

Macro-economic determinants of consumer price knowledge: A meta-analysis of four decades of research

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Abstract

For the past four decades, dozens of researchers have studied consumer price knowledge, often with disagreements on the extent of consumer' ignorance about prices. While some of these disagreements have been attributed to research design variations among studies, no inquiry has yet been made on the role of the economic environment on consumer price knowledge. Nevertheless, environmental factors such as interest rates, unemployment, and economic growth may significantly influence consumers' knowledge of prices. Certain economic environments may therefore provide marketers with the ability to utilize pricing tactics which rely on limitations in consumers' knowledge of product prices. Using a meta-analytic framework, this paper synthesizes the results of 297 previous price knowledge studies to document the effects of inflation, unemployment, GDP growth, interest rates, country of study, and passage of time on consumer price knowledge. The meta-analysis results demonstrate that economic factors have considerable influence on explaining variations in consumer price knowledge. Managerial and public policy implications of the findings in light of turbulent economic environments are discussed.

Keywords: Price knowledge; Consumer memory; Macro-economics

1. Introduction

A fundamental tenet of neoclassical economic thinking is a consumer who is fully knowledgeable about prices (Marshall, 1890). Ever since Gabor and Granger's (1961) pioneering study of the price memory of hundreds of British housewives, dozens of researchers have tested consumers' price memory through a variety of research methods, with a number of results challenging the fundamental tenet of price memory. Researchers have, for example, shown that consumer knowledge of prices may be affected

by the format in which prices are presented (e.g., Schindler and Wiman, 1989), the promotional status of a product (e.g., Krishna et al., 1991), or the research design choices used in collecting price knowledge data (Estelami and Lehmann, 2001; Monroe and Lee, 1999).

However, no inquiry to date has empirically established the role of basic economic trends on consumer price knowledge. The primary reason for lack of such an inquiry has been an inability to experimentally manipulate economic forces, as variations in the economic environment cannot be realistically simulated in laboratory settings with experimental subjects (e.g., Shamir, 1985). For example, unable to detect variations in consumer price knowledge among

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four price knowledge studies conducted in different economic environments, Gabor (1988) concluded that a persistence of the ability to recall prices is an inherent characteristic of the consumer (p. 244). Other researchers disagree. McGoldrick and Marks (1987), for example, state that the approaches, scope and methodologies differ greatly, making it difficult to compare the findings (p. 593). The net result has been the accumulation of a large body of inconclusive research findings, and general disagreement on the role of the economic environment on consumers' knowledge of prices.

This line of inquiry is especially timely in light of emerging turbulent economic environments in the industrial world, and a global economic slowdown, as evident in economic indicators such as interest rates, GDP growth, and unemployment rates across a great part of the world. Economic forces such as inflation, unemployment, and high interest rates represent risks to consumer welfare, and are often assumed to provide incentives for consumers to improve their knowledge of prices, thereby affecting marketers' ability to capitalize on consumer ignorance of price information (e.g., Monroe, 1990; Kotler and Roberto, 1989; Nagle and Holden, 1995). From a practical perspective, this research would therefore help identify economic environments which foster consumer ignorance of prices, providing both marketers and public policy makers with the improved ability to recognize environments which may allow sellers to capitalize on consumer's limited knowledge of prices. From an academic perspective, this line of inquiry would also shed light on the accuracy of consumer price knowledge measures obtained under various economic circumstances, thereby helping future researchers gauge the extent of variance in price knowledge resulting from the economic environment in which the studies are conducted.

The accumulation of price knowledge studies spanning a period of four decades provides a unique opportunity to examine the role of economic forces on consumer price knowledge. To facilitate such an inquiry and to combine the various study results, a meta-analytic approach is utilized in this paper. The authors integrate 297 price knowledge studies from over two dozen manuscripts spanning the 1961–1999 time period and covering over 50 product categories

to examine the effects of macro-economic factors such as inflation, unemployment, and interest rates upon consumer price knowledge. The paper concludes with a discussion of managerial implications of the findings.

2. Macro-economic drivers of consumer price knowledge

Consumer exposure to prices has been realized to initiate a sequence of events in which the eventual storage of numeric price information in long-term memory may occur (Jacoby and Olson, 1977). Repeated exposures are likely to create stronger memory traces for prices, which are subsequently recalled and used in evaluating future purchases (Monroe, 1973; Winer, 1986). Moreover, according to the multiple-store theory of memory (Lindsay and Norman, 1972; Shiffrin and Atkinson, 1969; Sawyer, 1974), heightened importance of prices due to economic factors such as inflation and unemployment increases the likelihood of elaboration and rehearsal of price information (Jacoby and Olson, 1977). As a result, variations in consumer price knowledge can be expected to occur under different economic circumstances, and at different points in time.

