Economic Impact of the California Global Warming Solutions Act (SB-775) on CA Households

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EXECUTIVE SUMMARY

This study examines the economic impact of the California Global Warming Solutions Act (SB-775) on household incomes across the state.

SB-775 would put a price on the use of fossil fuels through a "price collar" to reduce greenhouse gas (GHG) emissions by targets outlined in the legislation. By placing a price on the use of fossil fuels, consumers and businesses will be incentivized to reduce their GHG emissions, however this will also impact family incomes in California. The net impact on family incomes depends critically on who gets the revenue from this carbon price, which will ultimately be paid by consumers in the form of higher prices.

SB-775 proposes to recycle the revenue collected from the price on GHG emissions for three purposes: the first portion of the revenue will be given back to the public in the form of equal per-capita quarterly dividends (payments), a second portion of the revenue will be invested in the California Climate and Clean Energy Research Fund, and the third portion, will be invested in the California Climate Infrastructure Fund. Dividend payments will insulate household incomes from the impact of higher prices on carbon-intensive goods. This report analyzes the effects of carbon pricing and revenue recycling through the dividend, ignoring distributional issues associated with the other two funds.

Dividend payments would be the same for all Californians, so the net impact on family incomes (dividend minus the impact of higher prices) depends on the amount of fossil fuels they directly and indirectly consume. Households directly consume carbon when they purchase gasoline, electricity, natural gas, etc. Households indirectly consume carbon when they purchase goods with embedded carbon. When the price of gasoline goes up, so too will the price of oranges - but to a lesser extent -- because they require fossil fuels to produce and bring to market. Families that consume more carbon will have lower net benefits; families who consume less carbon will have higher net benefits. But regardless of their consumption level, all will have an incentive to limit their use of fossil fuels in response to the market price signals resulting from pricing GHG emissions.

Because high-income households generally consume more fossil fuels than low- and middle-income households, they will tend to pay more as a result of higher prices from a price on GHG pollution. Despite high-income households generally paying more, setting a price on GHG emissions tends to be regressive, with low-income consumers paying a higher percentage of their incomes. The policy design in SB-775 can mitigate this regressivity through the provision of the equal per-capita dividends, which can make the policy progressive depending on the benefit level.

This brief will focus on the initial incidence (cost) of placing a price on GHG emissions and the ability of the dividend payment to protect household incomes. We model three alternative revenue recycling schemes for the dividend and assess the economic impact on households across the

income distribution. Specifically, this brief examines: 0% of revenue recycled as a dividend, 30% than they receive as a dividend, and 80% of revenue recycled as a dividend.

The findings demonstrate that a sizable dividend, around 80% of total revenue raised through the auctioning of pollution permits, is essential to protecting the purchasing power of the majority of CA households.

INTRODUCTION

This study analyzes the economic impacts of the California Global Warming Solutions Act (SB-775), a bill introduced by Senator Bob Wieckowski (D-Fremont) in May 2017. Specifically, we estimate the impacts of three different revenue recycling scenarios under the bill on household's incomes across the state of California.

California currently has one of the most comprehensive climate change and greenhouse gas (GHG) reduction programs in the world. Legislation supporting the reduction of pollutants include AB 32 and SB 32, which set emissions targets for the state of California. In addition, the state has passed laws such as SB 350 to expand clean energy, energy efficiency, and zero pollution transformation.

While California currently has a cap-and-trade program in place to reduce GHG emissions, there are substantial legal concerns with the function of the current program post 2020. In turn, SB-775 enacts into law a new post-2020 carbon pricing program.

SB-775 aims to safeguard both the Earth's climate and the health of Californians, while promoting economic security of Californian families. SB-775 seeks to protect the climate by reducing the use of fossil fuels through a price collar (a hybrid between a price on emissions and a cap on emissions) to gradually reduce statewide GHG emissions to at least 40% below 1990 levels by 2030. At the same time, SB-775 seeks to protect family incomes by recycling a portion of the revenue from the sale of pollution permits directly to the public through equal per-capita dividends, and devoting the remaining revenue to investments in clean energy research and development and infrastructure projects.

