Coalition for Sustainable Cement Manufacturing & Environment
1107 9th Street, Suite 930 | Sacramento, CA 95814 | (916) 447-9884

January 20, 2017

Ms. Mary Nichols
Chairman
California Air Resources Board
1001 "I" Street
Post Office Box 2815
Sacramento, California 95812

Subject: **Comments on Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms**

Dear Ms. Nichols:

The Coalition for Sustainable Cement Manufacturing and Environment ("CSCME"), a coalition of all five cement manufacturers in California,[1] provides these comments on the California Air Resources Board's ("CARB's") Proposed Amendments to the California Cap on Greenhous Gas Emissions and Market-Based Compliance Mechanisms released on December 21, 2016.

I. INTRODUCTION

Under AB 32, CARB is required to design and implement its cap-and-trade program to limit greenhouse gas ("GHG") emissions in a manner that minimizes emissions leakage.[2] CARB's primary means for minimizing leakage in the manufacturing sector is the allocation of allowances to at-risk industries.

CARB's current approach to allowance allocation provides a decreasing amount of allowances per unit of output produced. Under this framework, the cement industry, which is currently classified in the high leakage risk category, will receive 0.73 allowances for every ton of cement output in 2020 — roughly 8 percent lower than the GHG intensity of the industry's "best performer" prior to the start of the program. Under a "business-as-usual" scenario, the cement industry's allocation rate would decline to 0.60 allowances per metric ton of cement output in 2030.[3] As a point-of-reference, each metric ton of cement clinker generates 0.54 metric tons of process emissions, which are a natural and unalterable consequence of the chemical process needed to manufacture cement. In short, under a business-as-usual scenario, the cement industry's allowance allocation rate is likely to be below an emissions rate that is practically and technically achievable, much less economically and financially sustainable.[4]

[1] The Coalition includes CalPortland Company, Cemex, Inc., Lehigh Southwest Cement Company, Mitsubishi Cement Corporation, and National Cement Company of California Inc. There are ten cement plants located in California, eight of which are currently operating.

[2] AB32, Section 38562(b)(8).

[3] For this particular simulation, we assume that the benchmark and assistance factor remain constant, but the cap adjustment factor declines consistent with Table 9-2 of the proposed modifications.

[4] Against this backdrop, it is also worth noting that CARB has failed to fully explore the feasibility of implementing an incremental border carbon adjustment (BCA), as directed by the Board in 2010 via Resolution 10-42. As expressed to CARB on

Nevertheless, CARB is proposing a new allowance allocation framework that is a radical departure from the current approach and would result in substantially lower allowance allocation rates for virtually every industry, including cement. Although all three components of the allowance allocation framework (i.e., benchmark, assistance factor, and cap adjustment factor) are essential to minimizing leakage risk, the vast majority of the decline in allowance allocation rates is due to CARB's proposed assistance factors. Accordingly, CARB's proposed approach to establishing assistance factors merits special scrutiny to ensure that it is conceptually and technically sound, clearly superior to both the current approach and other viable alternatives, and that it complies with CARB's statutory obligations under AB 32.

The proposed allowance allocation framework fails to satisfy CARB's requirement to minimize emissions leakage,[5] and the cement industry represents a textbook example of that failure. As illustrated in Figure 1, under CARB's proposed approach, the cement industry's allocation rate would decrease <u>overnight</u> from 0.72 in 2020 to 0.53 in 2021 (i.e., less than the amount of <u>process emissions</u> associated with each metric ton of cement clinker produced).[6] According to the same studies that CARB has used to establish post-2020 assistance factors, such a decline in the industry's allocation rate would decimate the domestic cement industry. For instance, the results of the international leakage study suggest that, even after accounting for allowance allocations under CARB's proposed framework, an allowance price of just $20 would cause California cement production to <u>decline by 46 percent</u> (see Figure 2).[7]

In proposing such a framework, CARB has effectively taken the indefensible position that a 46 percent decline in domestic production is consistent with the spirit and the letter of AB 32 in general and with CARB's requirement to minimize leakage in particular.[8] The absurdity of that conclusion is indicative of a much more systemic problem: CARB's proposed approach to establishing assistance factors is logically inconsistent, conceptually unsound, technically deficient, and poorly executed at virtually every step of the process. For instance:

---

multiple occasions, even under a business-as-usual scenario in which the current allowance allocation framework is maintained but the allocation rate continues to decline due to the cap adjustment factor, a BCA will be essential to ensuring that cement importers face compliance obligations that are comparable to those faced by California cement manufacturers under the cap-and-trade program — thereby minimizing leakage risk. To the extent that the cement industry's overall allocation rate is reduced beyond the rate associated with a business-as-usual scenario, the urgency and importance of implementing an effective BCA will only grow.

[5] In addition to failing to minimize leakage and requiring reductions that are not technologically feasible, CARB's proposed approach undermines other statutory requirements under AB 32 because the proposed regulation is not "equitable," does not seek to "minimize costs", and does not consider "cost-effectiveness." AB32, Sections 38562(a), (b)(1), (b)(5), and (b)(8).

[6] This calculation assumes that the assistance factor is lowered to 0.74 and the cap adjustment factor declines as outlined in Table 9-2 of the proposed regulation. It also assumes that the cement industry's benchmark remains at its current level. To the extent that the benchmark is also lowered, the impacts on the industry will be even more severe than described here.

[7] According to the international leakage study, a $10 allowance price will result in a 72 percent reduction in domestic production in the absence of allowance allocation. Given an allocation rate of 0.54 and assuming that the industry's average GHG intensity equals 0.79 in 2021 (i.e., the GHG intensity of the industry "best performer" at the start of the cap-and-trade program), CARB's proposed approach would offset roughly 68 percent [0.54/0.79] of the impact or, alternatively, 49 percent of the 72 percent decline. This would result in a 23 percent decline in domestic production, which translates into a 46 percent decline under a more realistic allowance price assumption of $20 in 2021.

[8] Note that this illustrative example does not consider the impacts associated with "domestic leakage" and, consequently, is likely to dramatically understate the potential impacts.

- **Overall Analytical Approach:** CARB's proposed approach attempts to combine different metrics from different studies using different data, different methods, and different assumptions — resulting in separate measures for "domestic" and "international" leakage that are "oranges and pears" and cannot be combined to provide a complete and accurate picture of leakage risk.

- **Identifying Valid Leakage Measures:** CARB's proposed approach relies on the "international market transfer" (IMT) rate from the international leakage study, which consists of several conceptual and technical flaws that make it unsuitable for use in formulating public policy. For example: (a) the IMT calculation produces illogical results for 16 percent of the industries modeled; (b) an industry's IMT rate does not vary with alternative carbon price assumptions (i.e., the estimated leakage risk is the same regardless of whether one assumes a $1, $100, or $1,000 carbon price); and (c) an industry's IMT rate is almost perfectly correlated with its trade share (i.e., it adds no informational value beyond the trade shares used in CARB's current approach, which is much more simple, accessible, and intuitive).

- **Accounting for Process Emissions:** CARB's proposed approach relies on studies that explicitly do not consider the impact of process emissions, which significantly and systematically biases the results for certain industries, including the cement industry. CARB's attempts to address this deficiency are incomplete and do not successfully address this bias, resulting in artificially low assistance factors for several process emissions-intensive industries.

- **Calculating Assistance Factors:** CARB's overall methodology for translating the studies' results into assistance factors is conceptually incoherent and unnecessarily complex. For instance, an industry's assistance factor is determined by combining: (a) one "original" measure of international leakage risk calculated by the researchers; (b) one "derivative" measure of international leakage risk calculated by CARB staff; (c) two "original" measures of domestic leakage risk calculated by the researchers but with adjustments by CARB staff; and (d) two "derivative" measures of domestic leakage risk calculated and adjusted by CARB staff. The complexity of this process is a reflection of the deficiencies that permeate the underlying measures, as well as the misguided view that simply averaging together more measures will somehow eliminate those deficiencies.

Many of these issues (and others) have been expressed in previous comment letters by CSCME and other stakeholders. CSCME is deeply concerned that, despite extensive feedback, the most recent proposal is virtually identical to the prior version. CARB has provided no indication that it has seriously reassessed its proposed approach in light of this feedback or seriously considered the merits of alternative approaches that have the potential to address stakeholder concerns.

This comment letter reiterates concerns expressed previously and also elaborates on new issues that have come to light as a result of CARB's latest proposal and documents recently obtained through a Public Records Act request.[9] It also offers alternative approaches that address many (though not all)

[9] CSCME is continuing to review the documents provided under the Public Records Act request, and we may augment these comments as new issues come to light.

concerns that have been expressed by stakeholders.[10] CSCME looks forward to continuing to work with CARB to modify its proposed approach and establish an allowance allocation framework that will minimize emissions leakage in the cement industry and other industrial sectors.

II. CLARIFYING THE BOARD'S INTENT

CARB's efforts to revise the allowance allocation framework can be traced back to Board Resolution 11-32, which directed the Executive Officer to: "continue to review information concerning the emissions intensity, trade exposure, and in-state competition of industries in California, and to recommend to the Board changes to the leakage risk determinations and allowance allocation approach, if needed…"

In response to this directive, CARB commissioned three studies to evaluate the risk of leakage in various industries, including one regarding interstate leakage ("domestic leakage study") and one regarding international leakage ("international leakage study").[11]

Based on discussions at the beginning of that process, CSCME was under the impression that the studies would be used to inform and verify the accuracy of its current leakage risk classification — an impression that was recently confirmed by multiple members of the Board. Nevertheless, CARB is proposing to use the results of the studies as the <u>sole and determinative basis</u> for allocating allowances, which represents a radical departure from the current approach.

This radical shift in scope raises questions as to whether the Board is fully informed about the proposed approach, the potential consequences, and the wide range of stakeholder concerns that have been expressed. Accordingly, we request that CARB comment on the following questions:

- Has the Board been fully briefed on the results of the leakage studies?
- Has the Board been fully briefed on the proposed application of the studies' results, including the use of the international market transfer rate as a primary basis for determining industry-specific assistance factors?
- Has the Board been fully briefed on the extraordinary qualifications offered by the authors of the international leakage study regarding the IMT, including the warning that they cannot estimate a transfer rate for <u>any</u> given industry with <u>any</u> degree of confidence?

---

[10] Several flaws cannot be resolved because they are endemic to CARB's original decision to commission different studies to analyze different dimensions of leakage risk using different inputs, assumptions, methods, and output metrics (as opposed to commissioning a single study that evaluates leakage risk in general using an internally consistent methodology). CARB's decision to commission studies that rely on confidential (i.e., unverifiable) data only compounds this issue, as it makes it impossible for stakeholders (including CARB staff) to fully evaluate the strengths, weaknesses, and limitations of the studies, much less their relation to one another.

