NATIONAL BANK
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SPECIAL REPORT
Economics and Strategy

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CANADA: A BOTTOM-UP APPROACH TO ESTIMATING POTENTIAL GDP

Summary

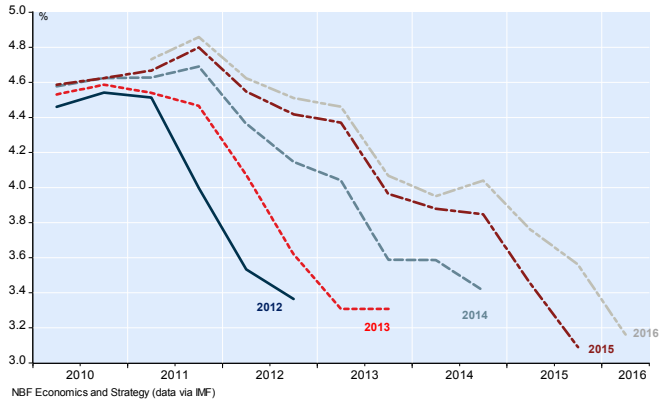
- ***Like many other countries, Canada has seen the cruising speed of its economy slow considerably on account of demographic shifts. However, as is the case across the advanced economies, potential economic growth varies widely from one Canadian province to the next.***
- ***In this study, we explain how we calculate potential GDP for the provinces and present the results we obtain applying the method.***
- ***To take account of the oil shock, which may bring about reversals in interprovincial migration, we developed our own demographic scenario. Today, the population growth outlook is less rosy for the fossil-fuel-producing provinces, whereas Ontario and British Columbia stand to gain from stronger migratory inflows.***
- ***According to our potential growth estimates for 2016, only British Columbia (2.1%), Manitoba (2.1%) and Ontario (+1.6%) exceed the national average of 1.5%. Alberta and Saskatchewan are on par with the average, whereas Quebec is at 1.0%. All of the Atlantic Provinces stand below the 1.0% mark.***
- ***Our calculation also shows that 6 of the 10 provinces have positive output gaps, including the three most populous provinces (Ontario, Quebec, British Columbia).***
- ***Our findings imply that there is no such things as a "one shoe fits all" strategy with respect to monetary/fiscal policy to address Canada's current challenges.***

While various organizations publish economic growth forecasts for the different Canadian provinces, none to our knowledge reveal their potential GDP growth estimate. This information is key to determining where the different economies are in the cycle and what their growth prospects are for the coming years. It is all the more important in that it would allow public authorities to make better informed budgetary decisions.

A worldwide phenomenon

Globally, economic growth has been disappointing in recent years, as illustrated in the chart below. In 2010, the IMF estimated that the world economy would expand about 4.5% annually over the next 5 years. As it turned out, the best performance for any one of these years did not top 3.4%. In retrospect, several reasons explained the poor showing. Despite a highly stimulative monetary environment, the economy was held back by a host of governments fiercely bent on taming their budget deficits. More recently, China's economic transition and the difficulties experienced by the oil-producing countries have sapped world growth as well. In addition to these more or less temporary factors, however, global economic growth has been slowed down also by various megatrends.

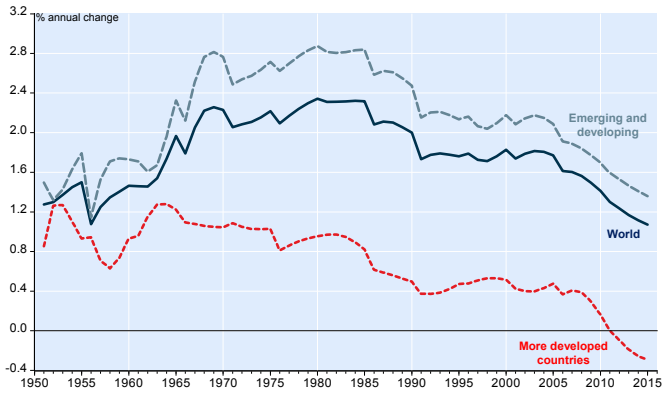
World: Growth much slower than expected, year after year
Change in IMF world real GDP forecast over time



Not only have productivity gains been disappointing on a global scale, the demographic transition has similarly limited economic growth. Indeed, the working-age cohort has been growing at a declining pace pretty much across all countries, be they developed, developing or emerging

(see chart below). In the developed countries, this cohort has even dipped into negative territory of late. The deceleration registered in recent years worldwide has been such that the cohort's growth rate in 2015 was the lowest on record since at least 1950.

