

Macroeconomic Impacts of Chronic Disease- NCDs on the particular economy and its impact on other economies of the world

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Background

- According to a recent World Health Organization report Non-communicable diseases (NCDs) are the leading cause of death globally today.
- Of 56 million **global deaths** in 2012, 38 million, or 68%, – were attributed to non-communicable diseases, comprising mainly cardiovascular diseases, cancers, type 2 diabetes and chronic respiratory diseases (WHO 2015).
- The prevalence of non-communicable diseases (NCDs) has been widely acknowledged as a major barrier to global development.
- The heavy burden of NCDs includes not only higher rates of mortality, **but also impede the pace of economic development by reducing labor supply and productivity.**

- Non-communicable chronic diseases have large individual costs, in terms of both monetary expenditures and wellbeing, as well as large social costs.
- NCDs create a significant burden on health systems and a growing economic burden on country economies.

- The global economic impact of the five leading non-communicable diseases (NCDs) – cardiovascular disease (CVD), chronic respiratory disease, cancer, diabetes and mental ill-health – could total US\$ 47 trillion over the next 20 years, according to World Economic Forum.
- Findings of [*The Global Economic Burden of Non-communicable Diseases*](#) show that the estimated cumulative output loss over the next 20 years represents approximately 4% of annual global GDP.
- While mental ill-health is typically left off the list of top NCDs, it alone accounts for over US\$ 16 trillion, or one-third, of the overall US\$ 47 trillion anticipated spend on NCDs.

- Two out of five Canadians, above the age of 12 years, have at least one chronic disease and 80% are at risk of developing a chronic disease
- In Canada, 177,800 people are diagnosed with cancer and seventy five thousand die each year.
- 1.6 million have heart disease, while over 3 million Canadians live with a chronic respiratory disease

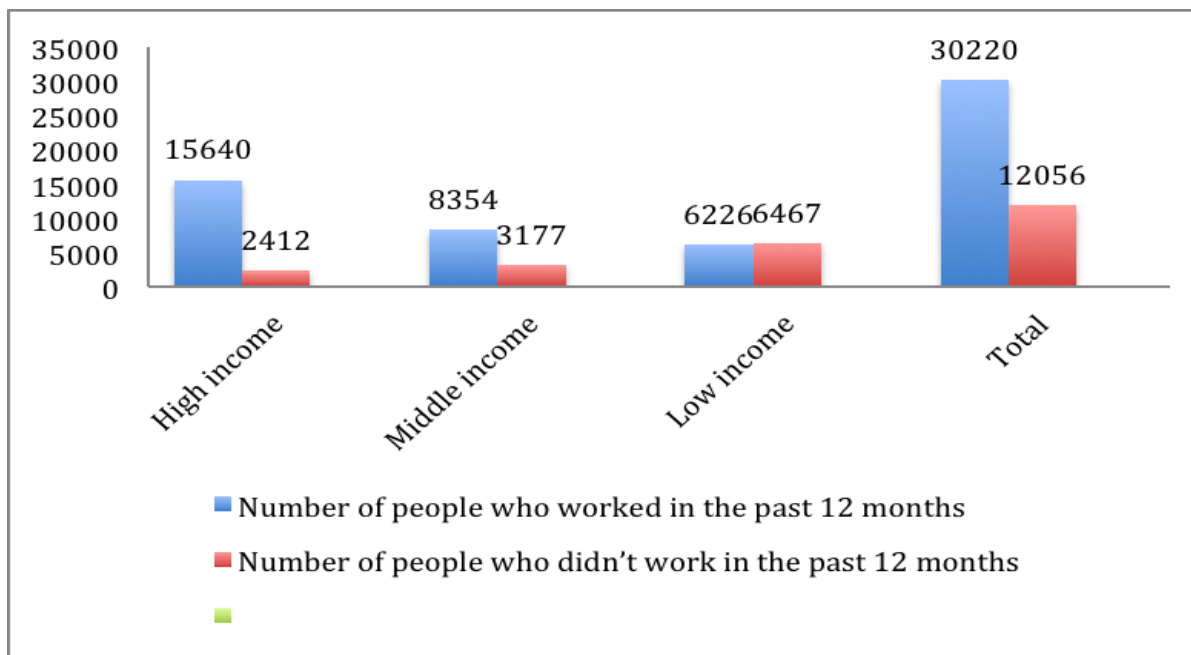
Objective

- The current study estimates the macro economic impact of NCDs reduction in Canada.

