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THE AUTOMATION POTENTIAL OF THE BRITISH COLUMBIA LABOUR MARKET: SOME INSIGHTS

HIGHLIGHTS

- This article provides some of the findings from a forthcoming BCBC paper on the scope for automation in the British Columbia (B.C.) labour market.
- About 42% of B.C. jobs are in occupations with high potential for automation in the next 10-20 years, from a technical capabilities standpoint.
- More than half of B.C. jobs are "sales and service," "business, finance and administration" and "trades, transport and equipment operators" occupations that, on average, face a high probability of eventual automation.
- B.C. has a slightly greater share of jobs in highly-automatable occupations compared to Canada and could therefore face more adjustment costs associated with technological change.
- The study is a technically-focused risk assessment only. The actual pace and extent of automation will depend on non-technical factors as well, including economic, social and regulatory developments. Furthermore, productivity gains and the creation of new roles for labour could more than offset automation's impact on overall labour demand. There is much uncertainty about the pace of digital innovation, adoption and transformation across the economy.

INTRODUCTION

The role of labour in our economy is changing. Technologies can perform an ever-expanding range of tasks in the production of goods and services. What are the implications of these trends for the British Columbia labour market? A forthcoming BCBC paper explores one aspect of that question.¹ It examines the potential for labour substitution (i.e. automation) from a technical capabilities perspective and based on the composition of provincial and national employment. Here, we highlight some of our findings.

The BCBC study is based on two U.S. studies ([Frey and Osborne 2017](#) and [Chui et al. 2015](#)) and adapted to the Canadian context by [Lamb \(2016\)](#). We update and extend the analysis for B.C. using 2016 Census data.²

The intuition is as follows. Technologies are becoming increasingly capable of performing activities that involve basic social interactions and routine, repetitive or rules-based tasks. Occupations featuring such tasks are susceptible to future automation. In other words, it will become technically possible to automate them. Firms

will have a choice between using labour or capital to perform the task. For example, based on their task structures, it is apparent that cashiers, cooks, paralegals and truck drivers have a high probability of automation over the long term.

In contrast, technologies are unable – and are unlikely soon to become able – to perform other human activities. Activities that are less easily automatable tend to involve: perception and manipulation (finger dexterity, manual dexterity and working in cramped spaces), creative intelligence (originality, problem

¹ To read more on the broader impacts of digitalization, see [Berger and Frey \(2016\)](#), [Bughin et al. \(2017\)](#), [D'Souza and Williams \(2017\)](#), [Oschinski, and Wyonch \(2017\)](#), [Carney \(2018\)](#) and [Nedelkoska and Quintini \(2018\)](#). Previous BCBC publications have explored the topic in the Canadian and B.C. context, including [St Laurent \(2017\)](#), [Williams \(2018a\)](#) and [Williams \(2018b\)](#).

² The results summarized below are based on the [Frey and Osborne \(2017\)](#) methodology focused on automation by occupation. Our longer paper also applies an alternative methodology focused on the automation of tasks within occupations, developed by [Chui et al. \(2017\)](#).

The BCBC study is a risk assessment only. The findings highlight the scope and distribution of automation-related adjustment costs that could lie ahead for the province.

solving and fine arts) or social intelligence (social perceptiveness, negotiation, persuasion, and assisting and caring for others). Engineering bottlenecks associated with these activities are unlikely to be overcome in the next 10-20 years. Therefore, occupations with tasks requiring these skills have a relatively low probability of automation over the indicated time period. Examples include teachers, lawyers, general practitioners, civil engineers, and restaurant and food service managers.

The BCBC study is a risk assessment only. The findings highlight the scope and distribution of automation-related adjustment costs that could lie ahead for the province. These costs could take the form of re-skilling, re-tasking, relocation or lower real wage growth for workers performing automatable occupations and tasks. Policy-makers, firms and workers will need to be alert to these challenges.

The *actual* pace and extent of automation will also depend on other, non-technical factors. These include labour supply and demand, relative factor prices, consumer preferences, regulatory and social acceptance of new technologies, as well as unforeseeable engineering

breakthroughs. More broadly, technological progress raises productivity and creates new roles for labour. These positive impacts could more than offset labour substitution effects on total labour demand.

