U.S. Bureau of Labor Statistics

PPI Nonresidential Building Construction Initiative:

An Overview

19 November 2008

Presentation Outline

- Overview of the Producer Price Index
- Background on PPI Nonresidential Building Construction Initiative
- New Building Construction Index Methodology
- New Building Construction PPI Trends & Analysis
- Specialty Trade Contractor Index Methodology
- Specialty Trade Contractor PPI Trends & Analysis
- Review of Nonresidential Building Construction PPIs
- Potential areas to expand the NRBC initiative

PPI history

- First published in 1902
- Known as the ‘Wholesale Price Index (WPI) until 1978
- Focused initially on Mining and Manufacturing Sector industries
- Since 1996 has been adding Service Sector industries
- Since 2005 has been adding Nonresidential Building Construction indexes

PPI scope

- The PPI is a voluntary monthly survey
- Covers more than 700 industries (NAICS-based)
- Includes over 25,000 participating firms
- Tracks prices for over 110,000 goods & services
- Publishes more than 10,000 indexes monthly (most are national average measures) within 2-3 weeks of the reference month

PPI Definition & Goal

- The Producer Price Index (PPI) measures average changes in prices received by domestic producers for their output

- The Goal of the PPI is to measure price trends by capturing price information for a representative sample of items from a representative sample of producers in each in-scope industry

PPI methodology

- In concept, the Producer Price Index is calculated according to a modified Laspeyres formula:

$$I_t = (\Sigma Q_a P_t \,/\, \Sigma Q_a P_o) \times 100$$

- where
  - *It* is the price index in the current period;
  - *Po* is the price of a commodity in the comparison period;
  - *Pt* is the current price of the commodity; and
  - *Qa* represents the quantity shipped during the weight-base period

PPI index classifications

- Industry Classification
  - Establishment-based
  - Compatible with other economic time series
  - Conversion to NAICS from SIC effective January 2004

- Commodity Classification
  - Product-based
  - Unique to the PPI

- Stage-of-Processing
  - Class of buyer/Degree of Fabrication
    - Finished Goods (Copper wire)
    - Intermediate Materials (Copper mill shapes)
    - Crude Materials (Copper ore)

- Special Groupings
  - Inputs to Construction industries

PPI establishment sampling

- Establishments selected from the universe of firms classified in an industry
- Probability proportionate to size sampling methodology
- Sampled firms visited by a BLS Economist to select specific products/services

PPI item sampling

- Probability sampling technique 'disaggregation' used to select specific and unique items

- Detailed item description and specific transaction price collected

PPI monthly pricing process

- Each month forms for each item a firm has agreed to ‘price’ for the PPI are sent
- Forms completed and returned to the PPI by participating firms
- Data reviewed, corrected, and validated as necessary by a staff of 50 Economists

PPI industry resampling

- On average, the PPI selects new establishment and item samples for each industry about every 6 years

PPI primary uses

- Economic indicator---PPI for Finished Goods most often cited
- Deflator—Bureau of Economic Analysis (BEA) uses PPI data to deflate nominal GDP (Gross Domestic Product) estimates to ‘real’ GDP estimates
- Contract escalator—Businesses use PPI data to adjust input and output prices specified in contracts

Selected Aggregate PPIs

PPI Index	BLS Series ID	Sept 2007 – Sept 2008
Finished Goods	WPUSOP3000	+8.7%
Intermediate materials, supplies, and components	WUPSOP2000	-1.2%
Crude materials for further processing	WUPSOP1000	-7.9%
Inputs to Construction Industries	PCUBCON	+13.1%

Selected Construction Material PPIs

PPI Index	BLS Series ID	Sept 2007 –Sept 2008
Ready-mixed Concrete	WPU1333	+3.3%
Precast concrete products	WPU1334	+4.5%
Copper and brass mill shapes	WPU102502	-2.9%
Aluminum mill shapes	WPU102501	+4.1%
Cement	WPU1322	-1.7%
Diesel fuel	WPU057303	+39.0%
Lumber and plywood	WPUSI004011	-3.4%
Fabricated Steel Plate	WPU1076	+32.9%
Copper pipe and tube	WPU10250239	-7.0%
Electric wire and cable	WPU10260301	+3.6%
Steel Mill products	WPU1017	+38.2%
Asphalt paving mixtures & blocks	WPU136	+51.2%
Gypsum products	WPU137	+1.7%

