Canada JOLTS: Shedding Light on Labour Market Flows in Canada

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I INTRODUCTION

The labour market is one of the most important indicators used by financial markets and policymakers to gauge the state of the economy. As such, it is a key input in public policy and monetary policy decisions. For example, debates about the effect of increasing the minimum wage have been at the center of public policy discussions for years, and the lackluster wage growth Canada has experienced throughout the current recovery has been the subject of much analysis.

Moreover, the labour market is multidimensional. To properly understand the dynamics at play at any given time, several measures need to be considered. For instance, Janet Yellen, the Chair of the Board of Governors of the U.S. Federal Reserve Bank, famously uses a "dashboard" of several labor market indicators to gauge the state of the recovery and the appropriate stance of monetary policy to take. Besides the major labour market indicators, such as the number of jobs created in a month and the unemployment rate, are also included the quits rate and hires rate from the Job Openings and Labor Turnover Survey (often referred to as the JOLTS). Conducted by the Bureau of Labor Statistics (BLS), the data collected include employment, job openings, hires, quits, layoffs and discharges, and other separations. According to the BLS, "information on labor turnover is valuable in the proper analysis and interpretation of labor market developments and as a complement to the unemployment rate." The BLS goes on to say that "these data serve as demand-side indicators of labor shortages at the national level. As such, financial markets and policymakers use the JOLTS as an important indicator of labour market and economic turning points and momentum

In Canada, no survey exists that can be compared to the JOLTS. As a result, labour-market watchers tend to put more weight on aggregate measures like the change in employment and the unemployment rate. The unemployment rate measures the scale of unemployment within the labour force, the latter being the total of people employed and unemployed but looking for work. Although it is a good indicator of the state of the labour market, it provides no information about the important flows in and out of unemployment that occur each month. In fact, at any given time, the unemployment pool is made up of people who either moved from being employed to being unemployed (inflows) and people who moved from being unemployed to employed (outflows). Finally, not considered in this report but also significant are the people flowing in and out of the labour force, moving between employment or unemployment and not being engaged in the job hunt at all.[1]

Unemployment flows are relevant in interpreting the unemployment rate because an increase in the unemployment rate due to an increase in the inflows rate does not have the same policy implications as an increase in the unemployment rate due to a decrease in the outflow rate.[2] As described by Campolieti (2011), "if high unemployment rates are due primarily to inflows into unemployment, then public policy may want to emphasize unemployment insurance or programs that provide labour market information or assistance with job search. In contrast, if high unemployment rates are the result of longer unemployment spells (or, equivalently, lower outflow rates from unemployment) then governments may want to emphasize retraining or the mobility of workers or even more extensive wage insurance options to encourage unemployed persons to accept lower-wage jobs".

Unemployment flows are also of interest because of their potential to predict economic downturns. They can provide insight on the behaviors of firms, whether they choose to limit their hiring or let go of employees. If strongly correlated with real GDP and other important economic variables, unemployment flows could be used in various economic models to predict recessions or movements in the economy.[3]

Despite the usefulness of unemployment flows data, a regularly updated time-series of these figures is not available for Canada. In the present report, the Institute of Fiscal Studies and Democracy (IFSD) presents a simple model of unemployment outflows, the rate at which unemployed workers find a job and exit unemployment, and inflows, the rate at which workers exit their position towards unemployment. We construct full time-series of monthly unemployment flows to 1976 to 2017. These figures will be updated monthly to provide researchers and economic commentators with up-to-date information. For instance, for the third quarter of 2017, we estimate a rise of 8 percent in the unemployment outflow rate, signifying a sharp increase in the speed at which unemployed workers find jobs.[4] At the same time, we also estimate an increase of 6 percent in the unemployment inflows rate. Looking at our estimated measure of the quits and layoffs rate, a slight uptick in the layoff rate in the second quarter of 2017 might explain part of that moderate increase in the inflows rate.[5]

Historically, we find that the unemployment outflow and inflow rates evolve in opposite directions. The outflow rate demonstrates pro-cyclical properties, rising during economic booms and falling during recessions; the inflow rate exhibits counter-cyclical properties. Moreover, decomposing the change in the unemployment rate by the relative change in the outflow and inflow rates, we find that, on average, 75% of the rise in unemployment during a major recession is caused by the collapse in the outflow rate.[6] Section 2 of the report provides a simple overview of the methodology. For the equations and a deeper discussion about the methodology, see Annex A. Section 3 follows with a complete set of historical unemployment flows. To further understand fluctuations in the unemployment rate, Section 4 presents a decomposition of changes in the unemployment rate into changes in inflows and outflows in recession periods. Finally, Section 5 provides concluding remarks.

II METHODOLOGY

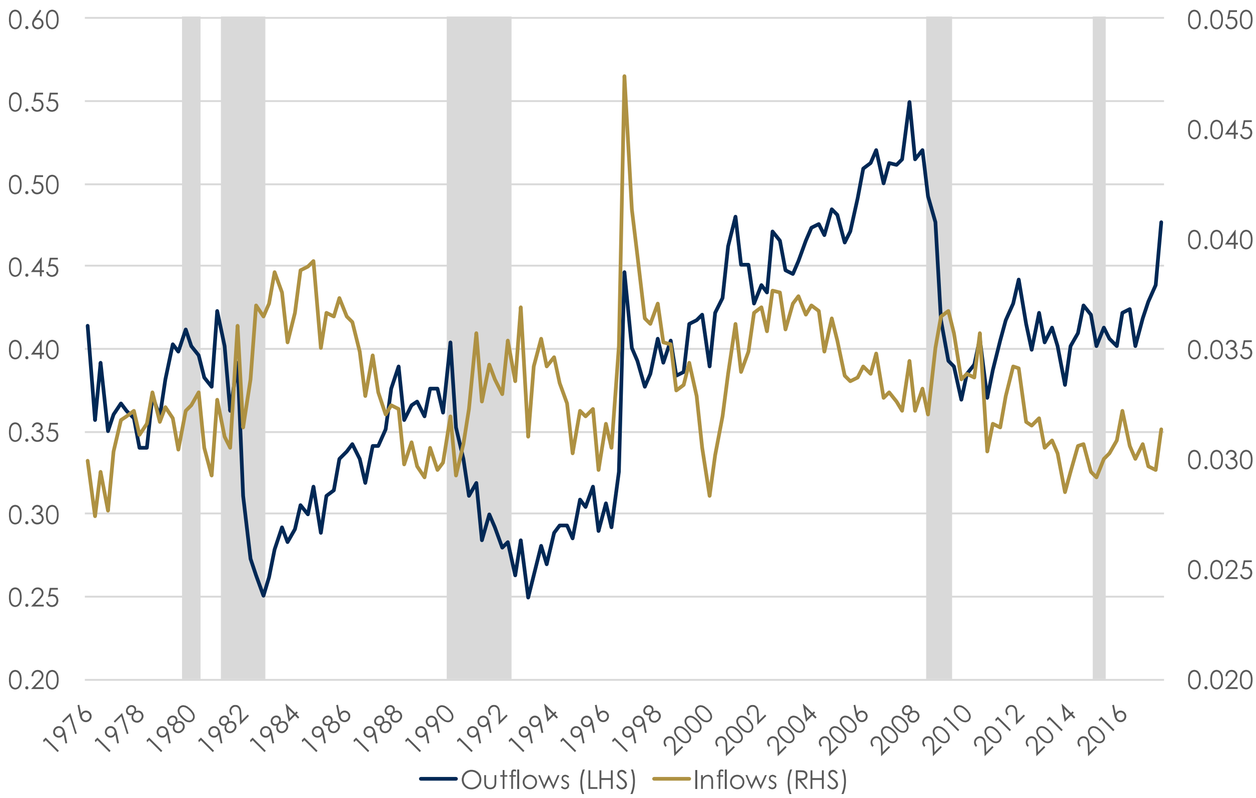
The methodology used in this report follows a theoretical and practical framework widely used to determine unemployment flows in the United States, as presented in Shimer (2012) and Elsby et al. (2009). This framework was applied to Canada first by Campolieti (2011), who covered until 2008, and then used by the Parliamentary Budget Officer (Bartlett and Tapp, 2012), who provided an overview of unemployment flows until 2012. The main variables of interest when studying unemployment flows are the job finding probability for unemployed workers F_t and th e exit probability for employed workers S_t. The probability of finding a job for unemployed workers, F_t, is the probability that an unemployed worker finds at least one job. Similarly, the exit probability for employed workers, S_t, represents the probability that an employed worker exits at least one job.[7] Then, through a simple relationship based on a Poisson process, it is assumed that unemployed workers find jobs at a rate, f_t, and that employed workers exit their job under the same process at a rate, s_t (Shimer, 2012). The Poisson process allows the model to be on a continuous time frame even if the measurements are monthly. Therefore, rates f_t and s_t can be interpreted as relative "speed" over which unemployed workers find jobs and employed workers exit jobs.

