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Staff Discussion Paper/Document d'analyse du personnel 2016-2

Extending the Labour Market Indicator to the Canadian Provinces

by Alexander Fritsche and Katherine Ragan

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Bank of Canada Staff Discussion Paper 2016-2

January 2016

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ISSN 1914-0568

Acknowledgements

We would like to thank Konrad Zmitrowicz and Mikael Khan for providing us with their programming code and for helping us to better understand some of the data concepts. We would also like to thank Laurent Martin, Farrukh Suvankulov as well as our colleagues in the Bank's regional offices for their help and comments.

Abstract

Calculating the labour market indicator (LMI) at the provincial level provides useful insights into Canada's regional economies and reveals differing trends in the state of underlying labour market conditions across provinces. Conclusions based on the Canadian LMI do not necessarily translate to the provinces. In most cases, the correlations between the provincial LMIs and the underlying labour market variables have the expected sign. Differences among provinces reflect idiosyncratic differences among provincial labour markets. The values of the provincial LMIs are not invariant to the sample period used when constructing them. We find that using a longer sample estimation period improves the properties of some of the provincial LMIs. Recent values for the LMI show that labour markets have deteriorated notably in Alberta, Saskatchewan, and Newfoundland and Labrador. At the same time, the LMIs for British Columbia, Ontario, Quebec and New Brunswick have improved over the course of the past year and the gap between the unemployment rate and the LMI has tended to narrow.

JEL classification: E2, E24, E27, J2, J21, J23
Bank classification: Labour markets; Recent economic and financial developments

Résumé

Le calcul de l'indicateur du marché du travail (IMT) à l'échelle provinciale donne des indications utiles sur les économies régionales au Canada et met en évidence les évolutions différenciées des conditions sous-jacentes du marché du travail d'une province à l'autre. Les conclusions tirées de l'IMT canadien ne se vérifient pas forcément à l'échelle des provinces. Dans la plupart des cas, les corrélations entre les IMT provinciaux et les variables sous-jacentes du marché du travail présentent le signe attendu. Les différences entre les provinces témoignent des spécificités des marchés du travail provinciaux. Les valeurs des IMT provinciaux sont influencées par la période choisie au moment de l'élaboration de ces indicateurs. Il ressort de notre analyse que le choix d'une plus longue période d'estimation permet d'améliorer les propriétés de certains des IMT provinciaux. D'après les dernières valeurs de l'IMT, le marché du travail s'est particulièrement détérioré en Alberta, en Saskatchewan et à Terre-Neuve-et-Labrador. Parallèlement, les IMT de la Colombie-Britannique, de l'Ontario, du Québec et du Nouveau-Brunswick se sont améliorés depuis un an et l'écart entre le taux de chômage et l'IMT a eu tendance à se rétrécir.

Classification JEL : E2, E24, E27, J2, J21, J23
Classification de la Banque : Marchés du travail; Évolution économique et financière récente

1 Introduction

This paper extends the labour market indicator (LMI) to Canada's provinces. Recent analysis by the Bank of Canada on the state of the Canadian labour market since the Great Recession (Zmitrowicz and Khan 2014) found that the unemployment rate, the most widely used measure of labour market conditions, likely overstated the extent of post-recession recovery in Canada's labour market. Using eight measures of labour market conditions, Zmitrowicz and Khan (2014) constructed a composite LMI as a benchmark against which the unemployment rate can be evaluated. Due to its simplicity and informative value, the LMI has become a useful monitoring tool for the Bank. By extending the LMI to the provincial level, regional differences in underlying labour market conditions prior to and since the Great Recession can be explored. The provincial LMIs therefore provide a new regular monitoring tool for regional analysis that can help the Bank better understand regional labour market conditions as the economy undergoes a complex adjustment to the decline in commodity prices.

The paper is organized as follows: section 2 provides a brief overview of the methodology and explains how the methods were applied in the provincial context. Section 3 provides an overview of the variation among labour market measures across the provinces. Section 4 compares the relationship between the LMI and the unemployment rate across the provinces. Section 5 explores the correlations between the LMI and each underlying labour market measure across provinces. Section 6 concludes.

2 Methodology

Following Zmitrowicz and Khan (2014), we construct provincial-level labour market indicators (LMI) based on eight labour market variables using a statistical method known as principal component analysis (see, for example, Johnson and Wichern 2007).[1] For each province, we begin by extracting the first principal component from these labour variables. Because the principal component is based on standardized data, we regress it on the unemployment rate and a constant in order to bring it into the unemployment rate space. The fitted values of that regression become the LMI. This procedure ensures that the LMI is comparable to the unemployment rate.

The labour variables used to create the LMI are the labour underutilization rate,[2] long-term unemployment rate, job-finding rate, separation rate, labour force participation rate, average hours worked, nominal wage growth, and the unemployment rate. All the required data are available from Statistics Canada at the provincial level. The job-finding rate and the separation rate are constructed

[1] Principal component analysis extracts the common movement across these variables to build a summary measure of labour market activity. This technique identifies patterns in data by converting a set of possibly correlated variables into a set of linearly uncorrelated variables called principal components. The first principal component accounts for as much of the variability in the data as possible.

[2] The labour underutilization rate, R8, is a broader measure of the unemployment rate that includes discouraged searchers, the waiting group and a portion of involuntary part-timers.

manually using data on the number of individuals employed and unemployed, and the number of individuals unemployed for one to four weeks (short-term unemployed).[3]

Unlike Zmitrowicz and Khan (2014), who estimate the LMI using monthly data from January 2003 onward, we estimate the LMI using monthly data starting in January 1998. Because Zmitrowicz and Khan compare Canada with the United States, they are constrained by U.S. data limitations. Since we have no such restriction, we can take advantage of the longer time series available for the provinces. As a result, we are able to calculate the provincial LMIs starting as early as January 1998.[4] However, since the construction of the LMI involves a forward lag in the calculation of the job-finding and separation rates, we can calculate the LMI for each province up to November 2015.[5]

Lastly, because the LMI is constructed using principal component and regression analysis, the sample estimation period also affects the estimated values for the LMI. With each new data point that is added, the loading factors of the principal components change slightly, as does the relationship between the first principal component (PC1) and the unemployment rate, thus resulting in a slightly different value for the LMI for the entire sample period. To avoid the problem of changing historical values from one month to the next, we estimate the LMI over a base period, specifically the period from January 1998 to January 2015. Beyond the base period, we hold the loading factors for the principal components as well as the coefficients from the regression on the unemployment rate constant. In the future, this base period can be extended to ensure that the weights remain relevant.

