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U.S. Department of Labor
U.S. Bureau of Labor Statistics
Office of Prices and Living Conditions

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Working Paper 578
December 10, 2024

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Abstract

U.S. import and export price indexes (MXPI) replaced unit value indexes forty years ago, given quality concerns of mismeasurement due to unit value bias. The administrative trade data underlying the unit values have greatly improved since that time as have index calculation methods and processing capabilities of computers. The transaction records are now more detailed, available electronically, and compiled monthly with little delay. Academic researchers use the administrative trade data to calculate unit values and study firms' pricing decisions. Moreover, other national statistical offices (NSOs) produce unit value indexes based on administrative trade data. The U.S. Bureau of Labor Statistics will begin using these data for about 40 percent of the MXPI beginning in 2025. Years of research show that the characteristics available in the data allow detailed items to be constructed that mimic a matched-item model. In fact, we estimate that using the administrative trade data for the MXPI between 2017 and 2023 would have had little impact on both import and export price index levels, changing them by less than one percentage point.

*The entire administrative trade data team has taken the lead in developing and implementing the methodology described in this paper. Don Fast leads the research stage of this project and Larry Lang leads the team that is implementing these changes. The other members of the team over the course of the project are Adib Ahmad, Ruhul Amin, Taylor Aultman, Lena Benson, Marshall Blackman, Jeffrey Blaha, Patrick Carr, Daniel Desranleau, Michael Havlin, Halie Johnson, Ara Khatchadourian, Blair McCarthy, Helen McCulley, Roland Patcha, Mimi Perez, Tyler Powers, Praveen Reddy, Tamar Schmidt, Daryl Slusher, and Neill Smith. This research was overseen by the International Price Program Research Steering Committee including Susan Fleck, Dave Mead, Steve Paben, Aric Schneider, and Rozi Ulics. Dominic Smith is on both teams and wrote this paper assisted by the other authors on editing, fact checking, and tables.

1 Introduction

The U.S. Department of Labor, through the U.S. Bureau of Labor Statistics (BLS), is responsible for the development and publication of U.S. Import and Export Price Indexes through the International Price Program (IPP). Currently, monthly estimates of import and export price indexes for merchandise goods are published for approximately 740 industry and product classification areas, including the Harmonized System (HS), Bureau of Economic Analysis (BEA) end-use System, and North American Industry Classification System (NAICS). Every month, approximately 16,000 prices for merchandise goods are collected from businesses using the voluntary U.S. Import and Export Price Indexes survey. The participating businesses are selected based on a statistically representative sample of import and export goods trade.

The International Price Program has developed an approach to maintain and expand the number of publishable price indexes for merchandise goods for the Import and Export Price Indexes which will be implemented in 2025. Approximately 500 more price indexes will be published as a result of this new approach. IPP will use administrative trade transaction records to replace one-third of the sample and other secondary data sources that combined cover 40 percent of merchandise goods trade. Monthly prices will be calculated from detailed unit values derived from millions of trade transaction records. These administrative records are reported by companies for regulatory purposes and are compiled by the U.S. Census Bureau to publish official international trade statistics. The Census Bureau is collaborating with the BLS to share the records for use in calculation of the MXPI. These records have not been used recently to calculate monthly price indexes. Rather, they have been used by the BLS at an aggregate level on an annual basis to establish the sample frame for the U.S. Import and Export Price Indexes survey and to calculate annual trade weight shares.

This change is taking place after multiple years of research and communication with data users and stakeholders. An initial proof of concept was published in a conference volume of the National Bureau of Economic Research (Fast and Fleck 2019). In 2020, initial research indexes were released showing the results of calculating indexes using the administrative trade data and a Tornqvist formula (Fast, Fleck, and Smith 2022). These results were then presented to the BLS Technical Advisory Committee (Smith and Administrative Data Team 2022) and the final methodology was outlined in a Federal Register Notice (Bureau of Labor Statistics 2024). This paper describes the final methodology that will be used to produce the MXPI with administrative trade data.

Traditionally, MXPI have been calculated using price quotes collected from respondents monthly. These price quotes are aggregated to the classification group level (which is typically one 10-digit HS code) as a price index which is used as the building block for aggregating price indexes in the various classification trees

that are published each month.

Classification group price indexes using administrative trade data will be calculated in multiple steps. First, transactions with similar characteristics (such as foreign country and U.S. trading party) are grouped to form items. Which characteristics are used to group items varies across classification groups and is a result of analysis using the Match-adjusted R-squared technique (Chessa 2021). The prices of these items are then filtered to remove outliers and an index is created using a Tornqvist formula for each year. In the Tornqvist formula, the base year strategy is used to minimize chain drift while keeping the weights associated with each item relatively current (Suopera et al. 2021). These indexes are then reviewed for outliers and other issues before being integrated into the MXPI processing pipeline. The administrative trade data will be used for 18,121 out of 28,638 classification group indexes accounting for 40 percent share of the MXPI beginning with the data release in March 2025. This approach substantially increases the number of items being used to calculate indexes and the fraction of trade that directly contributes to index calculation.

