The Beacon Hill Institute

*The Transportation & Climate Initiative: COVID-19 Economic Impacts on Massachusetts**

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Executive Summary

From the first shutdowns in March, the COVID-19 pandemic wreaked havoc on the Massachusetts economy. In the second quarter of 2020, Massachusetts real gross domestic product (GDP), a key measure of the state's economic vitality, declined at the fastest pace in state history.[1] The impact of the mass closures and restrictions on businesses within the state will be felt for years to come.

Even with the development and distribution of vaccines nearing, in addition to the potential for further economic stimulus from the federal government, BHI projects that the state economy will not return to pre-pandemic levels for multiple years.

Although the state economy is currently mired in one of the worst economic contractions in state history, Massachusetts legislators are keen on the state's participation in the Transportation and Climate Initiative (TCI).

TCI is "a regional collaboration of 12 Northeast and Mid-Atlantic states and the District of Columbia that seeks to improve transportation, develop the clean energy economy and reduce carbon emissions from the transportation sector."[2] The purpose of the TCI is "to reduce greenhouse gas emissions, minimize our transportation system's reliance on high-carbon fuels, promote sustainable growth, address the challenges of vehicle-miles traveled and help build the green energy economy."

In an analysis of the economic impacts of TCI on Massachusetts in March of this year, the Beacon Hill Institute (BHI) found that the program would carry harmful

[1] Bureau of Economic Analsysis, Real GDP by State, https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1

[2] Transportation Climate Initiative Declaration, (February 3, 2020) https://www.transportationandclimate.org/sites/default/files/TCI-declaration.pdf.

economic effects while providing negligible environmental benefits.[3] This analysis assumed that the state would have fully recovered from the pandemic by the time of the TCI's implementation in 2022. Another independent analysis of TCI, by the Center for State Policy Analysis, found that the program could considerably impact the prices of on-road gasoline and diesel.[4] In our analysis here, BHI estimates the costs imposed if Massachusetts participates in TCI while the state undergoes a delayed recovery, lasting beyond 2022, from the coronavirus pandemic.

We find that, particularly in the first two years, TCI would bring more severe effects as the state economy slowly recovers. We report our results for three emissions cap scenarios from 2022 through 2026 to capture the short-term economic impacts on the Massachusetts economy. The scenarios are caps set at 20, 22.5, and 25 percent of baseline emissions. Table 1 displays the results of a cap set at 22.5 percent.

Revenue resulting from auction allowance proceeds under a 22.5 percent emissions cap scenario has been estimated to be $450 million in Massachusetts. However, if the usage of gasoline and diesel fuel for on-road vehicles continues to trend lower than it did pre-pandemic, TCI auction allowance revenues could plummet (as seen in California.)

In our earlier analysis, which took place at the start of the pandemic, we found that TCI would reduce business investment by $229 million, disposable income by $1,524 million, and private employment by 7,629 jobs in 2022. The cost per average Massachusetts household would be $585. State real GDP would fall by $788 million. That was before we could know that the pandemic would severely impact the state economy this year.

[3] The Transportation Climate Initiative: Its Economic Impacts on Massachusetts, http://beaconhill.org/BHIStudies/2020/3-10-2020_BHI_and_FAF_Study_on_TCI.pdf.

[4] Assessing the Impact of TCI, The Center for State Policy Analysis, https://tischcollege.tufts.edu/research/assessing-impact-tci.

Assuming that on-road gasoline and diesel emissions return to their pre-pandemic levels, the emissions cap would reduce investment by $305 million, disposable income by $1,649 million, and private employment by 9,993 jobs in 2022. On average, Massachusetts households would incur a cost of $630. State real GDP would fall by $1,001 million. The emissions cap would reduce other tax revenues, resulting in a net rise of $428 million in state tax revenues.

By 2026, a 22.5 percent emissions cap would reduce investment by $325 million, disposable income by $1,762 million, and private employment by 7,677. The average Massachusetts household would incur a cost of $673. State real GDP would fall by $865 million. The emissions cap would reduce other tax revenues, resulting in a net rise of $430 million in state tax revenues.

