

## **Appendix 12 (as supplied by the authors): Additional placebo tests and sensitivity analyses**

### Placebo tests

We performed an ‘in-time’ placebo in which we estimate the cross-national fixed effects model testing for difference-in-differences in supply between 1985-88 and 1989-92 when no trade agreement occurred. This did not identify a significant difference between supply of caloric sweeteners in Canada compared with Australia and the UK between 1985-1988 and 1989-1992 when no trade agreement occurred (Difference-in-differences (DD): 13.7; 95% Confidence Interval (CI): -0.2 to 27.5).

We also conducted within-country placebos in order to isolate the effect of lower tariffs from other changes in NAFTA and elsewhere in Canada. We compare the supply of caloric sweeteners with bananas which were already tariff free, and our models yielded an estimated effect of NAFTA on supply of 38.73 kcal/ capita/ day (95% CI: 22.33 to 55.13). We also estimate our models comparing supply of bananas between countries in order to test for cross-national differences in supply in the absence of tariff reductions in NAFTA. This did not identify a difference in banana supply between Canada, Australia and the UK before and after NAFTA (DD: 0.34; 95% CI: -1.17 to 1.85).

### Specification tests

Additional analyses test whether our results are sensitive to our sample and model specification. We test the sensitivity of our results to changes in the country donor pool and differences in trade instruments between Canada and the comparison countries by iteratively re-constructing the synthetic Canada and omitting in each iteration one of the countries in the comparison country donor pool. Our confidence that our results are attributable to an impact of NAFTA rather than differences in trade instruments between NA and Europe would be undermined if the leave-one-out analysis was sensitive to the inclusion of European countries in the ‘donor pool’ of comparison countries. Appendix 11 above shows results from the leave-one-out analysis. The results were consistent with our main analysis as caloric sweetener supply in Canada was at least 34.9 kcal/ capita/ day higher than synthetic control Canada in all donor pool specifications.

We then evaluated whether including European Economic Area (EEA) members in the donor pool impacts the level of supply in the synthetic control due to a quota on HFCS production and due to differences in trade instruments between Canada and the EEA. We re-estimated our results including in the donor pool only OECD countries that were not EEA members: Japan, Switzerland, Australia and New Zealand. Table 1 below shows the country weights from this model and Table 2 summarizes the results.

*Table 1. Country weights in non-EEA sample*

| <b>Country</b> | <b>Weight</b> |
|----------------|---------------|
| Australia      | 0.67          |
| Japan          | 0.13          |
| New Zealand    | 0.00          |
| Switzerland    | 0.20          |

*Table 2. Synthetic control results with non-EEA sample*

|                        | <b>Treated</b> | <b>Synthetic</b> |
|------------------------|----------------|------------------|
| GDP per capita         | 27,216.25      | 29,167.75        |
| Inflation              | 3.55           | 4.64             |
| Supply, t-1            | 21.25          | 20.72            |
| Cereals                | 657.75         | 756.86           |
| Fruit                  | 115.25         | 106.26           |
| Meat                   | 358.38         | 475.19           |
| Vegetables             | 81.50          | 59.78            |
| Veg. Oils              | 417.25         | 345.26           |
| Animal Fats            | 238.25         | 152.21           |
| Total                  | 3,060.38       | 3,147.14         |
| <i>Pre-NAFTA RMSPE</i> |                | <i>1.43</i>      |
| <i>NAFTA estimate</i>  |                | <i>41.7</i>      |

The non-EEA model yields slightly less accurate predictions of supply (a higher pre-NAFTA RMSPE) in Canada and weaker predictor balance in the pre-NAFTA period compared with the original model. This is likely attributable to the limited number of countries to match with in the non-EEA sample. Nonetheless, these results are consistent with our main results, estimating an effect size for NAFTA of 41.7 kcal/capita/day. This suggests that our results are not attributable to our sample specification.

As a final test for the sensitivity of our results to our sample and model specification we conduct a further test in which we expand the donor pool of countries to include all countries with available data. This test allows us to assess the impact of an improvement in predictor balance on our findings, and whether our results are consistent in a model which makes relaxes the assumption that unobserved structural processes are common to all comparison countries. As shown in Table 3 below, comparing the OECD sample to a sample with all countries improves predictor balance on some – though not all – variables. The model yields the same substantive findings as our original models with an effect estimate for CUFTA on caloric sweetener supply of 35.4 kcal/ capita/ supply. This suggests that our findings are not affected by predictor imbalance in the OECD sample.

