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Minimum wage and food prices: an analysis of price pass-through effects

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Abstract

An Input-Output model is used to analyze price pass-through effects of a minimum wage increase on prices of the food and kindred product and food-service industry. Although these sectors employ a disproportionate share of minimum wage workers, our results suggest a $0.50 increase in the minimum wage would minimally affect food prices.

1. Introduction

Should consumers care if the minimum wage is increased? For those old enough to remember the cost-push inflation years of the 1970s, the response may well be an affirmative nod. For younger consumers, it may be more of an open question. Should managers in the food processing and food services industries care if the minimum wage is increased? Higher wages could lead to higher labor and total costs, which means lower profits unless the firms are able to raise output prices. For consumers, higher costs for business could mean higher consumer prices, which may lead to a decline in consumers' real purchasing power. Certainly both consumers and firm managers potentially have a stake in a higher minimum wage. The crucial question is whether that is all it is, a potential care, or whether it is significant enough that they should really care.

Because of the nature of employment needs in food processing and eating and drinking

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places if there were a group of consumers that could be vulnerable to the potentially higher prices from a higher minimum wage, it would be food consumers. And, because of the larger role of food expenditures in lower income households' budgets, if food prices rise enough a minimum wage increase could more severely affect those consumers it was designed to help. We examine how increases in the minimum wage will affect food prices. More specifically, we assess the likely increases in output prices in the food and kindred industry and eating and drinking places when a minimum wage increase is passed on to output prices.

In a perfectly competitive instantly adjusting market, average cost equals marginal cost, which in turn equals output price. Under these conditions, any increase in the labor cost (wage) will increase the industry's output price by the affected labor's share of operating cost. The higher labor cost is thereby passed through ultimately to be paid by the industry's consumers. Since lower wage unskilled workers make up a relatively larger share of the workforce in the food and kindred and food services than in other industries, an examination of the effects of increases in the minimum wage on output prices is appropriate and timely. Supporters of minimum wage increases usually argue that a higher minimum wage will raise the earnings of low-income workers and primarily benefit the poorest working families. Opponents assert that the basic laws of supply and demand suggest that raising the minimum wage will increase the price of labor, and firms will naturally hire fewer workers. If this occurs, the wage increase could lead to widespread job losses among the very workers the legislation was intended to help. Countering supporters' arguments that the minimum wage primarily benefits the poorest working families, MaCurdy and O'Brien-Stain (2000) provide evidence that minimum wage workers are not concentrated in low-income families. They found that one in four California families had a minimum wage worker and that families with minimum wage workers were distributed rather evenly across income classes.

Many studies have been conducted on the employment effects of minimum wage increases, but little work has been done on the impact of a minimum wage increase on prices in general and on food prices in particular. Because food expenditures account for a higher proportion of lower income households' budgets, public policy makers may want to know how food prices may be affected by raising the minimum wage. Because eating and drinking places employ many workers at or near the minimum wage, a logical question is: "Will raising the minimum wage significantly increase prices of food away from home?"

2. Economic models of cost pass-through to prices

At the risk of oversimplification, economic models of cost pass-through to prices can be grouped into two broad categories. At the core of one group are the tax incidence studies characteristic of the public finance literature. At the core of second group are studies using input/output (I/O) analysis-based price pass-through. Both approaches generally oversimplify reality. The incidence studies recognize the effects of different market elasticities faced by the firm liable for the tax and how these effects ultimately affect the incidence of the tax. These studies gain their insight at the expense of being able to assess the effect of the tax several stages away from the original tax assessment. The price pass-through models based on I/O analysis can assess these different effects on related sectors, but they do so at the

expense of being able to consider differing market elasticities faced by the firms. These models assume that all the elasticity effects are unitary. For an analysis of the economic impact of a rise in the minimum wage, the second simplification of economic reality better fits the situation: Whereas a tax may be assessed uniformly across firms and sectors of the economy, the effect of a minimum wage increase on a firm or sector can be greatly influenced by the cost structure of the firms and sectors. I/O analysis allows more detail on sector cost structure to be integrated.

Price pass-through models based on I/O analysis have been used to analyze changes in prices due to exchange rate fluctuations, for example, Gron and Swenson (1996), Lee and Wills (1989), and Yang (1997). Recently, Aaronson (forthcoming) and Card and Krueger (1994, 1995) have conducted studies of the minimum wage pass-through to food prices.

Card and Krueger did the best-known study of the potential for a minimum wage increase to result in higher prices of meals at fast-food restaurants. They estimated the effect of the minimum wage on the prices of meals at fast-food restaurants as a single-sector full pass-through (proportional to the share of minimum wage labor in total factor cost). They surveyed 410 fast-food restaurants in New Jersey and eastern Pennsylvania before and after New Jersey's 80-cent minimum wage increase in April 1992 and found that, in New Jersey, average prices rose enough to cover the costs of the higher minimum wage (Card & Krueger, 1995: p. 390). Aaronson also explored the price impact of minimum wage hikes in Canada and the US using a competitive market price pass-through method. He analyzed an industry-wide increase in the price of labor on prices of food away from home and found that prices rose approximately one-to-one with changes in the wage bill in the shortrun, but the price effect dissipates over time. His regression analyses suggest a 1.2- to 1.6-percent increase in hamburger and chicken prices for every 10-percent increase in the minimum wage (Aaronson, forthcoming).

In this study, we used an I/O model to analyze a pass-through to output prices for all costs incurred due to a minimum wage increase. This approach seems to mirror the way that firms in a perfectly competitive market equate their price to average and marginal cost. Thus, our analysis allows a full pass-through to not only the direct costs of minimum wage on a sector, but also to the indirect costs on related sectors. Because a full pass-through may not be realized, our estimates have to be interpreted as "upward bounds" estimates of the price effects of the minimum wage increases.

