Costs of A Local Air Quality Regulation on Dairies in the San Joaquin Valley

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Abstract
This research estimates the costs of a local air quality rule (Rule 4570) adopted in the San Joaquin Valley in 2006 to reduce Volatile Organic Compounds (VOCs) emissions from dairies. Using a panel of farm-level cost data from dairies throughout California, I estimated the effects of the regulation on feed, labor, and other operating costs.

Methodology
I identify the effects of Rule 4570 on dairies using a difference-in-differences (DD) framework.

(1) \[ y_{st} = \beta_0 D_R + \beta_1 D_{4570} + \gamma_s + \lambda_s S_{fed} + \chi_{st} + e \]

where the vector of the cost variables of dairies, \(D_R\) indicates the original rule, and \(D_{4570}\) indicates the amended rule, which took effect in 2011. This model also includes a set of diary fixed effects and time fixed effects. \(S_{fed}\) represents region-specific time trends and is a vector of farm-specific \(x_n\) explanatory variables, such as the number of milk cows and fat test percentage.

Regulatory Background
Notes: Dairy CAFs can design their own mitigation measures for all source categories. “NS” indicates that the dairy chose not to adopt the rule.

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Description of Measures</th>
<th>2006 - 2007</th>
<th>Adop-</th>
<th>2008 - 2010</th>
<th>Analysis</th>
<th>Analysis</th>
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<tbody>
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<tr>
<td>7. Food</td>
<td>a) Feed according to Natural Resource Council Guidelines b) Store grain in a weather-proof structure c) Remove feed from feed bins</td>
<td>NS 12 14</td>
<td></td>
<td>NS 49 21 50</td>
<td></td>
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</tr>
<tr>
<td>1. Silage</td>
<td>a) Cover the surface of silage piles</td>
<td>10 3.69 41</td>
<td></td>
<td>12 3.34 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Milk Purifier</td>
<td>a) Place liquid manure piles</td>
<td>NS NS 106</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Feed, Pile</td>
<td>a) Feed, pile, and manure piles</td>
<td>2.22 0.17 27</td>
<td></td>
<td></td>
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<tr>
<td>7. Corral</td>
<td>a) Clean manure from corral at least four times per week b) Ensure feed contact lines in corral every 42 hours c) Inspect water pipes and troughs and repair leaks d) Harrow, rake or scrape manure in manure storage surface e) Keep volatile compounds with light evaporative cooling with solid-corrosion resistant f) Keep silage-ash structures with light evaporative cooling</td>
<td>2.22 9.1 27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Liquid Manure</td>
<td>a) Use and separate</td>
<td>NS 17.22 38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Land Application</td>
<td>a) Land application covers with training</td>
<td>NS NS 106</td>
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</tbody>
</table>

Notes: Dairy CAFs can design their own mitigation measures for all source categories. “NS” indicates that the dairy chose not to adopt the rule. The estimated cost savings includes: reduced feed costs, reduced labor costs, and reduced other operating costs.

Data
Rule 4570 relies mainly on management practices, rather than control devices, to prevent emissions from dairies. Most mitigation measures were expected to result in higher labor costs, and fuel or electricity costs. I estimated the effects of the regulation on major categories of occupational expenses.

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<tr>
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</thead>
<tbody>
<tr>
<td>2005</td>
<td>12.37</td>
<td>0.27</td>
<td>0.11</td>
<td>0.53</td>
</tr>
<tr>
<td>2006</td>
<td>10.55</td>
<td>0.22</td>
<td>0.09</td>
<td>0.40</td>
</tr>
<tr>
<td>2007</td>
<td>10.55</td>
<td>0.22</td>
<td>0.09</td>
<td>0.40</td>
</tr>
<tr>
<td>2008</td>
<td>10.55</td>
<td>0.22</td>
<td>0.09</td>
<td>0.40</td>
</tr>
<tr>
<td>2009</td>
<td>10.55</td>
<td>0.22</td>
<td>0.09</td>
<td>0.40</td>
</tr>
</tbody>
</table>

In addition, I allow the effects of the regulation to vary across years. Other controls, as shown in the preceding table, are also included in the following table of regression results. Results indicate that the effect of the rule, relative to a 16% increase in hired labor costs for covered dairies.

Results
Rule 4570 costs of A Local Air Quality Regulation on Dairies in the San Joaquin Valley

Summary
Preliminary estimation results indicate that neither Rule 4570 nor the amended version of it affected the costs of milk production. The rule had some negative effects on hired labor and operating costs.