

Saskatchewan’s carbon tax numbers are in and the answer is ... reporting errors

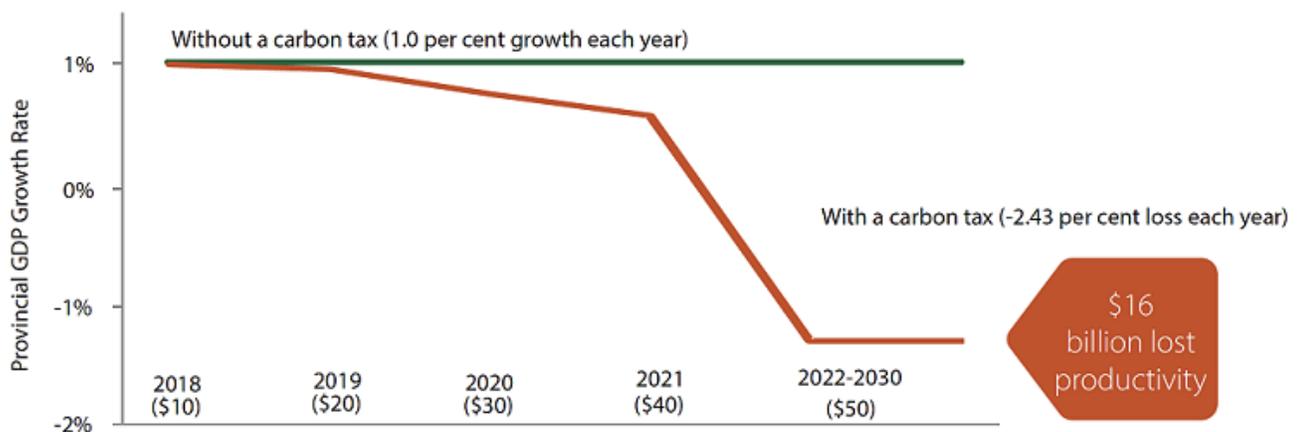
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The Government of Saskatchewan is challenging the federal government in court over its plan to implement a tax on greenhouse gas emissions. Saskatchewan opposes the federal plan in part because it claims the economic costs of the carbon tax would be catastrophic. We took a close look at Saskatchewan’s analysis, and the numbers simply don’t add up. Our best guess is that Saskatchewan’s own modelling suggests that the impacts of a carbon tax have been overstated by multiple orders of magnitude!

Saskatchewan claims the federal carbon tax would end economic growth in the province and cause a near permanent recession. While provincial gross domestic product is expected to **grow** by one per cent each year in the absence of the tax, the government claims a carbon tax would **shrink** the province’s economy by 1.43 per cent every year between 2022 and 2030. The figure from Saskatchewan’s news release is shown in Figure 1.

Figure 1: Saskatchewan’s news release on the economic impact of the federal carbon tax



Source: Government of Saskatchewan, 2018, “Federal Carbon Tax Could Reduce Saskatchewan GDP By Almost \$16 Billion By 2030”, available from: <http://www.saskatchewan.ca/government/news-and-media/2018/june/27/fed-carbon-tax>, last accessed on December 19, 2018.

This kind of GDP contraction would be unprecedented in any developed countries in recent times. In Canada, we would need to go back to the 1930s Great Depression to see an equivalent. In the past 100 years, only the world wars and the Spanish Civil War caused a more devastating recession in any European country.

What is behind Saskatchewan's incredible projections? I suspect that the answer is much less dreadful for Saskatchewan's economy: The Government of Saskatchewan simply reported the wrong numbers!

How did this happen? It appears that two big reporting errors compounded into an even larger error.

First, the Government of Saskatchewan appears to have confused **GDP growth** with **total GDP**. While the news release claims that a carbon tax "would reduce **provincial GDP** by 2.43 per cent", their figure (see Figure 1) shows that the tax would instead reduce the provincial **GDP growth** rate by 2.43 per cent. Reductions in GDP and GDP growth are not the same: either the statement or figure must be wrong. The analysis behind the figure focuses on a GDP change, not GDP growth, so the figure is likely incorrect. If the Government of Saskatchewan corrected this mistake, the carbon tax would cease to be recessionary.