3. Overview of the structure of the US food and kindred industry

Based roughly on the 3-digit 1987 Standard Industrial Classification (SIC), we disaggregated the food and kindred industry (SIC 20) into 12 sectors. Furthermore, since, from the demand perspective, eating and drinking places (SIC 58) are closely related to the food and kindred industry, we also included eating and drinking places in our analysis. The food and kindred product industry includes establishments that manufacture or process food and beverages for human consumption (as well as certain related products, such as manufactured ice, chewing gum, vegetable and animal oils, and prepared feeds for animals and fowl).

Table 1
Wage and salary jobs, in thousands, food subsectors and total U.S., selected years.

Industry	1987 SIC number	1972	1977	1982	1987	1992	1996
Meatpacking	2011-13	304.2	302.7	277.5	308.2	303.2	336.9
Poultry and Egg	2015-17	42.8	49.0	69.4	77.1	129.9	144.4
Dairy	2021-26	216.6	187.5	166.4	160.5	153.3	143.7
Canning & Preserving	2032-38	244.2	242.7	229.1	231.9	247.3	237.2
Flour Milling	2041-48	172.4	184.1	173.8	157.3	157.7	158.0
Bakery Products	2051-53	261.7	240.5	223.0	214.7	208.3	210.1
Sugar Processing	2061-63	57.1	45.5	40.8	29.0	31.5	29.6
Oil Mills	2074-79	68.7	79.4	64.5	66.4	54.7	55.6
Confectionery	2064-68	62.7	68.3	61.3	67.8	73.4	69.0
Beverages	2082-87	227.5	227.5	230.3	203.4	175.6	178.5
Fish and Seafood	2091-92	4.9	15.9	9.7	19.9	12.8	13.0
Miscellaneous	2095-99	77.2	63.5	87.0	79.6	114.8	116.8
Food & Kindred Products	20.0	1740.0	1706.6	1632.8	1615.8	1662.5	1692.7
Eating & Drinking	58.0	2860.2	3948.6	4829.4	6085.7	6609.3	7499.4
U.S. total		75136.9	84983.4	91863.4	104253.3	110915.8	121684.0

Source: BLS

Eating and drinking places include retail establishments that sell prepared food and drink for consumption on the premises and include fast food establishments.

In Table 1, we provide information on wage and salary jobs reported by BLS for selected food and kindred product sectors, and in Table 2, we provide percentage changes in jobs for selected years. We selected the years 1972, 1977, 1982, 1987, and 1992 to correspond with the years the BEA published US I/O tables (US Department of Commerce, Bureau of Economic Analysis, 1998). Employment in the food and kindred industry as a whole remained around 1.6 to 1.7 million jobs throughout these years, but evidence of widely varying sector employment patterns emerge from these two tables. The fluctuations in sector employment, however, reflect the trend of the industry's output resulting from the changing pattern of consumer demand for processed food. Especially notable are eating and drinking places, which showed a steady increase in employment, 69% (from 2.86 million to 4.829 million) between 1972 and 1982 and 37% (to 6.609 million) between 1982 and 1992. The overall increase was 131% between 1972 and 1992. Among the factors contributing to this increase is that more Americans dine out when two individuals within the household, rather than one, work. Schluter, Lee, and LeBlanc (1998) report that "consumer spending for food consumed away from home has grown faster than consumer spending for food consumed at home, nearly twice as fast from 1980 to 1996."

Employment in the eating and drinking places sector grew faster than the nationwide average, which increased 22.3% and 20.7% during the decades of 1972 to 1982 and1982 to 1992. The employment situation was weaker in the food and kindred industry as employment fell 6.2% (from 1.74 million to 1.63 million) in the decade of 1972 to 1982 and gaining slightly, 1.8% (to 1.7 million), in the decade of 1982 to 1992. During 1972–92, jobs for wage

Table 2
Percentage change of wage and salary jobs, selected periods

Industry	Percentage change (%)				
	1972–1977	1977–1982	1982–1987	1987–1992	1992–1996
Meatpacking	−0.48	−8.33	11.07	−1.64	11.13
Poultry and Egg	14.39	41.69	11.07	68.61	11.13
Dairy	−13.43	−11.25	−3.55	−4.49	−6.26
Canning & Preserving	−0.61	−5.60	1.22	6.64	−4.08
Flour Milling	6.79	−5.59	−9.49	0.25	0.19
Bakery Products	−8.10	−7.28	−3.72	−2.98	0.86
Sugar Processing	−20.32	−10.28	−28.89	8.37	−6.10
Oil Mills	15.58	−18.79	2.92	−17.59	1.70
Confectionery	8.95	−10.28	10.61	8.37	−6.10
Beverages	0.00	1.23	−11.68	−13.67	1.65
Fish and Seafood	222.55	−39.09	105.83	−35.90	1.70
Miscellaneous	−17.70	37.04	−8.52	44.22	1.70
Food & Kindred	−1.92	−4.32	−1.04	2.89	1.82
Eating & Drinking	38.05	22.31	26.01	8.60	13.47
U.S. total	13.10	8.10	13.49	6.39	9.71
	By Decade				
	1972–1982		1982–1992		1972–1992
Meatpacking	−8.77		9.24		−0.34
Poultry and Egg	62.07		87.27		203.52
Dairy	−23.18		−7.87		−29.22
Canning & Preserving	−6.18		7.94		1.27
Flour Milling	0.81		−9.26		−8.53
Bakery Products	−14.79		−6.59		−20.41
Sugar Processing	−28.52		−22.94		−44.92
Oil Mills	−6.14		−15.18		−20.39
Confectionery	−2.25		19.87		17.17
Beverages	1.23		−23.75		−22.81
Fish and Seafood	96.45		31.94		159.20
Miscellaneous	12.79		31.94		48.81
Food & Kindred	−6.16		1.82		−4.45
Eating & Drinking	68.85		36.86		131.08
U.S. total	22.26		20.74		47.62