We therefore examine the role of six potential situational drivers of consumer price knowledge: inflation, economic growth, unemployment, interest rates, country of study, and time. These factors have been chosen since they are commonly viewed as economic control mechanisms, and since prior works (e.g., Shamir, 1985; Van Raaij and Gianotten, 1990; Warr, 1984) suggest them to be potentially strong drivers of key consumer responses such as consumer confidence, purchase intent, and price sensitivity. Moreover, the dynamics by which these factors influence consumer price knowledge may be interrelated. For example, both unemployment and inflation present threats to consumers' financial security and welfare and as such are expected to be factors, which should heighten consumer sensitivity to prices. Similarly, both economic slowdown and rising interest rates are expected to limit consumers' disposable income, and as such should positively impact consumer desire to learn about price information. The effects of these situational factors are outlined below.

2.1. Inflation and unemployment

In his classic pricing book, Gabor (1988) compared studies conducted across decades and concluded that a price-conscious behavior remains satisfied in the case of frequently purchased items in respect of the majority of shoppers despite variations in the annual rate of inflation (p. 240). However, Gabor also acknowledged that due to methodological variations, the results are not truly comparable (p. 240). This lack of comparability may be driven by not having taken into account variations in research methodology among the studies examined, and by the small number of studies used which render the detection of statistically significant differences difficult, if not analytically impossible.

The Gabor (1988) observation is especially interesting, as it conflicts with a large body of established research on consumers' processing of price information. A series of studies have suggested that inflation increases the intensity of consumers' processing of price information. For example, Behrend (1964, 1981) studied the effects of rising prices on consumer responses. His work and subsequent research (e.g., Daniel, 1975) have shown that market price increases have significant influence on consumer attitudes, price expectations, and purchase behavior. Similarly, Alt (1979) studied consumers' inflationary expectations and demonstrated significant biases in consumer responses. Alt specifically showed that an upward bias, evident by an over-estimation of expected inflation rates, is present in consumer responses. A subsequent study by Kemp (1984) suggests that the source of this bias in consumer responses may be human inability to estimate exponential growth functions—a pattern which has also been observed in other lines of inquiry in human decision making.

However, theoretical and field studies seem to suggest that inflationary environments hinder consumer price knowledge, rather than help improve it. Economic research has established a positive relationship between inflation rate and price variance in markets (Lucas, 1973; Vining and Elwertowski, 1976; Parks, 1978). Increased price variance may result in an inability by consumers to learn and utilize price information. Rothschild (1974) and Friedman (1977), for example, indicate that price

instability associated with inflation reduces the diagnostic value of prices to consumers. This instability, in turn, may result in a reduction in consumer desire to learn price information (Bettman, 1979; Grewal and Marmorstein, 1994). It is therefore expected that under inflationary environments, consumer price knowledge will suffer.

Similar to inflation, unemployment threatens the welfare of consumers. Unemployment not only presents economic hardship, but also challenges the social and psychological well-being of individuals (Goldsmith et al., 1996; Jahoda, 1981). Increased unemployment places consumers at risk, and should help increase consumer attention to basic economic variables. This may help increase consumers' cognitive price processing activity, potentially resulting in increases in consumer attention to price information (Inman et al., 1990). It is therefore expected that higher levels of unemployment will motivate increased consumer knowledge of prices.

Hypothesis 1. Consumer price knowledge is negatively related to the inflation rate.

Hypothesis 2. Consumer price knowledge is positively related to the unemployment rate.

2.2. Economic growth and interest rates

Economic growth is characterized by increased output and higher household income, and is reflected in growth in the gross domestic product (GDP). Economic expansion has been a primary driver of increased wages and is associated with higher levels of disposable income (Fischer and Dornbusch, 1983; Varian, 1984). At times of high economic growth, consumers have a high marginal wage rate, and may find limited benefits in price shopping. Higher disposable income limits the perceived importance of price in day-to-day consumer decisions and as a result reduces consumer motivation to encode price information (Urbany, 1986). As a result, the amount of price information search has been shown to decline with increased prosperity (Beatty and Smith, 1987).