Table 1: The Costs and Benefits of a 22.5% Emissions Cap on Massachusetts

Variable	2022	2023	2024	2025	2026
Dynamic TCI revenue ($, mil.)	450	450	450	450	450
Revenue changes other state taxes ($, mil.)	-22	-22	-20	-20	-20
Total dynamic revenue change ($, mil.)	428	428	430	430	430
Private employment (jobs)	-9,993	-9,290	-8,821	-8,072	-7,677
Investment ($, mil.)	-305	-283	-290	-313	-325
Disposable income, real ($, mil.)	-1,649	-1,666	-1,701	-1,723	-1,762
Cost per household ($)	630	636	650	658	673
State real GDP ($, mil.)	-1,001	-974	-941	-906	-865

Massachusetts households with lower incomes and small businesses who are currently struggling with the current COVID-induced economic conditions would largely carry the burdens imposed under TCI.

Introduction

The Transportation and Climate Initiative of the Northeast and Mid-Atlantic States (TCI) Framework for a Draft Regional Policy Proposal, released October 1, 2019, proposes a "Cap and Invest" system in which fuel suppliers would be required to purchase carbon allowances through an auction-based system.[5] The "cap" or limit for carbon emissions is determined through the use of a "combination of baseline emissions for three recent years, and projected emissions estimated through modeling." The cap would be set at a level that then declines every year at a rate chosen by TCI jurisdictions to support their emissions reduction goals. Analysis of the program's impact would also inform the cap level.

After determining the cap, carbon allowances (designated allowances of carbon emissions from the combustion of the fossil fuel component of finished motor gasoline and on-road diesel fuel in the region) would be auctioned off to the highest bidder. Accompanying the auction process and new market for carbon allowances, a "regional organization would be used to conduct carbon market monitoring, auction administration and allowance tracking. This would include the establishment and maintenance of a system to collect and manage reported emissions-related data from regulated entities and track allowance accounts." TCI will also monitor emission allowances and transportation fuel markets.

According to the TCI Framework for a Draft Regional Policy Proposal, "Fuel suppliers would be required to report emissions to TCI jurisdictions, plus supporting information. Compliance obligations would be calculated based on the emissions that occur when the affected fuel is combusted, using standard emission factors developed by

[5] Transportation Climate Initiative, Framework for a Draft Regional Policy Proposal, (February 3, 2020) https://www.transportationandclimate.org/sites/default/files/TCI-Framework_10-01-2019.pdf.

the United States Environmental Protection Agency (US EPA), California, or other similar sources." To monitor emissions, "TCI Jurisdictions," most likely individual states or regional enforcement bodies, would have to create an electronic monitoring system. Reports would be required monthly or quarterly, and would either be verified by a third-party, a government agency, or self-verified.

According to TCI, "position holders would be the primary point of regulation for compliance obligations." A position holder is considered a company that owns fuel inventory, in this case on-road gasoline and diesel, at a terminal.[6]

COVID-19 Impact on Massachusetts Economy

The coronavirus crisis has had a devastating impact on the economy. At the height of the pandemic, businesses deemed non-essential were ordered closed, leaving owners with no income to pay their employees or meet other business expenses. The unparalleled shutdown has rippled throughout the state economy.

The labor market incurred significant losses as demand went into free fall. The restaurant, tourism, retail, and leisure industries (all major industries in Massachusetts) incurred the bulk of job losses after businesses were shuttered or heavily limited in day-to-day operations.[7] Employment in other sectors followed as construction sites closed down, office parks emptied, education sent offline, and recreational outlets closed.[8]

[6] Legal Information Institute, Taxable fuel; Definitions, https://www.law.cornell.edu/cfr/text/26/48.4081-1.

[7] Bureau of Labor Statistics, https://lmi.dua.eol.mass.gov/LMI/CurrentEmploymentStatistics/News.

[8] Ibid.

However, the state economy has moderately recovered thanks to the reopening of business, in addition to the help provided through federal fiscal stimulus.