[11] CARB has effectively discarded a third study on leakage in the food processor industry because staff, "was not able to follow the calculations by which the study developed its market transfer measurements. Staff also needs to verify that the elasticities from previous literature used inputs for the market transfer calculation that are appropriate for comparison with the elasticities of the other two studies." CSCME has similar concerns regarding the transparency of the data and methods used in the domestic and international leakage studies, as well as the extent to which those two studies can be combined to provide a complete and complementary view of an industry's leakage risk.

- Has the Board been fully briefed on the extent and nature of stakeholder concerns regarding the proposed approach, including the lack of transparency in the process, the limitations of the studies results, and the inappropriate application of the studies' results?
- Has the Board approved the use of the studies as the sole and determinative basis for establishing assistance factors?
- Has the Board been fully briefed on the potential consequences of the proposed assistance factors, including the resulting decline in each industry's domestic production, as projected by the studies? In particular, is the Board aware that the leakage studies suggest that, under a $20 allowance price, the proposed approach will likely result in a reduction in domestic cement production of <u>at least</u> 50 percent? If so, does the Board believe that such a result is consistent with the spirit and letter of AB 32 and, in particular, CARB's requirement to minimize leakage?

III. LEAKAGE RISK & ALLOWANCE ALLOCATION: A BROADER VIEW

3.1 CARB Should Consider All Aspects Of The Allowance Allocation Framework When Evaluating An Industry's Risk of Leakage

CARB asserts that the leakage studies have provided staff with a methodology for developing and applying revised assistance factors, and that this methodology, "would arrive at sector specific revised [assistance factors] to minimize the risk of leakage".[12] However, the extent to which allowance allocation will minimize leakage in a given industry is not determined solely by the assistance factor. Rather, it is determined by the overall allowance allocation rate (i.e., allowances received per unit of output), which is a function of the assistance factor as well as the product benchmark and the cap adjustment factor. Given that changes to any one of these factors will affect an industry's overall allocation rate, it is important to consider all three of them when evaluating leakage risk.

Under CARB's current approach, both the benchmark and the cap adjustment factor reduce an industry's overall allowance allocation rate. Consequently, even if CARB can successfully identify industry-specific assistance factors that minimize the risk of leakage, the application of the benchmark and the cap adjustment factor ensures that the overall rate of allowance allocation will be less than the rate needed to minimize leakage. In other words, an assistance factor that purportedly minimizes the risk of leakage does not account for the additional leakage risk associated with the cumulative application of the benchmark and cap adjustment factor to reduce allowance allocation.

As a result, CARB's proposed approach will (by definition and design) fail to meet its mandate to minimize leakage. CSCME recommends that CARB establish industry-specific assistance factors that, when combined with an industry's benchmark and the cap adjustment factor, will result in the allowance allocation rate that is needed to minimize leakage risk.

[12] Staff Report: Initial Statement of Reasons (Aug 2016). Appendix E, Page 4.

3.2 CARB Should Set Cap Adjustment Factors For Industries With Significant Process Emissions Using The Best Data Available

In the draft regulation, CARB proposes to maintain its general approach to establishing cap adjustment factors, including an alternate trajectory for industries with significant process emissions. Specifically, as with the current approach, CARB proposes to reduce the rate of decline in the cap adjustment factor by half for all industries with significant process emissions. This one-size-fits-all approach was appropriate when CARB initially established the program, as it lacked sufficient data on the proportion of process emissions for each industry. However, as demonstrated by the proposed methodology for setting assistance factors, CARB now has verified emissions data on each industry that allows it to calculate industry-specific adjustments. Consistent with its objective of establishing industry-specific assistance factors, CARB should use this more accurate and readily available data to produce industry-specific cap adjustment factors that account for the true proportion of process emissions.

IV. CARB'S PROPOSED APPROACH DOES NOT MEET BASIC STANDARDS FOR SOUND PUBLIC POLICY

4.1 CARB's Proposed Approach Lacks Transparency & Accountability

CARB's current approach to allowance allocation is based on metrics that are simple, transparent, verifiable, and consistent with those used in other cap-and-trade programs. In contrast, CARB's proposed approach for the post-2020 program is based on two studies that use highly complex methods that many stakeholders do not understand and confidential data that no stakeholder (including CARB staff) can access and verify. Specifically, CARB's proposed approach relies almost exclusively on the results of the leakage studies, which are based on confidential data from the U.S. Census Bureau that cannot be accessed, inspected, or verified by anyone other than the researchers.

The fact that the studies rely on confidential data gives rise to two fundamental issues. First, the regulated community has no ability to verify the accuracy of the underlying data, the analytical methods used, or the final results — creating a regulatory "black box" that lacks transparency and effectively denies the regulated community any possibility of due process.[13] Second, given that only the researchers can access the data, CARB has no ability to verify the accuracy of the data, methods, or results — meaning that CARB has effectively abdicated its regulatory responsibilities and outsourced them to unaccountable third parties.

Although the use of data that can only be accessed by the researchers may be an acceptable practice for intellectual or academic pursuits, it is an unacceptable basis for formulating public policy that will have a profound consequence on manufacturing facilities, their employees, and the communities that they support. Given this lack of transparency and accountability, CARB should consider alternative approaches in which the studies may inform assessments of leakage risk, but do not constitute the sole and determinative basis for establishing assistance factors (see Section 8).

---

[13] See Exhibit 1.

4.2 CARB Should Subject The Leakage Studies To Peer Review

The lack of public transparency and accountability only heightens the importance of subjecting the studies to a peer review process that would allow an independent assessment of each study's strengths, weaknesses, and limitations. Despite repeated requests from multiple stakeholders, CARB has refused to establish such a process. Given stakeholder concerns about CARB's proposed approach and the real-world consequences of allowance allocation decisions, it is irresponsible for CARB to proceed with the rulemaking process without subjecting them to peer review.

4.3 CARB Should Provide Stakeholders With More Time To Analyze Recently Released Data

Although the confidential nature of the raw data that underpins the leakage studies ensures that stakeholders (again, including CARB staff) will <u>never</u> have an opportunity to verify the accuracy of the results, CARB has recently supplied additional data that will allow stakeholders to better understand and validate how CARB is translating those results into assistance factors. We applaud CARB for releasing this essential data. However, we also note that the data was released more than seven months after the studies were released. In contrast, CARB has provided stakeholders with less than a month to review, analyze, and develop thoughtful comments regarding the data. Again, given stakeholder concerns about CARB's proposed approach and the real-world consequences of allowance allocation decisions, it is irresponsible for CARB to proceed with the rulemaking process before it provides stakeholders with adequate time to fully evaluate this essential data.[14]

V. CONCERNS COMMON TO BOTH STUDIES

5.1 Both Studies Are Based On Flawed Assumptions

At a high level, both the domestic and international leakage studies use the same two-step process: (1) analyze historical data to estimate the relationship between energy prices and key outcomes for individual industries and (2) simulate the effect of a given carbon price on individual industries. In making the leap from the first step to the second step, the authors of both studies must make several explicit and implicit assumptions that are unlikely to hold true in reality, including:

- **Assumption #1: The conditions of competition within an industry will not change in response to a carbon price impact.** The studies calculate an industry's response to past variations in energy prices, and then assume that those historical relationships will hold <u>regardless of the carbon price</u>. In reality, however, there is a price point at which an industry's market structure (especially trade patterns) will fundamentally shift in response to the policy intervention. To the extent that a carbon

[14] On a related note, CSCME has not been able to replicate the IMT calculations using the data provided by CARB. As one example, in the worksheet labeled "berkeley data", the ratio of "imp_p50" and "prod_p50" elasticities does not appear to equal the values for "ratio_imp_p50." Given that all values are hard coded into the spreadsheet, it is impossible to trace through the actual calculations. To the extent that CSCME is misinterpreting the data, we would appreciate clarification from CARB staff. To the extent that the data is incorrect, we recommend that CARB: (1) issue the correct data; (2) comment on the source and nature of the error; and (3) comment on whether, how, and the extent to which the error affects any values contained in the proposed regulation.

price changes the conditions of competition in an industry, the studies are likely to understate future impacts, especially for emissions-intensive industries such as cement.[15]

- **Assumption #2: The energy cost impacts observed in the past are likely to be similar to the carbon price impacts experienced in the future.** The studies assume that the magnitude of energy price changes in the past will be similar to the magnitude of carbon price changes in the future. Yet, according to the international leakage study, "The magnitude of the energy price impacts associated with a $10 to $15 per metric ton of CO_2 carbon price lie within the scale of the variation in relative energy prices that we will use to identify impacts on production and trade flow."[16] Given that the allowance price floor is estimated to be approximately $20 per metric ton of CO_2 in 2025, it is clear that the energy price impacts observed in the studies is likely to be at least 25-50 percent lower than the carbon price impacts after 2020. To the extent that carbon price impacts are non-linear at higher values, the studies are likely to understate the future impacts, especially for emissions-intensive industries such as cement.

- **Assumption #3: An industry's response to a transitory, market-driven, and relatively "private" cost impact is likely to be similar to its response to a permanent, policy-driven, and relatively "public" cost impact.** An industry's response to a temporary cost impact (i.e., a market-driven change in natural gas prices) is likely to be different than its response to an unambiguously permanent cost impact (i.e., a policy-driven cost increase via carbon pricing). Likewise, an industry's response to energy prices that have gradually evolved over many years is likely to be different than its response to the sudden cost increase that would occur with a change in policy. Finally, a competitor's response to a relatively private cost impact, such as changes in a California producer's energy costs, are likely to be different than its response to a public cost impact, such as a carbon price, which clearly signals an opportunity for out-of-state producers.

5.2 Both Studies Omit Factors That Are Critical To Accurately Measuring Leakage Risk

- **Other Costs Associated with AB 32:** Both studies estimate the direct compliance costs associated with the cap-and-trade program and ignore the cost impacts associated with other AB 32 measures and requirements, such as the renewable portfolio standard, the low carbon fuel standard, administrative fees, and compliance activities. Some of these costs are relatively large and some are relatively small, but all of them add to the collective financial burden associated with AB 32 and, therefore, should be considered when estimating the risk of leakage associated with it. As a result, the studies are likely to understate the risk of emissions leakage in most industries, including the California cement industry.

- **Process Emissions:** Both studies explicitly do not model the impact of process emissions, despite the fact that: (1) process emissions make up a substantial portion of the GHG footprint for several

[15] This is particularly true for the international leakage study, which estimates import and export elasticities. Although domestic producers are effectively "locked in" to their existing capital stock, trade flows can swiftly shift as foreign producers redirect their product to the California market to take advantage of their policy-induced cost advantage.

