 | 0.221 | 0.209 | 0.213 |
| Sector FE | YES | YES | YES | YES |

Sources: Current Population Survey, Job Openings and Labor Turnover Survey, US Bureau of Labor Statistics; Organisation for Economic Co-operation and Development and IMF staff calculations.
Note: Estimation sample: 2003Q1–2020Q1. Tightness is calculated as the V/U ratio; labor productivity is calculated as output per hour for all employed persons in nonfarm business sector. Robust standard errors in parentheses (*** $p$ <0.01, ** $p$ <0.05, * $p$ <0.1)

## Annex 4 Table 2. Wage Phillips Curve Estimation for the United Kingdom

| Dependent Variable: Nominal Hourly (percent, year-over-year) Wage Inflation | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Nominal hourly (%yoy) wage inflation *t–12* | -0.420*** | -0.423*** | -0.427*** | -0.430*** |
| | (0.027) | (0.027) | (0.026) | (0.027) |
| Tightness *t–1* | 1.967*** | 1.616** | | |
| | (0.555) | (0.694) | | |
| (Tightness * low-pay) *t–1* | | 5.744** | | |
| | | (2.671) | | |
| Labor productivity growth *t–1* | 0.329** | 0.319** | 0.334** | 0.336** |
| | (0.118) | (0.161) | (0.119) | (0.161) |
| 4Q moving average of CPI inflation *t* | 0.002 | 0.079 | 0.078 | 0.092 |
| | (0.203) | (0.250) | (0.202) | (0.255) |
| Unemployment rate (%) *t–1* | | | -0.245 | -0.116 |
| | | | (0.185) | (0.116) |
| (Unemployment rate(%) * low-pay) *t–1* | | | | -0.383** |
| | | | | (0.192) |
| Constant | 2.951*** | 2.520*** | 5.098*** | 5.076*** |
| | (0.504) | (0.739) | (0.996) | (0.728) |
| Observations | 1,188 | 1,188 | 1,188 | 1,188 |
| *R*-squared | 0.189 | 0.192 | 0.188 | 0.190 |
| Industry FE | YES | YES | YES | YES |

Sources: Labour Force Survey, Office of National Statistics, Organisation for Economic Co-operation and Development and IMF staff calculations.
Note: Estimation sample: 2001Q4–2020Q1. Tightness is calculated as the V/U ratio; labor productivity is calculated as output per hour worked for the whole economy (ONS). Robust standard errors in parentheses (*** $p$ <0.01, ** $p$ <0.05, * $p$ <0.1).

Based on the estimated coefficient for tightness from the specifications above, the following back-of-the-envelope calculations are performed (presented in Figure 10, panel 1): (1) the average increase in tightness between 2020Q2 and 2021Q4 is computed and multiplied by the tightness coefficient from Column (1) Table 1 to produce an estimate of the direct impact of changing tightness on overall wage inflation, (2) the tightness increase between 2020Q2 and 2021Q4 is computed separately for the low-pay and other sectors, and multiplied with the respective coefficients from Column (2) Table 1 to produce an estimate of the direct impact of changing tightness on wage growth for each industry group, (3) the payroll-weighted impact of changing tightness on wage growth is computed based on the direct impact of changing tightness for low-pay and other industries, using 2021Q4 labor incomes in the two industry groups as weights.

# Annex 4. Box 1: Vacancies in Low-Wage Jobs

Box 1 uses data from Indeed, a sizeable online aggregator of job advertisements operating in several countries. The note uses Indeed data from January 2019 until November 2021 for four countries: Australia, Canada, the United Kingdom, and the United States. For each job advertisement, the version of the data used for the note contains the job title and the date in which it was first posted. Although each job post could be advertising multiple positions, several studies using data from Indeed suggest that assuming one vacancy per post replicates well the time-series variation of vacancies from more traditional sources and nationally representative surveys (Adrjan and Lydon 2019, Adrjan and others 2021, Ens and others 2021).

Through a set of text matching algorithms, the job title of each vacancy is assigned to an occupation from the 4-digit version of the 2008 International Standard Classification of Occupations (ISCO-08), developed by the International Labour Organization. The matching is done via the coding index published by the UK's Office of National Statistics.