First, we sketch the basic features of SB-775. We then estimate the economic impact of SB-775 on household incomes across the income distribution (income brackets) in California, taking into account the impacts of higher prices on consumers. Next, we estimate the impact under three different funding scenarios for the dividend, the primary mechanism to protect consumers from higher prices and redistribute the revenue back to the residents of the state.

SB 775 OVERVIEW

SB-775 would implement the most advanced carbon-pricing policy in United States history. It creates a new carbon pricing program that begins on January 1, 2021. The new program will still apply to the same set of covered entities under the current program. Specifics of SB-775 are discussed below.

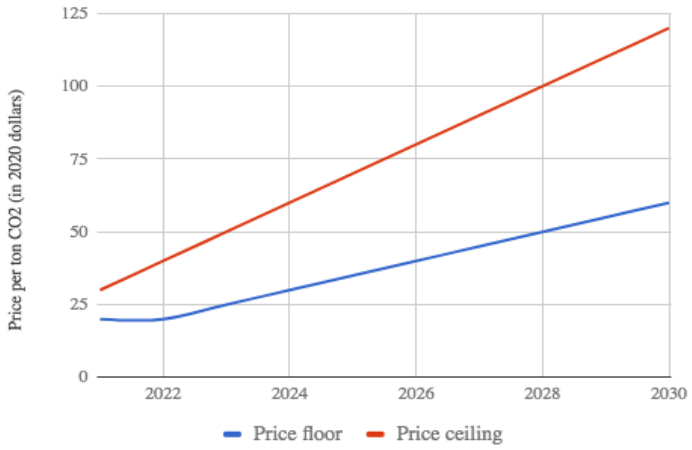
Pollution Permits

Under SB-775 polluting entities will have to purchase pollution allowances or permits through a quarterly auction. The state will auction 100% of the permits required to bring GHG emissions into the CA economy, so there are no permit giveaways. The price at the auction is bounded by a "price collar" that establishes both a floor and a ceiling.

- The initial price floor begins at $\$20/tCO_{2e}$ in 2021 and rises at $\$5/tCO_{2e}$ per year, plus inflation (CA CPI-U), after a one-year delay.
- The initial price ceiling begins at $\$30/tCO_{2e}$ in 2021 and rises at $\$10/tCO_{2e}$ per year, plus inflation.
- There is a $\$20/tCO_{2e}$ spread between the floor and ceiling after one year of market operations and a $\$60/tCO_{2e}$ spread between the floor and ceiling in 2030

A price collar is a sizable policy improvement upon a simple price on CO_{2e} or a firm cap on emissions. A tax, or price, on CO_{2e} sets the price of a tCO_{2e} and allows the quantity to vary. A cap sets the quantity of CO_{2e} that can be emitted and issues permits up to that cap, allowing their price to vary. The problem is, policymakers do not know exactly how much CO_{2e} will be released into the atmosphere at a given price, nor do they know what the price of a permit will be given a set cap. A price collar gives consumers and firms relative price certainty, while also providing greater certainty that California meets its emissions targets. The carbon price to stay near the floor if emissions are reduced easily, or the ceiling if emissions are difficult to reduce.

Figure 1. Carbon Price Floor and Price Ceiling Under SB-775



Revenue Recycling

The amount of money that will be raised annually by pollution permit auctions is likely to be substantial. In 2021, the first year the legislation will be in effect, we assume statewide GHG emissions will be 408 $MMtCO_{2e}$ with household consumption accounting for 359 $MMtCO_{2e}$. In this paper we implicitly "keep government whole" by only redistributing revenue raised from households consumption. This assumption will maintain government purchasing power. If we assume a permit price at the floor ($\$20/tCO_{2e}$), this revenue will amount to $6.1 billion dollars. If the permit price is at the ceiling ($\$30/tCO_{2e}$), this revenue will amount to $9.2 billion dollars.[3]

This revenue does not grow on trees. The total value of the permits is equal to the increased cost of goods to consumers, as firms pass on the cost of permits to end-users of fossil fuels.[4] Although these higher fuel prices are a cost to consumers, they are not a cost to the economy as a whole. Instead they are a *transfer*. Unlike the higher fuel prices resulting from, say, OPEC supply caps, the extra dollars paid as a result of carbon pricing policies are recycled *within* the Californian economy. In other words, the economic pie of California remains intact. What changes is how the pie is sliced - and this depends on who gets the money.