3 Variation of labour market measures among provinces

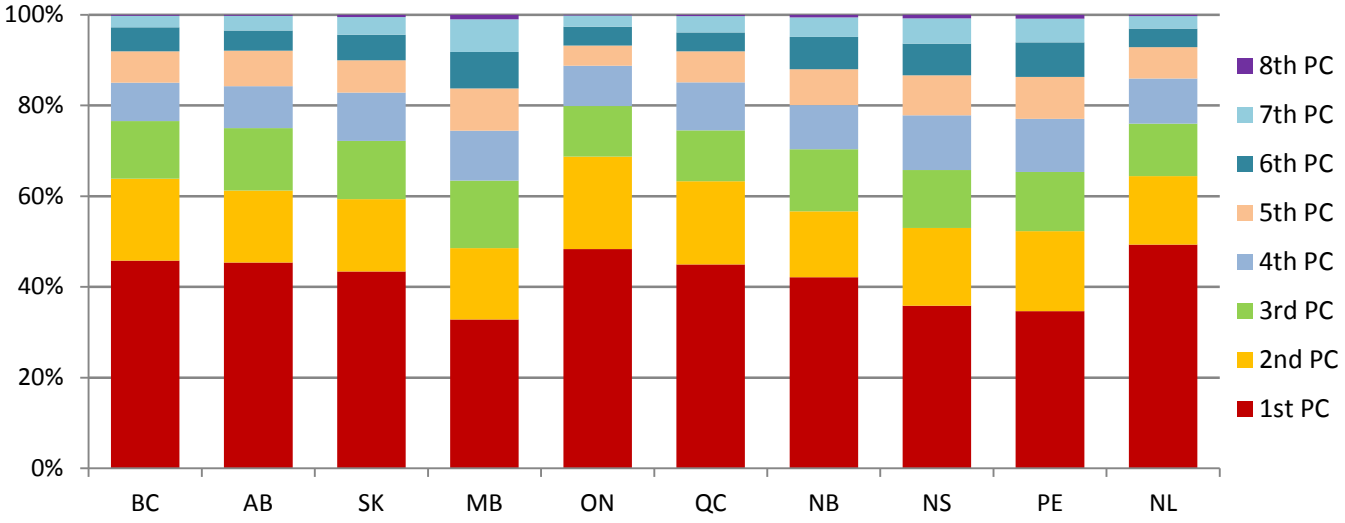
Each principal component explains a portion of the variation in the labour market data for each province. However, the portion of the variance explained by the first principal component (PC1) varies among provinces (Chart 1). In fact, the proportion of the variance explained by all of the principal components tends to differ somewhat among the provinces. This speaks to the regional nature of labour markets and to idiosyncratic differences among the provinces, including different data variances related to the relative size of the provinces.

[3] Zmitrowicz and Khan (2014) construct the job-finding and separation rates before seasonally adjusting the data. This adjustment sequence was possible for all provinces except Prince Edward Island and Newfoundland and Labrador, for which negative numbers in the calculated rates made multiplicative seasonal adjustment impossible. In these two cases, we seasonally adjusted the component series before calculating the job-finding and separation rate. We found that this did not affect the dynamics of the labour market indicator in either case.

[4] Data for R8, the broadest measure of unemployment, as well as data for provincial wage rates are only available starting in January 1997. Since we use annual wage growth in the principal component analysis, our estimation period begins in 1998.

[5] The extended estimation period is preferable for the construction of the LMI at the provincial level since it reduces the number of counterintuitive signs between the LMI and several underlying labour market variables, especially in the case of Quebec (see Appendix C).

Chart 1: Share of the variation in labour market measures explained by the eight principal components
For Alberta and Ontario, the first principal component explains a larger share of the variation among the labour market measures than for other provinces.



For Ontario, and Newfoundland and Labrador, the PC1 explains roughly 50 per cent of the variance across labour market measures. By contrast, for Manitoba, Prince Edward Island and Nova Scotia, the PC1 explains only about 30 per cent of the variance across labour market measures. Part of this difference can be attributed to the fact that variation in the data naturally increases for smaller provinces. However, idiosyncratic differences among provincial labour markets may also play a role. For instance, for Quebec, the PC1 explains notably less of the variance among the labour market indicators than for Newfoundland and Labrador, even though Quebec is considerably larger. Similarly, the PC1 explains somewhat more of the variance in labour market measures in Ontario than it does in British Columbia or Alberta.

4 Comparing provincial unemployment rates and LMIs

Evolution of provincial LMIs since the Great Recession

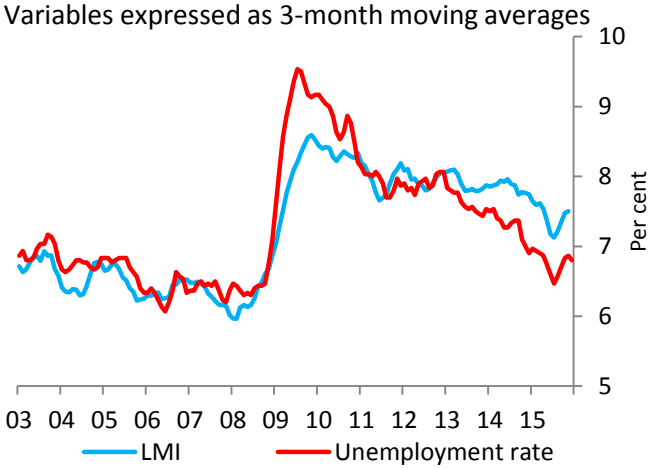
In general, the LMI is less volatile than the unemployment rate itself. This is true for all of the provinces as well as for Canada as a whole. Whether the LMI falls above or below the unemployment rate at any given time provides an indication of whether underlying labour market conditions are better or worse than suggested by the unemployment rate alone.

A full set of charts with provincial LMIs is provided in Appendix A. Examining the charts yields notable regional differences in the relationship between the unemployment rate and the LMI at the provincial level. When constructed using the established methodology, this relationship can be categorized according to three general patterns.

Pattern 1: *The LMI for the province has evolved much in the same way as the LMI for Canada.*[6] That is, the unemployment rate was higher than the LMI during the recession and fell more rapidly than the LMI in the years since, trending above the unemployment rate since then (Chart 2). This pattern occurs for Ontario, British Columbia, Quebec and, until recently, Alberta. The pattern indicates that other measures of labour market conditions have not improved as much as the unemployment rate in these provinces. The divergence of the LMI from the unemployment rate in Ontario and British Columbia can be explained by a prolonged and slow recovery in the job-finding rate and the slow decline in the percentage of long-term unemployed following the recession.

