Appendix B

ECONOMIC ANALYSIS – SENSITIVITY RISK SCENARIOS

A. Introduction

For this analysis to estimate the potential economic impacts of the proposed amendments in the unlikely event that the CCM is triggered, staff prepared sensitivity scenarios which simulate unlikely pessimistic conditions of the LCFS credit market, where credit generation lags and deficit generation exceeds expectations. Staff prepared two separate potential illustrative compliance scenarios, the first corresponding to the business-as-usual case (baseline) and the second corresponding to one where proposed amendments are adopted. *For this appendix, these scenarios will be labelled with the prefix SA, corresponding to the sensitivity analysis scenarios.*

In these sensitivity analysis scenarios, staff assumed a slower ramp up rate for several credit generating activities when compared to the latest illustrative compliance scenario analysis, published in August 2018. This includes a lower growth rate of the use of low-CI biofuels (renewable diesel, biodiesel, sugar cane ethanol, alternative jet fuel and renewable natural gas) and a slower rate of development of credit generating projects such as refinery investment projects, CCS projects at ethanol plants, and innovative crude projects. Staff also assumed higher fossil fuel use than in the 2018 illustrative compliance scenario analysis.

1. Comparison of Potential Compliance Responses under SA Proposed Amendments and the SA Baseline

In this section, staff provides a comparison of potential compliance responses (e.g. volumes and credits generated by alternative fuels as well as credits generated through petroleum projects) under the SA proposed amendments and the SA baseline.

The SA baseline condition assumes the regulation continues without any changes to the cost compliance mechanism. Figures BA-1 and BA-2 show the estimated volumes of alternative fuels and credits generated by source for the risk scenario under the baseline conditions.

Figure BA-1: Alternative Fuel Volumes in the SA Baseline Scenario1

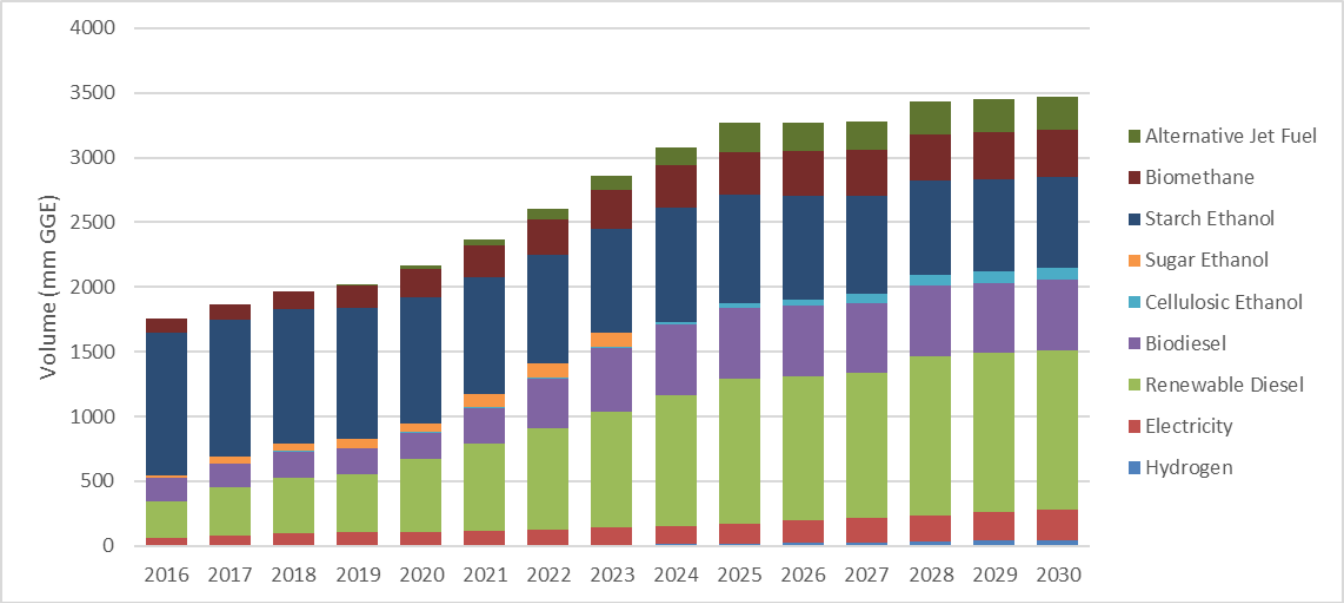
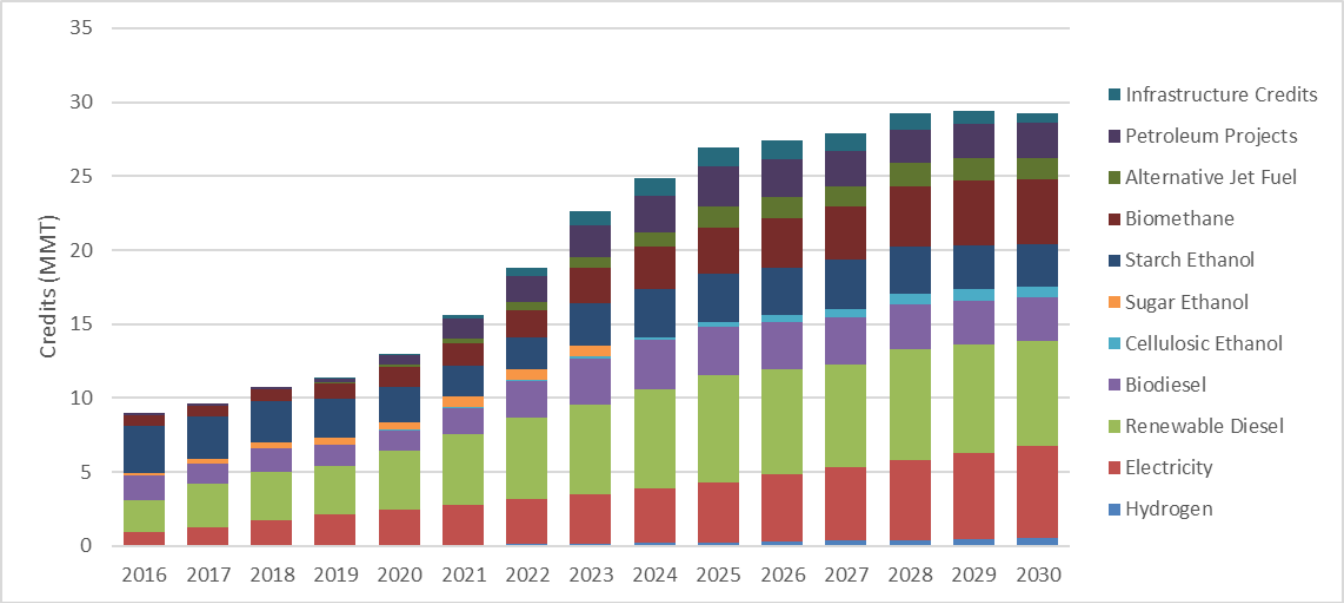


Figure BA-2: Credits Generated in the SA Baseline Scenario[2]



In the SA baseline, the following general trends are observed from current conditions through 2030:

- Gasoline consumption decreases due to efficiency improvements across the vehicle fleet and due to adoption of Zero Emission Vehicles (ZEVs) including battery-electric vehicles, plug-in gasoline/electric hybrids, and hydrogen-fuel-cell electric vehicles. This results in a commensurate decrease in the volume of ethanol as the total volume of ethanol is determined by the 10 percent

[1] Fuel volumes are reported in gallon gasoline equivalent (GGE).
[2] MMT stands for million metric tons CO_2 equivalent.

blending limit with CARBOB to produce gasoline. However, adoption of CCS technology in ethanol plants is expected to decrease the CI of starch ethanol substantially, and the sector continues to generate a similar share of credits. The reduction in gasoline consumption also results in a decrease in the total quantity of credits necessary for compliance with the 20 percent target between 2020 and 2030.

- Biomass based diesels (biodiesel, renewable diesel, and alternative jet fuel) consumption increase.
- Renewable natural gas, electricity, and hydrogen consumption continue to grow through 2030 as additional ZEVs and renewable natural gas powered vehicles are purchased.
- Credits from petroleum projects increase substantially.
- Electricity will continue to play a bigger role in the program, as the state electrifies a larger proportion of its fleet.
- Under the SA proposed amendments scenario, the major difference in credits is driven by the issuance of borrowed credits in the years 2020 – 2022, when the credit is overdrawn by excess deficit generation to credit generation. Credit generation from electricity is subsequently reduced for 2026 – 2030, corresponding to the years where the borrowed credits are recouped.

Overall, however the volume and quantity of fuels consumed in California are relatively unchanged. The exception is that under the SA proposed amendments scenario slightly fewer credits are generated by refinery renewable hydrogen in 2025 - 2027. This is driven by a reduction in deficit generation due to the effective elimination of accumulated interest, by ensuring sufficient credits are available in the CCM through borrowed credits. The lower deficit generation results in a slight reduction in the demand of credits in this period, which subsequently is estimated to result in a reduction of the use of refinery renewable hydrogen. Even though the reduction in demand of deficits due to elimination of accumulated deficit is small in magnitude, less than 1 million credits in 2023 – 2026, and the change of fuel production is also relatively small, it may result in a relatively significant impact on the cost of compliance with the LCFS standard.