SB-775 shares the revenue among three funds: The California Climate Dividend Fund, The California Climate Infrastructure Fund, and The California Climate Clean Energy Research Fund. The bulk of this report will focus on the Dividend Fund, which functions as the primary mechanism to protect consumers from higher prices.

While SB-775 does not specify how the revenue will be divided amongst these three funds, there is a strong case to be made that the majority of the revenue is devoted to equal per-capita carbon dividends (payments) to all CA residents. Any policy that limits the use of a scarce environmental resource, in this case the carbon storage capacity of the atmosphere, creates new property rights. Since permits represent the property right to pollute one tCO_{2e}, a cap-and-dividend represents an arrangement in which individuals pay fees based on their use of the scarce resource that they own in common, and are rebated an equal portion of the revenue from the use of their commonly owned resource.

Border-Adjustment Tax

California engages in trade both within the United States and with the global economy. To ensure CA businesses remain competitive, SB-775 includes a border-adjustment tax. To protect the competitiveness of CA firms and prevent firms from relocating across state lines to produce carbon-intensive products, the state will levy a tax on imported goods based on their carbon content. Likewise, the state will provide a credit to CA firms that export carbon-intensive products. This

[3] This assumes that 75% of statewide GHG emissions are covered by the pollution price. The analysis assumes that capped sectors reduce emissions by the same percentage as to total statewide emissions.

[4] In this analysis, we assume the permit price will be nominally paid by producers and importers, but the full burden will ultimately be passed on to households in the form of higher prices for goods proportional to their carbon intensity. Please see the appendix for further details.

ensures that goods produced in CA are not put at a disadvantage in the national and international markets while goods imported cannot escape GHG pricing.

This mechanism will be a transparent and straightforward adjustment to imports and exports from the CA economy. To administer the program, SB-775 creates a new Economic Competitiveness Assurance Program.

No Offsets

Zero "offsets" are allowed under SB-775. Polluters cannot avoid buying permits or curbing their use of fossil fuels by paying someone else to clean up after them. This simplification from previous legislation minimizes firms' ability to game the system by purchasing fraudulent offsets. After all, all polluters should pay a fair price for their pollution. Benefits go beyond fairness - eliminating offsets is particularly important for California residents to realize the full health benefits of reducing GHG emissions across the state. Eliminating offsets is particularly beneficial to environmental justice communities that have received more than their fair share of pollution.

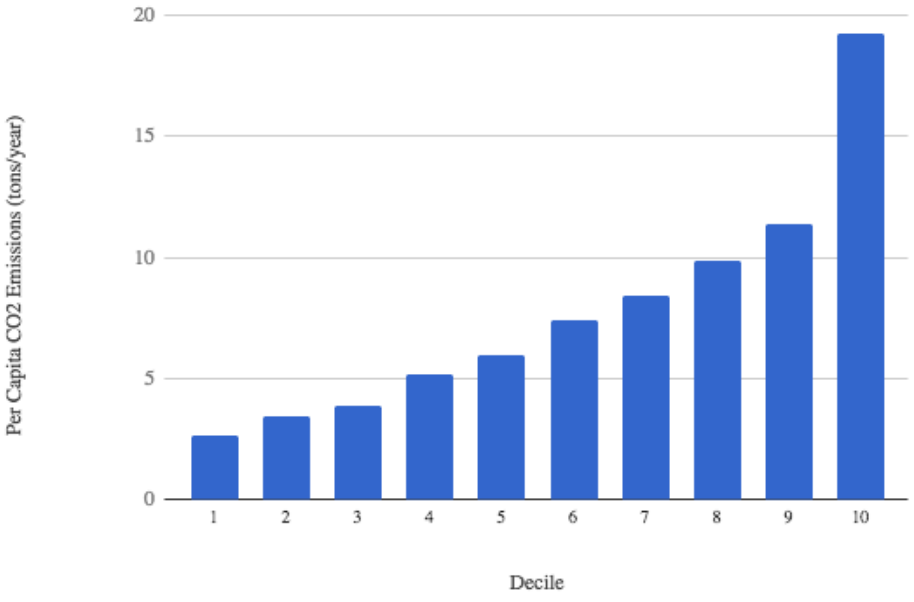
THE DIVIDEND: IMPACT ON HOUSEHOLD INCOMES

