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ISIC 5210 – Warehousing and Storage

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1. Description and Characteristics of the Industry

1.1 Definition of the Industry

ISIC class **5210, Warehousing and Storage**, and its NAICS (North American Industry Classification System) counterparts (493110, 493120, 493130, and 493190) are defined in the tables below.

This report will refer to the industries by their NAICS, which is the classification system used in the United States. In addition, the terms revenue, receipts, and turnover will be used interchangeably.

ISIC Rev. 4 Class	NAICS (2017-Basis)
<p data-bbox="321 726 688 758">5210 – Warehousing and Storage</p> <p data-bbox="201 774 812 926">This class includes: --operation of storage and warehousing facilities for all kinds of good: - operation of grain silos, general merchandise warehousing, refrigerated warehouses, storage tanks etc.</p> <p data-bbox="201 957 643 1052">This class also includes: --storage of goods in foreign trade zones --blast freezing</p> <p data-bbox="201 1083 716 1199">This class excludes: --parking facilities for motor vehicles, see 5221 --operation of self-storage facilities, see 6810 --renting of vacant space, see 6810</p>	<p data-bbox="886 726 1370 758">493110 – General Warehousing and Storage</p> <p data-bbox="834 774 1421 1031">This industry comprises establishments primarily engaged in operating merchandise warehousing and storage facilities. These establishments generally handle goods in containers, such as boxes, barrels, and/or drums, using equipment, such as forklifts, pallets, and racks. They are not specialized in handling bulk products of any particular type, size, or quantity of goods or products.</p> <p data-bbox="886 1052 1370 1083">493120 – Refrigerated Warehousing and Storage</p> <p data-bbox="834 1100 1421 1325">This industry comprises establishments primarily engaged in operating refrigerated warehousing and storage facilities. Establishments primarily engaged in the storage of furs for the trade are included in this industry. The services provided by these establishments include blast freezing, tempering, and modified atmosphere storage services.</p> <p data-bbox="886 1346 1370 1377">493130 – Farm Product Warehousing and Storage</p> <p data-bbox="834 1394 1421 1545">This industry comprises establishments primarily engaged in operating bulk farm product warehousing and storage facilities (except refrigerated). Grain elevators primarily engaged in storage are included in this industry.</p> <p data-bbox="919 1566 1338 1598">493190 – Other Warehousing and Storage</p> <p data-bbox="834 1614 1421 1745">This industry comprises establishments primarily engaged in operating warehousing and storage facilities (except general merchandise, refrigerated, and farm product warehousing and storage).</p>

1.2 Market Conditions and Constraints

Industry Size and Concentration

The table below highlights the importance of NAICS 493110, 493120, 493130, and 493190 relative to the entire transportation and warehousing sector (NAICS 48-49) of the U.S. economy. It should be noted however that the Economic Census Sector 48-49 does not include Rail Transportation or the Postal Service in the sector total. Based on data published from the 2012 and 2017 Economic Census, one can see that the size of these industries in terms of overall turnover has increased but has remained relatively flat as a proportion of the sector total.

NAICS Level	Value of sales, shipments, receipts, revenue, or business done (\$1,000)		Percent of Transportation and Warehousing Sector	
	2017	2012	2017	2012
48-49 – Transportation and Warehousing ¹	895,225,411	730,541,303	100.0%	100.0%
493110 – General Warehousing and Storage	24,123,906	17,617,039	2.69%	2.41%
493120 – Refrigerated Warehousing and Storage	5,806,706	4,097,750	0.65%	0.56%
493130 – Farm Product Warehousing and Storage	796,012	737,768	0.09%	0.10%
493190 – Other Warehousing and Storage	7,359,241	6,041,098	0.82%	0.83%

1 – Excludes NAICS 482 (Rail Transportation) and NAICS 491 (Postal Services)

2012 Economic Census of the United States: Transportation and Warehousing: Geographic Area Series: Summary Statistics for the U.S., States, Metro Areas, Counties, and Places: 2012

2017 Economic Census of the United States: Transportation and Warehousing: Summary Statistics for the U.S., States, and Selected Geographies: 2017

The 2018 Service Annual Survey (SAS) publication displays the continued upward trend of total turnover by industry for all industries associated with warehousing since the 2017 Economic Census. (These figures have not yet been benchmarked to the Economic Census.)

Estimated Revenue for Employer Firms (in millions of dollars)				
NAICS Level	2018	2017	2016	2015
4849y – Transportation and Warehousing ¹	991,615	918,981	879,220	876,498
493110 – General Warehousing and Storage	22,945	21,827	20,619	19,486
493120 – Refrigerated Warehousing and Storage	5,199	4,931	S	S
493130 – Farm Product Warehousing and Storage	850	811	798	786
493190 – Other Warehousing and Storage	7,329	7,170	6,995	6,698

1 – Excludes NAICS 482 (Rail Transportation) and NAICS 491 (Postal Services)

S - Estimate does not meet publication standards because of high sampling variability or poor response quality or other concerns about the estimate's quality. Unpublished estimates derived from this table by subtraction are subject to these same limitations and should not be attributed to the U.S. Census Bureau. For a description of publication standards and the total quantity response rate, see <http://www.census.gov/about/policies/quality/standards/standardf1.html>.