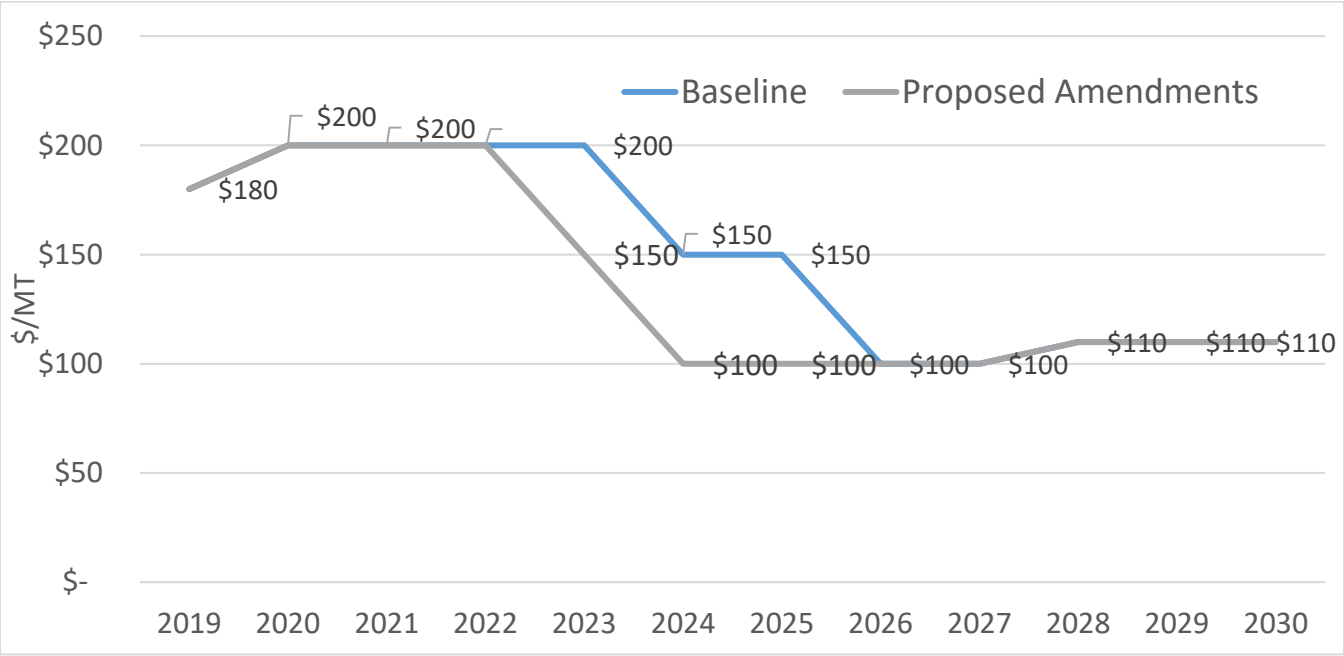
The economic impacts of these changes are mostly driven by the change in the LCFS credit price. To understand why prices can change so significantly due to a relatively small change in the quantity of credits, requires a brief explanation of the LCFS market dynamics in the case of a CCM being triggered due to a significant credit shortage. In such cases, regulated entities will have to participate in the CCM, whereby they must accept a price of $200 per credit, in 2016 and adjusted for inflation in subsequent years. The market price of LCFS credits will be thus be dictated by the CCM price cap; credit sellers will be unwilling to sell credits at a lower price since they know that regulated entities will have to enter the CCM, and would be willing to accept credits at the CCM price cap. Therefore, whenever the LCFS credit market experience a shortage in credits that necessitates a CCM to be held, prices will be pushed to the CCM price cap.

The additional deficits due the interest on accumulated deficits will be generated at a time when credit generation is insufficient, driven by the pessimistic assumptions imposed to generate the sensitivity scenario. As there are no additional credit generation opportunities, the market experiences a CCM for an additional year under the SA baseline scenario relative to the SA proposed scenario. In 2024 and 2025, additional credit generation opportunities are available by relying on the relatively expensive refinery renewable hydrogen production. Under the SA proposed amendments scenario, staff estimates that refinery renewable hydrogen production would subside earlier, as LCFS prices decrease due to sufficient credit generation from less expensive pathways.

As will be shown later in Sections B through E of this appendix, the LCFS credit price plays a large role in the economic impact of adopting the proposed amendments if the ceiling price is triggered and credits are borrowed under this sensitivity analysis. The LCFS credit price was estimated using the cost of obtaining the marginal, most expensive, credit in a given year.[3] The difference between the projected price pathways is described in the previous paragraph. Figure BA-3 shows the estimated credit price for each of the scenarios from 2019 through 2030. Most of the economic impacts of the SA proposed amendments are driven by the fact that the proposed amendments are estimated to result in lower credit prices in years 2022 through 2025.

[3] The method used by staff to estimate the LCFS credit price for the purpose of this analysis does not assume fully rational intertemporal pricing for the LCFS credit market. Instead it shows possible market behavior under each scenario based on CARB's best estimate of LCFS market dynamics. Specifically, the LCFS credit price trajectories include a higher near-term credit price to reflect possible market behavior (and subsequent LCFS credit prices) during the period of steepest program target decline from 2019 through 2021, followed by a gradual settlement toward a longer-run equilibrium, that should reflect the long-run marginal cost of reducing the carbon intensity of the transportation fuel pool. These prices should be treated as illustrative rather than predictive.

Figure BA-3: Estimated Credit Prices for SA Baseline and SA Proposed Amendments Scenarios[4]



Figures BA-4 and BA-5 show the estimated annual credit balance and bank of credits for the SA baseline and SA proposed amendments scenarios. Under the SA baseline scenario, the credit bank is exhausted in 2020, potentially resulting in high prices for an extended period as regulated entities try to build up their credit position to meet their annual deficit obligations. Under the proposed amendments, the bank is maintained, as credits are borrowed to meet annual deficit obligation.[5] In the period of 2026 – 2030, the bank will build at a more rapid rate than the baseline, as borrowed credits are repaid.

[4] All prices are in 2016 dollars, adjusted for inflation

[5] Staff assumed that a certain number of credits banked will not be available for the CCM, but instead will be held by regulated entities to meet their annual obligations.

Figure BA-4: Annual Net Credits and Credit Bank for the SA Baseline Scenario

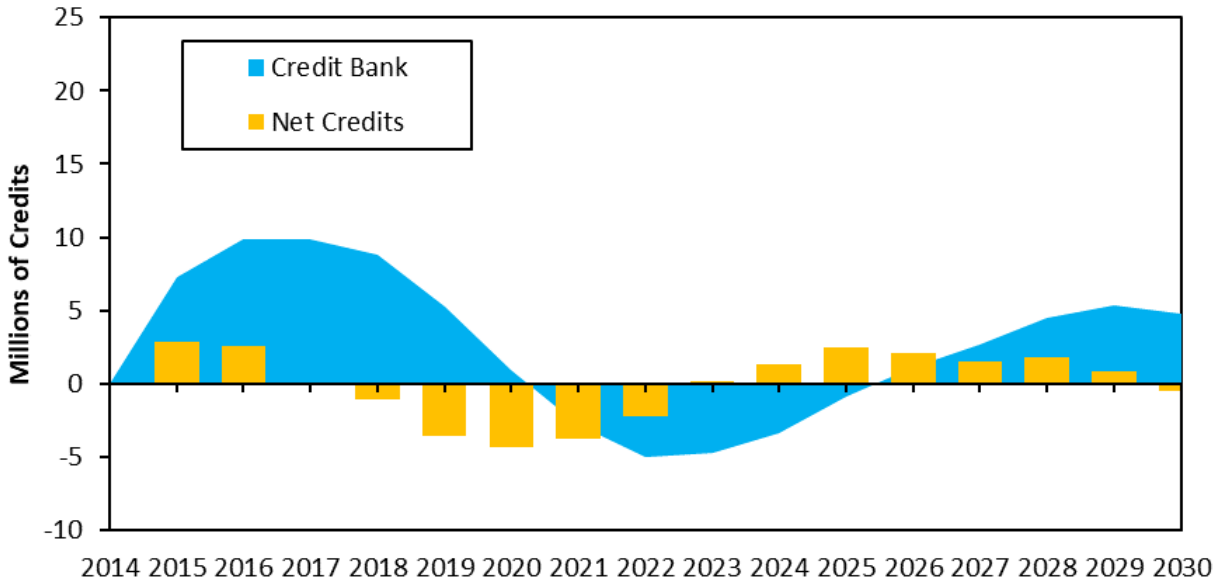
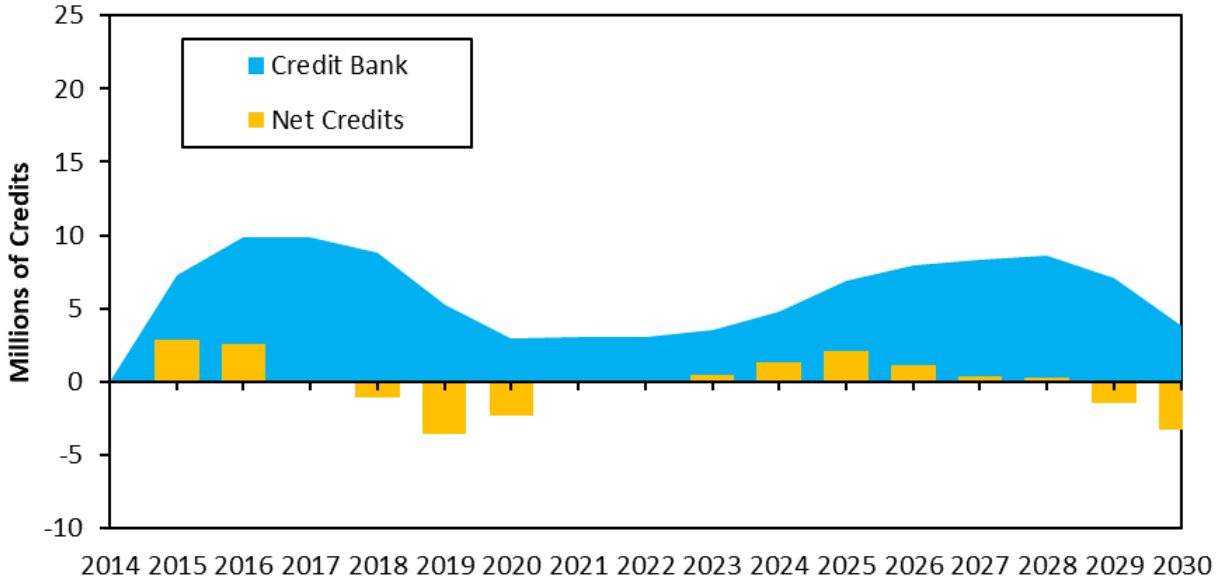