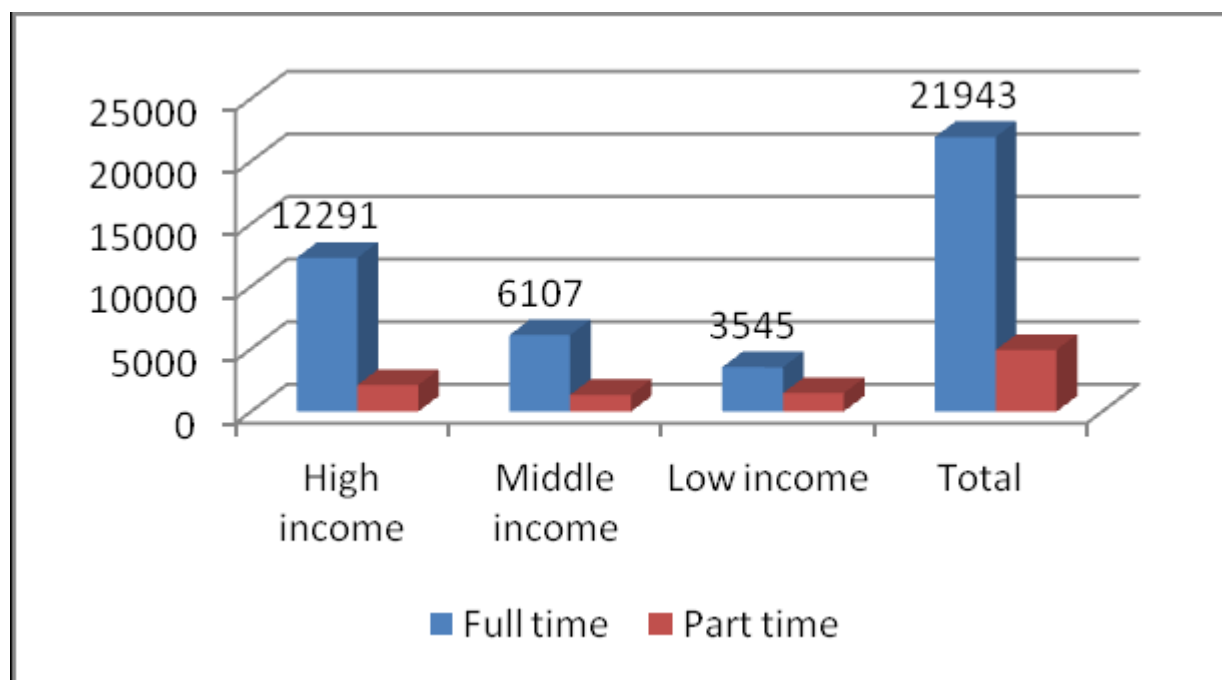
CCHS SURVEY

- The CCHS survey had 49,897 households respond to the survey.
- The high income group accounted for the largest proportion, which accounted for 40.2% of the total households.
- The number of households in the low income group was the second largest, with 33.1% of the households in the sample.
- The middle income group had the lowest number of households (27%).