NRBC Initiative Background

- Measuring Price Changes for construction is a longstanding problem
- See *Stigler Committee Report,* 'The Price Statistics of the Federal Government, from the National Bureau of Economic Research (1961)' and others
- Structures not mass produced at fixed locations in regular intervals using consistent inputs and methods.
- Difficult to measure construction price changes using standard approaches

NRBC Initiative

- Goal: Develop output price indexes for the nonresidential building construction sector of the U.S. economy

- Catalyst: BEA need for improved GDP deflators

NRBC Initiative Chronology

- **December 1997:** Proposed joint BLS-Census-BEA research leading to NRBC price indexes
- **FY1998:** Cross-agency meetings. BLS conducts preliminary research.
- **FY 1999:** BLS conducts Pilot Study of experimental methodology.
- **FY 2000:** NRBC initiative not funded. Project suspended.
- **FY 2001:** NRBC initiative funded. Project re-started.

NRBC Initiative: Scope & Status

Index	Status	Public Release
New Warehouse Building Construction	Publication	July 2005
New School Building Construction	Publication	July 2006
New Office Building Construction	Publication	January 2007
New Industrial Building Construction	Publication	January 2008
Nonresidential Electrical Contractors	Publication	July 2008
Nonresidential Plumbing, Heating, and Air-Conditioning Contractors	Publication	July 2008
Nonresidential Roofing Contractors	Publication	July 2008
Nonresidential Concrete Contractors	Publication	July 2008

Building Index Methodology

- BLS uses building model-based pricing approach
- BLS uses professional construction cost-estimating firm to develop building models
- BLS uses building models developed for distinct geographic regions (NE, S, W, and MW) for each building type

Building Index Methodology

- BLS uses secondary source input cost data from the cost-estimating firm
- BLS directly collects Overhead & Profit data from building contractors
- BLS combines secondary source data with directly collected data to estimate output price

Building Index Methodology

- **Step 1:** Establish building model specifications
- **Step 2:** Select survey respondent samples
- **Step 3:** Select building assemblies for pricing
- **Step 4:** Update building model specs and costs

Building Index Methodology: Step 1 Model Building Specifications

- Purchase actual building project data, both public and private construction, for specific building types [Building data includes location, size, structural data, and participating building contractors]

- Develop and select high-level building model specifications for each regional model based on the observed data [High-level specs include roofing material, structural framework material, exterior wall material, and building size]

- Select actual projects meeting high-level building model specifications to serve as the PPI regional models

Warehouse Model High-Level Specifications

Warehouse Model: Midwest
Stories: 1
Square footage: 400,393 SF
Building frame: Steel
Exterior wall: Tilt-up Concrete Panels
Roof: Ethylene Propylene Diene Monomer (EPDM)
HVAC: Gas Heat, Electric Cooling (office areas only)
Percent of office space: 10%

Building Index Methodology: Step 1 Model Building Specifications

- Professional Cost Estimating firm completes each building model using actual building plans
- Each model consists of a series of building ‘assemblies’ which represent a single job that would be the responsibility of a specific type of trade contractor (Models have 50 -100 assemblies.)
- Each assembly is further broken down into component lines which provide additional detail about the material, labor, and equipment used to produce the assembly

Building Index Methodology: Step 1 Model Building Specifications

- Models are actual buildings selected to represent typical construction for building type within each region
- Models use regional average material and installation costs
- Assemblies represent all of the tasks necessary to construct the building model
- Models do not include costs for land acquisition, permitting, architectural or engineering services, pre- or post-construction site preparation

NRBC Building Models

NRBC Building Models						
	Warehouses (2003)	*Warehouses (2008)*	*Schools (2004)*	*Offices (2005)*	*Industrial (2006)*	
Northeast	• 1 Story • 37,500 SF	• 1 Story • 42,300 SF	• High School • 200,100 SF	• 54 Stories • 1,600,000 SF	• Food Processing Plant • 86,300 SF	
South	• 1 Story • 37,500 SF	• 1 Story • 320,567 SF	• Elementary • 78,100 SF	• 10 Stories • 460,750 SF	• Auto Assembly • 812,500 SF	• Auto Parts Plant • 80,000 SF
Midwest	• 1 Story • 25,000 SF	• 1 Story • 400,393 SF	• Middle School • 106,000 SF	• 1 Story • 50,000 SF	• Printing Plant • 41,600 SF	• Chemical Plant • 168,000 SF
West	• 1 Story • 100,000 SF	• 1 Story • 83,077 SF	• Elementary • 61,400 SF	• 3 Stories • 125,000 SF	• Plastics Mfg • 106,000 SF	