There are three concerns with the use of administrative trade data in the MXPI. The first concern is that administrative trade data indexes are subject to unit value bias. Unit value bias occurs when changes in the ratio of value to quantity are caused by changes in composition of the products grouped within a transaction. The BLS has spent years studying the indexes produced with unit values to identify areas where unit value indexes closely track indexes produced using a matched-item model. Because administrative trade data unit value indexes have been in alignment with matched-item model indexes the BLS will refer to all the MXPI as price, not unit value, indexes.[1]

The second concern with administrative trade data is nonsampling error because some observations are not usable for index calculation. Some records have incomplete data or are excluded from calculation because their unit values are either significantly higher or lower than other similar transactions. Excluding these transactions may create biased indexes if the excluded transactions have systematically different inflation rates. These errors cannot be measured with current methods.[2]

The third concern with administrative trade data is that it is difficult to adjust the data for quality change over time. This is not a major concern for the areas that will be converted to administrative trade data which are mostly under foods, feeds, and beverages and industrial supplies and materials, with a few under

[1]The CPI produces average price indexes as a separate product that does not replace their regular indexes or aggregate up to the main CPI top-level numbers. The indexes calculated from administrative trade data are similar to elementary level items in the CPI and will be part of the regular import and export price indexes and aggregate up to the top-level indexes. In addition, some HS and NAICS indexes will not be 100 percent Census trade data, but will instead be composed of a mix of unique items and items derived from the trade data, because of the way classification groups are combined to form aggregated indexes. Thus, the BLS will continue to call all indexes under the MXPI umbrella price indexes.

[2]It is likely that many such errors are caused by mismeasurement of quantity which would likely be uncorrelated with actual inflation rates.

consumer goods. These areas are not associated with substantial quality changes. Furthermore, any quality changes that do take place would not be measured with current methodology. Areas subject to quality changes such as capital goods, automotive vehicles, and more technically advanced consumer goods are not being converted to administrative trade data at this time.[3]

However, the administrative trade data also provide an opportunity to decrease error in the MXPI. The current sources of error for survey data are a combination of sampling and nonsampling error. The survey data contain sampling error, especially for more detailed indexes, because these indexes may be based on a small number of prices which have different price movements from the population of prices. Sampling error is not relevant to price indexes calculated using administrative trade data because the administrative trade data cover almost all trade transactions. There is a lag between when new goods are introduced and when they can be incorporated into the MXPI sample. These changes appear more quickly in indexes using administrative trade data, essentially eliminating substitution bias in lower level calculations. Thus, differences between the indexes calculated with administrative trade data and current MXPI are expected to reflect an improvement in index accuracy.

The BLS has released research series of administrative trade data indexes and plans to release more in the near future. The initial release contained series of the detailed 5-digit BEA end-use import and export price indexes from 2012 to 2021. The BLS will soon provide updated indexes covering the period from 2017 to February 2024 using an updated classification group mapping. Additionally, the BLS will continue to update the research series to current periods and will provide an overlap of the research data series with the official data series once the transition to including administrative trade records occurs in 2025. The most current version of the research data series are posted to the MXPI research webpage (http://www.bls.gov/mxp/data/research.htm).

2 Background

The import and export price indexes are calculated with a modified Laspeyres formula, using current period prices and fixed trade weights that reflect trade quantities at the time of sampling, and that are adjusted annually. The target population for coverage of these price indexes is merchandise trade, excluding military goods, works of art, used items, charity donations, railroad equipment, items leased for less than a year, rebuilt and repaired items, and custom-made capital equipment. The measures are presented at a national

[3]Miao and Wegner (2022) found that unit value indexes using administrative trade data perform well in some of these areas, in addition to finding that they perform well in the areas covered in this paper.

level and are published using three classification systems; by product with the BEA end-use Classification System and the Harmonized System, and by industry according to the North American Industry Classification System. The estimates are based on a combination of sampled items provided voluntarily by company respondents to the U.S. Import and Export Price Indexes survey and secondary source data published by industry groups and other U.S. government agencies. The company respondents are selected based on a sample drawn from the frame of administrative trade data provided by importers and exporters to the U.S. government for regulatory purposes.

The number of companies and prices that support the MXPI has declined over time. In the 7-year period from 2017 to 2024, there was a 25-percent decline in the monthly number of prices collected, from 21,800 to 16,000. While the quality of the top-level price indexes has been sustained, the reduction in the number of prices has negatively impacted publishability of detailed price indexes and thus the relevance of the statistical measure for data users. The initiative to evaluate the unit prices of administrative trade records to replace prices reported in the directly collected survey started in 2017 in response to the decline in prices collected. The research initiative has successfully shown that unit values from Census administrative trade records can be used in estimating import and export price indexes in many areas because the price indexes using the new source and method show similar trends to the current official measures. The new approach also significantly reduces respondent burden.

3 Data Description

The administrative trade data are made available by the Census Bureau. The BLS has used data dating back to 2011 to evaluate indexes and determine where using administrative data in place of current sources is appropriate. The data contain millions of observations per month covering almost all trade in goods. The BLS calculated unit value indexes for all product areas available in the data to identify good candidates for replacement. The primary advantage of the administrative trade data is that they provide values and quantities for almost all U.S. trade within a month, unlike a voluntary survey which contains a limited number of items in detailed product areas. The primary disadvantage is that the administrative trade data contain less information about the physical goods being traded than is available in the MXPI surveys. The major task of this project was to decide when the administrative trade data contain enough information about the goods being traded to approximate the matched-item model that is currently used in the MXPI surveys.

