American Law & Economics Association Annual Meetings

Year *Paper* 1

When Little Things Mean a Lot: On the Inefficiency of Item Pricing Laws

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JEL Codes: K20, L11, L81, E31

Key Words: Item Pricing Laws, Costs and Benefits of Item Pricing Laws, Cost of Pricing, Cost of Price Adjustment, Pricing Accuracy

Last Revision: February 3, 2005

* We thank the participants of the August 2003 NBER Law and Economics Program Meeting in Cambridge, MA and the June 2003 INFORMS-Marketing Science Conference in College Park, MD, as well as the seminar participants at Bar-Ilan and Hebrew Universities for useful comments and discussions. We are particularly grateful to Joel Waldfogel, who, as the discussant at the NBER Law and Economic program meeting, provided thoughtful and constructive comments, and to Michael Beenstock, David Genesove, Daniel Kessler, Saul Lach, Daniel Rubinfeld, Rob Sauer, Eytan Sheshinski, and Kip Viscusi for suggestions and advise. We also thank Jeff Sandgren and Bob Venable for helpful discussions, Xiaogong Huang for helping with data analyses, and Mona Zeliger for helping with data collection. All authors contributed equally. The usual disclaimer applies.

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Abstract

Item pricing laws require that every item sold by a retailer must have a price label attached to it. Currently, some form of item pricing law exists in ten US states, in Canada, in some European countries, and in Israel. Israel has one of the strictest forms of the law, but its relevance and usefulness is currently reassessed by the Ministry of Industry, Commerce, and Employment. In this paper we study item-pricing laws and examine and quantify their costs and benefits. On the cost side, we argue that item-pricing laws increase the retailers' costs, forcing them to raise prices. We test this prediction using US data on retail prices from large supermarket chains in the Tri-State area of New York, New Jersey and Connecticut. The Tri-States offer a unique setting—a natural experiment—to study item-pricing laws, because the States vary in their use of item-pricing laws, but otherwise offer similar markets and chains operating in a close proximity to each other in a relatively homogenous socioeconomic environment. We use two datasets, one emphasizing the breadth in coverage *across products* and the other *across stores*. We find consistent evidence across products, product categories, stores, chains, states, and sampling periods, that the prices at stores facing item-pricing laws are higher than the prices at stores not facing the item pricing laws by about 25¢ or 9.6% per item. We also have data from supermarket chains that would be subject to item-pricing laws but are exempted from item pricing requirement because they use costly electronic shelf label systems. Using this data as a control, we find that the electronic shelf label store prices fall between the item-pricing law and non-item-pricing law store prices: they are lower than the item-pricing law store prices by about 15¢ per item on average, but are higher than the non-item-pricing law store prices by about 10¢ per item on average. On the benefit side, we study the frequency and the magnitude of supermarket pricing errors, which the item-pricing laws are supposed to prevent. We quantify the benefits of the IPLs by conservatively assuming that they successfully accomplish their mission of preventing *all* price mistakes. Comparing the costs of item-pricing laws to their benefits, we find that the item-pricing law costs are at least an order of magnitude higher than the benefits.

"As Michigan's Attorney General, I want you to know that every time you open your wallet, my office will be there to protect your transactions. Our state law requires that most items on store shelves be clearly marked with a price tag. If those price tags don't match the price scanned at the register, the law gives you specific rights. Keep this card in your wallet or purse and refer to it whenever you have a question about your item pricing rights. Mike Cox, Attorney General."

***Item Pricing Wallet Card*, "Item Pricing Bill of Rights," August 28, 2002**[1]

"Having been a retailer in Michigan since '47, we are well aware of the item pricing laws here and its expense. It takes 3 times or more to price and then stock shelves in our store… We also spend 50 hours a week, having someone scan each item making sure it agrees with the computer… this may have been one of the reasons Michigan has not seen tremendous growth in competition from those same national retailers. Our overhead is way out of line with the rest of the country."

Marv Imus, a Michigan Retailer, July 17, 2002[2]

"Chains in these [item pricing law] states don't make less money, yet we know their costs are higher, so it would follow that their prices must be higher, ceteris paribus… they try to avoid the cost by changing fewer prices, although this is only partially feasible, as much of the cost is unavoidable, as every item sold incurs the cost."

Bob Venable, Industry Expert[3]

I. Introduction

Item pricing laws (IPLs) are an interesting, albeit understudied, form of pricing regulation. These laws require that in addition to putting price labels on shelves, every item sold by a retailer must have a price label attached to it, with some exceptions.[4] According to Food Marketing Institute, currently, ten U.S states have some form of IPL: California, Connecticut, Illinois, Massachusetts, Michigan, Minnesota, New Hampshire, New York, N. Dakota, and Rhode Island.[5] IPLs exist also in Canada, in some European countries, and in Israel. Israel has one of the strictest versions of the law, but its Ministry of Industry, Commerce, and Employment is currently considering its elimination.

IPLs first became a topic of public debate over two decades ago when electronic checkout scanners became widespread. As retail supermarkets moved from item pricing to using only shelf price labels and checkout scanners, states debated the merits of this transition and many considered IPLs. The debate continues today in states, which have adopted these laws. For example, the Michigan State Assembly is currently considering a revision of the state's IPL, which is one of the oldest and perhaps the most demanding, because it requires item pricing at *all* retail establishment, regardless of their nature.[6] In contrast, the IPLs in other states apply only to few types of retail establishments, most often to food stores. The currently proposed bill would make individual item pricing optional if the retailers use electronic shelf labels.[7] Similarly, a recent change in the IPL of Quebec, Canada, exempts retailers from item pricing requirement if there are a minimum number of hand-held scanners available for use by consumers.[8]

In this debate the arguments in support of IPLs are based on protecting consumers. Among the supporters of these laws are various consumer advocacy groups and consumer associations, legislators, labor unions (such as Michigan AFL-CIO, and the United Food and Commercial Workers), various chapters of the American Association of Retired Persons, and similar groups. The

[1] Source: the Attorney General's Office, State of Michigan (www.michigan.gov/ag).
[2] Source: www.morningnewsbeat.com.
[3] Source: private correspondence with one of the co-authors.
[4] In the US, there are three different, although related, pricing laws: *Shelf price laws*, which are in effect in all US states, require a price tag on the shelf for each product. *Unit price laws*, also in effect in most states and localities, require the product price per standard measurement unit such as per oz, per liter, per gallon, etc. The purpose of unit price laws is to help the shoppers in comparison-shopping when products are packaged in different sizes. *Item pricing laws* require that a price tag be attached to every single item the retailer offers for sale.
[5] Source: www.fmi.org. In Appendix I, we describe the IPLs of New York and Connecticut.
[6] As the opening quotation indicates, the Attorney General of the State of Michigan, on August 28, 2002 has even issued the "Item Pricing Wallet Card" which describes the Michigan consumers' "Item Pricing Bill of Rights."
[7] Source: "Legislators to consider changes in item pricing law," *Holland Sentinel*, Online edition, Monday, January 27, 2003 (www.hollandsentinel.com).
[8] "Price Marking in Quebec: New Regulatory Rules," (www.opc.gouv.qc.ca/programmes/LettreAffPrice_Marking.pdf), January 2001.

primary and the most commonly cited reason in support of the IPLs is that without item pricing the public would be unable to detect pricing mistakes, and especially price overcharges, which occur when the price charged at the cash register exceeds the price indicated on the shelf price tag.[9] The proponents of IPLs also mention other benefits. For example, they argue that without item pricing price comparison-shopping would be difficult and therefore it would be easier for stores to raise prices because consumers cannot remember the price of every item. In other words, they argue, that the IPLs reduce search costs consumers would need to incur in order to make informed shopping decisions. In addition, they argue, shelf price labels are often difficult to read, and misplaced items make shopping difficult because of the difficulty of identifying their price.

These benefits, however, are secondary, in comparison to their primary concern about retailers' pricing inaccuracy and consumers' inability to notice them without IPLs.[10] Consistent with this interpretation is the fact that in many jurisdictions, the IPL requirements are waved if retailers meet certain price accuracy criteria. For example, in Philadelphia, grocery stores that have more overcharges than undercharges must item price until it passes four consecutive price accuracy inspections.[11] In Schenectady County (New York), retailers are exempted from IPL requirements as long as their pricing errors do not exceed 2.3%.[12] Similarly, the Massachusetts retailers are exempted from the item pricing requirement if they meet the 98 percent pricing accuracy criterion.[13] Supermarkets operating in Connecticut, which has an IPL, are exempted from item pricing requirement if they install an electronic shelf label (ESL) system because ESL systems ensure that the shelf price and the cash register prices are identical. The proposed revisions in the Michigan and Quebec IPLs will allow the same to Michigan and Quebec retailers.[14] If we consider the secondary benefits of IPLs, the ESLs are subject to the same criticism as the regular shelf price tags. Yet states and jurisdictions exempt retailers from IPL if they install the ESLs. This suggests that pricing inaccuracy is indeed the key concern of legislative and policy-making bodies.

On the other side of the debate are the retailers, represented by local and state-level retailers' associations, supermarket industry associations and other trade groups, and trade publications. The opponents of the IPLs contend that the item pricing requirements are inefficient and too costly, consuming too much of the retailers' resources.[15] They say requiring price tags on individual items

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[9] Source: "Farewell to Item-Pricing?" *Consumers Research Magazine* 64, October 1981, 11–13.

[10] For example, Richard Gamber, executive director of the Michigan Consumer Federation stated in an interview to *Detroit News*: "They say we're behind the times. I say we're ahead of the times. Without a price tag on an item, a consumer is powerless to spot scanner errors" (Source: "The Battle Over item Pricing, Michigan Style," www.nacsonline.com, July 16, 2002). "We're opposed to any change in the item pricing law. It's a law that protects the consumers by allowing them to know when they are being charged the wrong price," says Ken Fletcher, legislative director for the Michigan AFL-CIO (Source: "Legislators to consider changes in item pricing law," *Holland Sentinel*, Online edition, January 27, 2003, www.hollandsentinel.com). Consider also the titles of typical articles published in various publications addressing this topic: "UPC Scanner Pricing Systems: Are They Accurate?" (*Stores*, August 1994, RR10–RR11), "Don't Get Cheated by Supermarket" (*Money* 22, April 1993, p. 132–138.), "What's the Price? Chains Get Into Trouble Over Not Using Price Tags" (*Drug Topics* 138(17), September 5, 1994, p. 92), "The Price is Right" (*Supermarket Business* 50(2), February 1995, 27–28), "Is Precision Pricing Possible?" (*Progressive Grocer* 73(12), December 1994, 88–89), and "UPC Scanner Pricing Systems: Are They Accurate?" (*Journal of Marketing* 58, April 1994, 20–30). While suggestive, these and numerous similar articles published in trade and popular publications try to address the public's concern with retail pricing accuracy.

[11] Source: www.s-t.com/daily/08-97/08-24-97/f01bu217.htm.

[12] Source: "Smart Business: Item Pricing Laws."

[13] Source: "Retail Electronic Price Systems Exemptions," Section 329D, Amendment to Massachusetts Chapter 94, "Item Pricing Law," Outside Section 125 (www.mass.gov/eoaf/budget/fy04/print/outsec/p125.htm).

[14] See footnotes 7 and 8.

[15] For example, according to one retailer, "I have been in retail for over 15 years in 8 different states… The pressure that is put on the employees to price the items, and the time and labor invested to comply with the laws could be better used to provide the customer service the consumers complain they do not have." Posted on the web page of www.MichiganVotes.org by an anonymous citizen, on 12/10/2002.

leads to more human error because new tags are needed on every item every time the price changes. They argue that allowing retailers to substitute electronic shelf label systems for labor-intensive, hand-held "price guns" would save on labor costs, which they would pass on to consumers. Some have even suggested that the high item pricing costs may be preventing the opening of retail stores by national chains. For example, according to a 1998 report by Deborah Moore of the *Albany Business Journal*, "… Aldi, a German company with U.S. headquarters in Batavia, Ill., will not open stores in areas where grocers must place a price sticker on each article for sale. The company maintains that the labor costs for item pricing are too high to maintain profit margins."[16]

It appears, therefore, that IPLs impose substantial costs on retailers, which theory predicts will likely be passed on to consumers in the form of higher retail prices. Although IPLs have not been studied, other studies of "consumer protection" laws often find that they provide few if any benefits, but have substantial costs. A well-known example is Peltzman's (1972) study of the FDA, finding that increased regulation in the 1960s had few benefits but substantial costs. This finding has been duplicated numerous times. Many studies have also found that laws regulating information provision often have large costs.[17] We might expect similar results for IPLs.[18]

Despite the fact that IPLs have been around for almost 30 years, there are no studies that measure the costs and the benefits incurred by consumers as a result of the laws. Our purpose is to fill this gap in the literature. On the cost side, we quantify the impact of IPLs on retail prices at large US supermarket chains. Economic theory predicts, we argue, that the IPLs give the retailers incentive to raise prices because IPLs increase their costs.[19] This would be true even if the supermarket industry is competitive because all stores in the market with IPLs are subject to the same cost increase.

To test this hypothesis, we collected price data at large supermarket stores facing IPLs and stores not facing IPLs, with the restriction that all sampled stores be operating in similar markets and socioeconomic environments. In addition, we have collected price data from supermarket stores that are subject to the IPLs but are exempted from the item-pricing requirement because the stores are using electronic shelf label (ESL) systems. The latter data are used as a control.[20]

We are fortunate to have a natural experiment in the Tri-State area of New York, Connecticut and New Jersey because these states vary in their use of IPLs—New York has an IPL, New Jersey does not, and Connecticut has an IPL that can be waived if stores adopt an ESL system—but otherwise they offer a remarkably similar set of markets and socioeconomic environments, with similar and even identical supermarket chains.

We went through two rounds of data collection. In the first round, we collected data from four supermarket chains. Two of them (one in NY and the other in CT) are subject to the IPL, the third (also in CT) has an IPL but is exempted from the law because the store is using an ESL system and the fourth (in NJ) does not have IPL. We have randomly selected 15 brand-name products in 11 product categories. We visited each store four times from January 2001 to April 2001 to hand-record the actual selling price of the sampled 165 products. This process yielded 2,640 price observations.

In the second round of data collection, we focused on only two product categories, and

[16] *The Business Review*, Albany, NY, July 13, 1998 (www.albany.bizjournals.com).

[17] See, for example, Benham (1972) and Gerstner and Hess (1990). This literature is summarized in Beales, Craswell and Salop (1981) and Rubin (1991).

[18] For an early study of the economics of information, see Stigler (1961). For a recent study, see Jin and Leslie (2003).

[19] Some industry experts we talked to (who also included a senior manager at a company that manufactures electronic shelf label systems), have made a similar prediction, as the third leading quotation suggests.

[20] See Milyo and Waldfogel (1999).

instead expanded the number of stores sampled. The decision to consider a smaller number of categories was driven partly by the uniformity of the results in the first study and partly by feasibility considerations. We found that the first set of results were the same for all product categories: the IPL store prices were systematically higher than the non-IPL store prices for every category sampled. The pattern was consistent across the four trips. Moreover, we discovered that the average price difference was also quite stable, about $0.25 per item on average.

Focusing on a smaller number of categories and restricting the data collection to a single trip enabled us to sample from a larger number of stores. The decision to consider a wider selection of stores was driven by our desire to examine the robustness of our results across different chains and stores. For this we added 16 new stores to our sample. On the second round, therefore, we sampled price data from 20 stores for the 30 products included in the two categories. Of the 20 stores (which belong to 7 different chains), 12 are subject to IPLs (10 in NY and 2 in CT), 3 (all in CT) are also subject to an IPL but are exempted from it because they use ESL systems, and 5 (all in NJ) are not subject to IPLs. The second price collection process, therefore, yielded 600 price observations.

To isolate the effect of the IPLs, we compare prices of the sampled products at IPL and non-IPL stores. In addition, we have conducted a comparison across products, product categories, stores, chains, and sampling periods. We find that the results of the analysis of the second round data are similar to—and confirm—the results obtained from the first round data.

To briefly summarize our findings, we find consistent evidence across products, product categories, stores, chains, states, and sampling periods that the IPL store prices are indeed higher than the non-IPL store prices. The average price difference per product is $0.25 or about 9.6%, which seems substantial. Using the ESL stores as control, we find that the ESL store prices fall between the IPL and non-IPL store prices: they are lower than the IPL store prices by about 15¢ per item, but are higher than the non-IPL store prices by about 10¢ per item, on average. ESL system allows the retailers to manage prices and price changes at a lower cost in comparison to paper price label based systems. The systems, however, are costly: the retailers purchasing them incur substantial fixed cost (purchase price) as well as variable cost (operation, maintenance, upgrade, troubleshooting, etc.). Given the high cost of the ESL system, the finding that the ESL store prices fall in between the IPL and the non-IPL store prices confirms our interpretation of the cost effects of IPLs on retail prices.

We also explore the benefit side of the law by examining the existing evidence on the size and the frequency of pricing mistakes in the retail supermarket industry. This enables us to quantify the potential benefits of the IPLs, conservatively assuming that they successfully accomplish their mission of preventing *all* price mistakes. We find that price overcharges in large supermarket stores average 0.9¢ per item. Thus, the benefit of the IPL, as measured by the pricing mistakes it may help to prevent, will at most equal 0.9¢ per item on average. If we factor in the average undercharges, then the benefit of item pricing is reduced to a mere 0.13¢ per item. In contrast, our price data suggest that the IPLs lead to a 25¢ increase in price per item on average.

Thus, we find that the costs incurred by consumers because of the IPLs are at least an order of magnitude higher than the benefits these laws provide. We conclude, therefore, that the IPLs are inefficient, not only from the perspective of retailers, but especially from the perspective of consumers: the IPLs seem to harm consumers greatly, even though the primary reason for creating these laws is to protect them. In light of these findings, we conclude that policy makers and regulators should reconsider the usefulness and practical efficacy of these laws.

The paper is organized as follows. In section II, we discuss the existing literature on IPLs. In

section III, we analyze the effect of IPLs on retail prices. In section IV, we describe the data collection methodology. The results obtained from the analysis of the two datasets are reported in sections V and VI, respectively. In section VII, we describe the ESL systems and discuss their cost structure. In sections VIII and IX, we compare the ESL store price data with the non-IPL and the IPL store price data, respectively. In section X, we conduct cost-benefit analysis of IPLs. In section XI we discuss potential biases and other data measurement issues. Section XII concludes. A detailed description of various IPLs is included in appendix I. Appendix II provides some details on the supermarket chains and the stores sampled.

II. Existing Literature on Costs and Benefits of Item Pricing Laws

Much of the literature on IPLs comes from trade press due to the lack of academic literature on this matter. These articles typically focus on various "price check" and "price accuracy" surveys of checkout scanners conducted by federal, state, and local government agencies and sometimes also by retail trade groups and publications. These surveys try to assess the benefits of IPLs indirectly by measuring the size and the frequency of pricing errors, both overcharges and undercharges. These measurements are based on the belief that IPLs help the consumers notice the pricing mistakes at the cash register and then alert the cashier. Much less is known on the cost side of the IPLs.

There have been several studies of retail checkout scanners accuracy. Earlier studies have had a more narrow scope and breadth compared to more recent studies. One main conclusion that emerges from these studies is that since early eighties the pricing error rates as well as the sizes of both overcharges and undercharges have been continuously decreasing.[21]

One study of checkout scanners accuracy was conducted by *Money* magazine in 1993. In the survey, the prices of 10 randomly selected items were checked in 27 supermarket stores in 23 states. According to the survey, the mistakes in scanned prices were found to overwhelmingly favor the retailer over the consumer: 30 percent of stores overcharged, while only 7 percent undercharged. In case of an overcharge, a consumer was overcharged for one out of every ten items, on average.[22]

Goodstein (1994) sampled 30 items in 3 categories, at 15 stores of three chains in California. He also found that the errors tended to favor the retailer, but not as universally as was indicated in the *Money* magazine study. On regularly priced items he found that consumers were undercharged 4.8 percent of the time and overcharged 3.6 percent of the time. On sale items, however, consumers were overcharged 7.3 percent of the time and undercharged only 1.8 percent of the time. In addition, Goodstein found that for end of aisles promotional items, the shoppers were on average overcharged 6.0 percent of the time and undercharged 3.6 percent of the time.

The most comprehensive studies in terms of the scope and the breadth of their coverage were conducted by the Federal Trade Commission in 1996 and 1998. The two studies, called "Price Check" and "Price Check II," respectively, produced very different results from the earlier studies. The 1996 study was conducted by the FTC, the National Institute of Standards and Technology, and the states of FL, MA, MI, TN, WI, and VT.[23] The purpose of the study was to check the accuracy of checkout scanners in retail stores. It inspected the pricing accuracy of 17,928 items in 294 department

[21] See, for example, a recent report on the pricing accuracy survey of the State of Michigan, "Few Scanner Errors in State's Pricing Survey," by Dee-Ann Durbin of the Associated Press, December 4, 2002, *Detroit Free Press*. According to the report, "Five national retail chains had a relatively low error rate in this year's survey of price scanners… The average error rate was 3.2 percent, the same as last year's and significantly lower than other recent years."

[22] Vanessa O'Connell, "Don't Get Cheated By Supermarket Scanners," *Money* 22 (April 1993), 132–138.

[23] The Federal Trade Commission, *Price Check: A Report on the Accuracy of Checkout Scanners* (1996).

stores, drugstores, supermarkets, and other retail establishments. 113 of these stores were food retailers. Scanned prices were compared with the lower of the posted or advertised price of a sample of randomly selected items. Overall, the results of the study were positive for consumers, because the results showed that the total number of undercharges exceeded the total number of overcharges. The total error rate was only 4.82 percent. Of these, 2.58 percent were undercharges, and 2.24 percent overcharges. In addition, the total amount of undercharges exceeded the amount of overcharges. The study also found that food stores had a lower error rate than non-food stores. According to the study, 1.92% of the items checked in food stores were overcharges, and 1.55% undercharges. Total dollar value of the undercharges exceeded by approximately $10.00 the total value of overcharges. The average overcharge was $0.53 while the average undercharge was $0.76, per item.

The 1998 study, which was conducted by states and localities in 37 jurisdictions, was five times larger than the 1996 study. In the 1998 study, the prices of 107,096 items were checked at 1,033 stores.[24] The study found that 1 in every 30 items was mis-priced. Of these errors, half were undercharges and half overcharges, while in the 1996 study, 1 in every 21 items was mis-priced and slightly more than half of the errors were undercharges. The 1998 study also examined whether there was a difference in pricing accuracy between sale and non-sale items. For sale items, pricing errors were found in 1 of every 28 items, and almost 2/3 of the errors were overcharges. For non-sale items, pricing errors were found in 1 of every 32 items checked, and slightly more than 1/3 of the errors were overcharges. Once again, the 1998 study found that among the types of stores inspected, food stores had the highest pricing accuracy. Further, the study found that the error rates decreased since the 1996 survey. For example, at supermarkets 1.36 percent of the price mistakes found were overcharges and 1.06 percent undercharges. The average overcharge and undercharge per item was $0.66 and $0.73, respectively.

We have less information on the costs that IPLs impose on various market participants. According to Weinstein (1991, p. 21), the annual costs of item pricing for the average supermarket in 1991 was about $154,000.[25] A remarkably similar figure was reported independently by the management of *Giant*, a large supermarket chain operating in the North Eastern US. According to the October 1981 issue of *Consumers' Research Magazine*, "Giant estimates its savings from the removal of item pricing per se at close to 1 percent" of its revenues (p. 12).[26] According to Levy, et al. (1997, p. 812), the annual revenue of a large US supermarket chain is $15,052,716 per store on average. Using this figure as a rough estimate of *Giant*'s revenues, 1 percent saving translates to $150,527.16 total annual saving per store. Another measure is reported by James Gillette, an executive of *Gillette's Food Market*. According to him, "… a full 6 percent of his labor costs go toward complying with the IPL as prices go up and down on individual items in his supermarket."[27]

Levy, et al. (1997, 1998) study the impact of IPLs on the costs of price *adjustment*, and the frequency of price change activity, in the grocery industry. They measure the cost of physically adjusting prices (also known as "menu cost" in the macroeconomics and IO literature) at five large US supermarket chains, one of which operates in a locality with IPLs. In a retail setting, menu costs include the labor costs of changing shelf labels, the printing and delivering costs of new price tags,

[24] The Federal Trade Commission, *Price Check II: A Follow-up Report on the Accuracy of Checkout Scanner Prices* (1998).
[25] As the source of this figure, Weinstein (1991) cites a Cornell University study, which was commissioned by the New York State Food Merchants Association.
[26] "Farewell to Item Pricing? What 'Scanning' Means for Supermarket Shoppers," *Consumers Research Magazine* 64, October 1981, 11–13.
[27] Source: "Opponents Check Out Views on Item-Price Law," March 11, 1999 (www.rny.com).

the costs of mistakes made during price changes, and the cost of in-store supervision during price changes. They found that the marginal cost of price change in chains subject to the IPL was $1.33, while the marginal cost of price change in the other four chains was only $0.52.[28] [29]

Thus, the menu cost at the IPL chain was more than two and one half times the menu costs at the other four chains. Moreover, at the IPL chain, the average weekly frequency of price changes was only 1,578, in contrast to 3,916 at the other four chains.[30] Thus, the IPL chain changed its prices only 40 percent as frequently as did the other four chains, on average.