and salaried workers rose in five out of twelve food and kindred product sectors. Reflecting the changing taste of American consumers, from red meat to white meat and to fish and seafood, the larger increases were in the poultry (204%) and fish and seafood (159%) sectors. Of the seven sectors showing decreases, the biggest loss was in the sugar processing sector (45%). The sugar sector experienced a decline in output attributable mostly to a decrease in demand resulting from increased consumption of a substitute product, HFCS (high fructose corn syrup). HFCS is a liquid caloric sweeter made from ordinary cornstarch. Since its commercial introduction in 1972, HFCS has been a substitute for beet and cane sugar in a wide range of processed food products such as beverages, baked goods, dairy products, and jams and jellies. In total, the food and kindred industry lost 4.4% of its jobs during 1972–92,

Table 3
Cost shares of output prices (in dollars), by industry, 1992

	Imported goods	Agricultural & food products	Manufactured goods	Transportation & trade services	Other Services	Total intermediate	Wage & salary	Residual income
Meatpacking	0.0272	0.7355	0.026	0.0315	0.0442	0.8644	0.0993	0.0364
Poultry and Egg	0.0062	0.6070	0.0374	0.0340	0.0603	0.7449	0.2023	0.0528
Dairy	0.0146	0.5525	0.0769	0.0612	0.0691	0.7743	0.1025	0.1231
Canning & Preserving	0.0637	0.1699	0.1560	0.1062	0.0951	0.5909	0.1540	0.2551
Flour Milling	0.0310	0.4230	0.0839	0.1469	0.1195	0.8044	0.0936	0.1020
Bakery Products	0.0234	0.2068	0.0838	0.0683	0.1071	0.4894	0.2794	0.2312
Sugar Processing	0.0408	0.5340	0.0413	0.1130	0.0838	0.8129	0.1299	0.0572
Oil Mills	0.0464	0.5864	0.0260	0.1383	0.0694	0.8665	0.0618	0.0717
Confectionery	0.0234	0.2068	0.0838	0.0683	0.1071	0.4894	0.2794	0.2312
Beverages	0.0454	0.1310	0.1936	0.0748	0.1028	0.5476	0.1050	0.3475
Fish and Seafood	0.4010	0.1245	0.0601	0.1186	0.0721	0.7763	0.1649	0.0588
Miscellaneous	0.0377	0.1433	0.1423	0.1268	0.1524	0.6025	0.1528	0.2447
Food & Kindred Products	0.0405	0.3862	0.0958	0.0837	0.0903	0.6963	0.1351	0.1686
Eating & Drinking	0.0472	0.2117	0.0046	0.0608	0.1961	0.5203	0.3393	0.1404
U.S. Total	0.0392	0.0333	0.1225	0.0515	0.1867	0.4334	0.3300	0.2364

Source: USDC, BEA

while the eating and drinking places sector gained 131%, well above the average US gain, 47.6%.

In Table 3, we show average costs accounted for by intermediate inputs and by primary factors of production. Under perfectly competitive conditions, a sector's output price equals its average cost. Thus, it is important to review the cost structure of the economy since labor cost is a part of the average cost, and a changing minimum wage affects labor cost, which in turn affects food prices. Intermediate input purchases from other sectors are presented in five subsectors to better summarize the input structure of the sector's production. With this approach, each intermediate input and primary factor share the unit value of a given sector's output.

In 1992, for example, the meatpacking sector's unit value ($1.00) consisted of 2.72 cents of imported inputs, 73.6 cents of domestic farm and processed food products, 2.6 cents of domestically manufactured goods, 3.2 cents of trade and transportation services, and 4.4 cents of other services, totaling 86.4 cents for total intermediate input costs. Returns to wage earners in terms of compensation were 9.9 cents (seventh column) and the remaining 3.6 cents was residual income (the last column). The residual income includes returns allocated to profit, interest, depreciation allowances, and so forth The shares of wage earners in total costs were highest in the bakery and confectionery sectors (28 cents) and smallest in the oil

mills sector (6.2 cents). The residual income share was highest in the beverage sector (34.8 cents) and smallest in meatpacking plants (3.6 cents).

The food and kindred industry as a whole spent 4.1 cents on imported inputs (row: food and kindred products, first column) and 38.6 cents on domestic farm and processed food products (second column). Manufactured inputs, trade and transportation services, and other services were 9.6, 8.4, and 9 cents. Total intermediate inputs were 69.6 cents (sixth column). Compensation to wage earners and returns to residual incomes were 13.5 and 16.9 cents.

The eating and drinking places sector spent 4.7 cents on imported inputs, 21.2 cents on food processing inputs, 0.5 cent on manufactured inputs, and 19.6 cents on other services. Total intermediate input costs, however, were far less for the eating and drinking places sector than for the food and kindred industry (52 cents vs. 69.6 cents). The share accounted for by compensation to wage earners was far more in the eating and drinking sector (33.9 vs. 13.5) while residual income was slightly less (14 vs. 16.9 cents). This is an indication of labor-intensive practices by eating and drinking sector.

In summary, the food and kindred industry uses more domestically produced farm and processed food products as its inputs (38.6 cents in 1992) than eating and drinking places (21.1 cents) and US industry as a whole (3.3 cents). The food and kindred industry and eating and drinking places used less manufactured inputs (9.6 cents and less than a penny) than US industry as a whole (12.2 cents). Overall, both the food and kindred industry and eating and drinking places used more intermediate inputs (69.6 cents and 52 cents) than the economywide average (43.3 cents), the food and kindred industry had lower returns to wage earners (13.5 vs. the economywide average of 33 cents), and both had lower residual incomes (16.8 cents and 14 cents) than the economywide average (23.6 cents).