3.1 Data Timing

The directly collected data and administrative trade data have different coverage within a reference month. In the directly collected survey, prices are collected as the transaction price for the first trade of a product in the reference month. Indexes using administrative trade records account for all transactions throughout the entire reference month when calculating a weighted average unit value for each item. The reporting requirements for administrative trade data extend beyond the calendar month, so that the preliminary estimate of the MXPI will be weighted more heavily towards the beginning of the month. Subsequent revisions to the MXPI will incorporate all transaction records for the reference month that meet data quality verification criteria.

A key challenge of using the administrative trade data is processing the data in time to meet publication deadlines for the MXPI. Importers and exporters have about two weeks to submit the final paperwork associated with each transaction which means the data used to calculate indexes for a month are not fully available in time to be included in initial publication of the MXPI for that month. For this reason, indexes using administrative data will be subject to revisions as more data become available, in line with the current practice with directly collected data.

3.2 Price Concepts

The BLS prefers that directly collected prices are a transaction price in U.S. dollars although prices in the currency traded are also accepted and are converted to U.S. dollars by the BLS. Prices exclude insurance, fees, taxes, and duties. The administrative trade data also exclude insurance, fees, taxes, and duties from the reported value, but the value is always reported in U.S. dollars. This dollar value, in international commercial accounting terms, aligns with the free on board (f.o.b.) cost basis for imports, and the free alongside ship (f.a.s.) basis for exports. In the administrative trade data, the prices are unit values averaged over all transactions in a month with similar characteristics (see the next subsection). The BLS is only using the administrative trade data in places where the indexes calculated with these unit values have been shown to closely approximate the indexes calculated with prices on unique goods in the survey data.

3.3 Selection of Item Characteristics

The administrative trade data contain many characteristics that can be used to create items. These characteristics are defined in Table 1, in addition to the percentage of the time the characteristics are missing.

Using more characteristics helps mitigate unit value bias by increasing the detail associated with each item. However, the more characteristics that are used to create items, the less likely it is that an item will be traded consistently. When an item is not traded it cannot be used to calculate price changes and thus is not included in the index. If items are not traded frequently the potential for bias in the index increases if inconsistently traded items have different inflation rates. The descriptive data in these tables cover the 134 5-digit BEA end-use product categories whose underlying detailed classification groups will be replaced with administrative trade data.

Table 1: List of Variables Used from the Administrative Data

Variable	Availability	% Missing (Imports)	% Missing (Exports)	Description
Required Variables				
Harmonized System Code	B	0	0	10-digit classification number of transaction
Country	B	0	0	Foreign country code
Trading Parties				
Consignee	I	0.11	NA	EIN of party with a legal right to claim goods at the destination. (Typically, equal to importer.)
Importer	I	0.14	NA	EIN of legally responsible party for import.
Manufacturer ID	I	1.57	NA	Identifier of foreign manufacturer. (See Kamal and Monarch)
Exporter	E	NA	0.57	EIN of US Principal Party of Interest
Related Party	B	3.25	1.52	Indicator of whether one of the parties in a trade transaction has a significant stake in the other party.
Domestic or Foreign Export	E	NA	0	Foreign or domestic merchandise
Location				
Foreign Port	I	0.01	NA	Foreign port of departure
Foreign Trade Zone (FTZ)	B	95.16	69.45	Indicator of which FTZ (if any) is involved in the import
Country Subcode	I	0.01	NA	Indicator of special trade agreement location
State	B	0.04	0.51	State where good is exported from
ZIP Code	E	NA	0.80	5-digit location of US party in transaction
Other				
Customs Type	I	2.93	NA	Transaction type code (consumption, warehouse, etc.)
Schedule D	B	0.01	0	Classification of CBP domestic districts and ports

Note:
The table lists the variables used from the administrative trade data. Availability refers to whether the variable is in the E(xport) data, I(mport) data, or B(oth) data sets. The numbers are the fraction of observations (multiplied by 100) with a missing value in the import or export data (according to the column name) at the transaction level from 2011 to 2023.

3.4 Choosing Characteristics using Match-adjusted R-squared

In this subsection, we describe our implementation of the Match-adjusted R-squared (MARS) methodology to select which subset of available characteristics should be used for each classification group to create items. These subsets are called item keys. The methodology was suggested and applied to scanner data

for consumer prices by Chessa (2021). This methodology features a trade off between mitigating unit value bias by using more characteristics in an item key and selection bias. Unit value bias occurs when physical goods with different prices are grouped in the same item. In this case, changes in unit values can reflect changes in which physical goods are being traded within the item, instead of reflecting actual price changes. Determining which characteristics in the data influence the price that goods are traded at is important so that those characteristics can be included in the item key. Then, once the best item key given the data is determined we must evaluate whether the available information is sufficient to create items that are homogeneous. For example, if within a classification group each manufacturer produces only one variety of each good then our data will be sufficient to define homogeneous items even if different manufacturers produce different varieties of the same good. This additional information on transactions is the key reason that this project improves on previous attempts to use administrative data in trade indexes.