The Massachusetts economy's recovery, however, is threatened as infections surge to their highest levels to date.[9] According to Johns Hopkins University's Coronavirus Resource Center, the percentage of positive COVID-19 tests (7-day moving average) rose from under 0.6% in mid-September to 5.7% in mid-December.[9] Believing that conditions will worsen in Massachusetts before they improve, Governor Charlie Baker and Boston Mayor Marty Walsh recently announced rollbacks to the Commonwealth's and the city's planned reopening schedule.[10]

As of October, over 268,000 people in Massachusetts are unemployed and the unemployment rate stands at 7.4 percent, down from its peak of 17.7 percent in June.[11] In October, total U.S. nonfarm payrolls are down 9.2 percent from October of the previous year.[12] The latest Department of Labor Unemployment Insurance Weekly Claims report noted that workers in Massachusetts filed 25,838 unemployment claims in the week ending December 5th.[13] In the previous week, unemployment claims in the state totaled 24,178. Massachusetts had the 6th highest insured unemployment rate in the country in the week ending November 21st.[14]

Federal employment benefits are set to expire at the end of the month for nearly 12 million people nationwide, including many unemployed in Massachusetts.[15] The state's recovery is largely dependent on the ability of the unemployed to return to work,

[9] Massachusetts Map and Case Count, https://www.nytimes.com/interactive/2020/us/massachusetts-coronavirus-cases.html.
[9] Johns Hopkins University, Massachusetts Testing Trends, (December 16, 2020) https://coronavirus.jhu.edu/testing/individual-states/massachusetts.
[10] "Boston Closes Museums, Gyms As Coronavirus Cases Rise Again", WBUR News, https://www.wbur.org/news/2020/12/14/boston-rolls-back-reopening-coronavirus-museums-gyms.
[11] Bureau of Labor Statistics, https://www.bls.gov/news.release/laus.nr0.htm.
[12] Ibid.
[13] Department of Labor Unemployment Insurance Weekly Claims, https://www.dol.gov/ui/data.pdf.
[14] Ibid.
[15] "12 million Americans set to lose unemployment benefits by year's end", CNBC, https://www.cnbc.com/2020/11/19/12-million-americans-set-to-lose-unemployment-benefits-by-years-end.html.

and as restrictions are increased to help stave off infections, more people are at risk of losing employment. With federal jobless benefits set to expire, the unemployed will be forced to endure financial hardship.

Not only are workers looking for employment but many small businesses have struggled to stay afloat during the pandemic. According to the Opportunity Insights Economic Tracker, as of November 30th, the number of small businesses open fell by 33.8 percent since January 1st.[16] Moreover, as of November 30th, total small business revenue in Massachusetts has decreased by 44.2 percent since January 1st.[17] Without supplemental money provided through the Payroll Protection Program, small businesses around the state are left vulnerable, especially if non-essential businesses are forced to close again.

State real GDP is a key indicator of the Massachusetts economy's performance. In the first quarter of 2020 (the beginning of the pandemic), Massachusetts real GDP declined by 1.6 percent.[18] In the second quarter of 2020, Massachusetts real GDP declined at a 31.5 percent rate, the worst quarter in state history.[19]

To analyze the economic effects of TCI on the state economy as it recovers, BHI estimated the state's key economic indicators. Table 2 reports Massachusetts real GDP and unemployment rate for December 2019 (before the pandemic) and BHI's forecast for Massachusetts GDP and unemployment rate for December of 2020 through December of 2023 previous to and after the economic recession.

Table 2: Massachusetts Key Economic Indicators, December Forecasts[20]

Variable	2019*	2020	2021	2022	2023
State Gross Domestic Product ($, mil.) **	519,962	530,465	540,491	548,598	554,687
State Gross Domestic Product ($, mil.)	519,962	490,843	508,023	519,707	530,102

[16] Oppurtunity Insights, Economic Tracker, https://opportunityinsights.org/tracker-resources/.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Real GDP is annualized.

Unemployment Rate (%) **	2.8	3.1	3.5	3.9	3.9
Unemployment Rate (%)	2.8	7.2	6.2	5.1	4.6

*Actual data for Massachusetts real GDP and unemployment rate in December 2019.
** Baseline before the economic recession.

Under a scenario where the pandemic-induced economic recession never happened, Massachusetts real GDP would be $530.4 billion in December 2020, up from $519.9 billion in December of 2019. Over time, Massachusetts real GDP would increase to $554.6 billion in December 2023. In the current scenario, BHI estimates that Massachusetts real GDP will fall to $490.8 billion in December 2020, from $519.9 billion in December 2019. Over time, Massachusetts real GDP will increase to $530.1 billion in December 2023. As seen in the table, BHI estimates that Massachusetts real GDP will not return to its 2019 level until 2022, the first year under TCI implementation. By the end of 2022, BHI estimates that Massachusetts real GDP will be nearly $29 billion lower than its 2022 non-recession level.

