PRACTITIONER'S CORNER

INSIDE THE STANDARD INDUSTRIAL CLASSIFICATION CODES: HOW MANY PAPER MILLS ARE THERE IN WASHINGTON?

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Comparison of enterprise data from different government agencies yields a surprising conclusion: there is no consensus on the number of enterprises in particular SIC codes, even in a concentrated, highly visible industry such as Washington paper mills. Reasons for the disagreements include differing treatment of multi-product firms and specialized purposes of data-gathering agencies, but not all of the observed disagreements can be explained by such identifiable factors. A 1990 industry trade publication and 1988 U.S. Census Bureau data are in complete agreement, finding 5 pulp mills (SEC 2611), 13 paper mills (SIC 2621) and 4 paperboard mills (SIC 2631), for a combined total of 22 mills. However, for 1989 Washington state agencies report as many as 42 and as few as 10 mills in these categories combined. U.S. EPA data for 1990 finds 21 mills total, but none in SIC 2631. Some agencies classify an enterprise into SIC categories on the basis of primary product shipped; others allocate fractions of an enterprise to different SIC codes in proportion to the product mix. Environmental agencies often have specialized enterprise counts focused on number of discharge points, which may differ from counts based on economic activity. Further work is evidently needed on standardization and interpretation of SIC codes, to provide a universal standard of classification, and to allow meaningful inter-agency comparison of industry data. For now, the number of paper mills in Washington is probably 22, but depends on who you ask.

1. INTRODUCTION

The Standard Industrial Classification (SIC) codes are taken for granted by most analysts. The codes appear to provide a well-established, clearly defined, and non-controversial method of identifying business and industrial groupings. Most economists and statisticians have never given much thought to the uncertainty and ambiguity involved in applying the SIC codes. Neither had we until a recent research

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project sponsored by the Washington (state) Department of Ecology required further clarification.[3]

The objective of the project was to compare economic and environmental data for individual industries. This required identifying a set of economic data series that could be used to 'normalize' or benchmark pollution data, with pollutant emissions expressed per unit of economic activity (per employee, per dollar of output, etc.). We selected Washington's paper industry as one of the first test cases.

Paper was selected because it is a comparatively well-studied industry, and because paper mills are large and easy to identify—by sight if not by smell. An industry trade publication, the 1990 Lockwood-Post's *Directory of the Pulp, Paper and Allied Trades*, lists 23 pulp and paper mills in Washington state; of these, one appears to be primarily a paper products manufacturer. We therefore assumed that 22 was the correct total for the number of pulp and paper mills in the state, and set about collecting economic and environmental data on these mills.

Most agencies report data on paper mills by SIC codes. However, we quickly found that agencies differ widely in their application and interpretation of these codes. One key distinction arises in the case of multi-product firms which often make products belonging in different SIC categories. Should such firms be classified according to their primary product or allocated among industries in proportion to their product mix? The former approach produces an accurate count of enterprises but blurs industry and product lines; the latter creates a fictitiously high count of enterprises but produces an accurate picture of the relative size of different industries and products.

A second set of differences in classification arises from the specialized purposes of the data-gathering agencies. For example, an agency interested in employment will tend to count the number of places where payrolls are kept, while an agency interested in water quality will tend to count the number of places where water pollution is discharged. Each agency may refer to the things being counted as 'paper mills', but if there are payrolls without water pollution in some places, or water pollution without payrolls in others, then the things being counted are not identical.

Either of these types of differences can clearly cause incommensurability between industry data from different sources. In our case study, both turned out to be of critical importance. Although many agencies report seemingly comparable data on Washington's paper mills, they are not referring to a consistently defined universe of enterprises.

2. PAPER MILLS: THE SIC DEFINITIONS

In the SIC codes, the paper industry is the two-digit category SIC 26. It includes both paper mills and many lines of paper product manufacturing (sometimes called 'converting'). To identify the paper mills alone, it is necessary to go to the three-digit

or four-digit level.[4] Pulp, paper and paperboard industries are defined, in the federal Office of Management and Budget's (OMB) *1987 Standard Industrial Classification Manual*, as follows:

- 2611 Pulp Mills—Establishments primarily engaged in manufacturing pulp from wood or from other materials, such as rags, linters, wastepaper, and straw. (p. 119).
- 2621 Paper Mills—Establishments primarily engaged in manufacturing paper from wood pulp and other fiber pulp; and which may also manufacture converted paper products. (p. 119).
- 2631 Paperboard Mills—Establishments primarily engaged in manufacturing paperboard, including paperboard coated on the paperboard machine, from wood pulp and other fiber pulp; and which may also manufacture converted paperboard products. (p. 120).