School Building Model – High Level Specifications

School Model: Midwest Junior High School
Stories: 1
Square footage: 106,000 SF
Building frame: Steel
Exterior walls: Brick veneer over concrete
Roof: Ethylene Propylene Diene Monomer (EPDM)
HVAC: Multi-zone AC
Student capacity: 1,000
Rooms included: Standard classrooms-22; multipurpose rooms-2; science labs-6; administration-1; library-1; gym/lockers-1; cafeteria-1

Office Building Model – High Level Specifications

Office Building Model: Midwest	
Stories: 1	Elevators: none
Square footage: 50,000 SF	Entrances: 16
Building frame: Steel	Lavatories per floor: 10
Exterior wall: Curtain wall of glass and metal	
Roof: single-ply membrane	
HVAC: Rooftop single-zone AC	
Occupancy: 375	

Industrial Building Model – High Level Specifications

Industrial Building Model: Midwest Chemical Plant
Stories: 2
Square footage: 168,000 SF
Building frame: Steel
Exterior wall: Steel siding
Roof: Built-up Roof
HVAC: Rooftop single-zone AC
Elevators: 4
Special equipment: Laboratory equipment

Building Index Methodology: Step 2 Survey Respondent Samples

- Develop respondent samples by type of contractor and region
- Include firms that performed work on, or bid on, a new project of each specific building type in the last three years
- Use data from purchased project file, trade associations, and trade journals

NRBC Buildings PPI Methodology: Step 2 Survey Respondent Samples

- Survey respondent samples were selected for the following six building contractor categories by region:
  - General contractors
  - Electrical contractors
  - Plumbing, heating, and air-conditioning contractors
  - Roofing contractors
  - Concrete contractors
  - Other trade contractors

Building Index Methodology: Step 3 Building Assembly Selection

- General Contractors provide OH&P figure for managing the project based on total estimated costs
- Trade (installing) Contractors provide OH&P figure based estimated input costs for selected building assemblies
- Use Probability, random, and judgmental selection methodologies to determine which assemblies each respondent will price
- Maximum of four assemblies priced by each respondent (contractor)

Building Index Methodology: Step 4
Monthly Updates

- Respondents are provided specification description and input cost information
- Respondents price a ‘new’ bid when calculating OH&P percentage
- Respondents provide updated OH&P percentage for each assembly being re-priced

Building Index Methodology: Step 4
Quarterly Updates

- Material and installation costs for models updated every three months by the cost-estimating firms based on regional cost data collected through their on-going surveys
- Models are reviewed for percentage changes in components, assemblies, and total
- Percentage changes are reviewed for reasonableness based on changes in PPI's and industry reports
- Questions on cost anomalies are forwarded to the vendor for verification and explanation

Estimating an Output Price for a Building Assembly

Data Provided by Cost Estimating Firm (Installing contractor: Overhead Door)							Data From Respondent	Estimated Output Price
Source	**Description**	**Quantity**	**Unit**	**Material Cost**	**Installation Cost**	**Total Input Cost**	**OH&P Percentage**	**Total Price**
Assembly	Door, steel 24 gauge, overhead, sectional, electric operation,12'-0" x 12'-0" opening	5	Opng.	$7,287.20	$2,715.82	$10,003.02	10% on Materials, 20% on Installation	**$11,274.90**
Component	Overhead commercial, no frame, steel, 24 gauge sectional, manual, 12' x 12' high	5	Ea.	$4,343.17	$1,973.54	$6,316.71		
Component	Overhead, for electric trolley operator, 1/3 H.P., to 12' x 12', add	5	Ea.	$2,944.03	$742.28	$3,686.31		