2018 Service Annual Survey: Table 2. Estimated Revenue by Tax Status for Employer Firms: 2015 Through 2018

Due to 2017 data not being available yet, according to the 2012 Economic Census, General Warehousing and Storage was the largest amongst the four warehousing related industries. The four largest firms account for roughly one quarter of the entire industry's revenue. However, the industry is the least concentrated amongst the four warehousing industries; the 50 largest firms accounted for only 51.5% of the industry total.

NAICS 493110	Number of establishments	Revenue (\$1,000)	Revenue of largest firms as percent of total revenue (%)	Annual payroll (\$1,000)	First-quarter payroll (\$1,000)	Number of paid employees for pay period including March 12
All firms	10,243	17,617,039	100.0	23,162,725	5,642,167	599,384
4 largest firms	507	3,973,026	22.6	1,041,210	221,822	30,631
8 largest firms	680	5,247,340	29.8	1,301,226	289,264	36,967
20 largest firms	975	7,235,564	41.1	1,932,695	446,034	53,014
50 largest firms	1,248	9,065,477	51.5	2,522,527	578,247	68,216

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Estab & Firm Size: Concentration by Largest Firms for the U.S.: 2012

Refrigerated Warehousing and Storage is the second most concentrated warehousing industry based on the 2012 Economic Census behind Other Warehousing and Storage. The 50 largest firms make up 73.4% of total industry receipts.

NAICS 493120	Number of establishments	Revenue (\$1,000)	Revenue of largest firms as percent of total revenue (%)	Annual payroll (\$1,000)	First-quarter payroll (\$1,000)	Number of paid employees for pay period including March 12
All firms	1,175	4,097,750	100.0	1,729,454	426,827	41,823
4 largest firms	229	1,560,718	38.1	439,008	108,936	11,223
8 largest firms	304	2,075,709	50.7	686,985	169,149	17,619
20 largest firms	378	2,525,583	61.6	790,450	193,638	20,080
50 largest firms	432	3,006,343	73.4	899,337	219,737	22,582

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Estab & Firm Size: Concentration by Largest Firms for the U.S.: 2012

Farm Product Warehousing and Storage is the smallest warehousing industry in terms of establishments and receipts according to the 2012 Economic Census. This industry is the least concentrated at the 4 largest firms category.

NAICS 493130	Number of establishments	Revenue (\$1,000)	Revenue of largest firms as percent of total revenue (%)	Annual payroll (\$1,000)	First-quarter payroll (\$1,000)	Number of paid employees for pay period including March 12
All firms	525	737,768	100.0	205,501	51,436	4,816
4 largest firms	37	140,784	19.1	22,878	5,513	472
8 largest firms	53	211,400	28.7	27,052	6,619	597
20 largest firms	72	329,483	44.7	38,019	9,078	869
50 largest firms	136	506,346	68.6	69,677	16,390	1,692

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Estab & Firm Size: Concentration by Largest Firms for the U.S.: 2012

Other Warehousing and Storage companies are more concentrated according to the 2012 Economic Census than the other warehousing industries as the top four largest firms account for 50.7 percent and the top 50 firms account for 83.8 percent of industry revenue. At each published level, NAICS 493190 is more concentrated than its other three counterparts.

NAICS 493190	Number of establishments	Revenue (\$1,000)	Revenue of largest firms as percent of total revenue (%)	Annual payroll (\$1,000)	First-quarter payroll (\$1,000)	Number of paid employees for pay period including March 12
All firms	2,505	6,041,098	100.0	3,059,154	807,479	66,767
4 largest firms	665	3,059,828	50.7	645,171	201,655	10,808
8 largest firms	688	3,732,137	61.8	793,586	237,409	12,621
20 largest firms	791	4,546,495	75.3	948,584	275,142	15,593
50 largest firms	865	5,062,673	83.8	1,075,778	307,059	18,439

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Estab & Firm Size: Concentration by Largest Firms for the U.S.: 2012

Industry Regulation

Some regulations regarding the warehousing industries come from the Food and Drug Administration (FDA), the Occupational Safety and Health Administration (OSHA), and the Environmental Protection Agency (EPA). The FDA has many regulations covering aspects of food and drug warehousing but enacted the Food Safety Modernization Act (FSMA) in January 2011 to improve the safety practices of warehouses and other food-handling facilities. The law aims to prevent contamination before food makes its way to the public, and prevents retaliation against employees for reporting food safety violations.

