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Assessing Labour Market Slack for Monetary Policy

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Abstract

The large and uneven impact of COVID-19 has emphasized the complexity and diversity of the labour market. This complexity implies that traditional headline measures may be inadequate at providing a comprehensive picture of labour market health. We address this concern in two ways. First, we construct a summary indicator of the labour market and use it to evaluate the level of disagreement between various labour market measures. Our exercise reveals that the COVID-19 shock has heightened the degree of disagreement between different indicators. The unprecedented level of disagreement across individual measures implies that a single measure cannot fully account for differences in labour market slack across various groups, or for the quality of job gains. Second, we propose a comprehensive framework to assess the labour market recovery along three dimensions, all of which capture different elements of slack: overall labour market conditions, labour market inclusiveness and job characteristics. As an example of how to apply this approach, we identify areas of concern in the ongoing recovery of the Canadian labour market.

Topics: Business fluctuations and cycles; Coronavirus disease (COVID-19); Econometric and statistical methods; Labour markets; Monetary policy
JEL codes: E24, J21, J6

Introduction

Measuring labour market slack is essential for central banks: without full employment in the economy, inflation will not stay close to target. Given this critical relationship, we examine different ways to assess the amount of slack in the labour market.

COVID-19 has emphasized how diverse and segmented the labour market is.[1] Traditional measures may:

- mask the presence of slack from weakness in hard-hit groups
- miss weaknesses in job quality and opportunities for workers—signs of weak demand for labour

We propose a way to assess the health of the labour market more comprehensively than has been done before. By providing a clearer picture of key turning points in the economic recovery from the pandemic, this approach could help mitigate potential risks to inflation from extended low policy rates. This new, detailed approach allows us to identify important areas of weakness (or strength) in the labour market. This approach could also improve understanding of whether labour market weakness is driven by cyclical factors or by long-term structural trends like digitalization, although this is not an area of focus of this paper.

We tackle the need for a more comprehensive assessment in two ways.

First, we construct the expanded labour market indicator (ELMI). The ELMI is similar to the Bank of Canada's labour market indicator (LMI), a summary measure of labour market conditions, but features some changes in methodology and an expanded scope of variables to capture additional areas of slack. We also apply it differently: instead of using it as a summary indicator, we examine the amount of disagreement between measures to more systematically track and quantify unevenness in the labour market.

Because the ELMI captures more aspects of the labour market than previous indicators, it gives us a more comprehensive assessment of areas of weakness. It reveals that many measures are sending very different signals about the health of the labour market. This elevated variation across data series implies that traditional measures such as the unemployment rate cannot fully account for the difference in labour market slack across various groups or for the quality of job gains.

Second, to address the drawbacks of traditional measures, we propose a framework for assessing the labour market recovery along three different dimensions:

- overall labour market conditions
- labour market inclusiveness
- job characteristics

We present and discuss key measures for each of these dimensions.

We also discuss how to benchmark the recovery using this framework. Determining the exact end point for the labour market recovery is challenging. This uncertainty is particularly high as the Canadian economy comes out of a large and uneven shock. We suggest using possible signposts instead of a fixed target to determine when the labour market has recovered. These signposts include:

- most measures across the three dimensions returning to *at minimum* pre-pandemic levels
- the level of unevenness or disagreement between most measures in the ELMI easing to pre-pandemic levels of around one standard deviation (a sign that the recovery is inclusive)

[1] See Macklem (2020; 2021) for details.

We apply this framework to identify areas of concern within the Canadian economy as it recovers from the pandemic:

- the prevalence of long-term unemployment
- the slower recovery in the unemployment rates of those aged 55 years and older
- declines in the participation rate of non-university-educated workers

In addition to the work presented here, further research on barriers faced by groups underrepresented in the Canadian labour force could help improve the assessment of the health of the labour market. Central banks cannot fix structural barriers to employment. But understanding these barriers can give central banks greater insight into the limits of monetary policy in boosting employment.

1. Constructing a summary indicator using principal component analysis

In this section, we explore whether summary indicators can be used to evaluate labour market slack in the context of the COVID-19 crisis.

We begin by looking at an existing summary measure, the Bank's labour market indicator (LMI).[2] The LMI is a composite indicator that summarizes information from several labour market measures. Zmitrowicz and Khan (2014) apply principal component analysis (PCA) to extract the common movement across eight labour market variables to give a summary indicator of labour market activity. While the LMI is built using several measures, it does not have key measures of unevenness among specific demographics and class of worker.[3]

To expand the scope of the LMI, we construct a new set of summary indicators, the ELMI. In contrast to the LMI, the ELMI considers information from a broader set of measures, including those related to labour market inclusiveness and job characteristics. It also features some changes in methodology.[4]

Although the ELMI includes a greater range of information, we do not suggest it be used as a stand-alone summary indicator like the LMI has been. Instead, we view the ELMI as a complementary measure to the broader approach outlined in section 2. In particular, the ELMI adds value not in its summary view, but rather as a tool that allows us to identify and quantify areas of weakness across a large range of labour market variables. We explain this in more detail below.

Construction of the expanded labour market indicator

The ELMI is a set of composite indicators that consolidates information from both aggregate and disaggregate measures of labour market health (e.g., the unemployment rate and youth unemployment rate, respectively). In addition, the ELMI includes information from measures of labour market utilization and job characteristics.[5] By using the information from these different measures, the ELMI extracts the common cyclical movement across the various segments of the labour market and provides an estimate of aggregate labour market slack. Because the speed of recovery from the COVID-19 shock may vary

[2] See Zmitrowicz and Khan (2014) for more details.
[3] The measures in the LMI include a measure of labour underutilization (R8; see **Appendix B** for more details), unemployment rate, long-term unemployment, separation rate, labour force participation rate of prime-age workers, wage growth, average hours worked, and job-finding rate.
[4] The Reserve Bank of New Zealand also considers a broader set of labour market measures. See Robinson, Culling and Price (2019).
[5] For information on the variables used, see **Chart 2**.

significantly across the labour market, we also use the ELMI to assess how much each underlying measure has deviated from its predicted value. In other words, we assess the degree of disagreement between the actual measure and that predicted by our set of summary indicators of labour market slack.

We take several steps to construct the ELMI (see **Appendix A** for details on our methodology):

i. We first evaluate each measure for stationarity, using a Hodrick–Prescott filter to detrend measures identified as non-stationary.
ii. Having extracted the cyclical components of our non-stationary data, we then run a PCA to summarize the information contained in these measures.[6] The principal components are linear combinations of the underlying data and are constructed so that each principal component is not correlated with the other. In summarizing the data, the principal components represent the direction of the data that contains most of the variation. We find that the first three principal components explain approximately 70 percent of the variation in the data.
iii. Finally, we verify if the predicted value of unemployment from the first three principal components closely approximates the actual unemployment rate.[7] Upon verifying this, we then repeat the same exercise for all underlying data series and calculate the deviations of individual indicators from their values as predicted by the three principal components. We then standardize the deviations by dividing them by their historical standard deviations.

After constructing our ELMI, we conduct two additional exercises. To identify whether the ELMI provides an accurate assessment of the labour market across different dimensions, we follow Gilchrist and Hobjin (2021) and examine the extent to which individual measures disagree on the state of the labour market. We then compare how each measure deviates from its predicted values (which represent historical relationships with overall labour market conditions).

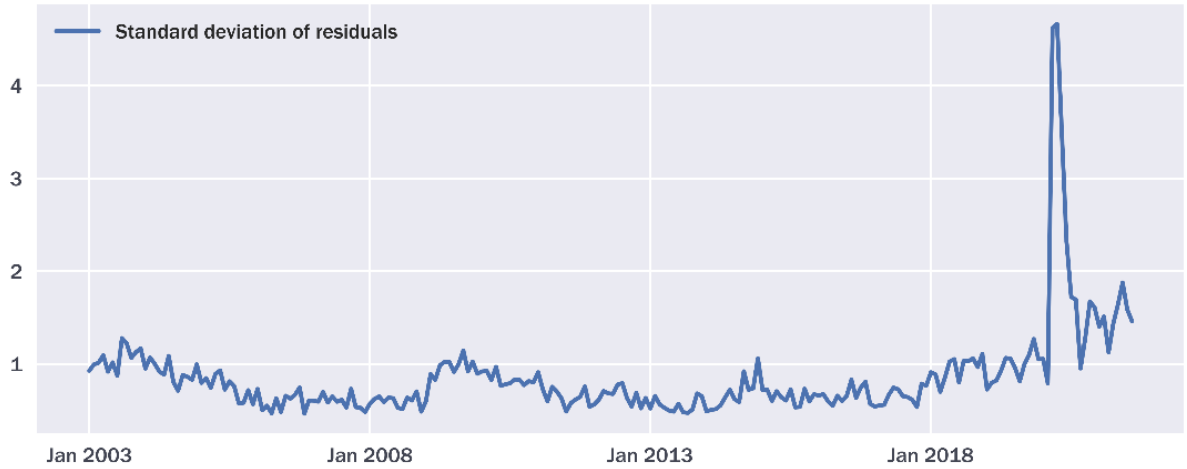
[6] **Appendix A** shows that our results would be relatively unchanged if instead of detrending the data, we applied the PCA on first-differenced data.

[7] We do this because, historically, the unemployment rate has been used as the headline indicator for the labour market. It should be noted that the LMI is constructed as the predicted value of unemployment when regressed against the first principal component. Our ELMI instead consists of the first three principal components, and we verify how well these three components capture the general labour market situation by comparing the unemployment rate predicted by these three principal components with the actual unemployment rate.

Results

Regarding current labour market conditions, we find that the amount of disagreement among individual measures is unprecedented. This disagreement is evident in **Chart 1,** which plots the standard deviation of the standardized residuals of all input measures for each period in our sample. The degree of disagreement reached an unprecedented level during the worst of the COVID-19 downturn (March and April 2020) and has since remained well above pre-pandemic levels.