RESULTS – AUTOMATION OF OCCUPATIONS

Overall Results

We find that 42% of B.C. workers are in occupations that have a high probability of being automated over the next 10-20 years (**Figure 1**). Another 21% are in occupations that have a moderate level of probability, while 37% of workers are in occupations with a low probability of automation. We define these long-term probability or risk regions as “high” ($\geq 70\%$ probability), “moderate” (30-69% probability) and “low” ($< 30\%$ probability).

How does B.C. compare to Canada? Canada has 41% of total employment in the high probability region, 22% in the moderate region and 37% in the low region (**Figure 2**). B.C. therefore has a slightly greater share of jobs at high risk, and a slightly lower share of jobs at moderate risk.

Results by Major Occupational Group

How do B.C. and Canada compare across major occupational groups? **Figure 3** plots the ten broad groups according to their share of total employment and their average probability of long-term automation. British Columbia has a larger share of employment in groups that have high average automation prospects. Also, the types of jobs found within the major occupation groups in B.C. tend

to have higher average prospects for automation than is the case in Canada as a whole. The analysis suggests that B.C. could face more adjustment costs from automation than Canada.

This can be seen by looking at two groups that make up about 40% of provincial employment. British Columbia has a larger share of jobs in “sales and service” occupations with high potential for automation. For “business, finance and administration” occupations, B.C. and Canada have similar employment shares, but the types of jobs found in B.C. are more likely to be automated.

Results by Individual Occupation

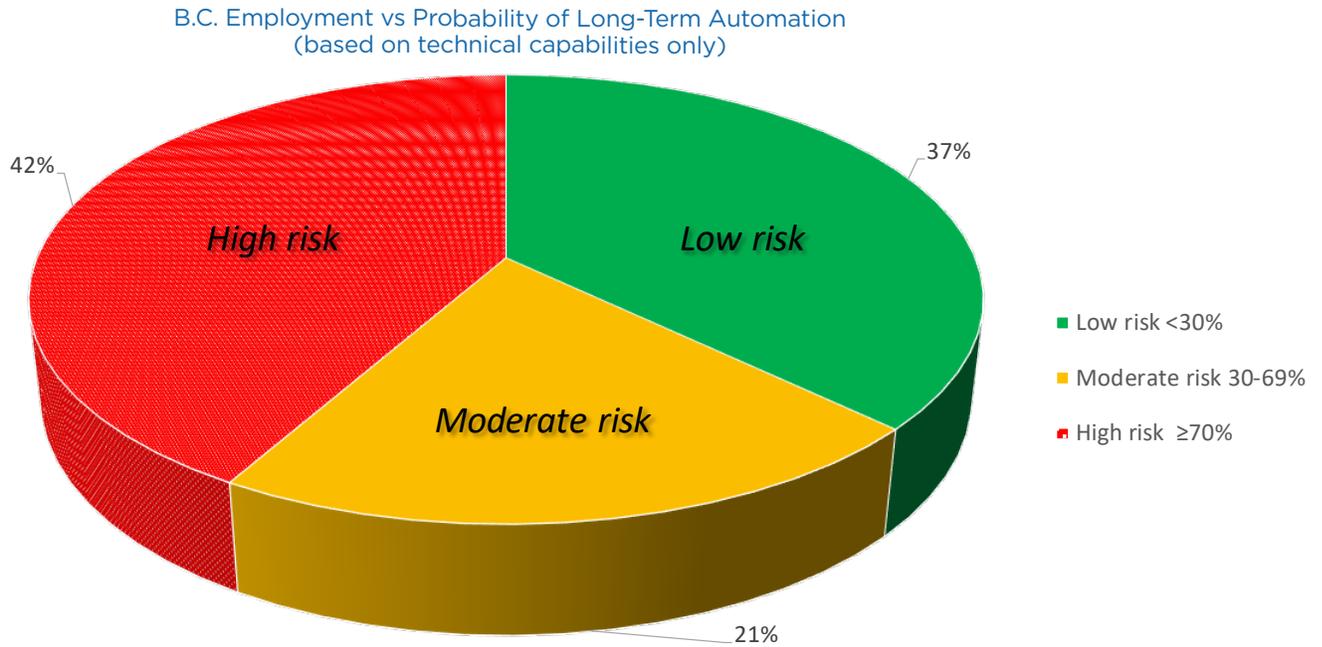
Figure 4 presents the results for 499 individual occupations.³ Most B.C. occupations are clustered in the high and low probability ranges. Some noteworthy occupations are separately identified.