Figure BA-5: Annual Net Credits and Credit Bank for the SA Proposed Amendments Scenario



This analysis demonstrates that if the price ceiling is triggered and credits are borrowed, the proposed amendments may alleviate pressure on LCFS credit prices in addition to improving compliance cost certainty.

B. Benefits

1. Benefits to California Businesses

Because the SA proposed amendments are estimated to reduce the price of LCFS credits for several years, California businesses that need to obtain credits to comply with the LCFS will face lower compliance costs. Table BB-1 shows the estimated credits price trajectory under the SA baseline and SA proposed amendments scenarios.

Table BB-1: Estimated Annual Credit Price for SA Baseline and SA Proposed Amendments ($2016)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline	$200	$200	$200	$200	$150	$150	$100	$100	$110	$110	$110
Proposed Amendments	$200	$200	$200	$150	$100	$100	$100	$100	$110	$110	$110

Under the SA proposed amendments, regulated entities are expected to generate slightly less deficits than the SA baseline scenario. The introduction of borrowed credits ensures that regulated entities will be able to meet their annual deficit obligations, which eliminates the accrual of interest on accumulated deficits. Cumulatively, 840,000 more deficits will be generated in the SA baseline than the SA proposed amendments due to the interest on accumulated deficits.

The lower prices and the smaller number of deficits that will be generated, results in a lower overall compliance costs in the SA proposed amendments scenario than the SA baseline scenario. Table BB-3 the change in the aggregate cost of obtaining LCFS credits to the proposed amendments. The cost of compliance for the SA proposed amendments was calculated by multiplying the credit price in a given year by the projected number of deficits in that year, and subtracting the same multiple from the SA baseline scenario. In the interim years, lower LCFS prices result in significant potential savings, from 2020 through 2030 the SA proposed amendments are expected to decrease the cost of obtaining LCFS credits by $3.6 billion relative to the SA baseline.

Table BB-3: Estimated Cost-saving of Obtaining LCFS Credits under the SA Proposed Amendments relative to the SA Baseline (million $2016)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
$0	$0	$27	$1,166	$1,207	$1,248	$0	$0	$0	$0	$0

2. Benefits to Small Businesses

Small businesses in California will see the same benefits likely to other in-state business discussed in the previous subsection. Many small businesses are exposed to transportation fuel costs, and thus will benefit from the imposition of a stable maximum credit price that limits the potential adverse impacts of high credit prices.

3. Benefits to Individuals

Similar to businesses, individuals will benefit from the reduced possibility of extended periods of high LCFS prices that may result in adverse impacts to California residents, especially as it relates to higher potential transportation fuel costs.

Under the sensitivity analysis, the proposed amendments have the potential to lower the costs of compliance to producers and importers of high-carbon intensity fuels. This would indirectly affect individuals in California that purchase transportation fuel, as staff assumes some portion of cost savings associated with production or import of high-carbon intensity fuels may be passed on to consumers in the form of lower prices for these fuels. This section uses the same methodology to the one staff used in the previous LCFS ISOR (California Air Resources Board, 2018g).

Staff report the maximum potential savings pass-through to fossil fuel consumers in Table AB4. Staff does not anticipate that producers and importers of fuels will likely pass-through most of the savings to consumers, and thus this estimate represent an upper bound estimation of potential reductions in gasoline and diesel prices in-state.

Table BB-4: Maximum Cost Savings Pass-through to Consumers under SA Proposed Amendments (relative to SA Baseline) (in cents/gallon)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gasoline	0	0	0	-7	-8	-9	0	0	0	0	0
Diesel	0	0	0	0	-8	-9	-10	0	0	0	0

C. Direct Costs

1. Direct Cost Inputs

Under the sensitivity scenario where the price ceiling is triggered and credits are borrowed, the adoption of these proposed amendments will not result in the increase of direct costs to any California or out-of-state businesses.

However, many California businesses generate LCFS credits, and the potential for lower credit prices under the SA proposed amendments scenario and will result in their revenues to potentially fall relative to the SA baseline. In Table BC-1, staff estimated the potential loss of revenues due to lower credit prices for California and out-of-state businesses. To apportion credits between in-state and out-of-state businesses, staff used an assumed percentage for production in-state and out-of-state for each fuel type. In the initial years, revenues increase due to credits borrowing. In subsequent years, revenues to credit generators will decrease, initially due to lower credit prices, and then in later years due to the reduction of credits generated by utilities to repay the previously borrowed credits.

Cumulatively from 2020 through 2030, the SA proposed amendments are estimated to lower low carbon fuel producer revenues by $3.2 billion. California business are estimated to face $833 million in lower revenue.

Table BC-1: Estimated Decrease in Revenues from LCFS Credit Sales under the SA Proposed Amendments relative to the SA Baseline (million 2016$)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
California Businesses	-$400	-$740	-$419	$400	$492	$564	$99	$108	$172	$257	$300	$833
Out-of-state Businesses	$0	$0	$0	$742	$791	$853	$0	$0	$0	$0	$0	$2386
Total	-$400	-$740	-$419	$1141	$1283	$1417	$99	$108	$172	$257	$300	$2918

*Negative values imply an increase in the revenue in that year

Additionally, the addition of an annual reporting requirement for the CFR program will impose an additional annual cost of $12,000 on the administrator of the CFR program. However, the administrator will be able to recoup these costs as the proposed amendments allow the use of up to 10% of the proceeds to the CFR program on administrative costs.

2. Impacts to Typical Businesses

Staff does not anticipate that the proposed amendments will impose any significant direct costs to businesses.

3. Impacts to Small Businesses

There are no specific increases in direct costs to small businesses in California.

4. Impacts to Individuals

There are no direct regulatory costs incurred by individuals as a result of the proposed amendments.

D. Fiscal Impacts

1. State Government

Implementing the proposed amendments will affect state government finances through a change in State tax revenues due to the change in the fuel mix and prices, and change in the fuel expenditures for government fleets under the unlikely assumption that the price ceiling is triggered and credits borrowed.

a. Change in State Taxes

Table BD-1 summarizes the State and local tax rates and fees on different fuels used to calculate the fiscal impact of the SA proposed amendments on State and local government.

Table BD-1: State and Local Taxes in California

	Gasoline[6]	Diesel[7]	CNG[8]	Hydrogen	Electricity
Excise Tax	$0.473/gallon + Annual CPI Adjustment	$0.36/gallon + Annual CPI Adjustment	$0.0887per 126.67 scf	-	-
Underground storage tank fee[9]	$0.02/gallon	$0.02/gallon	-	-	-
Road Improvement Fee				$100/vehicle (2020 and later) + Annual CPI Adjustment	$100/vehicle (2020 and later) + Annual CPI Adjustment
Sales Tax[10]	2.25%	13.00%	8.5%[11]	8.5%	3.51%[12]
State portion	0%	8.5%	4.00%	4.00%	0%
Local portion	2.25%	4.5%	4.5%	4.5%	3.51%

Table BD-2 shows the changes in California's State tax revenues due to the SA proposed amendments. Cumulatively over the time period from 2019 through 2030, State revenues are estimated to decrease by $79 million due to lower sales taxes resulting from lower fuel prices. Since volume of sales of diesel and gasoline are not expected to change, excise taxes are not expected to change.