Throughout we require that each item key must include the HS code and foreign country code. The HS code is included because it ensures each item is in one classification group (given that classification groups are formed as collections of HS codes). Foreign country is included to consistently calculate Locality of Origin import and Locality of Destination export price indexes with the same set of items used in the main indexes. This last selection means that indexes created with this methodology will not address country substitution bias. This decision was taken in order to maintain the integrity of the locality price indexes given that only one approach to country selection could be made in the face of resource constraints. For each import index we consider 12 characteristics which can be combined to form 638 item keys. For export indexes we consider 8 characteristics which can be combined to form 63 item keys. The primary difference between the variables in the import and export data is that the import data have information on the identity of the foreign manufacturer, while the export data do not contain any information on the foreign party for each transaction. For each potential item key, we calculate two statistics which are proposed by Chessa (2021). The first statistic captures the degree of "item turnover" between periods used in index calculation and the second calculates the degree of homogeneity of items. The statistics are defined such that including more characteristics in the item key (weakly) decreases item turnover and increases homogeneity. Thus, the statistics introduce a formal trade off between item turnover and unit value bias.

Item turnover is defined for a specific item key, W, as:

$$\mu_t^W = \frac{\sum_{k \in K_{b,t}^W} q_{k,t}^W}{\sum_{i \in G_t} q_{i,t}}.$$

In the equation, $K_{b,t}^W$ is the set of items traded in month t that were also traded in the base period with k

an individual item. The quantity associated with each item in month t is $q_{k,t}^W$. The entire set of items traded in month t is represented by G_t with $q_{i,t}$ the associated quantity of each item. When all items traded in a period were also traded in the base period this statistic is one. This result occurs in the case when only a few characteristics are included in the item key. As more characteristics, such as the identities of the trading parties, are included in the key, μ will decrease towards its lower bound of 0.

The degree of homogeneity in the index is calculated as the fraction of variation in transaction prices that is captured by variation in item prices within a month. For a given set of characteristics (item key), W, we calculate a unit value for all transactions that have identical values for the characteristics in W,

$$\bar{p}_t^W = \frac{\sum_{i \in G_t^W} v_{i,t}}{\sum_{i \in G_t^W} q_{i,t}}.$$

We then calculate how much of the variation in transaction unit values is explained by variation in item unit values

$$R_t^W = \frac{\sum_{k \in K^W} q_{k,t}^W (\bar{p}_{k,t}^W - \bar{p}_t)^2}{\sum_{i \in G_t} (v_{i,t} - q_{i,t}\bar{p}_t)^2},$$

where $\bar{p}_t = \frac{\sum_{i \in G_t} v_{i,t}}{\sum_{i \in G_t} q_{i,t}}$ is the unit value across all transactions in a month. This statistic is one if all transactions within an item have the same unit value and decreases when unit values of transactions within an item are more different.

Before calculating the MARS score the outlier filters described later are applied. Doing this ensures that the data used to determine the optimal MARS score match the data used in index calculation as closely as possible.

These statistics are calculated for each month in the historic data, combined within each month using a geometric mean to form a MARS score for a classification group, and then averaged across months and classification groups to form a ranking of item keys for each end-use category. For each end-use category we pick the item key with the highest average MARS score across all months. If multiple keys produce identical scores the shortest key is chosen.[4] This process leads us to choose 25 different keys for imports and 17 different keys for exports, covering the 134 end-use product areas that will use administrative trade data.

Table 2 shows the number of times that each variable appears in the item key. HS code and country are required to be in the item key so they appear in all 134 indexes that will use administrative trade data. Variables, such as foreign trade zone, that are missing a significant portion of the time are rarely chosen. State and ZIP Code can help indicate which establishment of a U.S. firm is performing the trade. These

[4]This typically occurs when a field happens to be the same for all transactions in a BEA end-use index.

variables are included in the item key in about half of the indexes. Finally, specific information about the domestic or foreign firm such as the importer, employer identification number, or manufacturer ID are included in the item key in 10 to 20 indexes each.[5]

Table 2: Frequency of Variable in Item Keys

Variable	**Export**	**Import**	**Total**
Harmonized System Code	62	72	134
Country	62	72	134
Consignee	NA	22	22
Importer	NA	14	14
Manufacturer ID	NA	11	11
Exporter	14	NA	14
Related Party	18	13	31
Domestic or Foreign Export	23	NA	23
Foreign Port	NA	1	1
Foreign Trade Zone (FTZ)	NA	2	2
Country Subcode	NA	0	0
State	33	27	60
ZIP Code	13	NA	13
Customs Type	NA	9	9
Schedule D	6	11	17

Note:
The table shows the number of times each variable appears in the item key. Some variables are only valid for exports or imports which is indicated by an NA.

4 Index Calculation Methodology

This section describes our approach to constructing indexes using the administrative trade data. We begin with all transactions that are not missing value, quantity, country, and HS code.[6] Then, the construction takes place in three steps. First, unit values for each trade transaction are computed from value and quantity. Second, unit values for transactions are combined to form item unit values using a weighted arithmetic mean. Items are defined and grouped by the selected item keys, as described above, within each classification group. Third, the price changes of these items are aggregated to a classification group using a Tornqvist index formula with a base-year strategy. Finally, the classification group indexes are aggregated to create 5-digit BEA end-use indexes using a modified Laspeyres formula which allows this step of aggregation to remain consistent with the current methodology in the official MXPI, and allows us to combine classification groups

[5]When an item key uses information about the domestic or foreign firm any transaction with missing values for the set of those variables included in the key is dropped.

[6]We also drop the transaction if quantity is imputed or if the item key for the transaction uses information about the domestic or foreign firm and that information is missing.

using both administrative trade data and directly collected survey data.