OSHA was created with the Occupational Safety and Health Act of 1970 to ensure safe working conditions by setting and enforcing workplace safety and health standards. Under the OSH Act, employers have the responsibility to provide a safe workspace.

Under the EPA section 112(r) of the Clean Air Act and 40 CFR part 68, covered facilities, including warehouses, are required to develop and implement a risk management program to prevent accidental releases of regulated substances. The EPA has the Risk Management Program (RMP) Guidance for Warehouses to provide guidance to owners and operators in determining if they are subject to these chemical accident prevention regulations.

Product Structure

The following tables display the product lines and their generated turnover according to the 2012 Economic Census for NAICS 493110, 493120, 493130, and 493190. It is clear that storage, handling, and packing services for goods are the three largest product line categories for all four warehousing industries. These codes fall under the broad line, warehousing services, which makes up over 89% of all four warehousing related industries. Smaller secondary lines of revenue can also be seen.

Meaning of products and services code NAICS 493110 General Warehousing and Storage	Revenue (\$1,000)	Product line sales as % of total sales of all establishments (%)
Industry total	17,617,039	100
Warehousing services	15,699,747	89.1
Storage services for goods	7,345,507	41.7
Handling services for goods	6,951,933	39.5
Packing services for goods	1,328,015	7.5
Transportation of boxed, palletized and other packed goods, not climate-controlled and not in intermodal containers, by road, truckload service	352,375	2
Other products	355,580	2
Transportation of other goods by road	327,783	1.9
Freight transportation arrangement services	173,111	1
Transportation of boxed, palletized and other packed goods, not climate-controlled and not in intermodal containers, by road, less-than-truckload service	151,349	0.9
Drayage services	160,208	0.9
Transportation of climate-controlled boxed, palletized and other packed goods, except in intermodal tank containers, by road	86,841	0.5
Moving services	62,764	0.4
Transportation of documents and parcels	60,885	0.3
Commercial moving services	28,178	0.2
Local transportation and delivery of small purchased or serviced items	35,419	0.2
Moving of other goods requiring special handling	18,391	0.1
Residential moving services	16,195	0.1
Transportation of climate-controlled intermodal containers, not elsewhere classified, by road	19,001	0.1
Transportation of other intermodal containers, not elsewhere classified, by road	25,698	0.1
Operations and supply chain management consulting services	17,993	0.1
Transportation of dry bulks, except in intermodal tank containers, by road	7,243	Z
Rental of transportation equipment, except cars, light trucks, and motor homes, without operators	5,838	Z
Transportation of waste by road	1,908	Z
Transportation of hazardous waste by road	1,539	Z

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Product Lines: Product Lines Statistics by Industry for the U.S.: 2012

Z - Rounds to zero

Shaded rows are detail product lines. All others are broad product lines.

Meaning of products and services code NAICS 493120 Refrigerated Warehousing and Storage	Revenue (\$1,000)	Product line sales as % of total sales of all establishments (%)
Industry total	4,097,750	100
Warehousing services	3,864,539	94.3
Storage services for goods	2,697,033	65.8
Handling services for goods	1,065,232	26

Packing services for goods	102,274	2.5
Drayage services	86,367	2.1
Other products	60,934	1.5
Transportation of climate-controlled boxed, palletized and other packed goods, except in intermodal tank containers, by road	55,880	1.4
Transportation of other goods by road	13,492	0.3
Freight transportation arrangement services	10,670	0.3
Operations and supply chain management consulting services	1,200	Z

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Product Lines: Product Lines Statistics by Industry for the U.S.: 2012

Z – Rounds to zero

Shaded rows are detail product lines. All others are broad product lines.

Meaning of products and services code NAICS 493130 Farm Product Warehousing and Storage	Revenue (\$1,000)	Product line sales as % of total sales of all establishments (%)
Industry total	737,768	100
Warehousing services	694,009	94.1
Storage services for goods	493,877	66.9
Handling services for goods	144,092	19.5
Packing services for goods	56,040	7.6
Transportation of other goods by road	26,957	3.7
Other products	7,289	1
Transportation of dry bulks, except in intermodal tank containers, by road	3,477	0.5

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Product Lines: Product Lines Statistics by Industry for the U.S.: 2012

Shaded rows are detail product lines. All others are broad product lines.