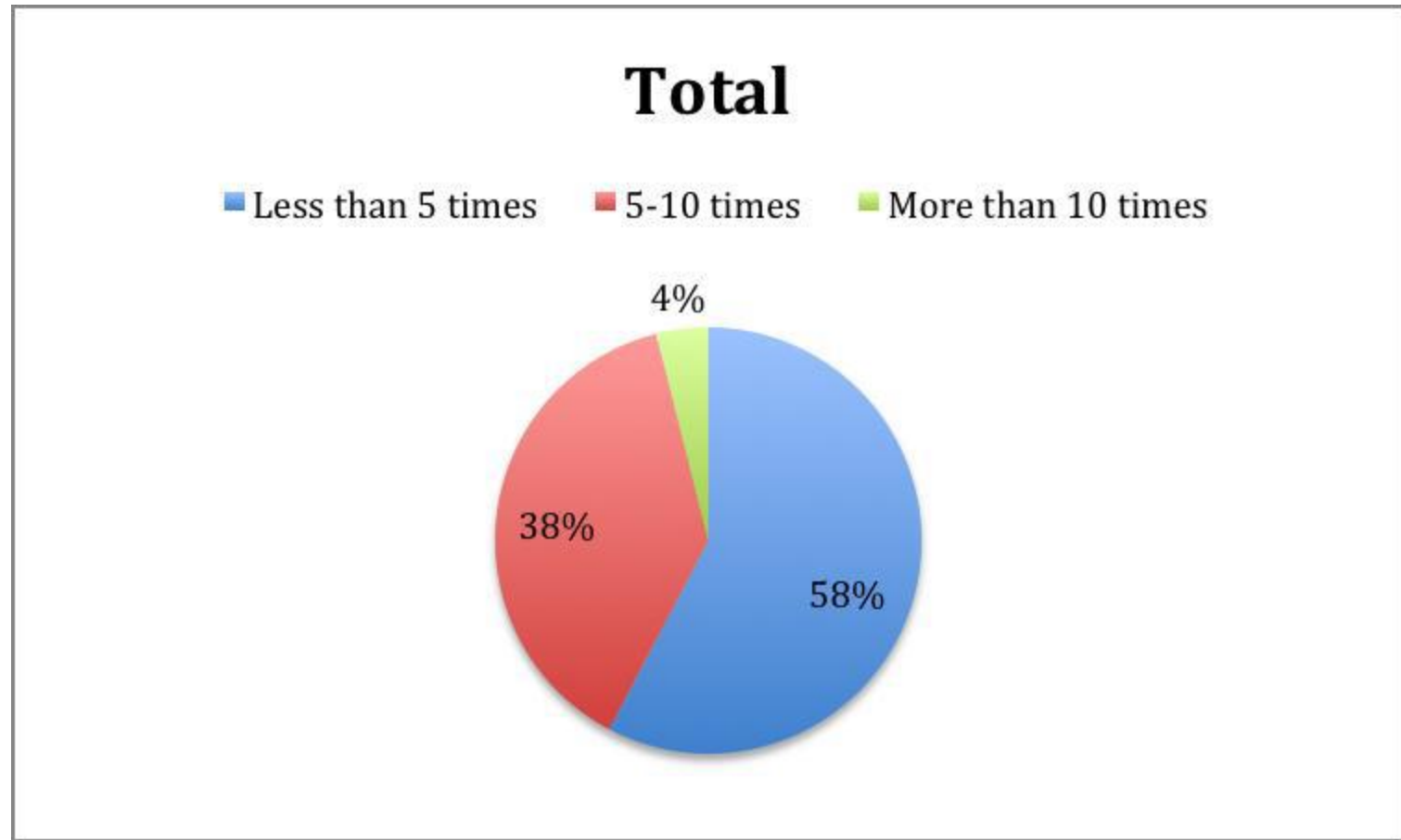
Employment Status among Canadian Household (CCHS sample)