In broad terms, the algorithm matches the job title in the vacancy post against the coding index, an ordered list of about 30,000 representative job titles showing the ISCO-08 occupation along which the job title is classified. After translating all job titles into English using neural machine translation—which is particularly relevant for Canada—and stripping each job title from non-salient words, the matching is performed in three steps. The first step seeks an exact match, word for word, between the job title from the job post and one of the job titles in the coding index. This step results in an assignment for a large fraction of job posts (for example, 41 percent for the United Kingdom). For the remaining unpaired vacancies in which the job title has at least three words, the second step seeks an approximate match in the coding index based on string similarity metrics, such as Levenshtein distance. A match is achieved when a score of at least 0.8 out of 1 is found. In the case of the United Kingdom, the second step brings the total fraction of classified observations to 50 percent. The remaining observations are then paired via a set of probabilistic algorithms, such as the Okapi BM25.

After each job post is assigned a 4-digit ISCO-08 code, aggregate series are constructed for the number of newly posted vacancies for each occupation code each day. Monthly series are then constructed as the average weekly vacancies over the first four weeks of each month. Each series is then normalized relative to the average monthly value in 2019, set to 100.

Due to the lack of granular occupational information in the microdata of some countries' labor force surveys, the classification of occupations as "low wage" is based on the United Kingdom and applied to all countries. Using the four waves of the UK LFS for 2019, the average hourly wage and the average share of employment are computed for each SOC2010 at the 4-digit level and then converted to ISCO-08 via a concordance table with a frequency-based split for non-unique mapping using the employment shares as weights. The ISCO-08 codes are then ranked based on the average hourly wage, and low-wage occupations are defined as those comprising 33 percent of employment starting from the bottom of the ranking. For the 4-digit ISCO-08 codes that do not have any pairing in the SOC 2010, the mean value of the other codes in the same 3-digit group is used to assign the low-wage label (for example, if more than 50 percent of the other 4-digit codes in the same 3-digit group are classified as low-wage).

# Annex 5. Box 2: Receding Immigration and Rising Vacancies in Canada and the United Kingdom

Box 2 uses data from Indeed and the Labour Force Surveys for Canada and the United Kingdom. For each country, the vacancies series from Indeed are constructed using an occupational classification and level of aggregation that is compatible with the Labour Force Survey.

For Canada, the Labour Force Survey contains information on each worker's occupation at the 2-digit level of the National Occupational Classification (NOC). Indeed vacancies, which are coded at the 4-digit level of the ISCO-08 classification, are converted into the 2-digit NOC using a conversion table published by Statistics Canada. Since the table provides a many-to-many mapping at the 4-digit level of both classifications, the conversion from the 4-digit ISCO-08 to the 2-digit NOC is "modal": that is, it selects the 2-digit NOC code with the most pairings to a 4-digit ISCO-08 code. In the case of a bi-modal match, the 4-digit ISCO-08 code is duplicated, and each instance is assigned a weight of 0.5 to rescale the number of vacancies.

For the United Kingdom, the Labour Force Survey contains information on each worker's occupation at the 4-digit level of the SOC 2010. However, the share of foreign workers in each 4-digit code is very volatile from one quarter to another, as some occupations only contain few observations per period. Hence, occupations are aggregated to the 3-digit level. Indeed vacancies are already coded at the 4-digit level of the SOC 2010, so that they are also easily aggregated into the 3-digit level.

In Figure 2.2, low-skill occupations are defined based on the share of workers with at least an undergraduate degree in 2019. After ranking occupations based on the share of college graduates, the bottom occupations comprising up to approximately 50 percent of total employment are defined as low-skill. Because the share of foreign workers is very volatile across quarters for smaller occupations, the change in the share plotted in Figure 2.2 is based on the yearly average for 2019 and the average over the first three quarters for 2021. Meanwhile, to capture the most recent developments in labor demand, the growth rate of vacancies is based on the third quarter of 2021 relative to the 2019 average.

# Annex 6. Box 3: Great Resignation

Quit rates are obtained from JOLTS for the United States. Labor market tightness is calculated using vacancy levels from JOLTs and unemployment from US CPS. In Figure 3.2, the linear lines showing the fitted line between quit rates and labor market tightness use the data from 2019 (pre-COVID).

Quit rates for the United Kingdom are computed using the 2-quarter longitudinal version of the United Kingdom's Labour Force Survey. A first step identifies as "job leavers" those workers who in the first quarter are employed and in the second quarter are either non-employed or employed but reporting a tenure of less than three months with their current employer. Within this population, quits are identified as those reporting that separation from their previous employer was due to a "voluntary quit." The quit rate is then measured as the ratio of the population of quitters to total employment in the first quarter.

# References

Adrjan, P., and R. Lydon. 2019. "Clicks and Jobs: Measuring Labour Market Tightness Using Online Data." Economic Letter No. 6/EL/19, Central Bank of Ireland, Dublin.