[16] Fowlie, M.L. et al., "Measuring Leakage Risk" (May 2016), ("International Leakage Study"), p 29.

industries; (2) the data needed to account for process emissions was readily available from CARB; and (3) incorporating process emissions directly into the models and simulations is a relatively straightforward task. For instance, process emissions constitute almost 60 percent of the cement industry's GHG intensity, which suggests that the impact on the industry should be at least 2.5 times higher than estimated by the studies.[17] More generally, to the extent that an industry produces process emissions, the studies are likely to understate the risk of emissions leakage in that industry, including the California cement industry.[18]

- **Inter-Industry Leakage:** Both studies attempt to evaluate the potential for intra-industry leakage (e.g., shifts in production across state lines within an industry), but neither evaluates the potential for inter-industry leakage (e.g., shifts in production across state lines among multiple industries). For instance, California cement producers compete for market share against out-of-state cement producers, as well as producers of other construction materials, including asphalt, steel, and lumber. To the extent that a carbon price results in a shift in market share to substitute products that are manufactured outside the state and transported to California for consumption, the modeling results are likely to understate the risk of emissions leakage in industries that compete with other products, including the California cement industry.

- **Emission Intensity Differentials:** As acknowledged by the authors, neither study accounts for differences in GHG intensity between products produced inside California and products produced outside the state. As a result, neither study takes the final step in translating estimates of "production leakage" to "emissions leakage." It stands to reason that most products manufactured in California are likely to have a lower GHG footprint than those produced outside of California due to: (1) the state's above-average energy prices, which encourages improvements in energy efficiency; (2) the state's history as a pioneer in environmental policy, which encourages increased use of low-carbon fuels; and (3) the added emissions associated with transporting products from distant markets to be consumed in California.[19] As a result, the studies' results are likely to understate emissions leakage in most industries, including the California cement industry.[20]

[17] A 60 percent process emissions ratio suggests that each unit of combustion-related emissions is associated with 1.5 units of process-related emissions — resulting in a total of 2.5 units of emissions. Note that a 2.5 multiple assumes that the industry's production, import, and export response functions are linear. To the extent that the response functions are non-linear at higher carbon price values, the process emissions adjust is likely to be incomplete and, therefore, the adjusted elasticities will likely understate the risk of emissions leakage.

[18] To its credit, CARB attempts to correct for this deficiently when translating the studies' results into assistance factors. However, that adjustment process is incomplete and a significant bias remains.

[19] It is also worth noting that the displacement of domestic production with out-of-state production is likely to significantly exacerbate non-GHG emissions in the most disadvantaged California communities. For instance, CSCME estimates that each million tons of domestic cement (around 10 percent of California production) that is displaced by imports will result in a shift in approximately 40,000 heavy-duty diesel truck trips (and their associated emissions) from the relatively sparsely populated areas surrounding California cement plants to the more densely populated areas surrounding California ports.

[20] For instance, all operating cement plants in California already utilize the most advanced and energy efficient technology available and have strong incentives to reduce the GHG intensity of fuel due to the cap-and-trade program. In addition, cement imports are routinely loaded on bulk carriers and transported vast distances to enter the California market, resulting in additional transportation emissions.

VI. CONCERNS SPECIFIC TO THE INTERNATIONAL LEAKAGE STUDY

6.1 The International Leakage Study Is A National Study That Does Not Adequately Reflect The Conditions Of Competition In The California Cement Industry

The international leakage study is an analysis of national industries, yet the national cement industry and the California cement industry are fundamentally different in important respects. As evidenced by more than two decades of U.S. International Trade Commission rulings, the California cement industry is a distinct regional market that operates in a competitive environment that is fundamentally different than cement industries in other U.S. regions or the United States as a whole. Unlike inland states, the California market is logistically and economically accessible by seaborne vessels from virtually every port in the Asia Pacific region, which amplifies the threat of imports and forces domestic producers to proactively suppress prices to maintain market share and achieve the high utilization rates needed in a capital-intensive industry. On the other hand, the California cement industry exports very little cement due to structural, geographic, and political barriers. As a result, the international leakage study's national approach is unlikely to accurately predict the impact of a carbon price on the California cement industry.[21]

6.2 The IMT Rate Is A Conceptually Unsound & Empirically Unreliable Metric

- **The IMT Produces Nonsensical Values For Many Industries**

The IMT rates are not an output of the International Leakage Study's modeling exercise. Rather, they are post-hoc calculations that use the study's modeled results as inputs to a simple arithmetic equation. This practice of calculating the IMT rates "outside the model" using independently estimated elasticities creates the potential for internally inconsistent and illogical results.

According to the data provided by CARB, the calculated IMT rates for several industries are, in fact, inconsistent and illogical. For instance, according to CARB, "IMT is the fraction of every dollar decrease in domestic shipments in response to a marginal GHG price that is offset by an increase in international production (i.e., IMT measures production leakage)."[22] Based on this definition, the IMT rates should logically assume values between zero and one. However, the study estimates values below zero and above one for a substantial number of industries.

CARB acknowledges these nonsensical results in its discussion of its methodology for calculating the regressed IMT when it states, "For sectors where raw IMTs were below zero, the raw IMT used in the

---

[21] See Exhibit 2. In an initial proposal to CARB to analyze the leakage in the cement industry, the study's authors make this same general point. Specifically, they state, "Ideally, these data will allow us to differentiate across regional markets (e.g. west coast versus Southern Tier), across import transaction type (e.g., intrafirm versus arms' length) and, possibility, across points of origin (i.e., Asia versus Europe). This is particularly important in the case of cement, where recent empirical work has documented striking heterogeneity in import responses across regions (Cohen-Meiden, 2011). Additionally, the authors state that, "there is convincing evidence to suggest that import supply elasticities vary significant both across and within regional cement markets (Cohen-Meidan, 2010)."

[22] Attachment B, page 4

regression was set equal to zero, and for sectors with raw IMTs exceeding one, the raw IMT used in the regression was set equal to one. Only sectors that were not covered by the program had raw IMTs below zero or above one."[23] However, CARB dismisses these unusual results as irrelevant outliers rather than recognizing that they are, in fact, warning signs that the IMT calculation is a conceptually unsound and empirically unreliable measure of leakage risk.

In addition, CARB fails to fully characterize the extent of the issue, leaving readers with the false impression that these nonsensical values are small in number and magnitude. However, the data provided by CARB suggests that roughly one out of every six industries modeled in the international leakage study have an IMT rate that is less than zero or greater than one, with values ranging from a low of -12.5 to a high of 18.8. Again, such results suggest that the IMT is a conceptually unsound and empirically unreliable measure of leakage risk.

- **The IMT Rate Does Not Vary By Carbon Price**

A critical flaw of the IMT calculation is that it does not vary by energy intensity or, more generally, the assumed cost increase (see Figure 3). Consequently, it is incapable of accurately capturing leakage risk. This feature is apparent once one rearranges the transfer rate equation presented in the international leakage study as follows:[24]

$$Transfer\ Rate = \frac{|ElasImp| \cdot Imp + |ElasExp| \cdot Exp}{|ElasProd| \cdot Prod} = \left(\frac{|ElasImp|}{|ElasProd|}\right)\left(\frac{Imp}{Prod}\right) + \left(\frac{|ElasExp|}{|ElasProd|}\right)\left(\frac{Exp}{Prod}\right)$$

This rearrangement illustrates that an industry's IMT is equal to the product of its "import elasticity ratio" and its historic import trade share plus the product of its "export elasticity ratio" and its historic export trade share. The rearrangement also crystalizes the fact that, by dividing one elasticity estimate by another, the IMT calculation effectively removes the magnitude of the cost increase from consideration. For example, the international leakage study estimates that the cement industry has an import elasticity of 0.88 and a production elasticity of -1.95, which means that a 1 percent increase in costs will result in a 1.95 percent decrease in production and a 0.88 percent increase in imports. This results in an "import elasticity ratio" of 0.45. Likewise, a cost increase of 10 percent would result in a 19.5 percent drop in production and an 8.8 percent increase in imports, which is consistent with an "import elasticity ratio" of 0.45 percent. Simply put, the calculation guarantees (by construction) that an industry's IMT, which CARB purports measures the risk of international leakage, will remain the same, regardless of whether it faces a carbon price of $1, $100, or $1,000.

It stands to reason that an industry's leakage risk will be heavily dependent on the size of the carbon price. All else being equal, a higher carbon price should translate into a higher leakage risk, and vice versa. Given that the IMT does not vary with the magnitude of carbon price, it is incapable of accurately

---

[23] Attachment B, page 5

[24] This arrangement is confirmed by the data dictionary supplied by CARB in the latest release, which expresses the IMT in a similar fashion.

reflecting leakage risk. This fatal conceptual flaw is proof positive that the IMT is unsuitable for policy applications.

- **The IMT Is Almost Entirely Dictated by Historical Trade Intensity**

Although the IMT rate does not vary by carbon price, it is almost entirely dictated by an industry's historic trade share. Conceptually speaking, this conclusion is evident in the equation above, which illustrates that the IMT is the equivalent of "scaling up" or "scaling down" an industry's trade share by the ratio of elasticities. Empirically speaking, a simple dot plot using the data provided by CARB illustrates that the IMT and trade share metrics are almost perfectly correlated (see Figure 4). This raises important questions about whether the IMT adds any value beyond CARB's current trade share measure, which is far more simple, transparent, and verifiable.

It also raises a more fundamental question about the extent to which an industry's trade share (whether it be expressed in terms of CARB's existing metric or the IMT rates) should even be used to evaluate leakage risk. On the one hand, a high trade share may offer compelling evidence that an industry is already exposed to international competition and, therefore, has limited ability to pass through a carbon price. On the other hand, a low trade share does <u>not</u> mean that an industry is free from international competition and, therefore, has the capacity to pass through a carbon price. In fact, CARB expressed this point of view in its justification of the current allowance allocation system more than five years ago. Specifically, when discussing the trade share metric, CARB cites a White Paper that concludes:[25]

> "While trade shares may provide a broad indication of carbon-cost pass through potential, in some cases current trade shares may not accurately reflect this. A product that has a low trade share, for example, may not necessarily face barriers to trade or have the capacity to pass through costs, since the imposition of a significant cost could lead to a change in trade patterns."

In a communication with CARB staff, the authors of the international leakage study express a similar viewpoint, stating that, "a sector could have a steep import supply curve at the margin, but have a large base of imports. On the contrary, another sector could have a potentially responsive import supply curve, with a small competitive base. We would conclude the first sector is more trade exposed using trade shares. However, a careful analysis at the margin would suggest that the second sector is more exposed to leakage."[26] In a separate communication with CARB, the same authors state that, "As previous authors have noted, there is no empirical evidence that the trade share metric that CARB is currently using is correlated with/indicative of actual relocation/leakage risk."[27]

Given that it correlates almost perfectly to an industry's trade share, the IMT does not advance CARB's efforts to more accurately measure international leakage risk. As a result, CARB's concerns about using

[25] Australian Government Department of Environment and Energy 2008 White Paper on the final design of the Carbon Pollution Reduction Scheme, Chapter 12. As cited in CARB Appendix K: Leakage Analysis, p K-17.