SB-775 specifies that pollution permits will be sold to polluting firms rather than distributed free of charge (i.e. there are no pollution giveaways), but firms will pass through the costs of the permits to consumers via higher prices. In other words, the money that the firms receive from consumers by virtue of higher prices will equal what the firms pay for the pollution permits. The distributional consequences of pricing pollution depends critically on how the revenue is recycled throughout the Californian economy.

Distribution of CO_2 Emissions in California

The cost to a household under SB-775 is simply a function of the amount GHG emissions embodied in the production and distribution of the goods and services the household consumes, or the household's carbon footprint. When the price of electricity goes up from pricing GHG emissions, so too will the price of oranges - but to a lesser extent -- because they require fossil fuels to produce and bring to market. Because lower-income households consume fewer goods than higher-income households, they typically have smaller carbon footprints. Differences in carbon emissions across the income distribution are shown in Figure 2. In the highest (richest) decile, carbon emission per capita are more than *seven times greater* than in the lowest decile.

Figure 2. Per Capita CO2 Emissions by Decile



Distribution of Burden of Carbon Price

As a *share* of their income, however, the poor spend more on carbon intensive goods than the rich. This is largely because fuels and electricity account for a larger share of low-income household's

budgets than high-income households' budgets. In the absence of a sizable carbon dividend or rebate, putting a price on carbon is a regressive policy, with the increased prices arising from carbon pricing disproportionately burdening low-income households.

Transfers to Households with Carbon Dividend

The net impact of this transfer on household incomes is the difference between what the household receives in dividends and what it pays as a result of higher prices. When the household's dividends exceed what it pays in the form of higher prices, the household experiences a net financial benefit as a result of the policy. When the additional cost of higher prices to the household exceeds the dividend payment, the household experiences a net financial cost. In this section we model three dividend scenarios to see how net benefits from SB-775 may vary across the income distribution in California.

The three revenue recycling scenarios modeled in this paper are the following:

1. No dividend payment - this scenario models the initial cost of the new pricing program to households.

2. A weak dividend payment - 30% of total revenue raised from permits is recycled to the public via equal per-capita dividends.[5]

3. A strong dividend payment - 80% total revenue raised from permits is recycled to the public via equal per-capita dividends.

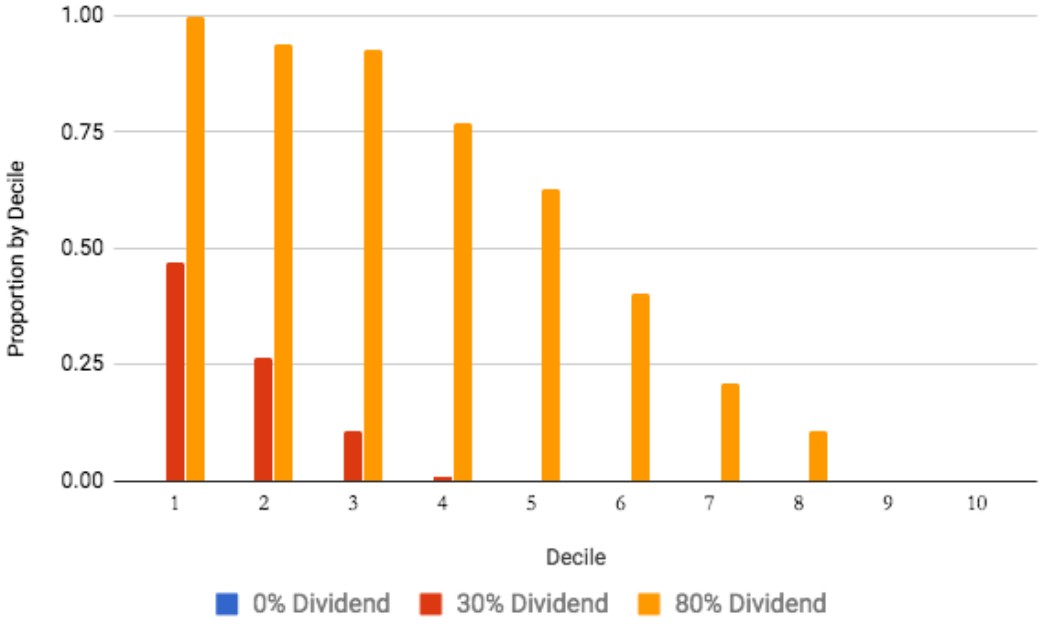
Figure 3 shows the portion of Californians whose carbon dividend exceeds the additional costs incurred through higher prices. The data in this figure indicates that a sizable dividend is vital to protecting California consumers from pricing pollution in the economy. While no rebate will result in higher prices for all California households without a transfer to protect their purchasing power, we see that the weak dividend provides an insufficient dividend to protect most Californians. On the other hand, a strong dividend payment is able to protect the majority of Californian households (50%).