Chart 1: Unexplained variation of labour market measures, expanded labour market indicator



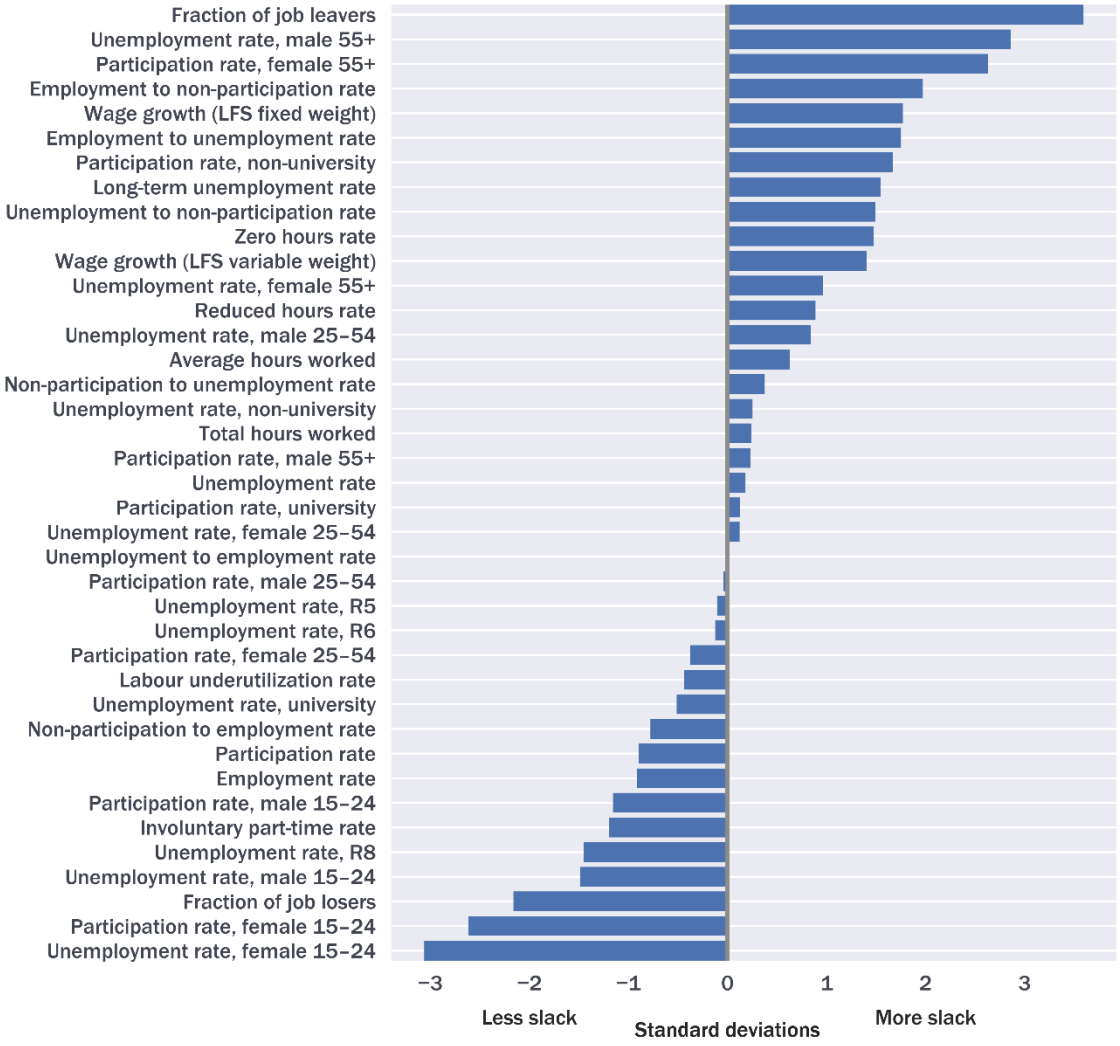
Note: This chart plots the standard deviation of the standardized residuals of all input measures for each period in our sample. Standardized residuals are calculated as the deviation of the actual value of a measure from its predicted value based on the first three principal components, normalized by historical deviations. All data series identified to be non-stationary are detrended using an HP filter.

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2021

The degree of disagreement can be seen in more detail in **Chart 2**, which shows the difference of each measure from its predicted value, expressed in terms of standard deviations. A value to the right (left) of the vertical axis indicates that the individual measure suggests more (less) slack than what the ELMI would predict.

Chart 2: Deviations of measures from co-movement, expanded labour market indicator



Note: This chart shows the standardized deviations of measures from their values predicted by the three principal components that summarize the co-movement of all input measures as of August 2021. A value to the right (left) of the vertical axis indicates that the individual measure suggests more (less) slack than what the ELMI would predict. All data series identified to be non-stationary are detrended using an HP filter. LFS is Labour Force Survey; R5, R6 and R8 are supplementary unemployment rates defined by Statistics Canada (https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410007701).

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2021

It is clear that individual measures are sending extremely mixed signals about the health of the labour market. Relying on traditional measures like the unemployment rate alone or on the summary values of composite indicators—including the ELMI—could be misleading. The magnitude of disagreement is remarkable—in some cases over three standard deviations in opposite directions. This suggests that summary indicators may be of little value in the current context. The disagreement between measures does, however, provide some useful insights into the state of the labour market. Several measures suggest more softness in the labour market than what the ELMI would predict. These measures highlight pockets

of weakness including long-term unemployment, the unemployment rate of those aged 55 and older and flows to non-participation. Measures such as the broad unemployment rate, the unemployment rate of young individuals and the fraction of unemployed who have lost jobs all indicate less slack than what historical co-movement with labour market conditions would predict.

2. Measures of labour market conditions

Given the complexity of the labour market, we propose a framework to evaluate its recovery along three different dimensions:

- overall labour market conditions
- labour market inclusiveness
- job characteristics

These dimensions capture labour market health or slack in somewhat different ways, and together provide a more comprehensive view of the state of the labour market than traditional measures. In the discussion that follows, we provide a rationale for analyzing each dimension and highlight particular measures that reveal areas of weakness in the recovery.

First dimension: Overall labour market conditions

To assess overall labour market conditions, we examine aggregate measures that indicate overall slack (see **Appendix B** for more details on the measures used).

While the unemployment rate is the most commonly used measure of slack in the labour market, we also look at other measures such as the employment rate and the labour force participation rate. These allow us to determine whether changes in the unemployment rate are driven by employment gains and losses or by entry into and exit from the labour force. The labour force participation rate also provides information about the extent to which workers have become discouraged from looking for jobs or have become detached from the labour force due to prolonged periods of unemployment. Meanwhile, unlike the unemployment rate, the employment rate is not affected by changes in the size of the labour force. Thus, it is a relevant measure of slack in the labour market because it provides a direct measure of the proportion of the population that is employed.[8]

The dynamics of unemployment can also be understood with a flows approach. A high unemployment rate can be due to increased job separations or a decline in the ability of the unemployed to find jobs. We therefore include measures such as the job finding rate (the flow from unemployed to employed) and job separation rate (the flow from employed to unemployed).

Because the job finding rate is affected by the number of job opportunities available for each unemployed job seeker, we also examine labour market tightness—that is, the ratio of job openings to unemployed. To construct this measure, we use job posting information from Indeed.com and divide total job postings by the total unemployed. We also look at Statistics Canada's Job Vacancy and Wage Survey (JVWS).[9]

[8] The employment rate is the proportion of the population aged 15 and above who are employed.

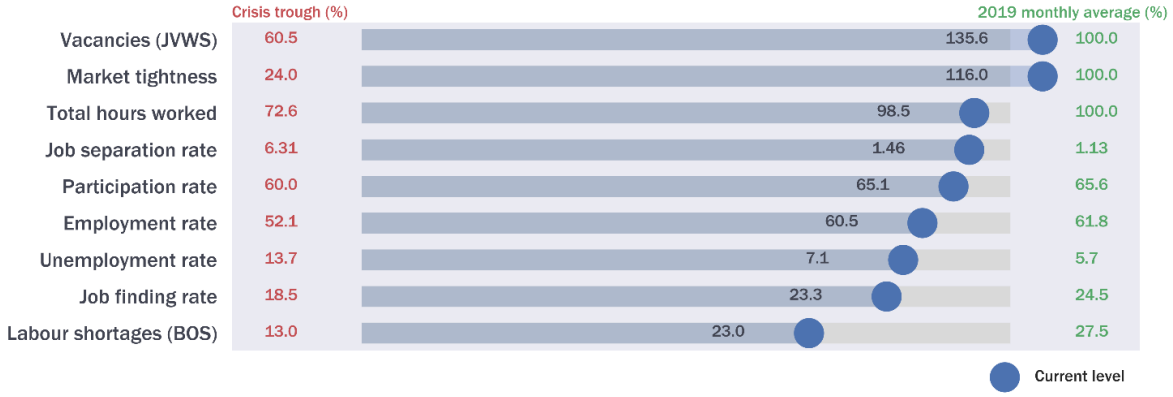
[9] We also look at the level of vacancies relative to 2019 using the data from Indeed.com. Because the results are similar, we present only the findings from the JVWS.

Total hours worked is another useful measure to assess labour market slack because it provides information on the total labour input used in production. As such, we also include this measure in our assessment of overall labour market conditions.

Finally, we include a measure from the Bank's Business Outlook Survey that provides information about the extent to which firms are facing labour shortages.

Chart 3 shows the extent to which aggregate measures have recovered since the depth of their troughs during the pandemic. We compare the latest available data with both a trough and a benchmark value—the 2019 monthly average—for each measure. Each bar shows the portion of the distance between the trough and the benchmark that the measure has regained.

Chart 3: Measures of overall labour market conditions



Note: This chart illustrates the extent to which measures of overall labour market conditions have recovered. The recovery is shown through progress bars, where the current value of each measure (depicted by a blue circle) is compared with its crisis trough and a benchmark value (the 2019 monthly average, pre-pandemic). Halfway progress implies that the measure has recovered half of the trough-benchmark distance. Market tightness is computed as the ratio of monthly averaged total job postings supplied by Indeed.com to total unemployed. Market tightness, JVWS quarterly vacancies and total hours worked are expressed as a ratio of their 2019 average. Missing JVWS data for 2020Q2 and 2020Q3 are imputed from growth rates of quarterly averages of Indeed.com total daily job posting data. Data for all series are from Statistics Canada's Labour Force Survey (LFS) unless otherwise noted. BOS is Business Outlook Survey; JVWS is Job Vacancy and Wage Survey.