[26] See Exhibit 3.

[27] See Exhibit 1.

trade share as a proxy for leakage risk remain as valid today as they were when they were expressed before the start of the cap-and-trade program.

- **The IMT Is Not Suitable For Public Policy Application**

In previous comment letters and discussions with CARB, CSCME has repeatedly pointed out the ways in which the IMT is a deeply flawed concept. The researchers themselves signal this concern in a series of extraordinary qualifications, including:

> "Note that these industry-specific transfer rates are constructed as a ratio of our imprecise elasticity estimates. A ratio of noisy numbers can be very noisy; our industry-specific estimates of market transfer rates are sensitive to changes in how the underlying estimating equations are specified."
>
> "Given the noisiness of these estimates, we cannot estimate the transfer rate for any given industry with any degree of confidence."
>
> "The imprecision of our estimates make it difficult to estimate leakage potential for any particular industry with any degree of precision."

To date, CARB has dismissed these extraordinary qualifications. However, as described above, the data provided in the most recent release sheds new light on the conceptual and empirical limitations of the IMT metric, and the researchers' own reluctance to embrace it as a reliable measure of an industry's leakage potential.

<u>Given the extensive conceptual and technical deficiencies identified above, CSCME recommends that CARB abandon its use of the IMT metric.</u>

VII. CONCERNS ABOUT CARB'S APPLICATION OF THE STUDIES' RESULTS

7.1 CARB'S "Two-Study" Approach Results In Substantial Internal Inconsistencies

Both leakage studies follow the same core approach to estimating the impact of a carbon price on California industries: (1) estimate an industry's output response due to a change in input costs (namely, natural gas and electricity costs) and (2) use those estimates to simulate an industry's output response under a given carbon price. Provided that the output responses are adjusted to reflect a common carbon price assumption, these headline results can be considered roughly comparable across industries and across studies – effectively an "apples and apples" estimate of industries' output response to a carbon price.

However, the international leakage study goes one step further than the domestic leakage study by estimating the international market transfer rate, or the share of an industry's output response that is "transferred" to international producers. This post-hoc calculation places the studies on unequal footing – effectively turning an "apple" into an "orange". Because the domestic leakage study does not provide an estimate that is comparable to the market transfer rate, CARB is proposing to make its own post-hoc adjustment to the domestic study's output response. However, it does so through an entirely different approach than the international leakage study (i.e., the "domestic drop cutoff" concept) — effectively turning the other "apple" into a "pear." In short, CARB is applying very different adjustments to very different measures, which results in an "oranges and pears" comparison that raises significant questions about whether it is technically valid to simply add the two measures together, as CARB has proposed.

7.2 CARB's Efforts To Account For Process Emissions Are Deficient

As previously discussed, neither leakage study explicitly accounts for process emissions in their modeling frameworks. As a result, CARB is left to make post-hoc adjustments to the studies' results to avoid adopting a methodology that significantly and systematically underestimates leakage risk. Unfortunately, CARB's efforts to make these adjustments are technically flawed and incomplete. Specifically, CARB makes no attempt to scale up the studies' original output responses to account for process emissions, uses the unadjusted output responses as inputs into its "alternative" methodology, and effectively unwinds the adjustments that it does attempt to make by averaging adjusted (e.g., regressed DD) and unadjusted (e.g., raw DD) estimates to calculate assistance factors. These methodological half measures result in a systematic underestimation of leakage risk for industries with a significant amount of process emissions, including the California cement industry.

- **CARB Fails To Adjust The Original Output Responses For Process Emissions**

CARB makes no attempt to scale the studies' original output responses to account for process emissions. In the case of the domestic leakage study in particular, adjusting the original output and value added estimates is relatively straightforward. Specifically, DD increases in a linear fashion with respect to price shocks, and there is no true distinction between fuel emissions and process emissions. As a result, the raw domestic drop measures can be directly scaled according to each industry's process emissions intensity by dividing the measures by the share of combustion-related emissions (i.e., one minus the process emissions ratio).

In the case of the international leakage study, the same approach can be used to scale the study's production, import, and export elasticities. However, note that this adjustment would have no bearing on the IMT rate, as the ratio of the elasticities used in the calculations will remain unchanged. The fact that adjusting for process emissions in the production, import, and export measures does not affect IMT values only underscores its flaws as a measure of leakage risk.

Making this adjustment for process emissions can result in materially different estimates of domestic drop. For instance, adjusting domestic drop estimates for the cement industry to account for process emissions would increase the DD on a value-added basis from 25 percent to 63 percent, and increase the DD on an output basis from 20 percent to 52 percent.[28]

---

[28] Calculations to adjust the domestic leakage study's original output and value-added responses for process emissions were performed using CARB's *F* values for the International AF Component Purchased Fuels Ratio, in Table 1 of Attachment B.

- **CARB Fails To Fully Account For Process Emissions In Its Regressions**

CARB's failure to directly adjust raw leakage measures to account for process emissions also impacts its alternative methodology. Specifically, although CARB adjusts the right-hand variables in each regression (e.g., energy intensity) to account for process emissions, it fails to adjust the left-hand variables (IMT or DD) in a similar fashion. In other words, CARB's process emissions "adjustment" via the regression IMT and DD measures makes only one adjustment for process emissions, when three are necessary.[29] This incomplete adjustment process biases regression estimates and, therefore, systematically underestimates leakage risk for all industries, but particularly those with a significant share of process emissions.

- **CARB Effectively Unwinds its Process Emissions Adjustment by Averaging Across Metrics**

Not only does CARB fail to adjust the studies' raw IMT and DD output measures before using them as inputs to its regressed estimates, but it then proceeds to unwind the limited adjustments that it does make by averaging the post-2020 assistance factors associated with the adjusted regressed IMT and DD estimates with those associated with the unadjusted raw estimates. CARB's decision to average, rather than take the highest IMT and DD estimates, systematically penalizes industries with a significant share of process emissions.

- **CARB Should Revise Its Approach To More Fully Account For Process Emissions**

CARB should revise its process emissions adjustment methodology and calculate the domestic assistance factor component according to the following steps:[30]

(1) Scale the study's raw output measures to account for process emissions;

(2) Use the scaled measures as inputs to CARB's regression estimates; and

(3) Base assistance factor components on the highest measure of DD.

To illustrate the extent of the bias in CARB's proposed approach, consider the case of the California cement industry. Under CARB's current methodology, the domestic assistance factor component is 0.675. In contrast, if one makes the necessary process emissions adjustments to the raw DD measures, uses those scaled measures as the left-hand side variables of the regressed DD measures, and takes the highest of the four possible DD measures, the cement industry's estimated domestic assistance factor increases to 0.9 (see Figure 6). If a similar approach were applied consistently throughout CARB's methodology, the the cement industry's post-2020 assistance factor would be 1.0 rather than 0.74 under CARB's proposed framework (see Figure 7). The fact that methodological missteps of this nature

[29] It is worth noting that there are no conceptual or technical barriers to directly adjusting the study's results to account for process emissions, and the reasons why CARB failed to do so prior to the most recent release is unclear.

[30] Again, the nature of the IMT metric precludes us from proposing any methodological adjustments short of removing it as an input to this process.

can result in a dramatically lower assistance factor only emphasizes the need for CARB to more carefully reassess every aspect of its proposed approach.

7.3 CARB's "Regressed" Measures Disadvantage Industries Most At Risk Of Leakage

CARB attempts to address certain deficiencies associated with the leakage study results by using regression analysis to estimate "alternate" measures. Unfortunately, CARB's proposed approach fails to fully address the flaws inherent in the original metrics, contains technical missteps, and is applied in a manner that systematically penalizes certain industries, such as those with significant process emissions. For instance:

- The "regressed IMT" uses the "raw IMT" as the left-hand variable and, consequently, does not address the deficiencies of the underlying measure — in fact, it perpetuates and amplifies them. For example, one of the most significant flaws of the "raw IMT" estimates is that it is almost perfectly correlated with trade intensity (see Section 6.2). By including trade intensity as a right-hand side variable, CARB's regressed IMT does not address this defect — it effectively doubles down on it.

- CARB uses energy intensity as a right-hand variable in its IMT and DD regressions, despite the fact that GHG emissions intensity is clearly a more relevant and reliable proxy for leakage risk. Energy intensity should only be used in the absence of reliable emissions intensity data, which is available and accessible for all industries that are subject to the mandatory reporting requirement.

- By estimating a regression across all industries in the manufacturing sector, the regressed IMT and DD measures effectively "force" each industry to conform to an industrial sector norm — thereby "unwinding" the industry-specific results that the studies were intended to produce. As a result, individual industries that have IMT or DD estimates above trend are systematically penalized while individual industries that have IMT or DD estimates below trend rewarded. The practical implications of this compression toward an industrial sector norm were previously mitigated by the fact that CARB was proposing to use the greater of the raw IMT and the regressed IMT.[31] However, CARB has inexplicably changed its methodology to average the original and regressed measures, which decreases assistance factors for industries that have IMT and DD measures that are "above average." Such a result conflicts with the basic intent of the allowance allocation framework (i.e., provide relatively higher levels of allowance allocation to industries that have relatively higher leakage risk, and vice versa).

7.4 CARB's Domestic Drop "Cut Off" Is Conceptually Incoherent & Poorly Executed

The DD cutoff rate represents CARB's estimate of a "typical" output decline in the manufacturing sector (in the absence of a carbon price), which CARB then uses as an assumption for the share of an industry's

[31] Staff Report: Initial Statement of Reasons (Aug 2016). Appendix E, Page 7. Specifically, CARB states that, "staff proposes additional levels of caution in establishing revised AFs for each sector. Additional IMT and DD values would be proposed for each sector based on alternate methodologies explained below. Each time the application of an alternate IMT or DD methodology resulted in a higher total revised AF, staff would award this higher revised AF from the alternate approach."

DD that would not be “transferred” to non-California producers. The DD cutoff is a misguided attempt to align the results of the domestic leakage study with those of the international leakage study, as opposed to discarding the IMT and using the production elasticities common to both studies to integrate them on an “apples-to-apples” basis.

That critical issue notwithstanding, the DD cutoff concept is methodologically flawed in at least two respects: (1) the historical data used to construct the measure does not provide any insights into whether or not past output declines resulted in economic leakage; and (2) the concept relies on selectively chosen, historical production data to make predictions about the future.

