



Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Some evidence on factor intensity and price rigidity

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ARTICLE INFO

Article history:

Received 16 October 2009

Received in revised form

3 February 2011

Accepted 23 March 2011

Available online 7 May 2011

JEL classification:

E30

Keywords:

Price rigidity

Factor intensity

ABSTRACT

This paper establishes a new empirical finding: the degree of labor intensity and the degree of price flexibility are negatively correlated across industrial sectors in the U.S. economy. This finding suggests that varying factor intensity can potentially generate different degrees of price stickiness across sectors and remove the need to exogenously impose the latter. Of course, labor intensity is just one more feature—in addition to others like the durability of goods produced and the degree of competition—that can explain some of the heterogeneity in price durations across sectors.

Published by Elsevier B.V.

1. Introduction

This paper finds a new industry characteristic that can explain observed differences in the degrees of price stickiness across U.S. industrial sectors. Using disaggregated data & establish that there is an inverse relationship between the degree of labor intensity and the degree of consumer price flexibility across industries.

Numerous studies indicate that the frequency of nominal price changes differs significantly across sectors of the economy.¹ For some goods and services the nominal price remains unchanged for years, while for others the price lasts less than a month. With the evidence of substantial heterogeneity across and within the sectors steadily accumulating, several studies explore product characteristics that might explain why some goods have flexible prices and others have sticky prices. Carlton (1986) and Caucutt et al. (1999) use the inverse of the concentration ratio as a measure for market competition and find a positive relationship between the degree of market competition and the frequency of price changes. Bils and Klenow (2004) look at different variables related to market competitiveness: the wholesale mark-up, the four-firm concentration ratio, and the rate of introducing substitute products. While they also find that prices of goods sold in more competitive markets change more frequently, Bils and Klenow (2004) discover that not all variables related to market competitiveness are robust predictors when controlling for whether a good is raw or processed. They conclude that the frequency of price changes is clearly related only to the importance of product turnover and the importance of raw materials. Both Bils and Klenow (2004) and Klenow and Malin (2011) show that raw goods display more frequent price changes than processed goods and services. The latter two studies also find that there is a positive correlation between durability and price flexibility. As for a correlation between input shares and frequency of price adjustments, a paper that also reports the labor share to be a significant determinant of the frequency of price adjustments is Alvarez et al. (2010), whose finding is based on Spanish producer price data.

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E-mail address: ekaterina.v.peneva@frb.gov¹ For example, see Carlton (1986), Cecchetti (1986), Kashyap (1995), Bils and Klenow (2004), and Nakamura and Steinsson (2008).

Three empirical findings have motivated this paper. First, as mentioned above, numerous studies indicate that the frequency of nominal price changes differs significantly across sectors of the economy. The evidence suggesting that prices are sticky has motivated the assumption of general nominal price stickiness in the Keynesian models. In these models, monetary policy shocks have real effects. In the opposite direction, the neoclassical literature relies on evidence² of flexible nominal prices of relatively homogenous commodities like food, gasoline, and computers, and assumes prices to be perfectly flexible. The evidence from recent empirical studies shows that not only sectors differ greatly in the frequency of price changes but also that the effects of monetary policy shocks differ across sectors.³

Second, with regard to wages, Taylor (1999) summarizes the direct and indirect evidences on wage stickiness and concludes that one-year wage contracts are the most common setting for the United States and are prevalent for both union and non-union workers.⁴

Third, production sectors vary in factor intensity. Based on a sectoral input–output database, Jorgenson and Stiroh (2000) provide data on the values of output and inputs employed by 35 industrial sectors in the United States. The share of labor, for example, varies from 0.09 in the petroleum and coal products industry to 0.5 in the trade industry.

The empirical evidence that factor intensities vary significantly across sectors, along with the findings on wage and price staggering, suggest looking for a relationship between the share of labor input and price stickiness. It is possible that the significant amount of wage rigidity along with the heterogeneity in factor intensity play a role in the cost pass-through and the heterogeneity in price rigidity. The contribution of this study is the finding that the degree of labor intensity and the degree of price flexibility are negatively correlated across industrial sectors in the U.S., and this negative correlation is not driven by a few labor-intensive sectors. The finding is based on micro-level consumer pricing data and holds even if price changes due to temporary sales are excluded.