Sources: Statistics Canada, Bank of Canada and Bank of Canada calculations

Last observations:
LFS and Indeed.com, August 2021;
BOS, 2021Q2;
JVWS, 2021Q2

Numerous measures point to ongoing slack. For example, the employment rate and the unemployment rate remain below and above their pre-pandemic average levels—by 1.3 and 1.4 percentage points, respectively. Because the number of individuals employed affects total labour input in production, total hours worked also remains about 1.5 percentage points below its 2019 level.

In terms of flows, while the job finding rate rose in June 2021 to a level above its 2019 average, it subsequently fell and has since remained below pre-pandemic levels. This recent volatility in the job finding rate partly reflects the effects of the economic reopening and the easing of restrictions. Finally, vacancies are above their pre-pandemic levels,[10] as is market tightness—defined as the ratio of vacancies to unemployed.[11] However, both vacancies and market tightness have only recently recorded values above the averages observed in 2019.

[10] Data are missing from the JVWS from March to September 2020. We impute the level of vacancies for this period by assuming that vacancy growth in the JVWS is equal to the quarterly vacancy growth rate observed in the job posting data from Indeed.com.

[11] To calculate market tightness, we use vacancy data from Indeed.com because the data are released more frequently.

Second dimension: Labour market inclusiveness

We now turn to measures that offer insight on labour market inclusiveness, or the unevenness of the labour market recovery. This is important for several reasons:

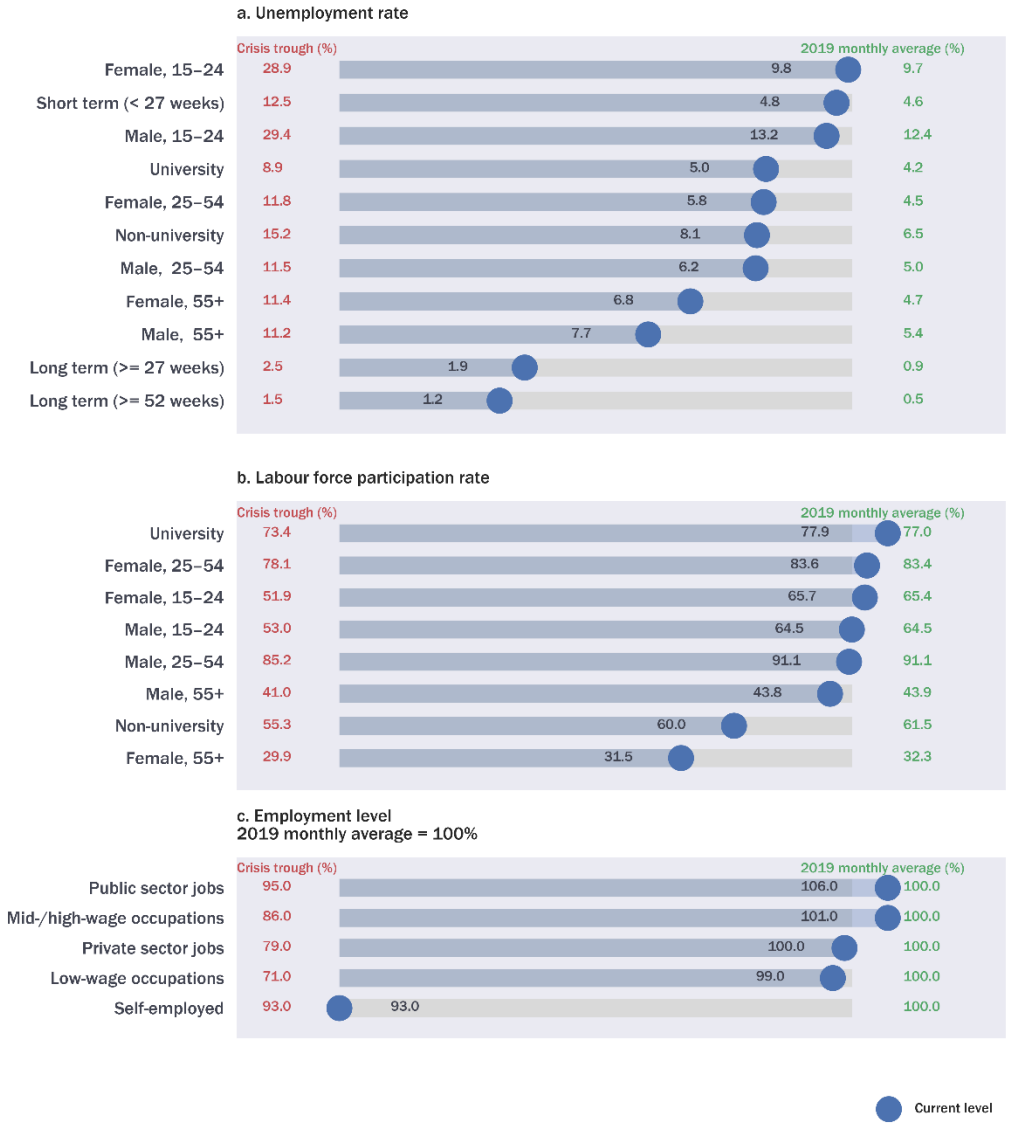
- It allows us to identify areas of the economy displaying excess slack that can be put into productive use without stoking inflationary pressures.
- A persistently slow recovery for certain groups may lead to scarring as long periods of unemployment make re-employment increasingly difficult.
- An uneven recovery may also increase income and wealth inequality.

To evaluate the inclusiveness of the labour market recovery, we break down the aggregate measures (unemployment, participation and employment) introduced in the previous subsection into their group-specific components. Specifically, we focus on key characteristics such as age, gender, educational attainment, wages and ethnicity.[12] We also look at unemployment duration. These distinctions are important because the long-term unemployed are more likely to experience skill depreciation and labour market stigma and exit the labour force.

Chart 4 shows which demographic groups are experiencing a delayed recovery in their labour market outcomes. The recovery in the unemployment rate for older workers lags behind the progress observed for their younger counterparts. Similarly, both the unemployment rate and participation rate of workers without a university degree have recovered at a slower pace than that observed for those with a university degree. **Chart 4** also highlights that a key area of weakness in the labour market stems from the exceptionally high long-term unemployment rate. The shares of the labour force that are unemployed for at least six months and for at least a year remain close to their peaks during the pandemic. If we focus on the recovery in jobs lost, we see that workers in occupations at all wage levels have experienced significant recovery in their employment levels, although the rate of recovery has been slightly slower for low-wage workers.

[12] We were unable to examine the experience of LGBTQ2S+ workers due to data gaps in Canada. However, a Statistics Canada release on this topic suggests that the age, gender and income distribution of the community puts members at higher risk of unemployment during the pandemic. See Prokopenko and Kevins (2020).

Chart 4: Measures of labour market inclusiveness



Note: This chart illustrates the extent to which measures of labour market inclusiveness have recovered. The recovery is depicted as progress bars, where the current value of a measure is compared with its crisis trough and a benchmark value (2019 monthly average). Halfway progress implies that the measure has recovered half of the trough-benchmark distance. Employment levels by wage are not seasonally adjusted.

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2021

The divergent pace of the labour market recovery is also evident when workers are categorized by ethnicity. **Table 1** shows that even before the pandemic, visible minorities experienced higher rates of unemployment compared with other workers.[13, 14] In July 2020, the unemployment rates of Black and

[13] According to the *Employment Equity Act*, visible minorities are "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour." The terms Aboriginal and Indigenous refer to individuals identifying themselves as First Nations people, Métis or Inuit.

[14] Information about labour market outcomes by ethnicity before COVID-19 is available only for July 2019. To understand the labour market conditions of diverse ethnic groups in Canada before July 2020 (when additional questions about ethnicity were introduced to the Labour Force Survey), Statistics Canada implemented an experimental method to integrate data from other sources to supplement previous direct interviews.

South Asian Canadians were roughly twice as large as those of individuals who were not Indigenous or members of a visible minority group. Between July 2019 and July 2020, South Asian and Chinese Canadians also experienced the largest percentage-point increases in their unemployment rates.[15]

Table 1: Unemployment rates by ethnicity, before and after waves of the pandemic

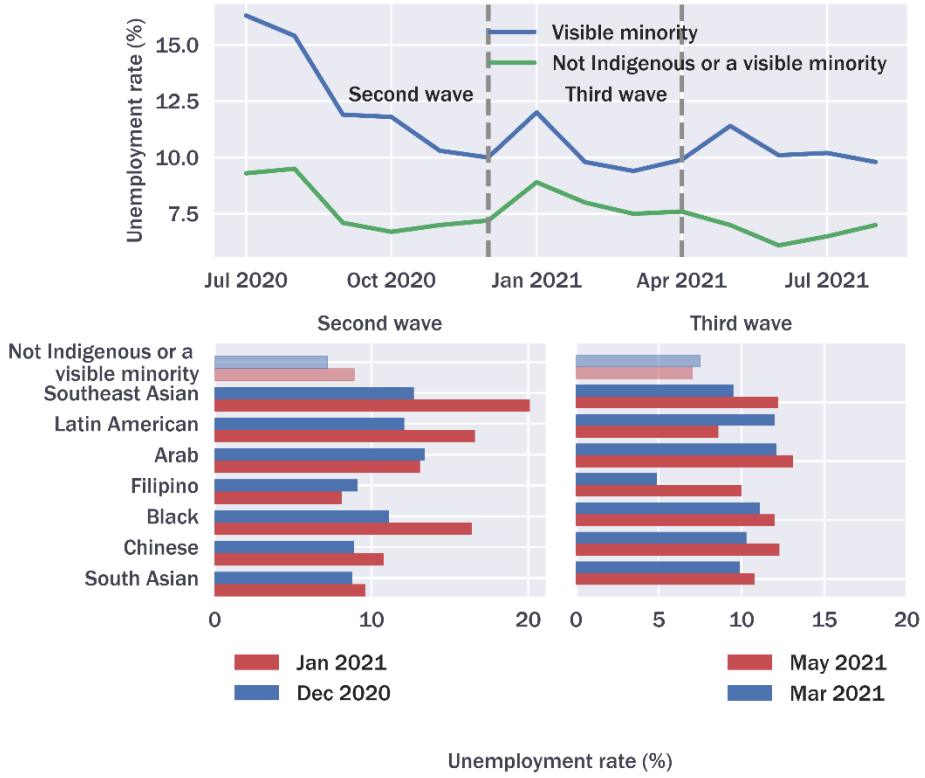
Ethnicity	2019 July (%)	2020 July (%)	2021 July (%)	2020 August (%)	2021 August (%)
South Asian	8.5	17.6	8.1	15.1	8.8
Chinese	5.6	14.0	11.8	13.3	9.5
Black	10.3	16.6	10.7	17.7	10.8
Filipino	7.2	13.4	10.1	12.7	8.5
Not Indigenous or a visible minority	4.9	9.3	6.5	9.5	7.0

Sources: Statistics Canada and Bank of Canada calculations. Data for 2019 are available only for the month of July 2019. The time series begins in July 2020.