In contrast, economic slowdowns reduce consumers' disposable income and may provide stronger

incentives for households to learn price information (e.g., Gabor and Granger, 1961; Wakefield and Inman, 1993). The budget constraints faced by households at times of economic slow-down make the economic benefits associated with price search and learning behavior more evident (Stigler, 1961; Zeithaml, 1982), resulting in an inverse relationship between household prosperity and price sensitivity (e.g., Frank, 1967; Wakefield and Inman, 1993). It is therefore expected that economic growth would be associated with lower levels of consumer price knowledge.

Similar to economic slowdowns, rising interest rates limit consumers' disposable income. As a result, interest rates are a key mechanism by which regulators control consumer spending (Katona, 1975). Interest rates reduce consumers' purchasing power and help create financial risks for households heavily dependent on credit. Moreover, time series analysis of consumers' psychological and behavioral responses such as consumer sentiment, confidence, and purchase intentions indicates a causal link between interest rate increases and reductions in these fundamental constructs (e.g., Van Raaij and Gianotten, 1990). It is therefore expected that higher interest rates will increase consumer motivation to process price information, with a subsequent improvement in consumer price knowledge.

Hypothesis 3. Consumer price knowledge is negatively related to the GDP growth rate.

Hypothesis 4. Consumer price knowledge is positively related to interest rates.

2.3. Passage of time

Unable to detect significant variation in price recall accuracy among studies conducted at different points in time, Gabor (1988) contends that consumers' level of price knowledge is a persistent and stable construct. However, Bates and Gabor (1986) acknowledge that differences in approach are existent in the research methodologies of the various studies (p. 294), making such comparisons difficult. In fact, considerable evidence on consumer buying trends indicates that consumers' level of cognition in

the purchase process has deteriorated over generations. Increasing time pressure, information overflow, and a growing number of brand choices has contributed to a cross-generational evolution in the market environment (Leeftang and Van Raaij, 1995). As a result, consumer decision processes have become briefer and the cognitive processing of market information has become more demanding (Firat et al., 1995; Firat and Venkatesh, 1993; Van Raaij, 1993).

In addition, increased availability of consumer credit has helped reduce the relative importance of price in the decision making process. For example, in the United States alone, between the early- and late-1990s consumers' credit card debt has more than doubled, and consumers' savings rate reached its lowest level in over half a century (Hershey, 1998). Scanner panel data also indicates that the growing level of promotional activity in the marketplace has resulted in consumers who avoid price variations prompted by marketing tactics such as couponing and cyclical promotions (Jedidi et al., 1999; Mela et al., 1997). One result is a move toward simple every-day low pricing mechanisms, which do not require the learning and memorization of regular and promoted prices. It is therefore expected that the accuracy of consumers' knowledge of prices will decrease over time.

Hypothesis 5. Consumer price knowledge has been decreasing over time.

2.4. Country

While no study has formally conducted a comparison of consumer price knowledge across countries, there is established evidence on variations in consumer behavior across cultures. Ger and Belk (1996) examined consumption attitudes across a dozen countries, and found significant variations in consumer desires and level of materialism. For example, Western European consumers on average register lower scores on a materialism scale than US consumers. Steenkamp et al. (1999) have also identified cross-national differences in consumer innovativeness. There is also considerable evidence on differences that exist across cultures in purchase and

consumption behavior of food products (Senauer et al., 1993) as well as other categories of goods and services (Clark, 1990; Keegan, 1995). However, the impact of these forces on consumers' price knowledge is unclear. As Durvasula et al. (1993) suggest, many of the elements of the consumer decision making process are generalizable across cultures. As a result, the influence of nationality or culture on the relative importance of price is unclear, and therefore its impact on consumer price knowledge remains an exploratory hypothesis.

Hypothesis 6. Consumer price knowledge varies between US and non-US consumers.

3. Methodology

In order to synthesize the results of past studies, a meta-analysis was conducted. Meta-analysis, which is used to combine results from various studies utilizing different research designs, has been widely applied in the marketing literature (e.g., Peterson et al., 1985; Rao and Monroe, 1989; Sultan et al., 1990; Geyskens et al., 1999) as well as other fields of study.

3.1. Literature identification

To identify relevant past studies, a series of bibliographic searches were first carried out. A computerized bibliographic search using the *American Bibliographic Index* (for business publications), *PsychInfo* (for the psychology literature), *EconLit* (for the economics literature) and *Dissertation Abstracts International* (for defended doctoral and masters dissertations) was first conducted. This was complemented by an issue-by-issue examination of papers published in leading marketing publications between 1970 and 1999. These publications are listed in Table 1. In addition, previous related research cited in three pricing texts (Gabor, 1988; Monroe, 1990; Nagle and Holden, 1995) was obtained. Finally, papers cited in earlier review articles were identified and obtained for examination, and the advice of several experts on pricing was also sought to help identify non-published manuscripts.