Second, the numbers in the University of Regina's underlying analysis prepared for the government don't add up. In one section, their analysis shows that a carbon tax would reduce GDP in 2022 by 2.43 per cent. In another section, they report the change in each GDP component. No component even approaches a decline of 2.43 per cent. This is a big red flag. The largest change in any component of GDP is reported as a decline of 1.1 per cent in 2022. Some major components, such as household consumption, are only shown to decline by 0.2 per cent. So how can the total decline be so much more than its components?

Correcting for both the Government of Saskatchewan and the University of Regina's suspected errors, we get a reduction in economic growth of a much smaller – and far more realistic – 0.13 per cent from 2017 to 2022.

While I'm casting stones, let me acknowledge that I've made plenty of mistakes. In my first analysis using a computable general equilibrium model in 2008, I also misreported GDP but not to this extent. I caught my error and owned up to it.

Mistakes are made but the important next step is to acknowledge and correct them.

Disclaimers

The focus of this review is on how the University of Regina translated the numbers from their model into the report and news release, not on the analysis itself.

Neither Navius Research nor I are advocates for any specific policy or climate policy in general. Our job is to analyze the effect of climate policies so that the public, government, industry and non-governmental organizations can make informed decisions. Saskatchewan's analysis drew my attention because it is, at best, highly misleading.

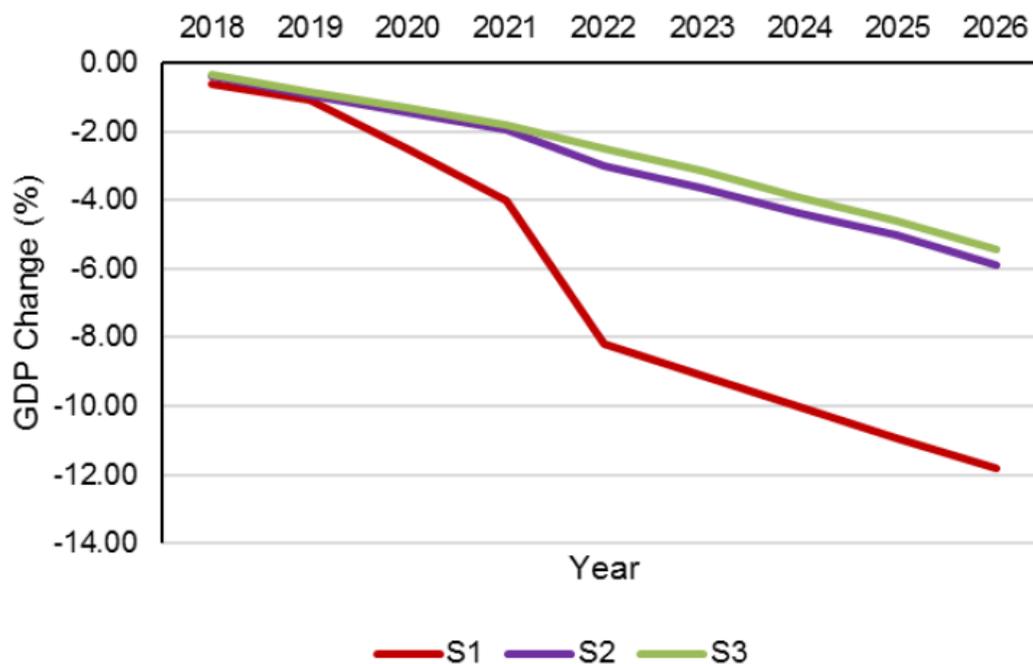
Appendix: A deep dive into the news release numbers

The Government of Saskatchewan references a 2.43 per cent reduction in GDP growth.¹

The number appears to come from a report by the University of Regina.² Section 5.2 of the report (“Impacts on Macro Economy [sic]”) shows “GDP change (%)” over time under three different scenarios. I’m pretty sure that the government’s news release is based on scenario “S3”, which appears to show a 2.43 per cent GDP change in 2022. To maintain consistency with this the underlying analysis and the news release, I’ve likewise focused on 2022.