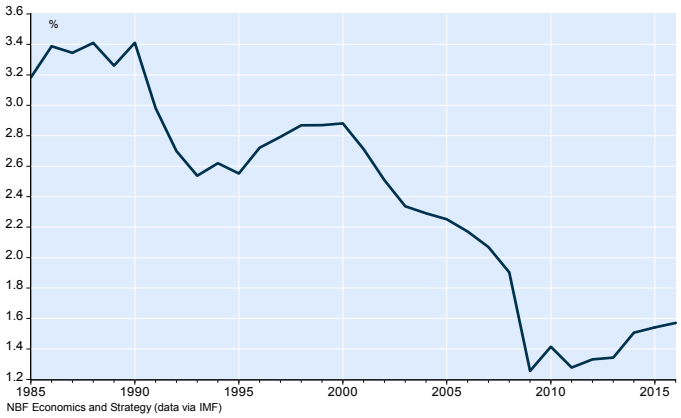
World: Working-age cohort growing at slowest pace since at least 1950
Growth of population 15-64 years



NBF Economics and Strategy (data via United Nations)

Recent IMF potential growth estimates reflect this new reality. Indeed, economic growth in the advanced economies has been cut by one-third over the span of ten years and by half compared with 30 years ago (see chart below).

Advanced economies: A much lower cruising speed
Potential GDP growth (1984 to 2017)



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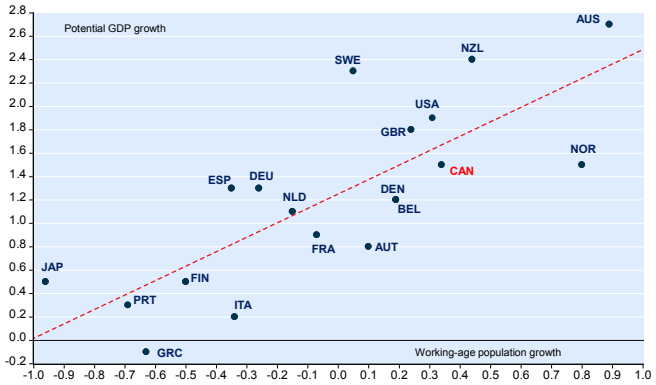
While Canada has not been spared by this reality, the fact is that the country presents a much better demographic profile compared with other advanced economies. The following chart plots the OECD's potential economic growth estimates for 2016 against working-age population growth. As we can see, this cohort continues to grow in Canada (unlike many other countries), which allows projecting economic growth in the vicinity of 1.5% based on the strong correlation between these two variables. Incidentally, this percentage essentially stands in the middle of the range estimated by the Bank of Canada.

The Canadian provinces, however, do not all share the same demographic profile. The present study is meant to examine the situation and to gauge how it might affect potential economic growth.

Long-term economic growth stimulated by demographics
Potential growth in 2016 and growth of population 15-64 years (selection of advanced economies)



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Canadian potential GDP: Our approach

First and foremost, we need mention that, as potential GDP is not observable, estimating it involves a fair degree of uncertainty. This said, potential GDP can be estimated using different methods that vary widely in terms of complexity. Perhaps the simplest of these consists in using a Hodrick-Prescott (HP) filter to fit a trend in gross domestic product. Others rest on the use of production functions in which inputs (e.g., labour, capital, productivity) determine the level of potential GDP. Finally, some methods are based on simultaneous equations models or multivariate time series. For this study, we developed an approach that takes account of the labour input and infers trend labour productivity with a HP filter.