The 1987 SIC manual also provides guidance for classifying integrated mills. Establishments engaged in integrated operations of producing pulp and manufacturing paper, paperboard, or products thereof are classified

- In industry 2611 if primarily shipping pulp.
- In industry 2621 if primarily shipping paper or paper products.
- In industry 2631 if primarily shipping paperboard or paperboard products. (p. 119)

Given these definitions and the primary-product-shipped convention for classifying integrated establishments, it would seem a simple matter to classify Washington's 23 mills into their appropriate four-digit SIC industries.

Consistent classification by government agencies producing economic or pollutant loading data for the paper industry is, of course, a prerequisite for the comparative calculations we hoped to perform. If establishments counted as paper mills by, say, the US Census Bureau are not the same ones counted as paper mills by the US Environmental Protection Agency (EPA) or Washington state's Department of Ecology (DOE), then Census Bureau economic activity statistics for paper mills cannot meaningfully be compared with pollutant statistics from EPA or DOE.

3. PAPER MILLS: THE SIC COUNTS

Table 1 lists pulp, paper, and paperboard mill counts by various state and federal governmental agencies, as well as the count based on the 1990 Lockwood-Post's listing of paper industry establishments (the latter classified by us into four-digit industries). The Washington Department of Employment Security (WADES) reports employment and payrolls by SIC codes; the Washington State Department of Revenue (WADOR) collects tax data by SIC code and analysed state tax returns, at our request, for use in our research project. EPA and the separate air and water quality branches of the DOE report pollutant emissions by SIC codes as well.

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[4] The distinction between three-digit and four-digit classifications is not important in this case; the three-digit industries 261, 262, and 263 each contain only a single four-digit industry.

TABLE 1. *Counts of Washington Paper Mills by Four-Digit SIC Classifications*

	Pulp 2611	Paper 2621	Paperboard 2631	Total
1990 Lockwood-Post's *Directory*	5	13	4	22[1]
1988 Census Bureau *County Business Patterns*	5	13	4	22[2]
1987 Census Bureau *Census of Manufacturers*	5	12	4	21
1989 WADES *Employment and Payrolls*	14	25	3	42
1988 WADES *Employment and Payrolls*	11	23	3	37
1987 WADES *Employment and Payrolls*	11	21	3	35
1989 WADOR *Customized Computer Run*	4	6	0	10[3]
1988 WADOR *Customized Computer Run*	4	8	0	12[3]
1987 WADOR *Customized Computer Run*	5	8	0	13[3]
1990 EPA NPDES Facilities	15	6	0	21[4]
1990 DOE Water Quality	10	6	2	18[5]
1989 DOE Air Quality	14	5	1	20

[1] Classification based on SIC primary-product-shipped convention. Keyes Fibre Co. in Wenatchee produces fruit packaging trays and pads from mostly recycled newsprint; accordingly, it is classified in SIC 2679. The paper mill industry count includes Ponderay in Usk, a newsprint mill which opened late in 1989.

[2] Includes a Grays Harbor County paper mill with less than five employees; does not include Ponderay.

[3] Data from computer runs requested for the DOE project, on gross business income for SIC codes 2611, 2621, and 2631.

[4] NPDES: National Pollutant Discharge Elimination System for wastewater discharge.

[5] Includes both Industrial Section and Regional mills.

Obviously, Table 1 reveals that there is substantial disagreement among the data gathering agencies. The number of pulp mills (SIC 2611) in Washington state is variously reported as between four and 15 during the 1987–90 period. The number of paper mills (SIC 2621) is likewise between five and 25; and the number of paperboard mills (SIC 2631) is zero to five. Pulp, paper, and paperboard mills in Washington state together total between 10 and 42, depending on which agency is counting.

Our categorization of the 23 establishments listed in the 1990 Lockwood-Post's *Directory* agrees with Census Bureau counts, after taking into account that Keyes Fibre is a molded pulp product producer (SIC Industry 2679) and that the new Ponderay Newsprint mill (SIC Industry 2621) opened in late 1989. The only unexplainable discrepancy is the Census Bureau's *County Business Patterns* listing of a Grays Harbor County paper mill having less than five employees. We know of no mill in Washington state that is that small.