Under a scenario where the pandemic-induced economic recession never happened, the Massachusetts unemployment rate would be 3.1 percent in December 2020, up from 2.8 percent in December of 2019. Over time, the Massachusetts unemployment rate would increase to 3.9 percent by December 2023. In the current scenario, BHI estimates that the Massachusetts unemployment rate will increase to 7.2 percent in December 2020, from 2.8 percent in December 2019. Over time, the Massachusetts unemployment rate will fall to 4.6 percent in December 2023. As seen in the table, BHI does not expect the Massachusetts unemployment rate to return to its December 2019 level in the foreseeable future.

California Cap-and-Trade System

The state of California has instituted cap-and-trade systems similar to TCI. California launched its cap-and-trade system in 2013.[21] According to the Center for Climate and Energy Solutions, "The cap-and-trade rule applies to large electric power plants, large industrial plants, and fuel distributors (e.g., natural gas and petroleum). Around 450 businesses responsible for about 85 percent of California's total greenhouse gas emissions must comply." The California Air Resources Board (CARB) is the entity responsible for enforcing the cap. The cap-and-trade rules first applied to electric power plants and industrial plants that emitted 25,000 tons of carbon dioxide or equivalent per year or more. In 2015, the program was extended to fuel distributors meeting the 25,000-metric ton threshold. In addition to the freely allocated emissions allowances from the state government, allowances are also sold to the highest bidder via auction. Between 2013 and 2018, California's cap-and-trade auction system generated $9.3 billion in revenue.[22]

Through 2016, the price of gasoline per gallon in California is estimated to have risen by 11 cents and the price of diesel fuel per gallon by 13 cents as a result of California's cap-and-trade system.[23] It is also estimated that since the implementation of a cap-and-trade, motorists spend about $2 billion more annually for transportation fuel.[24] From 2013 to 2017, California has seen a reduction of 3 percent in statewide greenhouse gas emissions, although not all of the decline in emissions can be attributable to the state's cap-and-trade program.[25]

[21] Article 5, California Cap on Greenhouse Gas Emissions, (April 1, 2019) https://ww3.arb.ca.gov/cc/capandtrade/capandtrade/ct_reg_unofficial.pdf.
[22] California Air Resources Board, (March 19, 2019) https://ww2.arb.ca.gov/news/report-cap-and-trade-spending-doubles-14-billion-2018.
[23] Legislative Analyst's Office, (March 4, 2016) https://lao.ca.gov/reports/2016/3438/LAO-letter-Tom-Lackey-040716.pdf.
[24] Ibid.
[25] GHG Current California Emission Inventory Data, (August 22, 2020), https://ww2.arb.ca.gov/ghg-inventory-data.

COVID-19 Impact on Potential TCI Revenues in Massachusetts

At the beginning of the pandemic, the government ordered businesses deemed non-essential to shutter, and instituted a stay-at-home advisory, and as a result, traffic throughout the Commonwealth and the country fell considerably. As the economy has slowly reopened and people have returned to work, traffic has increased, albeit not near its pre-pandemic level.

The impacts on revenues derived from the California cap-and-trade system have plummeted dramatically as a result of the COVID-19 pandemic.[26] At the May 2020 auction, California returned just $25 million in revenue proceeds, which was down from a range of $600-$850 million in previous years (a fall of up to 97 percent.)[27] According to data from the Energy Information Industry (EIA), monthly prime supplier sales of regular motor gasoline in California fell by 41 percent from its peak in February to its trough in April.[28] Monthly prime supplier sales of regular motor gasoline in California have recovered moderately, as they are down 17 percent in September (the most recent data available) from their peak in February.[29]

Similar to California, the COVID-19 pandemic has substantially impacted the usage of on-road motor fuels in Massachusetts. According to data from the Energy Information Industry, monthly prime supplier sales of regular motor gasoline in Massachusetts fell by 44 percent from their peak in February to their trough in April (the height of COVID-19 related lockdowns.)[30] Again, similar to California, Massachusetts

[26] "California's Cap-and-Trade Program Generates Severely Reduced Revenue", KQED (accessed December 8, 2020), https://www.kqed.org/science/1965124/californias-cap-and-trade-program-generates-severely-reduced-revenue.
[27] Ibid.
[28] Energy Information Administration, Consumption, https://www.eia.gov/beta/states/states/ma/data/dashboard/consumption.
[29] Ibid.
[30] Ibid.