First, as a threshold matter, the DD cutoff rate cannot in fact reject or confirm the assumption that there is a one-for-one relationship between output drop and leakage. Specifically, the way in which CARB has presented and applied the DD cutoff rate implies that any output decline of less than 7 percent in the manufacturing sector is “typical” or even “acceptable”, and that we should not expect such production to be transferred to a jurisdiction outside of California (i.e., leakage). In fact, the NBER data used to construct the cutoff rate provides no insights whatsoever into what actually happened to the “lost” output in years in which there was a decline. In other words, it is agnostic as to whether that average 7 percent decline was simply lost demand, or whether it was replaced by foreign supply. Rather, the data simply provides a retrospective view into how much output tends to fluctuate.

Second, CARB’s calculation of the threshold is conceptually incoherent and unnecessarily complex. CARB calculates the domestic drop cutoff as an average of three different measures: (1) the average decline in production across all available industries and all available years given that there was a decline; (2) the average decline in production across all available industries and all years prior to the Great Recession given that there was a decline; and (3) one-half of the average standard deviation across all industries and all years. CARB provides no explanation or rationale for why any of these three measures offer a better alternative to the one-for-one assumption, much less why the average of the three numbers is likely to produce a less arbitrary or more reliable estimate.

VIII. ALTERNATE APPROACHES

Momentarily putting aside our technical concerns with the studies, CSCME understands that CARB is interested in using the leakage study results to inform the assignment of an assistance factor for each industry. Regardless of what approach is used, we believe that it is essential that CARB adhere to three fundamental principles:

(1) Use estimates that were actually modeled results from the studies (i.e., output or value-added responses);

(2) Adjust those estimates to account for known deficiencies (e.g., not considering the impact of process emissions when estimating the size of the output response);

(3) Ensure that the results of the two studies are on an “apples-to-apples” basis before they are combined (e.g., standardize the carbon price assumption).

With those principles in mind, CSCME offers the following alternative approaches for consideration. Both alternatives are based on the notion that while the results of the leakage studies cannot be combined to provide accurate measures of absolute leakage risk, they can be combined to provide an accurate indication of relative leakage risk, assuming that they are appropriately adjusted for clear deficiencies and standardized to a common carbon price.

8.1 Alternative #1: Use The Results To Confirm Current Leakage Risk Classifications

A "first-best" approach is to use the results of the leakage studies to confirm or disconfirm CARB's current classification system. In other words, CARB should use the studies to answer the question: did we get it right the first time using far more transparent metrics and a less complex approach? To answer this question, CARB should adjust the domestic output drops calculated under both studies to account for process emissions, standardize those responses to the same carbon price assumption, combine the results, align them with the current leakage risk classifications of each industry, and analyze the results to identify any inconsistencies that might merit closer inspection. This approach could also be used to refine the leakage categories and create more granular "bands" (e.g., very high, high, medium-high, medium, medium-low, low, and very low leakage risk). Specifically, CARB would:

- Step 1: Adjust reported output responses for both studies to account for process emissions.
- Step 2: Standardize the adjusted output responses for both studies to a single carbon price.
- Step 3: Add the (adjusted and standardized) output responses across studies together.
- Step 4: Order the combined output responses from highest to lowest.
- Step 5: Map those ordered responses to current leakage risk classifications.
- Step 6: Identify and analyze inconsistencies between the two sets of results.

8.2 Alternative #2: Use The Results To Calculate Industry-Specific Measures Of Relative Leakage Risk

A "second-best" approach would be to undertake the above methodology but use the results to assign relevant metrics directly (i.e., each industry has its own unique assistance factor, as opposed to being classified in a risk "band"). For example, CARB could adjust the studies' results to account for process emissions, standardize them to a common carbon price, and add them together to calculate a measure of relative leakage risk that serves as the basis for determining assistance factors for each industry. If left unadjusted, these combined measures would effectively adopt the conservative assumption that each unit of decreased domestic production is displaced by an increase in production outside the state. Alternatively, CARB could adjust the combined measures to reflect a reasonable substitute for the one-for-one assumption.[32] Specifically, CARB would:

[32] In the event that CARB adopts a substitute for the one-for-one assumption, we do not recommend that CARB use its current approach to calculating a domestic drop "cut off", which (as explained above) is conceptually incoherent and poorly executed.

- Step 1: Adjust reported output responses for both studies to account for process emissions.
- Step 2: Standardize the adjusted output responses for both studies to a single carbon price.
- Step 3: Combine the (adjusted and standardized) output responses from both studies.
- Step 4: Adopt a one-for-one assumption or adjust the combined measures to reflect a reasonable substitute for that assumption.[33]

IX. CONCLUSION

CSCME appreciates the opportunity to provide these comments and recommendations. As in the past, we welcome the opportunity to work with CARB toward successful implementation of AB 32.

Sincerely yours,

John T. Bloom, Jr.
Chairman, Executive Committee, Coalition for Sustainable Cement Manufacturing & Environment

CC: Richard Corey, California Air Resources Board
Rajinder Sahota, California Air Resources Board
Jason Gray, California Air Resources Board
Mary Jane Coombs, California Air Resources Board
Mihoyo Fuji, California Air Resources Board
Derek Nixon, California Air Resources Board

Rather, we recommend that CARB survey academic literature to identify an alternative assumption that is supported by existing research.

[33] For instance, the combined measure of output responses is likely to be greater than 1.0 for a small number of industries, in which case CARB could cap the assistance factor at 1.0 for those industries and scale the combined measures for the other industries accordingly.