As it happens, gross domestic product (Y) can be broken down as follows:

1) $\mathrm{GDP} = \mathrm{Q} \times \mathrm{H} \times \sum_i^n E_i \; x \; A_i$

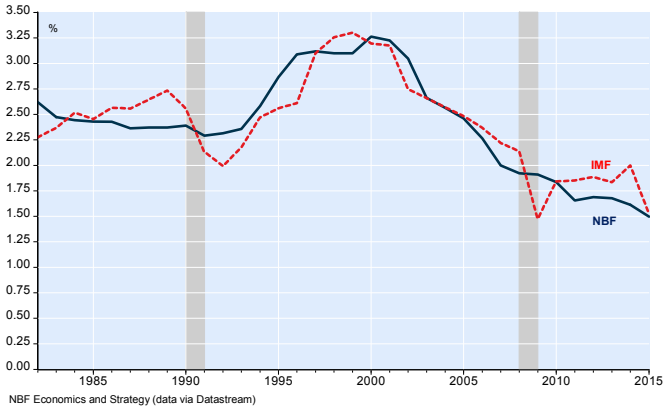
where *Ai* is the population in age group *i*, *Ei* is the employment rate in age group *i*, *H* is the average number of hours worked, and *Q* represents hourly productivity. In order to estimate potential GDP, a HP filter is used to estimate the trend in hourly productivity ($\hat{Q}$), average number of hours worked ($\hat{H}$), and employment rate by age group ($\hat{E}$). Potential GDP can then be expressed as follows:

2) $\widehat{GDP} = \hat{Q} \times \hat{H} \times \sum_i^n \hat{E}_i \; x \; A_i$

Unlike applying a HP filter directly to GDP, this method has the merit of taking into consideration ongoing

demographic shifts having a major impact on the labour market and, by the same token, on potential GDP. Applying this method to the Canadian economy as a whole yielded estimates comparable to the IMF's (see chart below). Consequently, we went ahead and applied it to the provinces.

Canada: Real potential GDP growth estimates
NBF vs. IMF

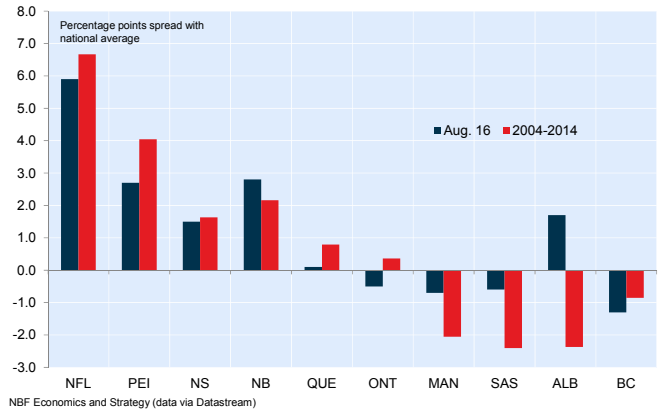


NBF Economics and Strategy (data via Datastream)

Migration reversals likely in provinces

However, which demographic scenario should we use for the coming years to determine *A* in equation 1 above? While Statistics Canada provides multiple scenarios, the current situation is unprecedented in that the persistent oil shock could bring about a reversal of the interprovincial population movements registered in recent years. For example, the jobless rate in Alberta is now 1.7 percentage points above the national rate, whereas in the decade prior to the shock, it stood on average 2.4 points below it.

Canada: Spread between provincial and national jobless rates
Provincial rate minus national rate



NBF Economics and Strategy (data via Datastream)

We opted to develop our own demographic scenario to take account of likely changes in interprovincial migration flows. This is because, to our eyes, even the M5 scenario—Statistics Canada's projection least favourable to Alberta—seemed overly optimistic in terms of average population growth and interprovincial movements given the province's deteriorating labour market. We believe instead that the fossil-fuel-producing provinces will fare less well regarding working-age population growth. We also believe that this turnaround in the situation will benefit primarily Ontario and British Columbia, which will record stronger growth than estimated prior to the oil shock (see table below).