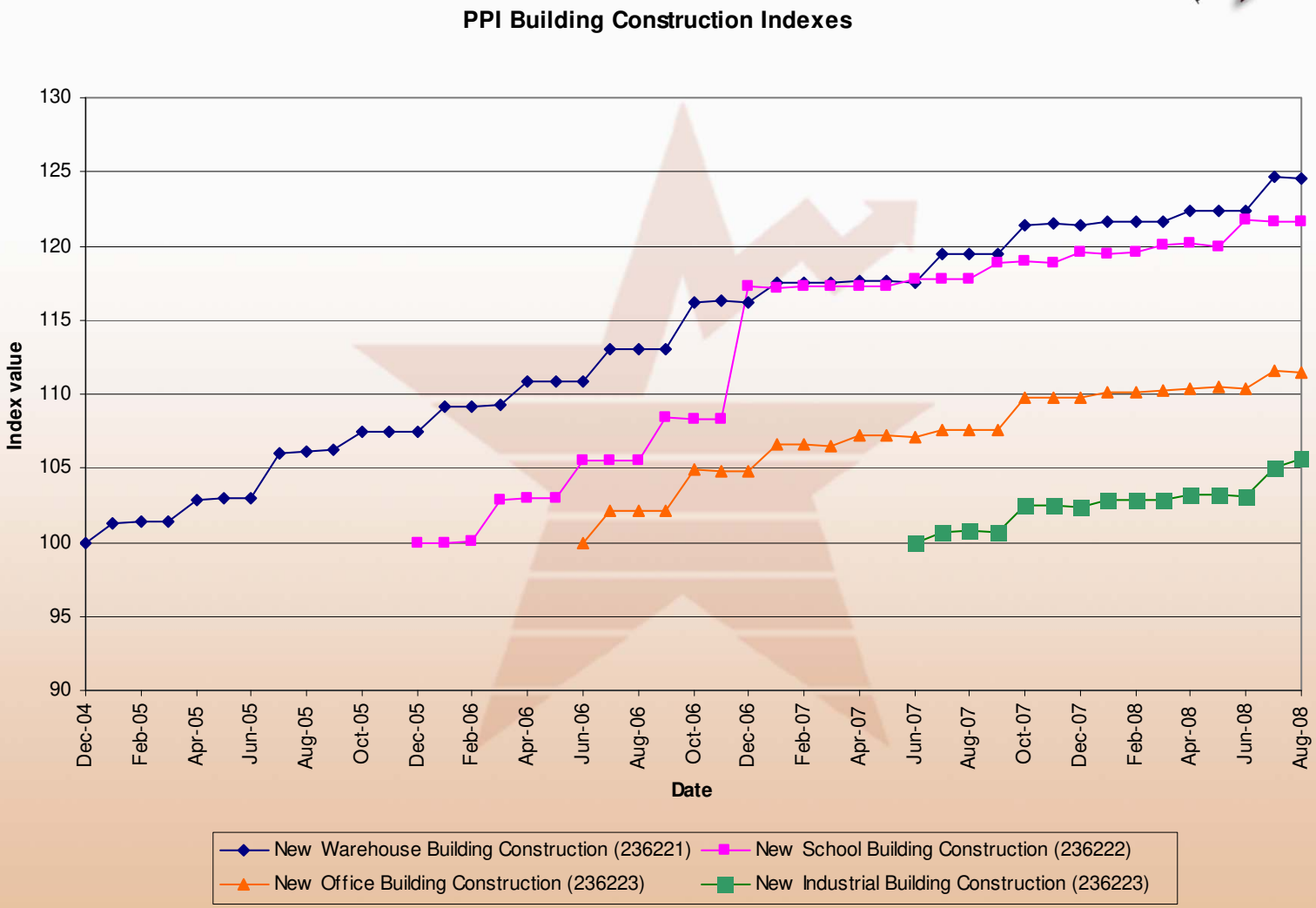
Building Model Re-specification

- Models scheduled to be re-specified every five years
- Warehouse models re-specified in 2008
- School models will be re-specified in 2009

Updated Warehouse Building Models

- The updated (2008) warehouse models are larger in terms of square footage of the floor area and taller in terms of building height
- The 2008 warehouse models reflect both single and multi-tenant designs
- Roofing materials have changed to reflect the increased use of newer, more energy-efficient materials
- Newer types of sprinkler systems such as the Early Suppression, Fast Response system have been incorporated
- Skylights are now included, which reflects the trend toward using more natural lighting and 'green' building construction
- The updated warehouse models include more energy-efficient lighting and HVAC systems