Figure 1: Allocation Rate for the Cement Industry, Current vs. Proposed

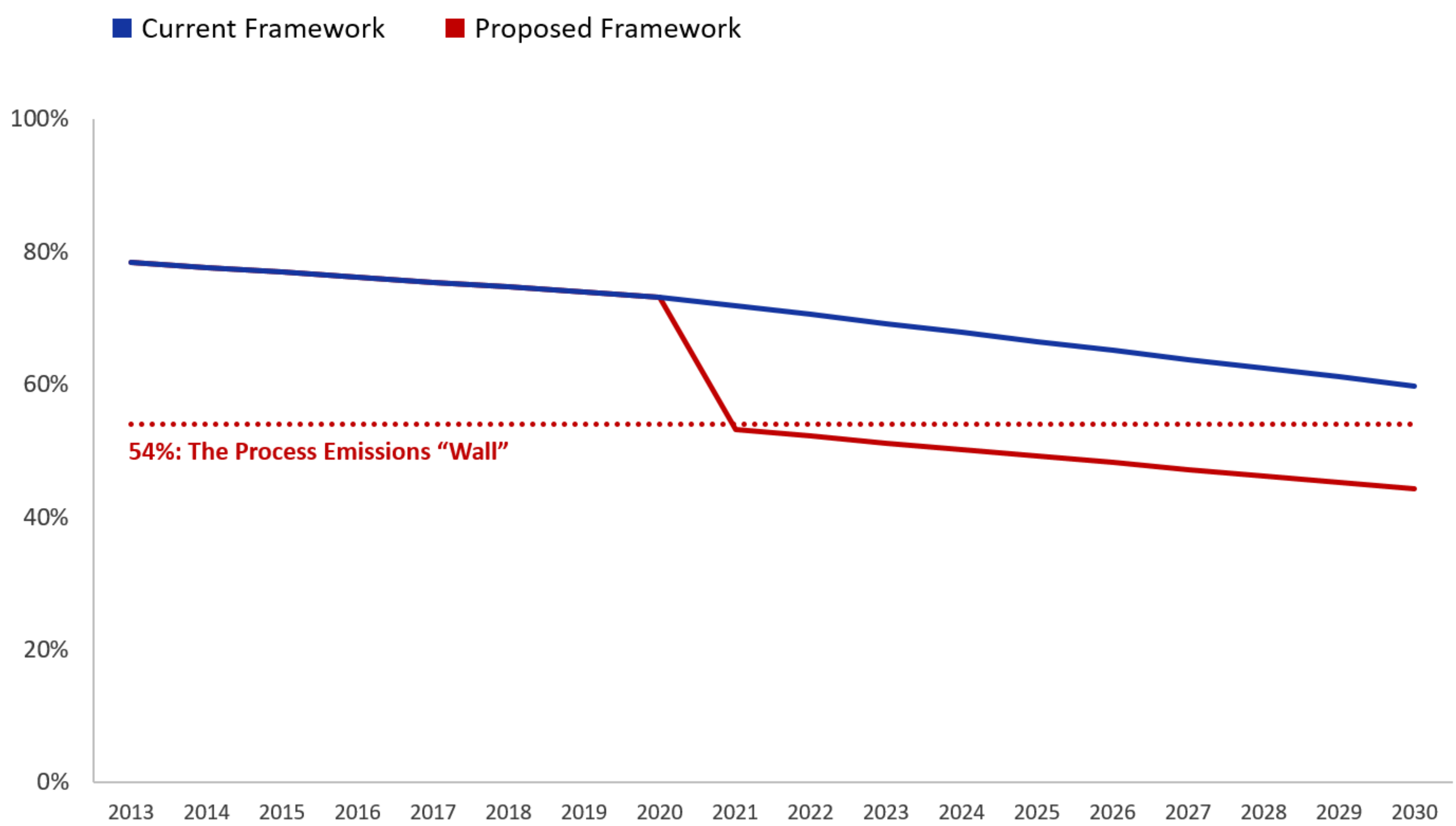


Figure 2: Change in Cement Production at Different Allowance Prices

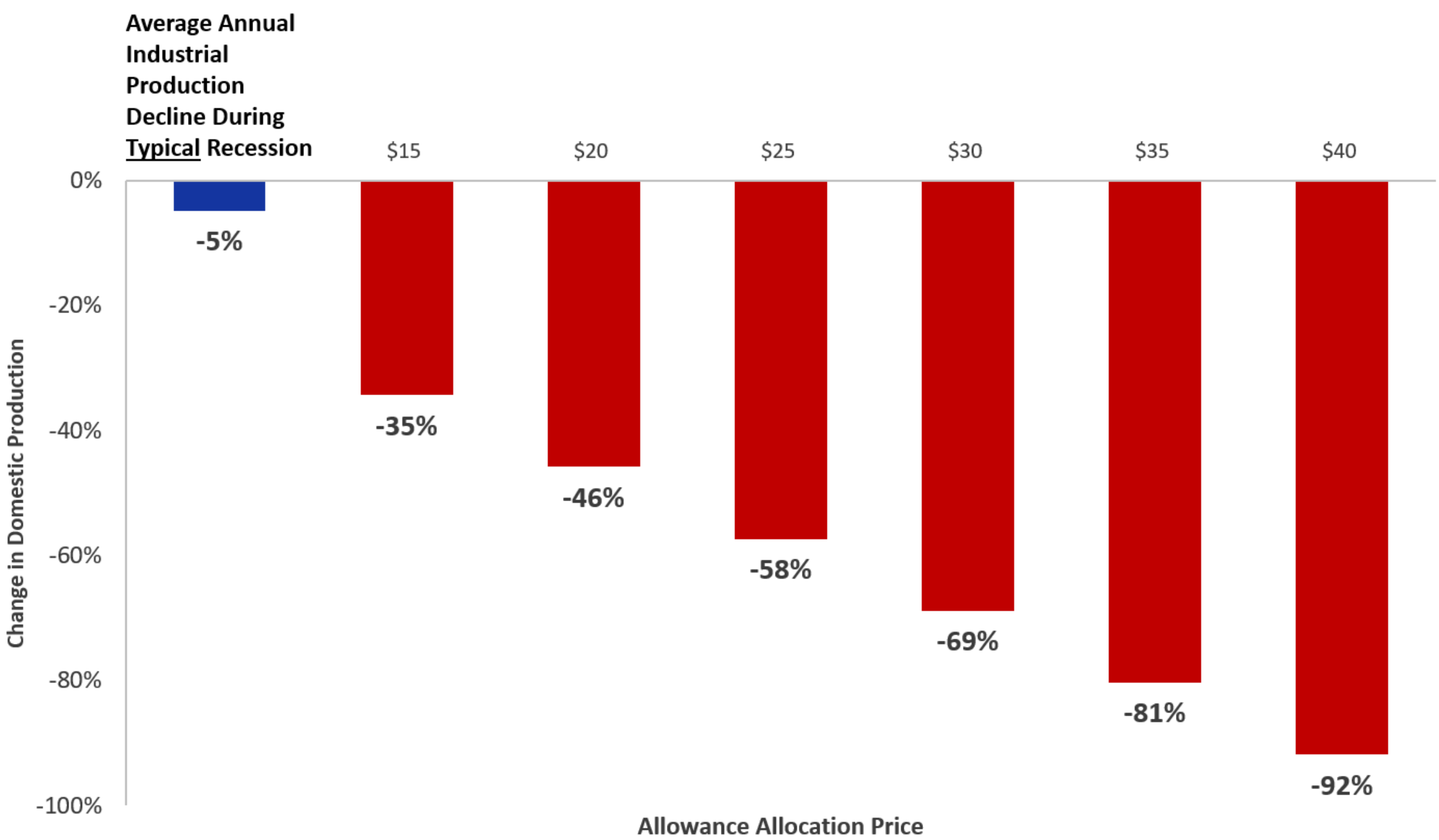
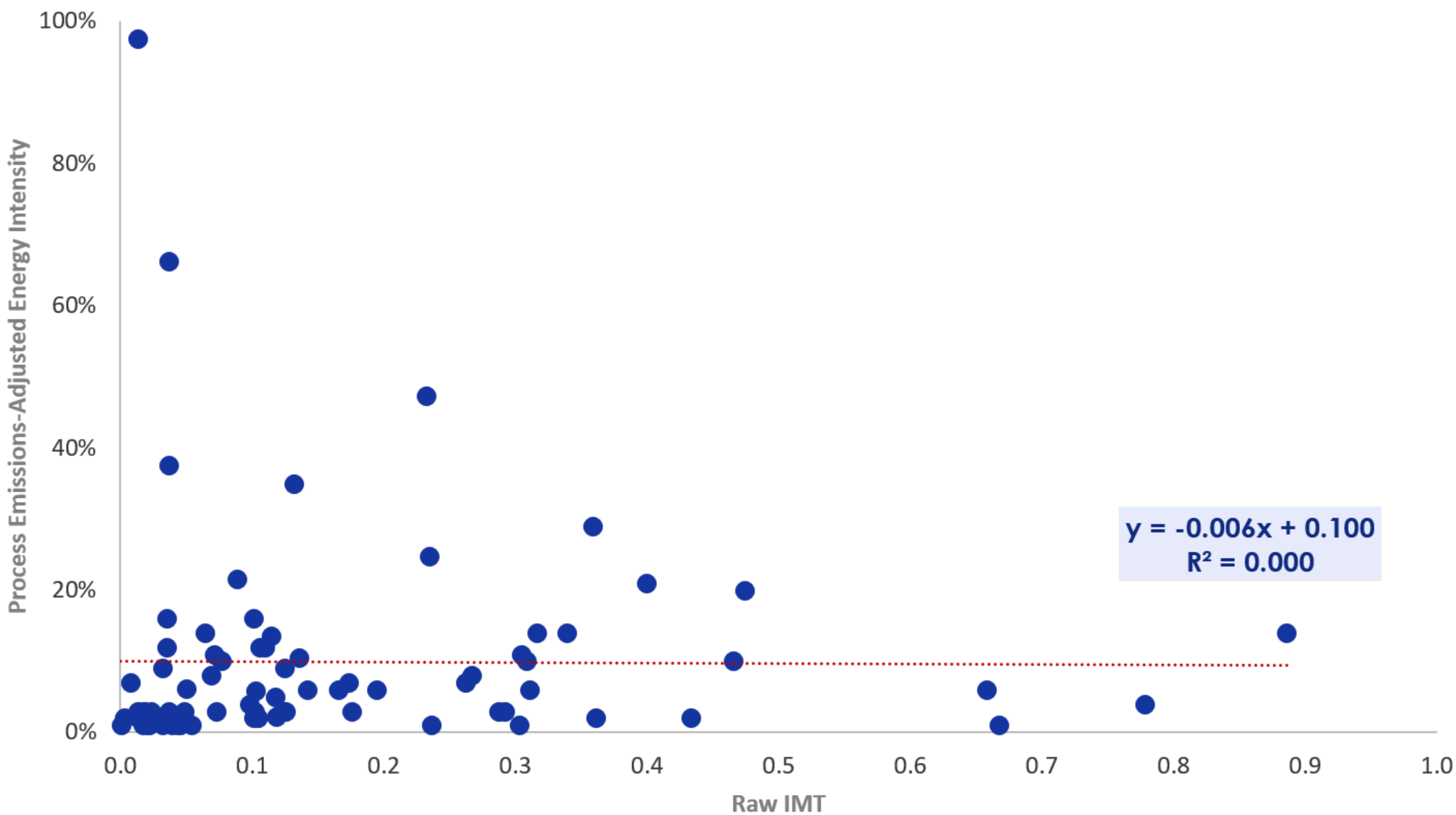


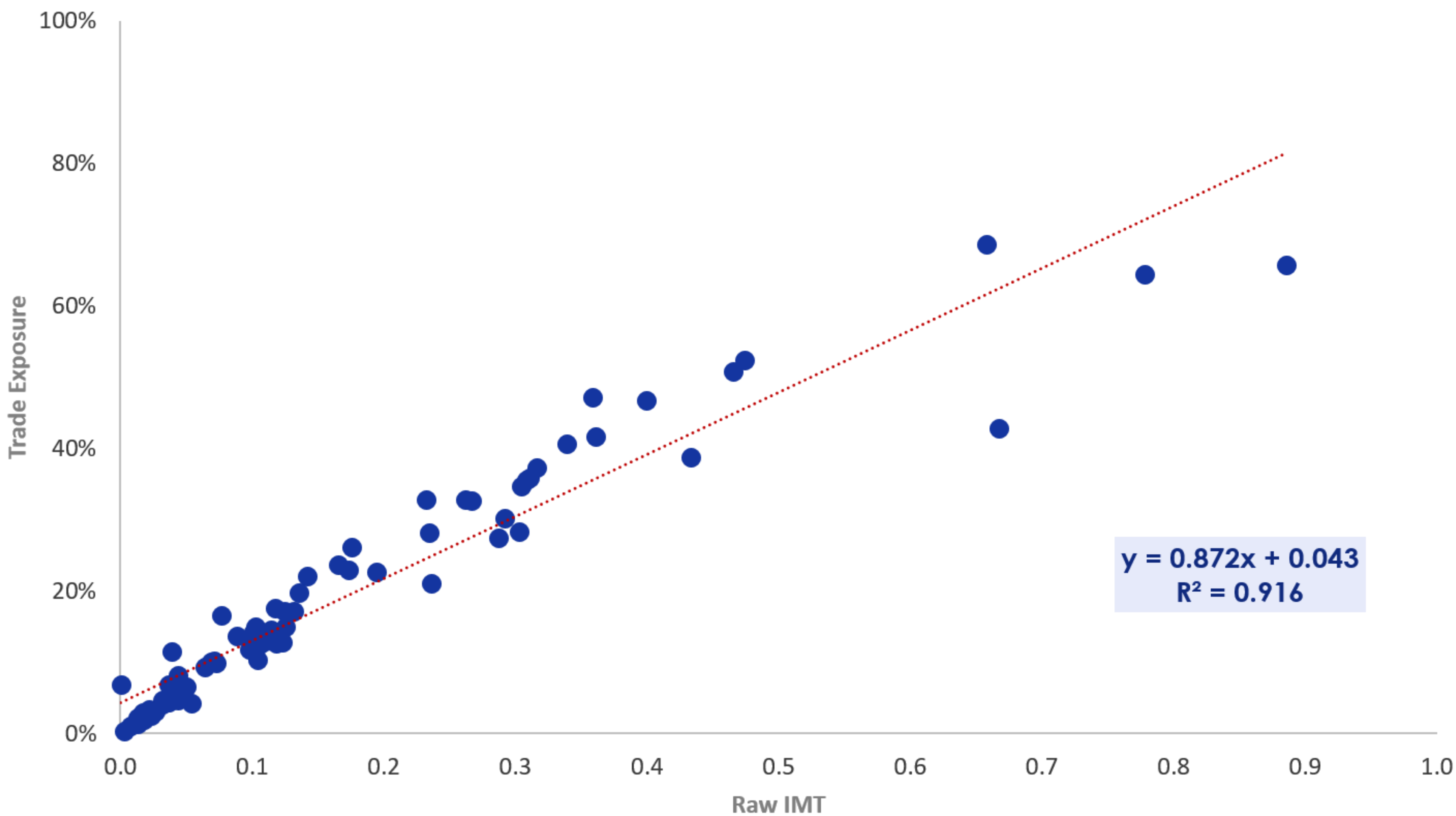
Figure 3: Process Emissions-Adjusted Energy Intensity vs. Raw IMT



Note: Excluded industries that the study estimated having IMT values below zero and above one.

Source: Attachment B: Post-2020 Assistance Factor Calculations Spreadsheet.

Figure 4: Trade Exposure vs. Raw IMT



Note: Excluded industries that the study estimated having IMT values below zero and above one.

Source: Attachment B: Post-2020 Assistance Factor Calculations Spreadsheet.