The existing evidence, therefore, suggests that IPLs increase the cost of price adjustment. Further, item pricing requirement appears so costly that it forms barriers to price changes. In other words, many price changes are not implemented under IPLs because of the costs involved in changing the individual item price tags. This certainly is costly for the sellers. But it may be harmful for consumers as well. For example, to the extent that a more competitive environment would lead to more frequent price changes, this evidence suggests that the IPLs deny consumers some of the benefits of competition.

III. Item Pricing Laws and Retail Prices

IPLs will have an effect on retail prices for at least two reasons. First, individual item pricing required by IPLs increases the retailers' operating expenses in comparison to the retailers operating in localities without IPLs. Second, individual item pricing requirement increases the menu cost, i.e., the cost of price adjustment, because a decision to change a product price means that the retailer has to change the individual price tag of every item of that product. Both costs are incurred for each individual item sold. Therefore, both are variable: the more units are sold, the higher these costs.

Consider first the direct cost of item pricing. Every item brought to store shelves must have a price tag. To get a sense of the necessary physical work involved in individual item pricing and their cost, note the huge number of individual items large supermarkets sell each year. According to Levy, et al. (1997, p. 812), the annual revenue of a large supermarket store is $15,052,716.00, while the average price per item is $1.70 (in 1993 prices). This implies that a large supermarket store each year sells over 5 million items, and it needs to put an individual price tag on many of them.[31]

We can estimate the labor-cost of item pricing using the figures Levy, et al. (1998) report based on time and motion measurements of pricing and price change processes at large US supermarket chains. According to their study (p. 101, Table 5), the steps required for applying individual item price tags (in addition to the steps needed to apply shelf-price tags), and the required

[28] Recall the complaint of Marv Imus, that "… it takes 3 times or more to price [every item] …" (see footnote 2).

[29] The actual cost of item pricing must be even higher. For example, Levy, et al (1997, p. 810) exclude from their menu cost estimate a sum of $44,168 (which the IPL store in their sample spends on putting price tags on new items as they are brought to shelves) because of the difficulty in determining how much of that amount was due to price change activity and how much was due to just pricing. As they state, however, "… these costs are clearly a direct consequence of the item pricing law." Therefore, in the context of our analysis, that amount should certainly be included in the total cost of price management at the IPL store. In that case, various IPL pricing cost measures as reported by Levy, et al. would increase by over 40 percent.

[30] A recent report indicates that some retailers change price even more often. For example, Home Depot *each day* changes the prices of about 13,000 different products ("Smart Business: Item Pricing Laws").

[31] We should note, however, that many of these products/items are exempted from item pricing requirement. For example, products that come in variable weight/size such as produce, baked goods, and floral, items sold through vending machines, items under three cubic inches in size, items that weigh 3oz or less, items priced at 50¢ or less, fast moving products such as snack foods (cakes, gum, candies, chips, and nuts weighing 5oz or less), eggs, milk, bread, canned and bottled soda, and baby food packaged in jars, are also exempted in most jurisdictions. In addition, products/items on sale or on weekend special are exempted. In general, most products with a shelf life of three weeks or less are exempted from the IPL. Therefore, the actual number of items that are subject to the IPL are far less. Despite these exemptions, the supermarket chains still need to attach individual item price stickers to hundreds of thousands of items each year.

time spent per product include (1) obtaining price labels, 3.7 seconds, (2) setting up item-pricing work station, 3.3 seconds, (3) take an item from the box, 33.6 seconds, (4) set price marking gun, 5.0 seconds, and (5) apply price tag, 36.4 seconds. In addition, there is a periodic need of (6) replacing the work station, 3.3 seconds, (7) allow for customer interruptions, 9.9 seconds, (8) clear jammed guns and reload gun, 1.7 seconds, (9) handle item packaging difficulty, 11.2 seconds, and (10) research price discrepancies, 1.8 seconds.[32] This yields a total of 109.3 seconds per product. Allowing for personal fatigue/delay allowance (15%), and multiplying by 25,000 (the number of products carried by an average large US supermarket store), yields 3,142,375 seconds, or 873 annual man-hours. Using $12.00 as the average hourly wage rate ($10.00 in 1991–92 adjusted for 20 percent inflation since then till 2001) plus 40 percent allowance for fringe benefits, the total annual labor cost of item pricing for a big supermarket chain comes to about $14,650.00 per store. Note, however, that this estimate includes only the physical labor cost of item pricing but not its verification, which is done after every item-pricing session (Levy, et al., 1998). Further, at some localities, large-scale price audits are done on an ongoing basis.[33] In addition, there are managerial costs (Zbaracki, et al., 2004). Also, note that this is just the cost of item pricing, not the cost of item price adjustment.

The effect of IPLs on the cost of retail price adjustment is subtler. Clearly IPLs increase the costs of price adjustment by forcing firms to put a new price tag on every item rather than simply changing one price label on a shelf. Indeed, as mentioned in the previous section, the cost of price adjustment per product at IPL stores is $1.33 while at non-IPL stores the cost is $0.52 (Levy, et al., 1997). These higher costs lead to less frequent price changes. In total, however, it is not obvious whether the total costs of price adjustment will go up or down. Price changes are more costly, but done less frequently. In their sample, Levy, et al. (1997) find that the *total* costs of price adjustment are very similar at the IPL and non-IPL stores. Therefore, if IPLs merely create larger menu costs, this will not necessarily imply higher retail prices; it may simply mean that retailers use pricing less often as a marketing activity.

We argue that IPLs do more to costs of price adjustment than just making them larger, however. We believe that IPLs actually change the nature of these price adjustment costs because they cause them to change as the volume of the products sold changes. The traditional menu cost is viewed as fixed cost paid when a firm decides to change a price (Mankiw, 1985). The larger this cost, the less frequently a firm will change its prices.[34]

IPLs increase menu costs because during the price change process, stores subject to IPLs have to change the price on each individual item, not just on the shelves. According to Levy, et al. (1997, 1998), stores go through 130 different steps during their shelf-price tag change process. Although most of the steps involved in changing prices are the same at IPL and non-IPL stores, the IPL stores have to undertake additional steps to obey this law when changing prices. These steps include (1) obtaining item price tags, (2) setting up workstations, (3) locating the product, (4) removing an item from the shelf, (5) removing old price tag, (6) setting marking gun, (7) applying new price tag, and (8) returning the item back to the shelf. The need to undertake these additional steps increases the amount of labor and materials needed to carry out price changes. The higher

[32] Note the difference between "product" and "item." Large US supermarkets carry about 25,000 different products ("SKU"), but they sell about 5.2 million individual items (Levy, et al., 1997, 1998). Thus, for example, Kellogg's Cornflakes 16oz cereal is a product, and the number of units (boxes) of Kellogg's Cornflakes sold, is the number of items.

[33] See footnote 54.

[34] Alternatively, these menu costs are sometimes treated as convex (Rotemberg, 1982; Cecchetti, 1985), which means that the menu cost changes with the size of the price change: the bigger the price change the larger the cost of adjustment.

frequency of mistakes that can potentially occur during this process bears its own cost.

The need to change the price tag of every individual item, when a price change decision is made, further amplifies the effect of the IPL. If a store decides to change the price of a product, it is not enough to change the price on the shelf. It is required to change the price tag on each individual item. The above 8 steps, therefore have to be repeated for every individual item in that category.

Thus, IPLs add another dimension to the cost of price adjustment: they make the cost of price adjustment depend on how many units of the product are sold. For example, if a firm plans to sell 4 units and has them on the shelf, it only incurs IPL costs for 4 prices. But if the firm is planning to sell 4,000 units, then its menu costs will be the cost of changing the price tags on all 4,000 units. This is a dimension of menu costs that has not been suggested before in the existing menu cost literature.[35]

Once we recognize that the cost of item pricing and the cost of price adjustment both depend on the sales volume, it is clear that both are variable costs—costs incurred for each unit sold. Thus, IPLs make pricing and price management more expensive by increasing the retailers' variable costs. Therefore, price adjustment costs would directly factor into a firm's pricing decisions, and create incentives for retailers to raise prices when IPLs are in effect. Even if the supermarket industry is competitive, prices will increase, because all stores in a market will be subject to the same cost increase. Thus, we predict that the prices will be higher in stores that are subject to IPLs in comparison to non-IPL stores. In sections V and VI, we empirically test this prediction.

IV. Data Collection Methodology

To test the above prediction, we use price data from supermarkets stores, some affected by IPLs and some not. We chose localities with and without IPLs that are similar demographically and socio-economically, close geographically, and have the same or similar supermarket chains in size, type, etc. The stores' geographical proximity is necessary to ensure that the customers shopping in these stores come from the same market, and that the shopping costs are similar across stores. To control for other variables, it is also necessary that the cities/towns where the stores are located have a homogeneous population demographically as well as socio-economically to the extent possible.

The fact that only nine states have IPLs narrowed our choices. New York, New Jersey, and Connecticut, which make up a region known as the Tri-State area, met all the necessary criteria and had other advantages as well. NY and CT both have IPLs while NJ does not. In addition, CT exempts retailers from IPL requirements if they install an ESL system. All three states have upscale suburban neighborhoods of NY City that are equidistant from the city. We collected data from these suburbs in NY, NJ, and CT. In Chart 1 we present a small map of the Tri-State area.

The suburban towns of NY City located in northern NJ, Westchester County in NY, and southern CT, are remarkably similar. They share reasonably similar population size and density, socio-economic levels, demographics, and distance from NY City. Moreover, geographically they are close to each other. A drive from northern NJ through Westchester County to southern CT can take as little as half an hour. People living in these towns are business owners, executives, and professionals who work in NY City or in surrounding towns. Most of these towns have quality public schools, quiet suburban roads with nicely sized houses, and downtown areas with a mix of small mom and pop businesses, and branches of national businesses like Starbucks. The similarity of the suburban

[35] We should note that pricing mistakes would also depend on the quantity sold: the greater the sales volume, the more pricing mistakes are likely to occur (Levy, et al., 1998). This places the benefit-side of the IPL on equal footing with the IPL cost-side, in our cost-benefit analysis of the IPLs.

neighborhoods in these three states makes the Tri-State area a natural place to conduct our study.[36]

Choice of Stores for Data Set I

We used two criteria for selecting the supermarket chains. The first was that the chain has stores located in the suburban areas of NY, NJ, and/or CT. The second criterion was that the chain uses Everyday Low Price Strategy (EDLP). In contrast to High/Low (HL) pricing strategy chains, the EDLP chains provide cleaner data for our purpose because they change their prices less frequently.[37] Steadier prices over time make it easier for us to compare the prices of goods across stores without having to discern if the price of an item was changed because of a sale or for some other reason.

We sampled price data from three types of stores, depending on the applicability of IPLs: (i) Stores that are located in the areas that are subject to IPLs (denoted as "IPL-Stores;" in the Tri-State area, these stores are located either in NY or CT); (ii) Stores that are located in the areas that are not subject to IPLs (denoted as "non-IPL Stores;" in the Tri-State area, these stores are located in NJ); (iii) Stores that are located in areas that are subject to IPLs but they are exempted from the item pricing requirements because they are using electronic shelf label systems (denoted as "ESL-Stores"; in the Tri-State area, these stores are located in CT).

Data Set I was sampled from two supermarket chains. One chain is Stop & Shop, a long-standing and successful chain that operates supermarkets in NY, NJ, and CT, and all over New England. The other chain is Food Emporium. Corporate structures of Food Emporium and Stop & Shop are similar. Both are large chains prevalent in the Tri-State area, and both have stores of similar structures and sizes that sell thousands of products. In addition, both use the EDLP pricing strategy.

We collected price data at 3 Stop & Shop stores and one Food Emporium store (Table 1.1). One Stop & Shop store is located in Tarrytown, NY, which has an IPL; another in Clifton, NJ, which does not have an IPL; and the third in Stamford, CT, which has an IPL. The Stamford store, however, is exempted from the IPL because it has an electronic shelf label (ESL) system. The Food Emporium store is located in Greenwich, CT, which has an IPL. We deliberately chose these locations. All four towns are affluent suburbs of NY City and similar in their linear distance from the City. Their demographic and socio-economic characteristics are also very similar.[38]

Choice of Products for Data Set I

We established the following criteria for choosing the products. First, the products had to be subject to IPLs (if the store was located in an area with IPL).[39] In other words, we chose the products

[36] A senior manager of an ESL system manufacturer has also suggested to us (in a personal email communication) that "… CT and NY provide some of the better 'neighboring counties' scenarios" for studying the effect of IPLs on retail prices.

[37] HL and EDLP refer to the general pricing strategy followed by the retail chain. Under the EDLP strategy, the retailer's prices are low for extended periods of time and therefore, it will offer less promotional sales or discounts. Under the HL pricing strategy, in contrast, the prices are higher, and the retailer tends to offer more frequent discounts through sales and promotions. (See Levy, et al., 1997 and 1998, and Dutta, et al., 1999, for more details.) Menu costs may be playing a role in the observed movement toward pricing strategies, which rely on fewer price changes, such as EDLP (Blattberg and Neslin, 1989; Lattin and Ortmeyer, 1991; and *Marketing News* of April 13, 1992, p. 8). According to *Progressive Grocer* (November, 1992, p. 50), "A growing number of operators say they have switched from high-low pricing [to EDLP]. They cite the inefficiencies of making frequent price changes..." Similarly, Hoch, Drèze, and Purk (1994, p. 16), state that EDLP lowers operating costs by lowering "... in-store labor costs because of less frequent changeovers in special displays." IPLs may be encouraging more supermarkets to switch to EDLP practice. However, the ongoing trend towards the movement from HL to EDLP practice is not limited to IPL states, rather it is occurring nationwide.

[38] For more details on the supermarket chains and the stores selected for data collection, their locations, and the surrounding areas, see Appendix II.

[39] Most IPLs exempt the stores from the item pricing requirement on goods and products that come in variable weight (e.g., fruits and vegetables, baked goods, floral, etc.), some dairy products, eggs, frozen concentrated juices and fruit drinks, baby food packaged in glass jars, individually packed chewing gums and candies for sale at cash register and checkout locations,

that could have an individual price tag put on them. So, for example, a can of tuna fish was acceptable while a bunch of grapes was not.[40] Second, the item had to be standard and common enough so that it could be found in all supermarkets. We therefore excluded private label products because they would not necessarily be comparable across stores (Hoch and Banerji, 1993; Barsky, et al., 2003). Instead, we used only brand name products because their quality remains unchanged across stores and also because they are most likely to be sold in all large supermarkets.

To make the data collection effort practically feasible, we limited our analysis to 15 products in 11 randomly selected product categories. These categories are (1) beverages, (2) breakfast cereal, (3) frozen foods, (4) dairy and juices, (5) soup and canned foods, (6) condiments and sauces, (7) candy and snacks, (8) paper products and pet supplies, (9) health and beauty aides, (10) baby products and food, and (11) households. These categories cover a broad range of goods making up a high percentage of consumers' purchases, and most of the products in these categories are subject to IPLs. The specific goods within each category were chosen by randomly pointing at goods up and down the shelves. The products sampled by each category are listed in Table 1.2.

Price Information Collection Process for Data Set I

To collect the data, one of the co-authors visited each supermarket 4 times, and recorded the price of each item.[41] We went to each store at set times, with one month in between each visit, on the same time and day of the week to ensure consistency of our data with supermarkets' weekly pricing cycle, as different supermarkets change their prices on different days (Levy, et al., 1998, Dutta, et al., 1999). The data collection schedule was as follows: Saturday mornings, Stop & Shop in Clifton, NJ. Then between 1:00 and 2:00 o'clock in the afternoon on Saturdays, Stop & Shop in Tarrytown, NY. Sunday mornings, Food Emporium in Greenwich, CT, and at noon, Stop & Shop in Stamford, CT.

The data collection was done during January 2001–April 2001, as follows. The first trip took place on January 14–15, 2001, the second on February 11–12, 2001, the third on March 11–12, 2001, and the fourth trip took place on April 8–9, 2001. We only recorded the shelf price. If the store was subject to an IPL, then we recorded the individual sticker price. Thus our prices do not reflect any manufacturer or newspaper coupon discount, or any other kind of promotional offer.

The price collection process for data set I yielded 2,640 price observations (4 stores $\times$ 4 visits $\times$ 11 categories $\times$ 15 products), which include 660 observations from the ESL store. The analysis described in section V uses 1,980 observations sampled from the IPL and non-IPL stores. The ESL-store data are used as a control, for comparing ESL-store prices to non-IPL stores prices (in section VIII) and to IPL-store prices (in section IX).

Data Collection Process for Data Set II

The analysis of the first data set revealed that for each one of the 11 product categories

refrigerated yogurt in 8oz sizes or less, sold individually or in packs, and products alike with a shelf-life of two weeks or less, etc. In addition, soda and beer packaged to a maximum of 24 units are also exempted from item pricing requirement. Finally, stores with three employees or less, and stores with three million dollars or less in revenue, are exempt from the item pricing. See Connecticut Food Association web page (www.ctfood.org/item.html) for details.

[40] We tried to exclude the products that are exempted from IPLs because in that case, we would have to deal with a complication arising from the possible cross-product subsidization in pricing decisions of a multi-product retailer. For example, the IPL will not necessarily lead to a price increase of the same amount even if it leads to the same cost increase, because of the cross product and cross-category variation in cross-price elasticity of demand. Unfortunately, we have no information of this kind, and studying that would be beyond the scope of this paper.

[41] To ensure the consistency throughout the entire study and to avoid possible biases, all price data we use were collected by the same individual.

sampled, the IPL store prices were with very few exceptions higher than the non-IPL store prices. Further, the pattern was consistent across the four trips, with a quite stable price difference of about $0.25 per product on average between the two types of stores.

To make the data collection process manageable and cost-effective, therefore, we have reduced the number of categories sampled to two, and instead visited a wider selection of stores and chains by adding 16 new stores to our sample. For data set II, therefore, we went to 20 stores to collect price data for the 30 products included in the two categories.[42] Of the 20 stores, 12 are subject to IPLs (10 in NY and 2 in CT), and 5 are not (all in NJ). The remaining stores, all located in CT (Greenwich, Stamford, and Norwalk), are subject to the IPL but are exempted from the law's requirements because they have installed ESL systems. We should note that all stores of a chain in a given state are only of one type, either IPL, non-IPL, or ESL. For example, in Connecticut there are no ESL and non-ESL stores that belong to the same chain. Table 2.1 lists these stores and their location. In Table 2.2 we list the 30 products included in the second data set.

In total, data set II contains 600 price observations (20 stores × 1 visit × 2 categories × 15 products), which include 90 observations sampled from the ESL stores. The analysis described in section VI uses 510 observations sampled from the IPL and non-IPL stores. As in data set I, the ESL-store data are used as a control, for comparing ESL-store prices to non-IPL and to IPL-store prices. In the two data sets together, we have a total of 2,640 + 600 = 3,240 weekly price observations.

V. Findings from Data Set I

In the top panel of Table 1.3 we compare the prices at two IPL stores (Stop & Shop and Food Emporium) to the prices at the non-IPL store (Stop & Shop), averaged over 15 products, 11 categories, and 4 visits. The figures indicate that the average IPL store price exceeds the average non-IPL store price by 25.2¢ (significant at 1% level) with a 95% confidence interval of 20.3¢–30¢.[43]

In the bottom panel of Table 1.3 and Figure 1.1 we compare the IPL store prices to non-IPL store prices, averaged over 15 product and 4 visits, by product category. According to the figures, the average IPL store price exceeds the average non-IPL store price in all 11 categories, 10 of them statistically significant, 8 at the 1% level, and two at the 5% level. In 8 categories, the average price gap exceeds 20¢, and in two categories, Health and Beauty products and Household products, 40¢.

In Table 1.4 and Figure 1.2, we compare the average price at the *Stop & Shop's IPL store* to the average price at the *Stop & Shop's non-IPL store*, averaged over 15 product and 4 visits, by product category. The exclusion of Food Emporium enables us to control for a possible *cross-chain* variation. As before, the IPL store prices exceed the non-IPL store prices in all 11 categories. The price gaps, ranging from 1.8¢ for frozen foods to 35.6¢ for health and beauty products, average to 20.3¢. All but two price gaps are statistically significant, 7 at 1%, one at 5%, and one at 10%.

Finally, in the 11 panels of Figure 1.3, we compare the average price at the IPL and non-IPL stores by individual product. The figures indicate that the average IPL store price is higher than the

[42] We chose to limit the second data collection to 30 products following the practice of many IPL jurisdictions when they conduct price accuracy audits. For example, in the State Massachusetts, the pricing accuracy compliance is determined based on checking the prices of 25 products ("Retail Electronic Price Systems Exemptions," Section 329D, Amendment to Massachusetts Chapter 94, "Item Pricing Law," Outside Section 125, www.mass.gov/eoaf/budget/fy04/print/outsec/p125.htm). Similarly, in California the pricing accuracy compliance is determined based on checking the prices of 30 products (California Dept. of Food and Agriculture, Division of Measurement Standards, DMS Notice QC-02-5, October 16, 2002, "Statewide Automated Checkstand Scanner Survey," Attachment B, Inspection Procedure).

[43] All the statistical tests we employ in this paper are two-sided, which yield more conservative *p*-values.

average non-IPL store price for 148 of the 165, or 90 percent, individual products. Thus, our results hold for the vast majority of the individual products as well.

VI. Findings from Data Set II

The analysis of the data set I convinced us that the IPL stores prices are systematically higher than the non-IPL store prices. Next, our goal was to see if this result holds across a wider variety of stores. Because we found that the first set of results were true for all product categories and for all 4 trips for most products, and also for budgetary reasons, we reduced the number of categories to two, condiments and household products, and the number of visits to one. This enabled us to visit a wider variety of stores in the Tri-States. On the second round, we visited a total of 20 stores that belong to 7 different chains. Of the 20 stores, 12 (10 in NY and 2 in CT) are subject to an IPL, 3 (also in CT) are also subject to an IPL but are exempted from it because they use ESL systems, and 5 (in NJ) are not subject to IPL. Thus, we have 12 IPL, 5 non-IPL, and 3 ESL stores. The ESL store data are used as a control and are analyzed in sections VII–IX. See Tables 2.1 and 2.2.[44]

In the top panel of Table 2.3, we compare the prices at the 12 IPL stores to the prices at the 5 non-IPL stores, averaged over 15 products and 2 categories. The figures indicate that the average price at the IPL stores exceeds the average price at the non-IPL stores by 24.3¢ with a 95 percent confidence interval of 7.6¢–41¢. This figure is statistically significant at 5% level.[45]

In the lower panel of Table 2.3 and Figure 2.1 we repeat the above comparison by product category. Here the averages are computed over 15 products. According to the figures, the IPL store prices exceed the non-IPL store prices in both categories. The average gaps, 27.2¢ in the Condiments, and 21.8¢ in the Households category, are statistically significant at 1% and 5% level, respectively.

In Table 2.4 and Figure 2.2, we compare the prices at IPL and non-IPL stores that belong to the *same chain*, by product category and thus control for a possible *cross-chain* variation. We have four chains that operate stores in both, IPL and non-IPL areas. These are A&P, Shop Rite, Path Mark, and Stop & Shop. As before, the IPL store prices exceed the non-IPL store prices. The price gap falls between 0.70¢–21¢ and 0.70¢–20.4¢ for the condiments and households category, respectively.

Finally, in the two panels of Figure 2.3, we compare the average IPL store prices to the average non-IPL store prices by individual product. The figures indicate that the average price in the IPL stores is higher than in the non-IPL stores for *all* 30 products, without exception.

Thus, we find that the results of the analysis of data set II are similar to the results of data set I. We conclude, therefore, that the IPL stores do in fact charge higher prices, on average, than the non-IPL stores, as our theory predicts. The average price difference per item between the two types of stores is about $0.25 (the average of 25.2¢ in data set 1 and 24.3¢ in data set 2).

Is a 25¢ difference big? As an absolute measure, a 25¢ difference per product may appear small. Consider, however, the fact the average price in our sample of non-IPL stores is $2.71 in data set I (see the top panel of Table 1.3) and $2.50 in data set II (see the top panel of Table 2.3). Thus, the percentage price difference between the two types of stores is about 9.2%–10.0%, which is substantial. We obtain similar figures, even if we use the average price based on a larger sample. For example, the average price in large US supermarket chains, during 2001 was about $2.08, which

[44] For details on the sampled stores, their locations, and the surrounding areas, see Appendix II.

[45] The confidence interval here is much wider than in data set I. The reason is the small sample size: the analysis of dataset II uses only 510 price observations in comparison to 1,980 price observations used in the analysis of data set I. Thus, the second sample, although useful for assessing the generalizability of our first round findings, has small sample limitations, and therefore, a formal statistical testing of some of our comparisons is not practically feasible.

yields the price difference of about 12 percent between the two types of stores.[46]

To see one implication of this magnitude, consider the following. In 2002, food represented 14% of total Personal Consumption Expenditures (Council of Economic Advisers, 2003).[47] If we take 14% as an approximation for households' grocery expenditures, then IPL laws appear to reduce the real incomes of residents of states with such laws by 1.4%, which is a significant amount.