4.1 Calculating Unit Values

The administrative data contain information on the value of shipments and the associated quantity that can be used to form unit values. We calculate the unit value for a transaction by dividing the dollar value by the quantity. The unit value, p, of a transaction, s for any given month, t, is the value of the transaction, $v_{s,t}$ divided by the quantity of units, $q_{s,t}$ in the transaction,

$$p_{s,t} = \frac{v_{s,t}}{q_{s,t}}.$$

The transactions, S_k, associated with some item k are aggregated using a weighted arithmetic mean to form a unit value for each item. The unit value of an item k at some month t is

$$p_{k,t} = \frac{\sum_{s \in S_k} q_{s,t} p_{s,t}}{\sum_{s \in S_k} q_{s,t}}.$$

4.2 Classification Group Indexes

The items, as defined by the selected item keys described above, and for which prices and price changes have been calculated, are then aggregated to the classification group using a Tornqvist formula and the base year strategy (Suopera et al. 2021). The base-year strategy is a method for updating the reference period for an index formula that avoids the potentially substantial drift associated with monthly chaining and the overhead and computational complexity of bilateral methods.[7] In the base-year strategy, the price of an item in each month is compared to the average price of that item in the previous year to form a ratio of price change that we call a mid-term relative (MTR). From year to year the index is constructed by chaining the average prices of items in each year. Thus, the base year strategy only chains once per year, instead of the 12 times a monthly index would chain. We have compared chain drift across potential index calculation methods by calculating indexes in the administrative trade data where the last month of data is artificially replaced with the first month of data which implies the price index level should return to 100. The base-year strategy performs significantly better than a monthly chained index in this test.

The unit value index for classification group c is calculated by aggregating the unit value indexes for the set of items K_c that belong to classification group c using quantity weights from the current month, t, and the

[7] Another benefit of the base-year strategy is that it can more accurately estimate price changes for seasonal items because the price of an item in a month is compared to the previous year, not the previous month.

previous year, $y(t)-1$. Let $V^t_{y(t)-1}$ be the total value **in year** $y(t)-1$ of items traded in the previous year and month t and $V_t^{y(t)-1}$ be the total value **in month** t of items traded in year $y(t)-1$ and month t. Also, let $v_{k,y(t)-1}$ be the current dollar value **in year** $y(t)-1$ of item k and $v_{k,t}$ be the value **in month** t of item k. Then, the classification group price index is

$$r_{c,t} = \prod_{k \in K_c} \left[\frac{p_{k,t}}{p_{k,y(t)-1}} \right]^{\frac{v_{k,y(t)-1}/V^t_{y(t)-1} + v_{k,t}/V_t^{y(t)-1}}{2}}.$$

This equation describes changes in the classification group index between each month and the previous year. This is converted to an index level by starting each index at the level of the corresponding official MXPI index in January of 2025 and advancing it using $r_{c,t}$. Therefore, the index level for a classification group in a month is

$$p_{c,t} = p_{c,y(t)-1} r_{c,t}$$

with $p_{c,0}$ coming from the official MXPI and

$$p_{c,y(t)} = p_{c,y(t)-1} \left(\prod_{k \in K_c} \left[\frac{p_{k,y(t)}}{p_{k,y(t)-1}} \right]^{\frac{v_{k,y(t)-1}/V_{k,y(t)-1} + v_{k,y(t)}/V_{k,y(t)}}{2}} \right).$$

This step shows that the base-year strategy only chains once each year, which results in minimal chain drift.

4.3 Forming 5-Digit BEA End-Use Price Indexes

We focus on aggregating the indexes to the 5-digit BEA end-use product category because that is the level at which decisions about whether to use administrative trade data indexes for a given set of classification group indexes were made.[8] Once the decision regarding whether to replace a 5-digit BEA end-use index with administrative data is made, the classification group indexes under that end-use index will be used as the building blocks for HS and NAICS based indexes as well. These indexes will be combined with price indexes from directly collected data using a modified Laspeyres index formula. The weights used to aggregate from classification group to BEA end-use product category are lagged values for consistency with directly collected data. The weights and classifications used in the MXPI are lagged 12 to 24 months and are updated in January of each year. Let the relevant trade value for the aggregation of classification group c be $v_{c,b}$.

[8] They were made at this level because the limited number of BEA end-use product categories allowed for a manual review of every index produced with this classification system. Additionally, one of the primary uses for the MXPI is deflating imports and exports for gross domestic product which uses this classification system.

Then, the formula for the price index for BEA end-use product category e is

$$r_{e,t} = \sum_{c \in C_e} \frac{v_{c,b}}{\sum_{i \in C_e} v_{i,b}} \frac{p_{c,t}}{p_{c,t-1}}.$$

This is converted to an index level by starting the index at the level of the official MXPI index in January of 2025 and advancing it using $r_{e,t}$. Therefore, the index level for a product category in a month is

$$p_{e,t} = p_{e,t-1} r_{e,t}$$

with $p_{e,0}$ the official MXPI index in January of 2025 if the index was published and 100 otherwise.

4.4 Locality of Origin and Destination Indexes

A subset of country-specific NAICS price indexes, called Locality of Origin (LOO) and Locality of Destination (LOD) price indexes, are used to measure U.S. competitiveness with trading partners. Currently, directly collected prices associated with each LOO or LOD region are combined with region-specific weights to form indexes. Indexes using administrative trade data will be formed by grouping items by country and locality before their unit values are aggregated to price indexes. Locality-specific price indexes will be weighted by the locality-specific dollar value of trade from the transaction to the price index level. Each locality-specific price index is mapped to a classification group and then aggregated to the locality-specific 6-digit NAICS industry category using a modified Laspeyres formula. The BLS hopes to expand the number of LOO and LOD indexes that are published over the next few years.