Scenario “S3” represents applying a carbon tax to Saskatchewan’s transportation and building sectors. The tax rises to \$50 per tonne in 2022. Revenues from the tax are transferred to households. It should be a decent representation of the levy on fossil fuels mandated by the federal government.

Figure 2: A figure from the University of Regina’s report entitled “The impacts of carbon tax on GDP and GHG emission [sic]”



¹ Government of Saskatchewan, 2018, “Federal Carbon Tax Could Reduce Saskatchewan GDP By Almost \$16 Billion By 2030”, available from: <http://www.saskatchewan.ca/government/news-and-media/2018/june/27/fed-carbon-tax>, accessed on December 19, 2018.

² University of Regina (Institute for Energy, Environment and Sustainable Communities), 2018, “Economic modeling to support the development of climate change regulations”, available from: <http://www.saskatchewan.ca/government/news-and-media/2018/june/27/fed-carbon-tax> (see IEESC Full Report in the Related Items), accessed on December 19, 2018.

GDP growth and GDP change are two very different concepts that the Government of Saskatchewan appears to confuse. The University of Regina uses the concepts in confusing ways.

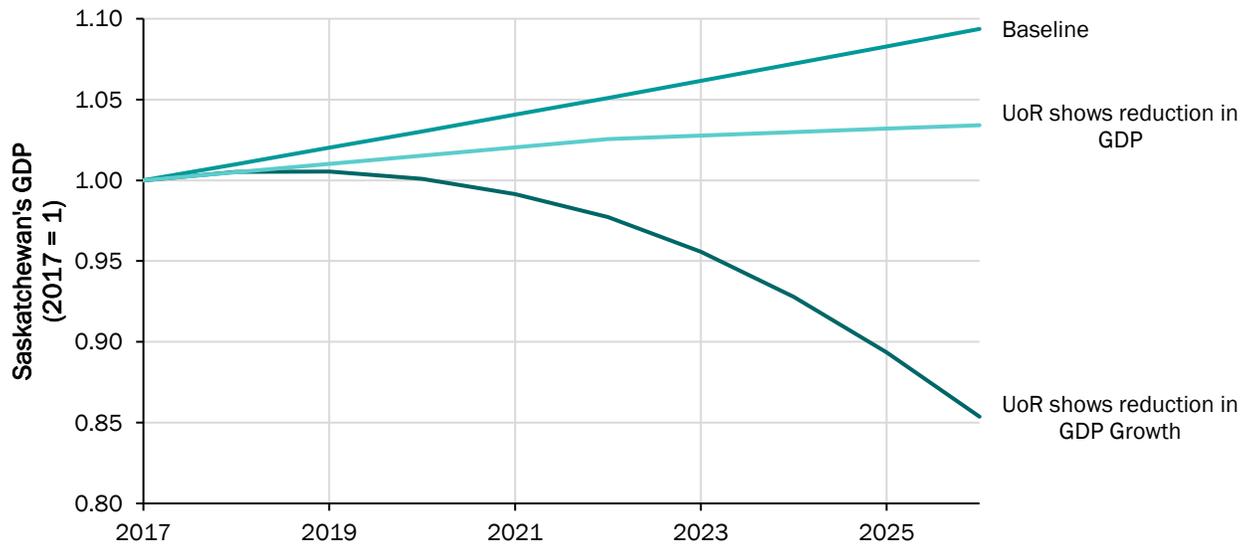
GDP growth refers to how GDP changes from one period to the next. You will often hear that GDP grew by a given percentage per year. If an economy experiences a recession, it experiences negative growth in GDP over a period of time (usually more than six months).