Importantly, we assume that jobs can be lost either by quitting or being laid off. This methodology does not account for flows to and from the non-participation pool, which Shimer (2012) has shown does not materially affect the resulting inflow and outflow rate. Statistics Canada's Labour Force Survey (LFS) Public Use Microdata Files are used to estimate the unemployment flows. The monthly results are seasonally adjusted internally using Eview's Census X12 approach and averaged quarterly.

III UNEMPLOYMENT FLOWS IN CANADA

Chart 1 displays the quarterly historical path of f_t and s_t, the rates of unemployment flows.[8] f_t and s_t typically move in opposite directions. Moreover, during recessions, the job-finding rate tends to decrease while the exit rate increases.[9,10] Those movements have been respectively labeled in previous studies as pro-cyclical and counter-cyclical (Elsby and al., 2009; Campolieti, 2011). For instance, between 2002 and 2008, the outflow rate was on a major structural uptrend while the inflow rate was on a structural downtrend, mirroring solid economic growth and a tight labor market. During the 2008-09 recession, outflows dipped enormously. The job-finding rate dipped by nearly 30%, while the exit rate increased by 10%. Since then, the outflow rate has been slowly increasing, with notable declines in 2012 and 2015, mirroring economic slowdowns.

Chart 1: Job Finding and Exit Rates

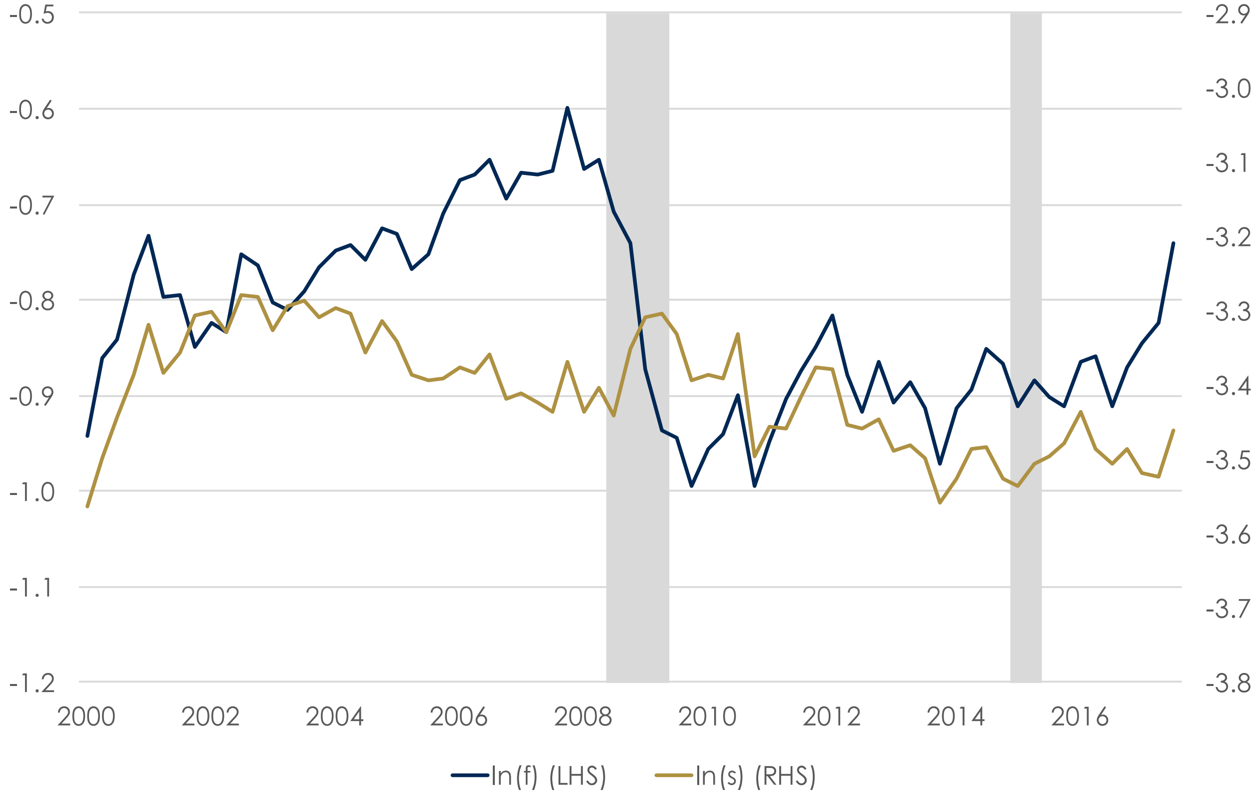


Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

The economic history of the past four years is an interesting case study. Following Elsby et al. (2009), Chart 2 displays the log of the rates f_t and s_t.[11]

A significant economic slowdown occurred in Canada in the first half of 2015 mainly due to the collapse in global crude oil prices that had started in mid-2014. Between the third quarter of 2014 and the first quarter of 2015, the outflow rate's decline was moderate, falling by 6%. However, it took until the second quarter of 2017 for the outflow rate to reach its pre-2014 high, suggesting a prolonged but moderate slump in hiring rates. The inflow rate took longer to adjust upward, increasing by 10% from the first quarter of 2015 to the first quarter of 2016. Comparing the pattern of peak-to-through of the two rates, we assert that the 2015 economic slowdown was marked more importantly by a rise in inflows into unemployment, e.g. layoffs, than a decrease in the speed at which the unemployed find positions.

Chart 2: Logs of Job Finding and Exit Rates

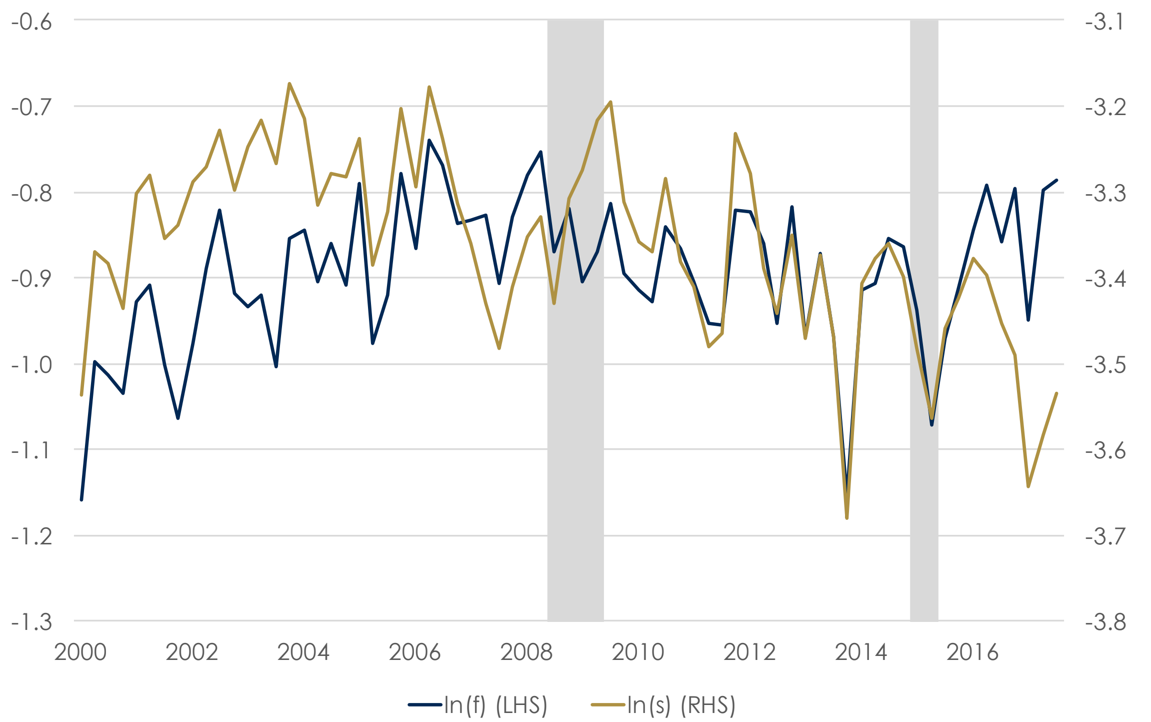


Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Looking at specific provinces, evidence suggests that the 2015 slowdown was not entirely confined to the oil-producing provinces. For instance, Quebec also experienced a rise in its unemployment rate in early 2015. As such, a fall in the Quebec outflow rate is observed around that time, partly offset by a corresponding fall in the inflow rate (Chart 3A). This was not the case in Ontario (Chart 3B).