4.5 Missing and New Items

One benefit of the administrative trade data with the base-year strategy is that imputing prices for missing data at the item level is not needed. For directly collected data, there are attempts to replace discontinued items and contact respondents for missing prices, whereas for the raw administrative trade data no transactions for an item indicate that no trade occurred.

Nevertheless, there are occasions that data must be imputed for a classification group because even though trade occurred in an area, no item has usable data in both the base period and current period. This can occur either when items are not traded frequently or when the items that are traded in both periods have large movements in unit values. In these cases, an index change must be imputed.

New items are generated each month when a not-previously-seen combination of characteristics in an item key occur in the data. When this happens the new item is immediately incorporated into calculations and can start impacting indexes once it has been traded for multiple months. To incorporate administrative trade data items into indexes more quickly their prices in the previous calendar year are "pre-imputed" using price changes for all other items in the same 10-digit HS product category.

When HS codes change, a new price series must be started; if the code change does not substantively change the product description, this new series must be linked to the previous series. The current method for starting a price series, or initialization, is to impute the first price of an item based on the value of the index for the weight group.[9] We improve on this method using administrative trade data by pre-imputing the first price of an item and then using the mid-term relative to calculate the current period price change. The current imputation approach for imputing a missing price at the classification group level does not change.

4.6 Outlier Removal

The administrative trade data are cleaned by the Census Bureau for its international trade data principal federal economic indicator, the FT900 report on U.S. International Trade in Goods and Services. When the data are transmitted to the BLS, they must be further refined to exclude price change outliers that, if included, would have an oversized impact on price movements. The data occasionally contain transactions with mismeasurement in value or quantity that can cause large changes in a price index if not removed. Additionally, in some cases, transactions within an item may represent different physical goods with different pricing trends. We take a three-step approach to determine when transactions should be filtered from index calculation. First, we calculate item prices based on a trimmed mean calculation, eliminating transactions with the highest and lowest prices within the item. Second, we calculate a coefficient of variation across transaction unit values for each item within a month and filter items with a large coefficient of variation. Finally, we filter the largest and smallest price changes within an end-use area in each month. We provide more detail on these steps below.

For the first outlier removal step, a trimmed-mean calculation is applied in the calculation of unit values for each item. Transactions within an item are ranked from lowest to highest unit value, and quantity accounting for 10 percent of the weight of the item from both the high and low ends of the unit value distribution is filtered Individual transactions can either be eliminated, partially eliminated, or not eliminated in this procedure. Items with only one transaction within a month are not affected by this calculation because the dropped quantity has the same unit value as the remaining quantity.

[9] A weight group is a collection of products traded by one company.

For the second outlier removal step, a coefficient of variation—ratio of (weighted) standard deviation to (weighted) mean unit value—within a month for each item is calculated using the transactions associated with that item. Items with the highest coefficient of variation are filtered until none remain with a coefficient of variation over 25 percent or until items representing more than 10 percent of the quantity in an index have been filtered.

The final step is to filter the items with the highest and lowest percent change in price between the current month and the previous year in each end-use category. Within most classification groups the highest 2 percent and lowest 2 percent of price changes are filtered. In some cases, more items are filtered if a manual review of flagged items determines that excluding these items improves the fit of the price indexes with MXPI. This decision was made by reviewing end-use indexes, which implies that all classification groups that comprise a given end-use index have the same trim level. Table 3 shows the number of indexes that have various trim levels. It shows that the majority of indexes are trimmed at the two percent level, but some indexes are trimmed at the 4, 6, 8, and 10 percent level. There is ongoing research into the optimal degree of trimming to exclude items from the index calculation that are not consistent with other prices in the classification group.[10]

Table 3: Count of 5-digit BEA End-Use Price Indexes using Various Trim Levels

Trim (%)	**Export Frequency**	**Import Frequency**
2	34	46
4	6	18
6	13	6
8	5	1
10	4	1

Note:
The percent trim refers to the fraction of price changes that are removed at both the top and bottom of the within month price change distribution. Export Frequency and Import Frequency refer to the number of BEA end-use indexes that have a given percent trim.

As a final data quality check, the classification group indexes that are produced are automatically checked for large index movements and for instances where individual items have large impacts on the index. Index changes above or below a specified (large) threshold are removed and items with large impacts are flagged for manual review. Research conducted by OECD (Miao and Wegner 2022) carries out similar outlier detection and filtering to calculate unit value indexes with similar successful results.

[10] A similar methodology will be used for item price changes between years when the annual chaining is performed each year. This procedure will use different trim percentages.

5 Deciding When to Use Administrative Trade Data

Once indexes were calculated for all areas, each index was reviewed to decide whether it was a good candidate to replace directly collected data. The primary benchmark for the indexes created with administrative trade data is the official MXPI when the relevant index is high enough quality to be published. Published indexes were deemed to be reliable benchmarks and ensuring the administrative trade data produce a similar index implies that changing data sources will not result in a break in series. In these cases, we compare the administrative trade data index to the official price index with directly collected data visually, and using a number of statistical criteria. Indexes with similar trends over time are determined to be good candidates for replacement. In areas where the MXPI are not a good benchmark, we consider statistics related to the variability of the index and, occasionally, whether the index has a similar trend to other available data sources.