monthly prime supplier sales of regular motor gasoline have recovered, but remain down 8 percent from their peak in February.[31]

In the week ending December 6th, the average traffic volume was down between 6% and 44% in Massachusetts compared with the same week in 2019.[32] In the previous week, ending November 29th, the average traffic volume was down between 11% and 43% in Massachusetts compared with the same week in 2019.[33]

If the usage of on-road gasoline and diesel continue to trend downward, then the current revenue estimates that would materialize under TCI could be significantly overestimated. The long-term effects of the pandemic could entirely change the workplace dynamic and shift the state to a scenario whereby GHG emissions from on-road motor fuels declines more rapidly. Such a scenario could expose a serious flaw within the cap-and-trade system outlined by TCI, whereby revenue proceeds for participating states are directly tied to the usage of motor fuels. While TCI price impacts on motor fuels could be diminished, along with its negative economic impacts, the positive impacts from revenue proceeds will also be diminished.

The Costs and Benefits of Massachusetts Participation in TCI

Finished gasoline and on-road diesel emissions were 23.8 million metric tons of carbon dioxide or equivalent (MMTCO2E) in 2017. The total emissions from finished gasoline and on-road diesel in Table 3 establish the baseline GHG emissions that would be affected by the cap outlined in TCI.

[31] Ibid.
[32] MassDOT, Mobility Dashboard, https://mobility-massdot.hub.arcgis.com.
[33] Ibid.

Table 3: Massachusetts Gasoline and Diesel Fuel GHG Emissions for Selected Years (MMTCO2E)[34]

Emissions	2012	2013	2014	2015	2016	2017
CO2E by Fuel						
Finished Motor Gasoline	15.2	15.3	15.6	16.1	17.4	17.2
On-Road Diesel	6.7	6.9	7.0	7.1	6.7	6.6
Total Emissions	21.9	22.2	22.6	23.2	24.1	23.8

Each participating jurisdiction, in this case Massachusetts, would set a cap on emissions from finished motor gasoline and on-road diesel. We assume that Massachusetts, if it were to participate, would set emissions caps of between 20-25 percent. In our analysis, we consider the period 2022 to 2026 to allow for the implementation of the program.

Emissions subject to the cap would be 23.8 MMTCO2E in 2017, the latest data available. We project Massachusetts emissions from finished gasoline and on-road diesel through 2026, assuming that emissions return to their pre-pandemic levels, using the compound annual growth rate (CAGR) from 2007 to 2017. Table 3 contains the results.

Table 4: Massachusetts Baseline Gasoline and Diesel GHG Emissions Projections (MMTCO2E)

Emissions	2022	2023	2024	2025	2026
CO2E from Fossil Fuel Combustion (Baseline)					
Finished Gasoline	16.5	16.4	16.2	16.1	15.9
On-Road Diesel	6.3	6.3	6.2	6.2	6.1
Total Emissions	**22.8**	**22.7**	**22.4**	**22.3**	**22.0**
CO2E from Fossil Fuel Combustion (20%)					
Finished Gasoline	16.3	16.1	15.8	15.6	15.4
On-Road Diesel	6.2	6.2	6.1	6.0	5.9
Total Emissions	**22.5**	**22.3**	**21.9**	**21.6**	**21.3**
CO2E from Fossil Fuel Combustion (22.5%)					
Finished Gasoline	16.2	16.0	15.7	15.5	15.2
On-Road Diesel	6.2	6.1	6.0	5.9	5.8
Total Emissions	**22.4**	**22.1**	**21.7**	**21.4**	**21.0**

[34] Environmental Protection Agency, State Inventory and Projection Tool, https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool.

CO2E from Fossil Fuel Combustion (25%)					
Finished Gasoline	16.2	15.9	15.5	15.2	14.9
On-Road Diesel	6.2	6.1	6.0	5.8	5.7
Total Emissions	**22.4**	**22.0**	**21.5**	**21.0**	**20.6**

We project that baseline emissions subjected under TCI will fall to 22.8 MMTCO2E by 2022 and fall to 22.0 MMTCO2E by 2026. Under a 20 percent cap scenario, we project that emissions will fall to 22.5 MMTCO2E in 2022 and fall to 21.3 MMTCO2E by 2026. In a scenario whereby a 22.5 percent emissions cap is imposed, we project emissions to fall to 22.4 MMTCO2E in 2022 and decrease to 21.0 MMTCO2E by 2026. And in the scenario where a 25 percent emissions cap is set, we project emissions in 2022 would to be 22.4 MMTCO2E and decrease to 20.6 MMTCO2E by 2026.