Adrjan, P., G. Ciminelli, A. Judes, M. Koelle, C. Schwellnus, and T. Sinclair. 2021. "Will It Stay or Will It Go? Analysing Developments in Telework during COVID-19 Using Online Job Postings Data." OECD Productivity Working Papers 30, Organisation for Economic Co-operation and Development, Paris.

Alon, T., S. Coskun, M. Doepke, D. Koll, and M. Tertilt. 2021. "From Mancession to Shecession: Women's Employment in Regular and Pandemic Recessions." NBER Macroeconomics Annual 36.

Ando, S., and others. Forthcoming. "Labor Market Fallout of the COVID-19 Crisis and Associated Policy Options." IMF Departmental Paper, International Monetary Fund, Washington, DC.

Armantier, O. Goldman, L. Koşar G., and van der Klaauw, W. 2021 "An Update on How Households Are Using Stimulus Checks." Liberty Street Economics, Federal Reserve Bank of New York, New York.

Attinasi, M. G., A. Bobasu, and A. Manu. 2021. "The Implications of Savings Accumulated during the Pandemic for the Global Economic Outlook." *ECB Economic Bulletin* 5.

Barrero, J. M., N. Bloom, and S. J. Davis. 2021. "Why Working from Home Will Stick." NBER Working Paper No. w28731, National Bureau of Economic Research, Cambridge, MA.

Bilbiie, F. G. Eggertsson, G. Primiceri, and A.Tambalotti. 2021 "'Excess Savings' Are Not Excessive." Liberty Street Economics, Federal Reserve Bank of New York, New York.

Bluedorn, J., F., Caselli, N. J. Hansen, I. Shibata, and M. M. Tavares. 2021. "Gender and Employment in the COVID-19 Recession: Cross-Country Evidence on 'She-cessions'." *Covid Economics: Vetted and Real-Time Papers* 76 (April): 87–109.

Borup, D., and E. Montes Schütte. 2020. "In Search of a Job: Forecasting Employment Growth Using Google Trends." *Journal of Business & Economic Statistics* (40)1: 1–38.

Byrne, D., and Z. Zekaite. 2018: "Missing Wage Growth in the Euro Area: Is the Wage Phillips Curve Non-Linear?" Central Bank of Ireland Economic Letter, Dublin, Press Release, November 6.

Coombs, K., A. Dube, C. Jahnke, R. Kluender, S. Naidu, and M. Stepner. 2021. "Early Withdrawal of Pandemic Unemployment Insurance: Effects on Earnings, Employment and Consumption." Harvard Business School Working Paper, No. 22-046, Boston, MA.

Dingel, J. I., and B. Neiman. 2020. "How Many Jobs Can Be Done at Home?" *Journal of Public Economics* 189 (C).

Ens, E., L. Savoie-Chabot, K. See, and S. L. Wee, 2021. “Assessing Labour Market Slack for Monetary Policy.” Bank of Canada Staff Discussion Paper No. 2021-15, Ottawa.

Fabrizio S., D. Gomes, and M. M. Tavares. 2021. “COVID-19 She-cession: The Employment Penalty of Taking Care of Young Children.” *Covid Economics* 72: 136–66.

Galí, J. 2011. “The Return of the Wage Phillips Curve.” *Journal of the European Economic Association* 9 (3): 436–61.

International Monetary Fund (IMF). 2021. “Recessions and Recoveries in Labor Markets: Patterns, Policies, and Responding to the COVID-19 Shock.” *World Economic Outlook*, Washington, DC, April.

Kaplan, G., B. Moll, and G. L. Violante. 2020. “The Great Lockdown and the Big Stimulus: Tracing the Pandemic Possibility Frontier for the US.” NBER Working Paper No. w27794, National Bureau of Economic Research, Cambridge, MA.

Nickel C., E. Bobeica, G. Koester, E. Lis, and M. Porqueddu. “Understanding Low Wage Growth in the Euro Area and European Countries.” ECB Occasional Paper Series No. 232, European Central Bank, Frankfurt.

Pizzinelli, C., and I. Shibata. 2022. “Has COVID-19 Induced Labor Market Mismatch? Evidence from the US and the UK.” IMF Working Paper No. 2022/005, International Monetary Fund, Washington, DC.

Şahin, A., J. Song, G. Topa, and G. L. Violante. 2014. “Mismatch Unemployment.” *American Economic Review* 104: 3529–64.

US Federal Reserve System. 2021. “The Beige Book: Summary of Commentary on Current Economic Conditions by Federal Reserve District – May 2021.” Washington, DC.

Woloszko, N. 2020, "Tracking Activity in Real Time with Google Trends." OECD Economics Department Working Papers No. 1634, OECD Publishing, Paris.

PUBLICATIONS

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