4. I/O model for analysis

The Leontief Input-Output (I/O) model is an empirical representation of the US production economy. Leontief's production scheme, however, is a special case because fixed proportions exist in all production processes. This special fixed-proportions production function allows no substitution among the inputs. It assumes that, in any given period, with existing production capacities for each sector, there is always one combination of resources that firms consider optimal. Therefore, the unit cost of production consists of the fixed cost of intermediate inputs and fixed direct primary factor costs. The unit value of an output consists of the unit values of its commodity services inputs, each weighted by the contribution to the output of the commodity plus the value of the labor and capital inputs per dollar of output. In equilibrium, the unit value of the j-th sector output price, P_j, just exhausts the values of the intermediate inputs and the primary factors of production as:

$$P_q = \boldsymbol{A}' * P_a + R + W; \tag{1}$$

where P_q is a vector of sector output prices (P_j's), P_a is a vector of input prices (P_i's), R and W are vectors of returns to residual and wage incomes (P_I*L), and $\boldsymbol{A}$ is the matrix of input-output technical coefficients, row sector purchases per dollar of output in the column

sector. Residual income is what remains from revenue after the payment of input and labor costs. The input prices are a weighted sum of import prices and domestic output prices. Thus:

$$P_a = \boldsymbol{b}*P_M + (I - \boldsymbol{b})*P_q \tag{2}$$

where P_M is a vector of import prices (P_m's), $\boldsymbol{b}$ is a diagonal matrix of weights, b. If the weights, b, are the proportions in which imports supply domestic demand ($m + q - x$) and are constant regardless of the type of domestic demand, then:

$$b = (\boldsymbol{m} + \boldsymbol{q} - \boldsymbol{x})^{-1}*m; \tag{3}$$

where m is a vector of imports, q is a vector of domestic outputs, and x is a vector of exports and $\boldsymbol{m}$, $\boldsymbol{q}$, and $\boldsymbol{x}$ denote a diagonal matrix of vectors, m, q, x, respectively. Eqs. (1) through (3) give:

$$P_q = [\boldsymbol{I} - \boldsymbol{A}'*(\mathbf{I} - \mathbf{b})]^{-1}*)\boldsymbol{A}'*\boldsymbol{b}*P_M + R + W). \tag{4}$$

Here P_q is the vector of new prices necessary to maintain the same residual incomes after the minimum wage increases. We can use Eq. (4) to calculate the new sector output prices if the new vector of wage compensations after the minimum wage hike is fully passed through. The calculation obviously assumes there is no rise in unit costs other than those due to minimum wage increases. Thus, the expected new output prices due to minimum wage increases are based on the assumption that the producers can pass through the higher input cost caused by increases in minimum wage as:

$$dP_q = [\boldsymbol{I} - \boldsymbol{A}'*(\mathbf{I} - \mathbf{b})]^{-1}*(\boldsymbol{A}'*\boldsymbol{b}*P_M + R + dP_l*L), \text{ where } P_l*L = W \text{ and } dP_q \tag{5}$$

is new output prices for wage rate (dP_l*) as the minimum wage increases. Other terms such as ($\boldsymbol{A}'$ * $\boldsymbol{b}$ * P_M + R) remain unchanged in Eq. (5) from Eq. (4) because we assume there are no changes in technology ($\boldsymbol{A}'$), import prices (P_M), or residual income (R).

If food and kindred markets are perfectly competitive, such that they equate output prices to average cost and marginal cost, then market condition will vary output prices as a result of higher input costs from hikes in the minimum wage. Eq. (5) can also be used in this instance to obtain the extent by which a producer's profit margins may diminish if the producer absorbs the price increases in labor inputs. Again, the above equation states that commodity output prices are equal to unit factor costs (direct and indirect) and output prices move together with factor costs. The expression $[\boldsymbol{I} - \boldsymbol{A}' * (\mathbf{I} - \mathbf{b})]^{-1}$ shows by how much the particular price P_q would go up (down) for every dollar added to (subtracted from) the wage income, assuming no changes in import prices (P_M) and residual income (R).

If current minimum wage workers make up 10% of an industry's employment and wages are 80% of compensation, then increasing their average wage by 15% would increase the industry's total wage cost by 1.2% (15% * 0.8 * 0.10). We then introduce this direct 1.2% increase in compensation into our I/O model to estimate both direct and indirect cost increases due to the minimum wage increase. The prices derived through Eq. (5) are sector output prices at point of production. To express these prices in terms of purchasers' prices,

the I/O tables adopt the convention of "margin." This "margin" is characterized by unbundling (recording the value of the trade and transportation margins separately, rather than incorporating it in the value of the merchandise) and forward shifting (showing the margins as being used directly by the user of the merchandise). The producers' prices represent the basic value at the production point, and adding various margins brings the good from the producer's cost to the user's cost. Therefore, to express producers' prices in purchasers' prices, we link producers'' prices and purchasers' prices through the bridge matrix that contains margins. The bridge table, which we derived from unpublished BEA bridge tables, links producers' prices and purchasers' prices based on the transportation and wholesale and retail trade margins. In other words, let **B** be an 80-row by 3-column bridge matrix. That is, each row entry will show percentage sectoral distributions of the output price (first column), and transportation and trade margins (second and third columns respectively). Then,

$$P_r = \mathbf{D_p}*\mathbf{B[.,1]} + \mathbf{P_t}*\mathbf{B[.,2]} + \mathbf{P_{tr}}*\mathbf{B[.,3]} \quad (6)$$