VII. Electronic Shelf Label Systems and their Cost Structure

In addition to the data used in the analysis discussed in sections V and VI, we also have data from two supermarket chains in Connecticut that are subject to the IPLs but are exempted from the item-pricing requirement because these supermarkets are using electronic shelf label (ESL) systems.

ESL systems allow retailers to display the shelf prices and to change them from a central computer electronically, via a wireless communication system. An ESL system consists of a personal computer based system controller, local wireless communication network, electronic shelf labels, which are small LCD screens, rails, and a fully integrated laser printer. The system obtains information from the in-store item and scanner price database, and broadcasts it to the shelf labels through a controller at each gondola. The laser printer produces the necessary paper shelf labels and signs. The system also maintains a continuous surveillance of the electronic labels to ensure that they are present and displaying the correct information. In addition, this label polling process creates data on the physical location of the ESL labels within the store.

Recall that the IPLs' primary goal is to ensure the accuracy of prices paid by consumers. ESL systems can ensure that the cash register prices are identical to the prices displayed on the ESLs simply because both are linked to the same database. Since 1993, therefore, the State of Connecticut exempts the supermarkets from IPL requirements if they install an ESL system.

According to Zbaracki, et al. (2002) ESL systems are costly to purchase (fixed cost) and maintain (variable cost). First, the purchase cost of the system runs from $125,000.00–$185,000.00 in 2001 prices, per store. The exact price depends on the options included. Second, the installation cost averages $9,000.00–$12,000.00 per store. Third, training the supermarket employees to use the system and to take advantage of its features entails additional cost. Fourth, the costs of converting to an ESL system include time-loss incurred by the stores, store employees, and its customers for downtime caused by readjustment. Further, the system software and hardware require continuous upgrade as the supermarket IT systems evolve. Also, ESL systems often break down, and thus require costly routine maintenance on an on-going basis. Finally, all 25,000 ESLs require routine battery replacement. If the ESLs disappear or break down because of tampering, then the ESLs themselves need to be replaced.[48] The transition from paper-based shelf price tags to ESL systems, therefore, entails a substantial capital investment as well as continuous upkeep cost on the part of retailers.

Thus, the ESL systems have both fixed and variable cost components. We anticipate, therefore, that because of the higher costs, the retailers that install these systems will increase their

[46] The average price of $2.08 is based on the average price figure reported by Levy, et al (1997, p. 813,). They report that during the 1991–1992 period, the average price in large US supermarket chains was $1.70, which, after adjusting for the 22.4 percent increase in the price level, as measured by the GDP deflator, from 1991 to 2001, yields $2.08.

[47] Not all grocery sales represent food expenditures, because they include non-food items such as household and health and beauty goods.

[48] Each electronic label costs $5.50 or more (source: "New Study: Pricing Law Prevents Innovation, Savings," *Michigan Retailer*, July/August, p. 1.

prices in comparison to non-IPL stores.[49]

Moreover, the fixed cost component of the ESL system increases the supermarkets' average cost, which could be passed through to consumers. This is because the retailers face capital constraints, as well as alternative investment opportunities, such as opening new stores or expanding existing stores, which may yield higher net present value: a payback period of 2 years or less appears to be the minimum necessary in the retail supermarket industry (Levy, et al., 1998, and Zbaracki, et al. 2002). According to Ted Phyllis, the Foods and Standards Division Supervisor at Connecticut, however, "… it may take between 3–7 years for a retailer to pay off the cost of the ESL system" (source: March 8, 2004 telephone interview with one of the coauthors). In an attempt to ensure timely payback, therefore, the supermarkets that install the ESL systems may pass some of the fixed costs of the system onto consumers.[50]

VIII. ESL-Stores versus Non-IPL Stores

The above discussion suggests that the prices at IPL stores with ESL systems will likely be higher in comparison to the non-IPL store prices because of the high cost of ESL systems. We examine this prediction by comparing the sampled ESL store prices with the non-IPL store prices.

Findings from Data Set I

In the top panel of Table 3.1, we compare the average ESL store (Stop & Shop in Stamford, CT) price to the average non-IPL store (Stop & Shop in Clifton, NJ) price. Since both stores belong to the *same chain*, we control here for a possible *cross-chain* variation. The averages are computed over 11 categories, 15 products, and 4 visits. According to the table, the average ESL store price exceeds the average no-IPL store price by 10.1 cents, with a 95% confidence interval of 7.5¢–12.7¢. The difference is statistically significant at 1% level.

In the bottom panel of Table 3.1 and Figure 3.1, we compare the ESL store and the non-IPL store prices, by product category, within the *same chain*, again *controlling for a possible cross-chain variation*. The prices are averaged over 15 products and 4 visits. According to the figures, the average ESL store price exceeds the average non-IPL store price in 8 of the 11 categories, all 8 statistically significant (6 at 1% level and 2 at 5% level). The average price difference ranges from 6.7¢ for paper products to 35¢ for Health products. For three product categories the price gaps are of the opposite sign, but statistically insignificant.

Finally, in the 11 panels of Figure 3.2, we compare the average price at the ESL and non-IPL stores for individual products. For 128 of the 165 individual products, that is, for about 78 percent of the products, the average price at ESL stores exceeds the average price at non-IPL stores.

[49] Indeed, according to Grace Nome, the President of Connecticut Food Association, "These [ESL] systems are fairly expensive to maintain and they often break down. These are additional [variable] costs the retailer has to bear. Consequently, it is not correct to assume that they will result in lower prices for the consumer in the long run" (source: February 23, 2004 telephone interview with one of the coauthors). A reader may suspect that a representative of the supermarket industry might not be unbiased when she is asked to assess the costliness of the ESL system. However, we have received a similar assessment from Ted Phyllis, the Foods and Standards Division Supervisor at the State of Connecticut. According to him, "… ESL systems maintenance cost could be substantial. For example, if the ESLs run on batteries, they may fail until battery replacement" (source: March 8, 2004 telephone interview with one of the coauthors).

[50] According to Grace Nome, the President of Connecticut Food Association, "The [ESL] system itself is very expensive and as a result the smaller retailers could not afford it. You will find that only some large retailers have adopted it and the smaller ones stick to the traditional item pricing for the products that they have to" (source: March 8, 2004 telephone interview with one of the coauthors).

Findings from Data Set II

We begin by comparing the average price at three ESL stores, which consist of two Stop & Shop stores (one in Greenwich, CT and the second in Stamford, CT) and one Shop Rite store (in Norwalk, CT), with five non-IPL stores, which consist of two A&P stores (one in Montvale, NJ and the second in Pompton Lakes, NJ), one Shop Rite store (in Rochelle Park, NJ), one Path Mark store (in Montclair, NJ), and one Stop & Shop store (in Clifton, NJ). The comparison is based on the price data gathered for 2 product categories, 15 products in each category, and one visit to each store.

According to the top panel of Table 4.1, the average ESL store price exceeds the average non-IPL store price by 8¢, but the difference is statistically insignificant. According to the bottom panel of Table 4.1 and Figure 4.1, the price gaps in the condiments and households categories are 12.7¢ (significant at 5%) and 2.8¢ (not significant), respectively.

In Table 4.2 and Figure 4.2 we conduct category average price comparison between ESL and non-IPL stores by *chains*, thereby controlling for a possible *cross-chain* variation. We find that for each chain the average price at ESL stores is systematically higher than at non-IPL stores. First consider the condiments category. At Shop Rite, the average price is higher at the ESL store by 19.6¢ in comparison to the chain's non-IPL store. At Stop & Shop, the average price is higher at the ESL store by 17.1¢ in comparison to the chain's non-IPL store. Next, consider the households category. At Shop Rite, the average price is higher at the ESL store by 16.0¢ in comparison to the chain's non-IPL store. At Stop & Shop, the average price is higher at the ESL store by 12.0¢ in comparison to the chain's non-IPL store.

Finally, in the two panels of Figure 4.3, we compare the average price at the ESL and non-IPL stores for individual products. For 20 of the 30 individual products, that is, for about 67 percent of the products, the average price at ESL stores exceeds the average price at non-IPL stores.

In sum, we find that the prices on average are higher at ESL stores than at non-IPL stores, as predicted by our analysis. This implies that IPL requirements are costly to retailers either way, whether they are exempted from it (in case they choose to install an ESL system) or not. Consequently, the consumers affected by the IPLs end up eventually paying these higher costs. In the case where the stores install ESL systems, the consumers end up paying a price that is higher than at non-IPL stores by 8¢–10.1¢, per item on average.

IX. ESL-Stores versus IPL Stores

The ESL stores data can also be used for comparison with the IPL stores data. To the extent that supermarket chains pass through the higher costs IPLs impose on them, such a comparison may reveal the extent of cost saving ESL systems might offer. Another advantage of this comparison is the fact that some of the IPL-stores and all three ESL stores operate in Connecticut, and thus their comparison is not subject to *cross-state* differences.

The description of ESL systems in section VII suggests that the prices at ESL stores, that is, at the IPL stores with ESL systems, are expected be lower in comparison to IPL stores that are not equipped with ESL systems because ESL systems reduce the cost of individual item pricing and price adjustment. To examine this prediction, we compare the ESL stores' and the non-IPL stores' data.

Findings from Data Set I

In the top panel of Table 5.1 we compare the prices at the ESL store (Stop & Shop in Stamford, CT) to the prices at the two IPL stores (Stop & Shop in Tarrytown, NY, and Food

Emporium in Greenwich, CT). The prices are averaged over 11 categories, 15 products, and 4 visits. According to the top panel of Table 5.1, the average IPL store price exceeds the average ESL store price by 15.1¢, with a 95% confidence interval of 10.3¢–20¢. This difference is statistically significant at 1% level.

In the bottom panel of Table 5.1 and Figure 5.1, we compare the ESL store prices with the IPL store prices, by product category. The prices are averaged over 15 products and 4 visits. According to the figures, the average IPL store price exceeds the average ESL store price in 9 of the 11 categories; 8 of these 9 are significant at 1% level, and one at 5% level. The average price gap ranges from 11.9¢ for beverages and soups to 35.1¢ for breakfast cereals. In one category, baby products and food, the price gap is of the opposite sign, but statistically insignificant.

In the top panel of Table 5.2, we conduct a *within-state* comparison by excluding the NY-IPL store (S1), and comparing the average price at the *CT-ESL store* (S19) with the average price at the *CT-IPL store* (S16). The prices are averaged over 11 categories, 15 products, and 4 visits. According to Table 5.2, the average IPL store price exceeds the average ESL store price by 20.1¢, with a 95% confidence interval of 17.8¢–22.4¢. This difference is statistically significant at 1% level.

In the bottom panel of Table 5.2, and in Figure 5.2, we conduct a *within-state* comparison by comparing the prices at the *CT-ESL* store with the prices at the *CT-IPL store, by product category*. For each category, the prices are averaged over 15 products and 4 visits. According to the figures, the average IPL store price exceeds the average ESL store prices in 10 of the 11 categories, all 10 statistically significant at 1% level. The average price gap ranges from 14.5¢ for soups to 36.5¢ for breakfast cereals. In one category, baby products, the price gap is of the opposite sign and statistically significant at the 1% level.

Finally, in the 11 panels of Figure 5.3, we compare the average price at the ESL and IPL stores for individual products. We find that for 140 of the 165, or 85 percent, of the individual products, the average price at IPL stores exceeds the average price at the ESL stores.

Findings from Data Set II

Next we compare the prices at three ESL stores, which consist of two Stop & Shop stores (one in Greenwich, CT and the second in Stamford, CT) and one Shop Rite store (in Norwalk, CT), with the prices at 12 IPL stores (10 in New York and 2 in Connecticut). The comparison is based on price data gathered for two product categories (15 products/category), and one visit to each store.

According to the top panel of Table 6.1, the average price at the IPL stores exceeds the average price at the ESL stores by 16.3¢, with statistical significance at 5% level. If we consider individual product categories, then according to the figures in the bottom panel of Table 6.1 and Figure 6.1, we find that the difference in the average price for the condiments' and households' categories is 14.5¢ and 18.9¢. Both differences are statistically significant at the 5% level.

In the first panel of Table 6.2 and Figure 6.2, we compare the prices at the 3 *Connecticut ESL stores* with the 2 *Connecticut IPL stores*, controlling for a possible *cross-state* variation. According to the figures, the average price at the Connecticut IPL stores, exceed the average price at the Connecticut ESL stores by 16.6¢. The average price at the IPL stores is systematically higher than at the ESL stores for each category as well. For the condiments category, the average price at the IPL stores is higher by 20.4¢ in comparison to the ESL stores. For the household products category, the average price is higher at the IPL stores by 12.8¢ in comparison to the ESL stores.

In the second panel of Table 6.2 and Figure 6.3, we try to control *for the state as well as the*

locality by comparing the average price at 2 Connecticut ESL stores, both belonging to Stop & Shop, one in Greenwich, CT, and the other in Stamford, CT, with the average price at Food Emporium, which is an IPL store in Greenwich, CT. This comparison is useful because Greenwich and Stamford stores are close to each other, serving the same locality, because of the physical proximity of the two cities. According to the second panel of Table 6.2, the average price at the IPL store exceeds the average price at the ESL stores by 28.5¢. The average price at the IPL stores is systematically higher than at the ESL stores for each category as well. For the condiments category, the average price at the IPL store is higher by 26.9¢ in comparison to the ESL stores. For the household products category, the average price is higher at the IPL store by 30.0¢ in comparison to the ESL stores.

Refining our analysis further, in the third panel of Table 6.2 and Figure 6.4 we try to control *for the state as well as the locality* by comparing the average price at Stop & Shop in Greenwich, CT, which is an ESL store, with the average price at Food Emporium, in Greenwich, CT, which is an IPL store. This comparison is useful because the two stores are physically located on the same intersection in Greenwich, CT. Thus, the two stores are *in a direct competition with each other*, *serving the same community*. According to the figures, the average price at the IPL store exceeds the average price at the ESL store by 27.1¢. The average price at the IPL stores is systematically higher than at the ESL stores for each category as well. For the condiments category, the average price at the IPL store is higher by 24.9¢ in comparison to the ESL store. For the household products category, the average price is higher at the IPL store by 26.9¢ in comparison to the ESL store.

Finally, in the two panels of Figure 6.5, we compare the average price at the IPL and the ESL stores for individual products. According to the figures, for 29 of the 30 individual products, that is, for 97% of the products, the average price at the IPL stores exceeds the average price at ESL stores.

In sum, we find that the prices are higher at the IPL stores than at the ESL stores, by an average of 15.9¢ per item, which can be viewed as a measure of the cost saving that the ESL systems provide the retail supermarket chains that are affected by the item-pricing requirement.

We thus observe three sets of prices: the prices at non-IPL stores, the prices at ESL stores, and the prices at IPL stores. Let the cost at non-IPL stores be the baseline. Then at stores in IPL jurisdictions that do not adopt ESL, the cost is about $0.25 above the baseline. At stores in IPL jurisdictions that adopt ESL, the cost is $0.10 above the baseline. Thus, we have two price gaps: a gap of $0.15 between IPL and ESL stores, and a gap of $0.10 between ESL and non-IPL stores.

This set of observations is exactly what we would predict if IPLs increase costs and ESL systems can serve as a method of reducing but no entirely eliminating these costs. This set of observations is consistent with an average cost of $0.25 for IPL relative to no-IPL requirement. Then ESL adds $0.10 to cost relative to no-IPL requirement. The fact that the ESL prices are between the baseline and the IPL store prices, therefore, is powerful evidence supporting our theory.

X. Costs-Benefit Analysis of the Item Pricing Laws

Now that we have measured the costs of IPLs in terms of the price increases they seem to cause, we next want to briefly compare them to the measurable benefits of IPLs. Recall that the primary alleged benefit of IPLs is that they help consumers notice price mistakes. The main concern of consumers seems to be price overcharges at the cash register, which they may not notice in the absence of price tags on each individual item. In order to assess the benefits of the IPLs, therefore, we rely on the price accuracy studies, which were discussed in section II above.

We consider two surveys of pricing accuracy. The first is the 1993 survey of the *Money*

magazine, and the second is the 1998 "Price Check II" of the FTC. We choose these two because amongst the studies discussed in section II, the *Money* magazine study reported the *highest* amount of overcharge while the 1998 FTC's study reported the *lowest* amount of overcharge per item. By choosing the two extreme values we can provide a range for the IPL benefit by bounding it from above and below.[51] As a measure of the cost of IPL, we use the finding that IPLs lead to a $0.25 price increase per item on average.

In the *Money* magazine survey run in 1993, prices of 10 items were checked at 27 stores in 23 states.[52] The study found that 30% of the stores overcharged and 7% undercharged. At the stores that overcharged, 10% of the sample was overcharged. The article did not report the average overcharge, but it did mention three examples of overcharges ranging from $0.30 to $1.08, which implies an average overcharge of $0.069 (the average of $0.30 and $1.08, times 10%). According to our cost calculations, IPL stores charge $0.25 more per item, on average. Assuming that the item pricing protects the consumers from *ever being overcharged*, IPLs give them a benefit of $0.069, while it costs them $0.25, per item. Thus, the cost of IPL exceeds its benefit by a factor of 3.6, and that is a conservative estimate. If we factor in the undercharges, then the net loss is even higher.

In "Price Check II" run in 1998, prices of 107,096 items were checked in 1,033 stores, of which 303 were retail food stores where 32,753 items were checked.[53] According to "Price Check II," 1.36% of the items checked in food stores were overcharges and 1.06% undercharges. The average overcharge was $0.66 and the average undercharge $0.73, per item. Thus, according to "Price Check II," in a sample of 100 items, 1.36 items are overcharged, on average. At $0.66 per overcharge, that is a total overcharge of $0.90 per 100 items, or $0.009 per item, which represents the maximum benefit consumers can gain from item pricing according to this study, assuming that the IPL is *100 percent effective* in preventing all price overcharges. Comparing it to the cost of IPL, $0.25, we find that the cost of the IPL exceeds its benefit by a factor of 27! Again, if we factor in the 1.06 percent undercharges, then the IPL's benefit is wiped out completely. This would eliminate the ability to garner *any* benefits from item pricing altogether.[54]

If we conservatively assume that consumers are incredibly honest and dislike any price mistake, *even if it is in their favor*, then total benefit of the IPL would at most reach 0.009 + 0.0077 = 0.017 (where 0.0077 is obtained by multiplying 1.06 by 0.73). *Money* magazine study does not report average undercharge. However, if we assume that average undercharge equals the average overcharge, and we again conservatively assume that the shoppers are 100 percent honest (and thus correct the cashier even if the pricing error favors them), then the expected benefit of the IPL will double to about 0.138. The cost of the IPL in this case will still be twice as much as the benefit.

We infer that the costs incurred by consumers because of the IPLs are at least an order of magnitude higher than the benefits the IPLs provide. Moreover, all consumers in localities with IPLs pay the costs of the laws in the form of higher prices, but only a few will ever reap their intended benefits. This is because not all consumers are overcharged at cash registers. Further, the consumers

[51] We should note, however, that the FTC's "Price Check II" study is the most relevant for our case. This is because it was conducted in 1998 while the other studies date further back. We collected our data in 2001. Therefore, given the finding that the pricing accuracy has been increasing over time across the board and especially in the retail supermarkets industry, the 1998 study of the FTC appears most relevant for us given our sample period. Further, Price Check II is broadest as it relies on the biggest sample in terms of the sample size as well as the breadth of its coverage. We nevertheless conduct the analysis using the two extreme findings.

[52] O'Connell, "Don't Get Cheated," 132–138.

[53] FTC, "Price Check II," p. 9.

[54] We should note that three of the four studies discussed in section II, showed that, on average, undercharges exceeded overcharges in total value.

are not equally sensitive to price mistakes, especially if the mistakes are small.[55] But all consumers will pay higher prices for item pricing. If item pricing protects consumers from overcharges, and stores overcharge between 1–2 percent of the time, then that means that vast majority of the consumers are not overcharged. They, therefore, cannot benefit from item pricing, but they still have to pay the higher prices caused by item pricing.

XI. Potential Biases and Other Data Measurement Issues

Before concluding, we should discuss potential biases in our measurements. First, despite our best efforts to collect data at supermarkets located in areas as homogeneous as possible, there may still be some systematic differences between the localities covered. For instance, there may be systematic differences between the localities in terms of property taxes, land rents, labor costs (e.g., minimum wages), average household income, etc. To the extent that these differences are systematic and substantial, the estimated price differences may not be entirely due to the IPLs, and in that case our measure of IPL costs, 25¢ per item, may be biased upward. For example, NY and NJ have Federal minimum wages ($5.15/hour), while CT's minimum wage is higher ($6.90/hour).[56] Similarly, there may be differences in wholesale prices despite the Robinson-Patman Act.

These biases, however, may not be as important because the supermarket workers handling pricing and price change tasks are not minimum wage workers. More importantly, the fact that our findings are robust across numerous types of comparisons is reassuring that these kinds of biases, if present, are unlikely to be severe. For example, recall that we have conducted price comparisons not only *across states* with IPLs and without IPLs, but also *across chains* within a state, *across chains* within a county/locality/intersection, *across stores* within a chain, and *across product categories*. Thus, if for example, property tax rates vary across states or across counties, then the comparison of prices sampled from the stores within the same county (comparing prices at CT-IPL and CT-ESL stores) is not affected by that. Further, the corroborating evidence we offer, relying on the existing studies of IPLs' effect on price adjustment costs, as well as the evidence we offer based on the comparison of the ESL store prices' data in comparison to the IPL and non-IPL store prices data, and the survey of trade publications, all support our findings.

Second, in conducting the cost-benefit analysis of the IPLs, we have only focused on the IPL's primary costs and primary benefits and thus left the secondary costs and benefits unmeasured. For example, on the benefit side of the IPL, we have focused only on what the proponents of the law claim to be the IPL's primary benefit: prevention of pricing overcharges.[57] People, however, have cited other benefits of the law. For example, they have argued that without item pricing, price comparison would be difficult and therefore, it would be easier for stores to raise prices because consumers cannot remember the price of every item they buy. In addition, it has been argued, shelf price labels are often difficult to read, and misplaced items make shopping difficult because of the difficulty of identifying their price.

However, the IPLs do not necessarily yield all these benefits. For example, the suggestion that without IPLs price comparison would be difficult and that would make it easier for stores to raise

[55] See, for example, Chen, et al. (2001), Bergen, et al. (2003), Sims (2003), and Reis (2003).

[56] It also depends on whether or not these workers are unionized or not.

[57] It is worthwhile to note that although the proponents of the IPLs are clearly motivated by consumers' best interest, it is not obvious that they are representing all consumers' opinion when it comes to the IPLs. For example, according to the *Washington Post* report, "… out of 60 shoppers questioned, a majority of three to one favored elimination of item prices as long as prices stayed lower. Only one-sixth of the people surveyed preferred individual item pricing even if prices were not lowered." Source: "Farewell to Item Pricing?" p. 11.

prices, may not be valid in light of the findings of Dickson and Sawyer (1986) who report that item-pricing requirement does not necessarily lead to a better price recall. Also, "search consumers" will not necessarily benefit from IPLs. For them, unit price information, such as price per oz or price per liter, is more valuable, and IPLs do not require unit pricing on each item. Moreover, many search consumers primarily focus on "sales" or "weekend special" items. These items, however, are exempted from many IPLs (e.g., in Massachusetts), and therefore, IPLs cannot really help these consumers in comparison-shopping. Therefore, the marginal benefit of reduced search cost that IPLs offer these "price sensitive" consumers may not be large.

Similarly, the argument that retailers will have incentive to take advantage of their consumers by frequent overcharging if there is no item-pricing requirement is unlikely to be valid, certainly not universally. This is because the stores also have powerful incentives not to overcharge. Consider the following report: "When Payless Drug Store and Eagle Hardware & Garden in Seattle were criminally cited recently because scanner prices didn't match shelf prices, the story made the front page of the *Seattle Times*. The fines facing the stores were minimal, ranging from $20 to $200, but the damage from a public relations standpoint was considerable" Hennessy (1994, p. 88). Thus, as Goodstein (1994) notes, while undercharging means a small loss of profit for the retailer, overcharging means increased consumer mistrust and legal pressure for redress.

The above discussion assessed the likelihood of downward bias in IPLs' benefits. We have reasons to believe, however, that our measure of IPLs' costs may also be biased downward. This is because on the cost side, we have only focused on the primary costs of the IPLs ignoring various secondary costs the laws impose. For example, state and local governments spend substantial amount of resources monitoring the retailers' compliance with the IPL requirements. For instance, in Massachusetts the annual cost of monitoring pricing accuracy exceeds $600,000.[58] Similarly, the State of Michigan has been devoting a substantial amount of money to monitoring the pricing accuracy of Michigan retailers. For example, the state has been conducting annual price check surveys for several years in a row.[59] Other states and localities have been similarly conducting costly surveys and monitoring activities. In addition, the regulators need to devote resources to prosecuting violators of the IPLs.[60] [61] Moreover, as discussed in section II, item-pricing requirement forms barriers to frequent price changes. To the extent that a more competitive environment would lead to more frequent price changes, the IPLs may be denying the consumers some of the benefits of competition.