While the gap in unemployment rates between visible minorities and those who are neither visible minorities nor Indigenous has narrowed since July 2020, visible minorities were hit harder during subsequent waves of the pandemic, as shown in **Chart 5**. During the second wave, individuals who are neither visible minorities nor Indigenous experienced only small changes to their unemployment rate, while Black, Latin American and Southeast Asian Canadians experienced much larger increases in their unemployment rates. The onset of the third wave saw almost all visible minorities experience an increase in their unemployment rates. The same measure for individuals who are neither visible minorities nor Indigenous, however, exhibited little change. On a more positive note, the elevated unemployment rate for visible minorities since the end of the third wave largely reflects a significant increase in their participation rates (**Chart C-2**) with the end of containment measures.

[15] Reported changes in the unemployment rate between July 2019 and July 2020 are obtained from Statistics Canada before the population rebasing of the Labour Force Survey (LFS). We impute the level of unemployment rate in July 2019 by combining reported changes from Statistics Canada with July 2020 data adjusted for LFS rebasing.

Chart 5: Unemployment rates by ethnicity



Note: The top panel plots the unemployment rate of visible minorities and non-Indigenous/non-visible minorities. The bottom panel shows the change in the unemployment rate experienced by different ethnicities during the second and third waves of the pandemic. Data are not seasonally adjusted.

Sources: Statistics Canada and Bank of Canada calculations Last observation: August 2021

Third dimension: Job characteristics

To assess job characteristics, we look at job quality and opportunities for workers. Both are relevant for setting monetary policy because they provide information on the extent of slack from underemployment or labour underutilization. They also provide a signal about the demand for workers. Previous measures focused on changes in employment status based on the number of jobs (extensive margin) but were less informative about the types of jobs being created, for example, how many hours employees work (intensive margin).

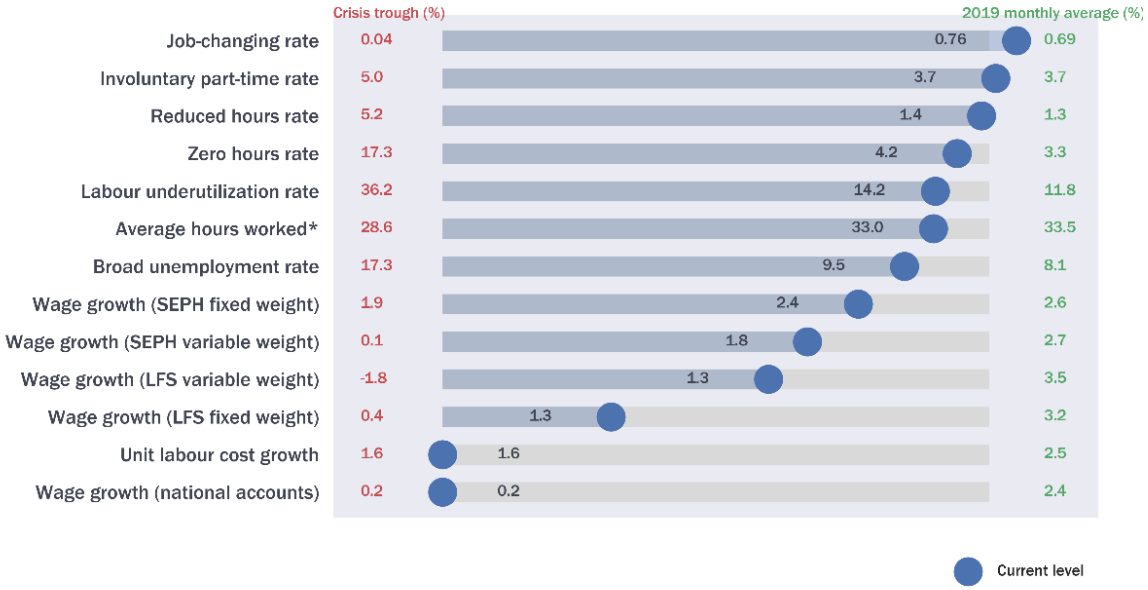
Underemployment can show up in different forms:

- *Visible* underemployment arises when a worker is employed in a job that offers fewer hours than desired. Several measures serve as good proxies for this type of underemployment—for example, the fraction of the working-age population who work part-time involuntarily and the change in average hours worked. The latter measure can be further analyzed by looking at workers with particularly low hours, as measured by the rates of reduced hours or zero hours (see **Appendix B** for definitions of these variables).
- *Invisible* underemployment occurs when a worker's job is considered suboptimal due to skill underutilization or mismatch or due to low productivity or wages. To capture this type of

underemployment, we include wage growth—a somewhat imperfect measure of productivity—and the job-changing rate, which may partially reflect the reallocation of workers toward better job opportunities. Labour underutilization can also be found among individuals who are not in the labour force. For example, this includes individuals who would like to have a job but are discouraged and those who are waiting to be recalled to a job they have been laid off from. We use broader measures of unemployment and the labour underutilization rate to account for this.

Measures of underemployment continue to signal slack in the labour market, including the elevated broad unemployment rate and labour underutilization rate (**Chart 6**). Most measures of wage growth remain soft and below pre-pandemic levels. On a positive note, the fraction of employed who switched jobs between months has fully recovered to its pre-pandemic level.

Chart 6: Measures of job characteristics



Note: This chart illustrates the extent to which measures of job characteristics have recovered. The recovery is shown through progress bars, where the current value of each measure (depicted by a blue circle) is compared with its crisis trough and a benchmark value (the 2019 monthly average, pre-pandemic). Halfway progress implies that the measure has recovered half of the trough-benchmark distance. Data for all series are from Statistics Canada's Labour Force Survey (LFS) unless otherwise noted. SEPH is Survey of Employment, Payrolls and Hours.
*Average hours worked are expressed in hours and not percent.

Sources: Statistics Canada, Bank of Canada and Bank of Canada calculations

Last observations:
LFS, August 2021;
SEPH, July 2021;
National accounts, 2021Q2;
Productivity accounts, 2021Q2

3. Areas of concern

To illustrate how to apply this framework, in this section we combine signals from the measures presented along the three dimensions (summarized in **Chart 7** below) as well as the ELMI and discuss three areas of concern.[16]

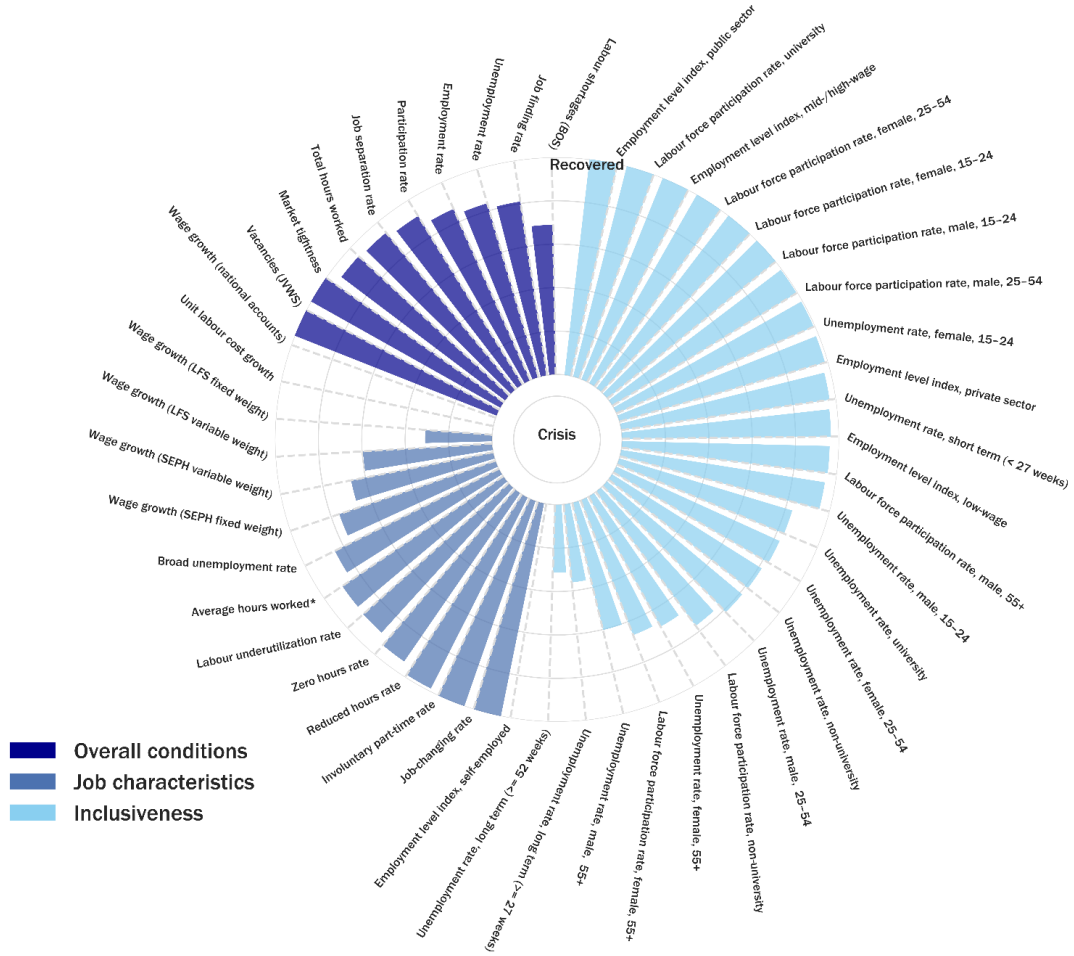
[16] In **Appendix C**, Chart C-3 and Chart C-4 show the evolution of Chart 7 between June 2020 and June 2021, respectively, to highlight some of the changes over the course of the pandemic.