Meaning of products and services code NAICS 493190 Other Warehousing and Storage	Revenue (\$1,000)	Product line sales as % of total sales of all establishments (%)
Industry total	6,041,098	100
Warehousing services	5,882,546	97.4
Storage services for goods	5,444,435	90.1
Handling services for goods	324,450	5.4
Packing services for goods	113,661	1.9
Other products	37,803	0.6
Transportation of climate-controlled boxed, palletized and other packed goods, except in intermodal tank containers, by road	30,187	0.5
Freight transportation arrangement services	17,901	0.3
Moving services	11,839	0.2
Transportation of documents and parcels	13,543	0.2
Transportation of bulk liquids and gases, except in intermodal tank containers, by road	9,460	0.2
Transportation of dry bulks, except in intermodal tank containers, by road	14,290	0.2
Moving of other goods requiring special handling	5,078	0.1
Residential moving services	5,139	0.1

Local transportation and delivery of small purchased or serviced items	3,101	0.1
Transportation of boxed, palletized and other packed goods, not climate-controlled and not in intermodal containers, by road, truckload service	3,391	0.1
Transportation of other goods by road	5,745	0.1
Drayage services	3,941	0.1
Transportation of other intermodal containers, not elsewhere classified, by road	2,202	Z
Towing services	1,643	Z
Commercial moving services	1,622	Z
Operations and supply chain management consulting services	498	Z
Rental of transportation equipment, except cars, light trucks, and motor homes, without operators	220	Z
Transportation of automobiles and light trucks by road	17	Z

2012 Economic Census of the United States: Transportation and Warehousing: Subject Series - Product Lines: Product Lines Statistics by Industry for the U.S.: 2012

Z – Rounds to zero

Shaded rows are detail product lines. All others are broad product lines.

1.3 Specific Characteristics of the Industry

The primary role of a warehouse is storing, receiving and shipping goods on behalf of their customers. General, Refrigerated, Farm Product, and Other Warehousing and Storage all have these primary goals. The distinctions between them are determined by the good they are storing. General warehousing establishments generally handle goods in containers, such as boxes, and/or barrels. They are not specialized in handling bulk products. Refrigerated warehousing and storage establishments generally handle refrigerated and frozen products. “Modified atmosphere storage services” are included in this industry, so although the industry title is refrigerated, all atmosphere controlled establishments are included here. Farm product warehousing and storage establishments generally handle bulk farm products; included are grain elevators primarily engaged in storage. Other warehousing and storage establishments cover the storage of products not included in the other three industries. Included are household goods warehousing, which generally handle the storage of furniture and other household goods, and specialized goods warehousing, which generally handle the storage of specialty items, such as bulk petroleum chemicals, automobile dead storage, lumber storage terminals, and whiskey warehousing.

Warehouses are typically located in an area that is close to market proximity with enough space to store products. It is important to be well connected to infrastructure, including but not limited to highways, railways, airports, and seaports.

Demand in warehousing industries is closely tied to the economy. When the economy is good, there is more need for warehousing and storage as companies are keeping inventories high. A downturn in the economy lowers the demand for this space.

All four warehousing industries have the same three major components to the services provided: storage services, handling services, and value added services. Storage services are the foundation of a warehouse; the use of space to store goods. Handling services cover the flow of goods in and out of a warehouse. Value added services are any product preparation or

enhancement done by the warehouse. Illustrative examples would include packing, labeling, tracking, sorting, etc. Third-party logistics (3PL or TPL) provider related services and other services provided would be considered secondary streams of revenue for these companies.

Over time, warehouses have become more integrated into the 3PL provider role. This has caused warehouses to diversify into other services, primarily transportation and distribution. This movement matches others entering the 3PL market, NAICS 484 (Truck Transportation), and NAICS 492 (Couriers and Messengers). The primary business service must still be warehousing and storage to keep the company classified as a warehouse.

2. Revenue/Output Measurement

2.1 General Framework

Objectives of Key Users

The U.S. Census Bureau provides output data for the warehousing industries as part of the Quarterly Services Survey (QSS), Service Annual Survey (SAS), and the quinquennial Economic Census.

The U.S. Bureau of Labor Statistics (BLS) Producer Price Index (PPI) program uses Economic Census data to update industry and product index weights.

BLS also uses SAS industry revenue and expense data as a main source for service industry labor productivity and cost measures.

The U.S. Bureau of Economic Analysis (BEA) uses revenue data in the creation of national and regional accounts. In addition, annual industry accounts, including both Gross Domestic Product (GDP) by industry and annual input-output (I-O) accounts are shaped by revenue/output data. The Economic Census is used as the measure of output in the benchmark (I-O) tables.

Definition of Output

Revenue is in scope to these industries when the firms are providing warehousing, storage, handling, and packing services for goods. These services are the main contributors to the total revenue figure but secondary revenue streams are also captured. Measurement issues can arise when establishments incorrectly or erroneously report their primary business activity. Additionally, firms can be classified under NAICS 493110, 493120, 4903130, or 493190 and because of either confusion or unawareness, fail to properly report that they are misclassified. In these instances, firms may continue reporting in one of these industries when they actually should be classified elsewhere.

The Census Bureau classifies warehouses providing storage facilities for their own enterprise into all four of these industries, NAICS 493110, 493120, 493130, and 493190, based on what they are storing. These establishments typically do not have revenue, are identified as auxiliaries with-in the company, and are assigned an industry served code. Locations classified as auxiliaries are included in all Census Bureau counts and tabulations and are included in the

figures in the tables above. The Census Bureau publishes a sector level report for these auxiliary establishments by industry served during the Economic Census.