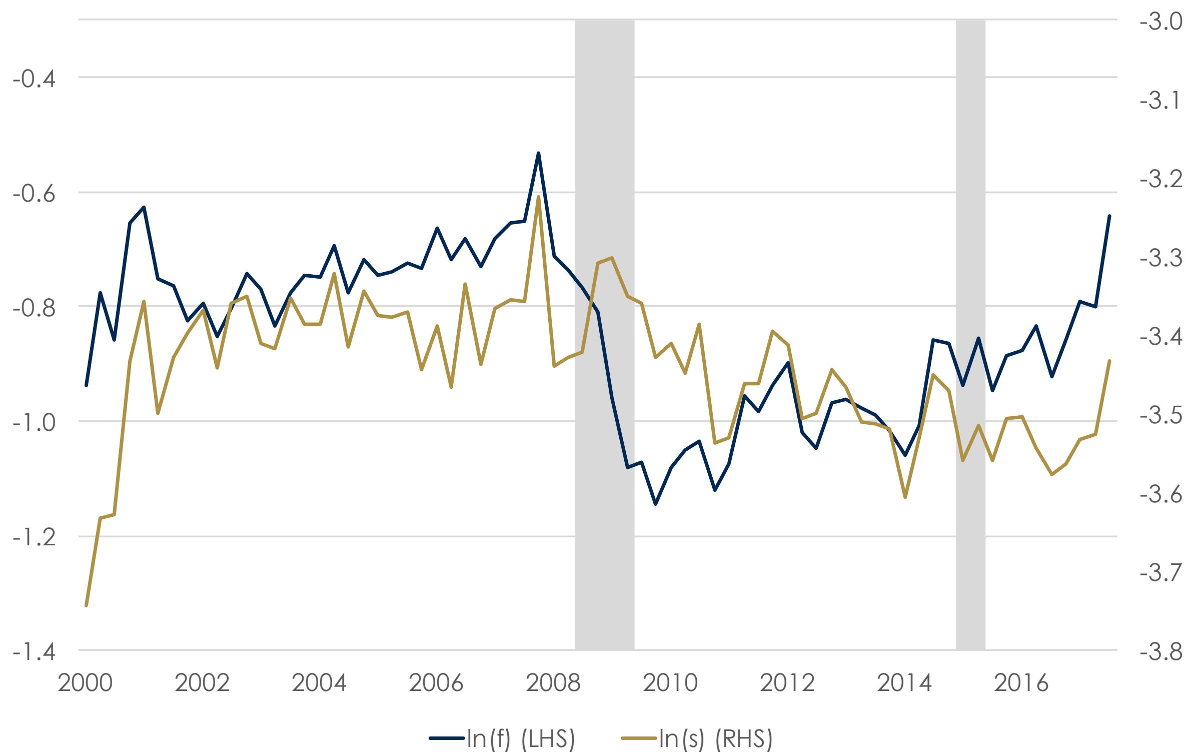
Movements in Quebec's unemployment flows were nevertheless moderate compared to movements observed in Alberta and Saskatchewan, where both provinces experienced dramatic increases in their inflow rate and sharp drops in their outflow rates (Chart 3C and 3D).

Chart 3A: Logs of Job Finding and Exit Rates – Quebec



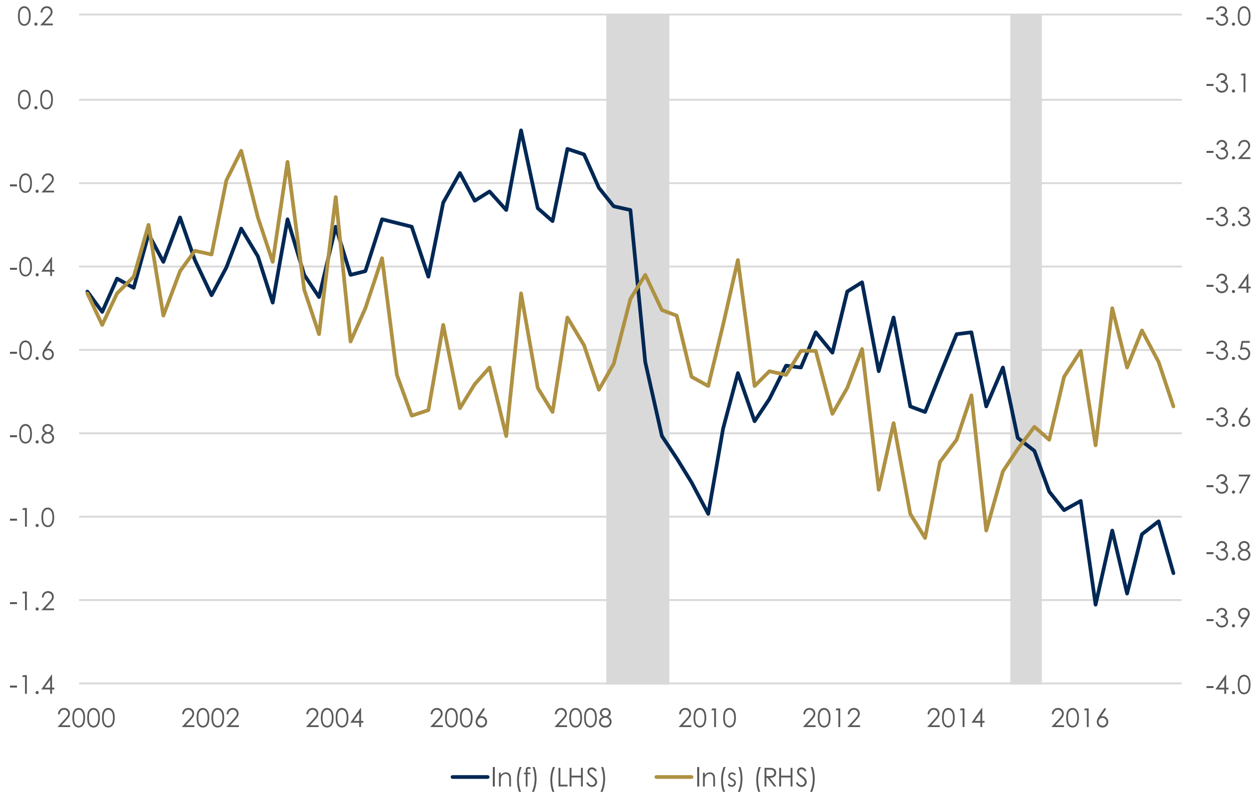
Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Chart 3B: Logs of Job Finding and Exit Rates – Ontario