Chart 2: Similar pattern to Canada: LMI has trended above the unemployment rate – e.g. Ontario

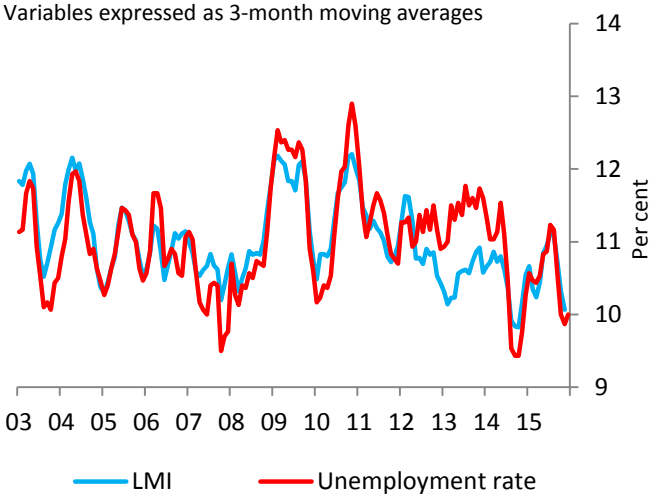
Variables expressed as 3-month moving averages



Pattern 2: *The LMI for the province has tended to be below the unemployment rate for parts of the post-recession period* (Chart 3). This pattern occurs in Prince Edward Island and to a lesser extent in New Brunswick. The divergence can be notable, but appears to have reversed for both New Brunswick and Prince Edward Island starting in 2014. The trend is not visible elsewhere in Canada, suggesting that underlying labour market conditions between 2012 and mid-2014 were better than would be suggested by the unemployment rate alone. One explanation for this relative improvement could be a steeper recovery in the labour underutilization rate in New Brunswick and Prince Edward Island. However, the small size of each of these provinces may affect the reliability of the labour market indicator.[7]

Chart 3: Different pattern from Canada: Recent LMI was below the unemployment rate for parts of the post-recession period – e.g. Prince Edward Island

Variables expressed as 3-month moving averages



[6] For references to the Canadian LMI, see Zmitrowicz and Khan (2014).

[7] Subsequent analyses may calculate the LMIs based on the regional aggregates used in the *Business Outlook Survey*: British Columbia, the Prairies (Alberta, Saskatchewan and Manitoba), Ontario, Quebec, and the Atlantic provinces (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador).

Pattern 3: *The LMI for the province has closely followed the unemployment rate since 2003, suggesting that the unemployment rate is a fairly accurate reflection of underlying labour market trends* (Chart 4). This pattern occurs for Manitoba and Saskatchewan, two provinces with generally little variation in unemployment rates. It is also true for Nova Scotia and Newfoundland and Labrador, which have historically experienced much more volatility in the unemployment rate.

Table 1 summarizes these findings.

Chart 4: The LMI generally follows the unemployment rate closely – e.g. Manitoba

Variables expressed as 3-month moving averages

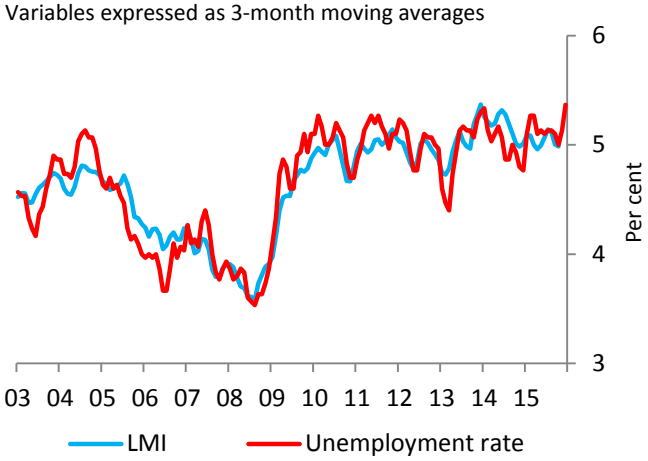


Table 1: Relationship between the LMI and the unemployment rate

Pattern 1: ***The LMI has trended above the unemployment rate since the recession***	**Pattern 2:** ***The LMI has trended partially below the unemployment rate since the recession***	**Pattern 3:** ***The LMI moves closely with the unemployment rate***
Canada	Prince Edward Island	Saskatchewan
British Columbia	New Brunswick	Manitoba
Alberta		Nova Scotia
Ontario		Newfoundland and Labrador
Quebec		

Recent developments in provincial LMIs

In October 2015, the LMI for Canada (7.3)[8] remained above the national unemployment rate (7.0 per cent), suggesting that the unemployment rate continues to overstate labour market conditions for Canada as a whole. However, the difference between the two has been narrowing. Among the provinces, the difference between the unemployment rate and the LMI continues to exhibit a notable range (Table 2). However, for nearly all provinces, recent values of the LMI are also higher than the unemployment rate. For New Brunswick and Ontario, the difference between the two indicators is the largest, indicating that the unemployment rate continues to overstate labour market conditions in those provinces. Conversely, as a result of the recent deterioration in the labour markets of Alberta and Saskatchewan, the unemployment rate has moved above the LMI, indicating that labour market conditions in those provinces have not deteriorated by quite as much as suggested by the change in the unemployment rate. However, the deterioration in the LMI for both Alberta and Saskatchewan has been sizable over the course of the past year.

[8] For the latest values of the Canadian LMI see http://www.bankofcanada.ca/rates/indicators/capacity-and-inflation-pressures/.

Table 2: Recent developments in provincial LMIs					
Province/Region	**LMI** Nov 2015	LMI change from Oct 2015	LMI change from Nov 2014	**Unemployment rate** Nov 2015	LMI less U-rate Nov 2015
British Columbia	6.7	0.0	-0.1	6.3	0.4
Alberta	6.5	0.2	1.3	6.7	-0.2
Saskatchewan	5.1	0.1	1.1	5.4	-0.3
Manitoba	5.5	0.1	0.1	5.5	0.0
Ontario	7.5	0.0	-0.3	6.9	0.6
Quebec	8.0	0.1	-0.2	7.6	0.3
New Brunswick	9.6	-0.2	-0.5	8.8	0.8
Nova Scotia	8.8	0.1	0.3	8.4	0.4
Prince Edward Island	10.1	-0.3	-0.1	9.9	0.2
Newfoundland and Labrador	13.3	-0.2	0.8	13.2	0.1

Note: Changes reflect changes between 3-month moving average LMI values.

