*Online Appendix*

*Moving Matters: The Effect of Location
on Crop Production*

Appendix Table 1
INDEX VALUES

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Simple |   | Paasche |   | Laspeyres |
|  |  |   |  |  |  |   |  |  |  |
|   | *(index value, 1909=100)* |
| 1879 | 69 | 63 |   | 101 | 67 | 106 |   | 102 | 68 | 107 |
| 1889 | 83 | 73 |   | 110 | 77 | 105 |   | 108 | 75 | 103 |
| 1899 | 104 | 96 |   | 107 | 97 | 101 |   | 107 | 98 | 102 |
| 1909 | 100 | 100 |   | 100 | 100 | 100 |   | 100 | 100 | 100 |
| 1919 | 92 | 89 |   | 104 | 89 | 100 |   | 103 | 89 | 99 |
| 1924 | 71 | 84 |   | 86 | 83 | 99 |   | 87 | 83 | 99 |
| 1929 | 83 | 85 |   | 99 | 86 | 102 |   | 97 | 84 | 100 |
| 1934 | 46 | 63 |   | 74 | 76 | 120 |   | 60 | 62 | 98 |
| 1939 | 91 | 79 |   | 113 | 83 | 106 |   | 109 | 80 | 102 |
| 1944 | 109 | 86 |   | 120 | 93 | 109 |   | 117 | 91 | 106 |
| 1949 | 109 | 76 |   | 128 | 83 | 109 |   | 131 | 85 | 111 |
| 1954 | 102 | 68 |   | 132 | 85 | 125 |   | 121 | 78 | 114 |
| 1959 | 145 | 71 |   | 170 | 82 | 116 |   | 176 | 85 | 120 |
| 1964 | 132 | 55 |   | 194 | 67 | 122 |   | 198 | 68 | 124 |
| 1969 | 174 | 53 |   | 260 | 66 | 124 |   | 263 | 67 | 125 |
| 1974 | 171 | 62 |   | 221 | 72 | 117 |   | 237 | 77 | 125 |
| 1978 | 266 | 71 |   | 302 | 88 | 123 |   | 303 | 88 | 124 |
| 1982 | 294 | 71 |   | 328 | 83 | 117 |   | 355 | 90 | 126 |
| 1987 | 263 | 60 |   | 355 | 70 | 117 |   | 376 | 74 | 125 |
| 1992 | 340 | 70 |   | 389 | 78 | 111 |   | 438 | 88 | 124 |
| 1997 | 341 | 72 |   | 387 | 82 | 114 |   | 416 | 88 | 122 |
| 2002 | 337 | 69 |   | 395 | 84 | 121 |   | 401 | 85 | 123 |
| 2007 | 499 | 88 |   | 472 | 101 | 116 |   | 491 | 106 | 121 |

*Source*: Calculated using the data described in the text.



Appendix Figure 1

Region Definitions

*Source*: Recreated based on USDA (1998, p. 18).

Equiproportional versus Relative Changes in a Laspeyres Area Index

Consider the Laspeyres area index, defined as

.

Suppose that each county changes its area by the same (decimal) percentage, say  percent, so that . This equi-proportional increase in area will generate an index value of . However, the same *total* area change can generate a different index value if the new (or deleted) areas are not distributed across counties in proportion to their base-period areas. Suppose the increase was not equi-proportional, and that county *N* increased its area by some other amount, *α* percent, but that the overall increase in area remained the same. For this condition to hold, one must derive the percentage by which the other counties increased their area. Let that parameter be called γ. Then, the total area increase will be maintained if:



Solving for γ reveals:



The goal is to determine how much the index value differs when a change in national area is distributed evenly across counties from its value when the total area changes by the same amount, but is not equally distributed across counties. The numerator of the index will be:

.

Subtracting the numerator for a proportional change in area and manipulating the expression yields:

,

where is county *i*'s share of the total acreage in counties 1...(*N*–1). Finally, the numerator of the index for the unequal redistribution will be equal to the numerator of the proportional increase plus the following term:



Thus, the non-proportional increase in acreage alters the calculated index value by

.

Notice that the bracketed term is equal to the area weighted average yield of counties whose acreage increased by γ percent (hereafter denoted *μ*–*N*.) less the yield for the county whose area increased by α percent.[[1]](#footnote-1) Thus, there are several possible scenarios:

1. If α > *p*, county *N* took more than its area weighted share of the new acres and the first bracketed term will be negative. In this case,
	1. if *ybN* < *μ–N*, the yield in county *N* is less than the area-weighted average of yields in other counties. The second bracketed term will therefore be positive. The index will decrease since a low-yielding county increased its share of area.
	2. If *ybN > μ–N*, the yield in county *N* is higher than *μ*–*N*. The second bracketed term is also negative and the index will increase since a high-yielding county increased its area share.
	3. If *ybN = μ–N*, the second bracketed term is equal to zero, and there is no effect on the index.
2. If α < *p*, county *N* took less than its share of the new acres, and the first term is positive.
	1. If in addition, *ybN < μ–N*, the second term will be positive and the index will show an increase since acres were allocated away from a low-yielding county.
	2. If *ybN > μ–N*, the overall effect will be negative.
3. If α = *p*, county *N* increased its area in the same relative proportion as the other counties. The first term will equal zero and there will be no effect on the index.

Reference

USDA. *Agriculture Fact Book 1998*. Washington, DC: United States Department of Agriculture, 1998.

1. Note that the conclusions apply to the more general case in which several counties change at different rates since the “*N*th county” and its associated area, growth percentage and yield in both periods could represent a weighted average of any arbitrary aggregation of counties. [↑](#footnote-ref-1)