Long-term unemployed: The large share of long-term unemployed is well above pre-pandemic levels. One concern is that a growing number of these individuals have been out of work for 52 weeks or more, suggesting that those who were displaced at the start of the pandemic continue to be without employment. By August 2021, about 63 percent of the long-term unemployed had been unemployed for 52 weeks or more. The dramatic rise in long-term unemployment is of particular concern because it raises the possibility of skills erosion and exits from the labour force (Kroft et al. 2019).

Unemployment among older workers: While small employment gains have driven the gradual decrease in the unemployment rate of male older workers, the unemployment rate for older female workers in August 2021 had unfortunately fallen because of a decline in their labour force participation rate over the previous month.

Those with less than a university education: During the onset of the pandemic, people without a university education saw larger increases in their unemployment rates, and their participation rates have remained persistently below pre-pandemic levels. This is in contrast to those with a university education who have seen their labour force participation rate rise *above* its pre-pandemic level.

Chart 7: Summary of labour market measures



Note: This chart illustrates the extent to which measures of labour market health have recovered. The recovery is depicted as progress bars, where the current value of a measure is compared with its crisis trough and a benchmark value (2019 monthly average). A full bar implies that the measure has fully recovered while a bar on the centre ring implies that the measure is at its crisis trough. SEPH is Survey of Employment, Payroll and Hours; BOS is Business Outlook Survey.

Sources: Statistics Canada, Bank of Canada and Bank of Canada calculations

Last observations:
LFS, August 2021;
SEPH, July 2021;
BOS, 2021Q2; JVWS, 2021Q2;
National accounts, 2021Q2;
Productivity accounts, 2021Q2

4. Benchmarking the progress of the recovery

In this section we discuss how to interpret economic progress using the three dimensions of assessment in our proposed framework.

Assessing individual indicators

When assessing the recovery of the labour market, we first have to consider which benchmark is most appropriate. The most useful would be a “bright line” test—a clearly defined benchmark that, once

reached, would suggest that the labour market has fully recovered. Unfortunately, the benchmarks currently available do not allow for such clarity. But some can serve as useful signs of progress.

We discuss three benchmark options:

- **Pre-pandemic levels**. A natural starting point is a measure's average level in 2019, assuming only modest structural shifts. But we know that this level should be considered a minimum. Before COVID-19, the labour market was generating jobs above population growth while inflationary pressures remained in check. But some groups lagged: youth participation was well below where it was before the 2008–09 global financial crisis, female participation seemed to have room to grow as well, and the unemployment rate of visible minorities was significantly higher than that of the broader population.
- **Trend estimates**. Trend estimates of key indicators can also be used as guides, such as the trend unemployment rate or the non-accelerating inflation rate of unemployment. However, the experience following the global financial crisis highlights the drawbacks of relying too strongly on these estimates. Before the pandemic, unemployment in Canada was below the estimated trend rate without generating above-trend inflation (**Chart 8**). The ranges for these estimates can be extremely large.[17] This is particularly true when the implications of an event or activity are still unknown, such as the COVID-19 shock and ongoing structural changes related to digitalization. Because of the unevenness of the shock, we would need estimates for a much broader set of variables than in the past.
- **Equality of outcomes**. For historically disadvantaged groups, it is possible to look at many of the same benchmarks as those used for the broader population. However, a cyclically hot labour market may not necessarily reduce systemic barriers. This could instead require structural changes through other policy tools (e.g., enhanced access to child care for working parents) or action on hiring biases. Future research and analysis on the challenges faced by disadvantaged groups would help the Bank better assess the amount of slack in the labour market.

Chart 8: The Canadian unemployment rate fell well below trend estimates after the 2008–09 global financial crisis

Note: This figure plots the unemployment rate against real-time estimates of the trend unemployment rate. Real-time estimates are constructed using the methodology outlined in Brouillette et al. (2019) and the trend unemployment rate is a weighted average of the four best-performing models presented in that same paper.

Sources: Statistics Canada and Bank of Canada calculations Last observation: 2019Q4

[17] For example, see Aaronson (2020).

Assessing progress across multiple measures

Even in a strong labour market, some individual measures may signal slack while others show signs of overheating. So how can we determine whether the labour market has fully recovered from the COVID-19 shock?

Similar to the practice of other central banks, and recognizing the difficulties in finding a fixed target for the labour market, we do not propose set targets. Instead, we suggest evaluating progress against the measures in our framework. In particular, the following would be signs of a recovery:

- Most measures are at or above their pre-pandemic levels along each of the three dimensions (overall labour market health, labour market inclusiveness and job characteristics). In a practical sense, this means examining the progress of each measure as presented in charts 3 to 6 or summarized in **Chart 7**. Further, as more measures reach their pre-pandemic values, greater focus could be placed on measures that capture signs of pressures building in the labour market. These could include wage and labour cost measures (**Chart 6**) as well as indicators of job vacancy and labour market tightness (**Chart 3**).
- The degree of disagreement between measures is close to historical levels (similar to measures highlighted in section 1, **Chart 1** and **Chart 2**). The high level of dispersion across measures signals slack in some sub-components of the labour market that may be potentially obscured by headline measures. The current extreme levels of disagreement show that the pandemic continues to have highly distortionary and uneven effects on the labour market.

5. Future work

Despite the enormous depth of the pandemic's shock—employment was down 3 million at its worst — the Canadian labour market is recovering. While there are still important gaps, there remains an open question as to what the upper limits of the labour market is—or, put differently, what is the maximum sustainable level of employment that could be achieved.

While the framework presented here is tailored to the COVID-19 recovery period, as the benchmarks are based on pre-pandemic (2019) experience, some elements could apply more generally to tracking labour market conditions once they have normalized. Indeed, many of the insights, including looking beyond headline indicators and taking a more granular focus (e.g., examining differences among demographic groups) would be relevant in a labour market that is experiencing slack or tightness. To apply this framework to assess labour market slack in the future, additional work could perhaps be most useful in benchmarking. These new benchmarks could be identified, for example, by analyzing the relationships between the variables in the framework and overall labour market conditions.

Appendix A: Construction and application of the summary measures

- Many of the indicators that we focus on exhibit trend behaviour. As such, we choose to detrend the data to extract only the business cycle component of the indicator. To do this, we first test whether the data exhibit non-stationarity on a sample that excludes the current pandemic—that is, we consider the period spanning from January 2003 to February 2020.
- We do this because the effects of the COVID-19 pandemic on the labour market have been on an unprecedented scale and have caused some variables to appear to have reversed trend during the pandemic. As such, when we test for stationarity in the data, we choose to limit our sample to the pre-pandemic period.
- In testing for stationarity, we perform a simple augmented Dickey–Fuller unit root test on each of our indicators. In other words, we test the null hypothesis that a particular series has a unit root (difference stationary) against the alternative hypothesis that it has a root not equal to 1.
- For most of our indicators, we are unable to reject the null hypothesis, suggesting non-stationarity. As such, for the indicators that are deemed to be non-stationary, we detrend them using a Hodrick–Prescott (HP) filter with a smoothing parameter of 900,000.
- This smoothing parameter is larger than what is typically used in business cycle analysis, and captures the fact that trends in labour market variables tend to exhibit lower frequency movements, as they reflect slow-moving structural shifts such as demographic changes.
- This larger smoothing parameter is consistent with that of 10^5 used by Shimer (2005) on quarterly data. We follow Backus and Kehoe (1992), who suggest multiplying the smoothing parameter used on quarterly data by the square of the frequency of observations relative to the quarterly data.[18] Thus, for monthly data, the frequency of observations is three times that of quarterly data. Hence, we arrive at a smoothing parameter of 900,000. This smoothing parameter is also used by Mueller (2017) and Bils, Chang and Kim (2009).
- Having extracted the cyclical components of our non-stationary data, we then run a principal components analysis (PCA) to summarize the information contained in these indicators. In general, the principal components are new variables that are linear combinations of the data. These combinations are computed such that each principal component is uncorrelated with the other. The principal components themselves represent the direction of the data that captures most of the variation.
- To run our PCA, we first ensure that all variables are on the same scale by standardizing our de-trended data. This means that for each variable's value at each point in time, we subtract its mean and divide that difference by the standard deviation. Once we have standardized the data, we compute the covariance matrix and conduct an eigendecomposition to compute the associated eigenvalues and eigenvectors (principal components).
- We then rank the eigenvalues from largest to smallest to identify the amount of variance explained by each principal component. From our analysis, we find that the first three principal components explain about 70 percent of the data. As such, throughout our analysis, we utilize the first three components. To obtain the estimated loadings, we restrict the sample to pre-pandemic periods (until February 2020). However, in the analysis that follows, we use the fixed loadings and the full sample to retrieve the recast data from our selected principal components.

[18] This can be seen by their choice of a smoothing parameter of 100 for annual data. For a smoothing parameter of 1,600 for quarterly data, one can compute a smoothing parameter of $1{,}600 * (1/4)^2 = 100$.