The key takeaway from a strong dividend is that such a policy would keep the majority of the middle class "whole" - in other words, the majority of low- and middle-income households would receive more money back than they pay in. In fact, such a policy would maintain, or improve, the purchasing power of 85% of households in the bottom half of the income distribution. These families would see a net benefit in simple monetary terms, not counting the policy's main benefits in

[5] This scenario is meant to approximate the current California Climate Credit (a utility rebate). Nevertheless, there are important differences in our reported numbers and the current program. In our model we assume that 30% of revenue is recycled to residents through an equal per capita rebate, whereas the utility credit is returned on a per-meter basis, bypassing those that do not directly pay utility bills. In other words, the dividend modeled provides universal coverage, while the utility rebate credit misses a large portion of Californian residents.

the form of reduced dependence on fossil fuels, protection from climate change, and health benefits from reduced pollution.

Figure 3. Proportion of Californians whose Carbon Dividend Exceeds their Cost



While one common objection to carbon pricing is that it disproportionately burdens low-income households, the data demonstrate this can be avoided through policy design. Because gross costs to households are based on the household's carbon footprints, while dividends are paid equally to all, the net impact of carbon pricing can be made *progressive* through a strong dividend payment.

To illustrate these findings in terms that are easily translated to households, we next model the net transfers to households in 2021, the first year SB-775 is activated. This scenario assumes the permit price is at the ceiling, which is \$30/tCO_{2e}.[6]

[6] Note that if permits trade at a lower price, positive and negative transfers would be proportionately smaller.

Table 1. Net Transfers to Households in 2021, with Carbon Price of at Price Ceiling

	Mean Net Transfer to Households		
Decile	0% Dividend	30% Dividend	80% Dividend
1	-$287	-$206	$287
2	-$402	-$311	$245
3	-$526	-$418	$238
4	-$578	-$495	$13
5	-$628	-$544	-$32
6	-$740	-$662	-$185
7	-$872	-$794	-$316
8	-$909	-$841	-$420
9	-$973	-$909	-$516
10	-$1,440	-$1,381	-$1,020
Mean Bottom Half of Population	**-484**	**-395**	**150**
Mean Total Population	**-735**	**-656**	**-171**

Notes. Household expenditures and net transfers are in 2017 dollars. At the price ceiling of $30/ton, the carbon dividend amounts to $71 (30% dividend) or $190 (80% dividend) per person.

Under this scenario, we see that the average cost to a household in the state will be around $735 per year, however this will vary substantially across the income distribution. The average cost for households in the lowest income bracket (the 1st decile) will pay an estimated $287 a year in higher prices, while those in the highest income bracket (10th decile) will pay an estimated $1,440 per year. While the "no dividend" scenario means households shoulder the entire burden of higher prices in the economy, recycling the revenue through dividends can greatly alter the distributional impact of the policy.

Under the weak scenario (30%), we calculate that households receive an average annual payment of $71 per person. This payment is insufficient to protect the majority of consumers, be they either low- or middle-income from higher prices. On the other hand, a strong dividend (80%) would provide an average annual payment of $190 per person. This would protect half of CA households, while ensuring the most vulnerable households, those in the bottom half of the income distribution are kept whole. In other words, under a strong dividend recycling program, these households will actually come out ahead, having more money in their pockets at the end of the day despite higher prices for carbon-intensive goods.