2. Data on labor intensity and frequency of price changes

Bils and Klenow (2004) paper includes a dataset containing the average frequencies of price changes and substitutions for 350 categories of goods and services covering about 70% of consumer spending. The dataset is based on unpublished U.S. Bureau of Labor Statistic (BLS) data over the 1995–1997 period. Intrigued by the dramatic range of price-change frequencies across the 350 Entry Level Items (ELIs), Bils and Klenow (2004) take upon exploiting this diversity. They match most of the Entry Level Items (ELIs) to 123 National Income and Product Accounts (NIPA) categories.⁵ This allows them to use the NIPA time series on prices and study the correlation between the frequency of price changes and the persistence and volatility of inflation across the goods categories.

I use Bils and Klenow (2004) dataset but I focus on the relationship between labor intensity and frequency of price changes. The motivation for this analysis comes from the observation that in the bottom 10th percentile of the Bils and Klenow (2004) data (i.e. the ELIs whose prices change least often—less than once a year) 82.6% are services, an industrial category characterized by relatively high labor intensity. On the other hand, of the 10% of the goods and the services with the most flexible prices, only 7.6% are services. So it is interesting to see whether labor intensity might explain why the prices of dry cleaning, newspapers, vehicle inspection, and other similar services remain unchanged for 4–5 years, while the prices of gasoline and tomatoes on average remain unchanged for less than a month. While this observation plays an important role for the motivation, the main finding holds more broadly across sectors and is not driven by the services sector only. Bouakez et al. (2009), who use Jorgenson's database for sectoral input expenditures as well, also note that services sectors are labor intensive and that price rigidity is mostly concentrated in services but do not explore the relationship between price rigidity and labor intensity further. Rather, they examine the relationship between the sectoral degree of price stickiness and inflation responses.

Similar to Bils and Klenow (2004), I group the ELIs. The level of aggregation in this analysis, however, is driven by the data availability for sectoral input expenditures. Dale Jorgenson's data, Jorgenson and Stiroh (2000), on sectoral input expenditures are only available for 35 sectors at roughly the two digit level of the Standard Industrial Classification (SIC). Jorgenson's dataset contains information on the value of employed inputs (capital, labor, materials, and energy) as well as the value of output for each industrial sector for the 1958–1996 period. Using the SIC system, I manually match the 350 ELIs into one of the sectors in the Jorgenson's database by which these goods and services were produced. The ELIs can be matched to 29 out of the 35 sectors but many of the SIC sectors are broader. Table A.1 shows the industrial sectors and the number of ELIs assigned to each sector. For each industry, the table shows average monthly frequency of price changes, the sector's weight, and the share of labor inputs. The frequencies are computed as the weighted average of the frequencies of the category components, with weights given by the share of each ELI in the 1995 Consumer Expenditure Survey (CEX).

² See Dutta et al. (2002) and Davis and Hamilton (2004).

³ Ohanian et al. (1995) show that the real effects of monetary disturbances differ across sectors because of variation in the degree of price stickiness, and Bouakez et al. (2009) find that heterogeneity in price stickiness is the most important factor for the heterogeneity in sectoral inflation responses.

⁴ Direct evidence on wage setting shows that there is some heterogeneity in the wage setting (Cecchetti, 1987; Taylor, 1983; Card and Hyslop, 1997). I am not aware of studies presenting evidence for significant differences in the average duration of wage contracts across various sectors of the economy. Furthermore, using macroeconomic data for the U.S., Taylor (1993) estimates that about 80% of workers have annual wage contracts.

⁵ NIPA is a collection of statistics on aggregate economic activity in the United States, published by the Bureau of Economic Analysis (BEA). It contains estimation of Gross Domestic Product (GDP) and its components, classified by type of product, sector, and industry.

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