The law of demand states that if price of a good increases, then the quantity demanded will fall. Therefore, as the quantity demanded (or consumed) goes down, which occurs under an emissions cap, then the price will be driven up. If a cap on emissions from the combustion of finished gasoline and on-road diesel is enforced, the prices of each product will increase.

We account for this by calculating the percentage decrease in the quantity of both finished gasoline and on-road diesel, calculating the responsiveness of each product to changes in price, and applying the resulting change in price of each product to projected prices for 2022. This allows us to calculate the increase in the price of each product due to the various emissions cap scenarios. The Appendix contains the details of these calculations.

The TCI emissions cap would apply only to Massachusetts emissions from the combustion of gasoline and on-road diesel destined for final sale. Both products have very low responses, or elasticities, to changes in price. Again, assuming that emissions

from the combustion of on-road gasoline and diesel return to their pre-pandemic levels, the proposed emissions cap scenarios would have a significant impact on prices in Massachusetts. In the 20 percent emissions cap scenario, the price of finished gasoline would increase by 18 cents per gallon and the price of on-road diesel by 36 cents per gallon. If a 22.5 percent emissions cap were imposed, the price of finished gasoline would increase by 21 cents per gallon and the price of on-road diesel by 42 cents per gallon. And in a scenario whereby a 25 percent emissions cap is enforced, the price of finished gasoline would increase by 26 cents per gallon and the price of on-road diesel by 52 cents per gallon.

To estimate the economic effects of Massachusetts participating in TCI, BHI utilized its MA-STAMP (Massachusetts State Tax Analysis Modeling Program).[35] BHI adjusted the MA-STAMP model to reflect the current and future economic conditions in light of the COVID-19 induced economic recession. Using the STAMP model, we find that the increase in price of finished gasoline and on-road diesel resulting from various emissions caps would generate a less competitive business environment, resulting in slower economic growth, lower employment, disposable income, and investment (particularly as the state still recovers from the pandemic-related economic contraction.)

We use estimates of the revenue that would result from auction allowances of finished gasoline and on-road diesel emissions, assuming that emissions from both motor fuel products return to their pre-pandemic levels.[36] The resulting revenue would be $300 million annually in a 20 percent emissions cap scenario, $450 million annually in a 22.5 percent emissions cap scenario, and $600 million in a 25 percent emissions cap scenario. It is important to note that these revenue estimates could be significantly lower if emissions trend downward as a result of changing motor fuel usage.

[35] For a description of the model see www.beaconhill.org.
[36] Climate X-Change "The dollars and cents of carbon pricing in Massachusetts" (May 2, 2019) https://climate-xchange.org/2019/05/02/dollars-cents-carbon-pricing-massachusetts/.

Table 5 shows that a 20 percent emissions cap would reduce investment by $235 million, disposable income by $1,460 million, and private employment by 7,431 jobs in 2022. The cost per average Massachusetts household would be $558 in 2022. State real GDP would fall by $861 million. Under a 20 percent emissions cap scenario, the emissions cap would reduce other tax revenues, resulting in a net rise of $285 million in state tax revenues in 2022.

As time passes, a 20 percent emissions cap would reduce investment by $253 million, disposable income by $1,579 million, and private employment by 5,894 jobs in 2026. The cost imposed per average Massachusetts household would be $603 in 2026. State real GDP would fall by $765 million. Under a 20 percent emissions cap scenario, the emissions cap would reduce other tax revenues, resulting in a net rise of $286 million in state tax revenues in 2026.