On a month-to-month basis, the 3-month-moving-average LMI of most provinces ticked up in November 2015, with worsening labour market conditions centred in the Prairies. The LMI increased (i.e. deteriorated) in Alberta, Saskatchewan, Manitoba, Quebec and Nova Scotia. The LMI edged down (i.e. improved) in New Brunswick, Prince Edward Island, and Newfoundland and Labrador. The LMI in British Columbia and Ontario was unchanged from October to November.

While the Canadian LMI has been improving compared to a year ago, this is true for only a select number of provinces. The largest year-over-year improvements occurred in Ontario and New Brunswick, both of which have seen declines in the LMI of roughly 0.3 percentage points and 0.5 percentage points, respectively, since November 2014. In Alberta, the decline in oil prices that began in 2014 has resulted in an increase of 1.3 percentage points in the LMI. In fact, throughout 2015, the Alberta LMI steadily increased and is approaching levels last seen during the recession in 2009. Much of the deterioration in the Alberta LMI is the result of a weakening of several underlying factors. For instance, the job-finding rate has dropped to levels lower than in the last recession; meanwhile, the separation rate, the underutilization rate and the long-term unemployment rate increased substantially over the course of 2015. Similarly reflecting the decline in oil prices, the LMIs for Saskatchewan and Newfoundland and Labrador have increased by 1.1 percentage points and 0.8 percentage points, respectively, from the previous year.

5 Comparing correlations among provincial LMIs

Appendix B contains a full set of charts for the correlations of underlying labour market variables and the provincial LMIs. Table 3 and Table 4 summarize the aggregate results.

Overall, the large majority of the correlations between labour market variables and the provincial LMIs have the expected sign. In the few cases where the sign is counterintuitive, the correlation between the variable in question and the unemployment rate also does not have the expected sign. In that sense, to

the extent that the unemployment rate partially reflects the state of regional labour markets, the counterintuitive sign for the correlation is neither without precedent nor entirely unexpected. Moreover, counterintuitive correlations may appear if some underlying labour market variables exhibit more variation than others and are therefore more represented in the first principal component. Differences in variation in the underlying labour market data can reflect idiosyncrasies in regional labour markets, differences in industrial structure, and the size of the labour market in general.

Table 3: Expected sign of correlations between LMI and underlying labour market variables

	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Unemployment rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Underutilization rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Long-term unemployment rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prime-age participation rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Average hours worked	✓	✗	✗	✗	✗	✓	✗	✗	✓	✓
Wage growth	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓
Job-finding rate	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓
Separation rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: Correlations with checkmarks have the expected sign. X represents a counterintuitive sign. Correlations in grey are not significant at the 5% level. In all cases with counterintuitive correlations, the correlation with the unemployment rate is of equal sign and similar magnitude, i.e. equally counterintuitive.

Overall, the correlation of the underlying labour market measures with the LMI varies notably among the provinces.[9] However, the relationship between the provincial correlations and the underlying labour market measures can be categorized into four general categories, as outlined in Table 4.

Table 4: Comparison of correlations between LMI and underlying labour market variables

	Pattern	Variables
1 -	Correlations with the LMI tend to be strongly positive for most provinces.	Underutilization rate Unemployment rate
2 -	Correlations with the LMI tend to be positive, but exhibit a wide range of values among the provinces.	Long-term unemployment rate Separation rate
3 -	Correlations with the LMI tend to be negative, but exhibit a wide range of values among the provinces.	Prime-age participation rate Wage growth Job-finding rate
4 -	Correlations with the LMI tend to be relatively modest and exhibit a range of positive and negative values.	Average hours worked

[9] Reflecting our longer estimation period and higher variability in provincial data, these correlations can differ from the correlations reported in Zmitrowicz and Khan (2014) for the Canadian LMI.

6 Conclusion

Calculating the LMI at the provincial level provides useful insights into Canada's regional economies and reveals differing trends in the state of underlying labour market conditions across provinces.

Conclusions based on the Canadian LMI do not necessarily translate to the provinces:

- For British Columbia, Alberta, Ontario and Quebec, the LMI has tended to be above the unemployment rate after the recession. This trend mirrors that of Canada. For Saskatchewan, Manitoba, Nova Scotia, and Newfoundland and Labrador, the LMI has tended to closely follow the unemployment rate and does not seem to provide notably more information on the state of the provincial labour market.
- For Prince Edward Island and New Brunswick, the LMI has tended to be below the unemployment rate for part of the period following the recession. This suggests that underlying labour market conditions between 2012 and mid-2014 were better than would be suggested by the unemployment rate alone.

In most cases, the correlations between the provincial LMIs and the underlying labour market variables have the expected sign and only in a few cases are the signs of the correlations counterintuitive. Most correlations with underlying labour market variables feature a wide range of values; however, correlations with the underutilization rate and the unemployment rate tend to be nearly uniformly strong. Differences in correlations are likely a reflection of idiosyncratic differences among provincial labour markets that are shaped by factors such as industrial structure, provincial regulations and overall size of the labour market.

As shown in Appendix C, the values of the LMI are not invariant to the sample period used when constructing it. Using a longer sample estimation period results in meaningfully different LMIs for Quebec, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador than would be obtained using the estimation period employed by Zmitrowicz and Khan (2014). For the remaining provinces, the choice of estimation period has a relatively minor impact on the range of the LMI estimates.

Recent values for the LMI show that labour markets have deteriorated notably in the energy-producing provinces of Alberta, Saskatchewan, and Newfoundland and Labrador. In fact, as a result of the recent deterioration in Alberta and Saskatchewan, the unemployment rate in those provinces has moved above the LMI for the first time since the recession. At the same time, the LMI for British Columbia, Ontario, Quebec and New Brunswick has improved over the course of the past year and the gap between the unemployment rate and the LMI has tended to narrow.

References

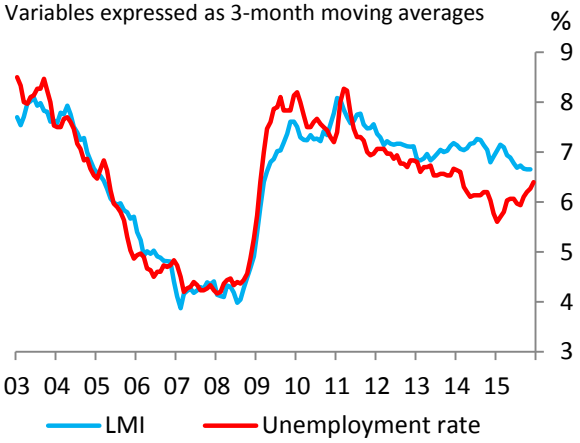
Johnson, R. and D. Wichern. 2007. *Applied Multivariate Statistical Analysis* (6th ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

Zmitrowicz, K. and M. Khan. 2014. "Beyond the Unemployment Rate: Assessing Canadian and U.S. Labour Markets Since the Great Recession." *Bank of Canada Review* (Spring): 42–53.