where P_r is a vector of purchasers' prices and $\mathbf{D}_p$ is an 80 by 80 diagonal matrix of producers' prices (Pq) derived from Eq. (5). **B[., 1]** is a column vector (the first column of the matrix **B**), showing the producers' prices' percentage share of the sector purchasers' prices. $\mathbf{P}_t$ and $\mathbf{P}_{tr}$ are 80 by 80 diagonal matrices of the producers' prices of transportation and wholesale and retail trade, and **B[., 2]** and **B[., 3]** are vectors showing the transportation and trade margins' percentage shares of the sector purchasers' prices. The practical significance for our study of this treatment of retail (final users') prices is that if minimum wage legislation affects transportation and wholesale and retail trade less than food processing (either $\mathbf{\Delta P}_q > \mathbf{\Delta P}_t$, or $\mathbf{\Delta P}_q > \mathbf{\Delta P}_{tr}$ or both), then the estimated effect of an increase in the minimum wage on food prices is softened from what we observe at the food processor level. If the retail food price is not a linear combination of independent prices at the food processor level, but food retail prices are set as a markup over delivery prices at the store, then producers' and retail prices are dependent. If this dependency exists, the price shock at the processor level induced by an increase in the minimum wage may be transmitted to the retail level on a higher scale than we estimate.

5. Wage distributions in the food industry and special modeling considerations

For the distribution of workers by wage group in this study, we used the earnings file of the Current Population Survey (CPS) (National Bureau of Economic Research, 1979–1993). The CPS permitted us to create a distribution of wage groups by the 3-digit industry classification codes. The distribution allows us to examine the breakdown of how many people are making the minimum wage in each of the 991 industries covered in the CPS. We can then condense this 991-sector distribution into an 80-sector I/O model. We took the usual earnings per week reported in the CPS, and divided it by the usual hours worked per week to arrive at the implicit amount earned per hour. We excluded those who reported themselves as self-employed, employed without pay, or as never having worked. The resulting wage distributions are broken into categories to demonstrate the effect of a minimum wage increase on these divisions. The first classification consisted of the wages less than or equal

Table 4
Distribution of U.S. workers by wage category, 1992 and 1997.

1992		1997	
Wage category	Percentage of workers	Wage category	Percentage of workers
$4.25 or less	10.33%	$5.15 or less	8.12%
$4.26–4.75	4.08%	$5.16–5.65	3.47%
$4.76–5.25	5.67%	$5.66–6.15	4.52%
$5.25–5.75	3.30%	$6.16–6.65	3.49%
Over $5.76	76.62%	Over $6.66	80.40%

Source: Calculated using the Current Population Survey.

to the minimum wage for the year in question. We increased the bounds of the categories in 50-cent increments. This classification allows us to examine the impact of a spillover effect. Thus, adding 50 cents to the first group makes the range for 1992 $4.26 to $4.75, and so forth The resulting distributions for 1992 and 1997 are shown in Table 4. The difference between the scenarios is the level at which the minimum is set: for scenario 1, the minimum wage is $4.25 with a 50-cent increase, whereas scenario 4 includes scenario 1 plus 3-percent spillover in the next wage category. For 1997, wage levels of each range are indexed to 1992 dollars using the CPI-U. For instance, the ultimate $5.15 minimum wage in 1997 is $4.50 in 1992 dollars. We condensed these wage distributions, developed for the 3-digit industry classifications, into our 80-sector I/O model. Because our supporting I/O model reflects 1992 price, wage, and production conditions, we did our initial analysis in 1992 dollars. We included the 1997 analysis to explore whether the 1997 CPS information on wage distribution would give different results from those obtained for 1992.

Four key factors influence how a minimum wage increase might affect the prices of food and kindred products. The first factor is the percentage increase in the legislated minimum wage itself. The second factor is the share of total workers in the minimum wage bracket. We derived this number from the CPS. The third factor is the share of wages and salaries in the total cost. For this purpose, we used the most recent (1992) disaggregated US I/O table. The fourth factor is the share of wage and salary cost in total employee compensation. When the minimum wage is raised, total compensation does not necessarily increase proportionally with the minimum wage. We used data from the Census of Manufactures, 1992 (US Department of Commerce, Bureau of Census, 1996), to determine the wage and salary portion of total compensation.

The nature of production and the wage structure within a firm can influence the effect of the minimum wage on the firm, and in turn, its potential to adjust production techniques when its costs of production inputs change unequally, that is, substitution flexibility. As the cost of labor rises, the firm may be able to move to cheaper inputs, such as capital equipment, to lessen its need for labor. Our analysis assumed that such substitution is not possible in the short run. Second, the firm's wage structure affects spillover effects. Spillover effects occur when a minimum wage increase results in higher wages for employees who earn more than the minimum wage. Spillover effects on a firm's or a sector's wage distribution can range from only increased wages at the lowest level to increased wages for all as the whole wage

Table 5
Scenarios analyzed ranged from a rise in the minimum wage to more complex effects on labor costs

Scenario	Minimum wage increased	Second tier—3 percent spillover	Third tier—1 percent spillover	Supplemental compensation increased	$1 increase in minimum wage
1—1992 1—1997	Yes	No	No	No	No
2—1992 2—1997	Yes	Yes	No	No	No
3—1992 3—1997	Yes	Yes	Yes	No	No
4—1992 4—1997	Yes	Yes	Yes	Yes	No
5—1997	Yes	Yes	Yes	Yes	Yes

structure shifts upward so the distribution between wage groups remains constant. Spillover effects occur because employers also may increase the wages of workers who already were earning slightly more than the minimum wage to maintain the firm's chosen wage parity across groups of its workers. However, because this is an individual firm's decision, there is no empirical evidence of a general rate of wage increases due to potential spillover effects.

Card and Krueger (1995, pp. 160–66) explored the existence of this spillover effect. They suggested that while a minimum wage increase boosts incomes of some workers, the wages of workers who already were earning slightly more than the minimum wage might increase as well.