From a practical point of view, however, it is not clear how one could measure these

[58] According to the Massachusetts Government home page, its "Division of Standards is responsible to enforce the item pricing law and the unit pricing regulations… The division administers and awards grants to local agencies for the purpose of enforcing scanner and item pricing accuracy in retail stores. This year the item pricing scanner accuracy grants will exceed $600,000 dollars, which doubles the amount of money allocated for this purpose by the legislature the previous year. Grants for this purpose last year resulted in 18 agents being authorized for enforcing scanner accuracy laws. These agents inspected over 1,800 stores." Source: www.state.ma.us/standards/aboutus.htm.

[59] "Few Scanner Errors in State's Pricing Survey," by D. Durbin of the AP, December 4, 2002, *Detroit Free Press*.

[60] For example, according to the Nov-Dec 2000 issue of *Iowa Oil Spout*, Wal-Mart and OfficeMax were sued by Michigan's Attorney General's office, alleging that the retailers were failing to affix individual price tags to the merchandise within its stores. According to the investigators of Michigan Attorney General's office and of the Department of Agriculture, IPLs were violated by 10 Wal-Mart and 9 OfficeMax stores in Michigan. The parties have eventually settled the lawsuit. Under the settlement, Wal-Mart has agreed to pay $250,000.00 and OfficeMax $125,000.00 in civil penalties. In addition, both companies agreed to ongoing compliance audits, to ensure that IPLs are not violated in their stores.

[61] According to the January 22, 2004 report, a $7.35 million settlement has been reached in the class action lawsuit filed regarding Wal-Mart Corporation's alleged failure to comply with Massachusetts' item-pricing regulation. According to the report, Wal-Mart will spend $5.6 million in the next three years to bring its Massachusetts stores into compliance with the regulation, as well as $750,000 to attorneys and $1 million in grants to several consumer and charitable groups and the office of Attorney General (http://www.bigclassaction.com/settlements/consumer.html).

secondary costs. The measurement of the secondary benefits of the IPLs seems to be even harder. From a conceptual point of view, therefore, it is unclear how the exclusion of these secondary costs and benefits may have biased our findings.

Another possible difficulty may be data limitations because of the sample size. In total, our data set contains only 3,240 weekly price observations. Some might consider this a small sample in comparison to say, supermarket scanner data used by Müller, et al. (2002), Barksy, et al. (2003), Chevalier, et al. (2003), Bergen, et al. (2003), Chen, et al. (2004). However, we should emphasize a big difference between the two types of data. Scanner data are typically available in large volumes electronically from supermarket chains themselves or from various data-collection companies (i.e., AC Nielsen). The data we use, in contrast, requires manual collection over multiple store visits. Our sample size is actually larger than other studies have used. For example, Goodstein' (1994) manually sampled price data contain only 450 observations (3 chains × 5 stores × 3 categories × 10 products). Bergen, et al. (1996) have manually sampled 446 observations to study price variation between manufacturer brands at retail stores. Warner and Barsky (1995) have also used hand-collected price data of a similar size. Thus, our sample size, over 3,000 observations, is at least seven times bigger than the samples of these studies.

These possible shortcomings notwithstanding, we believe, that as a first approximation, our analysis and the resulting figures are reasonable, assuming that we have correctly identified the primary costs and benefits of the law. As a comparison, we are aware of one study, conducted by Arthur D. Little, which tried to measure the cost of a government regulatory rule of a type similar to the IPL.[62] The study, which is cited by Viscusi, (1993, p. 57), analyzed labeling costs associated with state-specific labels such as the California Proposition 65 Warnings for Carcinogens. According to Viscusi, for a 50¢ product the total extra cost of these state-specific warning labels was 5.4¢ per unit, which translates to 5.4/50 = 10.8 percent, a figure that is remarkably similar to our findings.

XII. Conclusion

IPLs seem to be one of those laws adopted under the pressure of small interest groups, yet it appears to affect all supermarkets and buyers in the localities that have adopted these laws. The fact is that only 9 US states have an IPL. An economist's explanation, for why we do not see a more widespread use of IPLs, would be that if people wanted item pricing, then the market would offer it without the need of the law. Nevertheless, studying the costs and the benefits of IPLs is important for identifying and quantifying their effects on various market participants.

This paper makes four specific contributions. First, we offer a theoretical explanation for predicting the effect of IPLs on retail prices. Second, we test the prediction using transaction price data from natural experiment. Third, we quantify the cost effect of IPLs on retail prices. And fourth, using existing evidence on the accuracy of retail prices, we conduct a cost-benefit analysis of IPLs.

Our findings suggest that stores facing IPLs charge higher prices in comparison to the stores not facing these laws because the item-pricing requirement increases the stores costs. We find that the average price gap is about $0.25 per item or about 10 percent of the average item price, which seems quite substantial. The findings reported for the ESL stores, we believe, offer evidence consistent with this interpretation of the effects of item pricing requirements on retailers' costs.

In general, more information is better than less information and therefore, marking individual

[62] We are grateful to Kip Viscusi for bringing this study to our attention.

item price information on each and every item sold, can indeed be useful as this may reduce consumer search cost. In addition, item-pricing information can help buyers make "better" choices. This argument, however, ignores the cost of providing the item-pricing service. If item pricing is costly and these costs are born by consumers, then they many not want item pricing. Note also that the extra information the shoppers get because of the IPLs is marginal because there already are two other laws, the shelf price law and the unit price law, which provide useful information in different forms. This, along with the costliness of the IPLs further diminishes the value of IPLs for consumers.

Recent literature on rational inattention (Mankiw and Reis, 2002; Ball, et al., 2003; Sims, 1998 and 2003; Bergen, et al., 2003; Reis, 2003; and Chen, et al., 2004) suggests that collecting, absorbing, analyzing, and processing information is a costly activity. For example, shoppers who routinely buy hundreds of products may rationally choose to ignore some price information. For instance, Bergen, et al. (2003), who study the phenomenon of 9- and 99-ending prices, and Chen, et al. (2004) who study the phenomenon of asymmetric price adjustment in the small, argue that given the cost of information processing, buyers may ignore, and thus not to react to, small price changes. Both studies provide empirical evidence consistent with these predictions. These studies, and more generally the idea of rational inattention, suggest that the benefits of IPL may not be high.

We conclude, therefore, that the IPLs may be very inefficient, not only from the perspective of retailers, but especially from the perspective of consumers: the IPLs seem to harm the consumers greatly, even though the primary reason given by proponents for creating these laws is to protect them. We believe this is the first direct evidence on the inefficiencies inherent in IPLs.

Our findings suggest that potential inefficiencies caused by IPLs should be more carefully considered in public policy debates on these laws. This is particularly important now, as several US counties and states, and other countries (e.g., Canada and Israel) are in the midst of discussing the renewal/revision of the existing IPLs. There are other interesting questions that arise in the context of these laws. For example, it may be useful to explore theoretical implications of endogenous price adjustment costs where the costs vary with the quantity sold. Further, more empirical work should be done using data from other stores, products and markets to determine the generality of our findings. Future empirical work should also consider a wider selection of products, including those exempted from IPLs. For example, comparing the prices of exempted products across IPL and non-IPL stores may reveal whether the price gaps between the two types of stores hold for the exempted products as well. This is interesting because the retailer may be treating price adjustment costs as fixed and spreading them across the "exempted" products in a form of cross-subsidization. In that case, the non-exempted products may not incorporate all the increased operational costs that result from IPLs.

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Appendix I. Item Pricing Laws in New York and Connecticut

A) New York's Item Pricing Law

New York's IPL is defined in Section 214-i of Article 17 of the Agriculture and Markets Chapter in the New York State Consolidated Laws. The law begins by stating that although scanning technology is efficient and might make it economically advantageous for supermarkets to remove price markings on individual items, the legislature finds "that price constitutes an indispensable ingredient to a consumer's right to all reasonable information in order to make an informed purchase choice." The law finds that item pricing is necessary to protect consumers even while electronic universal product code check out systems are further developed. It goes on to require that any store that sells food at retail has to clearly label each consumer commodity it sells with its selling price. Certain goods, like milk, eggs, produce, and single packs of gum, are excluded from the item-pricing requirement. In addition, if the store has fewer than three employees or grosses less than three million dollars in revenue annually, then it is exempt from the law. The law also says that a store cannot charge a price for an item that is higher than any item, shelf, sale, or advertised price of the item.

Next, the law details violations, penalties, and enforcement. Enforcement is left to municipal consumer affairs offices or to the municipal directors of weights and measures. If a store is inspected, then a sample of no less than fifty of the commodities subject to the law in a store are to be checked. For the first four violations, each penalty will be $50; $100 for each of the next twelve violations; and $150 for each subsequent violation, but the maximum penalty for the first inspection of the year can be no more than $5,000. However, if in subsequent inspections in a twelve-month period more violations are found, then the penalties will be doubled and there will be no maximum penalty. Failure to have a clearly readable price on three identical items of the same commodity is considered a violation. The law also allows the enforcement agent to compare the item, shelf, sale, or advertised price of an item with the price that is displayed in the computer at check out. In the case of overcharges, penalties ranging from $50 to $300 will be levied depending on the number of violations, and there is no maximum penalty. In subsequent inspections in a twelve-month period, the fines will double for violations. An inspector also has the authority to issue a "stop-removal order," which would prohibit the store from selling particular items until it can correct the violations it has with those items.[63]

B) Connecticut's Item Pricing Law

Connecticut's IPL is similar to New York's, although it is less detailed. Section 21a-79 of the General Statutes of Connecticut defines the state's IPL. Currently, there is a bill being considered in the Connecticut General Assembly that would update its IPL. A consumer commodity is defined by Connecticut as "any food, drug, device, cosmetic or other article, product or commodity of any other kind or class, except drugs sold only by prescription, which is customarily produced for sale to retail sales agencies or instrumentalities for consumption by individuals, or use by individuals for purposes of personal care or in the performance of service ordinarily rendered in or around the household, and which usually is consumed or expended in the course of such consumption or use."[64]

Connecticut's IPL states that any establishment that utilizes universal product coding in totaling a retail customer's purchases of consumer commodities, shall mark each consumer commodity with its retail price. It has the same product exceptions as New York's law, but also adds to its list of exceptions

[63] New York State Consolidated Laws, "Item Pricing," Agriculture and Markets Chapter, Article 17, Section 214-I, Bill SO3847 (2001).

[64] Connecticut General Assembly, "Unit Pricing Statutes and Regulations," General Statutes of Connecticut, Section 21a-73.

alcoholic beverages and carbonated soft drinks. It goes on to state that the item pricing requirements will not apply if the Commissioner of Consumer Protection allows a store to use an electronic pricing system.

Connecticut's penalty for price accuracy errors is not as severe as New York's. It states that if an item is advertised as being on sale, then each item does not need to be remarked at the new price, but a sign indicating the sale price needs to be put adjacent to the items. If at the checkout counter a consumer is overcharged for the item on sale, then it will be given to the consumer for free.

The Commissioner of Consumer Protection is given the authority to enforce Connecticut's IPL. Penalties for violations of the law can be a warning citation, a civil penalty, or a fine. For the first offense, the civil penalty can be no more than $100 and the fine no more than $200, and there is no minimum specified. For subsequent offenses, the civil penalty can be no more than $500 and the fine no more than $1000, and there is no minimum specified. There are also no maximum amounts of penalties and fines specified.[65]

Connecticut's IPL does not have strict penalties for price accuracy errors in stores, while New York's IPL does. Connecticut's law also does not exempt certain businesses that gross under a certain amount in sales, like New York's law does. Connecticut's law simply says that any establishment that uses universal product coding is subject to the IPL. New York gives enforcement authority to municipalities, while Connecticut gives enforcement authority to a central state office. Penalties specified in both laws are severe for violations, but only New York specifically allows the enforcing agent to put an immediate stop on the sale of goods. New York's law details a structured penalty scheme, while Connecticut's law gives the enforcement agent more discretion.

Perhaps the most significant difference between the IPLs in each state though is that Connecticut has the electronic pricing system exception while New York does not. In fact, Connecticut is a unique state regarding IPLs. In 1992, the Connecticut legislature exempted stores from its IPL if the stores installed electronic pricing systems. The idea is that electronic pricing systems eliminate errors. Electronic labels that appear beneath goods on shelves are connected to the central computer of the supermarket. So when the price of an item is changed in the central computer, the new price is automatically displayed in the electronic label beneath that item. Besides saving thousands of labor hours and label and printing costs each year, supermarkets that use this system reduce the chances of human and scanning price errors that cause consumer mistrust and fines levied by the state. Supermarkets all over the country are increasingly using electronic pricing systems as the technology improves and its costs go down. However, in Connecticut especially, supermarkets are installing this technology to be exempt from IPLs which otherwise increase their annual costs by thousands of dollars.

[65] Connecticut General Assembly, "An Act Requiring the Display of Prices on Retail Items," General Statutes of Connecticut, Section 21a-79, Committee Bill No. 5135 (2001).

Appendix II. Information on the Supermarket Chains and the Stores Sampled

A) Supermarket Chains Sampled

Stop & Shop – In 1996, Stop & Shop became a wholly owned subsidiary of Royal Ahold NV, the fourth largest food retailer in the world. Headquartered in the Netherlands, Royal Ahold NV has supermarket companies in the United States, Europe, Latin America and Asia. Worldwide, the company employs more than 300,000 people and owns 4,000 stores with annual sales of approximately $35 billion. Today, Stop & Shop is a multibillion-dollar corporation and the largest food retailer in New England, operating two hundred and seventy-four supermarkets in five states: Connecticut, Massachusetts, New Jersey, New York, and Rhode Island. Stop & Shop employs 41,000 associates in its network of stores, distribution centers, manufacturing plants, and offices, which stretch across more than 180 communities.[66]

Food Emporium – With forty-two stores in Manhattan and upscale neighborhoods in Westchester, Long Island, Northern New Jersey, and Connecticut, Food Emporium is a preeminent supermarket in the Tri-State area. Food Emporium's parent company is The Great Atlantic & Pacific Tea Company, or A&P for short. The Great Atlantic & Pacific Tea Company, based in Montvale, New Jersey, operates combination food and drug stores, conventional supermarkets, and limited assortment food stores in sixteen U.S. states, the District of Columbia, and Ontario, Canada, under the A&P, Waldbaum's, Super Foodmart, Food Emporium, Super Fresh, Farmer Jack, Kohl's, Sav-A-Center, Dominion, Ultra Mart, and Food Basics trade names. By February 26, 2000, the Company operated 750 stores and served 65 franchised stores.[67]

C-Town – C-Town supermarkets are independently owned and operated. Since the chain's founding in 1975, it has grown to a group of almost 200 supermarkets doing business in a 5 state region encompassing New York, New Jersey, Connecticut, Massachusetts, and Pennsylvania. C-Town now ranks as the fifth largest food retailer in the metropolitan New York area. C-Town Supermarkets are supplied by Krasdale Foods. Founded in 1908, Krasdale Foods has become a leading distributor of name brand and store brand grocery products in the region.[68]

Pathmark – Pathmark supermarket chain was established in 1968. The company is known for pioneering the "super center" concept. Pathmark was also the first supermarket company in the Northeast to operate its stores 24 hours each day, 7 days a week. It was also among the first to adopt electronic scanning cash registers at the checkout. As of April 2003, Pathmark operates 144 supermarkets in the New York-New Jersey and Philadelphia metropolitan areas, employing over 27,000 associates. The company has stores that are located in both urban and suburban marketplaces. Since September 2000, Pathmark is a publicly traded company (PTMK, on the NASDAQ).[69]

Shop Rite – Shop Rite supermarket chain was born in 1946 as a cooperative of seven independent grocers under the name Wakefern Food Corporation. In 1951 the name Shop Rite was adopted. By the end of their first ten years in business, there were more than 70 Shop Rite Members with an annual sales volume of $100 million. In the late 1960's, Shop Rite lost nearly half of its wholesale volume when its largest Member, Pathmark, withdrew from the cooperative. Since then, Shop Rite has grown into the largest retailer-owned cooperative in the United States and the largest employer in New Jersey. The

[66] Stop & Shop, About Us, http://www.stopandshop.com.
[67] The Great Atlantic and Pacific Tea Company, "Our Company," http://www.aptea.com.
[68] Source: www.ctownsupermarkets.com/Menu5/Default.htm.
[69] Source: www.pathmark.com, or www.restorationplaza.org/jv/rsc/rsc.html.

cooperative is comprised of 43 members who individually own and operate 190 Shop Rite stores in New Jersey, New York, Connecticut, Pennsylvania and Delaware.[70]

A&P – Founded in 1859, The Great Atlantic & Pacific Tea Company Inc (or A&P) A&P operates 465 stores in 10 US states (Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Louisiana, Mississippi, Michigan, and Ohio) and the District of Columbia, and 180 stores in Ontario, Canada, under 11 retail banners, which include conventional supermarkets, food and drug combination stores, and discount food stores (under the names A&P US, A&P, Waldbaum's, A&P Super Foodmart, Food Emporium, Super Fresh, Farmer Jack, Sav-A-Center, Food Basics, A&P Canada, Dominion, Ultra Food & Drug, and The Barn Markets). A&P employs 78,000 associates and has annual sales volume of about $11 billion. The Company's shares are traded on the NYSE (under GAP). The Company also distributes private label product lines sold exclusively throughout its U S and Canadian banners.[71]

Shaws – Founded in 1860 in Portland, Maine, Shaw's supermarket chain operates 200 stores in Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont, with annual sales of over $4.4 billion, and about 30,000 employees. The chain serves about 4 million customers each week. In 1987, the chain was purchased by J. Sainsbury, which is England's largest supermarket chain operator.[72]

B) Stores Sampled

(S1) Stop & Shop in Tarrytown, NY – Tarrytown and the surrounding Hudson Valley river towns in southern Westchester County are quiet upper class suburbs of New York City. See Chart 1. The Stop & Shop in Tarrytown is located right on the border between Tarrytown and Irvington (another small upper class town). There are also lower income parts of Tarrytown, and residents from these areas may shop at the Stop & Shop along with residents from the higher income areas of Tarrytown and Irvington.

(S2) C Town in Ossining, NY – Located in a solo building in a small commercial area of a residential suburban community in northeastern Westchester County. The store is of a relatively small size for a large chain. Ossining, while suburban, has lower income neighborhoods that are more predominant than in an area like Tarrytown, NY.

(S3) A&P in White Plains, NY – Located in a strip mall in a heavy commercial area of the small city of White Plains. The store is large. While many of the residents of White Plains are of lower income, we suspect that due to this store's location near higher end suburban communities, shoppers may come from these areas as well. White Plains is an urban city similar in size and look to Buckhead (Atlanta), but not as fancy.

(S4) Path Mark in Hartsdale, NY – Located in a strip mall in a heavy commercial area off of a busy main road that goes through southern Westchester. The store is of an average size. Hartsdale is a suburban, middle-income town that is near high income and low-income communities.

(S5) A&P in Scarsdale, NY – Located in a solo building on the same main road that the Path Mark in Hartsdale is on, but much farther down. The store is of an average size and is in a very commercial area. Scarsdale is a very high-income community, one of the highest, in Westchester County. Scarsdale is also large, and this store is not very near to all of the higher income areas of Scarsdale. It is close to Yonkers,

[70] Source: www.shoprite.com/home/srframeset.htm.
[71] Source: www.aptea.com/company.asp.
[72] Source: www.shaws.com.

NY, and we suspect that the shoppers are a mix of a few high income, mostly middle income, and a few lower income people.

(S6) Path Mark in Yonkers, NY – Located in a part of a strip mall in a heavily commercial area just off of the same main road that the last 2 stores are on, but much farther down. The store is of an average size. Yonkers is relatively large and has a mix of middle and low-income neighborhoods, in an urban environment. This store is near both of these types of neighborhoods, and we suspect it gets an equal number of shoppers from both.

(S7) Food Emporium in Hastings, NY – Located in a large solo building in a small and light commercial area of a small residential and suburban town in the southern part of Westchester. Hastings is a high income, small town on the Hudson River, with many quiet suburban areas, and while close to Yonkers, Hastings is a good distance away from lower income neighborhoods.

(S8) Shop Rite in Monsey, NY – Located in a strip mall in a medium commercial area that is right in the middle of many suburban areas. Monsey is in Rockland County, which is on the other side of the Hudson River from Westchester County. Monsey, which is mostly middle income, has a mix of communities from blue-collar workers to retired senior citizens to an African American neighborhood to an ultra-orthodox Hassidic Jewish community. This supermarket seemed to be the largest one and the main one in the area, so we suspect its shoppers come form all of these areas.

(S9) Food Emporium in New York City – Located in the Upper East Side (Sutton Place) – This is one of the most expensive places to live in the entire world (Sutton Place). Many of the apartment buildings here have apartments worth as much as tens of millions of dollars. Many celebrities who live in NYC on the Upper East Side are known to frequent this store. It is located on 1st Avenue right underneath the 59th Street Bridge, and is large in size (it is the biggest supermarket in NYC that we have ever seen, and just might be the biggest in size). Needless to say, most of the shoppers are rich New Yorkers.

(S10) Food Emporium in Armonk, NY – Located in a small solo store in a small commercial area. Armonk is a small, affluent, suburban town in northwestern Westchester right near the Connecticut border. Not near any low-income areas.

(S11) A&P in Montvale, NJ – Located in a medium sized solo building off of a main road in a residential and suburban area. This is middle to high-income town. It is right near the New York border (Rockland County) in northeastern New Jersey in Bergen County. Bergen County is one of the most high-end counties in New Jersey, if not the highest end, and is the closest county to NYC.

(S12) Shop Rite in Rochelle Park, NJ – Located in a small building in a mixed commercial and residential suburban town. It is part of a strip mall. The area seems to be more middle income and with smaller homes than many of the other areas of Bergen County.

(S13) A&P in Pompton Lakes, NJ – Located in a very large, solo building. It is located off of two main roads/highways, but is in a very suburban and residential area. Pompton Lakes is in the central part of northern New Jersey, which is Passaic County, and is not close to NYC. The area seems to be higher than middle income, but lower than high income. While suburban, the area is more spread out than the tighter suburban areas of southern Westchester County, NY.

(S14) Path Mark in Montclair, NJ – Located in a medium sized building in an underground commercial mall. Montclair is an urban neighborhood that is almost entirely lower income. In fact the area resembles an inner-city ghetto. There is graffiti on all of the buildings and many burned and abandoned buildings

around. Montclair is in Essex County, NJ. The store itself seemed to be in need of repair and had chipped paint and an unsightly ceiling with low hanging pipes. We don't think any of the shoppers here are of high income, with maybe a few being middle income, and most being low income.

(S15) Stop & Shop in Clifton, NJ – Clifton is a small suburban city of New York City that is surrounded by many high-income towns. It is located in southern Passaic County, New Jersey, right near the border of Bergen County, New Jersey. Bergen County, like Westchester County in New York, has many upper class towns and cities that are less than twenty miles from New York City. Due to the location of the Stop & Shop in Clifton, New Jersey, customers of the store most likely reside in these surrounding suburbs of Passaic County and Bergen County.

(S16) Food Emporium in Greenwich, CT – Greenwich location is perhaps the most upper class and prestigious location of all Food Emporium locations. Greenwich is located in southwestern Connecticut and is approximately the same distance out of New York City as Tarrytown. It has many areas of extreme wealth, where rich families have lived for generations. In fact, the Food Emporium in Greenwich is settled snuggly in between a Porsche and a Ferrari dealership with a Rolls Royce and a Mercedes dealership directly across the street.

(S17) Shaws in New Canaan, CT – This store is very small for a supermarket (the smallest we went to). Shaws is also the smallest chain of all the chains we went to, having the fewest number of stores and being exclusively in CT. This store is in a small, quaint commercial area. It is actually a very pretty store in a quiet shaded location. New Canaan is a very high income and small and quiet suburban town, and is around 10 miles north of Stamford.

(S18) Stop & Shop in Greenwich, CT – This store is literally right across the street from the Food Emporium listed above (less than 100 feet away). It is a medium size store, which is bigger than the Food Emporium (medium to small sized). It is newly renovated (earlier it was Grand Union station) and has an ESL system.

(S19) Stop & Shop in Stamford, CT – Stamford, Connecticut is another small suburban city of New York City that is surrounded by high-income towns and neighborhoods. It is located in the southwestern part of Connecticut and is a short drive from the New York State border. Of all the towns, Stamford is the farthest from New York City, but only by four to five miles. The Stop & Shop in Stamford is part of a mall complex that most likely draws its customers in from the surrounding high-income neighborhoods. However, there are a few lower income areas of Stamford that might also be a part of the store's customer base. The Stop & Shop in Stamford is only four to five miles southwest of the Food Emporium in Greenwich.