Table BD-2: Estimated Changes in State Government Tax Revenue under the SA Proposed Amendments Relative to SA Baseline (million $)

	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Change in Sales Tax	$0	$0	$0	-$22	-$26	-$29	$0	$0	$0	$0	$0

[6] Revenue and Taxation Code, §7360.
[7] Revenue and Taxation Code, § 60050.
[8] Revenue and Taxation Code, § 8651.6.
[9] California State Board of Equalization. *Tax Rates and Fees.* http://www.boe.ca.gov/sptaxprog/tax_rates_stfd.htm. Accessed Oct. 31, 2017.
[10] California's basic sales tax rate is 7.25%, with 3.94% going to the State and the rest to local authorities. In addition to the basic sales tax, districts levy special taxes that differ amongst districts. The BOE calculated a weighted average special district tax which amounted to 1.23% in July 2017, increasing the average sales tax rate to 8.48%. For this analysis, staff assumes that sales tax rates will remain at July 2017 levels.
[11] Natural gas sold for transportation is not exempt from sales taxes unless it is delivered by a pipeline. To conservatively estimate the fiscal impact, staff assumes all natural gas sales are fully taxable.
[12] In the 2018 LCFS proposed amendments SRIA, staff erroneously assumed the rate of taxes applied to sales of electricity in California. Electricity sales are exempt from state Sales taxes ("Revenue and Taxation Code, § 6353,"). Local taxes differs depending on the city and county. Staff calculated a population weighted average for utility taxes using the most recent data of utility tax rates by city/country (California Secretary of State, 2018)

*Negative costs imply tax revenues are lower than under the proposed amendments than under the baseline for that year.

b. Change in Costs to State Government Fuel Purchases

Table BD-3 summarizes the estimate of changes in cost for fuel purchases by the California government. To calculate the change in the cost of fuel purchases, staff obtained the most recently available fuel purchase data from the Department of General Services (California Department of General Services, 2019). It is assumed that the consumption of gasoline and diesel by the State's fleet will change by the same rate as the assumed overall statewide change in gasoline and diesel consumption.[13] Cumulatively, the state's spending on high carbon fuel purchases is expected to decrease by $6 million, a relatively small decrease in expenditure given that the state purchased about 30 million gallons of gasoline and diesel in 2016.

Based on these assumptions, staff estimated the gasoline and diesel fuel purchases from 2020 through 2030 by state fleets. The maximum cost pass through for gasoline and diesel for each year of the proposed amendments was multiplied by the total gasoline and diesel purchases to estimate the effect of the SA proposed amendments on fuel purchases by the state government.

Table BD-3: Estimated Changes in State Government High Carbon Fuel Purchases under the SA Proposed Amendments Relative to SA Baseline (million $)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gasoline	$0	$0	$0	-$1	-$2	-$2	$0	$0	$0	$0	$0
Diesel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$0	$0	$0	-$2	-$2	-$2	$0	$0	$0	$0	$0

*Negative costs imply costs are lower than under the proposed amendments than under the baseline for that year. Total may not up due to rounding

2. Local Government

Three separate impacts related to the SA proposed amendments affect local government finances: revenue generated from the sale of credits from transit fleets that use low-CI fuels, change in local tax revenues due to the change in the fuel mix and prices, and change in the expenditure on fuels for government fleets

[13] Recent legislation and executive actions may drive higher rates of ZEV adoption by the State's fleet. SB 498 (2017-2018) requires at least 50% of the light-duty vehicles purchased for the state vehicle fleet each fiscal year to be zero-emission vehicles, except for vehicles that require special performance requirements for the protection of public safety. AB 739 (2017-2018) establishes ZEV heavy duty vehicles purchase requirements for the Department of General Services (DGS) and other State entities. AB 236 (2007-2008) requires DGS to implement a petroleum reduction plan to reduce the use of petroleum products to fuel the State's fleet. Executive Order B-16-12 requires the State's fleet to increase ZEV adoption through regular fleet replacement as to increase the percentage of ZEVs to be at least 10% of the light duty vehicles by 2015 and 25% of the light duty vehicles by 2020, except for vehicles that have special performance requirements for the protection of public safety.

Many local governments are already generating credits from the LCFS program, which generate revenue. As discussed above, the SA proposed amendments may lead to lower prices for LCFS credits relative to the SA baseline scenario, which may lead to a decrease in local government revenues when compared to the existing regulation.

a. Revenue from the LCFS Credits

In 2016, local governments earned 312,092 credits from the LCFS, which were primarily generated from low-CI fuel use in public transit systems. This sum does not include credits generated by public-owned utilities (POU) for the use of electricity in electric vehicles, since the utilities are obligated to pass the value of these credits to the electric vehicle owners. Of the credits generated by local governments, 44 percent were generated from the use of natural gas, from either fossil or renewable sources, and 56 percent were generated from the use of electricity for transportation from non-POU sources. The average price of LCFS credits in 2016 was $103, and thus the LCFS program is estimated to have contributed over $32 million to local governments.

Staff conducted an analysis to project the number of credits generated by local governments under the proposed amendments making the following assumptions:

- Electricity for non-bus use such as light rail service will stay at 2016 levels. This assumption conservatively awards local governments less credits than expected, as many municipalities in California will expand light rail service by 2030.
- Estimates of the number of buses and their type (diesel, gasoline, natural gas, or electricity) were obtained from the Draft 2017 Climate Change Scoping Plan Update.[14]
- The natural gas used by local authorities will have the same average mix (i.e. fossil, landfill, and dairy) as the projected annual State's average for the baseline and proposed amendments.

Table BD-4 shows the estimated decrease in revenue generated local governments under the SA proposed amendments, which are driven by the decrease in the LCFS credit price in 2024 – 2026. Cumulatively, local governments' revenues are expected to decrease by $79 million in the SA proposed amendment's scenario relative to the baseline.

Table BD-4: Estimated Changes in Revenue Generated by Local Governments from the Sale of LCFS Credits under the SA Proposed Amendments Relative to SA Baseline (million 2016$)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
$0	$0	$0	$0	-$26	-$26	-$27	$0	$0	$0	$0

b. Change in Local Tax Revenue

[14] The PATHWAYS model was used to produce an estimate of the number of buses and their types. PATHWAYS output can be found at California Air Resources Board (2019a), under Modelling Information/PATHWAYS Output tool.

Similar to changes in tax revenue for the State government, tax revenue for local governments will be affected by the proposed amendments. The primary factors affecting fuel tax revenue are the changes in price of gasoline and diesel. Table BD-1 summarizes the State and local taxes on different fuels that were used to calculate the fiscal impact of the SA proposed amendments on State and local government. Table BD-5 shows the changes in the local government tax revenues due to the SA proposed amendments. Cumulatively over the time period from 2020 through 2030, local government revenues are estimated to decrease slightly by $98 million due to lower sales taxes resulting from lower fuel prices, representing a decrease of less than 1% in total local taxes from fuel sales.

Table BD-5: Estimated Changes in Local Government Tax Revenue under the SA Proposed Amendments Relative to SA Baseline (million 2016$)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
$0	$0	$0	-$31	-$33	-$35	$0	$0	$0	$0	$0

c. Change in Costs to Local Government from Fuel Purchases

Table BD-6 summarizes the estimated change in fuel purchases by local California government. To analyze the effects of the proposed amendments on the cost of fuel purchases, staff obtained the most recently available fuel purchasing data from the Department of General Services, and the number of State and local government fleet vehicles from the California Energy Commission (California Department of General Services, 2019; California Energy Commission, 2017). The available fuel data from the State fuel purchases is scaled by the ratio of local fleet vehicles to the State government fleet vehicles in 2015, to get an estimate of the fuel use by the local fleet vehicles. It is further assumed that the fuel economy ratings of the local government fleets for passenger and light-duty trucks are similar to the fuel economy ratings for the State as a whole. The maximum pass through cost for each year of the proposed amendments was multiplied by the total gasoline and diesel purchases to estimate the effect of the proposed amendments on fuel purchases by the local governments. The savings in local government expenditures due to the proposed amendments, similar to other fiscal impacts, is small. According to staff's estimate, local governments in California purchased about 140 million gallons of gasoline in diesel in 2016, and a cumulative reduction in expenditure by $30 million in 2020 – 2030 represents a small overall savings to local governments.

Table BD-6: Estimated Changes in Local Government High Carbon Fuel Purchases under the SA Proposed Amendments Relative to SA Baseline (million 2016$)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gasoline	$0	$0	$0	-$7	-$8	-$8	$0	$0	$0	$0	$0
Diesel	$0	$0	$0	-$2	-$2	-$2	$0	$0	$0	$0	$0
Total	$0	$0	$0	-$9	-$10	-$10	$0	$0	$0	$0	$0

3. CARB

Implementing the proposed amendments will not result in the need for additional personnel at CARB.

E. Macroeconomic Impacts

The proposed amendments have no impact relative to the baseline, and would have no costs or benefits. However, there would be impacts of the proposed amendments under the SA baseline. This section estimates the impact of the SA proposed amendments on the California economy under the SA baseline.