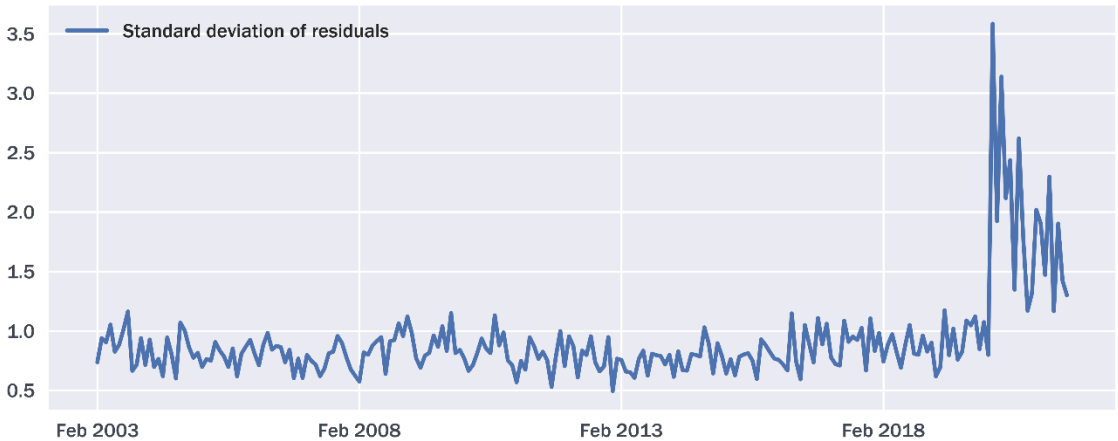
- Finally, to calculate predicted values of the indicators, we regress (where applicable, the cyclical components of) the data against the recast data from our selected principal components. To calculate the deviation from the common components, we take the difference between the actual (cyclical component) and predicted values and divide this difference by the historical standard deviation (i.e., the standard deviation of the error term from the regression of the data against the common components).
- To make things interpretable, we multiply certain series, such as the labour force participation rate, by -1, so that when the actual indicator is larger than the predicted value, this is a sign of less slack. For other series, such as the unemployment rate, we apply no further transformation. In this case, when variables are not further transformed, the actual indicator being greater than the predicted value is a sign of more slack.

Alternative methods of detrending

The large and unprecedented labour market fluctuations during the pandemic may influence the outcome of HP filtering the time series due to large end-of-sample changes in the data. We explore the implications of alternative methods of detrending the underlying measures included in the PCA. In particular, instead of applying an HP filter to data series identified to be non-stationary, we detrend the data through first-differencing—a procedure that is not subject to the same end-of-sample effects described above.

Chart A-1 shows that under this alternative detrending method, we still observe a sizable increase in the standard deviation of standardized residuals during the crisis**. Chart A-2** also shows that comparing the predicted value of measures (when data are regressed against the recast data from selected principal components) with the actual value of measures conveys a similar message about the sizable disagreement across the underlying labour market measures, resulting in mixed signals about the health of the labour market.

Chart A-1: Unexplained variation of labour market measures, expanded labour market indicator

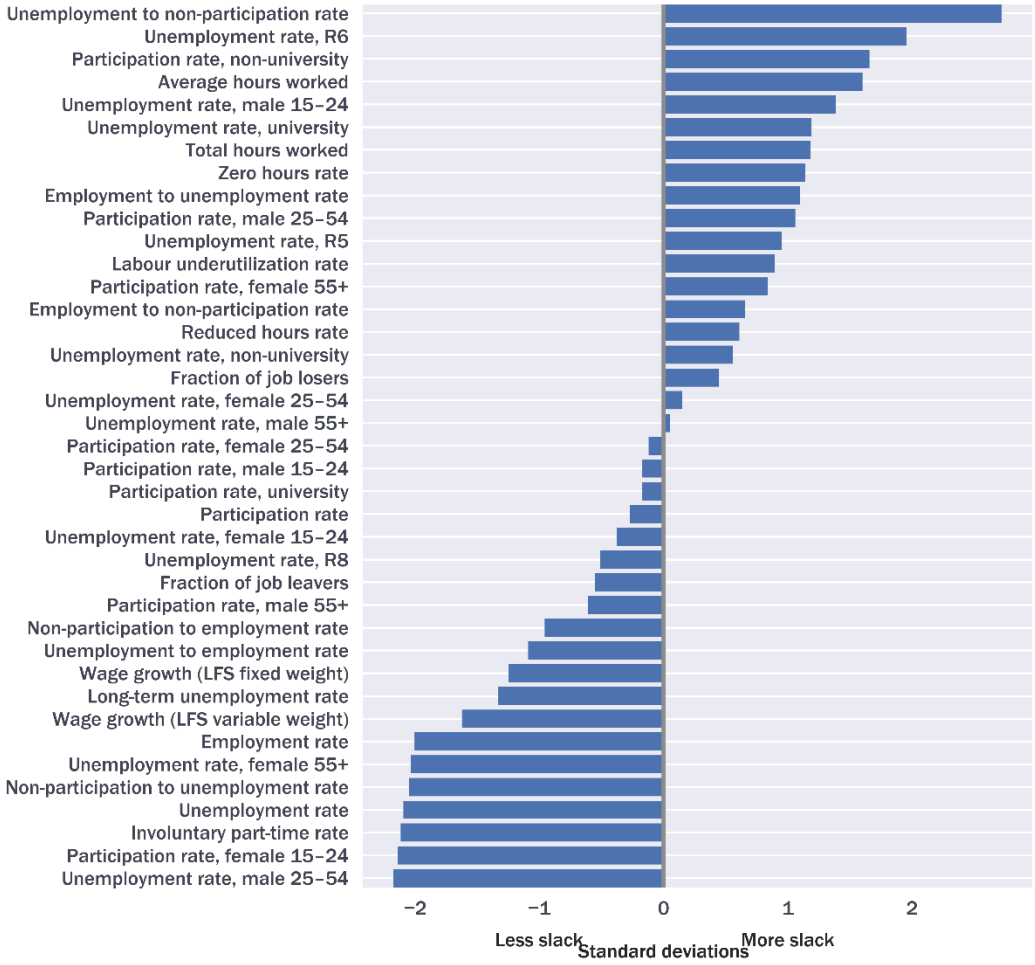


Note: This chart plots the standard deviation of the standardized residuals of all input measures for each period in our sample. Standardized residuals are calculated as the deviation of the actual value of a measure from its predicted value based on the first three principal components, normalized by historical deviations. All data series are first-differenced.

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2021

Chart A-2: Deviations of measures from co-movement, expanded labour market indicator



Note: This chart shows the standardized deviations of measures from their values predicted by the three principal components that summarize the co-movement of all input measures as of August 2021. A value to the right (left) of the vertical axis indicates that the individual measure suggests more (less) slack than what the ELMI would predict. All data series are first-differenced. LFS is Labour Force Survey; R5, R6 and R8 are supplementary unemployment rates defined by Statistics Canada (https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410007701).

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2021

Appendix B: Overview of labour market measures

Below is an overview of the labour market measures considered in this paper and their value in assessing the health of the labour market.

Overall labour market health

Unemployment rate: The unemployment rate is defined as the percentage of the labour force that is not employed. The unemployment rate is arguably the most direct measure of labour market underutilization because it counts the number of individuals in the labour force who are not employed. But changes in the unemployment rate can be difficult to interpret. By construction, the unemployment rate is affected by decisions to enter into and exit out of the labour force. As such, declines in the unemployment rate can arise either when employment gains increase or when more unemployed individuals choose to exit the labour force. Understanding how both the employment rate (ER) and the labour force participation rate (LFPR) evolve over the business cycle can help supplement the information contained in the unemployment rate (**Box B-1**).

- **Unpacking the unemployment rate**: The ER measures the ratio of people currently employed relative to the total working-age population (aged 15 years and older). Unlike the unemployment rate, the ER is not affected by changes in the labour force. Nonetheless, the ER tends to show less variation than the unemployment rate on a high-frequency basis and hence is viewed as a complementary measure to the unemployment rate in terms of assessing the health of the labour market.
- **Unpacking the labour force participation rate**: The LFPR is the sum of employed and unemployed individuals divided by the total working-age population.

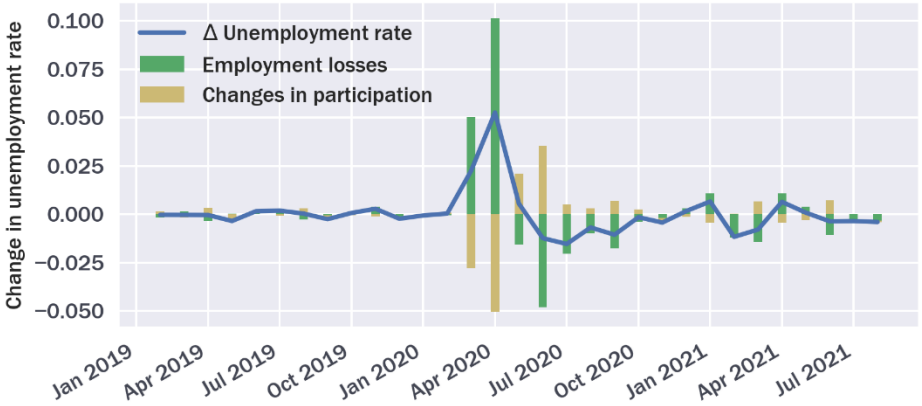
Box B-1: Decomposing changes in the unemployment rate

Because both the employment rate (ER) and labour force participation rate (LFPR) were changing over the course of the COVID-19 pandemic, a natural question that arises is how much of the recent declines in the unemployment rate can be attributed to increases in employment? Starting from the definition of the unemployment rate, one can show that variations in the unemployment rate can be decomposed into changes in (the natural log) of ER and LFPR. In particular, changes in the unemployment rate can be written as:

$$du_t = (1 - u_t)[d\ln(L_t/P_t) - d\ln E_t/P_t],$$

where u_t is the unemployment rate, L_t is the labour force, E_t is total employment and P_t is the working-age population. **Chart B1-1** shows that, at the height of the recession, increases in employment losses (green bars) were partially mitigated by declines in the labour force participation rate (yellow bars), causing the unemployment rate to increase by less. More generally, **Chart B1-1** shows how changes in the three measures are linked and helps provide a sense of which of the two factors (employment or labour force participation) are driving unemployment changes.

Chart B1-1: Decomposition of changes in the unemployment rate



Note: This chart decomposes changes in the unemployment rate into those that arise from changes in employment and from changes in participation. Data are seasonally adjusted.