To look at how these transfers may change as the price of pollution permits increase over time, Table 2 shows the net transfers to households in 2030. Here, we assume the price of pollution permits is at the ceiling, amounting to $\$120/tCO_{2e}$.

Table 2. Net Transfers to Households in 2030, with Carbon Price of at Price Ceiling

	Mean Net Transfer to Households		
Decile	0% Dividend	30% Dividend	80% Dividend
1	-$800	-$575	$800
2	-$1,119	-$866	$682
3	-$1,466	-$1,166	$663
4	-$1,611	-$1,380	$36
5	-$1,757	-$1,516	-$88
6	-$1,903	-$1,844	-$514
7	-$2,049	-$2,213	-$882
8	-$2,195	-$2,343	-$1,171
9	-$2,341	-$2,533	-$1,439
10	-$2,487	-$3,849	-$2,844
Mean Bottom Half of Population	**-1351**	**-1101**	**418**
Mean Total Population	**-1773**	**-1828**	**-476**

Notes. Household expenditures and net transfers are in 2017 dollars. At the price ceiling of $120/ton, the carbon dividend amounts to $198 (30% dividend) or $528 (80% dividend) per person.

The stakes are raised with a more robust price on permits. While the poorest decile will now pay roughly $800 in higher prices due to the permit price, households in the richest decile will pay roughly $4,014 a year. As we saw above, a sizable dividend can protect against higher prices, ensuring that the vast majority of low-income and the majority of middle-income households are not burdened by placing a price on GHG emissions. Under a weak dividend payments will amount to $198 per person a year, while under the strong dividend payments will amount to $528 per person a year. The data clearly indicate that the strong dividend scenario is vital to protecting the incomes and purchasing power of CA residence.

The accurate way to characterize differences in net impacts across the distribution would be to say that cap-and-trade "takes money" from households with outsized carbon footprints (tending to be high-income households) and dividends it equally to all. Thus, if a person pollutes less than the average person in CA the person gets more money back than they pay in through the dividend.

These results have political implications as well as economic significance. The fact that a strong dividend protects the real incomes of the low- and middle-class can help ensure SB-775 receives broad-based support from the public - support that must be sustained over several decades in order to make the clean energy transition.

CONCLUSION

SB-775 would put a price collar on the use of fossil fuels in the CA economy so as to reduce GHG emissions causing adverse health outcomes and climate change. Any policy that limits the use of fossil fuels will raise their price, impacting real family incomes. But the net impact on family incomes depends on who gets the money that is paid by consumers as a result of higher prices on carbon-intensive goods.

SB-775 will split all money collected from permit sale into the following three funds:

(1) The California Climate and Clean Energy Research Fund.

(2) The California Dividend Fund

(3) The California Climate Infrastructure Fund

While clean energy research and development and green infrastructure are worthwhile pursuits for the state, this paper has highlighted the distributional outcomes from SB-775. Findings indicate that low-income consumers will pay a higher share of their incomes as a result of higher prices, despite the fact that high income households pollute substantially more. To protect consumers across the board, and in particular low- and middle-income consumers in the state a sizable dividend is vital. This analysis shows that a weak dividend will lead to net benefits for only 9% of households across the state, while a strong dividend will protect the incomes of 50% of CA households. Further, the strong dividend will protect the incomes of 85% of households in the bottom half of the income distribution, ensuring the most vulnerable CA households do not bear the brunt of the cost of the transition to a green economy.

Acknowledgements

We are grateful to Danny Cullenward and Michael Wara for advice and comments. Mistakes, alas, remain our own.

APPENDIX

This analysis is based on a national-level analysis, which is described in detail in Fremstad and Paul (2017). That analysis uses national Input-Output tables to estimate the carbon intensity of 64 industries and 33 consumer expenditure categories in the United States and calculate the carbon footprints of a representative sample of U.S. households. As in that paper, we make the following assumptions:

(1) A carbon price will be nominally paid by producers and importers, but the full burden will ultimately be passed on to households in the form of higher prices for goods proportional to their carbon intensity.