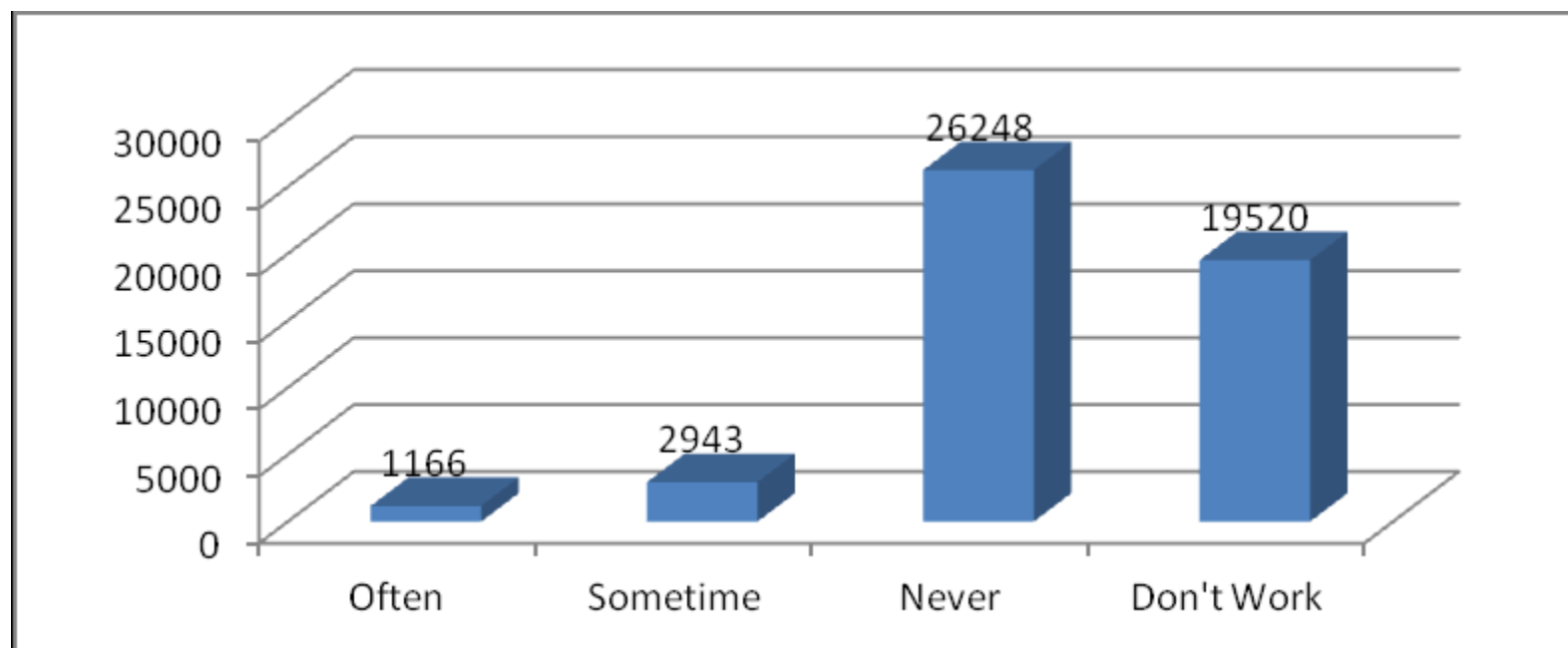
Number of Full-Time and Part-Time Employees by Income Category



Daily Consumption of Fruits and Vegetables among Canadian Household



Number of Individuals Who's Health Problems Impacted their Ability to Work



Employment status during the Last 3 Months

	High income group	Middle income group	Low income group	Total
Employed	14,502	7,574	5,221	27,297
Un Employed	1,019	705	878	2,602

Absent from work because of many factors in the past 3 months

Income group	High income group	Middle income group	Low income group	Total
Total number of persons employed	14,502	7,574	5,221	27,297
Number of persons absent from work	904	708	1,740	3,352
%	6.24	9.34	33.32	12.27

Categories of chronic conditions	High income group	Middle income group	Low income group	Total
Arthritis	67	61	187	315
Osteoporosis	5	3	21	29
Cardiovascular disease	37	29	118	184
Kidney disease	12	8	14	34
Asthma	20	14	22	56
Chronic obstructive pulmonary disease	12	21	49	82
diabetes	18	19	54	91
migraine	78	42	38	158
Ack problems	150	110	241	501
Cancer	33	35	65	133
Mental illness	80	73	296	449
Neural disease	33	28	79	140
Digestive diseases	31	18	38	87
Fibromy chronic fatigue syndrome	29	31	67	127
Other	299	216	451	966
Total number of people who lost work days last 3 months due to chronic condition	904	708	1740	3352

Methodology

Basic Structure of GTAP

- The basic structure of the Global Trade Analysis Project (GTAP) model includes: industrial sectors, households, government, and global sectors. across countries.
- Countries and regions in the world economy are linked together through trade
- Prices and quantities are simultaneously determined in both factor markets and commodity markets.
- Five main factors of production are included in the model: skilled labor, unskilled labor, capital, natural resources, and land

Household behavior in the model is determined with an aggregate utility function. The private household buys bundles of commodities to maximize utility subject to its expenditures constraint.

Structure of GTAP

- Firms minimize input costs given their level of output and fixed technology. The production side of the model assumes CRS and perfect competition. The model incorporates the Armington assumption
- International trade is linked through Armington substitution among goods differentiated by country of origin
- Transportation sector takes into account the difference in the price of a commodity as a result of the transportation of the good between countries
- Global bank sector brings into equilibrium the savings and investment in the model

In the equilibrium, all firms have zero real profit, all households are on their budget constraint, and global investment is equal to global savings

- Demand equals supply in all markets

Changing the model's parameter allows one to estimate the impact from a country's /region original equilibrium position to a new equilibrium position

data

- GTAP version 8.1
- With a base year of 2007 for 129 countries/regions and 57 sectors

Regions are aggregated to 10

Canada, USA, Mexico, Brazil, EU_27, China, India, Japan, Rest of OECD and Rest of the World (ROW).