4. REASONS FOR DISAGREEMENT

The WADES count produces the highest counts for pulp, paper, and paperboard mills, and by far the highest totals for the three industries combined. WADES used

OMB's 1987 SIC manual convention and categories beginning in 1988. WADES obtains higher estalishment counts because it counts auxiliary establishments connected to an industrial facility—such as general administration, computer services, and factory power plants—as separate employer units; this would boost establishment counts but would not necessarily affect employment totals by four-digit industries.

WADES also asks multi-area and multi-industry employers to 'furnish supplemental reports allocating their employment and wages to specific areas and/or industries. ... If ... an employer has operations in more than one industry and/county of the state, each establishment is counted as an employer unit'.[5] Some vertically integrated establishments at a single location may produce intermediate materials, such as pulp, which are both used in succeeding stages of production at the same location and also sold to other firms. WADES disaggregates employer unit counts and employment data for such establishments into more than one four-digit industry provided that the enterprise is willing and able to supply the necessary information. Thus a mill that both sells pulp on the market and uses it to make paper would be split into an establishment in 2611 and another in 2621, for example.[6]

As shown in Table 1, WADES' procedure yields a report of 42 paper industry 'establishments' in 1989—14 pulp mills, 25 paper mills, and three paperboard mills. The number of paper mills alone is greater than the number of paper industry establishments listed by Lockwood-Post's *Directory*. One might expect the WADES method of classification to yield upper bound counts of mills in each category: every mill counted by another agency in a four-digit industry should show some activity in the same industry under the WADES procedure. However, the WADES count for paperboard mills is less than the figures obtained from the Census Bureau and Lockwood-Post's *Directory*. This may be due to a difference in classification for either Longview Fibre or Weyerhauser's kraft mill in Longview.

The WADOR count of paper industry establishments is lower than any other agency's count. This is surprising because WADOR uses the primary-product-shipped convention to assign each establishment to just one four-digit SIC industry. A firm's SIC code is determined jointly by the agency and the business when the firm applies for its state business license. The four-digit categorization is periodically reviewed by WADOR for possible update.

The WADOR data reported in Table 1 are from a categorized computer run requested for our research project. Gross business income data for the three four-digit SIC categories reported in this computer run were slightly different from total gross business income for industries 2611 through 2631 reported in WADOR's *Quarterly Business Review*. However, the discrepancy is less than 5% of the reported totals.

As suggested by the data in the final rows of Table 1, air and water quality regulatory agencies apparently have yet additional four-digit SIC classification conventions. Regulatory agencies appear to rely on air or water emissions, rather than products manufactured, when making SIC classifications. In the first place, a

[5] WADES, *Employment and Payrolls in Washington State by County and Industry*, 1989 Annual Averages (Nature and Limitations of Data, page 1).
[6] Telephone conversations with WADES personnel Jim Nygaard and Marcia Hanson in early 1991, and follow-up conversation with Nygaard in September 1992.

mill is not included in any of the three (pulp, paper, or paperboard) categories if it does not qualify for regulation because discharges are too small or not of sufficient toxicity. For example, EPA's NPDES Permit Rating Work Sheet compares waste-water flow and stream flow, pounds of total suspended solids per day, pounds of oxygen demand per day, and human health toxicity of the emitted pollutants, among other factors, in determining whether a particular mill's wastewater discharges are to be regulated. Container Corp. in Tacoma apparently is not regulated under an NPDES permit for this reason.

Second, a mill may be excluded from regulatory agency establishment counts because it uses the wastewater treatment and outflow facilities of another establish-ment. For example, DOE does not include the North Pacific or Weyerhauser paper mills in Longview because those two establishments use the Weyerhauser pulp and paperboard mill's treatment plant and wastewater discharge outflow. Similarly, Gray's Harbor Paper in Hoquiam uses ITT Rayonier's wastewater facilities. However, in these examples the wastewater discharges of the uncounted establishments are nevertheless included in measurements of discharges from the firms that own and operate the jointly used water discharge facilities. On the other hand, Container Corp. in Tacoma discharges to the City of Tacoma sewer. So its wastewater discharges are not even included in DOE data on paper industry wastewater pollutant loadings.

Third, a mill may be counted in more than one category if the regulating agency is able to disaggregate its pollutant generation activities. The approach is similar in spirit, though not necessarily in detail, to WADES's disaggregation of vertically integrated mills that market both pulp and paper or paperboard. For example, Simpson Tacoma and Scott Paper in Everett each get counted as both a pulp mill and a paper mill in the DOE air emissions data. Air quality is often monitored at more than one place on a paper industry establishment's site, e.g. because the mill has more than one stack. This allows DOE to classify air emissions from the pulp operation separately from the paper making operation.