Sources: Statistics Canada and Bank of Canada calculations Last observation: August 2021

Employment and unemployment transitions: The evolution of the unemployment rate can be understood in terms of the ease of finding jobs and the rate at which workers separate from jobs. An increase in the **job-finding** (**unemployment-to-employment**) rate reduces unemployment, while a spike in the **job-separation** (**employment-to-unemployment**) rate raises it. The job-finding rate is defined as the share of unemployed workers in period $t - 1$ who found employment in period *t,* while the job-separation rate is defined as the share of employed workers in period $t - 1$ who entered unemployment in period *t*.

Labour shortages (BOS): This is defined as the share of firms that answered yes to the Bank of Canada Business Outlook Survey (BOS) question: "Does your firm face any shortages of labour that restrict your ability to meet demand?"

Vacancy level relative to 2019 (JVWS): Before October 2020, the JVWS (Job Vacancy and Wage Survey) collected information on job vacancies on a quarterly frequency. Starting in October 2020, the data were released on a monthly basis. Because the pandemic caused data collection activities to cease between March 2020 and September 2020, we use the growth rate in quarterly job postings data from Indeed.com to impute the number of vacancies for the 2020Q2–2020Q3 period. Finally, we take the average over 2019 and normalize it to 100. A value less than 100 represents fewer vacancies relative to the average in 2019, while a value greater than 100 represents more vacancies relative to the average in 2019.

Market tightness: Market tightness is defined as the ratio of (online) vacancies to unemployed. Data on the average number of vacancies per day come from Indeed.com. Data on the unemployed are taken from the Labour Force Survey (LFS). To construct this ratio, we assume that the total number of unemployed is the same for each day of the reference month. Market tightness is thus the measure of the average number of online vacancies per unemployed per day.

Total hours worked: This is defined as total actual hours worked at all jobs from the LFS.

Labour market inclusiveness

Unemployment rate and labour force participation rate by demographic groups: As in past recessions, the COVID-19 pandemic and the deterioration of labour market conditions tend to adversely affect some groups more than others. In the paper we look at demographic differences related to age, gender, education and ethnicity. We examine these groups along measures such as the unemployment rate and participation rate.

Short-term unemployed: The short-term unemployment rate is defined as the share of the labour force who are unemployed for fewer than 27 weeks.

Long-term unemployed: The long-term unemployment rate is defined as the share of the labour force who are unemployed for 27 weeks or more. As an added measure, we also look at the share of labour force who have been unemployed for 52 weeks or more.

Employment level of low-wage occupations versus mid-/high-wage occupations: We classify workers as being employed in low-wage occupations and middle-/high-wage occupations. Low-wage occupations are those whose median wage in 2019 was less than $16.03 per hour (two-thirds of the 2019 annual median wage of $24.04 per hour). Occupations are based on two-digit National Occupation Classifications. Middle-/high-wage occupations are the rest of the occupations not considered low-wage.

Employment level of public/private/self-employed: These measures capture the composition of employed workers across the different classes of workers relative to their levels in 2019. The level in 2019 was normalized to 100. A value of less than 100 implies that current employment in that category is less than its level recorded in 2019.

Job characteristics

The above aggregate series measure labour underutilization in terms of the number of individuals engaged in production. Nonetheless, this is only one way of viewing labour market conditions. Examining average weekly hours worked, the share of involuntary part-time employment, wage and earnings

growth, the share of workers marginally attached to the labour force, and the fraction of employed who change jobs provides insights into the extent of labour market weakness beyond simply measuring the number of individuals engaged in production.

Average hours worked: In addition to counting the number of individuals engaged in production, examining hours worked provides information on the *intensive* margin of labour utilization. Average weekly hours worked is defined as total hours worked divided by the total employed. Information on average weekly hours worked provides a measure of total labour input per person.

Zero hours rate: The zero hours rate is defined as the share of employed who worked zero hours. The definition of employed individuals who worked zero hours includes employees and self-employed who were absent from work all week but excludes individuals who were away for reasons such as "vacation," "maternity," "seasonal business" and "labour dispute."

Reduced hours rate: The reduced hours rate provides a sense of the share of individuals who have seen their hours reduced. It is calculated as the share of employed who work less than 50 percent of their usual hours and includes both payroll employees and the self-employed. Employees whose reason for absence were "vacation," "maternity," "holiday," "labour dispute" and "weather" were excluded from this calculation. Also excluded were employees who were away all week.

Both the zero hours rate and the reduced hours rate provide a rough approximation of capacity underutilization among employed individuals.

Involuntary part-time employment: Even if employment levels recover, labour underutilization can still exist if a substantial portion of the employed are involuntarily part-time. The involuntary part-time employment rate is calculated as the total number of individuals who are working part-time because of business conditions or because they could not find full-time work divided by the total number of employed. Monitoring this measure provides insights into a different dimension of labour underutilization that would not be captured by the unemployment rate, ER or LFPR. A rising share of involuntarily part-time employed individuals may also not be reflected in average weekly hours worked when individuals can hold multiple jobs. As such, this measure provides additional information on the health of the labour market that is not contained in other measures.

Broad unemployment rate (R8): This measure includes discouraged job searchers, those waiting for recall or jobs to restart in the future as well as those who are involuntarily part-time employed. Specifically, the numerator includes the sum of unemployed, discouraged searchers, individuals in the waiting group and the involuntarily part-time employed. The denominator of this rate includes the sum of the labour force, discouraged searchers and individuals in the waiting group. Individuals in the waiting group are either waiting to be recalled from a previous employer, waiting for a reply on a job they have applied for or have a job to start in five weeks or more.

Job-changing rate: Job changers are defined as workers who remain employed from one month to the next but who change jobs between months. The job-changing rate is the ratio of job-changers to total employed.

Labour market underutilization rate (COVID-19): This measure combines the unemployed, discouraged workers and the employed who are working less than the majority of their usual work hours for reasons likely related to COVID-19 as a proportion of the potential labour force.

Wage growth fixed weights (LFS): Wage growth is calculated on a year-over-year basis. Composition weights are fixed to their 2019 levels; that is, the distribution of workers in 2019 is treated as the representative composition of workers. The aggregate wage level is computed using these fixed weights. Thus, similar to the calculation of the consumer price index, the aggregate wage level is a Laspeyres index, and changes in the wage level reflect the extent of wage inflation. The calculation using fixed weights abstracts from wage changes due to the changing composition of workers.

Wage growth variable weights (LFS): Wage growth is calculated on a year-over-year basis. Growth rates are computed as the percentage change in the weighted average hourly wage rate of all employees, with the weights varying from month to month.

Wage growth fixed weights (SEPH): Produced by Statistics Canada, this measures year-over-year growth of a fixed-weight measure of average hourly wages based on the Survey of Employment, Payrolls and Hours (SEPH). Hours paid and employment composition among industries, provinces and territories and type of employee (hourly paid and fixed salary employees) are held constant through time. At present, the fixed weights (basket) are based on the 2005 annual SEPH data.

Wage growth variable weights (SEPH): This measures the year-over-year growth of weighted average hourly earnings. The measure excludes overtime for salaried employees and for employees paid by the hour.

Wage growth (accounts): This measures the growth of hourly compensation. Compensation of employees comprises wages and salaries as well as employers' social contributions. It is defined as all compensation paid to employees. Earnings received by self-employed persons or working owners of unincorporated businesses are not included in this measure. Information on hourly wages and salaries data are derived by dividing labour income by total hours worked from SEPH. Unlike the LFS and SEPH measures, this variable is released quarterly.[19]

Unit labour cost growth (productivity accounts): This measures the year-over-year growth of unit labour costs defined as the cost of workers' wages and benefits per unit of real gross domestic product.

[19] See Brouillette, Lachaine and Vincent (2018) for more information.

Appendix C: Additional tables and charts

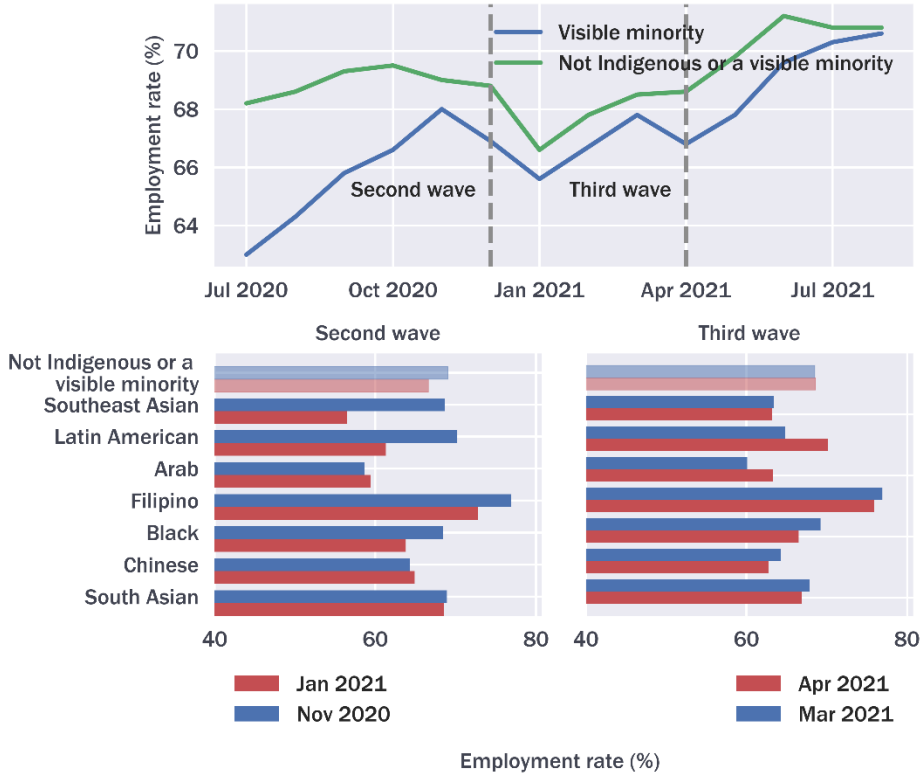
Table C-1: Employment rates by ethnicity before and after the pandemic					
Ethnicity	**2019 July (%)**	**2020 July (%)**	**2021 July (%)**	**2020 August (%)**	**2021 August (%)**
South Asian	69.6	62.5	73.5	64.4	73.6
Chinese	65.3	58.6	65	62.3	65.5
Black	71.7	66.5	75.4	64.6	71.8
Filipino	82.6	70.6	73.3	71.1	77.9
Not Indigenous or a visible minority	72.5	68.2	70.8	68.3	70.8