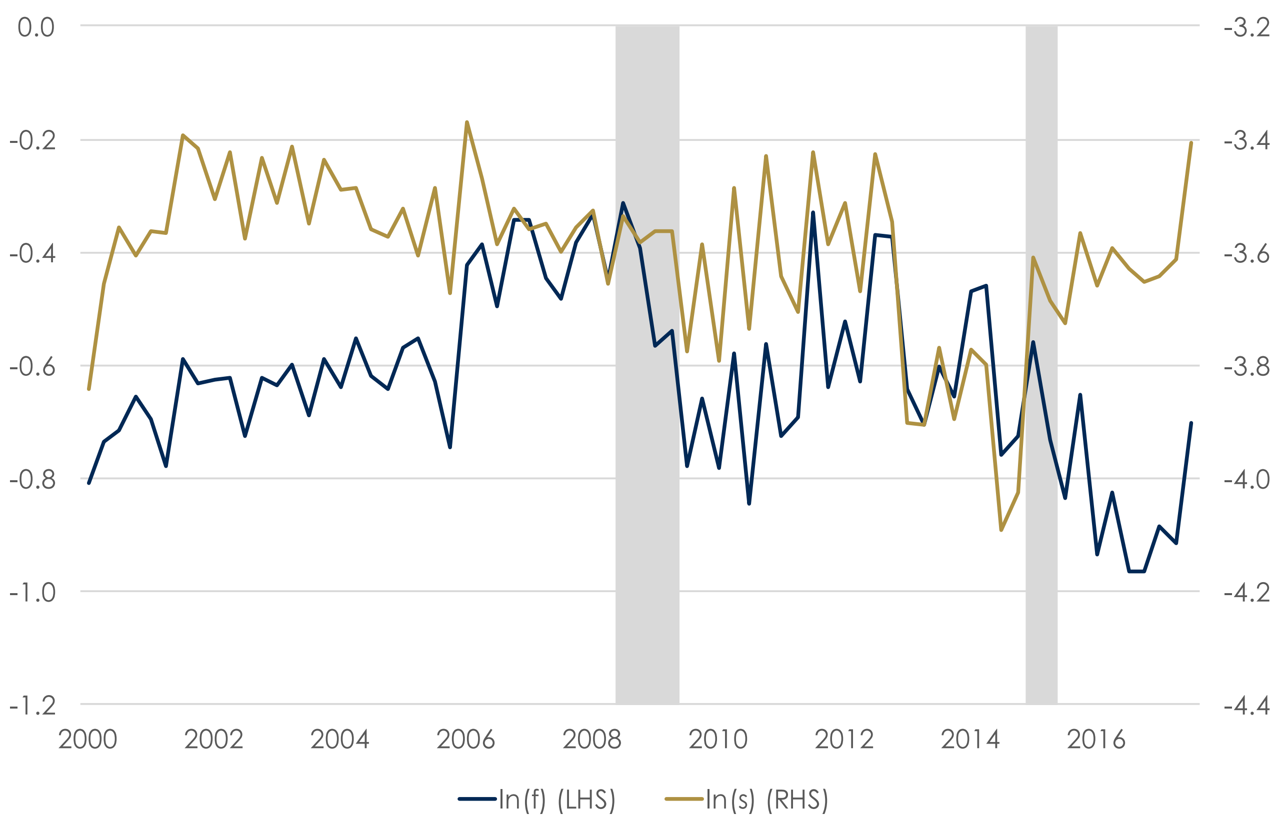
Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Chart 3C: Logs of Job Finding and Exit Rates – Alberta



Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

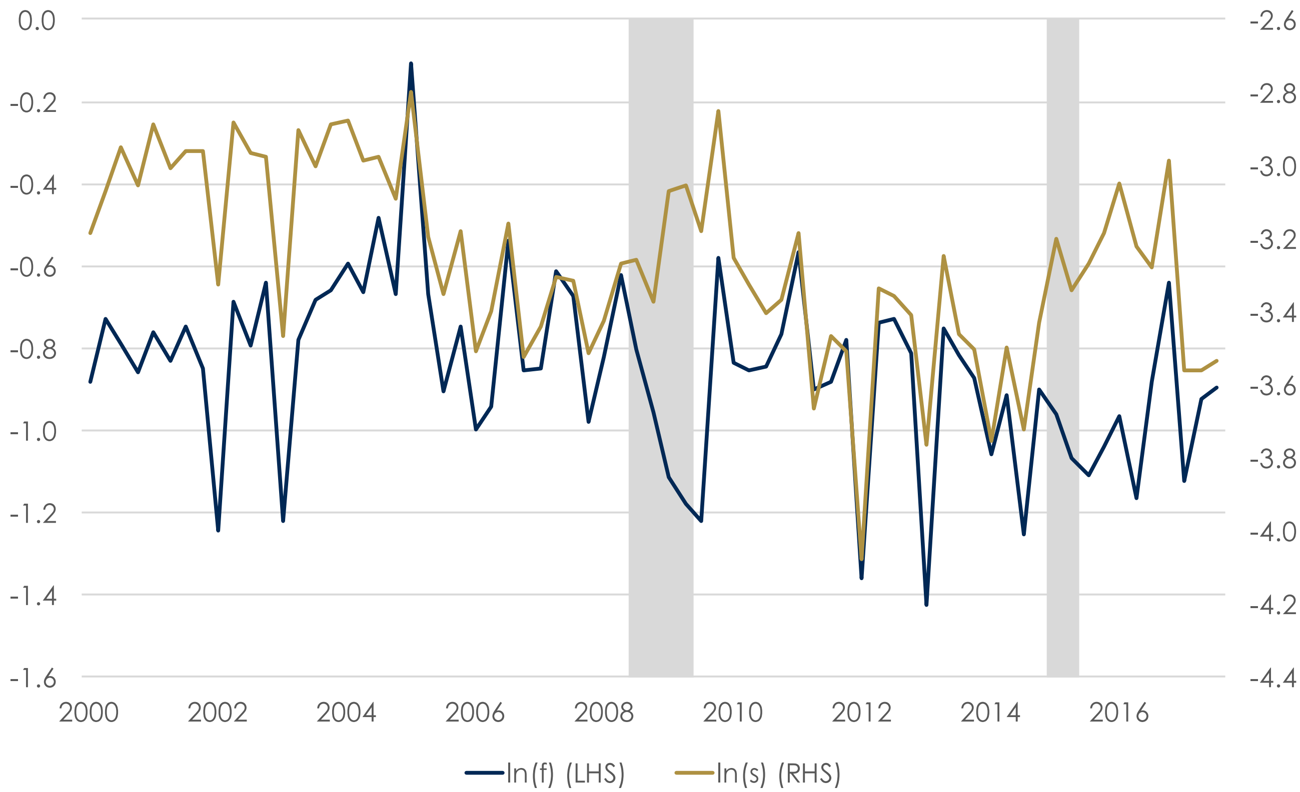
Chart 3D: Logs of Job Finding and Exit Rates – Saskatchewan



Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Looking at specific industries, the 2015 slowdown was of course dramatic for the mining, oil and gas industry (Chart 4A). Between 2008Q2 and 2009Q4, the inflow rate in the commodities sector increased by 42%. That rise was later topped between 2014Q4 and 2016Q4 with a 44% increase. In the manufacturing sector, the outflow rate was hit in 2015 with a 28% drop between 2014Q4 and 2016Q1 (Chart 4B). A rise in inflows and a drop in outflows was also observed in the retail sector around this time, albeit to a more moderate extent (Chart 4C). While it is important to keep in mind that the effect of the economic slowdown in energy-rich provinces also affected the national average in all those industries, the national changes suggest that the 2015 economic downturn in Canada was not necessarily confined to energy-rich provinces.