After settling on a preliminary list of areas where administrative trade data would be used, a small number of additional areas were identified for which it would no longer be cost effective to continue to directly collect data from respondents. Companies that are included in the MXPI sample often provide prices for goods in multiple classification groups. The most cost effective solution and the best way to decrease respondent burden is to convert all classification groups provided by a respondent to administrative trade data, if possible. Analysts identified a handful of end-use areas where the administrative trade data indexes barely failed the statistical criteria and where using administrative trade data would allow respondents to be completely removed from the MXPI sample. Those areas will also be converted to administrative trade data.

Table 4 shows the number of indexes that contain administrative trade data at the bottom of each classification tree. The decision to use administrative trade data (ATD) was made at the 5-digit BEA end-use level so all 5-digit BEA end-use indexes are either completely administrative trade data or no administrative trade data at all. When a BEA end-use area is switched, all the classification groups that contribute to this area will also be switched which means that classification groups are either 100 percent administrative trade data or zero percent administrative trade data. The lone exception is import natural gas where only one of the two classification groups in this end-use area will use administrative trade data. HS and NAICS indexes are different because the classification groups that are in a given HS code can map to multiple BEA end-use indexes, only some of which are being replaced. Thus, there are multiple indexes that will only be partially calculated with administrative trade data.

Table 4: Count of Detailed Price Indexes using ATD by Classification Tree

Group	Index Type	Complete ATD	Blended ATD	Not ATD
Export	BEA	62	0	68
	HS	695	95	433
	NAICS	145	94	139
	Classification Group	5,488	0	3,919
Import	BEA	72	0	66
	HS	682	145	394
	NAICS	151	110	118
	Classification Group	12,633	0	6,598

Note:
The numbers are the frequency of indexes that are completely ATD, partially (blended) ATD, and contain no ATD by classification tree. BEA refers to 5-digit BEA end-use codes, HS refers to 4-digit HS codes, NAICS refers to 6-digit NAICS codes.

6 Publication Decisions

The use of administrative trade data allows the BLS to increase the number of published MXPI. The BLS determines whether to publish each of the BEA end-use, HS, and NAICS indexes that compose the MXPI based on estimates of the quality of the index and whether an index can be published while maintaining respondent confidentiality. Using administrative trade data decreases the risk of exposing respondent identifiable information and increases the quality of more detailed indexes because of increases in the number of observations in the data.

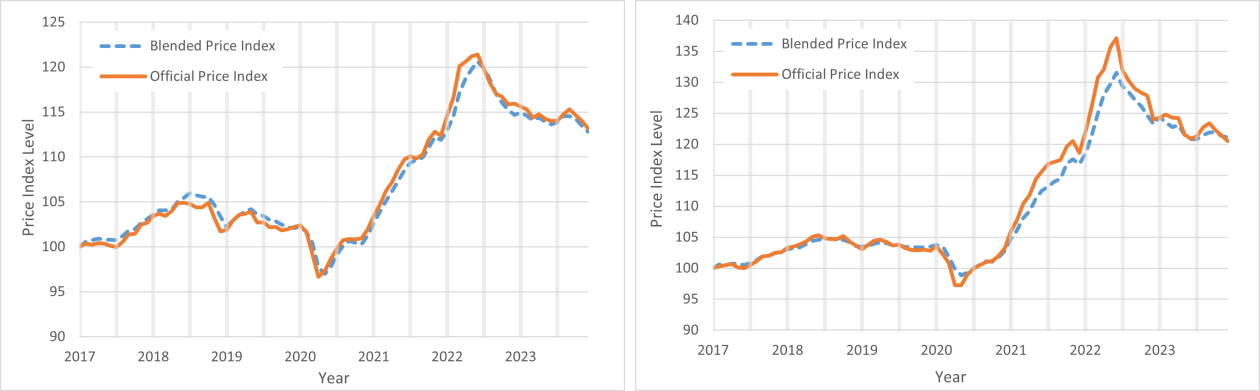
6.1 BEA End-Use Price Index Review

Each of the BEA end-use price indexes that will be converted to administrative trade data was individually reviewed for data quality and confidentiality. These indexes will be published unless there are concerns related to confidentiality or the index was converted to administrative trade data because of the respondent burden criteria discussed in the previous section.

6.2 HS and NAICS Statistical Criteria

The decision on whether to publish HS and NAICS price indexes was based on criteria related to protecting the confidentiality of company identity in the data and criteria related to the quality of inputs and outputs to the index. The BEA end-use indexes produced with administrative trade data all received substantial review to ensure that their quality remained high. However, HS and NAICS classifications are more numerous and

Figure 1: The Impact of Administrative Trade Data on Headline MXPI



(a) Imports

(b) Exports

Note: The figures show our calculation of a headline import and export price index using the blended price indexes compared to the official MXPI.

detailed, and thus there are indexes with minimal trade or where the specific transactions used for that index appear to have substantial variability. Typically, these areas are small parts of the relevant BEA indexes but it would not be prudent to publish the HS or NAICS indexes due to unreasolved concerns around variability. The result of this process is a substantial increase in the number of HS and NAICS indexes that will be published.