Sources: Statistics Canada and Bank of Canada calculations

Table C-2: Participation rates by ethnicity before and after the pandemic					
Ethnicity	**2019 July (%)**	**2020 July (%)**	**2021 July (%)**	**2020 August (%)**	**2021 August (%)**
South Asian	76.1	75.9	80.0	75.8	80.7
Chinese	69.1	68.1	73.7	71.9	72.4
Black	80.0	79.7	84.4	78.5	80.5
Filipino	89.1	81.6	81.6	81.4	85.1
Not Indigenous or a visible minority	76.2	75.2	75.7	75.8	76.1

Sources: Statistics Canada and Bank of Canada calculations

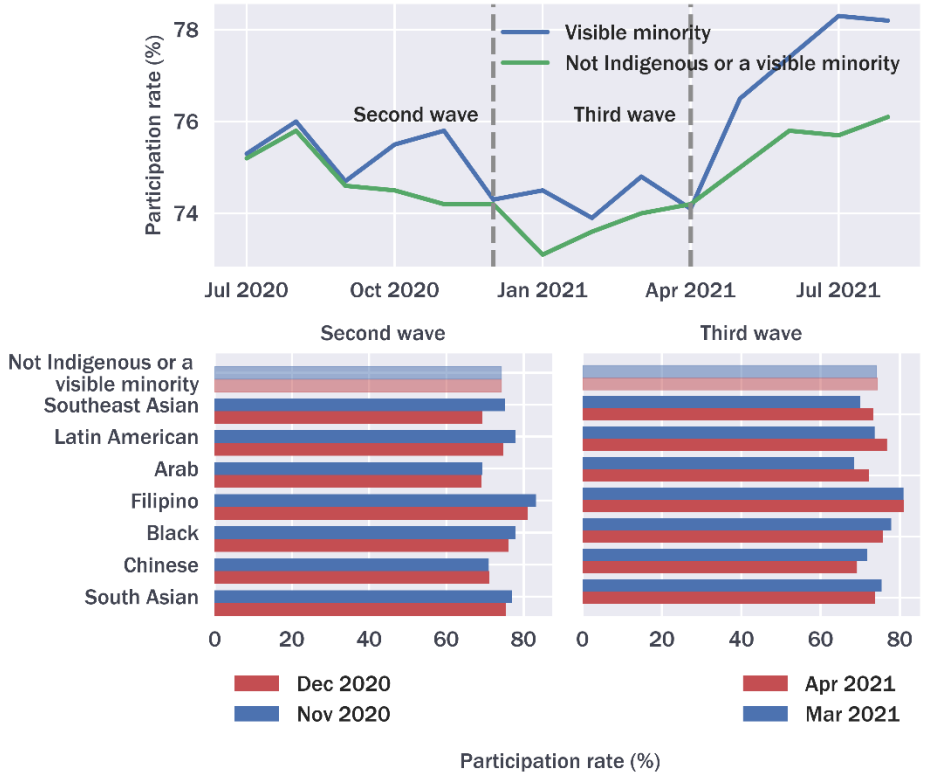
Chart C-1: Employment rates by ethnicity



Note: The top panel plots the employment rate of visible minorities and non-Indigenous/non-visible minorities. The bottom panel shows the change in the employment rate experienced by different ethnicities during the second and third waves of the pandemic. Data are not seasonally adjusted.

Sources: Statistics Canada and Bank of Canada calculations Last observation: August 2021

Chart C-2: Participation rates by ethnicity

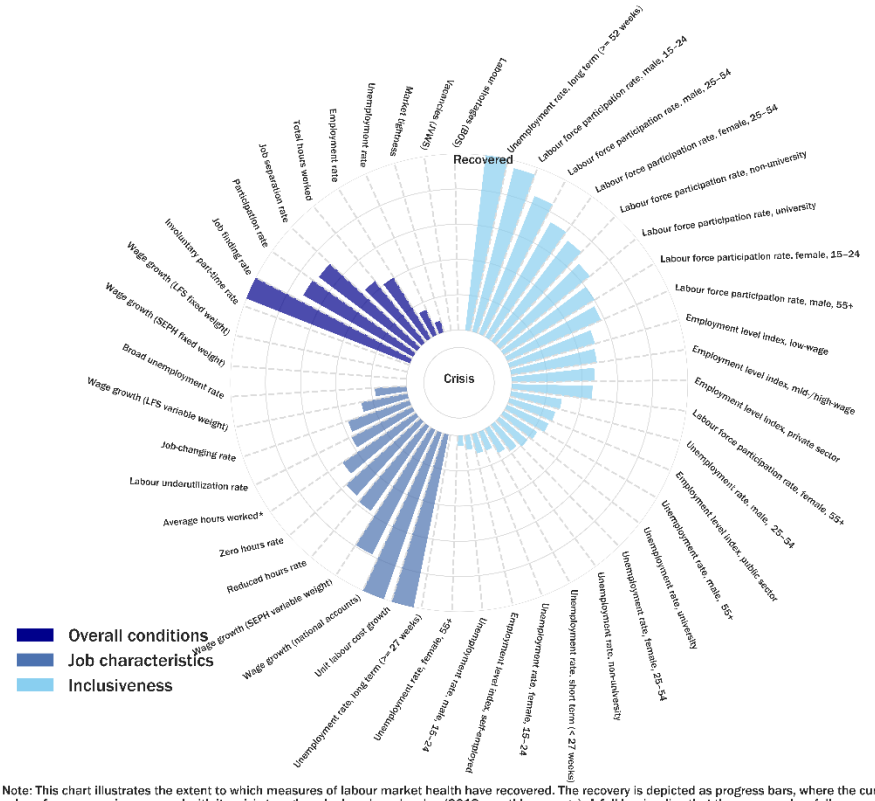


Note: The top panel plots the participation rate of visible minorities and non-Indigenous/non-visible minorities. The bottom panel shows the change in the participation rate experienced by different ethnicities during the second and third waves of the pandemic. Data are not seasonally adjusted.

Sources: Statistics Canada and Bank of Canada calculations

Last observation: August 2021

Chart C-3: Summary of labour market measures, June 2020

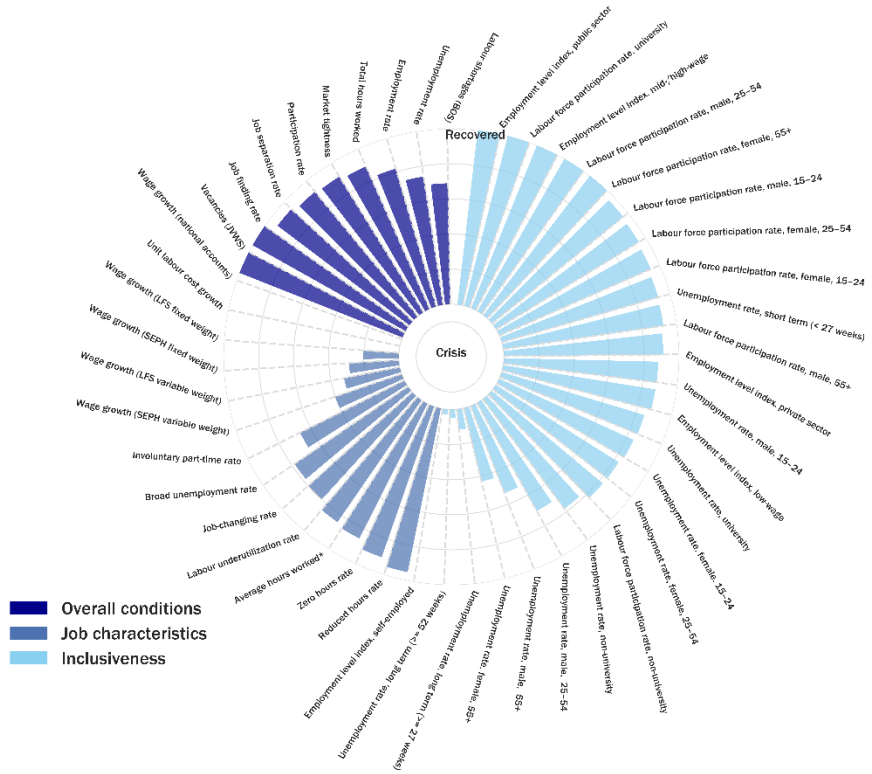


Note: This chart illustrates the extent to which measures of labour market health have recovered. The recovery is depicted as progress bars, where the current value of a measure is compared with its crisis trough and a benchmark value (2019 monthly average). A full bar implies that the measure has fully recovered while a bar on the centre ring implies that the measure is at its crisis trough. SEPH is Survey of Employment, Payroll and Hours; BOS is Business Outlook Survey.

Sources: Statistics Canada, Bank of Canada and Bank of Canada calculations

Last observations:
LFS, June 2020;
SEPH, June 2020;
BOS, 2020Q2; JVWS, 2020Q2;
National accounts, 2020Q2;
Productivity accounts, 2020Q2

Chart C-4: Summary of labour market measures, July 2021



Note: This chart illustrates the extent to which measures of labour market health have recovered. The recovery is depicted as progress bars, where the current value of a measure is compared with its crisis trough and a benchmark value (2019 monthly average). A full bar implies that the measure has fully recovered while a bar on the centre ring implies that the measure is at its crisis trough. SEPH is Survey of Employment, Payroll and Hours; BOS is Business Outlook Survey.

Sources: Statistics Canada, Bank of Canada and Bank of Canada calculations

Last observations:
LFS, June 2021;
SEPH, June 2021;
BOS, 2021Q2; JWS, 2021Q2;
National accounts, 2021Q2;
Productivity accounts, 2021Q2

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