57 sectors have been aggregated to 23 sectors.

Impact of NCDs on Labour Force Absenteeism

	CCHS	%
Population Sample in CCHS	49,897	
Working labour force within the CCHS sample	30,596	
Labour force reduction in the CCHS sample due to different types of NCDs		
NCD food related	952	3.11
NCD food related plus mental illness	1,383	4.52
All NCD except others	2,386	7.79

Estimates of Labour Force Reductions from NCDs on the Canadian Economy

	% Reduction	Estimates('000)
Total working labour force in Canada in 2010		17,044.2
NCD food related	3.11	530.3
NCD food related plus mental illness	4.52	770.4
All NCD except others	7.80	1,329.2

	% of skilled labour force	% of unskilled labour force
NCD food related	2.18	0.93
NCD food related plus mental illness	3.16	1.36
All NCD except others	5.46	2.34

Results

- The impact of a reduction in NCDs and the resulting reduction in absenteeism has a positive impact on Canada's GDP
- A reduction in NCDs that resulted primarily from an unhealthy lifestyle resulted in a 0.83% increase in Canada's GDP.
- Reducing absenteeism from both unhealthy lifestyle and mental illness resulted in a 1.23% increase in GDP
- While reducing all absenteeism from NCDs resulted in a 2.12% increase in Canada's GDP.
- The effect of the GDP gain appears to be limited to the Canadian economy with no significant effects on the GDP of other countries and region.

% changes in GDP

	Scenario 1	Scenario 2	Scenario 3
1 Canada	0.83	1.23	2.1207
2 USA	0.0000	0.0001	0.0001
3 Brazil	-0.0000	-0.0001	-0.001
4 EU_27	-0.0001	-0.0002	-0.0005
5 China	-0.00002	-0.0005	-0.0008
6 India	-0.0000	-0.0009	-0.0015
7 Japan	-0.0000	-0.0001	-0.0005
8 Mexico	0.0000	0.0001	0.0018
9 Rest of OECD	-0.0001	-0.0003	-0.0009
10 ROW	0.0000	0.0001	0.0003

Changes in regional household income

	Scenario 1	Scenario 2	Scenario 3
1 Canada	0.7111	1.0397	1.8041
2 USA	0.017	0.0251	0.0417
3 Brazil	-0.0005	-0.0011	-0.0013
4 EU_27	-0.001	-0.0012	-0.0021
5 China	0.0007	0.001	0.0018
6 India	-0.0026	-0.0028	-0.0062
7 Japan	-0.0039	-0.0061	-0.0116
8 Mexico	0.0034	0.0064	0.0107
9 Rest of OECD	0.0002	0.0003	0.0008
10 ROW	0.0106	0.0153	0.0263

Household Income

- There is a direct correlation between household income in Canada and the reduction in NCDs.
- A reduction in the number of NCDs has also a positive impact on the percentage change in household income.
- The percentage increase in household income in Canada ranges from 0.71% to 1.8% depending on the scenario.
- Household income in the USA has a marginal increase from the reduction in NCDs in Canada.
- The impact on other countries is not significant.

Industrial Output Changes in Canada Due to a Reduction in NCDs.

Sectors	Scenario 1	Scenario 2	Scenario 3
2 CrGrain	0.41	0.59	1.03
6 Sugarcane	0.73	1.06	1.86
7 Lstock_meat	0.58	0.84	1.47
11 Mining	0.45	0.64	1.12
12 Forestry	0.90	1.29	2.27
13 fishery	0.46	0.66	1.15
14 FdProducts	0.59	0.85	1.50
15 Oil_pcts	0.57	0.83	1.45
16 En_Int_Ind	0.50	0.72	1.25
17 light ind	0.67	0.97	1.71
18 heavy Ind	0.81	1.17	2.06
19 Electricity	0.73	1.05	1.85
20 Transport	0.64	0.93	1.63
21 other utilities	0.77	1.11	1.98
22 financial ser	0.73	1.05	1.86
23 Oth_Serv	0.74	1.07	1.89

Industrial output

- Industrial output increases due to the improvement of the health of the labour force.
- The 'services sectors' are the ones most positively affected by the greatest reductions in NCDs.
- the largest increases in industrial output were from the 'other utilities' sector followed by the 'heavy industries' sector.
- the agriculture sectors were the least affected in terms of industrial output from the reduction in NCDs.
- The 'livestock and meat' sector saw an increase of output.