Under the SA proposed amendments and SA baseline, credits are forwarded to utilities and are sold to deficit generators. The credit revenue from borrowed credits is used to fund the CFR, which provides point of purchase rebates to EV purchases. The forwarded credits result in avoided interest on refinery deficits and lower overall credit prices. These changes will affect employment, output, and investment in the credit and deficit generating industries, as well as the sectors that supply goods and services in support of these industries or demand goods from these industries. These lead to additional induced effects, like changes in personal income that affect consumer expenditures across all consumption categories. The analysis focuses on the incremental changes in major economic indicators from 2020 to 2030 including employment, output, and gross state product (GSP).

The costs and benefits discussed in Sections B, C, and D of this appendix are input into Regional Economic Models, Inc. (REMI), Policy Insight Plus Version 2.2.8 to estimate the macroeconomic impacts of the SA proposed amendments under the SA baseline. REMI is a structural economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric, and economic geography methodologies. REMI provides year-by-year estimates of the total economic impacts of the proposed amendments and alternatives, meeting the requirements of the Administrative Procedure Act and its implementing regulations.[15] CARB uses the REMI single-region, 160-sector model with the model reference case adjusted to reflect the Department of Finance conforming forecasts. These forecasts include California population figures dated May 2019 and U.S. real GDP and civilian employment growth numbers dated April 2019.

1. Inputs of the assessment

The estimated economic impacts of the proposed amendments and alternatives are sensitive to modeling assumptions. This section provides a summary of the assumptions used to determine the suite of policy variables that best reflect the macroeconomic impacts of the proposed amendments under the SA baseline. The effects of the proposed amendments estimated in the previous sections are translated into REMI variables and used as inputs for the macroeconomic analysis.

Under the SA baseline, electric utilities are directly impacted by the SA proposed amendments. Some credits that will be generated by electric utilities in years 2026 through 2030 are borrowed to years 2020 through 2023 and would be available for

[15] ("California Code of Regulations. Title 1. Division 3. Chapter 1. Sections 2000-2004")

purchase by deficit generators. Under the proposed amendments, revenue from borrowed credits is required to be used for the CFR. The savings to electric vehicle consumers from the CFR program increases the amount of income available to spend in all other consumption categories. Therefore the value of these credits is reflected in REMI as an increase in consumption reallocation, with a two year lag from when the credits are borrowed to reflect potential differences in timing from when credits are borrowed to when consumers may receive rebates.

For the credits that are not borrowed, electric utilities use approximately 62 percent of credit revenue in the CFR program, while the remaining 32 percent of credit revenue is invested by utilities in projects such as charging infrastructure. The reduced value of credits that would have been rebated to customers for electric vehicle purchases or invested in infrastructure projects, from credits generated in years 2026 through 2030, is modeled as a decrease consumption reallocation and decrease in demand for construction.

Advancing credits increases the overall supply of credits in years 2020 through 2023. As a result, deficit generators would be able to fulfil their deficit obligations each year and avoid interest on outstanding credit deficits. This results in cost savings to producers of high carbon fuels (petroleum and coal products manufacturing, NAICS 324). In addition, as modeled, the borrowed credits result in lower credit prices in the years 2023 through 2025. The lower credit prices result in additional cost savings for the producers of high carbon fuels. The savings to high carbon fuel producers from avoided deficits and lower credit prices are passed on to consumers, businesses, and government through decreased expenditures on transportation fuels. However, lower credit prices result in a decrease in credit revenue for the producers of low carbon fuels.

The REMI analysis requires aggregated input data by North American Industry Classification System (NAICS) code. Each NAICS code is a broad category which aggregates costs among multiple industries and fuel types. Table BE-1 summarizes the fuel types and their associated NAICS code that is used to classify them within REMI.

Table BE-1: Summary of credit and deficit generating fuels and associated NAICS industry

NAICS Industry	Fuel
Petroleum and coal products manufacturing (324)	CARBOB Gasoline
	Diesel
	Conventional Propane
Basic chemical manufacturing (3251)	Starch Ethanol
	Sugar Ethanol
	Cellulosic Ethanol
	Renewable Gasoline
	Hydrogen for LDVs
	Biodiesel
	Renewable Diesel
	Hydrogen for HDVs
	Renewable Propane
	Alternative Jet Fuel
Natural gas distribution (2212)	Conv. Natural Gas
	Dairy Natural Gas
Waste management and remediation services (562)	Landfill Natural Gas
Electric power generation, transmission, and distribution (2211)	Electricity for LDVs*
	Electricity for HDV**
	Electricity for Rail/Forklift/etc.**
Local Government Spending***	Natural Gas
	Hydrogen
	Electricity

* Credits from LDVs are rebated to consumers two years after they are generated and modeled as an increase in spending in all consumer categories.
** HDV fleets are assumed to own and operate electric vehicle fueling infrastructure. The value of the LCFS credits for electricity are modeled as being directly passed on to users of truck transportation.
*** Credits generated by local government are a subset of credits generated by the industry.

Under the SA baseline, the proposed amendments will impact the price of fuels, natural gas, used for transportation, and electricity used for transportation because of the decrease in credit prices. The fuel price impact is described in Section B and results in a change expenditures on fuel, a change in revenue in the fuel-producing industries, and changes in fuel taxes.

The categories of effects and corresponding changes in costs and demand are summarized in Table BE-2 below. Refer to Section F for a full list of REMI inputs used for this analysis.

Table BE-2: Industries and groups impacted by the SA proposed amendments under the SA baseline

Source of Impact	Primary Impacted Industry	Secondary Impacted Groups
Borrowed credits	Electric power generation, transmission and distribution (2211)	*Initial benefit:* Electric rebates to consumers *Future cost:* Electricity rebates to consumers and infrastructure investments
Fewer deficits generated by regulated entities	Petroleum and coal products manufacturing (324)	Consumer, business, and government fuel expenditures
Decreased credit prices faced by all fuel producers	Petroleum and coal products manufacturing (324), Basic chemical manufacturing (3251), Natural gas distribution (2212), Waste management and remediation services (562), Electric power generation, transmission, and distribution (2211), Government	Consumers, businesses, and government fuel expenditures.

2. Results of the Assessment

The REMI output provides the impact of the proposed regulation on the California economy, and is presented as the annual incremental change of the proposed regulation under the sensitivity analysis scenario. The California economy is anticipated to grow through 2030, therefore, negative impacts reported here should be interpreted as a slowing of growth and positive impacts as an increase in the rate of growth resulting from the proposed regulation.

The costs and savings described in Sections B, C, and D of this appendix are input into REMI to assess the macroeconomic impact of the SA proposed amendments. The macroeconomic impacts, for the even-numbered years between 2020 and 2030, are summarized in Table BE-3. Relative to the SA baseline, the SA proposed amendments are estimated to have a small, but positive, impact on the California economy. Impacts of the SA Proposed Amendments are estimated to begin in 2022 when the value of borrowed credits, through the CFR program, is assumed to increase income available to consumers for spending on all other consumption categories, and the elimination of interest on carryover deficits results in cost savings for deficit generators. From 2023 to 2025, the continued growth in the various economic indicators in large part illustrates the savings to the petroleum and coal products manufacturing industry because of lower credit prices and the decrease in spending on transportation fuels by consumers,

businesses and government. In the latter years, all economic indicators begin to return to baseline levels as the payback of the borrowed credits result in a small decreases in electric vehicle rebates and infrastructure investment in 2025 through 2030.

For the most part, all of the economic indicators follow similar trends, with the highest impacts in 2023 and 2024, showing the impact of the borrowed credits on the California economy. Additional private investment growth, which consists of the purchases of residential and nonresidential structures and of equipment and software by private businesses and nonprofit institutions, peaks in 2025, the year corresponding to large cost savings for high carbon fuel producers and the year of the largest savings in fuel expenditures.

Table BE-3: Change in Growth of Economic Indicators for SA Proposed Amendments Compared to the SA Baseline

		2020	2022	2024	2026	2028	2030
Employment (Jobs)	Baseline	24368647	24692674	25076809	25456182	25833964	26206546
	% Change	0.00%	0.02%	0.05%	0.01%	0.01%	0.00%
	Change	0	4200	12600	2700	1300	-900
Output (2016M$)	Baseline	5020446	5233022	5401284	5578283	5772830	5984634
	% Change	0.00%	0.02%	0.05%	0.03%	0.02%	0.01%
	Change	0	771	2431	1606	951	273
Private Investment (2016M$)	Baseline	396788	410910	421521	430926	441330	456156
	% Change	0.00%	0.00%	0.10%	0.12%	0.03%	0.00%
	Change	0	0	432	540	138	8
Personal Income (2016M$)	Baseline	2396724	2540364	2628165	2746555	2878929	2994309
	% Change	0.00%	0.01%	0.05%	0.01%	0.01%	0.00%
	Change	0	277	1366	229	212	38
GSP (2016M$)	Baseline	2690677	2804373	2896555	2996341	3104629	3218331
	% Change	0.00%	0.02%	0.05%	0.02%	0.01%	0.00%
	Change	0	413	1319	633	363	50

a. **Incentives for Innovation**

The proposed amendments will create greater certainty in the LCFS credit price which should provide for a more stable credit price environment. A stable environment is conducive for firms to increase investments in capital-intensive facilities and research and development projects that are essential to increased innovation in the low carbon fuel sector. Additionally, a stable LCFS price will encourage greater adoption of alternative fuel vehicles that can take advantage of the value created by LCFS credits to lower fuel costs.

b. **Competitive Advantage or Disadvantage**

Staff does not anticipate the proposed amendments to affect the competitive advantage of disadvantage of California businesses.

c. **Creation or Elimination of Businesses**

Staff expects the greater certainty in the LCFS credits to potentially increase investment and growth in the low carbon fuel sector. This may lead to growth of already existing businesses, or the creation of new participants in this sector. Business creation can occur either in-state or out-of-state, as the LCFS is neutral to the location of production.