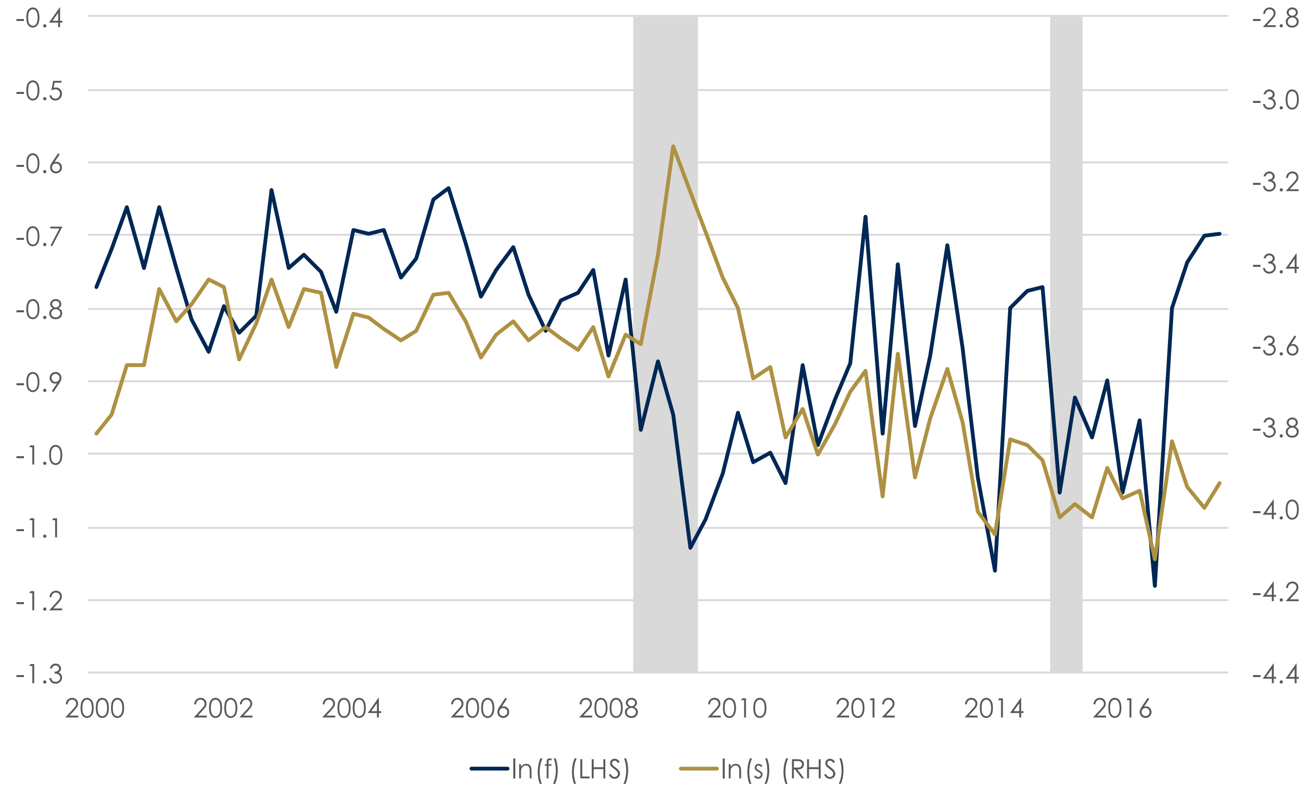
Chart 4A: Logs of Job Finding and Exit Rates – Forestry, Fishing, Mining, Oil and Gas



Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.

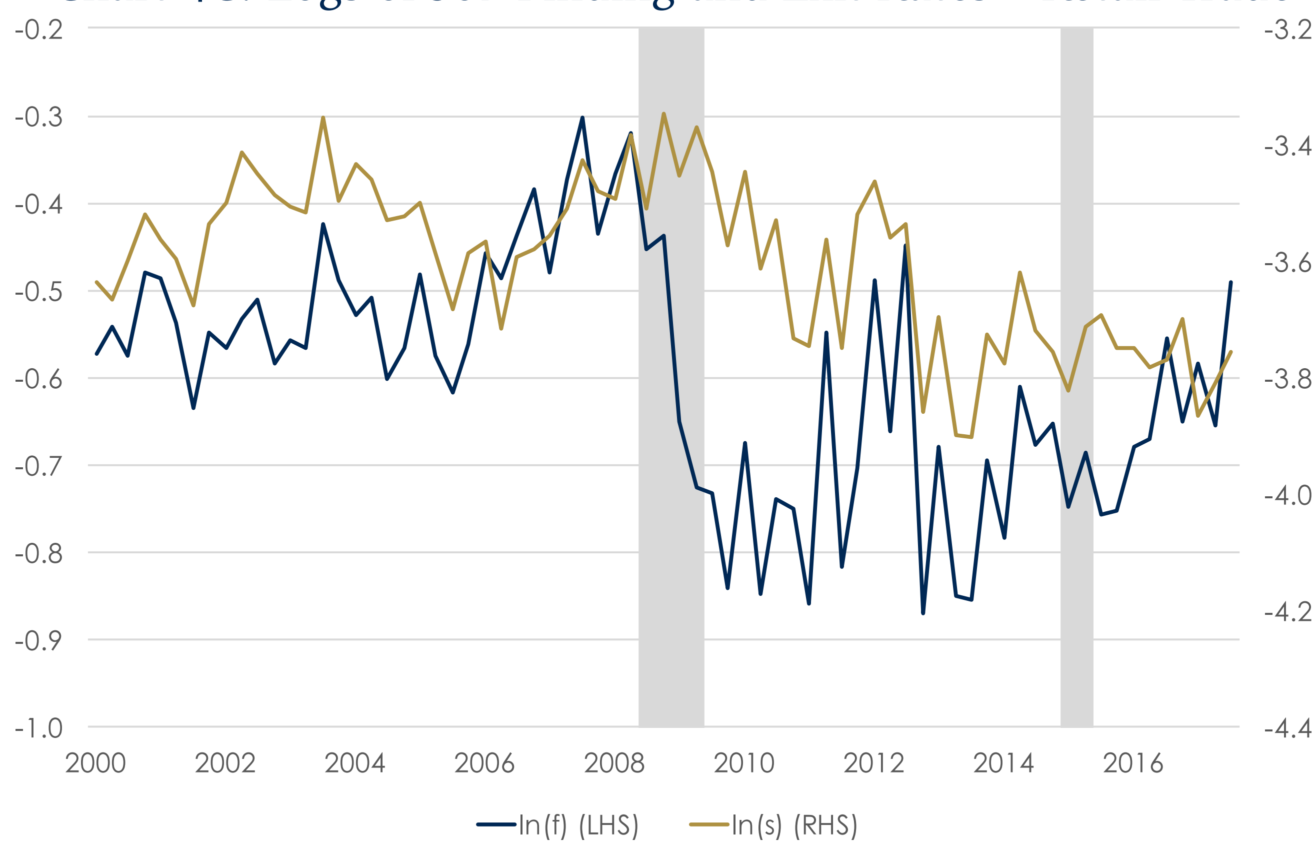
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Chart 4B: Logs of Job Finding and Exit Rates – Manufacturing



Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Chart 4C: Logs of Job Finding and Exit Rates – Retail Trade



Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

More recently, consistent with the pickup in global activity since mid-2016, the Canadian economy has been performing impressively well and so has its labour market.[12] As a reflection of this, the outflow rate has increased by 17% since 2016Q3, an increase almost equivalent to the one observed between 2010Q4 and 2012Q1 in the aftermath of the 2008-09 recession (Chart 2). That pickup in outflows is particularly well defined in Ontario (Chart 3B). Indeed, the provincial outflow rate of the province has almost reached its 2008 pre-recession high. Meanwhile, nationally, the inflow rate has increased by 5% meaning that the speed at which people exit employment has also increased (Chart 2). Looking at our estimated measure of the quits and layoffs rate, a slight uptick in the layoff rate in the second quarter of 2017 might explain part of the moderate increase in the inflow rate.[13]