Appendix A: Comparing provincial unemployment rates and LMIs

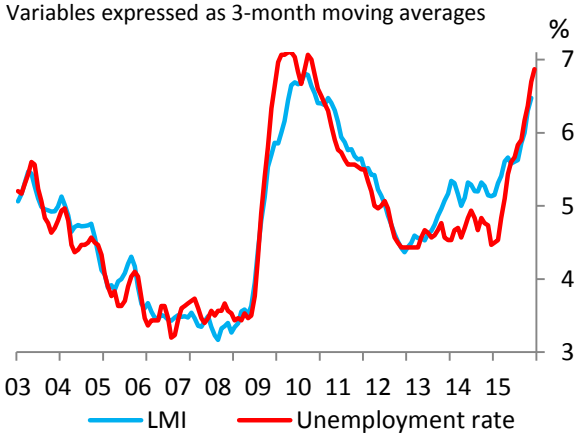
British Columbia

Variables expressed as 3-month moving averages



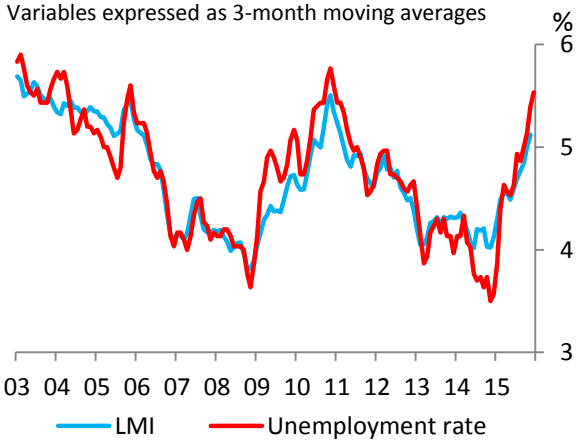
Alberta

Variables expressed as 3-month moving averages



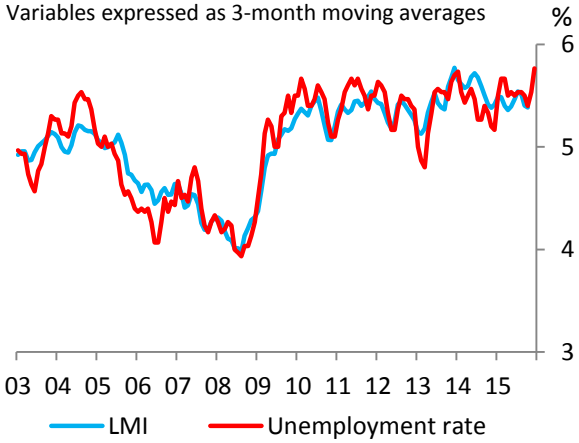
Saskatchewan

Variables expressed as 3-month moving averages



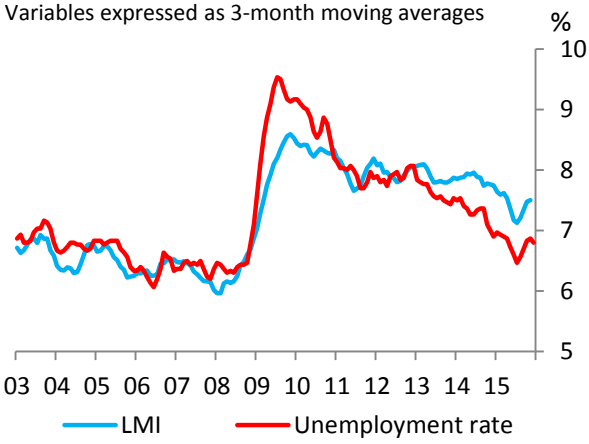
Manitoba

Variables expressed as 3-month moving averages



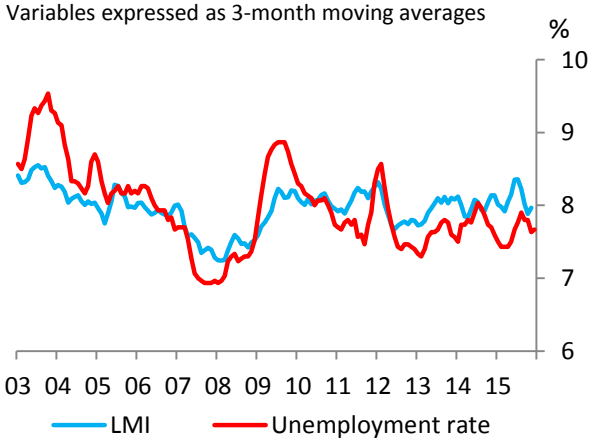
Ontario

Variables expressed as 3-month moving averages



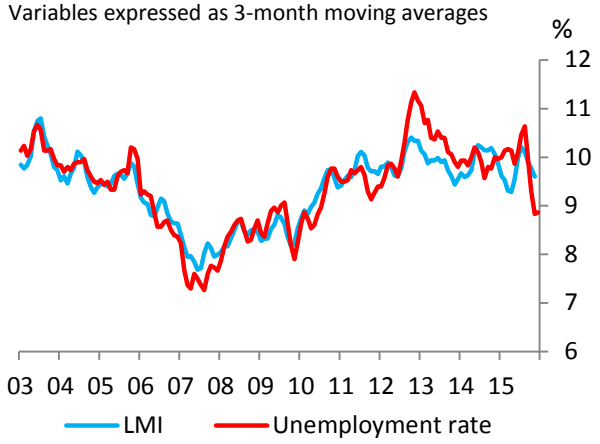
Quebec

Variables expressed as 3-month moving averages



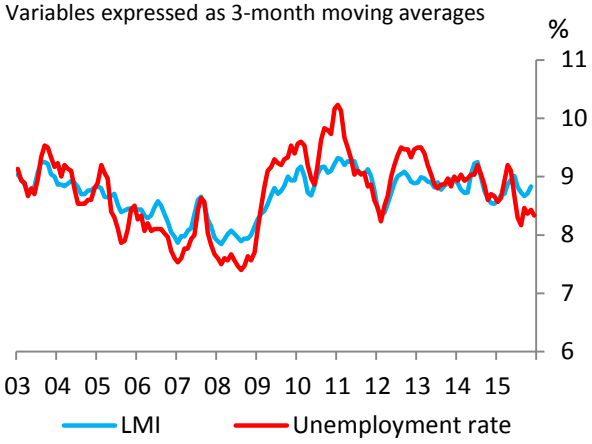
New Brunswick

Variables expressed as 3-month moving averages



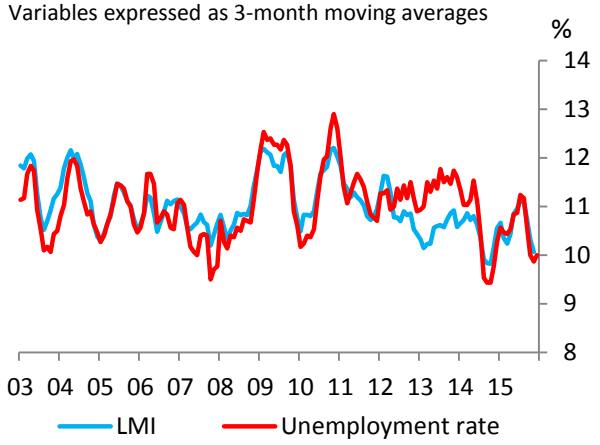
Nova Scotia

Variables expressed as 3-month moving averages



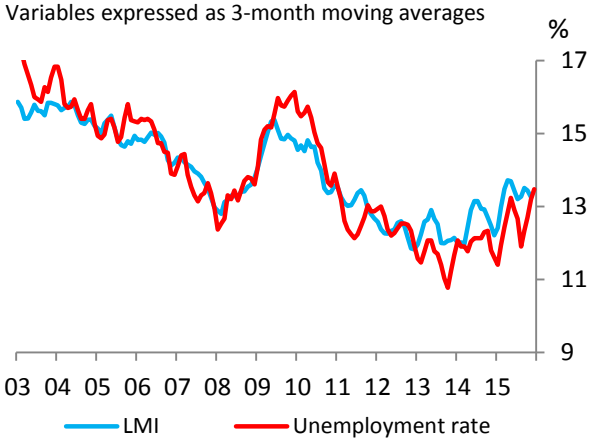
Prince Edward Island

Variables expressed as 3-month moving averages



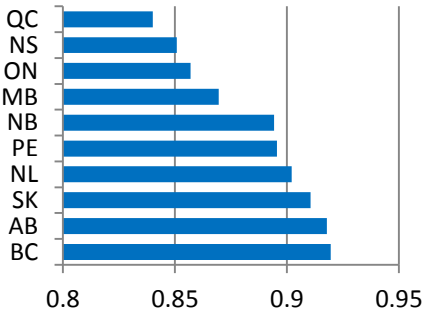
Newfoundland and Labrador

Variables expressed as 3-month moving averages



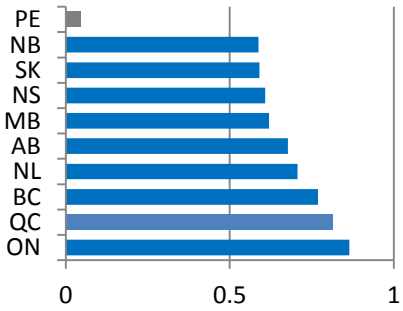