Index Trends – New Building Construction



Index Analysis - New Building Indexes

- Material Costs—Rising roughly 2-3 times installation costs
  - Represent about 62% of total input costs
  - Rising Steel Prices
  - Rising Concrete Prices
  - Rising Copper and Aluminum prices

- Installation Costs
  - Represent about 38% of total input costs
  - Rising labor costs
  - Rising fuel costs

- Changes in contractor OH&P
  - 5% of contractors typically report changes each month
  - OH&P decreases have been outnumbering increases recently

Index Methodology - Specialty Trade Contractors

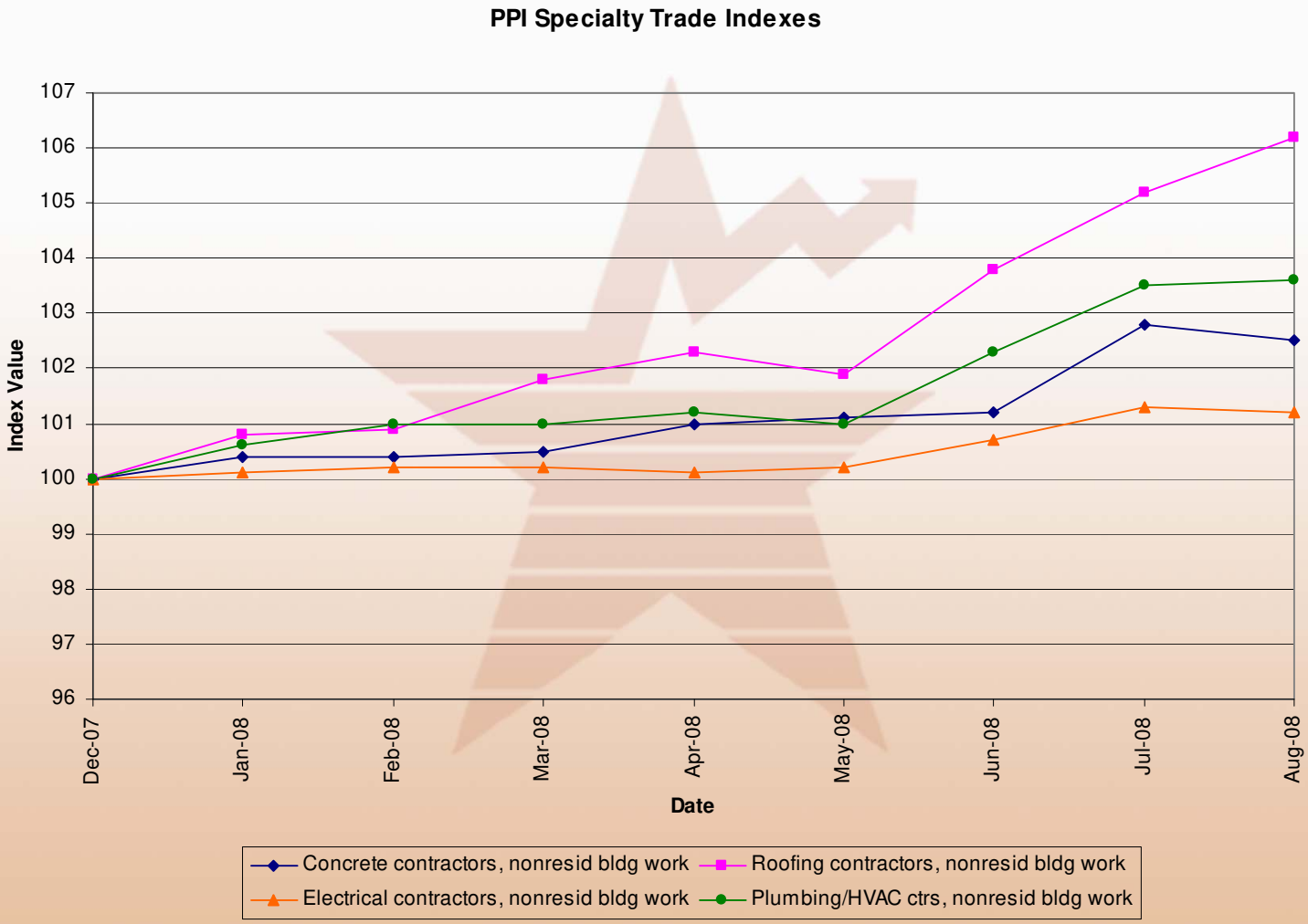
- BLS collects price data on maintenance and repair work directly from respondents on four trades (concrete, roofing, electrical, plumbing/HVAC)
- Work performed on any nonresidential structure (public or private) is considered in-scope
- Maintenance and repair jobs are actual jobs performed by respondents
- Each of the four trade contractor indexes is created by aggregating contractor-specific data previously collected for new construction activities for the four building types (warehouses, schools, offices, and industrial buildings) with data separately collected for maintenance and repair work performed by each of the contractors.