EXPORT(%)		Scenario 1	Scenario 2	Scenario 3
7 Lstock_meat		0.22	0.31	0.56
16 En_Int_Ind		0.22	0.31	0.55
17 light ind		0.38	0.54	0.94
18 heavy Ind		0.61	0.87	1.53
20 Transport		0.21	0.31	0.55
21 other utilities		0.50	0.72	1.27
22 financial ser		0.57	0.83	1.43
23 Oth_Serv		0.94	1.36	2.33
total		0.28	0.41	0.72

IMPORT(%)	Scenario 1	Scenario 2	Scenario 3
7 Lstock_meat	0.22	0.32	0.54
14 FdProducts	0.05	0.07	0.12
16 En_Int_Ind	0.22	0.31	0.53
17 light ind	0.39	0.55	0.95
18 heavy Ind	0.61	0.88	1.51
21 other utilities	0.50	0.72	1.24
22 financial ser	0.57	0.83	1.42
23 Oth_Serv	0.94	1.36	2.35
total	0.28	0.40	0.69

Export

- The increase in labour supply due to a reduction in NCDs resulted in an increase in both exports and imports of Canada.
- Total Canadian exports increased between US\$ 1.12 billion and US\$3 billion.
- The 'heavy industry' sector saw the largest growth among all sectors in all three scenarios, with exports increasing by 1.53%.
- the 'energy intensive sectors' and 'financial services' sectors with a gain of US\$ 0.43 billion and US\$ 0.41 billion respectively.
- the 'Oil', 'oil products' and 'gas products' sectors saw a decline in exports despite an increase in industrial output due to the reductions in NCD.

Import

- Canadian imports increased with the increase in labour supply due to the reduction in NCDs.
- The main driver of the increase in imports in the three scenarios is the growth in 'heavy industry' imports.
- This is followed by 'light industry' products.

Private Household Expenditures

- Private household demand increased the greatest for the services' sector.
- For the industrial sectors, private household demand increased the most for the 'heavy industry' sector, 'energy intensive industry' and the 'light manufacturing industry'.
- Among agricultural sectors 'crops' sector and the 'livestock and meat' sector

Private household expenditure

Sectors	Scenario 1	Scenario 2	Scenario 3
7 Lstock_meat	0.690	0.995	1.726
8 Coal	0.730	1.053	1.829
9 Oil	0.687	0.992	1.723
10 Gas_pcts	0.709	1.024	1.778
11 Mining	0.685	0.989	1.720
12 Forestry	0.594	0.859	1.502
13 fishery	0.499	0.722	1.258
14 FdProducts	0.683	0.985	1.709
15 Oil_pcts	0.713	1.029	1.787
16 En_Int_Ind	0.789	1.138	1.973
17 lightind	0.778	1.123	1.948
18 heavyInd	0.800	1.154	2.002
19 Electricity	0.680	0.981	1.702
20 Transport	0.794	1.146	1.986
21 othutilities	0.928	1.337	2.314
22 financialser	0.967	1.395	2.415
23 Oth_Serv	1.048	1.512	2.618

- A reason why a reduction in NCDs may have a larger effect on the service sectors is that NCDs resulted in a greater decrease in skilled labor relative to unskilled labor and the services sectors employed more skilled labour.

Welfare Implications from a Reduction in NCDs in Canada (million USD).

WELFARE	Scenario 1	Scenario 2	Scenario 3
CANADA	12031.3	17354.9	29518.24
USA	312.999	450.552	779.33
México	5.7354	8.2725	14.009
ROW	326	469.772	804.49
Total	12236.1	17648	30054.2

Conclusion

- The increase in labour supply that would result from a reduction in NCDs would have a positive impact on the Canadian economy.
- This increase in the labour supply is expected to increase GDP in Canada along with household income, private household consumption, industrial output, exports, imports and welfare.
- The sectoral impact in terms of industrial output, exports and imports varies by sector.
- The positive impacts are expected in the heavy industry sector and service sectors.
- Industrial and service sectors tend to have improvements in their economic performance because of the healthier workforce.
- This is a win- win situation for Canada.
- The impact of NCD reductions in Canada has some positive impact on the USA, Mexico and Brazil.

Thank you