GDP change refers to how total GDP changes from one scenario (e.g., Saskatchewan without a carbon tax) to another (e.g., Saskatchewan with a carbon tax).

The comparison between the two concepts is somewhat abstract. I find it easier to translate our understanding of the University of Regina's analysis into actual GDP numbers (e.g., GDP in Saskatchewan is X \$ in 2022) instead of growth or change. As the University of Regina did not provide total GDP in its report, I've converted GDP into an index in which GDP in 2017 is one (please refer to Figure 3):

- It appears that the University of Regina and the Government of Saskatchewan assume the province's economy will grow at a one per cent annual rate until 2026 if the carbon tax is **not** implemented (i.e., the baseline scenario in Figure 3).
- And, regardless of whether Figure 2 shows GDP growth or change, it captures a change relative to the baseline.
- If the University of Regina's analysis refers to a decline in GDP growth, GDP would follow the path shown in the bottom line of Figure 3. This shows that by 2022, GDP would be about seven per cent lower than it would have been in the absence of a carbon tax, and by 2026, GDP would be 22 per cent lower.
- If the University of Regina's analysis refers to a decline in GDP from a baseline scenario, as I suspect is the case, the impact on GDP would be more modest (shown in the middle line of Figure 3). Under this scenario, GDP would be lower than the baseline by 2.43 per cent in 2022, and 5.45 per cent by 2026.

Figure 3: Saskatchewan GDP under different interpretations of the University of Regina's data



Admittedly, the macroeconomic section of the University of Regina's report is confusing. The report sometimes uses "GDP change" and "GDP growth" interchangeably, making it difficult for the reader to know which metric is being reported. The "GDP change" figure (see Figure 2) is actually titled "The impacts of carbon tax [sic] on GDP and GHG emission [sic]", leading me to sincerely wonder if they accidentally reported GHG emissions instead of GDP (more on the validity of the numbers in this figure below). The text describing the figure reads "... the GDP change shown reflects the impacts of carbon tax on macro economy in Saskatchewan [sic]. It is seen from this figure that the carbon tax has negative impacts on economic growth."

Despite the confusing text, I think we have to take the figure at face value because it reports a GDP change (i.e., a change in GDP from the baseline) and not a change in GDP growth. Specifically:

1. Lower GDP attributed to a carbon tax would reduce GDP growth, so this interpretation is not inconsistent with the text.
2. Text referring to specific numbers indicates a "GDP reduction" or "GDP change", and not "GDP growth".
3. If the figure does indeed refer to GDP growth, the University of Regina has some explaining to do. A result in which a \$50 per tonne carbon tax on transportation and buildings reduces GDP growth by 2.43 per cent (and by 5.45 per cent in 2026!) would be vastly misaligned with the results from any other computable general equilibrium (CGE) model.

It therefore seems likely that the Government of Saskatchewan mistook GDP change for a change in GDP growth. I do sympathize to some extent because the macroeconomic section of the University of Regina’s report is poorly written and confusing. Nevertheless, I’d be surprised if the figure refers to GDP growth and not a GDP change from the baseline.

But even a 2.43 per cent reduction in GDP is a massive response to a carbon tax that amounts to a 12 cents per litre increase in gasoline prices. This impact is also contingent on there being no additional reporting errors in the University of Regina’s report.

Segue to the next suspected reporting error. In addition to reporting the aggregate impact on GDP, the University of Regina identifies how a carbon tax affects each component of GDP in section 5.3, titled “GDP decomposition analysis”. For a quick review of first-year macroeconomics, GDP is the sum of consumption (“C”), government expenditures (“G”), investment (“I”), changes in inventories (“STO”) and exports (“EX”), minus imports (“IM”):

$$GDP = C + G + I + +STO + EX - IM$$

In the University of Regina’s analysis, none of these components change by more than 1.1 per cent, with some major components of GDP (e.g., consumption) only changing by 0.2 per cent. See Table 1 for the University of Regina’s GDP decomposition in 2022.