2.2 Measurement Issues

Product Structure

The products that were available for respondents to report during the 2017 Economic Census were the same across NAICS 493110, 493120, 493130, and 493190, as revenue items could be applicable to many firms conducting these types of services. Below are the NAPCS (North American Product Classification System) collection codes or product lines displayed on the 2017 Economic Census questionnaires for these four industries. Although much of the content is the same, there are differences between the product structures from one Economic Census to another as the product structures are updated. Since these codes are considered primary for all four industries, they alone cannot be used for accurate NAICS classification. While the collection of products according to NAPCS is not new, the NAPCS products collection structure is new for the 2017 Economic Census and will be published in November 2020.

NAPCS Collection Code	NAPCS Description
7011900000	Warehousing and storage services
7011975000	Handling services for goods
7012000000	Packing services for goods
7011925000	Freight transportation arrangement and customs brokering services
7014650000	Operations and supply chain management and implementation services

The 2018 Service Annual Survey on the other hand does not include any product line data for these industries so the Economic Census is the only source for this type of information.

Other Available Data Sources

The Economic Census as well as SAS and QSS utilize administrative data provided by other Federal agencies in their imputation models and during analyst review of cases that may be missing key data items due to item or unit nonresponse. These data are used alongside U.S. Securities and Exchange Commission (SEC) filings and annual reports to provide opportunities to verify reported data, or to edit or impute data at the company level.

2.3 Description of Methods for Measurement

Frequency of Collection

The Economic Census occurs once every five years, and collects data for years ending in “2” and “7”; the SAS and QSS occur annually and quarterly, respectively. Data for the Economic Census and SAS are collected exclusively through the Internet, with respondents logging onto a secure website to provide their data. Respondents to the QSS can choose to respond through mail, fax, telephone, or Internet reporting.

Description of Estimation Procedure and Sampling Design

The Economic Census employs several imputation methods, which can be divided between two categories: 1) values derived by logical edits, and 2) values derived from statistical modeling due to nonresponse. Data captured in an economic census must be edited to identify and correct reporting errors. The data also must be adjusted to account for missing items and for businesses that do not respond. Data edits detect and validate data by considering factors such as proper classification for a given record, historical reporting for the record and industry/geographic ratios and averages. Nonresponse is handled by estimating or imputing missing data. Imputation is defined as the replacement of a missing or incorrectly reported item with another value derived from logical edits or statistical procedures.

Individual establishment records are tabulated in different ways based on data product and analytical needs. Tabulations include data summed by industry, specified geographic areas, establishment-size, products produced, materials used, fuels used, and product lines sold.

Total estimates for the SAS are computed using the Horvitz-Thompson estimator, i.e. the sum of weighted reported or imputed data, for all selected sampling units that meet the sample canvass and tabulation criteria. The weight for a given sampling unit is the reciprocal of its probability of selection into the SAS sample. These estimates are then input to a benchmarking procedure that uses estimates produced by the Economic Census. Variances are estimated using the method of random groups and are used to determine if measured changes are statistically significant.

The SAS is a survey of approximately 90,000 selected service businesses with paid employees, supplemented by administrative records data or imputed values to account for non-employer and certain other businesses.

The sampling frame used for the SAS has two types of sampling units represented: single establishment firms and multiple-establishment firms. The information used to create these sampling units was extracted from data collected as part of the 2012 Economic Census and from establishment records contained on the Census Bureau's Business Register as updated to December 2015. However, unlike the Economic Census, which is establishment based, the SAS and QSS are company-based samples.

In the initial sampling, firms are stratified by major and minor kind of business, and by estimated receipts or revenue. Within each stratum, a substratum boundary (or cutoff) that divides the certainty units from the non-certainty units is determined. Firms expected to have a large effect on the precision of the estimates (i.e., have annual revenue greater than the corresponding certainty cutoff) are selected with certainty. All firms not selected with certainty are subjected to sampling. Within each stratum a simple random sample of firms is selected without replacement.

During the period for which the samples are used, updates are made on a quarterly basis to reflect changes in the business universe. These updates are designed to account for new businesses (births) and businesses that discontinue operations (deaths). The samples are also updated to reflect mergers, acquisitions, divestitures, splits, and other changes to the business universe.

Estimates for employers plus non-employers are only published for total revenue. All other estimates are based only on employer firms. Firms without paid employees (non-employers) are included in the total revenue estimates for the SAS through administrative data provided by other Federal agencies and through imputation.

The QSS is a principal economic indicator series that produces, for selected service industries, quarterly estimates of total operating revenue and the percentage of revenue by class of customer (government, business, consumers, and individuals). The survey also produces estimates of total operating expenses from tax-exempt firms in industries that have a large not-for-profit component. In addition, for hospital services, the survey estimates the number of inpatient days and discharges.