"Restaurants with higher starting wages prior to the April 1991 minimum wage increase were more likely to grant raises to workers who were already earning $4.50 per hour. Among restaurants with the lowest initial starting wages, only 9% granted wage increases to workers earning $4.50 per hour when the minimum wage rose to $4.25. Among restaurants with higher starting wage rates, the corresponding fractions are higher. Thus, there is some evidence of wage spillovers for workers who were earning more than the new minimum wage. . . " [p.161].

We allowed for 3-percent and 1-percent spillovers into the next two wage categories. Our assumed spillover effects are arbitrary since no empirical evidence of particular spillover rates is found in the literature. However, the effects are also linear, so the sensitivity of alternative estimates of spillover effects can be made by prorating the Scenario 2 less Scenario 1 effects relative to the 3-percent spillover effect on the second wage category. Likewise the next spillover effect can be made by prorating the Scenario 3 less Scenario 2 effects relative to the 1-percent spillover effect on the third wage category.

We analyzed an increase in the minimum wage under four scenarios for 1992 and five scenarios for 1997 (Table 5).

- In scenario 1, we analyzed an increase of 50 cents—from $4.25 to $4.75 (or 12-percent) in the 1992 minimum wage and from $5.15 to $6.15 (or 9.7-percent) in the 1997 minimum wage.

Fig. 1. Share of minimum wage workers in the food subsectors.

- Scenario 2 was the same as scenario 1, but added a 3-percent spillover effect into the next wage category (see Table 4 for wage categories.)
- Scenario 3 was similar to scenario 2 but with an additional 1-percent spillover into the third wage category. In scenarios 1 through 3, we increased only wage and salary compensation, leaving unchanged supplemental compensation, such as health care, leave, and life insurance.
- In scenario 4, we assumed proportional increases in both wage and salary and supplemental compensation.
- In scenario 5 (1997 only) we analyzed a $1.00 increase instead of a $0.50 increase.

In 1992, 76.6% of US workers were in the highest wage category shown in Table 4. By 1997, this number had increased to 80.4%. This upward drift in the wage distribution could reflect, in part, the relative tightening of the labor market during the late 1990s. Results are similar when looking at food processing firms. Approximately 10.6% of their workers earned the minimum wage in 1992 versus 4.8% in 1997. Each subsector of the industry had a smaller percentage of workers earning minimum wage in 1997 than in 1992 (Fig. 1). The most extreme changes were in canned goods (16% in 1992 vs. 4% in 1997), oil milling (17% vs. 6%), and miscellaneous foods (17% vs. 6%). The smallest differences occurred in the bakery and confectionery sectors, which recorded a difference of just 0.01 percentage point between 1992 and 1997 (9.47% vs. 9.46%). For food processors overall, the drop in the percentage of workers at the minimum wage and below in 1997 versus 1992 was matched by the increase in workers in the highest wage category. The proportion of food processing workers in the highest wage category increased from 79% in 1992 to 85% in 1997 (that compares with the national workforce's distribution of 77% in 1992 and 80% in 1997 (see Table 2)).

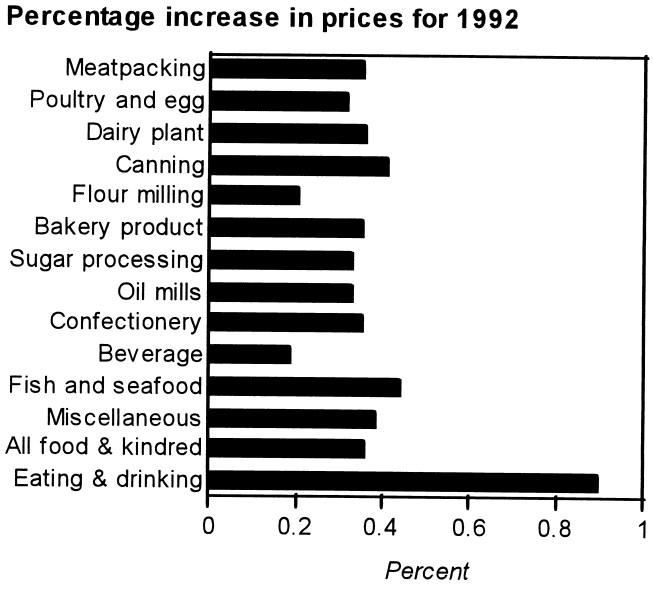

Fig. 2. Percentage increase in prices for 1992.

The wage distribution for eating and drinking places differs from that of food processors. In 1992, 23% of workers in this industry were earning minimum wage or below. By 1997, this number had increased to 28%. As a result, the trend in eating and drinking places was opposite that for food processors over the time period. Because of the higher proportion of minimum wage workers in eating and drinking places, we expect that an increase in labor costs would likely have the most impact on food prices at restaurants.[1]

6. Minimum wage increases and food prices

Our estimated effects of an increase in the minimum wage for 1992 and 1997 are presented in Figs. 2 and 3 and Tables 6 and 7. A simulated $0.50 increase in the 1992 minimum wage of $4.25 with no spillover effects and no increase in supplemental compensation raised wholesale food prices by about one-third of a percentage point and consumer prices by slightly less (Table 6 and Fig. 2). With spillover effects and increases in supplemental compensation, food prices increased more. In our most liberal scenarios (a 3-percent spillover on the second wage category, a 1-percent spillover on the third category, and raising supplemental compensation by the same percentage increase as the minimum wage increase), food prices rose less than 1% at the consumer level. Repeating the simulation using the 1997 distribution of workers by wage category results in smaller food price increases (Table 7 and Fig. 3). For example, a simulated $0.50 increase in the 1997 minimum wage of $5.15 per hour raised food prices by less than one-quarter of a percentage point at the retail level. As expected, simulated food price increases were higher at eating and drinking places than for food processing industries. The $0.50 increase in the 1992 minimum wage of $4.25