7 Impact on Headline Price Indexes

One concern with switching data sources is that the new data source may have significant differences in trends over time. Figure 1 shows that this concern is unfounded. Using administrative trade data from 2017 to 2023 would have had essentially no impact on headline indexes. The blended import index has almost identical levels and shape to the official headline import index. The blended export index is lower between 2021 and 2023 with a maximum difference of about 5 index points, but the cumulative difference between the blended and official index is small. Building the headline index using administrative trade data in place of current data sources leads to indexes that are cumulatively 0.6 index points higher for exports and 0.4 percentage points lower for imports over six years. These results indicate that although there may be differences between administrative trade data and current data sources for individual indexes there is no systematic difference between the two sources.

8 Data Processing During the Revision Period

The incorporation of administrative trade data may cause changes in the size of revisions of the MXPI. The MXPI are revised three times with monthly releases before being considered final. The administrative trade data are released to the BLS in multiple "cuts" as the data become available to the Census Bureau, because reporters have weeks to file final paperwork. Because of these delays and the publication schedule of the MXPI the initial release of each index will be based on the data that are available around the final date of the statistical month; those data should include most trade from earlier in the month, but will be missing much of the trade from the second half of the month. One particular concern is that exports to Canada are significantly underrepresented in the data used for the initial release of the MXPI. To compensate for that we use the last five days of the previous month in the initial release of data for trade with Canada, while also excluding those five days from calculation for the previous month. Lagged prices for trade with Canada are available and accounted for in their actual month by the second revision month of publication.

9 Conclusion and Next Steps

The BLS will use administrative trade data for multiple areas beginning with the data release in March 2025. This change is happening after years of research have documented that the unit values available in the administrative trade data produce indexes that closely track the official MXPI in the areas being replaced. This change will allow the BLS to greatly increase the number of published indexes and to update trade weights on a more frequent basis while decreasing respondent burden. Ongoing work aims to increase the number of published indexes and improve estimates of index variability.

10 Appendix

Table A1: Percentage of Merchandise Goods Trade Weight Represented by ATD

Year	Export (%)	Import (%)
2019	38	36
2020	40	37
2021	40	36
2022	42	36
2023	45	38
2024	48	39

Note:
Numbers represent the share of trade weight that would have used administrative trade data in previous years for imports and exports.

Table A2: Number of Classification Groups covered by Administrative Trade Data

	Import			Export		
Year	**Total**	**Covered by ATD**	**All months recorded trade**	**Total**	**Covered by ATD**	**All months recorded trade**
2017	11,707	6,594	4,466	7,631	4,223	2,972
2018	11,902	6,735	4,691	7,639	4,231	3,051
2019	12,317	7,014	4,831	7,910	4,386	3,093
2020	12,489	7,153	4,809	7,979	4,451	3,001
2021	12,533	7,187	5,062	7,982	4,454	3,122
2022	12,598	7,218	5,027	7,986	4,458	3,064
2023	18,840	12,426	7,475	9,156	5,415	3,539

Note:
CGs refer to classification groups which are similar to 10-digit harmonized system codes. The columns represent the number of CGs, how many would have been covered by administrative trade data (ATD), and a count of how many of the CGs that would have been covered by ATD report trade in each month of the year.

Table A3: Average Monthly Number of ATD Records Processed by Step in Calculation

	Import	**Export**
Raw transactions	3,294,484	978,003
Useable transactions		
All	3,156,868	837,375
Filtered to account for outlier exclusion	2,121,706	565,257
Final unique items	415,089	146,137

Note:
The first row of the table shows the average number of monthly transactions received by the BLS from the Census Bureau from 2017 to 2023 in the areas that will use ATD. The second row excludes transactions with missing or imputed quantity. The third row additionally excludes transactions that are completely removed at one of the outlier removal steps. The final row shows the average number of items used in all ATD-based indexes.

Table A4: Monthly Item Summary Statistics by Classification Group

Year	Type	CGs with Positive Trade	Total items	Mean	Median	Standard deviation	25th%	75th%
2015	Export	4,014	151,842	38	13	73	4	40
	Import	6,010	356,408	59	14	183	4	46
2016	Export	4,008	141,518	35	12	69	3	36
	Import	6,018	349,663	58	13	179	3	44
2017	Export	4,025	145,207	36	12	70	4	37
	Import	6,113	365,228	60	13	183	4	45
2018	Export	4,048	146,898	36	12	71	4	37
	Import	6,207	388,202	63	14	206	4	46
2019	Export	4,216	150,702	36	11	74	3	36
	Import	6,516	430,754	66	13	262	3	46
2020	Export	4,338	140,607	32	10	70	2	31
	Import	6,690	403,491	60	12	255	3	42
2021	Export	4,334	149,309	34	10	75	3	34
	Import	6,763	453,809	67	13	269	3	47
2022	Export	4,327	149,289	35	10	75	3	34
	Import	6,813	466,845	69	13	271	3	48
2023	Export	5,187	147,146	28	9	61	2	28
	Import	11,356	461,240	41	8	187	2	28

Note:
The numbers represent the number of classification groups (CGs) with positive trade at all during the year (column 3) and monthly summary statistics on the distribution of the number of items that are created for classification groups. Mean is the average number of items per classification group with positive trade and is the ratio of the two relevant columns. The 25th% and 75th% refer to the number of items such that 25 or 75 percent of classification groups have fewer items than that number. Classification groups for 2023 were subject to a major revision that increased the total number of groups.

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