IV CONTRIBUTIONS FROM UNEMPLOYMENT INFLOWS AND OUTFLOWS TO THE UNEMPLOYMENT RATE

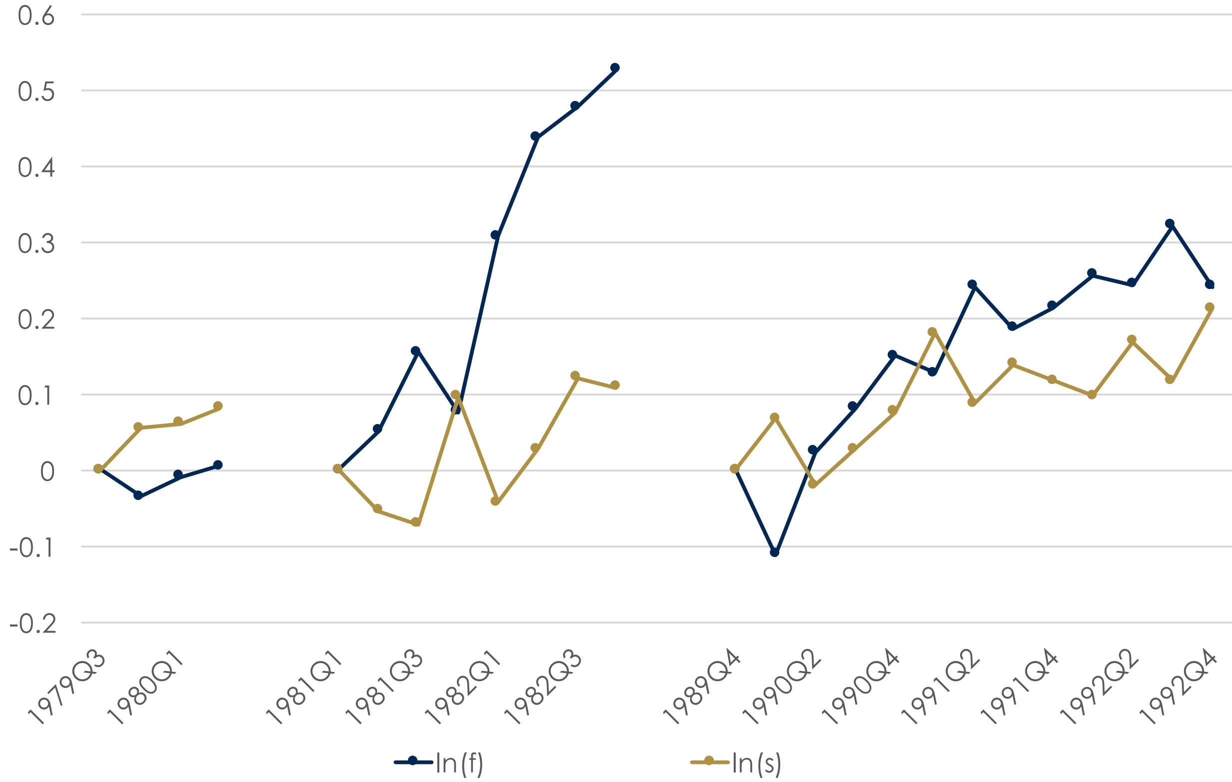
Changes in the unemployment rate can be decomposed into changes in unemployment flows. An increase in the unemployment inflows or a decrease in the unemployment outflows both cause an increase in the unemployment rate. Elsby et al. (2009) for the U.S. and Campolieti (2011) for Canada use change in log flows to understand the relative contributions of each. Formally, Elsby et al. (2009) and Shimer (2012) demonstrate that the change in the unemployment rate can be approximated by a "steady state" unemployment rate in which the inflow and outflow rates are constant. From there, the following relationship can be derived:

$$d \log \bar{u}_t \approx (1 - u_t^*)[dlog\ s_t - dlog\ f_t] \quad (1)$$

where $\bar{u}_t$ is the approximated measure of the unemployment rate and u_t^* is the steady state unemployment rate. Hence, the percentage change in the unemployment rate can be approximated by the difference between the percentage change in the inflow rate and the outflow rate, multiplied by one minus the current steady state unemployment e.g. the steady state employment rate.

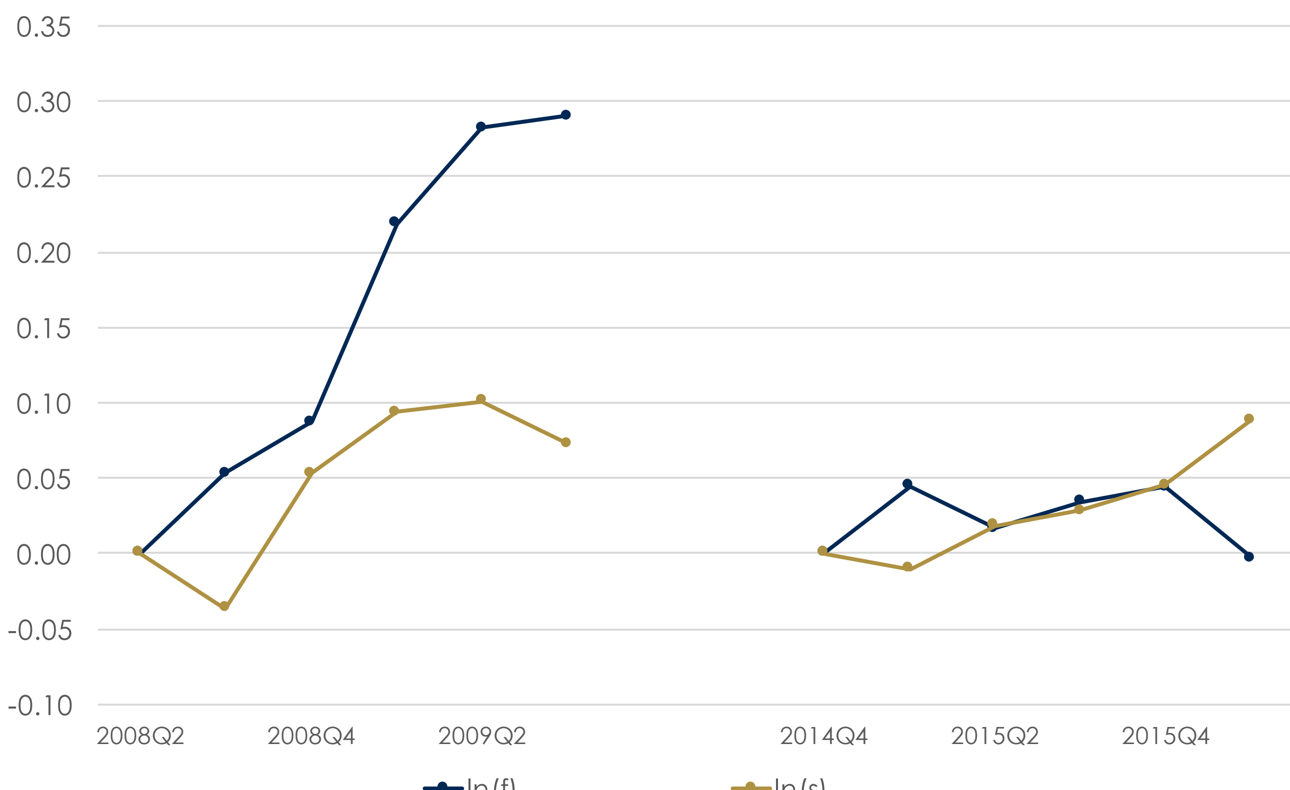
Chart 5 shows the inverse of the cumulative log change in f_t and cumulative log change in s_t around every Canadian recession identified by the Business Cycle Council of Canada since 1976 and in the first half of 2015.[14] In the recessions of 1981-82, 1990-92 and 2008-09, the slowdown in unemployment outflows contributed more to the rise of the unemployment rate than did the unemployment inflows, suggesting that difficulties finding jobs were at the core of the rise in labour market slack, not only massive layouts. The gap is especially large in 1981-82 and 2008-09. On the contrary, in the 1979-80 recession and the 2015 slowdown, inflows ended up contributing more to the rise in the unemployment rate. This rather mixed conclusion differs from the U.S. experience. Indeed, Elsby et al. (2009, Figure 4) shows that outflows were the most important contributor to the rise in U.S. unemployment in all recessions.[15] While recessionary dates vary, the results are also consistent with the Campolieti (2011, Figure 3) log change of unemployment flows in Canada for the 1981-82 and 1990-92 recessions.

Chart 5A: Cumulative Log Change in Unemployment Flows



Sources: Statistics Canada, IFSD calculations.

Chart 5B: Cumulative Log Change in Unemployment Flows



Sources: Statistics Canada, IFSD calculations.

More specifically, using (1) above, Table 1 below decomposes in percentage the rise in the Canadian unemployment rate due to decreases in the outflow rate and increases in the inflow rate. For the three major recessions between 1981 and 2009, outflows explain around three quarters of the rise in the unemployment rate. That finding is broadly consistent with prior research made in the U.S. (Shimer, 2012; Elsby et al. 2009) and Campolieti (2011) for Canada. However, when including the 1979-80 recession and the 2015 slowdown, the picture is more nuanced with around 60% of the rise in unemployment rate on average being caused by inflows. In any case, those averages are merely mechanical exercises and do not take into account the depth, duration, or diffusion of the recessions. This highlights, however, that one must be prudent in asserting which unemployment flows matter the most to the rise in the unemployment rate during an economic downturn, and therefore which policy measures are most appropriate in order to support the population during periods of high unemployment.

Table 1: Disaggregation of Change in the Unemployment Rate

Pre-Recession Low to Recession or Post-Recession Peak			
Dates†	Contribution of Outflows (%)	Contribution of Inflows (%)	Residuals (ppts)
1979Q4-1980Q2	6	97	3
1981Q2-1982Q4	93	19	13
1990Q1-1992Q2	53	47	0
2008Q3-2009Q2	82	21	2
2015Q1-2015Q2	-5	125	21
Average (1981 to 2009)	76	29	5
Average (All)	46	62	8

Sources: Statistics Canada, IFSD calculations.
Notes: Recessions correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.
† Accumulation starts one quarter before recession.