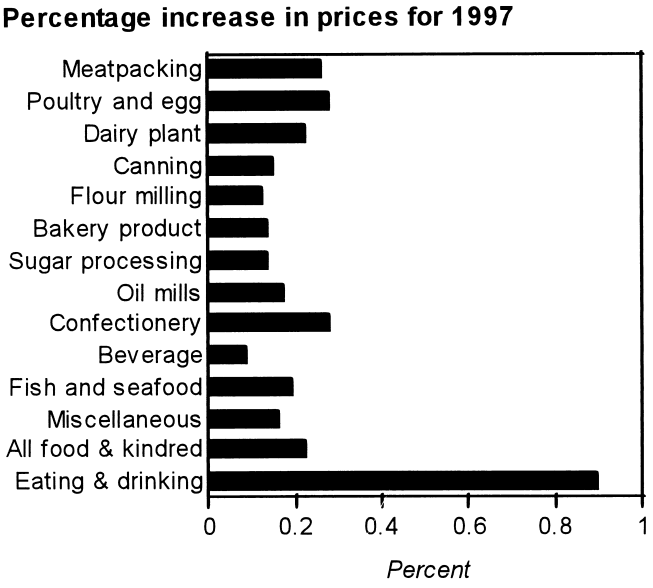

Fig. 3. Percentage increase in prices for 1997.

was estimated to have raised prices at eating and drinking places by 1 to 1.4%, depending on the extent of spillover effects and supplemental wage compensation.

Table 6
Percentage increase in prices due to a minimum wage increase, 1992

Industry	Producers' prices scenario (%)				Consumer prices scenario (%)			
	1	2	3	4	1	2	3	4
Meatpacking	0.353	0.389	0.413	0.497	0.288	0.315	0.332	0.408
Poultry and egg	.317	.345	.380	.459	.267	.290	.315	.389
Dairy plant	.360	.383	.405	.497	.295	.314	.329	.412
Canning and preserving	.407	.442	.446	.571	.314	.340	.343	.445
Flour milling	.202	.221	.234	.288	.181	.198	.206	.263
Bakery product	.351	.394	.397	.517	.284	.315	.314	.418
Sugar processing	.327	.340	.361	.445	.258	.271	.284	.359
Oil mills	.326	.355	.361	.450	.270	.293	.298	.378
Confectionery	.351	.394	.397	.517	.284	.315	.314	.418
Beverage	.184	.200	.214	.263	.171	.182	.192	.246
Fish and seafood	.437	.466	.487	.601	.321	.342	.355	.443
Miscellaneous	.383	.415	.418	.593	.307	.331	.334	.431
Food processing	.360	.383	.405	.497	.295	.314	.329	.412
Eating and drinking	.893	1.045	1.084	1.364	.893	1.045	1.084	1.364

Scenario 1: A $0.50 increase (12-percent) over 1992 minimum wage, $4.25 with no increase in supplemental compensation.

Scenario 2: Scenario 1 plus a 3-percent spillover effect on the second wage category.

Scenario 3: Scenario 2 plus a 1-percent spillover effect on the third wage category.

Scenario 4: Scenario 3 but with increases in total compensation (wage and salary plus supplemental).

Table 7
Percentage increase in prices due to a minimum wage increase, 1997

Industry	Producers' prices scenario (%)					Consumer prices scenario (%)				
	1	2	3	4	5	1	2	3	4	5
Meatpacking	0.257	0.290	0.306	0.366	0.673	0.209	0.240	0.254	0.303	0.552
Poultry and egg	0.276	0.320	0.343	0.413	0.746	0.226	0.265	0.284	0.341	0.612
Dairy plant	0.222	0.252	0.265	0.318	0.585	0.186	0.216	0.228	0.273	0.496
Canning and preserving	0.149	0.178	0.188	0.231	0.414	0.134	0.163	0.173	0.210	0.373
Flour milling	0.124	0.148	0.157	0.189	0.337	0.117	0.144	0.153	0.182	0.323
Bakery product	0.137	0.163	0.173	0.208	0.373	0.128	0.155	0.165	0.197	0.351
Sugar processing	0.133	0.163	0.174	0.214	0.378	0.124	0.153	0.163	0.198	0.348
Oil mills	0.170	0.203	0.214	0.258	0.462	0.150	0.180	0.192	0.230	0.410
Confectionery	0.274	0.294	0.311	0.400	0.753	0.218	0.241	0.256	0.323	0.601
Beverage	0.084	0.101	0.109	0.133	0.235	0.094	0.116	0.125	0.150	0.263
Fish and seafood	0.193	0.221	0.233	0.279	0.510	0.158	0.186	0.198	0.236	0.424
Miscellaneous	0.159	0.187	0.200	0.244	0.439	0.142	0.170	0.182	0.220	0.393
Food processing	0.222	0.252	0.265	0.318	0.585	0.186	0.216	0.228	0.273	0.496
Eating and drinking	0.896	1.007	1.042	1.219	2.266	0.896	1.007	1.042	1.219	2.266

Scenario 1: A $0.50 increase (9-percent) over 1997 minimum wage, $5.15 with no increase in supplemental compensation.

Scenario 2: Scenario 1 plus a 3-percent spillover effect on the second wage category.

Scenario 3: Scenario 2 plus a 1-percent spillover effect on the third wage category.

Scenario 4: Scenario 3 but with increases in total compensation (wage and salary plus supplemental).

Scenario 5: Same as scenario 4 but a $1.00 increase (19.4-percent) over the 1997 minimum of $5.15 (from $5.15 to $6.15).