Figure 5: Raw DD vs. PE-Adjusted DD (Value-Added)

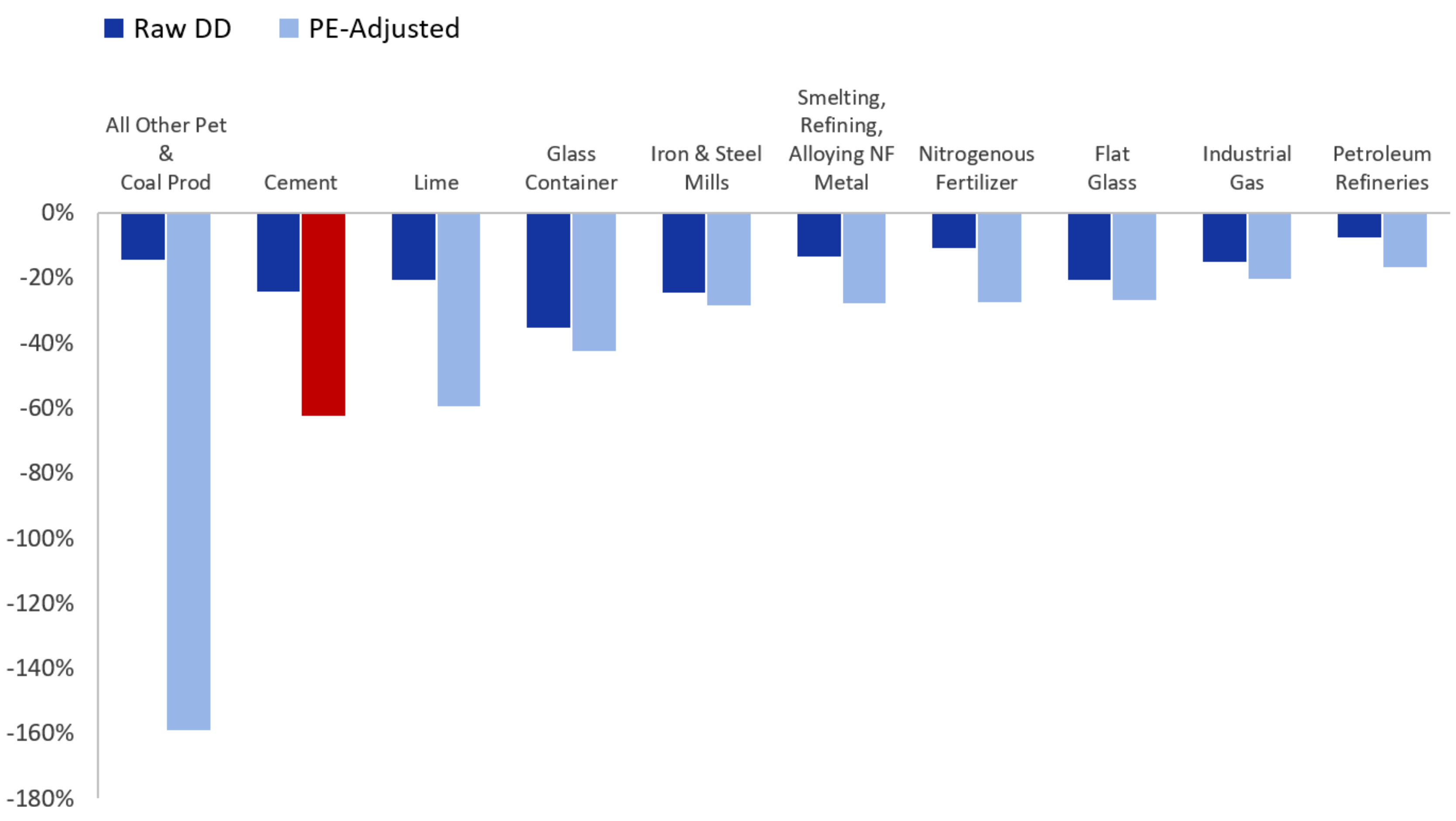


Figure 6: CARB Average Domestic AF vs. Peak Domestic AF (PE-Adjusted)

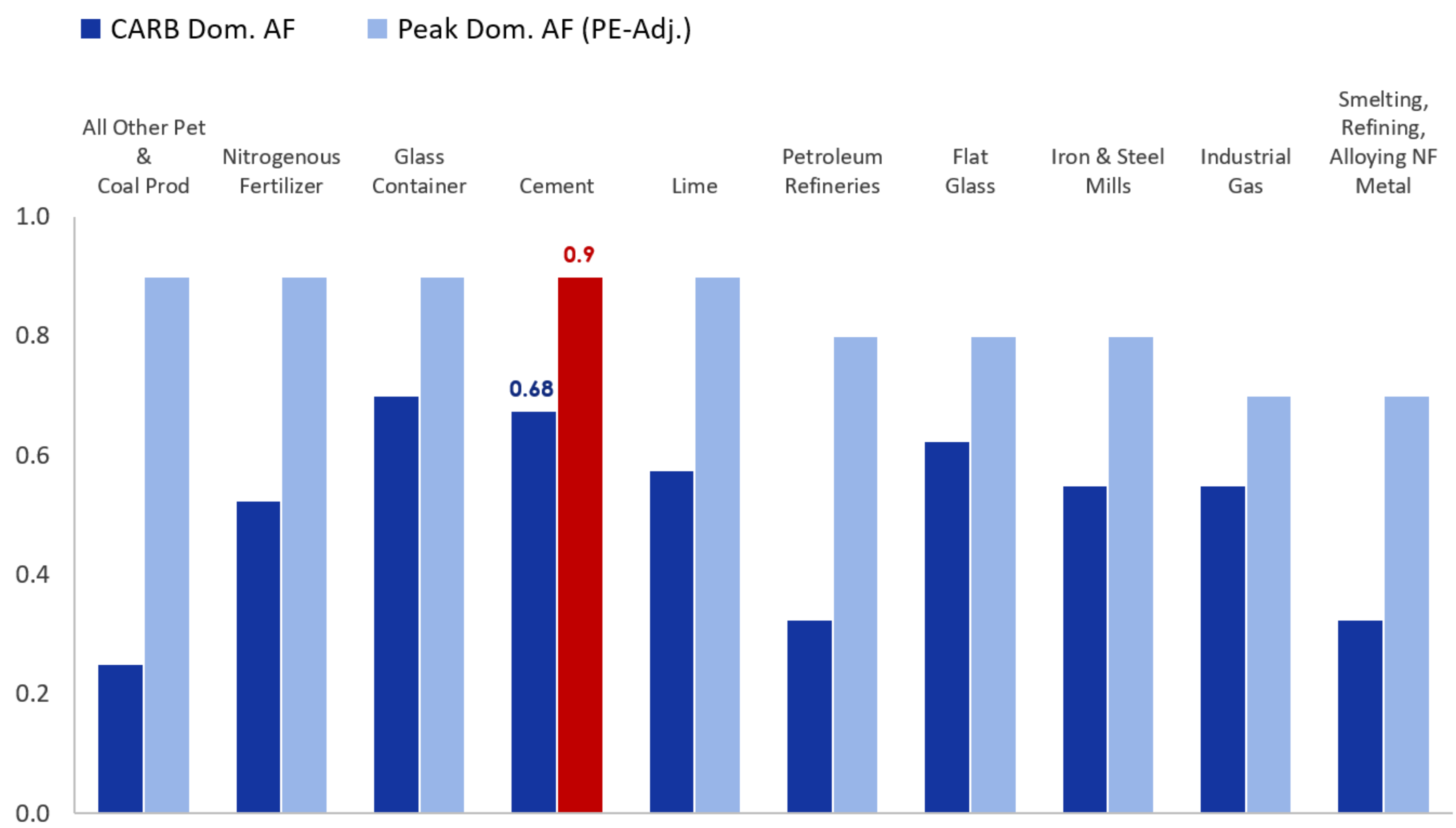
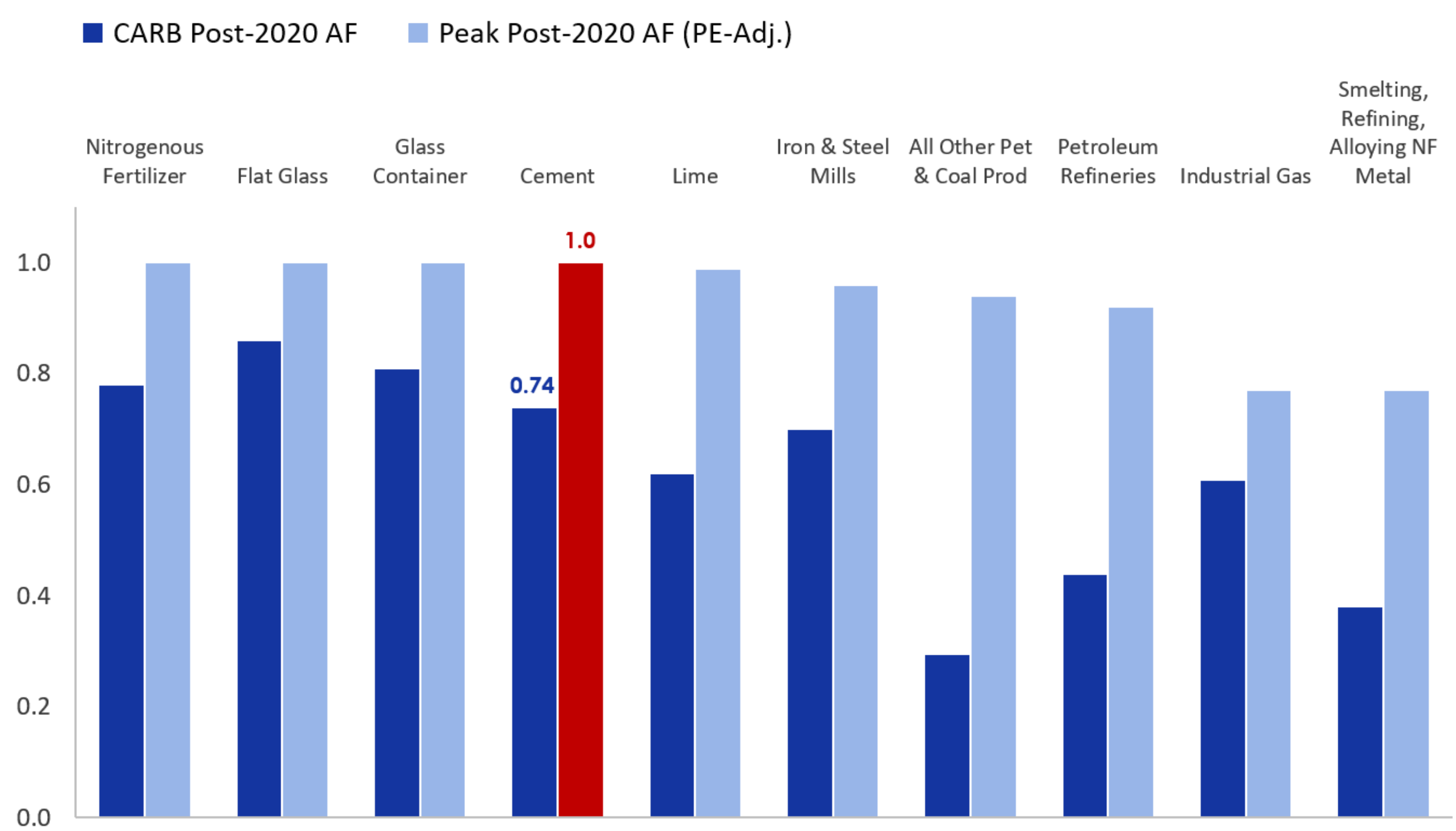