The QSS sample includes approximately 19,500 service businesses, is a subsample of the SAS sample and has the same types of sampling units as the SAS frame—single establishment firms and multiple-establishment firms. Sampling units represent clusters of one or more establishments owned or controlled by the same firm. The QSS estimates are published for less detailed industry groupings than the Service Annual Survey estimates.

Therefore, the industry stratification for the QSS sample is broader than the industry stratification used for the SAS sample. Sampling units are assigned to the industry stratum corresponding to the industry that contributes the most to the unit's sampling measure of size (i.e., annual revenue). Similar to SAS, within each industry stratum, sampling units are sub stratified by a measure of size related to their annual revenue. Sampling units expected to have a large effect on the precision of the estimates are selected "with certainty." Within each non-certainty substratum, units are selected using a systematic, probability proportional-to-size sampling scheme. The sample is redrawn approximately every 5 years to redistribute reporting burden and to introduce sampling and processing efficiencies. Estimates are produced using the same general methodology as the SAS.

3. Measurement of SPPI

3.1 General Framework

The U.S. Bureau of Economic Analysis (BEA) publishes GDP-by-industry quarterly at the NAICS three-digit level, 493, Warehousing and storage. On an annual basis, BEA also publishes these statistics at the NAICS three-digit level, 493, Warehousing and storage.

Input-output data is published annually by BEA at the three-digit NAICS level, 493, Warehousing and storage. Every five years, BEA also publishes a detailed benchmark table at the three-digit level, 493 Warehousing and storage.

BEA uses the following U.S. PPIs for publishing as deflators to determine real output in the industry account:

- 49311 – General warehousing and storage
- 49312 – Refrigerated warehousing and storage
- 49313 – Farm product warehousing and storage
- 493 – Warehousing and storage

3.2 Measurement Issues

Product Structure

The following tables show the U.S. PPI structure for three warehousing SPPIs: NAICS 493110, General warehousing and storage; NAICS 493120, Refrigerated warehousing and storage; and NAICS 493130, Farm warehousing and storage.

Index Codes	Index Title
493110	General warehousing and storage
493110P	Primary services
4931101	General warehousing and storage services
493110SM	Other receipts

Index Codes	Index Title
493120	Refrigerated warehousing and storage
493120P	Primary services
4931201	Warehousing and storage of refrigerated goods
493120SM	Other receipts

Index Codes	Index Title
493130	Farm product warehousing and storage
493130P	Primary services
4931301	Farm product warehousing and storage services
493130SM	Other receipts

Establishments for these SPPIs may also provide a number of services other than storage to their clients. These services may include freight transportation arrangement, customs brokerage and other freight forwarding services, rental or leasing of office space or other non-residential space, as well as other commodity or product preparation services.

The U.S. PPIs for warehousing and storage provide greater detail than the NAPCS structure. For comparison purposes, the following table shows the NAPCS structure for warehousing and storage services.

2017 NAPCS Code	Title
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64	Goods transportation services and related products
641	Goods transportation services and related products
64102	Warehousing and storage services
6410201	Warehousing and storage services
641020101	Warehousing and storage services
64102010101	Warehousing and storage services

Service Definition

These industries comprise establishments primarily engaged in operating merchandise warehousing and storage facilities. Establishments in this industry may provide a range of services related to the distribution of goods, often referred to as logistics services. Logistics services can include labeling, packing, packaging, etc. However, establishments in this industry always provide warehousing or storage of goods in addition to any other service. Furthermore, the warehousing or storage must be more than incidental to the performance of any other service.

There has been a trend among refrigerated warehouses to rebrand themselves as complete third-party logistics (3PL) providers. The essence of 3PL is to offer clients a wide array of services to support their clients' production process or service-delivery process. In many cases, this 3PL service will involve entering into deeply integrated relationships with certain clients, often setting aside an entire facility to the exclusive use of the client, or setting aside part of a semi-dedicated multi-client facility to the exclusive use of that client. In these cases, the warehouses may combine storage services, handling services, services related to storage, and either transportation or transportation arrangement services into a single bundled package. Moreover, it is the nature of these deeply integrated relationships that certain activities, which would be ordinarily described as "Process, physical distribution, and logistics consulting" if done independently, are performed as part of the set-up and delivery of these services. Furthermore, these services are often sold on the basis of a percentage of sales, a per-item mark-up basis, or on the basis of costs plus a percentage mark-up. Thus, these bundled services become something of a cross-over between the public warehouse service-delivery process and the private-warehouse service-delivery process. Private warehouses perform many of the same activities, with the exception that prices are usually not charged to the parent company, and thus, there generally are no transactions.

Sampling Design

A firm's probability of selection is proportionate to its size.

The sampling design is based on data availability for the particular warehousing industry. Typically, the sample unit is defined as an individual facility location. The largest chains have locations throughout the United States, thereby each facility has a chance for selection to ensure a nationally representative sample. The sample design objective is to capture the unique local and regional economic factors affecting storage prices.