Appendix B: Correlations of the provincial LMIs with eight labour market measures

Correlations of the LMI with the unemployment rate



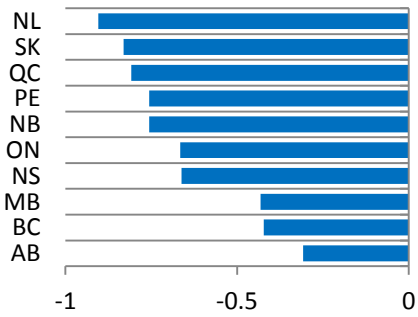
Source: Bank of Canada calculations

Correlations of the LMI with the long-term unemployment rate



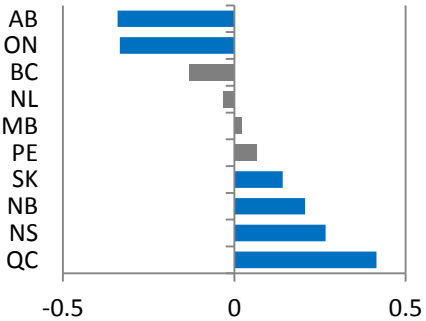
Source: Bank of Canada calculations

Correlations of the LMI with the prime-age participation rate



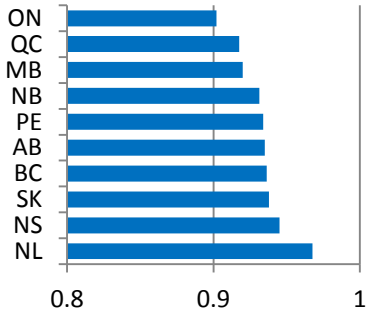
Source: Bank of Canada calculations

Correlations of the LMI with average hours worked



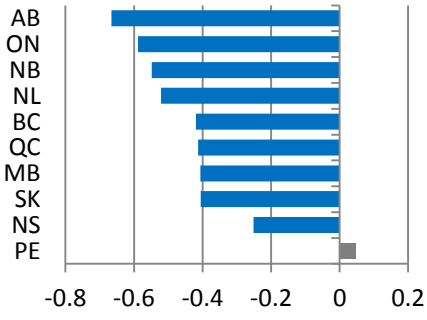
Source: Bank of Canada calculations

Correlations of the LMI with the underutilization rate



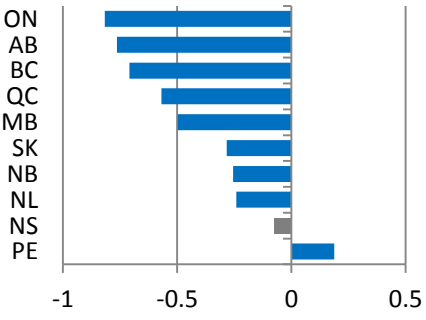
Source: Bank of Canada calculations

Correlations of the LMI with wage growth



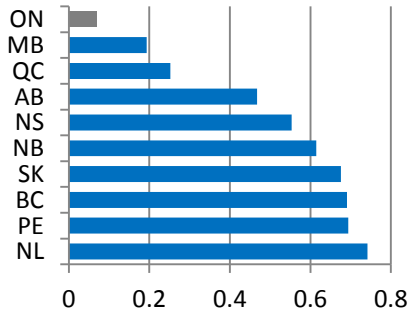
Source: Bank of Canada calculations

Correlations of the LMI with the job-finding rate



Source: Bank of Canada calculations

Correlations of the LMI with the separation rate



Source: Bank of Canada calculations

Note: Grey bars denote correlation coefficients that are statistically not different from zero at the 5% level.