The EPA and DOE also appear to have criteria for assigning a four-digit SIC code to a mill that do not conform to the 1987 SIC manual's industry definitions. For example, Georgia Pacific in Bellingham produces 450 tons per day (TPD) of bleached softwood sulphite market pulp, and 250 TPD of tissue and towel paper products. It is classified as a pulp mill in Census Bureau data, as a paperboard mill in DOE water quality data, and as both a pulp and paper mill in DOE air quality data.

Finally, over time the federal government has changed its SIC classifications. The 1987 revision of the SIC system included extensive renaming and reorganizing of the paper products industries. For example, the former SIC 2646, 'pressed and molded pulp goods', was consolidated into SIC 2679, 'converted paper products, not elsewhere classified'. Keyes Fibre in Wenatchee changed from SIC 2646 to 2679 for this reason.

The conceptual basis for classification of pulp, paper, and paperboard mills among SIC 2611, 2621, and 2631 was also changed in 1987, although the changes had little if any effect on reported statistics. Mills which primarily produced pulp, but also produced some paper or paperboard, were to be classified as paper (2621) or paperboard (2631) mills, respectively, in 1977. The 1987 manual suggests that such

mills could be reclassified as pulp (2611) mills. Review of the Census Bureau *County Business Patterns* data for 1980 through 1988 did not reveal any obvious changes in classification due to this change in SIC conventions for the paper industry. Similarly, the Bureau of Labor Statistics report contrasting nationwide employment by four-digit industry under the old and new systems showed no transfers into 2611, and virtually no change in any of the three paper mill categories.[7] Nonetheless, changes in SIC category definitions are one potential source of inconsistency over time, even for an agency which seeks to follow federal standard classifications.

5. CONCLUSIONS

There are more ways than we ever imagined to count a state's paper mills. Some agencies use the primary-product-shipped convention; others allocate across industries in proportion to employee activity; still others count by permits, discharge facilities, or other identifying characteristics. The 'official' definitions from OMB are not precisely or uniformly observed. Our conclusion is that, given currently available data, useful integration of data from different agencies may not be reliable at the four-digit SIC industry level. In the case which motivated our research, pollutant emissions data for a given four-digit industry will rarely, if ever, be based on the same establishments included in the four-digit industry's economic data. The same could potentially be true for comparisons involving employment, output, capital equipment, health and safety, or other industry-based indicators: if it comes from more than one source, an industry-based data set risks being based on incompatible SIC definitions.

Although we have not investigated the systems of classification outside the paper industry, we see no reason to believe that the problems are absent elsewhere. Paper mills are an important, high-visibility sector of the Washington economy, including less than two dozen establishments in total (in the opinion of the industry and government agencies other than WADES). In such a case, the problems of enumeration of enterprises should be at a minimum. Industries which include larger numbers of enterprises of varying sizes and product mixes might be expected to pose even more severe problems of classification.

Similar problems might exist at the two-digit major industry group level. However, in the two-digit case, the definitional problems may be simpler—it is easier to separate paper mills from oil refineries than it is to distinguish between pulp, paper, and paperboard mills. Moreover, the amount of data misclassified at the boundaries of two-digit industries may more often be dwarfed by the large numerical magnitudes for data that are consistently classified by the various governmental agencies involved.

[7] *Employment Data Under the New Standard Industrial Classification, First Quarter 1988*, BLS Report 772, October 1989. The brief text says nothing about paper mills; the bulk of the report consists of two detailed conversion tables. Table 1 shows only one change in paper mill industry definitions, the transfer of 35% of the employment in former industry 2661, 'building paper and board mills', into 2621; the remaining 65% of 2661 is shifted to industry 2493. Table 2 shows no change in the number of establishments or employment in 2611, 2621, and 2631; a footnote applied to these and a number of other industries says that 'these industries experienced very minor changes in their economic activities covered' under the 1987 versus 1972 classifications, so no establishments were reclassified.

However, if SIC codes are to provide a universal standard of classification and a basis for inter-agency comparison of data, further work is definitely needed in standardizing the interpretation of the codes. While industry and federal Census Bureau data agreed well with each other in our case study, several state agencies and EPA each had their own incompatible systems of classification. We believe there are 22 paper mills in Washington—but it is clear that the answer depends on whom you ask.