Table 5: The Costs and Benefits of a 20% Emissions Cap on Massachusetts

Variable	2022	2023	2024	2025	2026
Dynamic TCI revenue ($, mil.)	300	300	300	300	300
Revenue changes other state taxes ($, mil.)	-15	-15	-14	-14	-14
Total dynamic revenue change ($, mil.)	285	285	286	286	286
Private employment (jobs)	-7,431	-7,197	-6,610	-6,153	-5,894
Investment ($, mil.)	-235	-218	-225	-242	-253
Disposable income, real ($, mil.)	-1,460	-1,497	-1,524	-1,559	-1,579
Cost per household ($)	558	572	582	596	603
State real GDP ($, mil.)	-861	-832	-811	-792	-765

Table 6 shows that a 22.5 percent emissions cap would reduce investment by $305 million, disposable income by $1,649 million, and private employment by 9,993 jobs in 2022. On average, Massachusetts households would incur a cost of $630. State real GDP would fall by $1,001 million. The emissions cap would reduce other tax revenues, resulting in a net rise of $428 million in state tax revenues.

Table 6: The Costs and Benefits of a 22.5% Emissions Cap on Massachusetts

Variable	2022	2023	2024	2025	2026
Dynamic TCI revenue ($, mil.)	450	450	450	450	450
Revenue changes other state taxes ($, mil.)	-22	-22	-20	-20	-20
Total dynamic revenue change ($, mil.)	428	428	430	430	430
Private employment (jobs)	-9,993	-9,290	-8,821	-8,072	-7,677
Investment ($, mil.)	-305	-283	-290	-313	-325
Disposable income, real ($, mil.)	-1,649	-1,666	-1,701	-1,723	-1,762
Cost per household ($)	630	636	650	658	673
State real GDP ($, mil.)	-1,001	-974	-941	-906	-865

By 2026, a 22.5 percent emissions cap would reduce investment by $325 million, disposable income by $1,762 million, and private employment by 7,677. The average Massachusetts household would incur a cost of $673. State real GDP would fall by $865 million. The emissions cap would reduce other tax revenues, resulting in a net rise of $430 million in state tax revenues.

Table 7 shows that a 25 percent emissions cap would reduce investment by $402 million, disposable income by $2,211 million, and private employment by 12,084 jobs in 2022. The cost per average Massachusetts household would be $845. State real GDP would fall by $1,233 million. The emissions cap would reduce other tax revenues, resulting in a net increase of $570 million in state tax revenues.

Table 7: The Costs and Benefits of a 25% Emissions Cap on Massachusetts

Variable	2022	2023	2024	2025	2026
Dynamic TCI revenue ($, mil.)	600	600	600	600	600
Revenue changes other state taxes ($, mil.)	-30	-30	-29	-29	-29
Total dynamic revenue change ($, mil.)	570	570	571	571	571
Private employment (jobs)	-12,084	-11,660	-11,231	-10,647	-10,265
Investment ($, mil.)	-402	-409	-415	-419	-424
Disposable income, real ($, mil.)	-2,211	-2,248	-2,285	-2,307	-2,358
Cost per household ($)	845	859	873	881	901
State real GDP ($, mil.)	1,233	1,205	1,183	1,162	1,149

As time passes, a 25 percent emissions cap would reduce investment by $424 million, disposable income by $2,358 million, and private employment by 10,265 jobs in 2026. The

total cost per average Massachusetts household would be $901. State real GDP would fall by $1,149 million. The emissions cap would reduce other tax revenues, resulting in a net increase of $571 million in state tax revenues.

Conclusion

Massachusetts legislators have been assertive in endorsing policies to combat climate change, and are steadfast in the state's participation in TCI. The Massachusetts economy is currently recovering from one of the worst economic contractions in state history. However, the ongoing recovery is in jeopardy as COVID-19 cases surge, federal fiscal stimulus expires, and restrictions on non-essential businesses tighten.

As a result of the pandemic, GHG emissions in the transportation sector have fallen considerably as people have been forced to stay at home. While emissions are beginning to trend up again, the pandemic could change workplace and commuting dynamics. Have companies discovered potential savings from keeping workers at home instead of at the office? Will people who commute to work via public transportation feel safe in crowded areas? These questions pose serious challenges to the TCI program. They could alter dramatically the baseline emissions from motor fuels on which TCI will be predicated. In California's scenario, it is clear that unforeseen events such as the pandemic can have substantial effects on revenue proceeds from a system akin to TCI.

Cap and trade schemes are a problematical tool to address climate change. Under current and future economic conditions resulting from the COVID-19 pandemic, a cap-and-trade system will impose more severe costs upon lower-income households that spend larger portions of their household incomes on motor fuels.

As concluded in our previous study, the costs of Massachusetts partaking in the TCI far outweigh the benefits. However, while the state is recovering from a severe economic recession, TCI would impose even more harmful economic effects. TCI would particularly impact most those who are currently struggling during the economic crisis, such as people with lower incomes and small businesses.