(S20) Shop Rite in Norwalk, CT – Norwalk is about 10 miles northeast of Stamford (15 miles northeast of Greenwich) and is very similar to Stamford. Norwalk is a higher income suburban town with some heavy commercial areas, which is where this store is located. The store is off of a main road, and it is humongous in size. It is almost as big as a football stadium and is even bigger than the Stamford Stop & Shop, which is also very large. It is directly across the street from an equally humongous Stop & Shop (that we did not go into). This area is like "gigantic supermarket/store alley." All the stores, not just the supermarkets, are very big. The store has an ESL system and many aisles.

Chart 1: The Tri-State Area of New York, New Jersey and Connecticut

Note: Clifton, New Jersey, is in the bottom left, Tarrytown, New York, is in the top middle, and Greenwich, Connecticut, in the top right.
(Scale 1 inch=13.5 KM)

Table 1.1: Stores sampled for data set 1

IPL	NO-IPL
S1: Stop & Shop, Tarrytown, NY – 4 trips S16: Food Emporium, Greenwich, CT – 4 trips	S15: Stop & Shop, Clifton, NJ – 4 trips
ESL	
S19: Stop & Shop, Stamford, CT – 4 trips	

IPL = Item Pricing Law stores; NO-IPL = Non Item Pricing Law stores; ESL = Electronic Shelf Label stores

Table 1.2: Categories and products included in data set 1

Category and products in the category	Index	Category and products in the category	Index
Beverages		**Breakfast/Cereals**	
Coca Cola Classic – 2L bottle	B1	Kellog's Apple Jacks – 15oz	BF1
Diet Sprite – 2L bottle	B2	Kellog's Corn Pops – 15oz	BF2
Vintage Seltzer Water – 2L bottle	B3	Kellog's Special K – 12oz	BF3
Pepsi Cola – 12/12oz cans	B4	GM Cheerios – 15oz	BF4
Barq's Root Beer 12/12oz cans	B5	GM Cocao Puffs – 13.75oz	BF5
Dr. Brown's Cream Soda 6/12oz cans	B6	GM Lucky Charms –20oz	BF6
Poland Spring – 1 gallon container	B7	Post Raisin Bran – 20oz	BF7
Evian – 1L bottle	B8	Post Fruity Pebbles – 13oz	BF8
Lemon Lime Gatorade – 64oz bottle	B9	Nature Valley Granola Oats 'N Honey – 8.9oz	BF9
Arizona Iced Tea (boxed drinks) – 3/12oz	B10	Kellog's Nutri Grain Blueberry Bars – 8 bars	BF10
Fruit Punch Capri Sun – 10/6.75oz	B11	Kellog's Variety Pack – 10/1.5oz	BF11
V8 Vegetable Juice – 46 oz can	B12	Kellog's Pop Tarts Frosted Strawberry – 14.7oz	BF12
V8 Splash Tropical Blend – 64oz bottle	B13	Nestle Quick Drink Mix – 15oz can	BF13
Juicy Juice Fruit Punch – 46oz can	B14	Aunt Jemima Original Pancake Mix – 2lb box	BF14
Tropican Twisters Tropical Fruit – 1.75L bottle	B15	Aunt Jemima Pancake Syrup – 24oz bottle	BF15
Frozen Foods		**Dairy and Juices**	
Swanson Turkey (white meat) – 11.75oz	FRZ1	Farmland S.R. 1% Plus Lowfat Milk – ½ gallon	DR1
Swanson Salisbury Steak – 13oz	FRZ2	Lactaid 100 Fat Free Milk Lactose Free – 1 quart	DR2
Weight Watchers Smart Ones Basil Chicken – 9.5oz	FRZ3	Nesquick Chocolate Milk – 64oz	DR3
Weight Watchers Smart Ones Mac & Cheese – 10oz	FRZ4	Dannon Light Yogurt Cherry Vanilla – 8oz container	DR4
Healthy Choice Medly's Roast Turkey Breast – 8.5oz	FRZ5	Dannon Rasberry – 8oz container	DR5
Haagen Dazs Vanilla Ice Cream – 1 pint	FRZ6	Breakstone's Fat Free Cottage Cheese – 16oz	DR6
Stouffers Lean Cuisine Swedish Meatballs – 10oz	FRZ7	Land O' Lakes Salted Whipped Light Butter – 8oz	DR7
Stouffers Hearty Portions Salisbury Steak – 16oz	FRZ8	Kraft Fat Free American Cheese Singles – 16 slices	DR8
Green Giant Frozen Niblers Corn on the Cob – 4 ears	FRZ9	Philadelphia Cream Cheese – 8oz	DR9
Ego Blueberry Waffles – 16 count – 19.8oz	FRZ10	Nestle Carnation Coffemate – 16oz	DR10
Lender's Plain Bagels – 6 count	FRZ11	Breakstone's Fat Free Sour Creem – 16oz	DR11
Original Tombstone Supreme – 22.85oz	FRZ12	Tropicana Pure Premium Homestyle OJ – 64oz	DR12
Celentano Manicotti – 14oz bag	FRZ13	Welch's Fruit Cocktail White Grape Peach – 64oz	DR13
Ore Ida Golden Twirls – 28oz	FRZ14	Dole 100% Pineapple Juice – 64oz	DR14
Bird's Eye Mixed Vegetables – 10oz	FRZ15	Tropicana Pure Premium Grovestand OJ – 96oz	DR15

Table 1.2 (contd.): Categories and products included in data set 1

Category and products in the category	Index	Category and products in the category	Index
Condiments, Sauces & Spreads		**Soup/Canned Foods**	
Grey Poupon Dijon Mustard - 8oz jar	C1	Campbell's Chicken Noodle Soup - 10.75oz	SP1
Hellmann's Mayonnaise - 32oz jar	C2	Progresso Chicken & Wild Rice - 19oz	SP2
Heinz Ketchup - 24oz squeeze bottle	C3	Progresso Minestrone Soup - 19oz	SP3
Skippy Creamy Peanut Butter - 18oz	C4	Campbell's Cream of Broccoli - 10.75oz	SP4
Smucker's Concord Grape Jelly - 12oz Jar	C5	Campbell's Family Size Tomato Soup - 18.7oz	SP5
Kraft Thousand Island Dressing Free - 8oz	C6	Progresso New England Clam Chowder - 19oz	SP6
Wish Bone Fat Free Ranch Dressing - 8oz	C7	Campbell's Vegetarian Vegetable - 10.75oz	SP7
Domino Granulated Sugar - 2lb box	C8	Goya Black Beans - 15.5oz can	SP8
Equal Sugar Substitute - 50 count	C9	Ortega Thick & Chunky Medium Salsa - 16oz	SP9
Jello Cherry - 3oz box	C10	Dole Sliced Pineapple - 20oz can	SP10
Heinz Distilled White Vinegar - 32oz	C11	Del Monte Pear Halves - 29oz can	SP11
Pam Lemon Fat Free Cooking Spray - 6oz can	C12	Bumbe Bee Solid White Tuna in Water - 6oz can	SP12
A1 Steak Sauce Bold & Spicy - 10oz jar	C13	Starkist Chunk Light Tuna in Oil - 6oz can	SP13
Heinz Barbecue Sauce - 18oz bottle	C14	Chef Boyardee Beef Ravioli - 15oz can	SP14
Kraft Shake 'n Bake Classic Italian - 5.75 oz	C15	Mott's Homestyle Chunky Apple Sauce - 23 oz jar	SP15
Baby Products & Foods		**Health & Beauty Aides**	
Huggies Pull Ups for Boys 32 - 40lb's - 26 count	BBY1	Crest Multi Care Fresh Mint Toothpaste - 6.2oz tube	HLT1
Huggies Natural Care Scented Wipes - 80 count	BBY2	Scope Peppermint - 33oz	HLT2
Pampers Diapers Newborn to 10lb - 48 count	BBY3	Right Guard Sport Deodorant Gel Cool Scent - 3oz	HLT3
Luvs Diapers Ultra Leakguards #3 - 72 count	BBY4	Sudafed Max Nasal Decongestant - 24 tablets	HLT4
Beechnut Stage 2 Apples & Bananas - 4oz	BBY5	Halls Cough Drops Black Cherry - 25 count	HLT5
Earth's Best Organic Apples - 4oz	BBY6	Tylenol Extra Strength Gelcaps - 100 count	HLT6
Gerber 100% Apple Juice - 32oz bottle	BBY7	Johnson & Johnson Band Aids - 60 count	HLT7
Gerber Stage 1 Pears - 2.5oz	BBY8	Pepto Bismol - 12oz	HLT8
Enfamil Lactofree Infant Formula - 13oz can	BBY9	Bausch & Lomb Saline Solution - 12oz	HLT9
Johnson & Johnson Baby Shampoo - 15oz	BBY10	Oxi Max Cleansing Pads - 55 count	HLT10
Johnson & Johnson Baby Powder - 15oz	BBY11	Thermasilk Moisturizing Shampoo - 13oz	HLT11
Gerber Cereal for Baby Rice with Banana - 8oz	BBY12	Head & Shoulders Dandruff Shampoo Normal - 15.2oz	HLT12
Beechnut Cereal for Baby Oatmeal - 8oz	BBY13	Barbasol Original Shaving Cream - 11oz can	HLT13
Gerber Graduates Veggie Crackers - 4oz	BBY14	Dial Liquid Antibacterial Soap Refill - 15oz bottle	HLT14
Beechnut Table Time Mac & Cheese - 6oz	BBY15	Lever Soap 2000 - 2/4.5oz bars	HLT15

Table 1.2 (contd.): Categories and products included in data set 1

Category and products in the category	Index	Category and products in the category	Index
Candy & Snacks		**Paper Products, Bags & Pet Supplies**	
Planter's Mixed Nuts - 11.5oz can	CND1	Brawny Towels Thirsty Roll - 3 rolls	PAP1
Sun Maid Raisins - 9oz	CND2	Kleenex Cold Care Ultra - 70 count	PAP2
Sunsweet Pitted Prunes - 24oz	CND3	Vanity Fair 2 Ply Napkins - 100 count	PAP3
Hershey's Kisses Milk Chocolate - 8oz bag	CND4	Charmin Big Squeeze - 9 rolls	PAP4
Trident Original Sugarless Gum - 8/5 stick packs	CND5	Hefty Cinch Sak Trash Bags - 20 bags	PAP5
Rold Gold Pretzels Fat Free - 15oz	CND6	Glad Tall Kitchen Bags Quick Tie - 15 bags	PAP6
Wise B.B.Q. Potato Chips - 5.5oz	CND7	Ziploc Sandwich Bags - 100 bags	PAP7
Chips Ahoy Chocolate Chip Cookies - 12oz bag	CND8	Reynolds Wrap Aluminum Foil - 50 sq. feet	PAP8
Oreo Cookies - 1lb bag	CND9	Ziploc 1 Gallon Freezer Bags - 30 bags	PAP9
Pepperidge Farm Milanos - 6oz bag	CND10	Dixie Flatware Spoons - 50 count	PAP10
Pepperidge Farm Goldfish Cheddar - 6oz bag	CND11	Dixie Printed Bathroom Cups - 100/5oz	PAP11
Wheat Thins Original - 10oz box	CND12	Purina Dog Chow - 4.4lb bag	PAP12
Nabisco Ritz Bits Sandwich Crackers - 10.5oz box	CND13	Milk Bone Small - 24oz box	PAP13
Quaker Chocolate Chip Granola Bars - 10 bars	CND14	Purina Cat Chow - 56oz box	PAP14
Orville Redenbacher's Light Popcorn - 3/3.5oz bags	CND15	Fresh Step Cat Litter Scoop - 7lb bag	PAP15
Households			
Tide Ultra Liquid Detergent - 50oz	H1		
Downy Fabric Softener Mtn. Spring - 40 count	H2		
Clorox Liquid Bleach - 1 quart	H3		
Palmolive Original Dishwashing Liquid - 28oz bottle	H4		
Glade Rainshower - 9oz	H5		
Drano Build Up Remover - 32oz	H6		
Tilex Mildew Stain Remover - 32oz spray	H7		
Clorox Cleanup with Bleach - 32oz	H8		
Brillo Steel Wool Soap Pads - 18 count	H9		
Lysol Disinfectant Original - 12oz spray	H10		
Pledge Clean and Dust - 12.5oz spray	H11		
Fantastic All Purpose - 22oz	H12		
Windex Glass Cleaner - 26oz	H13		
Mr. Clean and Top Job with Ammonia - 40oz	H14		
Old English Lemon Polish - 12.5oz spray	H15		

Table 1.3: Comparison of average prices at IPL and NO-IPL stores in data set 1: All categories (top panel) and individual categories (lower panel)

Category	Mean	(Std. Err.)	Mean Diff	(Std. Err.)	Lower Bound	Upper Bound	*t*
All Categories							
IPL	2.965	(0.020)	0.252	(0.021)	0.203	0.300	11.721***
NOIPL	2.714	(0.008)					
Individual Categories							
Beverage							
IPL	2.431	(0.025)	0.298	(0.032)	0.227	0.369	9.411***
NOIPL	2.133	(0.020)					
Breakfast							
IPL	3.389	(0.020)	0.311	(0.032)	0.236	0.385	9.836***
NOIPL	3.078	(0.025)					
Frozen							
IPL	2.916	(0.026)	0.074	(0.031)	0.005	0.142	2.397**
NOIPL	2.842	(0.017)					
Dairy							
IPL	2.593	(0.031)	0.102	(0.034)	0.026	0.177	3.034**
NOIPL	2.492	(0.013)					
Condiments							
IPL	2.304	(0.035)	0.259	(0.036)	0.175	0.343	7.159***
NOIPL	2.045	(0.008)					
Soup							
IPL	1.497	(0.016)	0.242	(0.019)	0.200	0.283	13.055***
NOIPL	1.255	(0.009)					
Baby							
IPL	4.373	(0.072)	0.090	(0.076)	-0.083	0.264	1.191
NOIPL	4.283	(0.024)					
Health							
IPL	3.854	(0.039)	0.432	(0.046)	0.329	0.535	9.337***
NOIPL	3.422	(0.025)					
Candy							
IPL	2.736	(0.062)	0.262	(0.062)	0.116	0.409	4.245***
NOIPL	2.474	(0.002)					
Paper							
IPL	3.355	(0.051)	0.297	(0.056)	0.170	0.423	5.252***
NOIPL	3.058	(0.025)					
Households							
IPL	3.172	(0.033)	0.402	(0.050)	0.286	0.517	8.074***
NOIPL	2.770	(0.037)					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%.

Table 1.4: Comparison of average prices by product category in data set 1, Stop & Shop, Tarrytown NY (IPL) and Stop & Shop, Clifton NJ (NO-IPL)

Category	Store	Mean	(Std. Err.)	Mean Diff.	(Std. Err.)	Lower bound	Upper bound	*t*
Beverage	IPL	2.388	(0.241)	0.255	(0.076)	0.092	0.418	3.347***
	NOIPL	2.133	(0.268)					
Breakfast/Cereal	IPL	3.375	(0.197)	0.297	(0.077)	0.132	0.461	3.871***
	NOIPL	3.078	(0.201)					
Frozen Foods	IPL	2.860	(0.238)	0.018	(0.076)	-0.145	0.182	0.241
	NOIPL	2.842	(0.238)					
Dairy & Juices	IPL	2.524	(0.285)	0.033	(0.073)	-0.124	0.190	0.446
	NOIPL	2.492	(0.301)					
Condiments, Sauces & Spreads	IPL	2.213	(0.251)	0.167	(0.063)	0.033	0.301	2.672**
	NOIPL	2.045	(0.245)					
Soup/Canned Foods	IPL	1.470	(0.147)	0.215	(0.046)	0.116	0.313	4.673***
	NOIPL	1.255	(0.138)					
Baby Products & Foods	IPL	4.552	(1.487)	0.270	(0.080)	0.098	0.441	3.363***
	NOIPL	4.283	(1.437)					
Health & Beauty Aids	IPL	3.778	(0.526)	0.356	(0.117)	0.105	0.607	3.042***
	NOIPL	3.422	(0.515)					
Candy & Snacks	IPL	2.578	(0.196)	0.104	(0.027)	0.046	0.162	3.820***
	NOIPL	2.474	(0.203)					
Paper Products, Bags, & Pet Supplies	IPL	3.227	(0.333)	0.169	(0.096)	-0.036	0.373	1.763*
	NOIPL	3.058	(0.304)					
Households	IPL	3.115	(0.258)	0.345	(0.084)	0.164	0.526	4.083***
	NOIPL	2.770	(0.232)					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 2.1: Stores sampled for data set 2

IPL	**NO-IPL**
NEW YORK:	NEW JERSEY:
S1. Stop & Shop, Tarrytown, NY	S11. A&P, Montvale, NJ
S2. C Town, Ossining, NY	S12. Shop Rite, Rochelle Park., NJ
S3. A&P, White Plains, NY	S13. A&P, Pompton Lakes, NJ
S4. Path Mark, Hartsdale, NY	S14. Path Mark, Montclair, NJ
S5. A&P Scarsdale, NY	S15. Stop & Shop, Clifton, NJ
S6. Path Mark, Yonkers, NY	
S7. Food Emporium, Hastings, NY	
S8. Shop Rite, Monsey, NY	
S9. Food Emporium, NYC, NY	
S10. Food Emporium, Armonk, NY	
CONNECTICUT:	
S16. Food Emporium, Greenwich, CT	
S17. Shaws, New Canaan, CT	
ESL	
CONNECTICUT:	
S18. Stop & Shop, Greenwich, CT	
S19. Stop & Shop, Stamford, CT	
S20. Shop Rite, Norwalk, CT	

Table 2.2: Categories and products included in data set 2

Category and products in the category	**Index**	**Category and products in the category**	**Index**
Condiments, Sauces & Spreads		**Households**	
Grey Poupon Dijon Mustard - 8oz jar	C1	Tide Ultra Liquid Detergent - 50oz	H1
Hellmann's Mayonnaise - 32oz jar	C2	Downy Fabric Softener Mtn. Spring - 40 count	H2
Heinz Ketchup - 24oz squeeze bottle	C3	Clorox Liquid Bleach - 1 quart	H3
Skippy Creamy Peanut Butter - 18oz	C4	Palmolive Original Dishwashing Liquid - 28oz bottle	H4
Smucker's Concord Grape Jelly - 12oz Jar	C5	Glade Rainshower - 9oz	H5
Kraft Thousand Island Dressing Free - 8oz	C6	Drano Build Up Remover - 32oz	H6
Wish Bone Fat Free Ranch Dressing - 8oz	C7	Tilex Mildew Stain Remover - 32oz spray	H7
Domino Granulated Sugar - 2lb box	C8	Clorox Cleanup with Bleach - 32oz	H8
Equal Sugar Substitute - 50 count	C9	Brillo Steel Wool Soap Pads - 18 count	H9
Jello Cherry - 3oz box	C10	Lysol Disinfectant Original - 12oz spray	H10
Heinz Distilled White Vinegar - 32oz	C11	Pledge Clean and Dust - 12.5oz spray	H11
Pam Lemon Fat Free Cooking Spray - 6oz can	C12	Fantastic All Purpose - 22oz	H12
A1 Steak Sauce Bold & Spicy - 10oz jar	C13	Windex Glass Cleaner - 26oz	H13
Heinz Barbecue Sauce - 18oz bottle	C14	Mr. Clean and Top Job with Ammonia - 40oz	H14
Kraft Shake 'n Bake Classic Italian - 5.75 oz	C15	Old English Lemon Polish - 12.5oz spray	H15

Table 2.3: Comparison of average prices at IPL and NO-IPL stores in data set 2: All categories (top panel) and individual categories (lower panel)

Category	Mean	(Std. Err.)	Mean Diff	(Std. Err.)	Lower Bound	Upper Bound	*t*
All Categories							
IPL	2.745	(0.068)	0.243	(0.078)	0.076	0.410	3.105**
NOIPL	2.500	(0.038)					
Individual Categories							
Condiments							
IPL	2.300	(0.061)	0.272	(0.069)	0.125	0.420	3.936***
NOIPL	2.028	(0.033)					
Households							
IPL	3.190	(0.079)	0.218	(0.091)	0.024	0.411	2.400**
NOIPL	2.973	(0.044)					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 2.4: Comparison of average IPL and NO-IPL store prices by chain and by product category in data set 2

Store Chain	Category	IPL	NO-IPL	Mean Diff
A&P	Condiments	2.227	2.048	0.179
	Households	3.221	3.017	0.204
Shop Rite	Condiments	1.979	1.973	0.007
	Households	2.923	2.903	0.020
Path Mark	Condiments	2.219	2.094	0.125
	Households	3.083	3.077	0.007
Stop & Shop	Condiments	2.189	1.978	0.210
	Households	3.017	2.850	0.167

Table 3.1: Comparison of average prices at ESL (Stop & Shop in Stamford, CT) and NO-IPL (Stop & Shop in Clifton, NJ) stores in data set 1:
All categories (top panel) and individual categories (lower panel)

Category	Mean	Std. Err.	Mean Diff	Std. Err.	Lower Bound	Upper Bound	*t*
All Categories							
ESL	2.815	0.007	0.101	0.011	0.075	0.127	9.533***
NOIPL	2.714	0.008					
Individual Categories							
Beverage							
ESL	2.310	0.011	0.177	0.023	0.119	0.236	7.862***
NOIPL	2.133	0.020					
Breakfast							
ESL	3.040	0.018	-0.038	0.031	-0.115	0.038	-1.243
NOIPL	3.078	0.025					
Frozen							
ESL	2.763	0.027	-0.078	0.032	-0.161	0.004	-2.438
NOIPL	2.842	0.017					
Dairy							
ESL	2.440	0.011	-0.052	0.017	-0.095	-0.009	-2.969
NOIPL	2.492	0.013					
Condiments							
ESL	2.180	0.011	0.135	0.014	0.101	0.168	9.846***
NOIPL	2.045	0.008					
Soup							
ESL	1.381	0.014	0.126	0.017	0.083	0.169	7.570***
NOIPL	1.255	0.009					
Baby							
ESL	4.454	0.014	0.171	0.028	0.100	0.242	6.186***
NOIPL	4.283	0.024					
Health							
ESL	3.772	0.032	0.350	0.041	0.248	0.451	8.590***
NOIPL	3.422	0.025					
Candy							
ESL	2.546	0.015	0.072	0.015	0.024	0.119	4.710***
NOIPL	2.474	0.002					
Paper							
ESL	3.125	0.007	0.067	0.026	-0.008	0.142	2.600**
NOIPL	3.058	0.025					
Households							
ESL	2.954	0.045	0.184	0.058	0.040	0.328	3.154**
NOIPL	2.770	0.037					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 4.1: Comparison of average prices at ESL and NO-IPL stores in data set 2: All categories (top panel) and individual categories (lower panel)

Category	Mean	(Std. Err.)	Mean Diff	(Std. Err.)	Lower Bound	Upper Bound	*t*
All Categories							
ESL	2.580	(0.021)	0.080	(0.043)	-0.0271	0.187	1.848
NO-IPL	2.500	(0.038)					
Individual Categories							
Condiments							
ESL	2.155	(0.013)	0.127	(0.036)	0.036	0.218	3.554**
NO-IPL	2.028	(0.033)					
Households							
ESL	3.001	(0.031)	0.028	(0.054)	-0.104	0.161	0.523
NO-IPL	2.973	(0.044)					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 4.2: Comparison of average ESL and NO-IPL store prices by product chain and by category in data set 2

Store Chain	Category	ESL	NO-IPL	Mean Diff
Shop Rite	Condiments	2.169	1.973	0.196
	Households	3.063	2.903	0.160
Stop & Shop	Condiments	2.149	1.978	0.171
	Households	2.970	2.850	0.120

Table 5.1: Comparison of average prices at ESL and IPL stores in data set 1:
All categories (top panel) and individual categories (lower panel)

Category	Mean	Std. Err.	Mean Diff	Std. Err.	Lower Bound	Upper Bound	*t*
All Categories							
ESL	2.814	0.007	0.151	0.021	0.103	0.200	8.756***
IPL	2.965	0.002					
Individual Categories							
Beverage							
ESL	2.310	0.010	0.119	0.027	0.006	0.180	4.373***
IPL	2.429	0.025					
Breakfast							
ESL	3.038	0.019	0.351	0.027	0.289	0.414	12.830***
IPL	3.389	0.019					
Frozen							
ESL	2.763	0.028	0.153	0.038	0.065	0.240	4.028***
IPL	2.915	0.026					
Dairy							
ESL	2.438	0.010	0.155	0.033	0.080	0.231	4.700***
IPL	2.593	0.031					
Condiments							
ESL	2.180	0.011	0.125	0.036	0.042	0.208	3.440***
IPL	2.305	0.035					
Soup							
ESL	1.380	0.015	0.119	0.022	0.069	0.168	5.426***
IPL	1.500	0.016					
Baby							
ESL	4.450	0.014	-0.076	0.073	-0.247	0.094	-1.042
IPL	4.373	0.072					
Health							
ESL	3.773	0.034	0.083	0.051	-0.033	0.200	1.614
IPL	3.855	0.039					
Candy							
ESL	2.545	0.016	0.191	0.064	0.043	0.339	2.995**
IPL	2.736	0.062					
Paper							
ESL	3.125	0.009	0.230	0.051	0.110	0.350	4.480***
IPL	3.355	0.051					
Households							
ESL	2.953	0.046	0.220	0.056	0.084	0.356	3.902***
IPL	3.173	0.033					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 5.2: Average prices at CT-ESL (S19) and CT-IPL (S16) stores in data set 1: All categories (top panel) and individual categories (lower panel)