Canada: Working-age population growth
Growth of population 15-64 years based on different scenarios

	M5 scenario		NBF scenario	
	2016	2017	2016	2017
NFL	-0.8	-0.7	-1.2	-1.3
PEI	0.2	0.1	-0.6	-0.7
NS	-0.5	-0.5	-0.4	-0.7
NB	-0.5	-0.6	-1.0	-1.1
QUE	0.0	0.0	-0.1	-0.1
ONT	0.5	0.4	0.6	0.6
MAN	0.9	0.8	0.8	0.7
SAS	0.9	0.8	0.5	0.4
ALB	1.0	0.9	0.7	0.5
BC	0.4	0.4	0.8	0.8

NBF Economics and Strategy (data via Statistics Canada)

As for projected employment rates by age group, the trend rates for individuals under 55 years remain stable at current levels whereas the rates for those 55 and over continue to rise according to their recent trend given that younger women today still outstrip their predecessors in terms of labour market participation.

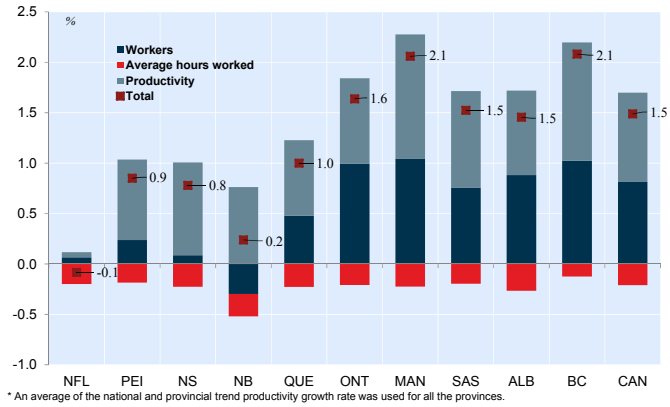
In regards to productivity, we chose to use an average of national and provincial trend growth rate for all of the provinces so as not to unduly favour (penalize) the provinces presently going through a period of strong (weak) productivity. Finally, we made one last adjustment. Newfoundland was the only province trending up recently in terms of average number of hours worked. All the others presented annual declines ranging from -0.12% to -0.23%. Given that Newfoundland is one of the province hit hard by the oil price shock, we chose to apply the national trend rate to it over the coming years.

Potential growth varies widely among provinces

Applying the method described above, we obtain a potential growth estimate of 1.5% in 2016 for the country as a whole. Where the provinces are concerned, however, only British Columbia (2.1%), Manitoba (2.1%) and Ontario (+1.6%) exceed the national average. Alberta and Saskatchewan are on par with the average, whereas

Quebec is at 1.0%. All of the Atlantic Provinces stand below the 1.0% mark.

Canada: National and provincial potential GDP growth rates
Sources of potential GDP growth for 2016 (NBF baseline demographic scenario)*

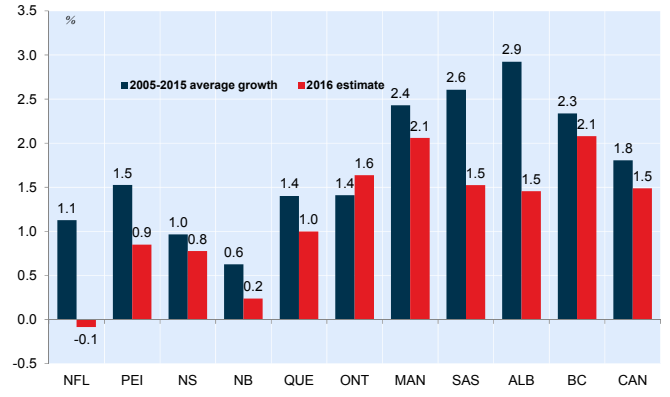


* An average of the national and provincial trend productivity growth rate was used for all the provinces.

NBF Economics and Strategy (data via Statistics Canada)

So how do our estimate compare against the potential economic growth that had been estimated for the past ten years? First, Canada's potential GDP growth in 2016 is three-tenths lower (1.5% vs. 1.8%) and only Ontario obtains a higher estimate - see chart below. Unsurprisingly, the sharpest declines are in the Prairie Provinces and in Newfoundland.