Maintenance & Repair Pricing Example

Maintenance/Repair Job. Customer name: XYZ, Inc. Customer/Job identification number: 903246-01. Maintenance/repair identification: Scheduled repair on a Built-up Roof (BUR). Nonresidential building type: Warehouse. Size of maintained/repaired area 35,000 sq ft. Reason for service: deterioration of surface coating due to weather damage.

Description	Rate	# of units/hours	Units/hours X rate
Labor	$75.00/hr	2 hours	$150.00
Shingles	$35.25/bundle	8 bundles	$282.00
Truck surcharge	$1.10/mile	30 miles	$33.00
Subtotal			$465.00
Overhead & Profit	15%		$69.75
Total Rate			$534.75

Index Trends – Specialty Trade Contractors



Index Analysis - Specialty Trade Contractor Indexes

- Material Costs—Rising faster than installation costs
  - Represent about 60% of total input costs
  - Passed on quickly to customer

- Installation Costs
  - Represent about 40% of total input costs
  - Rising due to labor costs
  - Rising due to increased implementation of fuel surcharges

- Changes in contractor OH&P
  - 5% of contractors typically report changes each month for new work
  - Approximately 3% of contractors typically report changes each month for maintenance & repair work
  - OH&P decreases also being reported for maintenance & repair work recently

Published Building Construction PPIs

Code	Title	Description
236211	New Industrial Building Construction	Measures the changes in output prices for new industrial building construction. Includes material, installation, and OH&P charges. Public and Private construction included.
236221	New Warehouse Building Construction	Measures the changes in output prices for new warehouse building construction. Includes material, installation, and OH&P charges. Public and Private construction included.
236222	New School Building Construction	Measures the changes in output prices for new school building construction. Includes material, installation, and OH&P charges. Public and Private construction included.
236223	New Office Building Construction	Measures the changes in output prices for new office building construction. Includes material, installation, and OH&P charges. Public and Private construction included.

Published Specialty Trade Contractor PPIs

Code	Title	Description
23811X	Concrete Contractors, Nonresidential building work	Measures the changes in output prices for new, maintenance, and repair work performed by Concrete contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.
23816X	Roofing Contractors, Nonresidential building work	Measures the changes in output prices for new, maintenance, and repair work performed by Roofing contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.
23821X	Electrical Contractors, Nonresidential building work	Measures the changes in output prices for new, maintenance, and repair work performed by Electrical contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.
23822X	Plumbing/HVAC Contractors, Nonresidential building work	Measures the changes in output prices for new, maintenance, and repair work performed by Plumbing/HVAC contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.

Unpublished Specialty Trade Contractor PPIs

Code	Title	Description
238113	Concrete Contractors, Nonresidential building maintenance and repair work	Measures the changes in output prices for maintenance and repair work performed by Concrete contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.
238163	Roofing Contractors, Nonresidential building maintenance and repair work	Measures the changes in output prices for maintenance and repair work performed by Roofing contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.
238213	Electrical Contractors, Nonresidential building maintenance and repair work	Measures the changes in output prices for maintenance and repair work performed by Electrical contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.
238223	Plumbing/HVAC Contractors, Nonresidential building maintenance and repair work	Measures the changes in output prices for maintenance and repair work performed by Plumbing/HVAC contractors on nonresidential buildings. Includes material, installation, and OH&P charges. Public and Private construction included.

Areas for Potential Expansion of the PPI Construction Initiative

- Additional Nonresidential Buildings
  - Hospitals
  - Retail/Multimerchandise
  - Communication
  - Lodging
  - Higher-education
- Heavy and Civil Engineering Construction
  - Highways and streets
  - Bridges
  - Power plants
- Residential Construction
  - Multifamily housing