The above approach is consistent with prescriptions made by Rosenthal (1991) for identifying a data base of relevant research, and closely follows the steps taken in earlier meta-analyses published in the marketing literature (e.g., Compeau and Gewal, 1998; Rao and Monroe, 1989). The manuscripts were then inspected for the presence of price recall measures. A total of 27 manuscripts were identified and are listed in Table 1. Most papers reported multiple measures of price knowledge, as they explored variations in factors such as the product category, promotional status, or the experimental conditions under study. This resulted in a total of 297 studies covering over 50 product categories.

3.2. Price knowledge

To assess the accuracy of consumers' knowledge of prices, researchers have utilized a variety of memory tests. These tests have examined the accuracy of consumers' recalled prices (e.g., Mazumdar and Monroe, 1990; Progressive Grocer, 1974), their ability to rank items in terms of their expensiveness (e.g., Brown, 1971), and their ability to recognize price labels (e.g., Dickson and Sawyer, 1990). Price knowledge has been typically measured as the accuracy of recalled prices in a given product category, and not the count of product categories in which consumers possess price information. Therefore, price awareness research has largely relied on price recall error as the key indicator of consumer price knowledge (Estelami and Lehmann, 2001; Monroe and Lee, 1999). Most price recall studies measure the deviation between the actual price and the recalled price. Price recall error is therefore gauged by measuring the percent deviation between prices elicited from the consumer and the actual price of the product, and is often reported as the percent error (e.g., Dickson and Sawyer, 1990; Estelami, 1998; Mazumdar and Monroe, 1992)

$$\text{Price Recall Error} = \frac{|\text{Actual Price} - \text{Recalled Price}|}{\text{Actual Price}}$$

The higher the error, the lower is consumers' price recall accuracy. In some studies, instead of price recall error, the authors report a distributional

Table 1
Manuscripts utilized in the meta-analysis

Author(s)	Publication ^a	Year of publication
Gabor and Granger	Applied Statistics	1961
Anonymous	Progressive Grocer (1964)	1964
Heeler	Progressive Grocer	1974
Harrell et al.	MSU Report	1976
Dietrich	Progressive Grocer (1977)	1977
Stephens and Moore	Journal of Advertising Research	1977
Goldman	Journal of Marketing	1977
Gabor	Management Decision	1979
Zbytniewski	Progressive Grocer (1980)	1980
Zeithaml	Journal of Consumer Research	1982
Bates and Gabor (1986)	Journal of Economic Psychology	1986
Shamir	Journal of Economic Psychology	1985
Conover	Advances in Consumer Research	1986
McGoldrick and Marks	European Journal of Marketing	1987
Helgeson and Beatty	Journal of Consumer Research	1987
Gabor	Pricing text book	1988
Schindler and Wiman	Journal of Business Research	1989
Dickson and Sawyer	Journal of Marketing	1990
Krishna et al.	Journal of Marketing	1991
Mazumdar and Monroe	Journal of Retailing	1992
Chernatony and Knox	Marketing Intelligence and Planning	1992
Wakefield and Inman	Journal of Retailing	1993
Le Boutillier et al.	Marketing Letters	1994
Turley and Cabannis	Journal of Professional Services Marketing	1995
Lawson et al.	Journal of Travel Research	1995
Kemp and Willetts	Journal of Economic Psychology	1996
McGoldrick et al.	Service Industries Journal	1999

^aPublications surveyed for the purposes of the meta-analysis: Advances in Consumer Research, American Marketing Association Educators Conference Proceedings, Fordham Pricing Conference Proceeding, International Journal of Research in Marketing, Journal of the Academy of Marketing Science, Journal of Business Research, Journal of Consumer Affairs, Journal of Consumer Marketing, Journal of Consumer Policy, Journal of Consumer Psychology, Journal of Consumer Research, Journal of Economic Psychology, Journal of Marketing, Journal of Marketing Research, Journal of Marketing Theory and Practice, Journal of Product and Brand Management, Journal of Product Innovation Management, Journal of Professional Services Marketing, Journal of Public Policy and Marketing, Journal of Retailing, Journal of Retailing and Consumer Services, Journal of Service Research, Journal of Services Marketing, Marketing Letters, Marketing Science, Marketing Science Institute Working Paper Series, Pricing Strategy and Practice, Psychology and Marketing.