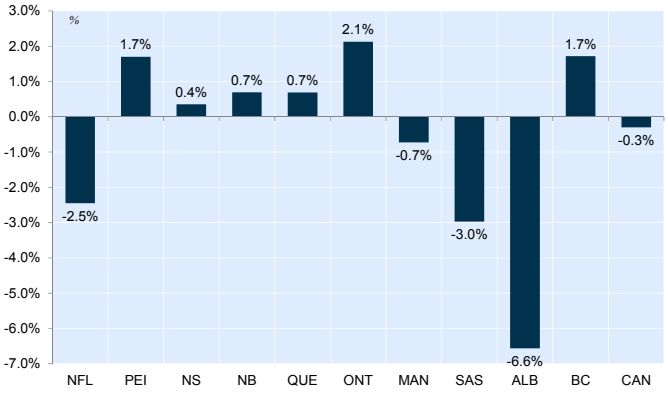
Canada: Potential GDP growth
2016 vs. past decade



NBF Economics and Strategy (data via Statistics Canada)

Now that we have an estimate of potential GDP growth per province, we can measure output gaps on a regional basis. At the national level, based on our method and our growth forecast, GDP in 2016 will essentially be in line with potential GDP (see chart below). By way of comparison, our estimate is slightly more optimistic than the IMF's indicating that GDP is 0.8% below potential.

Canada: Output gaps
NBF estimate of output gaps in 2016



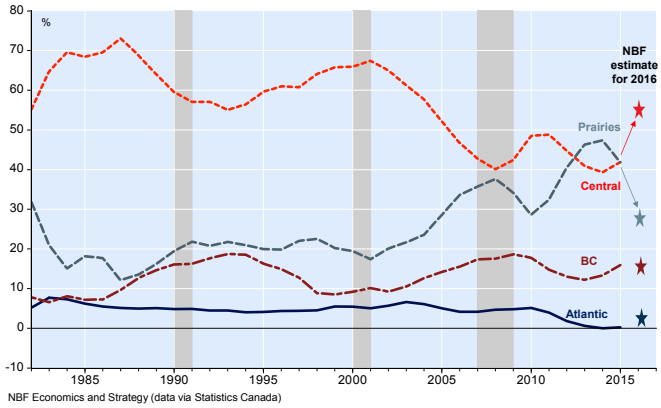
NBF Economics and Strategy (data via Statistics Canada)

Given that the current shock is affecting certain provinces more than others, it is not surprising that the output gaps vary so widely. On the one hand, 6 of the 10 provinces have positive output gaps according to our calculations, including the three most populous provinces (Ontario, Quebec, British Columbia), which represent no less than 2/3 of the Canadian economy. On the other, the fossil-fuel-producing provinces are facing a strong deterioration in their output gaps, with Alberta 6.6% below potential.

Conclusion

In this study, we laid out a way of calculating potential GDP per province and presented the results obtained with this method. As in other advanced economies, the cruising speed of the Canadian economy has decelerated considerably on account of ongoing demographic shifts and poor productivity. However, the Canadian provinces vary widely in terms of potential economic growth. To take account of the oil shock, which may bring about reversals in interprovincial migration, we developed our own demographic scenario. The population growth outlook is less rosy for the fossil-fuel-producing provinces, whereas Ontario and British Columbia stand to benefit from stronger migratory inflows. By our estimates, only British Columbia (2.1%), Manitoba (2.1%) and Ontario (+1.6%) exceed the national average of 1.5% in terms of potential economic growth. Alberta and Saskatchewan are on par with the average, whereas Quebec is at 1.0%. All of the Atlantic Provinces stand below the 1.0% mark. This means that the regional contributions to the country's potential growth may change significantly on account of the oil shock (see chart below). Our findings imply that there is no such things as a "one shoe fits all" strategy with respect to monetary/fiscal policy to address Canada's current challenges.

Canada: Significant change in regional contribution to growth
Contribution to potential GDP growth



NBF Economics and Strategy (data via Statistics Canada)

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