NAICS 493110, General warehousing and storage

The industry frame is constructed using data from the Unemployment Insurance file. A firm's probability of selection is based on its employment size. Private warehouses are excluded from the frame due to lack of repriceable transactions.

NAICS 493120, Refrigerated warehousing and storage

The frame is constructed using data from the Global Cold Chain Alliance (GCCA) Refrigerated Warehouse Database. A firm's probability of selection is based on warehouse facility size, calculated using cubic volume. As with general warehousing, private warehouses are excluded due to a lack of repriceable transactions

NAICS 493130, Farm product warehousing and storage

The industry frame is constructed using data from the U.S. Department of Agriculture's Farm Service Agency Licensed Warehouses Information. Each record represents a unique farm warehouse or grain elevator. A firm's probability of selection is based on its licensed capacity. Private warehouses or grain elevators are included as the homogeneity of products stored typically makes it relatively easy for the parent company to determine the storage price.

Data Sources for Various Weights

Sampled transactions are weighted by a measure of their size and importance. In the first stage of PPI computation, price indexes are constructed for narrowly-defined groupings of goods or services. The individual transactions included in these indexes are weighted by the producing firm's turnover for the product line. In the second stage of PPI computation, indexes for individual goods and services are combined into aggregate indexes. Data for weighting together the product line indexes comes primarily from the Economic Censuses of the U.S. Census Bureau. These weights are updated every 5 years.

3.3 Description of Pricing Methods and Criteria for Choosing the Method

Pricing Methods

There are two main pricing methodologies used in these industries: average prices and contract rates.

Average Prices

For NAICS 493110, General warehousing and storage and NAICS 493120, Refrigerated warehousing and storage, the preferred price to collect is an **average price per occupied cubic foot**. This is calculated by taking the total warehouse service revenues for the pricing period and dividing it by the total occupied storage space (in cubic feet) of the facility over the period. An average based on the first 21 days of the current month is preferred. If the respondent is unable to provide an average for the first 21 days, a monthly average based on revenue for the entire previous month is acceptable.

Example: Average Price

Storage	Total
A. Revenue for period	\$1,250,000
B. Total occupied cubic feet for period	500,000
C. Avg revenue per cu. ft. (= A / B)	\$2.50

Contract rates

For NAICS 493130, Farm product warehousing and storage, and as a fallback procedure when a general or refrigerated warehouse is unable to provide the average price per occupied cubic foot, the price to collect is a current **contract rate for a single bundled service**. The contract price is then estimated in subsequent pricing periods.

There are three main service aspects which are included in a bundled contract rate. Although each aspect is priced separately, they are often billed together, and collected as a single item for repricing.

- 1. Storage service:** This is the most basic aspect of warehousing service, and simply covers the utilization of the space by the goods. This aspect is usually priced on a per cubic foot (cu. ft.) per month basis or per hundredweight (100 lbs., abbreviated as “cwt.”) per month basis.
- 2. Handling service:** Handling service covers the normal flow of goods into or out from the warehouse. A special kind of handling service is “cross-docking” service. This involves the movement of goods through a warehouse without storage, such as directly from a rail unloading point straight to a truck dock. Although many warehouses may consider this to be a handling service, the U.S. PPI treats it as an Other receipt. Both normal “handling service, as well as cross-docking service, are usually priced on a per hundredweight, per box, or per pallet basis.”
- 3. Value-added-services:** Value-added-services refers to any aspect of commodity or product preparation or enhancement performed by the warehouse. Typical examples include packaging, packing, labeling, sorting, slow freezing, and blast freezing. These services are typically priced on a per hundredweight, per box, per pallet, or per count basis.

The following are examples of typical bundled transactions for warehousing and storage services. The respondent is expected to only update the rate for each service. The specific services rendered and multipliers should be held constant from period to period to ensure only a pure price change is reflected.

Example: General or refrigerated warehousing and storage service

Storage Service Description	Rate	Multiplier	Total
Storage rate (per day per cwt.)	\$0.25	5	\$1.25

Handling charge (per handling per cwt.)	\$0.21	3	\$0.63
Packaging (per cwt.)	\$7.27	1	\$7.27
Labeling (per package per cwt)	\$0.10	50	\$5.00
Total Rate			\$14.15

Example: Farm product warehousing and storage service

Cotton Storage Description	Rate	Multiplier	Total
Storage rate (per day)	\$0.10	3,551	\$355.10
Receiving (per bale)	\$3.10	44	\$136.40
Delivery (per bale)	\$5.25	44	\$231.00
Total Rate			\$722.50

Price Determining Characteristics

The price determining characteristics depend upon the pricing method used. If the pricing method is the average price per occupied cubic foot, then the price determining characteristics are the occupied storage volume, and the monthly revenue.