Category	Mean	Std. Err.	Mean Diff	Std. Err.	Lower Bound	Upper Bound	*t*
All Categories							
S19 (ESL)	2.814	0.007	0.201	0.008	0.178	0.224	23.283***
S16 (IPL)	3.015	0.004					
Individual Categories							
Beverage							
S19 (ESL)	2.310	0.010	0.162	0.016	0.123	0.202	10.151***
S16 (IPL)	2.472	0.012					
Breakfast							
S19 (ESL)	3.038	0.019	0.365	0.024	0.305	0.425	15.167***
S16 (IPL)	3.403	0.014					
Frozen							
S19 (ESL)	2.763	0.028	0.208	0.030	0.123	0.291	6.957***
S16 (IPL)	2.970	0.011					
Dairy							
S19 (ESL)	2.438	0.010	0.225	0.019	0.178	0.272	12.099***
S16 (IPL)	2.663	0.015					
Condiments							
S19 (ESL)	2.180	0.011	0.215	0.016	0.175	0.254	13.377***
S16 (IPL)	2.395	0.012					
Soup							
S19 (ESL)	1.380	0.015	0.145	0.019	0.100	0.192	7.660***
S16 (IPL)	1.525	0.012					
Baby							
S19 (ESL)	4.450	0.014	-0.255	0.017	-0.298	-0.212	-15.377***
S16 (IPL)	4.200	0.009					
Health							
S19 (ESL)	3.773	0.034	0.158	0.048	0.041	0.274	3.304**
S16 (IPL)	3.930	0.034					
Candy							
S19 (ESL)	2.545	0.016	0.350	0.018	0.303	0.397	19.170***
S16 (IPL)	2.895	0.010					
Paper							
S19 (ESL)	3.125	0.009	0.358	0.028	0.277	0.438	12.790***
S16 (IPL)	3.483	0.027					
Households							
S19 (ESL)	2.953	0.046	0.278	0.047	0.137	0.418	5.930***
S16 (IPL)	3.230	0.011					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 6.1: Comparison of average prices at ESL and IPL stores in data set 2: All categories (top panel) and individual categories (lower panel)

Category	Mean	(Std. Err.)	Mean Diff	(Std. Err.)	Lower Bound	Upper Bound	*t*
All Categories							
ESL	2.580	(0.021)	0.163	(0.072)	0.008	0.319	2.279**
IPL	2.743	(0.068)					
Individual Categories							
Condiments							
ESL	2.155	(0.013)	0.145	(0.062)	0.009	0.280	2.335**
IPL	2.300	(0.061)					
Households							
ESL	3.001	(0.031)	0.189	(0.085)	0.005	0.373	2.224**
IPL	3.190	(0.079)					

*** p≤0.01, ** p≤0.05, * p≤0.10; Confidence interval calculated at 95%

Table 6.2: Within-state comparison of average prices at CT-ESL and CT-IPL stores in data set 2, by store location and by product category

Comparisons	Category	ESL	IPL	Mean Diff
CT-ESL (S18+S19+S20)	All Categories	2.578	2.744	0.166
vs. CT-IPL (S16+S17)	Condiments	2.155	2.360	0.204
	Households	3.001	3.129	0.128
S18+S19 (ESL, Stop & Shop, Greenwich,	All Categories	2.559	2.844	0.285
and Stamford , CT) vs. S16 (IPL, Food Emporium,	Condiments	2.149	2.418	0.269
Greenwich, CT)	Households	2.970	3.270	0.300
S18 (ESL, Stop & Shop, Greenwich, CT)	All Categories	2.573	2.844	0.271
vs. S16 (IPL, Food Emporium., Greenwich, CT)	Condiments	2.169	2.418	0.249
	Households	2.149	2.418	0.269

Figure 1.1: Average category prices in data set 1

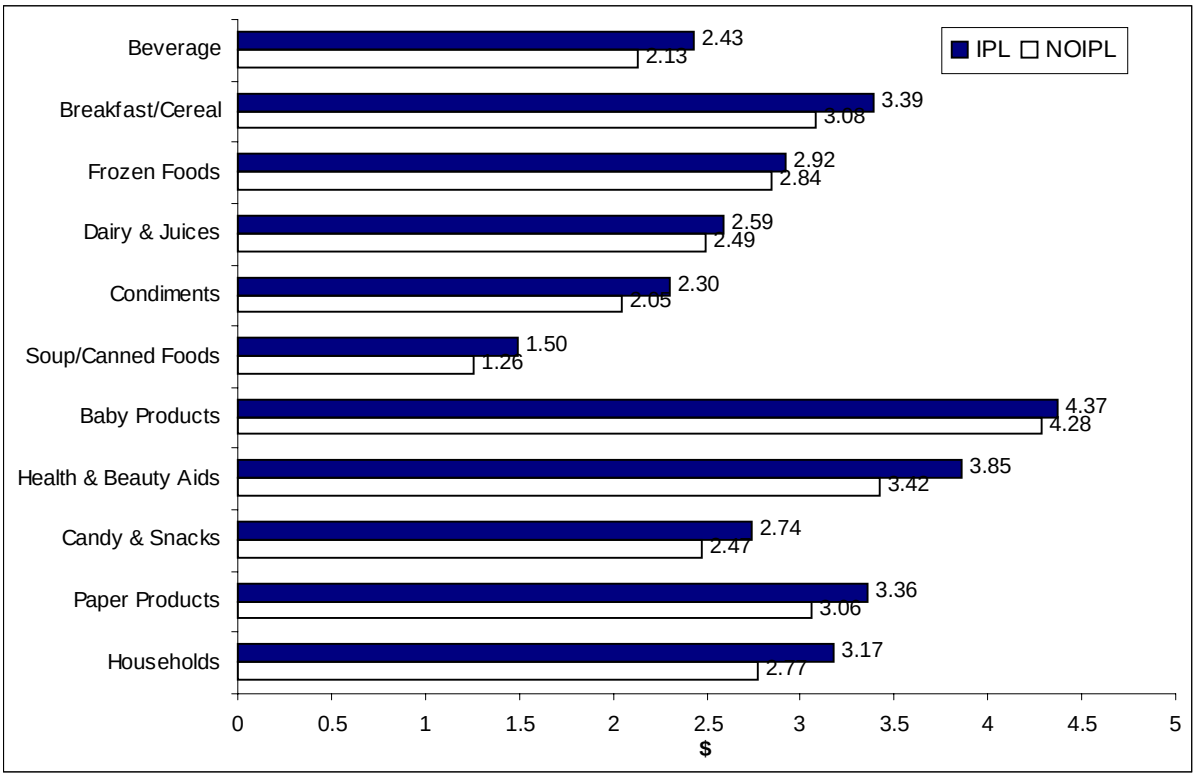


Figure 1.2: Average category prices at Stop and Shop in data set 1

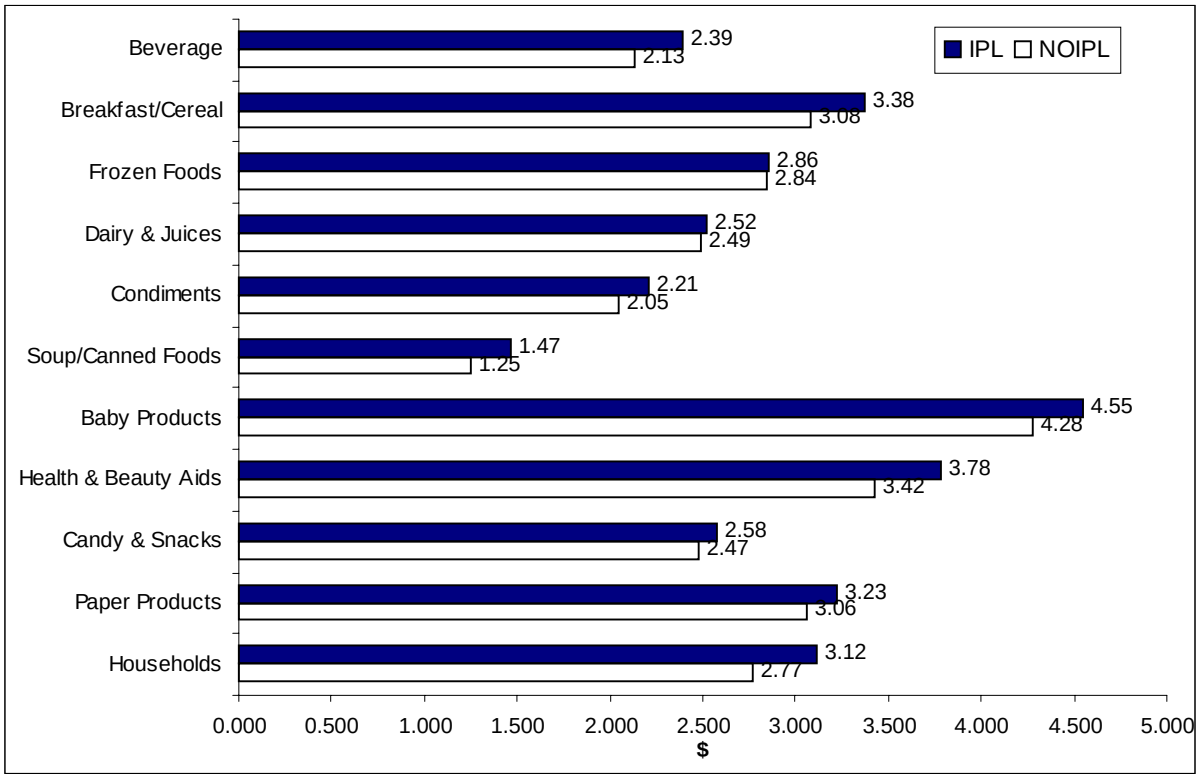


Figure 1.3: Average product prices in data set 1

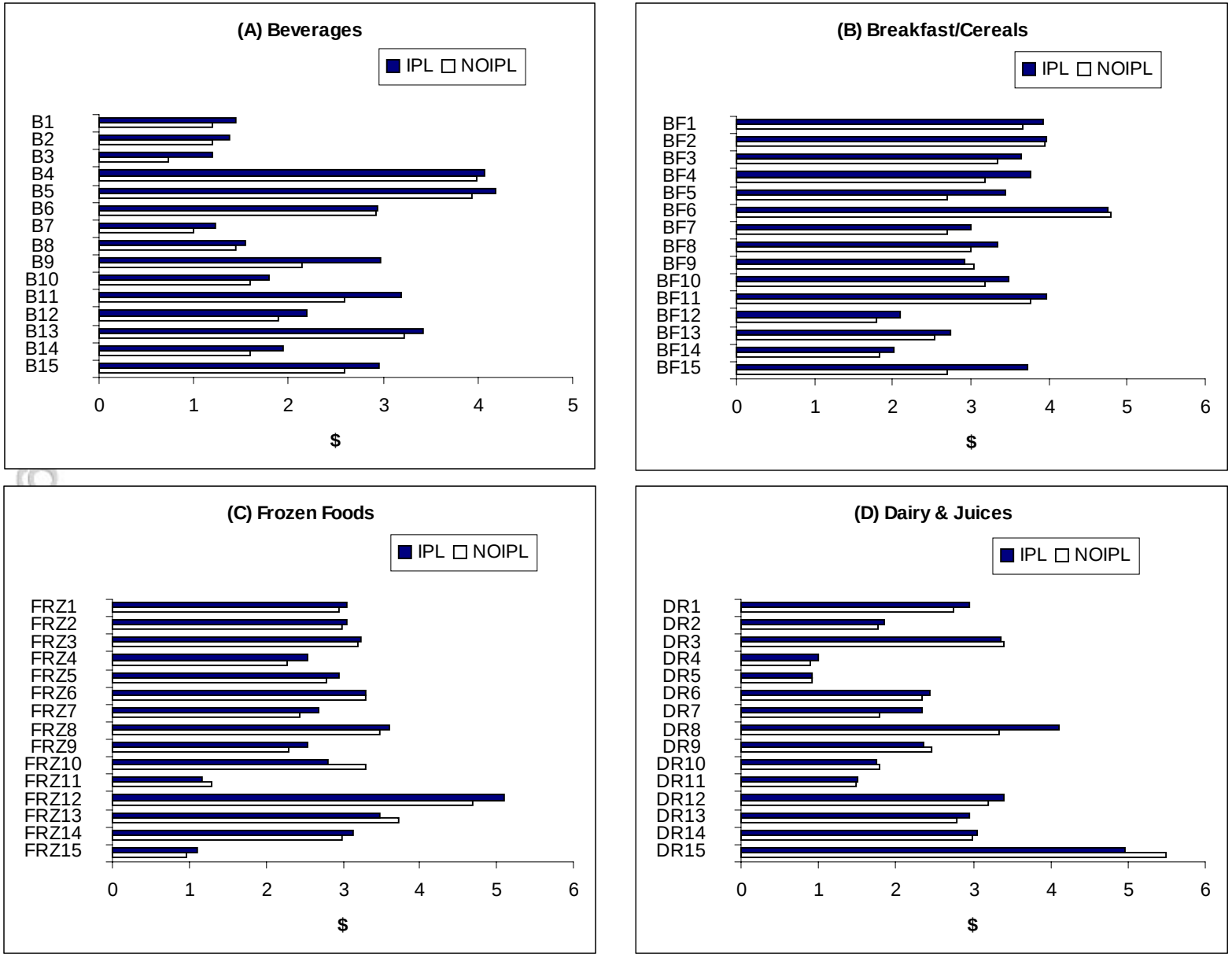


Figure 1.3 (contd.): Average product prices in data set 1

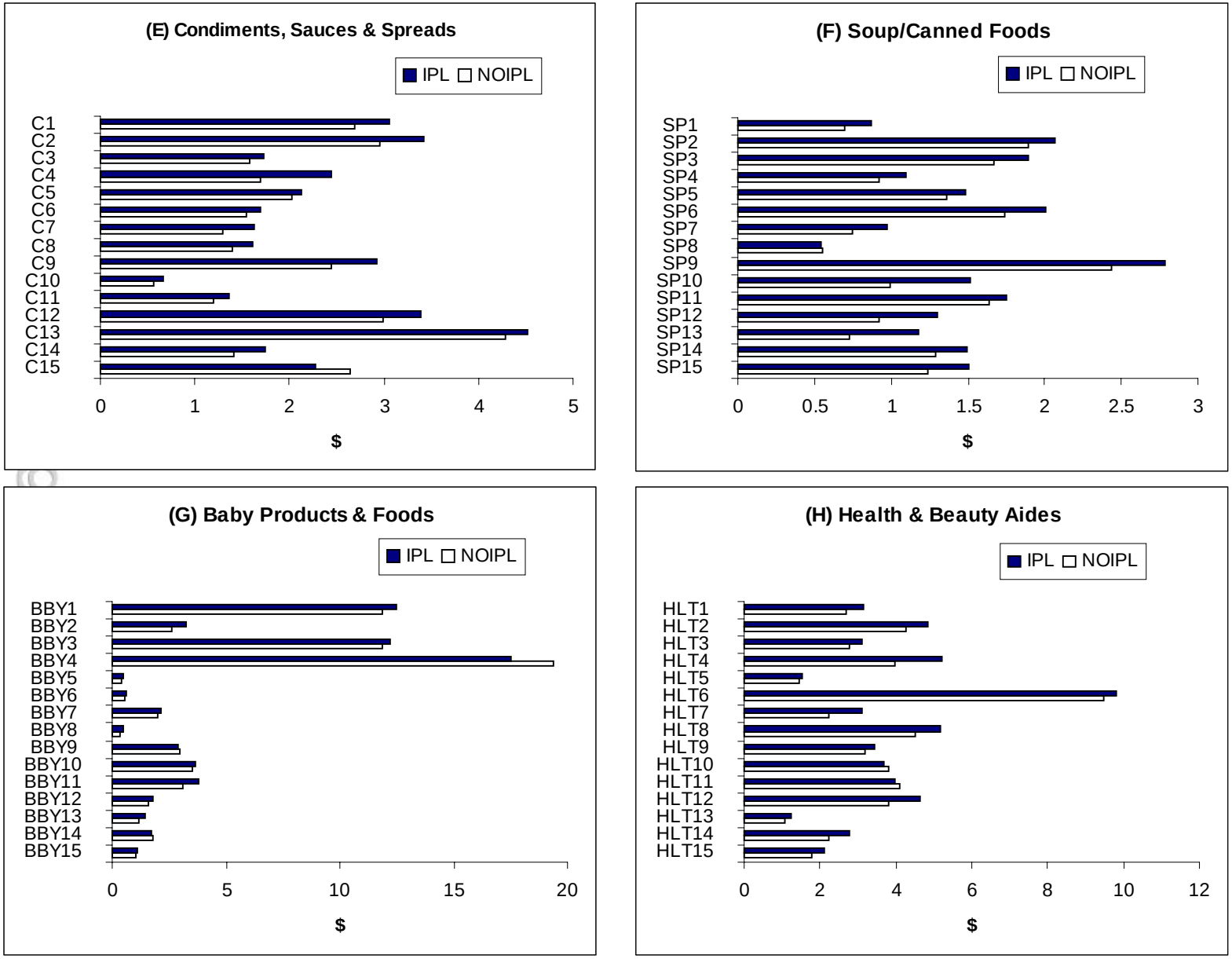
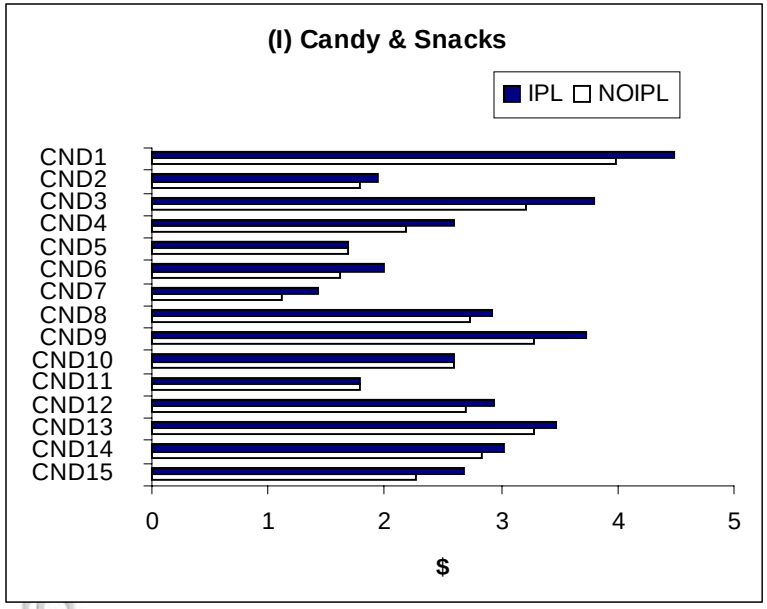
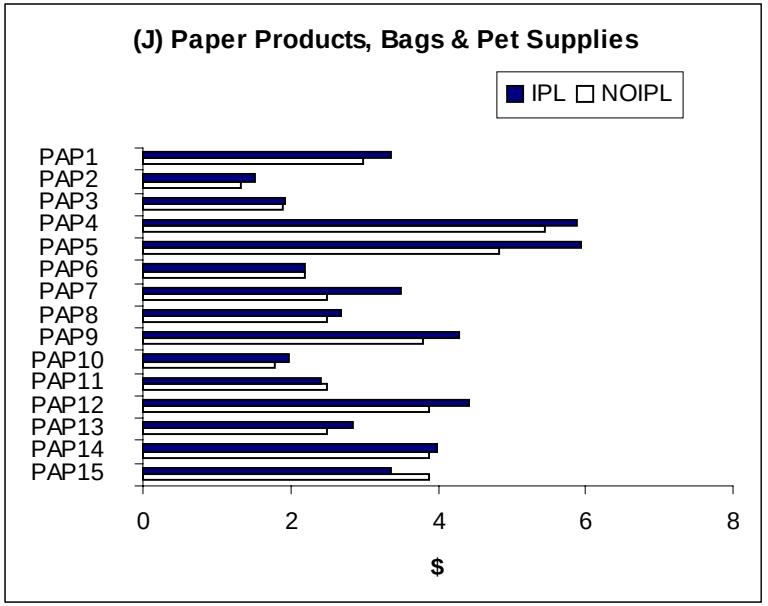


Figure 1.3 (contd.): Average product prices in data set 1





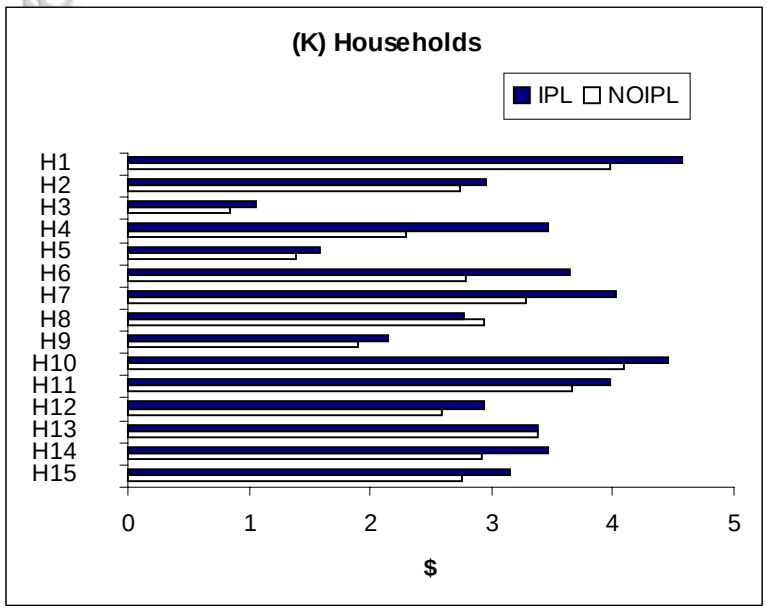


Figure 2.1: Average category prices in data set 2

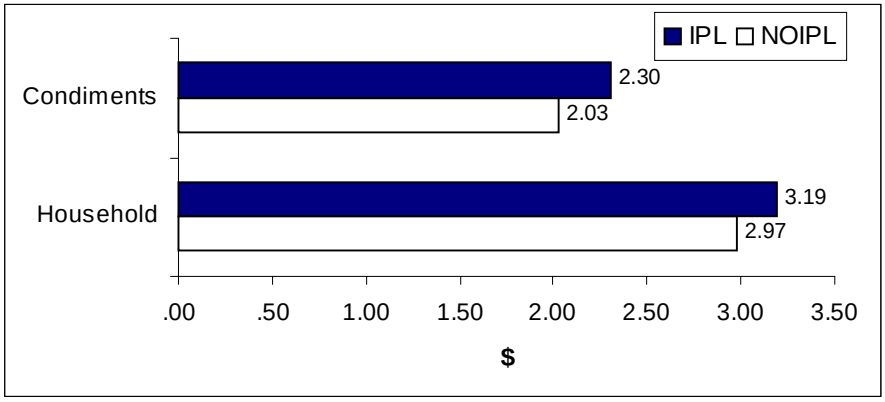
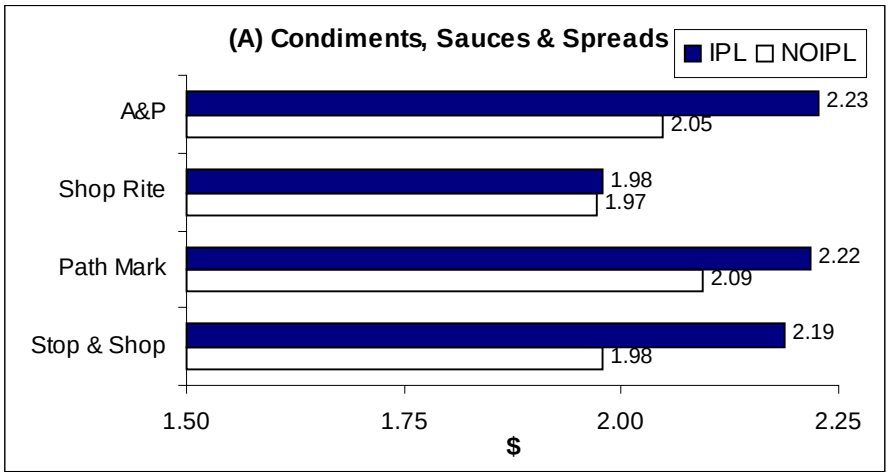