(2) We use expenditures (consumption) as a proxy for lifetime income. It is well documented that consumption is more equally distributed than income, and that consumption varies less year-to-year since households may save or borrow to smooth income shocks.

(3) Individuals are sorted into deciles by equivalent household expenditures using the square root scale, where equivalent household expenditures = household expenditures/(household size^1/2).

(4) A carbon price leads all households to reduce their carbon footprints by the same proportion. This allows us to estimate how much each household will pay (in the form of higher prices) and what they will receive from the government under different dividend schemes.

We make a number of adjustments to our national analysis to shed light on California's SB-775.

(1) The carbon intensity of most goods is the same in CA as it is in the United States. We adjust intensities for electricity, natural gas, and gasoline for price differences in CA and the intensity of electricity to account for California's relatively low-carbon electric grid.

(2) We restrict our analysis to a representative sample of CA households observed in the Consumer Expenditure Survey (CEX) between 2012 and 2014. Using their estimated carbon footprints, we analyze how a carbon price would burden households across the income distribution.

(5) We assume that introducing a carbon price leads Californian households to reduce emissions in line with the emissions targets in SB-775. It is possible that emissions will surpass target levels even if carbon permits trade at the price ceiling emissions surpass target levels. In this case, there would be more revenue raised and redistributed than is presented in this analysis, but the basic distributional effect would remain the same.

(6) Our calculations of net transfers are pre-tax. Because this analysis only redistributes carbon revenue raised from households, it implicitly maintains the purchasing power of federal, state, and local governments. These entities make up a sizable portion of polluting entities in the state of California.

(7) We assume population growth in the state as projected by the California Department of Finance, 2016 Baseline Projections.

Table A1. Distribution of Expenditures and CO2 Emissions in California

Decile	Household Expenditures	Per capita Expenditures	Household CO2 Emissions (tons/year)	Per Capita CO2 Emissions (tons/year)	Carbon Intensity of Expenditures (kgCO2/$)
1	$23,438	$7,110	10.3	2.7	0.44
2	$34,305	$9,313	14.4	3.5	0.42
3	$44,665	$10,657	18.9	3.9	0.42
4	$47,477	$13,586	20.8	5.1	0.44
5	$56,426	$16,746	22.5	5.9	0.40
6	$65,270	$20,684	26.6	7.4	0.41
7	$77,745	$24,059	31.3	8.4	0.40
8	$86,023	$29,950	32.7	9.8	0.38
9	$104,861	$38,085	34.9	11.4	0.33
10	$165,930	$69,085	51.7	19.2	0.31
Mean Total Population	**$70,614**	**$23,928**	**26.4**	**7.7**	**0.40**

Notes: Household expenditures are in 2017 dollars, and individuals are sorted into deciles by equivalent household expenditures using the square root scale, where equivalent household expenditures = household expenditures/(household size^1/2). Households' (direct and indirect) CO2 emissions are estimated using Consumer Expenditure Survey data for Californian households from 2012 to 2014 and national carbon intensities in Fremstad and Paul (2017), which are adjusted to account for differences in fuel prices and the carbon content of electricity in California.

Table A2. Proportion of Californians Whose Carbon Dividend Exceeds their Cost

	Proportion of Households Better Off		
Decile	0% Dividend	30% Dividend	80% Dividend
1	0.00	0.47	1.00
2	0.00	0.26	0.94
3	0.00	0.11	0.93
4	0.00	0.01	0.77
5	0.00	0.00	0.63
6	0.00	0.00	0.40
7	0.00	0.00	0.21
8	0.00	0.00	0.11
9	0.00	0.00	0.00
10	0.00	0.00	0.00
Mean Bottom Half of Population	**0.00**	**0.17**	**0.85**
Mean Total Population	**0.00**	**0.09**	**0.50**

Notes: Using the distribution of CO2 emissions from Table A1, we calculate the proportion of Californians who would receive more money back in equal per capita dividend then they pay in the form of higher prices. We assume that under the policy all households reduce emissions by the same proportion. We only redistribute carbon revenues raised from households, which implicitly keeps government whole.