3. Summary and Agency Interpretation of the Results of the Economic Impact Assessment

As modeled under the SA assumption that the price ceiling is triggered and credits are borrowed, CARB estimates the proposed amendments will have a positive, but minor net impact on the California economy. The economic modeling results show that the savings that result from decreased deficits and lower credit prices are reflected in the economy through short term increases in employment, output, investment, personal income and GSP. The largest impacts of this would be felt in years after credits are borrowed and in years where credit prices are lower under the SA proposed amendments than under the SA baseline. The SA proposed amendments are anticipated to have negligible impacts on any of the economic indicators in later years, once the credit market has reached equilibrium prices.

F. REMI Inputs

Table BF-1: REMI Inputs for SA Proposed Regulation

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Petroleum and coal products manufacturing (324)	0.00	0.00	-27.41	-1058.13	-1052.81	-1051.25	55.74	30.00	0.00	0.00	0.00
Production Cost	Basic chemical manufacturing (3251)	0.00	0.00	0.00	285.49	327.30	360.99	0.00	0.00	0.00	0.00	0.00
Production Cost	Natural gas distribution (2212)	0.00	0.00	0.00	18.97	25.25	29.79	0.00	0.00	0.00	0.00	0.00
Production Cost	Waste management and remediation services (562)	0.00	0.00	0.00	1.20	1.27	1.23	0.00	0.00	0.00	0.00	0.00
Consumption Reallocation	Electricity Credits	0.00	0.00	400.00	740.00	420.00	-78.35	-84.57	-91.25	-24.18	-48.36	-106.39
Consumer Spending	Motor vehicles fuels and lubricants	0.00	0.00	0.00	-804.72	-852.95	-894.70	0.00	0.00	0.00	0.00	0.00
Consumer Spending	Electricity	0.00	0.00	0.00	0.66	0.76	0.88	0.00	0.00	0.00	0.00	0.00
State and Local Government Spending	State Government	0.00	0.00	0.00	-23.81	-25.95	-28.08	0.00	0.00	0.00	0.00	0.00
State and Local Government Spending	Local Government	0.00	0.00	0.00	-64.85	-67.95	-70.80	0.00	0.00	0.00	0.00	0.00
Exogenous Final Demand	Petroleum and coal products manufacturing (324)	0.00	0.00	0.00	-239.49	-247.67	-258.09	0.00	0.00	0.00	0.00	0.00
Exogenous Final Demand	Basic chemical manufacturing (3251)	0.00	0.00	0.00	-97.57	-121.61	-142.42	0.00	0.00	0.00	0.00	0.00
Exogenous Final Demand	Eletric power generation, transmission, and distribution (2211)	0.00	0.00	0.00	39.93	45.95	53.14	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Exogenous Final Demand	Construction (23)	0.00	0.00	0.00	0.00	0.00	-48.02	-51.83	-55.92	-14.82	-29.64	-65.21
REMI Variables to Simulate Business Fuel Cost Changes												
Production Cost	Forestry; Fishing, hunting, trapping (1131, 1132, 114)	0.00	0.00	0.00	-0.49	-0.54	-0.58	0.00	0.00	0.00	0.00	0.00
Production Cost	Logging (1133)	0.00	0.00	0.00	-0.21	-0.23	-0.24	0.00	0.00	0.00	0.00	0.00
Production Cost	Support activities for agriculture and forestry (115)	0.00	0.00	0.00	-0.31	-0.33	-0.35	0.00	0.00	0.00	0.00	0.00
Production Cost	Oil and gas extraction (211)	0.00	0.00	0.00	0.03	0.03	0.04	0.00	0.00	0.00	0.00	0.00
Production Cost	Coal mining (2121)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Metal ore mining (2122)	0.00	0.00	0.00	-0.19	-0.20	-0.22	0.00	0.00	0.00	0.00	0.00
Production Cost	Nonmetallic mineral mining and quarrying (2123)	0.00	0.00	0.00	-1.02	-1.11	-1.21	0.00	0.00	0.00	0.00	0.00
Production Cost	Support activities for mining (213)	0.00	0.00	0.00	-0.57	-0.62	-0.67	0.00	0.00	0.00	0.00	0.00
Production Cost	Electric power generation, transmission, and distribution (2211)	0.00	0.00	0.00	0.08	0.09	0.11	0.00	0.00	0.00	0.00	0.00
Production Cost	Natural gas distribution (2212)	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Water, sewage, and other systems (2213)	0.00	0.00	0.00	-0.20	-0.21	-0.23	0.00	0.00	0.00	0.00	0.00
Production Cost	Construction (23)	0.00	0.00	0.00	-63.08	-68.81	-74.29	0.00	0.00	0.00	0.00	0.00
Production Cost	Sawmills and wood preservation (3211)	0.00	0.00	0.00	-0.04	-0.05	-0.04	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Veneer, plywood, and engineered wood product manufacturing (3212)	0.00	0.00	0.00	-0.13	-0.15	-0.15	0.00	0.00	0.00	0.00	0.00
Production Cost	Other wood product manufacturing (3219)	0.00	0.00	0.00	-0.12	-0.12	-0.12	0.00	0.00	0.00	0.00	0.00
Production Cost	Clay product and refractory manufacturing (3271)	0.00	0.00	0.00	-0.05	-0.05	-0.05	0.00	0.00	0.00	0.00	0.00
Production Cost	Glass and glass product manufacturing (3272)	0.00	0.00	0.00	-0.31	-0.33	-0.35	0.00	0.00	0.00	0.00	0.00
Production Cost	Cement and concrete product manufacturing (3273)	0.00	0.00	0.00	-0.24	-0.25	-0.23	0.00	0.00	0.00	0.00	0.00
Production Cost	Lime, gypsum and other nonmetallic mineral product manufacturing (3274, 3279)	0.00	0.00	0.00	-0.24	-0.26	-0.27	0.00	0.00	0.00	0.00	0.00
Production Cost	Iron and steel mills and ferroalloy manufacturing (3311)	0.00	0.00	0.00	-0.21	-0.22	-0.22	0.00	0.00	0.00	0.00	0.00
Production Cost	Steel product manufacturing from purchased steel (3312)	0.00	0.00	0.00	-0.08	-0.09	-0.09	0.00	0.00	0.00	0.00	0.00
Production Cost	Alumina and aluminum production and processing (3313)	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Nonferrous metal (except aluminum) production and processing (3314)	0.00	0.00	0.00	0.19	0.22	0.25	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Foundries (3315)	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Forging and stamping (3321)	0.00	0.00	0.00	-0.08	-0.09	-0.09	0.00	0.00	0.00	0.00	0.00
Production Cost	Cutlery and handtool manufacturing (3322)	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Architectural and structural metals manufacturing (3323)	0.00	0.00	0.00	-0.06	-0.05	-0.04	0.00	0.00	0.00	0.00	0.00
Production Cost	Boiler, tank, and shipping container manufacturing (3324)	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Hardware manufacturing (3325)	0.00	0.00	0.00	-0.02	-0.02	-0.02	0.00	0.00	0.00	0.00	0.00
Production Cost	Spring and wire product manufacturing (3326)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Machine shops; turned product; and screw, nut, and bolt manufacturing (3327)	0.00	0.00	0.00	-0.15	-0.16	-0.16	0.00	0.00	0.00	0.00	0.00
Production Cost	Coating, engraving, heat treating, and allied activities (3328)	0.00	0.00	0.00	-0.40	-0.44	-0.47	0.00	0.00	0.00	0.00	0.00
Production Cost	Other fabricated metal product manufacturing (3329)	0.00	0.00	0.00	-0.10	-0.10	-0.10	0.00	0.00	0.00	0.00	0.00
Production Cost	Agriculture, construction, and mining machinery	0.00	0.00	0.00	-0.03	-0.03	-0.03	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	manufacturing (3331)											
Production Cost	Industrial machinery manufacturing (3332)	0.00	0.00	0.00	0.05	0.07	0.09	0.00	0.00	0.00	0.00	0.00
Production Cost	Commercial and service industry machinery manufacturing, including digital camera manufacturing (3333)	0.00	0.00	0.00	-2.22	-2.43	-2.63	0.00	0.00	0.00	0.00	0.00
Production Cost	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing (3334)	0.00	0.00	0.00	-0.03	-0.03	-0.02	0.00	0.00	0.00	0.00	0.00
Production Cost	Metalworking machinery manufacturing (3335)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Engine, turbine, power transmission equipment manufacturing (3336)	0.00	0.00	0.00	0.03	0.04	0.06	0.00	0.00	0.00	0.00	0.00
Production Cost	Other general purpose machinery manufacturing (3339)	0.00	0.00	0.00	-0.13	-0.14	-0.13	0.00	0.00	0.00	0.00	0.00
Production Cost	Computer and peripheral equipment manufacturing, excluding digital camera	0.00	0.00	0.00	-0.04	-0.04	-0.02	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	manufacturing (3341)											
Production Cost	Communications equipment manufacturing (3342)	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Audio and video equipment manufacturing (3343)	0.00	0.00	0.00	0.03	0.04	0.05	0.00	0.00	0.00	0.00	0.00
Production Cost	Semiconductor and other electronic component manufacturing (3344)	0.00	0.00	0.00	-0.40	-0.43	-0.45	0.00	0.00	0.00	0.00	0.00
Production Cost	Navigational, measuring, electromedical, and control instruments manufacturing (3345)	0.00	0.00	0.00	-0.12	-0.12	-0.11	0.00	0.00	0.00	0.00	0.00
Production Cost	Manufacturing and reproducing magnetic and optical media (3346)	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Electric lighting equipment manufacturing (3351)	0.00	0.00	0.00	-0.19	-0.21	-0.23	0.00	0.00	0.00	0.00	0.00
Production Cost	Household appliance manufacturing (3352)	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Electrical equipment manufacturing (3353)	0.00	0.00	0.00	-0.18	-0.19	-0.21	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Other electrical equipment and component manufacturing (3359)	0.00	0.00	0.00	-0.44	-0.48	-0.51	0.00	0.00	0.00	0.00	0.00
Production Cost	Motor vehicle manufacturing (3361)	0.00	0.00	0.00	0.17	0.20	0.24	0.00	0.00	0.00	0.00	0.00
Production Cost	Motor vehicle body and trailer manufacturing (3362)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Motor vehicle parts manufacturing (3363)	0.00	0.00	0.00	0.01	0.02	0.04	0.00	0.00	0.00	0.00	0.00
Production Cost	Aerospace product and parts manufacturing (3364)	0.00	0.00	0.00	-0.42	-0.45	-0.44	0.00	0.00	0.00	0.00	0.00
Production Cost	Railroad rolling stock manufacturing (3365)	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Ship and boat building (3366)	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Other transportation equipment manufacturing (3369)	0.00	0.00	0.00	0.05	0.06	0.08	0.00	0.00	0.00	0.00	0.00
Production Cost	Household and institutional furniture and kitchen cabinet manufacturing (3371)	0.00	0.00	0.00	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Office furniture (including fixtures) manufacturing; Other furniture related product manufacturing (3372, 3379)	0.00	0.00	0.00	-0.04	-0.04	-0.03	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Medical equipment and supplies manufacturing (3391)	0.00	0.00	0.00	-0.49	-0.52	-0.54	0.00	0.00	0.00	0.00	0.00
Production Cost	Other miscellaneous manufacturing (3399)	0.00	0.00	0.00	-0.41	-0.43	-0.43	0.00	0.00	0.00	0.00	0.00
Production Cost	Animal food manufacturing (3111)	0.00	0.00	0.00	0.09	0.10	0.13	0.00	0.00	0.00	0.00	0.00
Production Cost	Grain and oilseed milling (3112)	0.00	0.00	0.00	0.22	0.27	0.36	0.00	0.00	0.00	0.00	0.00