Appendix

BHI used its multisector STAMP model to estimate the economic cost of a proposed cap and investment of finished gasoline and on-road diesel in Massachusetts. The existing models provide fields in which we can enter changes in the state income, corporate, sales, and motor fuels tax. We modified the model by (1) adjusting the model's baseline forecasts using an autoregressive integrated moving average (ARIMA) model to reflect current and future economic conditions as a result of the COVID-19 pandemic, (2) adding separate taxes on gasoline and diesel, and (3) adding the Auction Allowances Fund under the TCI, and allocate the resulting revenue to the sectors who will benefit. We assume that 50 percent of the Auction Allowances Fund will be spent towards transportation spending and the other 50 percent towards investment in improvements of energy efficiency such as electric car charging stations.[37]

BHI then forecasted the baseline emissions, assuming emissions return to their pre-pandemic level, from the combustion of finished gasoline and on-road diesel within the TCI region, using a compound annual growth rate (CAGR). BHI estimated that baseline emissions in the region will fall by 8 percent over the period 2022 through 2032. BHI next estimated scenarios whereby CO2E emissions from the consumption of on-road

[37] "Transportation and Climate Initiative Agreement to Deliver Northeast At Least $1.4 Billion in Transit System Investment," (December 17, 2019), https://www.mass.gov/news/transportation-and-climate-initiative-agreement-to-deliver-northeast-at-least-14-billion-in.

diesel and finished motor gasoline destined for final sale were capped at 20 percent, 22.5 percent, and 25 percent, leading to an increase in the price in subjected motor fuels. We subtracted the annual cap in emissions by the baseline fall in emissions to find our annual price increase for both products in Massachusetts. To accomplish this, BHI (1) estimated the price elasticities of demand for the different fuels specified in the Transportation and Climate Initiative MOU, (2) forecasted the price of fuels for the time period, and (3) estimated the price change for each fuel that would result from the various emissions cap scenarios.

BHI utilized data for on-road diesel and finished motor gasoline and consumption from the U.S. Department of Energy's Energy Information Administration (EIA) for Massachusetts to calculate price elasticities of demand for each product.[38] We calculated price elasticities of demand for the finished gasoline and on-road diesel portion of the transportation sector. We used a log-log model to calculate the elasticities using the following equation:

$$\log(consumption) = \beta + \log(price) + \varepsilon,$$

where β is the intercept, α is the elasticity, and ε is the error term.

Table A1: Elasticities of Demand for Finished Gasoline and On-Road Diesel in Massachusetts

Fuel	Transportation
On-Road Diesel	-0.112
Gasoline	-0.197

The EIA provides historical price data for each motor fuel in the transportation sector. However, we need to estimate the future prices of the motor fuels for our period.

[38] U.S. Department of Energy, Energy Information Administration, Massachusetts State Profile and Energy Estimates, More Data & Analysis in Massachusetts by Source, https://www.eia.gov/state/search/#?1=79&2=200.

The CME Group provides futures prices for gasoline (RB) and fuel oil products (MF). We used the percentage change in the futures prices to project the motor fuel prices for 2022.

The EIA provides carbon dioxide emissions coefficients by fuel per unit of volume and per million BTU. We converted the emissions coefficients into metric tons for motor fuels to match the measure used in the EIA price data.

Using our price elasticity of demand we calculated the price change that would result from the cap in carbon emissions for on-road diesel and gasoline. The EIA provides data on emissions by motor fuel in the transportation sector.

We assume that the emissions reduction under the cap would fall in line with the reduction in the supply of on-road diesel and gasoline. Thus, we divide the percentage decrease in quantity by the elasticity under the carbon emissions cap for on-road diesel and gasoline and then multiply that result by the forecasted price without the cap to get our estimate of the price increase. For example, we multiplied the decrease in the quantity of gasoline (1.38 percent) by the elasticity for gasoline (-0.197) to calculate the increase in the price of gasoline of 18 cents in 2022. Once again, this process was repeated for on-road diesel fuels.

Next, we insert the increase in the price of on-road diesel and gasoline that would result under the proposed emissions cap into our models. We also use obtained estimates of the resulting revenue figures from the auctioning of allowance as inputs to the STAMP models.

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