Table 1: University of Regina’s decomposition of GDP results for scenario S3 in 2022

GDP components	2022
C	-0.22%
G	-0.24%
I	-1.09%
STO	-0.76%
EX	-0.19%
IM	0.13%

If a carbon tax indeed reduces GDP by 2.43 per cent, but none of the components change by more than 1.1 per cent, you have a big red flag. I tried to reconcile the values in Figure 2 with the values in Table 1. The most reasonable way I found (which is completely unreasonable) was by inflating exports and imports so they both account for about 600 per cent of Saskatchewan’s GDP by 2022 (about 10 times greater than

what exports and imports have been historically)³. Let's just say that, even if this is theoretically possible, it is extremely unlikely. (If I saw this result in my model, I'd immediately start looking for the error.)

The University of Regina does not report the relative composition of GDP in 2022 in the absence of a carbon tax. For example, they don't say whether consumption accounts for 40 per cent of GDP or something different. This means that I can't say for sure how the University of Regina weighed each component of GDP to get an aggregate value.

To translate the decomposition into an aggregate impact, I used the share of each component of GDP in 2011 from Statistics Canada's Supply-Use tables⁴. I used this year to be consistent with the University of Regina's analysis, which claims to use a 2011 benchmark year.

Using the GDP decomposition in Table 1 and the contribution of each component to GDP in 2011, the carbon tax reduces GDP by closer to 0.64 per cent in 2022.

Now, the University of Regina's report suggests two different things in two different sections. In the aggregate GDP section, GDP declines by 2.43 per cent in 2022. And we can infer that aggregate GDP declines by about 0.64 per cent in the GDP decomposition section. Which is a correct representation of the University of Regina's analysis? The short answer is I can't say for sure. What I can say is that, absent some unreasonable assumption about GDP composition (e.g., imports account for 600 per cent of GDP), one of these sections is wrong.

My strong suspicion is that the aggregate GDP section is wrong and the GDP decomposition is right. For one, it's easier to screw up one figure than multiple. The aggregate GDP section only has one figure, which could plausibly have used incorrect data. And, remember that the figure was even titled "The impacts of carbon tax on GDP and GHG emission [sic]". So, maybe the figure shows GHG emissions after all! The GDP decomposition section has 10 figures and tables. It would have been a massive screw-up to get all these wrong.

A second reason why I suspect the aggregate GDP section is wrong is that even a 2.43 per cent reduction in aggregate GDP is misaligned with everything I've seen from a

³ In 2011, exports accounted for about 70 per cent of Saskatchewan's GDP, while imports accounted for 57 per cent. Imports have a negative effect on GDP, so exports and imports partially cancel each other out. Net exports then account for about 13 per cent of GDP. Source: Statistics Canada, 2017, "Supply and use tables, summary level, provincial and territorial", CANSIM Table 381-0035.

⁴ Statistics Canada, 2017, "Supply and use tables, summary level, provincial and territorial", CANSIM Table 381-0035.

CGE model. The results from the GDP decomposition section are more plausible based on the tool used.

In conclusion, using my expert judgment to interpret the University of Regina’s own analysis, a carbon tax most likely reduces GDP growth by 0.13 per cent each year from 2017 to 2022. So, instead of GDP growing by one per cent, it would grow by 0.87 per cent (a big difference from -1.43 per cent). For a disclaimer, I’m not endorsing this finding, but this is what I think the University of Regina’s analysis actually says. By 2022, the cumulative effect of lower growth is that GDP is 0.64 per cent lower than it would have been in the absence of the carbon tax.

Figure 4 shows a “corrected” projection based on my review. While the impact of a carbon tax would still be noticeable, it is a far cry from the Government of Saskatchewan’s current understanding.

Figure 4: GDP projection with “corrected” estimates