V CONCLUSION

This report presents a simple model of unemployment outflows, the rate at which unemployed workers find a job and exit unemployment, and inflows, the rate at which workers exit their position towards unemployment. This decomposition led to the conclusion that both unemployment inflows and outflows matter during an economic downturn and that both issues—people losing jobs and people having difficulties finding a position—need to be considered. The recent pattern of unemployment flows has been examined. As such, the important rise in unemployment outflows in the last couple of months is consistent with a pickup in Canadian economic activity.

Still, the information available from this model and the data source, Statistics Canada's Labour Force Survey (LFS) Public Use Microdata Files, is rich and the IFSD is expected to comment further on this topic. For instance, information about short-term unemployment and quits and layoffs rate by province can be gleaned from the data and the model. Patterns in quits and layoffs rates can then be compared with caution with some components of the U.S. Job Openings and Labor Turnover Survey (JOLTS). Moreover, the ability of unemployment flows to forecast other major economic indicators will continue to be examined.

Notes

[1] See section 2 for more details on the assumption related to labour flows in and out of the labour force.

[2] As explained in section 2 and Annex A, the outflow rate and inflow rate in this report are interpreted as the relative "speed" over which unemployed workers find jobs and employed workers exit jobs, respectively.

[3] Annex C of this report details IFSD's early efforts to use the unemployment flows as valuable inputs in economic analysis and forecasting.

[4] Academic papers refer to the change in inflow rates and outflow rates as the change in log points since this allows a better comparison of the evolution of the two rates. Since log points are similar to percentage change, that is what they are referred to here.

[5] See Annex B for more details on quits and layoffs rates.

[6] The proportion of the rise in the unemployment rate that comes from outflows versus inflows is sensitive to the definition of recession used and what specific periods are included in the calculation.

[7] It is important to note that F_t and S_t represent the probability to find or lose *at least one* job; during a month, an individual could find or lose more than one job.

[8] The job-finding F_t and exit probability S_t display very similar historical paths than the rates f_t and s_t. As a matter of simplicity and conciseness, we only show the rates.

[9] A spike in f_t and s_t can be observed in 1996 while no economic downturn occurred around this time. Campolieti (2011) suggests that this is due to a modification in the LFS questionnaire which led to more workers being identified as unemployed rather that not in the labour force. Although we are aware of this change, our analysis focuses largely on the change in the level of these variables rather than the level themselves and as such we have not applied any modification to the unemployment data prior to 1996.

[10] We highlight the first half of 2015 "as if it was" a recession in Canada because we judge that the economic slowdown was severe enough to make it interesting as a case study for unemployment flows.

[11] As explained in Section 4 and in Appendix A, using the log of f_t and s_t allows a better understanding of the relative change in unemployment flows as well as their relative contributions to the fluctuations in the unemployment rate.

[12] See the IFSD's September 2017 economic forecast for the latest details about the current evolution of the Canadian economy.

[13] See Annex B for more details on quits and layoff rates.

[14] The recession dates identified by the Business Cycle Council are largely focused on the change in real GDP. The unemployment rate cycle might be slightly different (e.g. lagging). Therefore, in order to capture the full cycle of the unemployment rate spike present in each recession, the starting date of the log accumulation is the quarter prior to the beginning of the recession and the end date is the unemployment rate peak within or after the end of the recession.

[15] Elsby et al. (2009) also highlights the importance of inflows.

Annex A: Methodology

To estimate unemployment flows, we use the methodology presented by Shimer (2012)[1] as well as by Elsby et al. (2009) and applied to Canada by Campolieti (2011) and Bartlett and Tapp (2012).

The main assumption underlying the methodology is that workers find and lose jobs according to a Poisson process, at rates f_t and s_t respectively. These rates cannot be observed in the data. However, the probability that a worker finds at least one job during the month (F_t) can be calculated with LFS data. We first estimate F_t, the probability that a worker finds a job, then using the Poisson distribution we estimate f_t, the rate at which jobs are found. S_t and s_t cannot be estimated the same way because of what is commonly referred to as time-aggregation bias. This bias occurs because a worker can flow into the unemployment pool in a particular month but be reemployed before the survey date. Since the LFS is conducted by Statistics Canada during the week containing the 15th day of the month, an inflow in the unemployment pool for which the person got reemployed prior to that date will not be captured. We use the continuous time-correction (Shimer, 2012) to solve this bias.

We begin with a simple equation that describes the relationship between the level of unemployment in one month and the next:

$$U_{t+1} = (1 - F_t)U_t + U^s_{t+1}$$

U_{t+1}, the level of unemployment in month $t+1$, is the sum of workers who were unemployed in month t and are still unemployed in month $t+1$ and workers who have become unemployed since month t[2]. F_t is the probability that an unemployed worker finds a job during month t, U_t is the unemployment rate in month t and U^s_{t+1} is the level of short-term unemployed (those who have been unemployed for one month or less in month $t+1$).

From there, we can isolate F_t:

$$F_t = 1 - \left(\frac{U_{t+1} - U^s_{t+1}}{U_t}\right)$$

To estimate the unemployment outflow rate, f_t, we use the assumption that workers lose their job according to a Poisson process with probability F_t and rate f_t. In general, a Poisson distribution estimates the probability that an event happens k times, given an average rate of λ, using the function:

$$P\,(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}$$

In our case, λ corresponds to f_t. The probability that a worker finds at least one job during a given month t is F_t. It is equal to subtracting from one the probability that a worker finds no job during a given month. That is:

$$F_t = 1 - P\,(X = 0)$$

$$F_t = 1 - \frac{f_t^{0} e^{-f t}}{0!}$$

$$F_t = 1 - e^{-f t}$$

Solving for f_t, the unemployment outflow rate, we find:

$$f_t = -\ln (1 - F_t)$$

Although the same methodology could in theory be applied to the inflows, as mentioned above, it cannot be used to estimate S_t and s_t because of the time-aggregation bias. Shimer (2012) proposes a solution. Changes in the unemployment level are described using the following differential equation:

$$\frac{du_t}{dt} = -(s_t + f_t)(u_t - u^*_t)$$

where u^*_t is the steady-state unemployment level , where $\frac{s_t}{s_t + f_t} L_t$ is the size of the labour force. Solving this differential equation leads to the following:

$$u_{t+1} = u^*_t - (u_t - u^*_t) exp - (s_t + f_t)$$

This non-linear equation can be solved for s_t. To estimate S_t from s_t, we apply the assumption that workers also exit jobs according to a Poisson process. Similarly, to above, we get:

$$S_t = 1 - e^{-St}$$

Due to the nature of the Poisson process, s_t and f_t are interpreted as monthly statements (discrete measures) of continuous variables. Moreover, as Elsby (2009) and Shimer (2012) note, those monthly measures need the assumption that the flows are constant between monthly surveys.

Finally, we adjust for seasonality using Eview's Census X12 approach and then aggregate to a quarterly frequency by averaging the monthly series.