Figure 7: CARB Post-2020 AF vs. Peak Post-2020 AF (PE-Adjusted)*



** The "peak" assistance factor includes the highest DD component after adjusting the raw DD measures for process emissions, and the higher of the raw IMT and regression IMT values.*

EXHIBITS

EXHIBIT A

From: Meredith Fowlie
To:
Cc:
Subject: Re: follow-up
Date: Saturday, February 09, 2013 9:46:15 PM
Attachments: Response_ _2013.docx

Hi -

Lots to respond to in your email. I will try to respond to these point by point. I am not sure I understand where some of your questions are coming from, so perhaps we can iterate on these.

I also attach a short memo that responds to your last question (i hope!). I try to elaborate upon what we discussed on the phone. I also take this opportunity to reiterate some important points made in our original proposal.

You write : *I also wanted to confirm that as you previously mentioned, that you will not be able to deliver any of the deliverables quicker than as laid out in the proposal (18 months from date of access to the census data(access ~ April 2013)). This would be true even if looking into interstate data?*

We did promise to deliver some of the intermediate deliverables within a year of getting started on the Census data. So I am a little confused by this question. We also talked about prioritizing some tasks over others. So the short answer is - we can rally to get some deliverables to you much sooner than 18 months after we gain access to the Census. But we will need to discuss the details of precisely which activities to prioritize.

You write: *What are the potential data sources that you might consider if you were to look at interstate trade? One item we had thoughts about was capacity utilization. I thought you had mentioned several other items/data sources, and that these would probably not be very good at completely capturing interstate trade. Could you restate what these were and the weaknesses?*

Much of the data we were looking into using would come from the Census. For example, we've been looking at the CFS. We have also looked into using the ACM to try to back out interstate/intranational shipments as a residual for those goods that are used primarily as inputs to manufacturing. There are also non-Census surveys of inter-state shipments in some industries. But so far what we have found is spotty at best. The primary weakness of all the sources we are looking into is that none are comprehensive.In contrast to the international trade data, we cannot track each and every shipment into / out of California that is coming from/going to another state.

You ask about opportunity cost. We budgeted time and research resources to cover the activities outlined in the proposal. If we add additional activities that require substantially more data work, then yes, we will need to either hire additional research assistance or eliminate some of the other planned research activities.

Happy to discuss further at your convenience

On Fri, Feb 8, 2013 at 5:10 PM,
wrote:

EXHIBIT A

Second, we will seek to identify data-driven metrics useful for identifying industries most vulnerable to policy induced impacts on output, employment, and import flows."

writes: *You had mentioned the tradeoff between potential forms of deliverable metrics of using a simple fraction of highly tangible items such as what we are currently using vs. using a metric based upon elasticities. The gist I got was that although a metric based upon elasticities might be stronger, it would have many caveats and be hard to defend to stakeholders. Could you expand on this a little*?

My response:

It is my understanding that you are interested in identifying those industries who are either (a) most vulnerable to emissions leakage or (b) most deserving of compensation to offset the costs associated with complying with the regulation. Having identified these industries, CARB will then deliver compensation in the form of free permits.

As previous authors have noted, there is no empirical evidence that the trade share metric that CARB is currently using is correlated with/indicative of actual relocation/leakage risk (see, for example, Martin et al., 2012). This begs the question... is there a better metric to use when identifying sectors with high leakage risk?

In theory, the degree to which import flows respond to changes in relative(foreign/domestic) operating costs is a particularly important driver of leakage (see, for example, Babiker, 2005; Fowlie, 2012; Fowlie et al. 2012). In economic models, this responsiveness is typically summarized by an elasticity parameter. We will estimate industry-specific elasticity parameters with unprecedented precision using historical Census data. Although this is not a perfect measure of leakage risk - historical responses need not predict future responses if the underlying structure of the industry changes- these elasticity parameters would constitute an improvement over the current trade share metric.

Of course, we face the added complication that we can track foreign imports closely, but not intra-national, inter-state imports. However, researchers from Resources for the Future will be analyzing how establishment-level output, value added, and employment levels in surrounding states respond to a change in operating costs in California. The coefficients they estimate could be used to measure of intranational leakage potential.

In practice, it could be difficult to use these estimated elasticities to determine eligibility for compensation. For one thing, the econometric estimation process that yields these estimates can seem like a "black box" from the outside looking in. In contrast, a simpler summary statistic (such as the trade share metric currently in use) has the advantage of being more transparent and easier to understand.

It seems that one approach could involve estimating the elasticity parameters which seem to be most informative about leakage potential, and then selecting a simpler measure that is highly correlated with the elasticity parameters, but easier to defend/explain. For example, a trade share metric that was augmented to reflect our best measure of intranational, interstate trade may be highly correlated with the elasticity parameters described above.

EXHIBIT B

Modeling Import Flows and Leakage in Emissions-intensive, Trade-exposed Industries

Meredith Fowlie,
University of California, Berkeley and NBER

Mar Reguant,
Stanford University

Stephen Ryan
MIT and NBER

Proposal submitted to California Air Resources Board

1 Introduction

The Global Warming Solutions Act of 2006 (AB 32) calls for California to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020. Under the auspices of this landmark act, California policy makers are preparing to implement a multi-sector cap-and-trade program.

The global nature of the climate change problem creates challenges for regional initiatives. In California, debates about how and when to implement state-level climate change policies have been dominated by concerns about potentially adverse impacts on industrial competitiveness, trade flows, and emissions "leakage." Specifically, there is concern that imposing a binding emissions cap will place California firms at a competitive disadvantage vis a vis firms in jurisdictions without comparable policies. If the regulation induces a shift in industrial production to less stringently regulated areas, emissions reductions achieved in California will be partially—or even completely—offset by increased emissions elsewhere.

change in domestic cement price. We estimate an average elasticity of 2.48%.

One important limitation of this approach pertains to data quality. Publicly available data on imports are highly aggregated and quite noisy. Noisy data beget noisy parameter estimates. Consequently, researchers have been unable to estimate region-specific import supply responses with any degree of precision (Burtraw et al, 2011; Fowlie et al. 2011). This significantly limits the accuracy with which policy simulation models can be used to simulate impacts of policy interventions on import flows. [1]

The LLFTD data represent a significant improvement over the data typically used to estimate trade flow parameters in policy simulation models. The richness of these micro-data should allow us to estimate import supply elasticities with unprecedented precision. Ideally, these data will also allow us to differentiate across regional markets (e.g. west coast versus Southern Tier), across import transaction types (e.g. intrafirm versus arms' length) and, possibly, across points of origin (i.e. Asia versus Europe). This is particularly important in the case of cement, where recent empirical work has documented striking heterogeneity in import responses across regions (Cohen-Meidan, 2011).

4 Stage 3: A more structured approach to analyzing trade flows in the cement sector

The reduced form approach to modeling import flows introduced in the previous section implicitly assumes that the structure of the import response will be unaffected by the policy interventions we are interested in analyzing.

[1] For example, Fowlie et al. (2011) must assume that all domestic cement imports respond identically to changes in the domestic operating environment. However, there is convincing evidence to suggest that import supply elasticities vary significantly both across, and within, regional cement markets (Cohen-Meidan, 2010).

EXHIBIT C

Measuring Leakage Risk: Interim Report

Meredith L. Fowlie,
Mar Reguant,
and Stephen P. Ryan

February 2, 2015

Alternatively, one can compute leakage effects in levels (not relative), as a response to an increase in domestic costs, i.e.,

$$\textbf{Leakage (in tons):} \qquad \frac{\partial E_f}{\partial \alpha_1} = \frac{B\gamma_2 e_f}{2\alpha_2(1+B\gamma_2)+2B}.$$

In both cases, the measure depends on the response of imports and demand to an increase in domestic prices. In absolute levels, the measure also depends on how elastic the domestic supply is. The intuition is that, *ceteris paribus*, a domestic industry with an inelastic supply curve will experience less leakage at the margin.

2.2 TRADE EXPOSURE AND LEAKAGE MEASURES

We have seen that leakage measures crucially depend on the shape of the demand and import supply curves. In practice, these objects (B, γ_2, α_2) are difficult to measure with precision. Policy makers have been using trade exposure as a proxy for leakage risk.

It is useful to relate trade shares to the economic fundamentals. Within the theoretical framework, the import share is given by,

$$\frac{q_f}{q_d+q_f} = \frac{B(\gamma_2(A+\alpha_1 B\gamma_2+\alpha_1)+\gamma_1(B\gamma_2+2))+2\alpha_2(B\gamma_2+1)(A\gamma_2+\gamma_1)}{A(2\gamma_2(\alpha_2 B\gamma_2+\alpha_2+B)+1)-\alpha_1(B\gamma_2+1)+\gamma_1(2\alpha_2(B\gamma_2+1)+B)}.$$

It is important to note that the import share is more sensitive to industry specific parameters. Specifically A, α_1 and γ_1 appear in this object, whereas they did not play a role in the leakage risk measures. Therefore, heterogeneity across sectors could drive some of the variation in trade shares, without being reflective of leakage risk.

The fact that the intercepts for marginal costs (α_1, γ_1) appear in the expression helps explaining why trade shares are not always a good measure of trade exposure. For example, a sector could have a steep import supply curve at the margin, but have a large base of imports. On the contrary, another sector could have a potentially responsive import supply curve, with a small competitive base. We would conclude the first sector is more trade exposed using trade shares. However, a careful analysis at the margin would suggest that the second sector is more exposed to leakage.

We will seek to understand how the additional factors that are part of the import shares can confound the analysis. One would expect (or hope) that, in many cases, these objects would be quite correlated. We will be able to directly test this hypothesis in the empirical analysis. Such analysis can also help envision strategies to improve leakage measures.