measure such as the percentage of respondents with price estimates within a particular range of the actual price (e.g., 15% of respondents have price estimates within 5% of the actual price). From this distributional measure, the average price recall error can be estimated by fitting the distributional measures to an exponential distribution (Estelami and Lehmann, 2001). Previous research reporting the distribution of price recall error measures indicates that this distribution closely follows an exponential form (e.g., Gabor and Granger, 1961; McGoldrick and Marks, 1987). Similar to an exponential distribution, price

recall error has a lower bound of zero, and its frequency gradually declines as one moves away from zero. Fitting an exponential distribution to price recall error data implies that

$$F(x) = 1 - e^{-\lambda x} = A$$

where A is the percentage of respondents who provide price estimates within x percent of the actual price, and F is the cumulative exponential distribution function with parameter $-\lambda$. This implies that

$$-e^{-\lambda x} = 1 - A$$

or,

$$\lambda = \frac{\log(1 - A)}{-x}.$$

Since the mean of the exponential distribution is equal to $1/\lambda$, the average price recall error can be estimated as

$$\text{Average Price Recall Error} = \frac{-x}{\log(1 - A)}.$$

The ability of this procedure to estimate actual average error values was examined by using studies where both the average error and distributional measures were reported. For these studies, the transformation was calculated, and the correlation between

the two measures was found to be strong ($r = 0.65$) and significant ($p < 0.001$).

3.3. Independent variables

In order to determine the effect of macro-economic variables on price recall accuracy measures of macro-economic variables for the time-frame of each study were obtained. The utilized measures include: inflation rate, unemployment rate, GDP growth rate, interest rate, year of publication, and the country of study. In addition, since price recall studies vary in their methodological approach, and since such variations have been shown to influence price recall

Table 2
Variable coding in the meta-analysis

Variable	Operationalization	Source
<i>Macro-economic</i>		
Inflation rate	Average yearly increase in the Consumer Price Index for the three years prior to the publication of the study.	International Financial Statistics (1984, 1999)
Unemployment rate	Average of the unemployment rates for the three years prior to the publication of the study.	International Financial Statistics (1984, 1999)
GDP growth rate	Average annual growth rate of the Gross Domestic Product for the three years prior to the publication of the study.	International Financial Statistics (1984, 1999)
Interest rate	Average prime lending rate for the three years prior to the publication of the study.	International Financial Statistics (1984, 1999)
Time frame	Year in which the manuscript was published.	Manuscript
Country of the study	Dummy variable which takes on a value of 1 if the study was conducted in the United States, and 0 if the study took place elsewhere.	Manuscript
<i>Research design</i>		
Purchase frequency	Percentage of respondents who purchase within the product category multiplied by the average number of purchases made by purchasers in that category, in a one-year period.	Marketing Fact Book (1995)
Gender	Percentage of respondents who are female. In manuscripts where this information is not provided, this percentage was set equal to the average for all studies where it has been reported.	Manuscript
Income	Average income of respondents in the study. Income figures were translated to 1999 dollars based on the consumer price index. If instead social class information was provided, dollar translations using data from the US Census Bureau were used (Census Bureau 1998, 1992, 1982, 1979, 1974, 1966).	Manuscript
Task size	The total number of products in a study for which the respondent has to provide prices.	Manuscript
Monetary participation incentives	Coded as 1, if the respondents in a study are given monetary compensation for their involvement. Otherwise, this was set to zero.	Source manuscript
Response format	Coded as 1, if the respondent is allowed to not provide a price estimate. Otherwise, this variable was set to zero.	Manuscript

accuracy measures (Estelami and Lehmann, 2001; Monroe and Lee, 1999; Schindler and Wiman, 1989), the effect of research design variables need to be controlled for in the meta-analysis. Removing their effect will help identify the incremental impact of the macro-economic variables of interest on price recall measures. Past research indicates that the knowledge measures obtained from respondents may be influenced by factors such as the product category (e.g., Estelami, 1998; Jacoby and Olson, 1977; Lindsay and Norman, 1972; Sawyer, 1975), respondent gender (e.g., Bates and Gabor, 1987; Jonung, 1981), household income (e.g., Gabor and Granger, 1961), task difficulty (e.g., Sawyer, 1975; Sudman and Blair, 1998), and the size of monetary compensation given to respondents (e.g., Carroll et al., 1986; Dansereau and Gregg, 1966). As a result, the following variables were also included in the meta-analysis to control for their potential effect on price knowledge measures: product category purchase frequency, respondent gender, income, task size, monetary participation incentives, and the response format. Table 2 provides a detailed summary of the operationalization of these variables.