Figure 2.2: Average chain level prices at IPL and no-IPL stores in data set 2



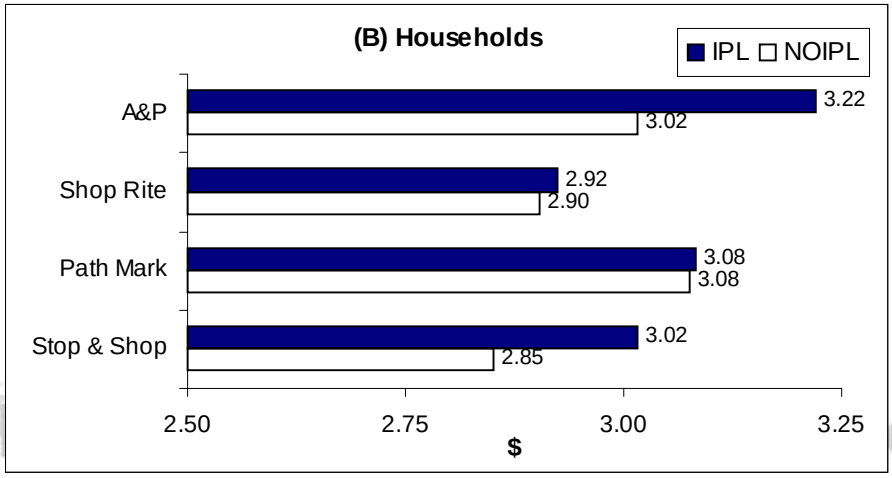
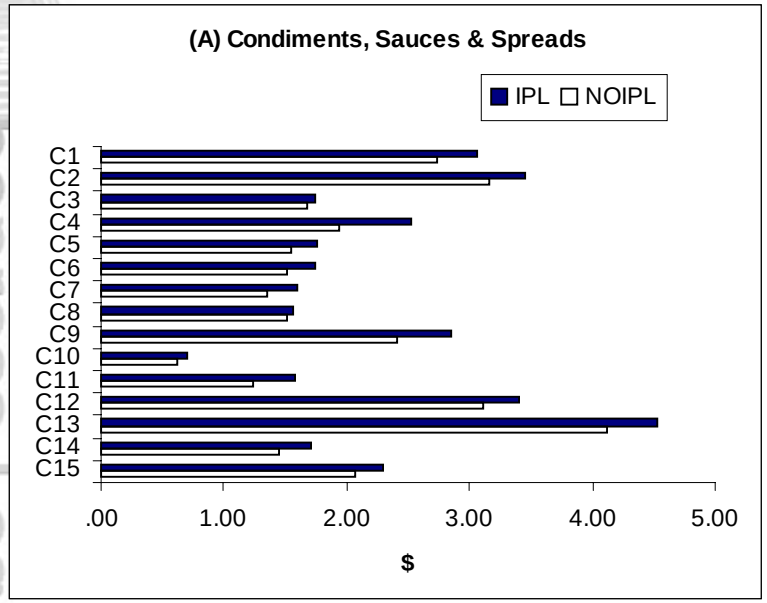


Figure 2.3: Average product prices in data set 2



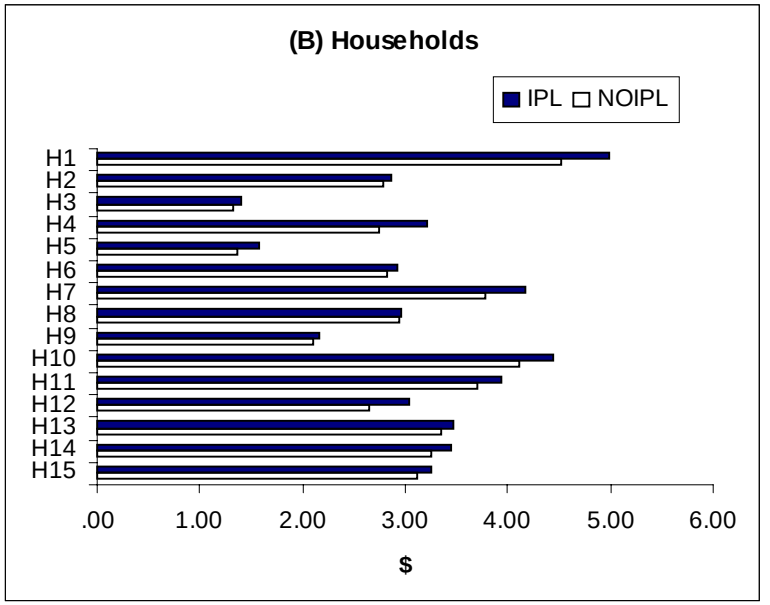


Figure 3.1: Average category prices at ESL (Stop & Shop, Stamford, CT) and NO-IPL (Stop & Shop, in Clifton, NJ) stores in data set 1

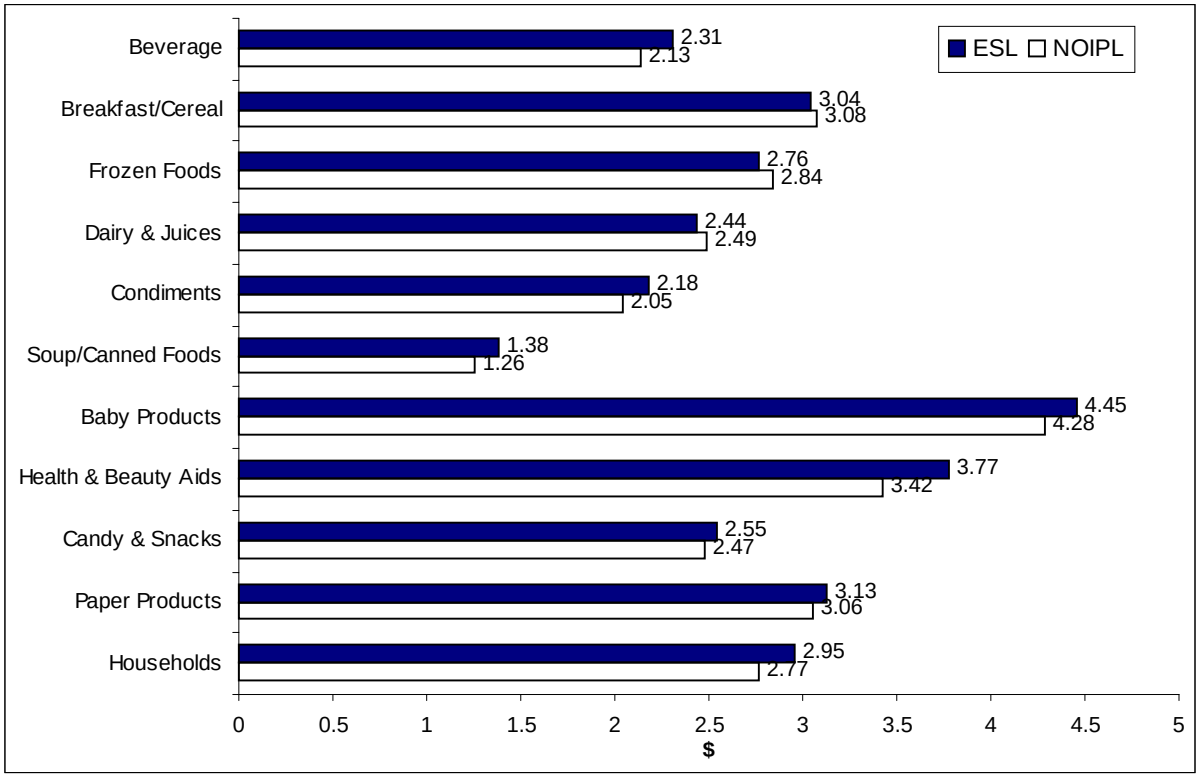


Figure 3.2: Average product prices at ESL and NO-IPL stores in data set 1

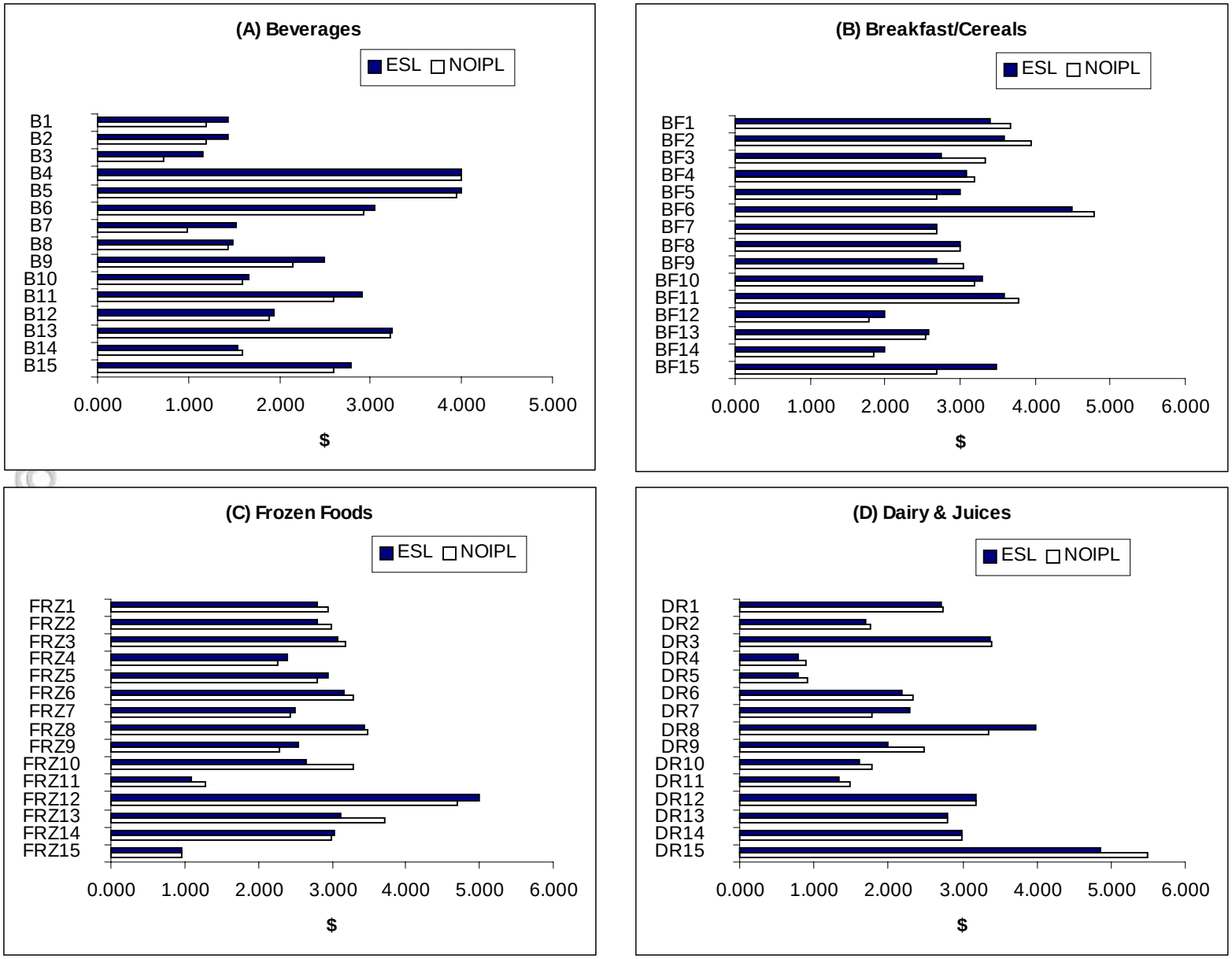


Figure 3.2 (contd.): Average product prices at ESL and NO-IPL stores in data set 1

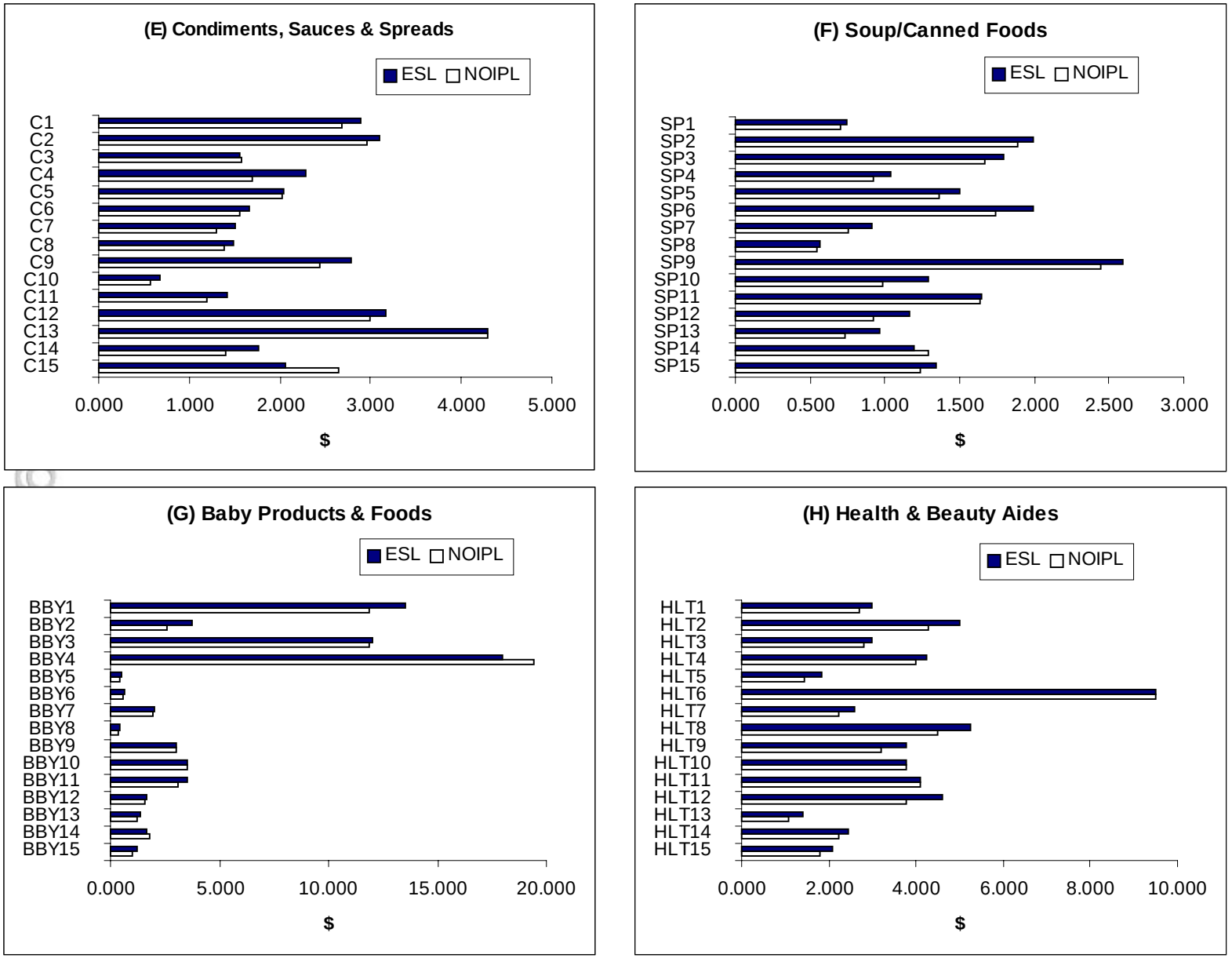
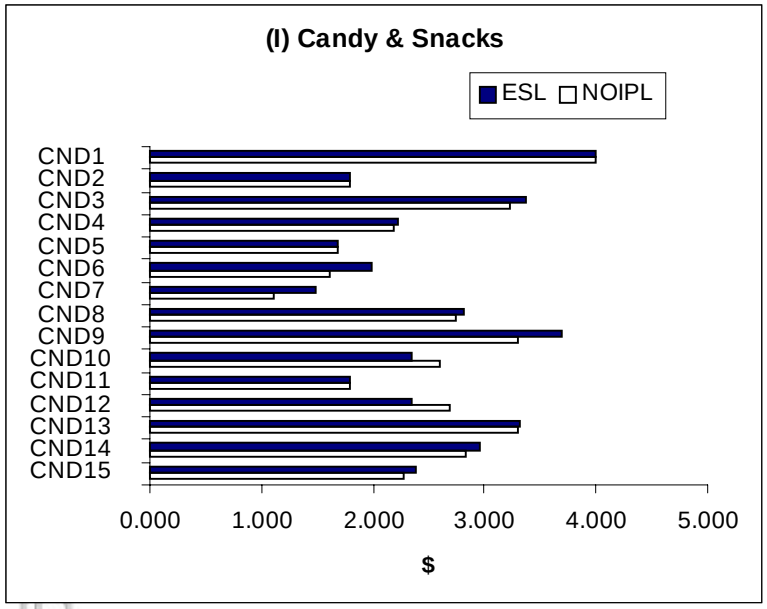
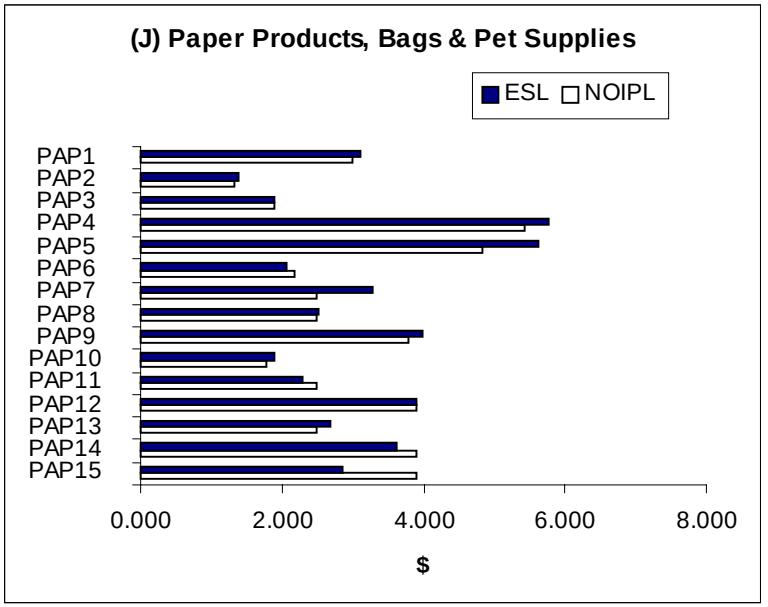


Figure 3.2 (contd.): Average product prices at ESL and NO-IPL stores in data set 1





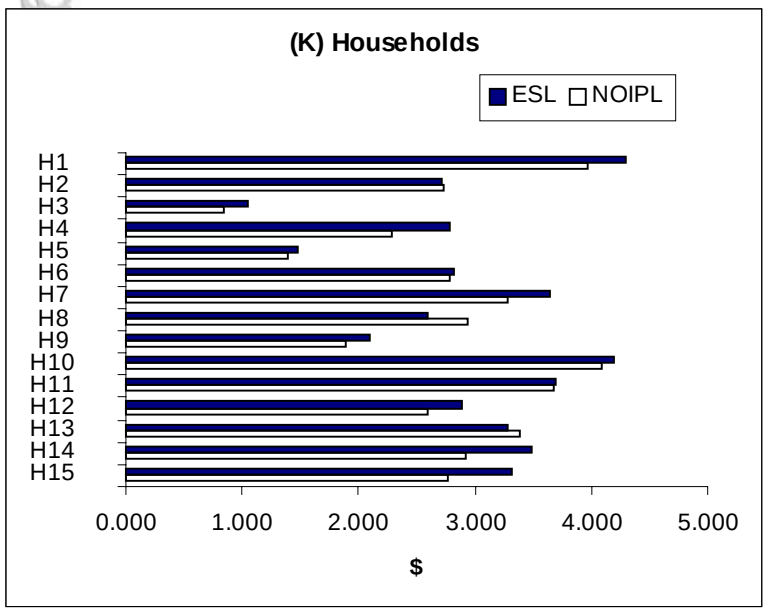


Figure 4.1: Average category prices at ESL and NO-IPL stores in data set 2

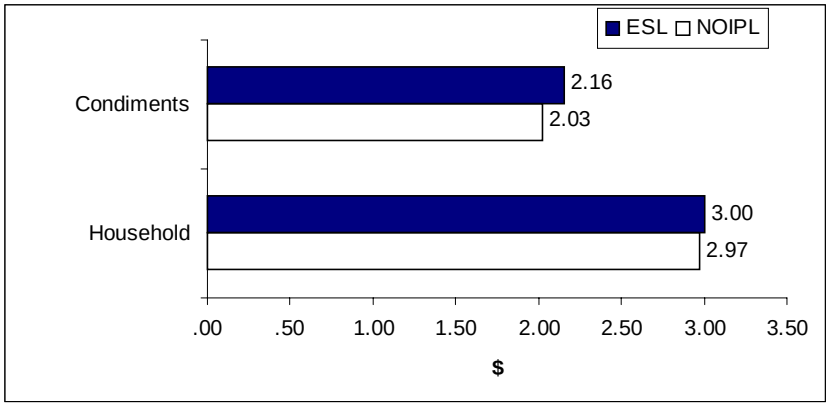
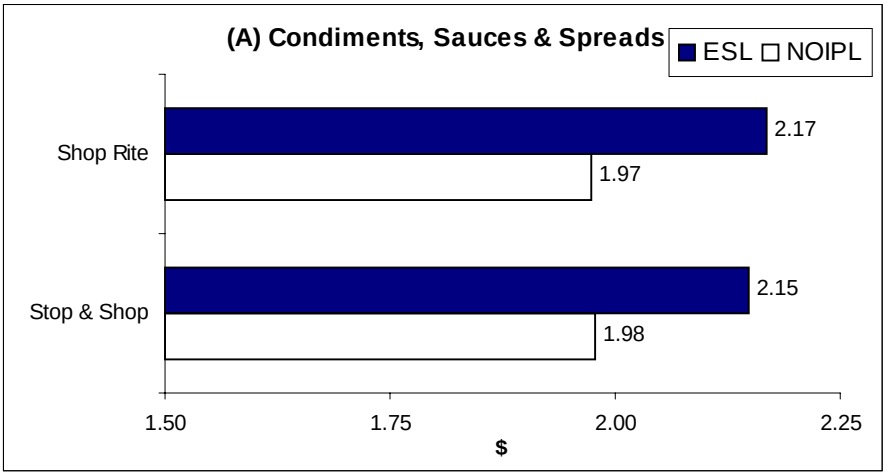


Figure 4.2: Average chain level prices at ESL and no-IPL stores in data set 2



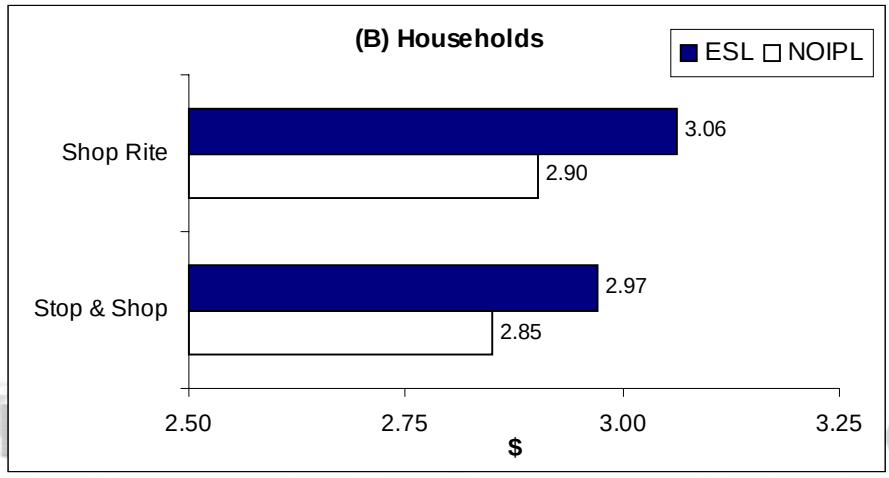
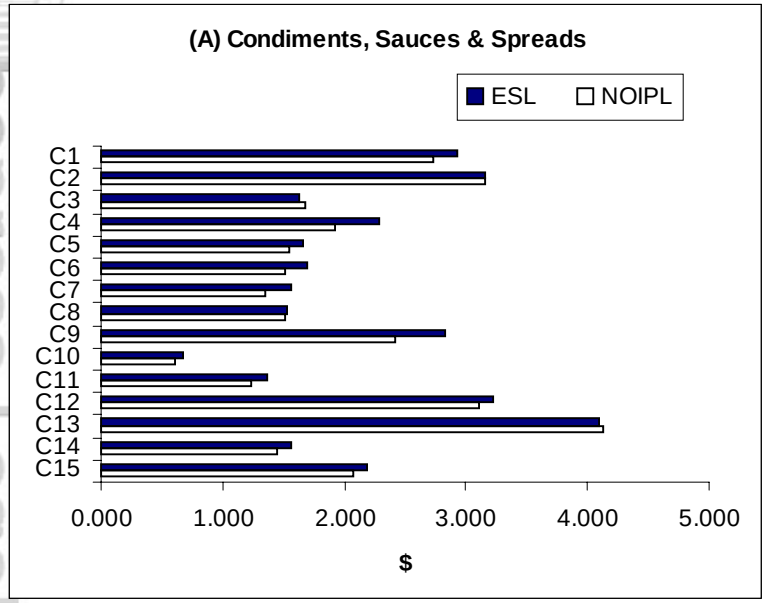