From a technical standpoint, technologies are increasingly capable of performing routine, repetitive and rules-based tasks and tasks requiring simple social interactions. Occupations featuring these sorts of tasks therefore have a higher probability of automation over the next 10-20 years. Examples include retail salespersons, food counter attendants, kitchen helpers and related occupations, cashiers, transport truck drivers, food and beverage servers, general office support workers, administrative offices and cooks.

In contrast, occupations featuring tasks involving perception and dexterity, creative intelligence and social intelligence are less easy to automate. Examples include retail

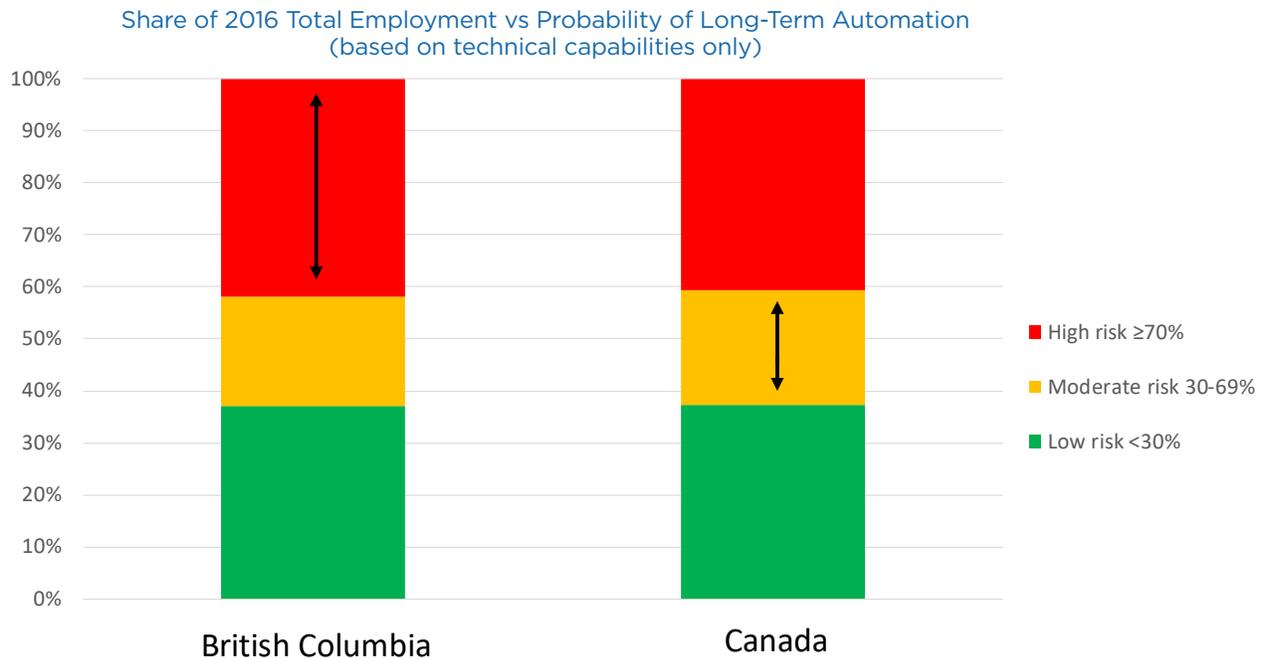
³ There are 500 National Occupational Classifications. We omit non-commissioned military personnel, leaving 499 individual occupations in our study.

FIGURE 1: B.C. EMPLOYMENT IS CONCENTRATED IN OCCUPATIONS WITH HIGH AND LOW PROSPECTS FOR AUTOMATION



Source: Frey and Osborne 2017, Lamb 2016, Statistics Canada, BCBC calculations.

FIGURE 2: B.C. HAS A SLIGHTLY GREATER SHARE OF JOBS IN OCCUPATIONS WITH HIGH PROSPECTS FOR AUTOMATION



Source: Frey and Osborne 2017, Lamb 2016, Statistics Canada, BCBC calculations.

and wholesale trade managers, nurses, elementary school and kindergarten teachers, social and community service workers, restaurant and food service managers, and secondary school teachers.