Appendix C: Stability of LMI estimates over time

As with any estimation procedure, the choice of the sample estimation period can have important effects on the results. For the calculation of the LMI, this occurs on two separate occasions: first, during the calculation of the principal component; and second, during the regression of the principal component on the unemployment rate. With each new data point added, the loading factors of the principal component change slightly, as does the relationship between the principal component and the unemployment rate, thus resulting in a slightly different value for the LMI for the entire sample period.

Table C1: Average range of LMI estimates over time (percentage points)	
British Columbia	0.21
Alberta	0.11
Saskatchewan	0.18
Manitoba	0.11
Ontario	0.14
Quebec	0.48
New Brunswick	0.21
Nova Scotia	0.37
Prince Edward Island	0.38
Newfoundland and Labrador	0.50

We explore the effect of using different sample estimation periods when creating LMIs for the provinces. Constructing provincial LMIs across a range of samples allows for further analysis into the variability of labour market indicators over time. The charts at the end of this appendix show the range of the LMI estimates over time for the provinces.

We calculate the LMI for each province for different sample periods, starting in January 1998 (then February 1998, and so on until December 2005), each one ending in February 2015. This approach results in 96 LMI series for each province, each with a different sample start date, but with the same sample end date. Comparing these series reveals the range of calculated LMIs for each province in any given month.

For Quebec, Newfoundland and Labrador, and to a lesser extent Nova Scotia and Prince Edward Island, the estimated LMIs vary markedly depending on the sample period used. The average range over time is roughly half a percentage point for both Quebec and Newfoundland and Labrador, and around a third of a percentage point for Nova Scotia and Prince Edward Island. An interesting structural pattern emerges in the case of both Quebec and Newfoundland and Labrador. Whereas prior to the Great Recession the LMI constructed using the estimation period beginning in 2003 trended near the maximum of the range, it trended near the minimum of the range in the years since 2009–10. This may be a result of idiosyncratic factors in the provincial labour market. However, the result is counterintuitive in the case of Quebec, as it would suggest that the unemployment rate understated the improvement in the Quebec labour market since the recession. When the LMI is constructed using the estimation period starting in 1998, as is done in this paper, the pattern is reversed for both provinces. The below charts show the range of LMI estimates for each province, depending on the sample used.

For other provinces, the choice of estimation period does not have a particularly significant impact on the range of the LMI estimates (Table C1). The ranges resulting from sample-specific LMI estimates over time average from 0.11 percentage points for Alberta to 0.5 percentage points for Newfoundland and Labrador. This suggests that, for the majority of the provinces, beginning the analysis for the LMI in 1998 does not result in materially different values for the LMI than if we were to begin the estimation several years later. Provinces for which the estimated values of the LMI are quite stable over time include British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and New Brunswick. Still, even in cases where the estimated values of LMI are relatively stable over time, the underlying correlations can change notably depending on the sample period used.

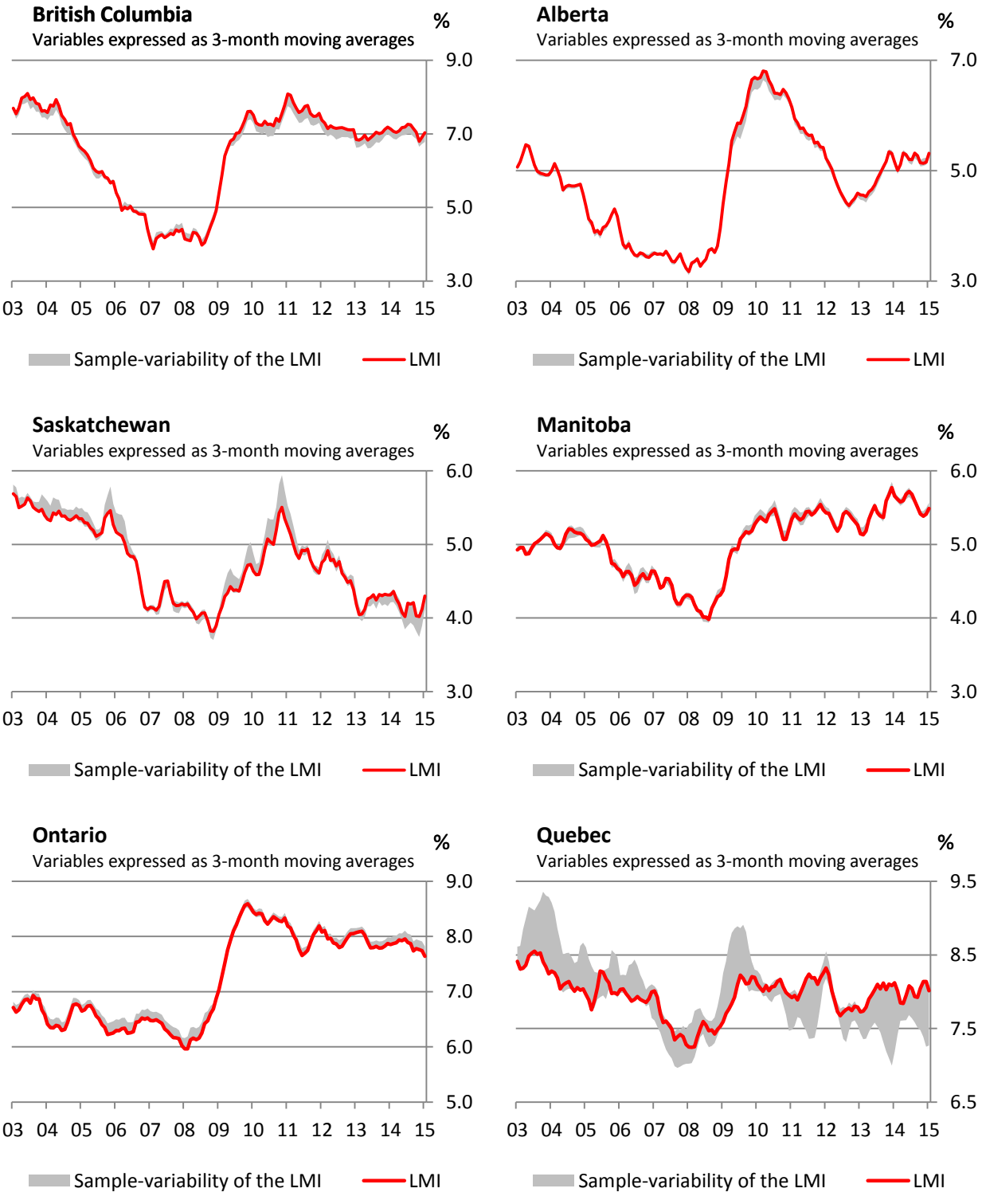
The correlations in Table C2 show that our extended estimation period is preferable for the construction of the LMI at the provincial level. Especially in the case of Quebec, the LMI constructed starting in 2003 (as in Zmitrowicz and Khan 2014) exhibits several counterintuitive signs. Our extended sample reduces the number of counterintuitive correlation coefficients from eleven to eight.