Figure 4.3: Average product prices at ESL and NO-IPL stores in data set 2



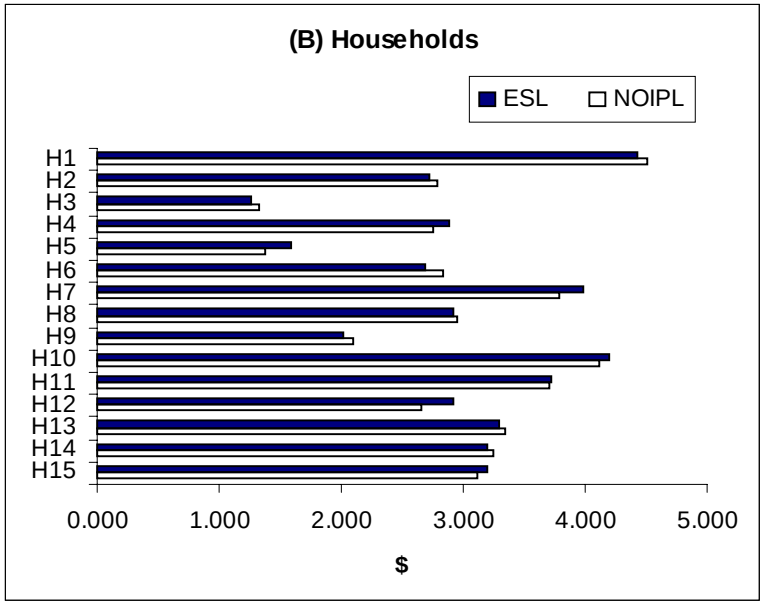


Figure 5.1: Average category prices at ESL and IPL stores in data set 1

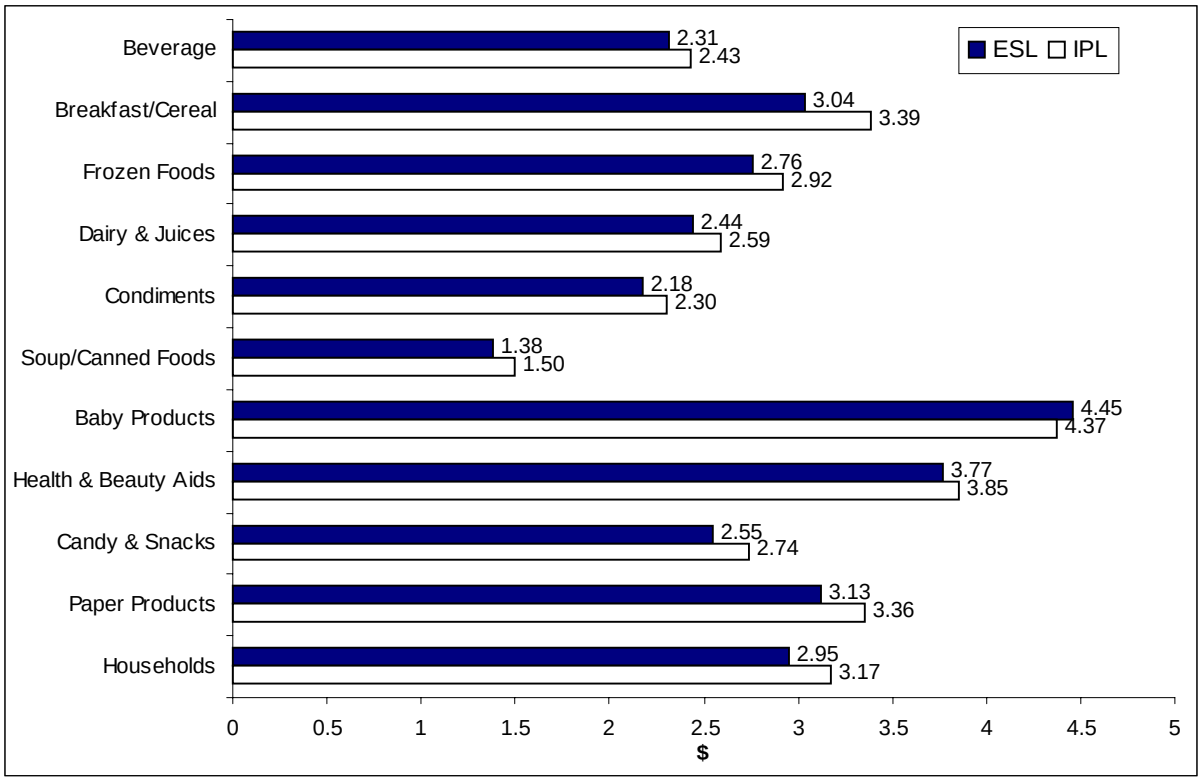


Figure 5.2: Average category prices at Stop & Shop (S19, ESL, Stamford, CT) and Food Emporium (S16, IPL, Greenwich, CT) in data set 1

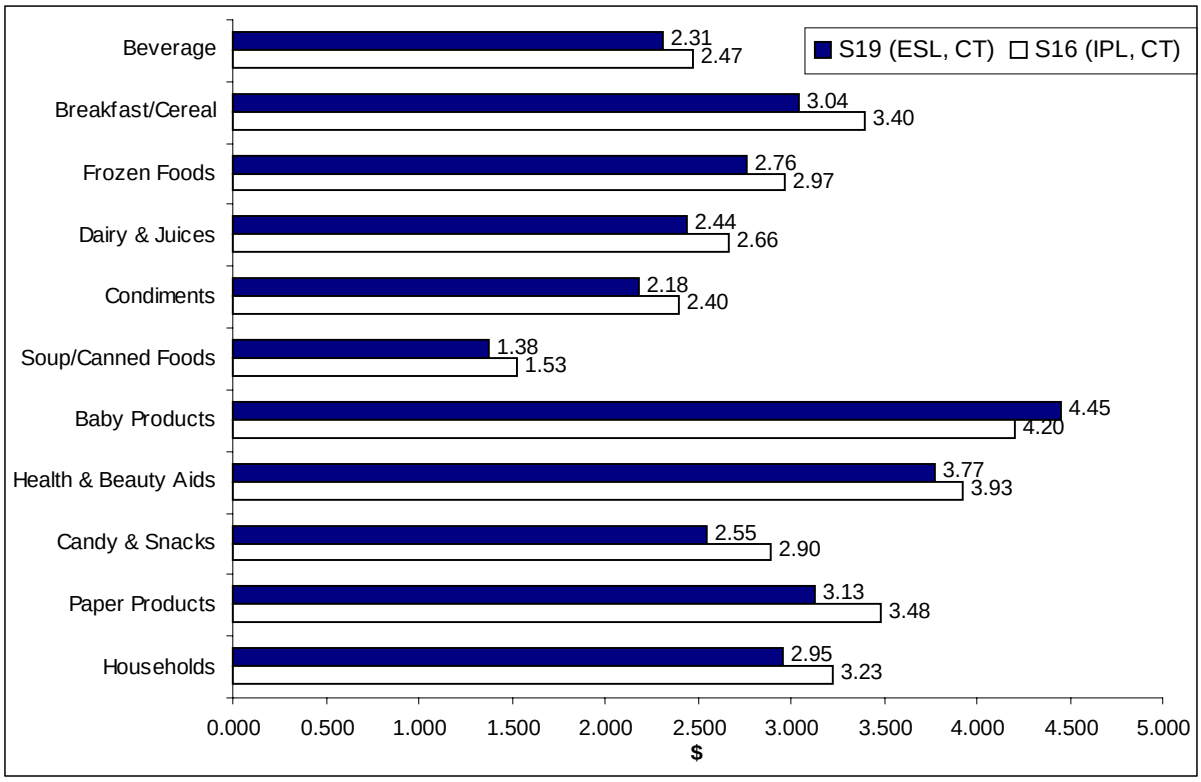


Figure 5.3: Average product prices at ESL and IPL stores in data set 1

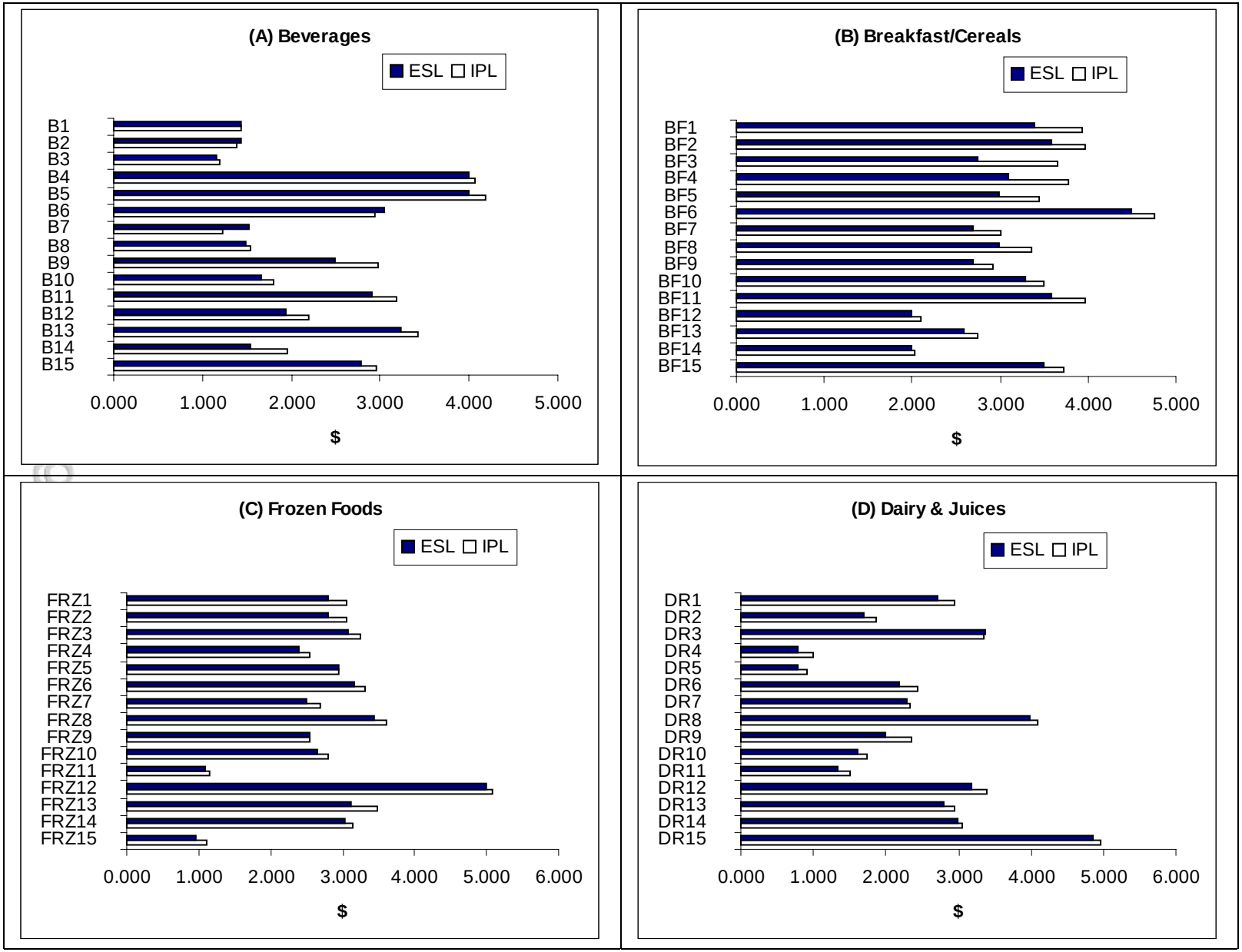


Figure 5.3 (contd.): Average product prices at ESL and IPL stores in data set 1

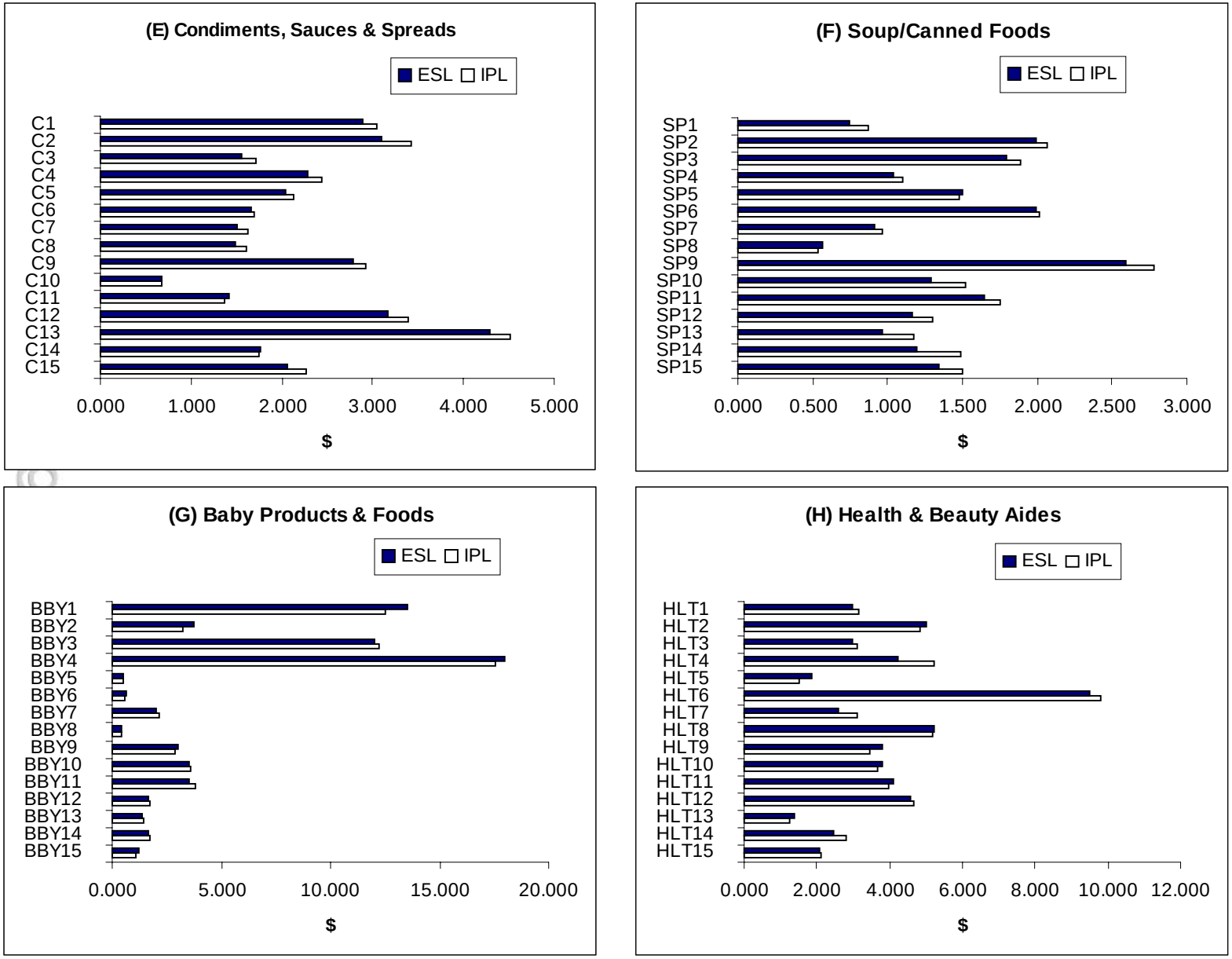
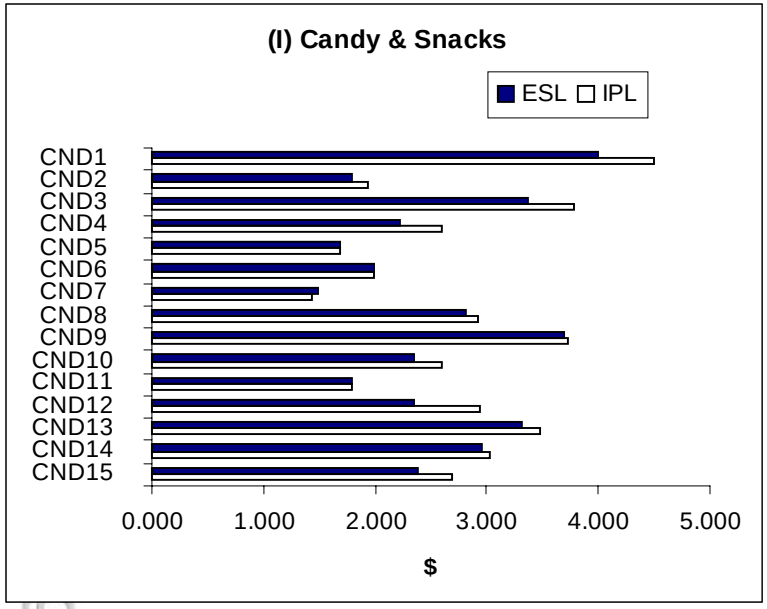
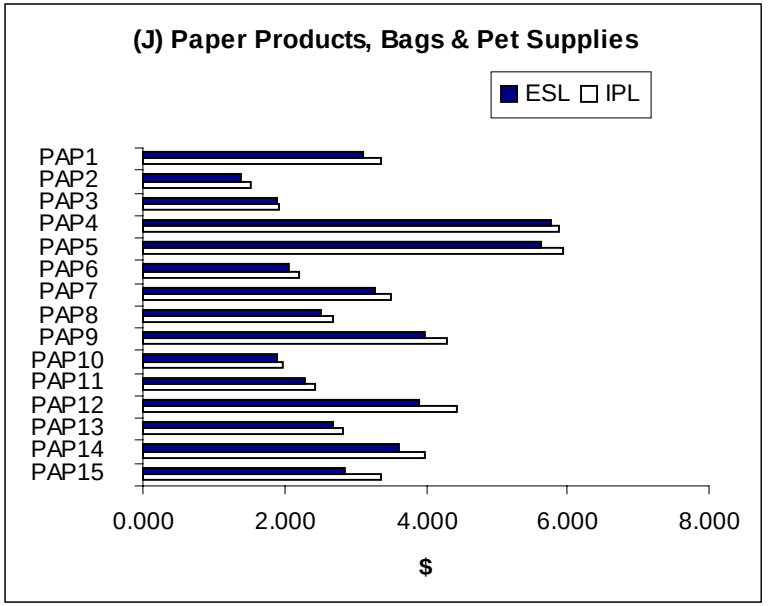


Figure 5.3 (contd.): Average product prices at ESL and IPL stores in data set 1





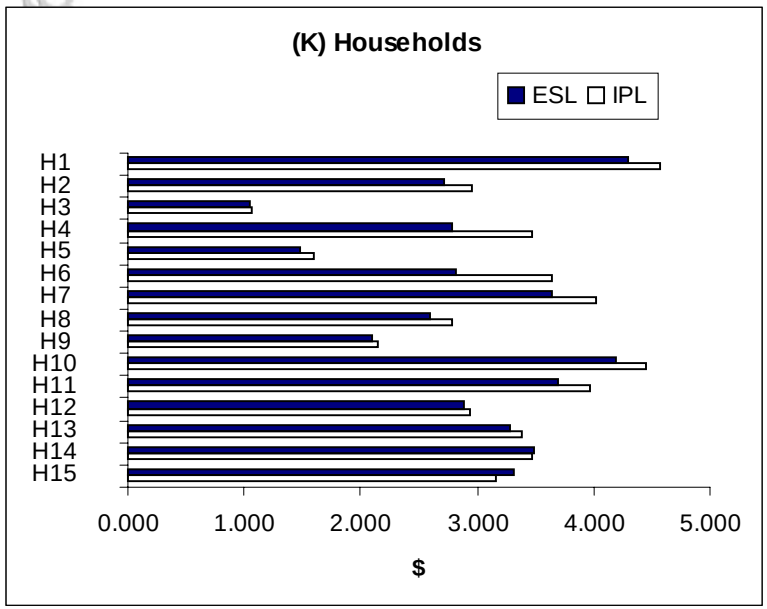


Figure 6.1: Average category prices at ESL and IPL stores in data set 2

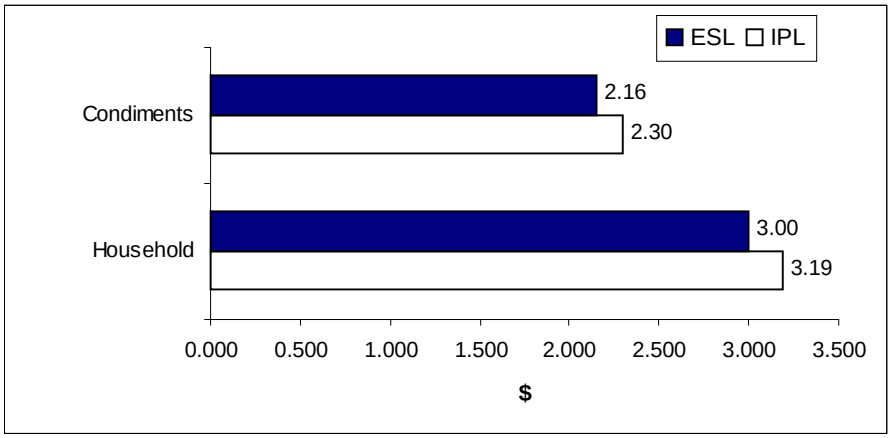


Figure 6.2: Average category prices at CT-ESL (S18+S19+S20) and CT-IPL (S16+S17) stores in data set 2

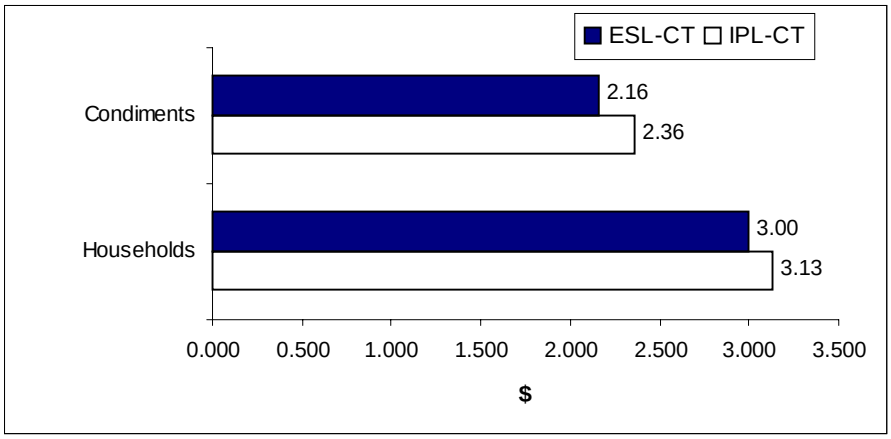


Figure 6.3: Average category prices at CT-ESL (S18+S19) and CT-IPL (S16) stores in data set 2

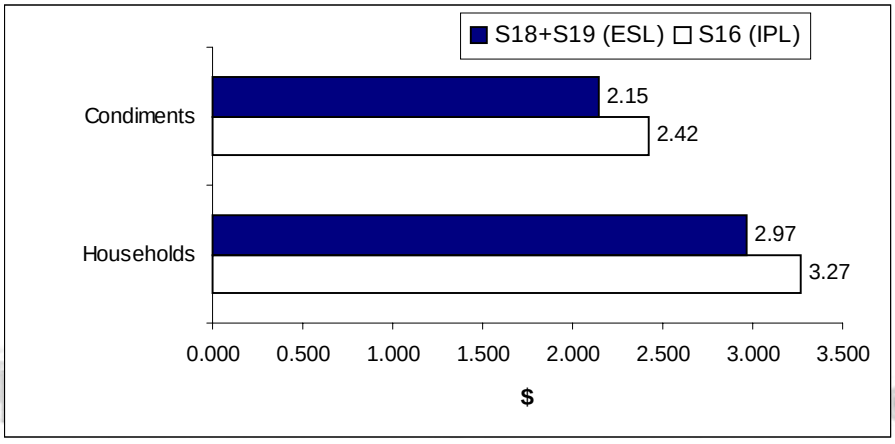


Figure 6.4: Average category prices at CT-ESL (S18) and CT-IPL (S16) stores in data set 2

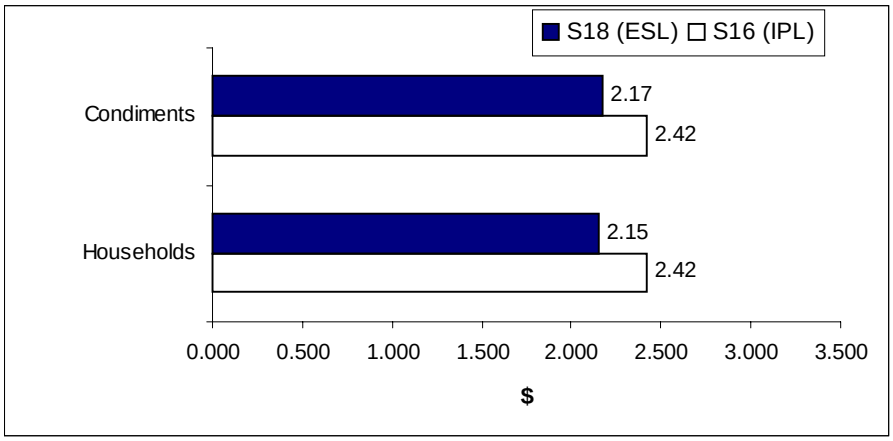


Figure 6.5: Average product prices at ESL and IPL stores in data set 2