*Table 3. OECD and full sample comparison*

| <b>Predictor</b> | <b>OECD sample</b> |                  | <b>Full sample</b> |                  |
|------------------|--------------------|------------------|--------------------|------------------|
|                  | <b>Treated</b>     | <b>Synthetic</b> | <b>Treated</b>     | <b>Synthetic</b> |
| GDP per capita   | 27,216.25          | 27,186.20        | 27,216.25          | 23,119.83        |
| Inflation        | 3.55               | 4.55             | 3.55               | 4.88             |
| Supply, t-1      | 21.25              | 21.21            | 21.25              | 20.64            |
| Cereals          | 657.75             | 770.68           | 657.75             | 786.22           |
| Fruits           | 115.25             | 111.79           | 115.25             | 115.27           |
| Meats            | 358.38             | 342.92           | 358.38             | 358.19           |
| Vegetables       | 81.50              | 74.52            | 81.50              | 76.29            |
| Vegetable oils   | 417.25             | 397.22           | 417.25             | 352.27           |
| Animal fats      | 238.25             | 206.41           | 238.25             | 191.75           |
| Total kcals      | 3,060.38           | 3,163.77         | 3,060.38           | 3,063.55         |

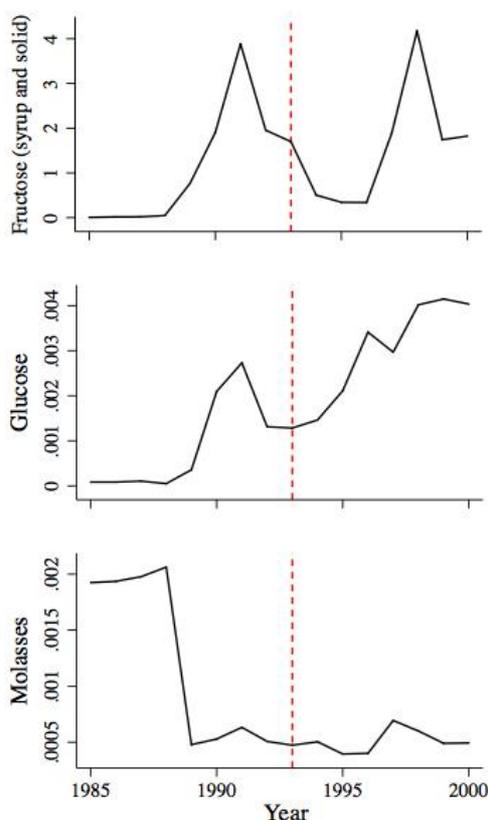
### Serial correlation

To account for possible serial correlation we follow a strategy proposed by Bertrand et al. (2004) by averaging the data in the pre- and post-treatment period and estimating the cross-national fixed-effects regression model (with Canada and Australia) using this averaged variable in a panel of time length equal to two.<sup>1</sup> Consistent with our synthetic control analysis this yielded an effect estimate of NAFTA of 41.12 (95% CI: 40.21 to 42.02). We then test for the sensitivity of our results to pre-intervention dip, i.e. whether supply fell in anticipation of NAFTA, by excluding the 2-years before and after NAFTA was implemented from our analysis. This also resulted in effect estimates of comparable magnitude to our main analysis (NAFTA coefficient: 43.62, 95% CI: 41.35 to 45.90).

### Alternative explanations

As a further test for possible different explanations for changes in supply findings we plot trends in US exports alternative caloric sweeteners not applicable for lower tariffs. Figure 2 shows that there was not a marked increase in exports of these alternative sweeteners.

Figure 2. US exports to Canada of beverage syrups not applicable for tariff reductions, 1989-2000



Notes: vertical line shows when NAFTA was implemented on 1 January 1994

Finally, we reviewed new investments by US companies in the Canadian corn syrup industry using data from the Canadian Government Investment Review Division.<sup>2</sup> We did not identify the establishment of a Canadian branch or acquisition of a Canadian company by the US's major corn syrup producers immediately post-NAFTA.

### References

1. Bertrand M, Duflo E, Mullainathan S. How Much Should We Trust Difference-in-Difference Estimates? *Q J ...* 2004;119 (1)(February):249-275. doi:10.1162/003355304772839588.

2. Government of Canada Investment Review Division. Listing of Completed Applications for Review and Notifications. 2015.