Production Cost	Sugar and confectionery product manufacturing (3113)	0.00	0.00	0.00	-0.51	-0.55	-0.58	0.00	0.00	0.00	0.00	0.00
Production Cost	Fruit and vegetable preserving and specialty food manufacturing (3114)	0.00	0.00	0.00	-0.28	-0.29	-0.26	0.00	0.00	0.00	0.00	0.00
Production Cost	Dairy product manufacturing (3115)	0.00	0.00	0.00	0.68	0.79	0.97	0.00	0.00	0.00	0.00	0.00
Production Cost	Animal slaughtering and processing (3116)	0.00	0.00	0.00	0.66	0.75	0.87	0.00	0.00	0.00	0.00	0.00
Production Cost	Seafood product preparation and packaging (3117)	0.00	0.00	0.00	0.02	0.03	0.03	0.00	0.00	0.00	0.00	0.00
Production Cost	Bakeries and tortilla manufacturing (3118)	0.00	0.00	0.00	-0.31	-0.33	-0.35	0.00	0.00	0.00	0.00	0.00
Production Cost	Other food manufacturing (3119)	0.00	0.00	0.00	-0.06	-0.05	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Beverage manufacturing (3121)	0.00	0.00	0.00	-0.91	-0.96	-0.95	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Tobacco manufacturing (3122)	0.00	0.00	0.00	-0.02	-0.02	-0.02	0.00	0.00	0.00	0.00	0.00
Production Cost	Textile mills and textile product mills (313, 314)	0.00	0.00	0.00	-0.07	-0.07	-0.07	0.00	0.00	0.00	0.00	0.00
Production Cost	Apparel, leather and allied product manufacturing (315, 316)	0.00	0.00	0.00	0.18	0.21	0.27	0.00	0.00	0.00	0.00	0.00
Production Cost	Pulp, paper, and paperboard mills (3221)	0.00	0.00	0.00	-0.66	-0.72	-0.78	0.00	0.00	0.00	0.00	0.00
Production Cost	Converted paper product manufacturing (3222)	0.00	0.00	0.00	-0.40	-0.43	-0.43	0.00	0.00	0.00	0.00	0.00
Production Cost	Printing and related support activities (323)	0.00	0.00	0.00	-2.41	-2.63	-2.84	0.00	0.00	0.00	0.00	0.00
Production Cost	Petroleum and coal products manufacturing (324)	0.00	0.00	0.00	1.12	1.26	1.47	0.00	0.00	0.00	0.00	0.00
Production Cost	Basic chemical manufacturing (3251)	0.00	0.00	0.00	-14.72	-16.07	-17.41	0.00	0.00	0.00	0.00	0.00
Production Cost	Resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing (3252)	0.00	0.00	0.00	-6.19	-6.77	-7.33	0.00	0.00	0.00	0.00	0.00
Production Cost	Pesticide, fertilizer, and other agricultural chemical manufacturing (3253)	0.00	0.00	0.00	-2.70	-2.94	-3.19	0.00	0.00	0.00	0.00	0.00
Production Cost	Pharmaceutical and medicine	0.00	0.00	0.00	-1.68	-1.82	-1.94	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	manufacturing (3254)											
Production Cost	Paint, coating, and adhesive manufacturing (3255)	0.00	0.00	0.00	-1.41	-1.53	-1.66	0.00	0.00	0.00	0.00	0.00
Production Cost	Soap, cleaning compound, and toilet preparation manufacturing (3256)	0.00	0.00	0.00	-1.70	-1.85	-1.99	0.00	0.00	0.00	0.00	0.00
Production Cost	Other chemical product and preparation manufacturing (3259)	0.00	0.00	0.00	-2.48	-2.71	-2.93	0.00	0.00	0.00	0.00	0.00
Production Cost	Plastics product manufacturing (3261)	0.00	0.00	0.00	-1.19	-1.29	-1.37	0.00	0.00	0.00	0.00	0.00
Production Cost	Rubber product manufacturing (3262)	0.00	0.00	0.00	-0.14	-0.15	-0.16	0.00	0.00	0.00	0.00	0.00
Production Cost	Wholesale trade (42)	0.00	0.00	0.00	-3.89	-4.21	-4.43	0.00	0.00	0.00	0.00	0.00
Production Cost	Retail trade (44-45)	0.00	0.00	0.00	-0.52	-0.41	-0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Air transportation (481)	0.00	0.00	0.00	-13.48	-14.74	-15.99	0.00	0.00	0.00	0.00	0.00
Production Cost	Rail transportation (482)	0.00	0.00	0.00	-3.90	-4.26	-4.63	0.00	0.00	0.00	0.00	0.00
Production Cost	Water transportation (483)	0.00	0.00	0.00	-10.02	-10.96	-11.89	0.00	0.00	0.00	0.00	0.00
Production Cost	Truck transportation (484)	0.00	0.00	0.00	-74.73	-81.67	-88.59	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Couriers and messengers (492)	0.00	0.00	0.00	-10.34	-11.30	-12.25	0.00	0.00	0.00	0.00	0.00
Production Cost	Transit and ground passenger transportation (485)	0.00	0.00	0.00	-6.20	-6.78	-7.36	0.00	0.00	0.00	0.00	0.00
Production Cost	Pipeline transportation (486)	0.00	0.00	0.00	-0.24	-0.27	-0.29	0.00	0.00	0.00	0.00	0.00
Production Cost	Scenic and sightseeing transportation and support activities for transportation (487, 488)	0.00	0.00	0.00	-3.30	-3.60	-3.87	0.00	0.00	0.00	0.00	0.00
Production Cost	Warehousing and storage (493)	0.00	0.00	0.00	-1.16	-1.27	-1.37	0.00	0.00	0.00	0.00	0.00
Production Cost	Newspaper, periodical, book, and directory publishers (5111)	0.00	0.00	0.00	0.04	0.04	0.06	0.00	0.00	0.00	0.00	0.00
Production Cost	Software publishers (5112)	0.00	0.00	0.00	-0.11	-0.12	-0.12	0.00	0.00	0.00	0.00	0.00
Production Cost	Motion picture, video, and sound recording industries (512)	0.00	0.00	0.00	-0.17	-0.18	-0.19	0.00	0.00	0.00	0.00	0.00
Production Cost	Data processing, hosting, related services, and other information services (518, 519)	0.00	0.00	0.00	-0.27	-0.27	-0.22	0.00	0.00	0.00	0.00	0.00
Production Cost	Broadcasting (except internet) (515)	0.00	0.00	0.00	-0.13	-0.14	-0.14	0.00	0.00	0.00	0.00	0.00
Production Cost	Telecommunications (517)	0.00	0.00	0.00	-0.57	-0.61	-0.62	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Monetary authorities, credit intermediation, and related activities (521, 522)	0.00	0.00	0.00	-1.28	-1.40	-1.52	0.00	0.00	0.00	0.00	0.00
Production Cost	Funds, trusts, and other financial vehicles (525)	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Securities, commodity contracts, and other financial investments and related activities (523)	0.00	0.00	0.00	-0.24	-0.26	-0.27	0.00	0.00	0.00	0.00	0.00
Production Cost	Insurance carriers (5241)	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.00
Production Cost	Agencies, brokerages, and other insurance related activities (5242)	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Real estate (531)	0.00	0.00	0.00	-3.67	-4.00	-4.30	0.00	0.00	0.00	0.00	0.00
Production Cost	Automotive equipment rental and leasing (5321)	0.00	0.00	0.00	-1.90	-2.08	-2.26	0.00	0.00	0.00	0.00	0.00
Production Cost	Consumer goods rental and general rental centers (5322, 5323)	0.00	0.00	0.00	-0.22	-0.24	-0.26	0.00	0.00	0.00	0.00	0.00
Production Cost	Commercial and industrial machinery and equipment rental and leasing (5324)	0.00	0.00	0.00	-0.23	-0.26	-0.27	0.00	0.00	0.00	0.00	0.00
Production Cost	Lessors of nonfinancial intangible assets	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	(except copyrighted works) (533)											
Production Cost	Legal services (5411)	0.00	0.00	0.00	-0.11	-0.12	-0.12	0.00	0.00	0.00	0.00	0.00
Production Cost	Accounting, tax preparation, bookkeeping, and payroll services (5412)	0.00	0.00	0.00	-0.08	-0.09	-0.09	0.00	0.00	0.00	0.00	0.00
Production Cost	Architectural, engineering, and related services (5413)	0.00	0.00	0.00	-0.88	-0.95	-1.01	0.00	0.00	0.00	0.00	0.00
Production Cost	Specialized design services (5414)	0.00	0.00	0.00	-0.05	-0.05	-0.05	0.00	0.00	0.00	0.00	0.00
Production Cost	Computer systems design and related services (5415)	0.00	0.00	0.00	-0.69	-0.75	-0.81	0.00	0.00	0.00	0.00	0.00
Production Cost	Management, scientific, and technical consulting services (5416)	0.00	0.00	0.00	0.07	0.09	0.12	0.00	0.00	0.00	0.00	0.00
Production Cost	Scientific research and development services (5417)	0.00	0.00	0.00	-1.92	-2.08	-2.23	0.00	0.00	0.00	0.00	0.00
Production Cost	Advertising, public relations, and related services (5418)	0.00	0.00	0.00	-0.20	-0.21	-0.21	0.00	0.00	0.00	0.00	0.00
Production Cost	Other professional, scientific, and technical services (5419)	0.00	0.00	0.00	-0.25	-0.27	-0.28	0.00	0.00	0.00	0.00	0.00
Production Cost	Management of companies and enterprises (55)	0.00	0.00	0.00	-2.09	-2.28	-2.47	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Office administrative services; Facilities support services (5611, 5612)	0.00	0.00	0.00	-0.28	-0.30	-0.33	0.00	0.00	0.00	0.00	0.00
Production Cost	Employment services (5613)	0.00	0.00	0.00	-0.02	-0.02	-0.02	0.00	0.00	0.00	0.00	0.00
Production Cost	Business support services; Investigation and security services; Other support services (5614, 5616, 5619)	0.00	0.00	0.00	-0.46	-0.50	-0.53	0.00	0.00	0.00	0.00	0.00
Production Cost	Travel arrangement and reservation services (5615)	0.00	0.00	0.00	-0.05	-0.05	-0.06	0.00	0.00	0.00	0.00	0.00
Production Cost	Services to buildings and dwellings (5617)	0.00	0.00	0.00	-6.74	-7.37	-7.99	0.00	0.00	0.00	0.00	0.00
Production Cost	Waste management and remediation services (562)	0.00	0.00	0.00	-2.71	-2.96	-3.19	0.00	0.00	0.00	0.00	0.00
Production Cost	Educational services; private (61)	0.00	0.00	0.00	-1.74	-1.90	-2.04	0.00	0.00	0.00	0.00	0.00
Production Cost	Offices of health practitioners (6211-6213)	0.00	0.00	0.00	-1.21	-1.31	-1.40	0.00	0.00	0.00	0.00	0.00
Production Cost	Outpatient, laboratory, and other ambulatory care services (6214, 6215, 6219)	0.00	0.00	0.00	-0.53	-0.57	-0.61	0.00	0.00	0.00	0.00	0.00
Production Cost	Home health care services (6216)	0.00	0.00	0.00	-0.13	-0.15	-0.16	0.00	0.00	0.00	0.00	0.00
Production Cost	Hospitals; private (622)	0.00	0.00	0.00	-6.03	-6.58	-7.11	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Nursing and residential care facilities (623)	0.00	0.00	0.00	-1.58	-1.73	-1.87	0.00	0.00	0.00	0.00	0.00
Production Cost	Individual and family services; Community and vocational rehabilitation services (6241-6243)	0.00	0.00	0.00	-0.84	-0.91	-0.97	0.00	0.00	0.00	0.00	0.00
Production Cost	Child day care services (6244)	0.00	0.00	0.00	-0.54	-0.58	-0.63	0.00	0.00	0.00	0.00	0.00
Production Cost	Performing arts companies; Promoters of events, and agents and managers (7111, 7113, 7114)	0.00	0.00	0.00	-0.36	-0.39	-0.42	0.00	0.00	0.00	0.00	0.00
Production Cost	Spectator sports (7112)	0.00	0.00	0.00	-0.07	-0.08	-0.09	0.00	0.00	0.00	0.00	0.00
Production Cost	Independent artists, writers, and performers (7115)	0.00	0.00	0.00	-0.07	-0.07	-0.07	0.00	0.00	0.00	0.00	0.00
Production Cost	Museums, historical sites, and similar institutions (712)	0.00	0.00	0.00	-0.18	-0.20	-0.21	0.00	0.00	0.00	0.00	0.00
Production Cost	Amusement, gambling, and recreation industries (713)	0.00	0.00	0.00	-2.17	-2.37	-2.56	0.00	0.00	0.00	0.00	0.00
Production Cost	Accommodation (721)	0.00	0.00	0.00	-1.38	-1.51	-1.62	0.00	0.00	0.00	0.00	0.00
Production Cost	Food services and drinking places (722)	0.00	0.00	0.00	-4.08	-4.42	-4.69	0.00	0.00	0.00	0.00	0.00
Production Cost	Automotive repair and maintenance (8111)	0.00	0.00	0.00	-0.92	-1.00	-1.06	0.00	0.00	0.00	0.00	0.00