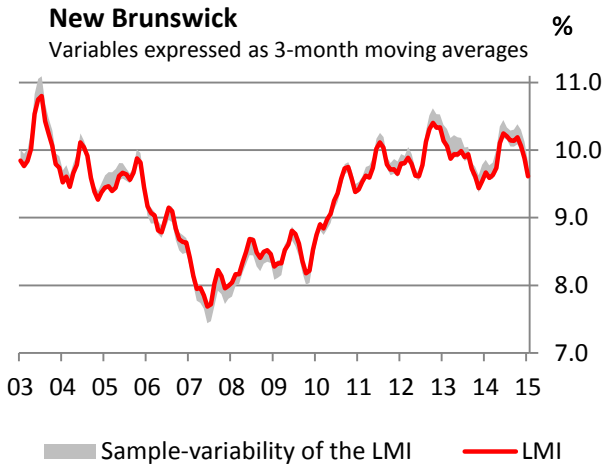
Table C2: Expected sign of correlations between LMI and labour market measures – 2003 sample

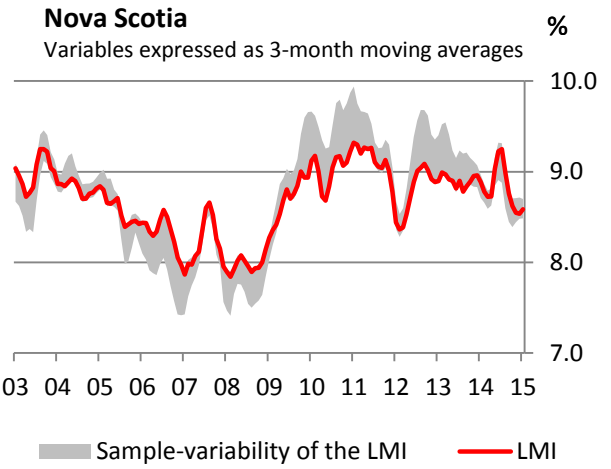
	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Unemployment rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Underutilization rate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Long-term unemployment rate	✓	✗✓	✓	✓	✗✓	✓	✓	✓	✓	✓
Prime-age participation rate	✓	✓	✗✓	✓	✗✓	✓	✓	✓	✓	✓
Average hours worked	✓	✓✗	✓✗	✗✗	✗✗	✓	✓✗	✓✗	✓	✓
Wage growth	✓	✗✗	✓✓	✓	✗✓	✓	✓	✓	✓	✓
Job-finding rate	✓✓	✗	✓✓	✓	✗✓	✓	✓	✓	✓	✓
Separation rate	✓	✓	✓✓	✓	✓	✗✓	✓✓	✓	✓	✓

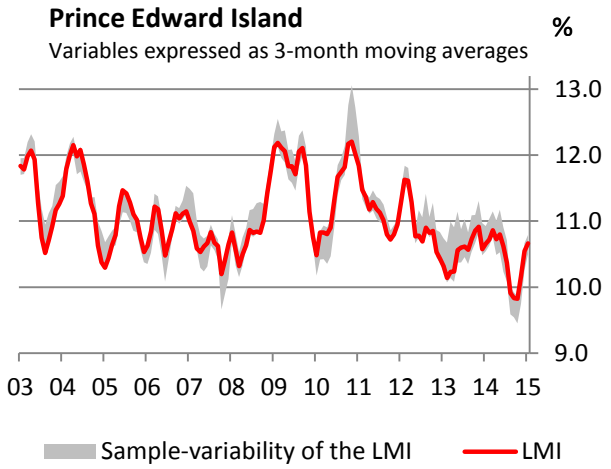
Notes: Correlations with checkmarks have the expected sign. X represents a counterintuitive sign. Correlations in grey are not significant at the 5% level. In all cases with counterintuitive correlations, the correlation with the unemployment rate is of equal sign and similar magnitude, i.e. equally counterintuitive. Superscripts denote the correlation in our extended sample estimation period starting in 1998 whenever the two have different signs.

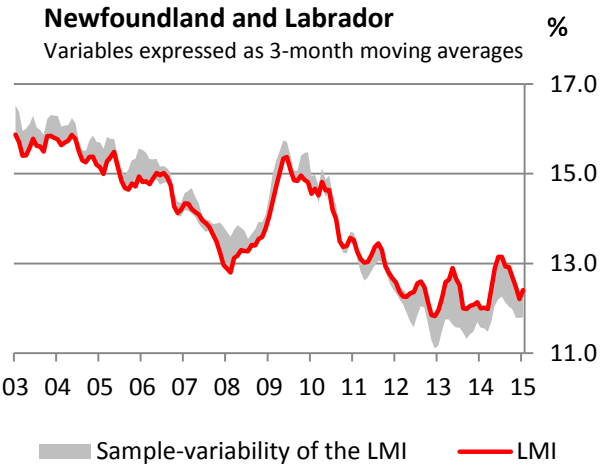
Range of LMI estimates for the provinces depending on the sample used




New Brunswick
Variables expressed as 3-month moving averages
%
11.0
10.0
9.0
8.0
7.0
03 04 05 06 07 08 09 10 11 12 13 14 15
Sample-variability of the LMI
LMI


Nova Scotia
Variables expressed as 3-month moving averages
%
10.0
9.0
8.0
7.0
03 04 05 06 07 08 09 10 11 12 13 14 15
Sample-variability of the LMI
LMI


Prince Edward Island
Variables expressed as 3-month moving averages
%
13.0
12.0
11.0
10.0
9.0
03 04 05 06 07 08 09 10 11 12 13 14 15
Sample-variability of the LMI
LMI


Newfoundland and Labrador
Variables expressed as 3-month moving averages
%
17.0
15.0
13.0
11.0
03 04 05 06 07 08 09 10 11 12 13 14 15
Sample-variability of the LMI
LMI