POLICY IMPLICATIONS

Digitalization will change labour's role in many production processes. These changes will create economic opportunities and adjustment costs that will need careful management. In aggregate, new technologies offer the potential to raise living standards by increasing labour productivity (GDP produced per hour of labour input).⁴ Governments should promote intense product market competition to drive the reallocation of labour and capital to best use (across and within firms and industries), accelerate innovation and the diffusion of new technologies across the business sector, and encourage firms to reap

Adjustment costs are painful and can cause economic and social distress. Re-skilling, re-tasking and relocation will be essential as some current tasks are automated and new roles for labour emerge. Institutions play a crucial role in ensuring that citizens are not left behind and have an adequate and comparable quality of life in the face of technological change.

technology's full benefits by scaling up.⁵ Governments will also need to provide regulatory frameworks and institutions suited to the emerging digital economy.

New job specializations will emerge as technologies continue to advance. Automation will free up workers' time to pursue new occupations, new tasks within existing occupations, or to work less. The role of governments, educational institutions and firms is to incentivize and support people in acquiring new skills for the non-automatable production tasks of the future.

B.C. may see somewhat higher adjustment costs compared to Canada, given the composition of provincial employment. Adjustment costs are painful and can cause economic and social distress. Re-skilling, re-tasking and relocation will be essential as some current tasks are automated and new roles for labour emerge. Institutions play a crucial role in ensuring that citizens are not left behind and have an adequate and comparable quality of life in the face of technological change.

Immigration policies should be carefully designed considering these technological developments. Future production processes will be more capital-intensive. Labour's role will increasingly be to provide advanced skills involving creative intelligence, social intelligence and perception and manipulation. Increasingly, production will not require large numbers of low- or mid-skill workers performing routine agricultural, industrial or clerical tasks.

Well-designed immigration programs can support productivity growth and mitigate inequality in market wages by increasing the supply of high-skilled workers. Conversely, poorly-designed immigration programs that increase the supply of workers with automatable skill sets could exacerbate the costs of labour market adjustment and income inequality. This could also suppress wage growth for lower skill workers and in doing so, reduce firms' incentives to invest in new labour-saving technologies - leading to slower growth in capital intensity and labour productivity.

LIMITATIONS OF THE STUDY

There are important limitations to our analysis. Automation will not solely depend on overcoming engineering bottlenecks. We have only considered the scope for automation from a technical perspective, in light of the occupational composition of B.C. and Canadian employment. The *actual* pace and extent of automation will also depend on many non-technical factors. These include labour demand and supply trends, relative prices for labour and capital, productivity, new job specializations, regulatory and social acceptance of new technologies, and unforeseeable engineering breakthroughs.

Another caveat is that not all tasks within occupations are automatable. An alternative approach by [Chui et al. 2015](#) examines the proportion of *tasks* within occupations that could be automated by a technology that exists today. We explore this approach in the B.C. context in the longer BCBC paper.

⁴ For a primer on digitalization and productivity, see [D'Souza and Williams \(2017\)](#).

⁵ [Williams 2018a](#) discusses recent Bank of Canada evidence on the slowing pace of 'creative destruction' in Canada.

CONCLUSION

About 42% of B.C. jobs are in occupations that have a high probability of automation in the next 10-20 years, from a technical capabilities standpoint. This percentage is slightly higher than for Canada, indicating that B.C. could face more automation-related adjustment costs. Over half of B.C. jobs are in occupations related to "sales and service," "business, finance and administration" and "trades, transport and equipment operators" that, on average, have a high probability of long-term automation.

Our study is a risk assessment. We have only considered the scope for automation from a technical perspective and based on the composition of provincial and Canadian employment. In practice, many other factors will influence the pace and extent of automation in the coming 10-20 years.

The central message for policy-makers and business decision-makers is that labour's role in the production process is changing. New technologies can increase productivity, raise living standards and create new job specializations. There could also be significant, unevenly-distributed adjustment costs from job destruction and dislocation that cause economic and social distress. Well-designed institutions and policies will be crucial in smoothing these adjustments.

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