REMI Policy Variable	REMI Industry	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Production Cost	Electronic and precision equipment repair and maintenance (8112)	0.00	0.00	0.00	-0.17	-0.19	-0.20	0.00	0.00	0.00	0.00	0.00
Production Cost	Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance (8113)	0.00	0.00	0.00	-0.13	-0.14	-0.15	0.00	0.00	0.00	0.00	0.00
Production Cost	Personal and household goods repair and maintenance (8114)	0.00	0.00	0.00	-0.10	-0.11	-0.12	0.00	0.00	0.00	0.00	0.00
Production Cost	Personal care services (8121)	0.00	0.00	0.00	-0.25	-0.27	-0.29	0.00	0.00	0.00	0.00	0.00
Production Cost	Death care services (8122)	0.00	0.00	0.00	-0.02	-0.02	-0.02	0.00	0.00	0.00	0.00	0.00
Production Cost	Drycleaning and laundry services (8123)	0.00	0.00	0.00	-1.69	-1.84	-2.00	0.00	0.00	0.00	0.00	0.00
Production Cost	Other personal services (8129)	0.00	0.00	0.00	-0.29	-0.31	-0.33	0.00	0.00	0.00	0.00	0.00
Production Cost	Religious organizations; Grantmaking and giving services, and social advocacy organizations (8131-8133)	0.00	0.00	0.00	-0.79	-0.86	-0.93	0.00	0.00	0.00	0.00	0.00
Production Cost	Civic, social, professional, and similar organizations (8134, 8139)	0.00	0.00	0.00	-0.68	-0.74	-0.80	0.00	0.00	0.00	0.00	0.00