As detailed previously, four key factors influence how a minimum wage increase might affect prices of processed foods. The first two are of primary concern at this point. First is the percentage increase in the minimum wage itself, resulting from legislation. In comparing a $0.50 increase in 1992 and a $0.50 increase in 1997, the higher percentage increase occurs in 1992. Because of this, we should see prices rise more in 1992 if our intuitive predictions are correct. This is what happens in our simulations, as Figs. 2 and 3 demonstrate. For every food processing sector, prices changed by a greater amount in 1992, when the percentage increase was 12% (50 cents over a $4.25 minimum wage), than in 1997 where the percentage increase was only 9.7% (50 cents over a $5.15 minimum wage). The effect of the second key factor (the share of total workers earning the minimum wage) significantly influenced simulated prices in eating and drinking places. While prices in eating and drinking places were simulated to rise slightly more in 1997 than in 1992, the difference was only 0.002%. The larger share of the industry's workers in the minimum wage bracket can explain the slightly higher estimated price effect. Industries with a higher proportion of minimum wage workers (restaurants and fast-food places, for example) do indeed feel more pressure to increase prices after a minimum wage hike. Eating and drinking places employ a high proportion of minimum wage workers. Consequently, our simulated minimum wage increase caused a greater increase in food prices at eating and drinking places than in food stores.

However, even in the food processing industry, sectors with a larger dependence on minimum wage workers also display larger price increases. For instance, in 1992, in the fish

and seafood and miscellaneous sectors, 17% of the workforce earned minimum wage or less. Our simulated increase in the 1992 minimum wage caused these industries to raise their prices by 0.437 and 0.383%, which were the largest simulated price increases in the processed food sectors for 1992. In 1997, the sectors with the highest proportion of minimum wage workers reflected the same simulated behavior. The confectionery sector had the largest share of minimum wage workers in the 1997 food processing industry, 9.5%. The simulated price increase by this sector was also the largest in the industry, at 0.27%.

Our simulations also show that, in 1992, the smallest price increase, 0.18%, was in the beverage sector, where only 4.6% of workers earned the minimum wage. The same pattern repeated in 1997. The beverage sector again had the lowest share of minimum wage workers (1.4%) and the smallest simulated price increase, 0.08%. Flour milling and sugar processing also had low percentages of minimum wage workers, 3.4% and 4.3%, respectively, in 1997. They also had the second and third smallest simulated price increases in the industry.

Tables 6 and 7 show the percentage changes from the unit base year price to the new price for the particular scenarios in columns 1 through 4 and 5. The first column, for example, shows the estimated percentage changes in sector prices in the food processing industries and eating and drinking places with a $0.50 increase in the minimum wage (scenario 1). An interesting aspect of the increase in the wage floor is the impact of a larger step-up on prices. For instance, columns 5 and 10 of Table 7 look at the price increases with a $1.00 increase in the minimum wage. Comparing this with columns 4 and 9 reveals that, as expected, the larger the increase in the minimum wage, the greater the percentage increase in prices. Thus, despite their interest in raising the living standards of low-wage workers, minimum wage advocates do not yet propose a $10-an-hour increase in the minimum wage.

It is tempting to apply a reality check at this point by comparing the simulated food price changes from this study with actual food price changes between 1992 to 1997. The CPI-Food at Home index rose 15.6% between 1992 and 1997. The CPI-Food Away from home index rose 11.6%. Given these large changes compared to our simulated food price increases, an optimistic reader might say this comparison supports our conclusion that minimum wage increases have a rather small influence on food prices. A pessimistic reader might say this comparison raises questions about why we studied the effect of minimum wage increases in food prices. We argue the actual situation is somewhere in between these two positions. Food and energy prices are so notoriously volatile that many analysts ignore their changes when estimating a “core inflation” index. Because of the many economic forces causing this volatility, it is unlikely one could find a clear instance where an increase in labor cost unilaterally explains a food price increase. Yet these increases in labor costs are likely to ratchet-up costs for food processing and food services. This same food price volatility provides opportunities for firms to pass through these higher labor costs onto their customers. Our simulated food price increases are thus best viewed as an index of cost pressures on food firms, and a ratcheting-up of the base around which food prices vary.

7. Summary and conclusions

We found that (1) within the food and kindred products industry, the share of workers in the minimum wage category is relatively small (less than 10% in most cases); (2) and the

share of labor cost in the total cost is also relatively small for most of the sectors in the food and kindred products industry. When the full cost of a minimum wage increase is passed through to consumer prices in the food and kindred products and food service (eating and drinking places) industries, a $0.50 increase in the minimum wage (an increase of 12% in 1992 from $4.25 to $4.75) would increase food prices at eating and drinking places less than 1% (0.9%) and less than four-tenths of 1% for average food and kindred products prices. When the minimum wage increase of $0.50 is applied to the 1997 level, a 9-percent increase from $5.15 to $5.65, food prices at eating and drinking places would increase less than 1% (0.9%), and less than three-tenth of one percentage for all 12 food and kindred product prices. Higher minimum wages do exert economic forces that could increase prices. In this study, we used an I/O model to analyze a pass-through to output prices of all costs incurred from a minimum wage increase.

Because our analysis allows a full pass-through and does not allow substitution of lower cost inputs to offset the higher labor costs, the estimates from the model are best interpreted as "upward bounds" estimates of the price effects of minimum wage increases. However, for the minimum wage increases we analyzed, even when the full higher labor costs are passed through to food consumers, the price increases are small. Thus, it is unlikely that higher food costs would fully offset the wage gains of minimum wage workers.

For managers in the food processing and food services industries, our assumption of a full pass-through of higher labor costs to output prices matters. If these costs cannot be passed on in higher prices, the loss of residual income (profits) can be significant, particularly for eating and drinking places. To the extent market demand conditions in the food processing and food services industries do not allow this full pass through, our model overestimates the output price effects (cost to consumers) and underestimates the residual income effects (the costs to business profits).

Notes

1. The present law may exempt some small food and kindred products firms and food-service firms and some tipped employees (US Department of Labor, Employment Standards Administration, 1996).

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