If the price is based on a contract rate, the price determining characteristics will be based on the services provided in a single bundled transaction and likely to include the storage, handling, and any value-added services described above.

Furthermore, when collecting a single bundled transaction, the actual length of storage becomes a key price-determining variable. Since the storage rates have a price trend based largely on the cost of capital (the real estate occupied by the warehouse); and the handling charges and value-added service charges have a price trend based largely on the cost of labor; the ratio of the length of storage to the handling and value-added services included in the bundle has a critical determinant upon the price trend of the item as a whole.

Additionally, the client and the geographic location of the facility are price-determining. The PPI controls for the geographic location of a facility by not clustering our sample, and thus primarily collecting prices from single-location record centers. In almost all cases, the PPI does not directly compare service substitutions from one location to another location, but instead uses the reporter's expertise in deciding if the client for one service is sufficiently comparable in size and scope to the client of a subsequent service in order to merit a direct price comparison.

Index Estimation Procedure, Including Estimation of Missing Prices

PPIs are calculated using the formula for a modified Laspeyres index. The Laspeyres index compares the base period turnover for a set of products or services to the current period turnover for the same set of products or services.

If no price report from a participating firm has been received in a particular month, the change in the price of the associated transaction is estimated by averaging the price changes for other transactions within the same detailed index line (i.e., for the same kind of services) for which price reports have been received.

Quality Adjustment

In cases where the primary repricing method used is a monthly average price per occupied cubic foot no quality adjustment has been found necessary. When the repricing method used is for a single bundled transaction, the repriced services are based on a hypothetical bundle, limiting the need for quality adjustment. If there are changes in service contract length or if there are additions or removals of particular service, they are treated more as a product substitution than as a quality adjustment issue.

Frequency of Collection

Warehousing and storage services firms report prices for the selected transactions, usually on a monthly basis, using a form provided by the U.S. PPI. Firms are asked to report their prices as of the Tuesday of the week containing the 13th of the month (average prices reported at this time are often for the entire prior month). If the firm fails to report or reports incomplete information, it is called by an economist who requests the needed information. Firms report prices through a web-based application. Firms continue to report until a new sample is selected for the industry – after 7 to 8 years, on average.

3.4 Evaluation of Comparability of Price Data with Output Data

As previously noted, the Census Bureau classifies warehouses providing storage facilities for their own enterprise into the warehousing and storage industries. BLS research and experience, however, indicate that private warehouses for NAICS 493110 and NAICS 493120 do not typically have reportable prices for transactions with their parent establishments. Since many online retailers, grocery stores, or wholesale trade establishments do not separate out as a distinct profit-maximizing-entity their warehouses, these warehouses are often not included in the frame and/or sample as productive warehousing establishments. The U.S. PPI still attempts to collect any private warehouses that are sampled, but it is not expected that any of these will result in productive establishments.

However, for NAICS 493130, private warehouses are included in the U.S. SPPI as price data is typically available from the parent company. Many farm warehouse facilities store a single commodity-type, making it relatively easy to determine the storage price, unlike general or refrigerated warehouses which can store hundreds of different types of products.

4. Evaluation of Measurement

The U.S. PPI recently transitioned to using the average price methodology described in Section 3. Due to the stagnant index movement for NAICS 493110, existing respondents were consulted to discuss the pricing methodology for warehousing and gather input as to whether it accurately reflected inflation in the marketplace. All contacts were in agreement that the previous pricing methodology (hypothetical, estimated prices) did not capture inflation for NAICS 493110 and 493120 as well as an average price per occupied cubic foot model.

The industry standard, according to contacted parties, is the average revenue per cubic foot of utilized storage for each type of designated facility. This methodology enables us to accurately capture price changes associated with shifts in the growing season, global/ regional threats, transportation costs, and other factors that affect the supply of goods and the prices charged at storage facilities. Static, estimated contracts were not consistently incorporating these factors into the prices, preventing an accurate inflation measurement.

The General warehousing and storage SPPI introduced the average price methodology as of June 2020. Prior to June 2020, the typical price collected for General warehousing and storage was a contract rate, which accounts for the stagnant price movement seen over the past two years. It is anticipated that the new price methodology will soon reflect more timely market conditions for general warehousing, just as it has for refrigerated, which transitioned to the average price methodology in June 2017.

Contract or transaction prices for the farm product warehousing and storage SPPI will continue to be used due to the standardization and limited amount of variation in the services provided.

The U.S. Census Bureau publishes turnover data based in NAICS classification. The Census Bureau currently has no issues or changes forthcoming and will continue to publish by NAICS classification as defined in section 1.1 above.

Any views expressed are those of the authors and not necessarily those of the U.S. Census Bureau. The Census Bureau has reviewed this paper for unauthorized disclosure of confidential information and has approved the disclosure avoidance practices applied. (Approval ID: CBDRB-FY20-ESMD002-024)