To compare the respective contributions of inflows and outflows to changes in the unemployment rate, we follow the methodology of Elsby et al. (2009) who use log differentiation of the steady state unemployment rate ($u^*_t = \frac{s_t}{s_t + f_t} L_t$) to obtain the following equation:

$$d \log u^*_t = (1 - u^*_t)[d\log s_t - d\log f_t]$$

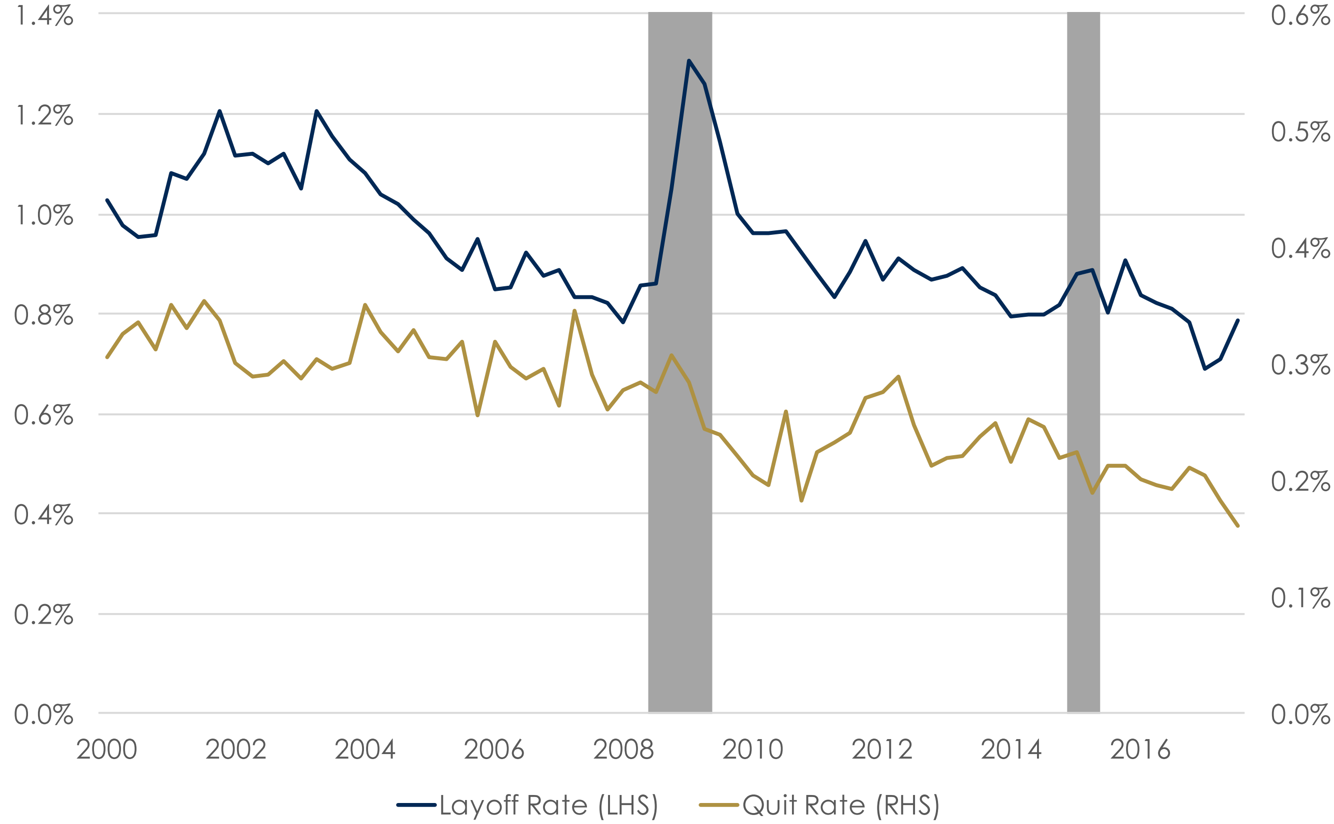
Elsby et al. (2009) found that the unemployment rate ($\bar{u}_t$) can be approximated using the steady state unemployment rate in Anglo-Saxon countries including Canada, which yields the equation used to approximate the contributions of inflows and outflows to changes in the unemployment rate:

$$d \log \bar{u}_t \approx (1 - u^*_t)[d\log s_t - d\log f_t]$$

Annex B: Quits and Layoffs Rate

The model of unemployment flows presented in this paper does not provide a decomposition of unemployment inflows by quits or layoffs. However, Statistics Canada Labour Force Survey (LFS) Public Use Microdata Files also include information on people who recently became unemployment either by quitting or losing their job.[3] Therefore, it is possible to estimate, as a share of total employment, the quits and layoffs rates (Chart B1). As expected, the layoff rate generally increases and the quit rate usually decreases during economic downturns. The layoff rate slightly increased from 0.8% to 0.9% in 2015Q1. It has since then fallen back to 0.7% with a moderate uptick in June and July 2017. The quit rate fell and rebounded slightly in 2015 but has continued to trend downward since then.

Chart B1: Quits and Layoff Rate



Sources: Statistics Canada, IFSD calculations. Last data point is 2017Q3.
Note: Shaded areas correspond to the Business Cycle Council of Canada designated recessions except 2015Q1-2015Q2.

Annex C: Unemployment Flows as Economic Indicator

This section presents the early work that the IFSD has been conducting into using the rate of unemployment flows s_t and f_t as useful economic indicators that could potentially be used in forecasting models of the Canadian economy. So far, efforts have been focused on the relationship between the unemployment flows and real GDP growth and have not found significant predictive power over the use of the standard unemployment rate in similar frameworks.

Table C1 below presents the cross correlation (up to three lags) of the log of unemployment outflow and inflow rates, the employment growth rate and the unemployment rate.[4]

Table C1: Labour Indicators Cross-Correlation With Real GDP

	Outflow Rate	Inflow Rate	Employment	Unemployment Rate
Lag 0	0.32 *	-0.11	0.68*	0.60*
Lag 1	0.26*	-0.13	0.48*	0.46*
Lag 2	0.13	-0.11	0.22*	0.23
Lag 3	0.06	0.00	0.00	-0.01

Sources: Statistics Canada, IFSD calculations.
* Significant at the 95% confidence level.

The outflow rate is indeed significantly correlated to real GDP contemporaneously and at a one quarter lag. However, so is employment and unemployment. Meanwhile, it has been found that the inflow rate is not significantly correlated to real GDP.

Simply observing linear cross correlation with real GDP might not provide a complete picture of the relationship between inflow rates and economic growth. The basic idea is that the relationship between labour market indicators and economic growth might be asymmetric e.g. non-linear. Over a certain state of the economy (a period of strong growth), a rise or fall in the unemployment rate or the unemployment outflow rate might not have the same effect as in another period (a recession for instance). The Markov-Switching autoregressive model developed by Hamilton (1989) allows relationships between variables to be modelled in two separate (unidentified) states. The conditional probability of switching from one state of the economy to another is governed by a hidden Markov chain. Therefore, the state in which the economy finds itself is endogenous.

Using real GDP growth as the dependent variable and the unemployment outflow rate as the independent variable in a Markov Switching GDP model similar to Hamilton (1989) and McCulloch and Tsay (1994), we find that this framework captures well the business cycle, identifying the states as growth periods versus GDP. Moreover, we find that the effect of the outflows (f) in a recession state (State 2 in Table C2) is much larger than in State 1 (56, 10 and 5 times larger at lag 0, 1 and 2 respectively). The coefficients are also all significant, which is not the case in the expansion state. Overall, one could conclude that movements from the unemployment pool to the employment up to 9 months ahead in a recession have an impact on current economic activity.

Table C2: MSA Model (with Outflow Rate)

Variable	Coefficient	Std. Error
State 1		
Constantǂ	0.008	0.001
dlog(ƒ)	-0.002	0.012
dlog(ƒ) (-1)	0.006	0.11
dlog(ƒ) (-2)	0.005	0.010
State 2		
Constantǂ	0.004	0.000
dlog(ƒ)ǂ	0.091	0.017
dlog(ƒ) (-1)ǂ	0.061	0.013
dlog(ƒ) (-2)ǂ	0.023	0.013
Common		
AR (1)ǂ	0.298	0.096
LOG (SIGMA)ǂ	-5.283	0.072

Source: Statistics Canada and IFSD calculations.
ǂ Significant at the 95% confidence level.

However, replacing the unemployment outflows with a standard measure of the unemployment rate actually yields better modelling outcome, limiting the relative usefulness of using the outflows to predict real GDP growth. Going forward, the IFSD will continue to investigate the ability of unemployment flows to predict major economic indicators in Canada.

Appendix Notes

1 The article Reassessing the Ins and Outs of Unemployment was originally published by Robert Shimer in 2005, then republished by the National Bureau of Economic Research in 2007 and then by the Review of Economic Dynamics in 2012. The latter is cited throughout this report.

2 Short-term unemployment is defined in the Canadian context as LFS respondents who declared to have been without a job and actively looking for one for the last four weeks or less.

3 With an unemployment spell of four weeks or less.

4 The Dickey-Fuller GLS-Augmented unit root test has been used for stationarity testing. Throughout the appendix, it is considered for convenience and comparability purposes that all variables are integrated of order 1. Therefore, the unemployment rate is used in first difference while the unemployment flows, employment growth and real GDP growth are used in log change.

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