4. Results

The average price recall error across all products was 0.14. However, considerable variation in error levels across the various conditions can be observed, and the standard deviation of the average recall error is 0.11. Table 3 reports the effects of the macro-economic variables on price recall error. The continuous economic variables (i.e., inflation, GDP growth, unemployment, and interest rates) are divided into three evenly distributed ranges in this table to enable examination of their effects on price recall error. The average unemployment rate was 5.9%; the average interest rate was 5.6%; the average annual economic growth rate was 3.6%; and the average inflation rate was 4.4%. Moreover, 80% of the studies were conducted in the United States, and the studies are evenly dispersed across the four decades. However, considerable variation in the macro-economic variables and the average recall error can be observed. For example, there seems to be a positive relationship between recall error and inflation ($r = 0.29$;

$p < 0.01$). Higher inflation rates are associated with higher average recall error levels.

Similarly, there is a positive relationship between price recall error, and economic growth. Moderate GDP growth rates are associated with higher error levels than low growth rates. This suggests that increased economic growth rates are associated with lower levels of consumer price knowledge. This is expected, as economic growth is often associated with household prosperity, which may reduce consumer sensitivity and attention toward price information. Table 3 also suggests that unemployment at moderate to high levels has no influence on price recall error.

The above results, obtained at the individual variable level, may suffer from omitted variable bias, given the non-orthogonal nature of the natural exper-

Table 3
Individual effects of macro-economic variables on price recall error

Independent variables	Number of studies	Average price recall error ^a
<i>Inflation rate</i>		
Less than 3.2%	115	0.106 (0.086)
3.2%–5.9%	96	0.128 (0.121)
6.0% or more	86	0.194 (0.107)
<i>Unemployment rate</i>		
Less than 5.5%	74	0.203 (0.130)
5.5%–6.4%	121	0.121 (0.094)
6.5% or more	102	0.111 (0.095)
<i>GDP growth rate</i>		
Less than 2.7%	92	0.126 (0.106)
2.7%–4.4%	111	0.151 (0.119)
4.5% or more	94	0.141 (0.102)
<i>Interest rate</i>		
Less than 4.4%	99	0.137 (0.092)
4.5%–6.4%	109	0.119 (0.113)
6.5% or more	89	0.167 (0.115)
<i>Geographic location of study</i>		
United States	239	0.148 (0.113)
Non-US	59	0.099 (0.089)
<i>Time frame of study</i>		
1960s	66	0.116 (0.076)
1970s	89	0.195 (0.123)
1980s	60	0.114 (0.085)
1990s	82	0.113 (0.114)

^aNumbers in parentheses are standard errors.

imental design. These results may be further affected by research design variables which influence consumer price recall measures (Estelami and Lehmann, 2001; Schindler and Wiman, 1989). To determine the relative effects of the macro-economic variables compared to research design variables on price recall error, three individual OLS regressions were conducted. The natural log of recall error was used as the dependent variable in the regression in order to account for potential non-linearity and to improve model fit (Lehmann et al., 1998). A regression with price recall error as the dependent variable and the macro-economic variables as the independent variables was found to be significant ($F_{6,285} = 28.4$; $p < 0.001$). Similarly, regressing price recall error on the research design variables was found to be significant ($F_{6,285} = 29.9$; $p < 0.001$). In addition, a regression with price recall error as the dependent variable and both the macro-economic and research design variables as the independent variables was found to be significant ($F_{12,265} = 24.4$; $p < 0.001$). These regression results indicate that the addition of the research design variables to the macro-economic variables yields a significant increase in model fit. This increase, tested through a Chow nested model test is significant at the $p < 0.01$ level and indicates that in conducting the analysis both the research design and macro-economic variables need to be included in order improve the interpretation of the regression estimates obtained. In addition, the amount of explained variance uniquely associated with the economic variables is nearly identical to that associated with the research design variables.

Regression estimates for the combined model are reported in Table 4. As in the previous set of regressions, the natural log of recall error was used as the dependent variable. In addition, weighted least squares (WLS) regression was utilized since variation in the sample sizes of the individual studies may affect the results (Hair et al., 1998). As expected, Table 4 shows significant effects for the research design factors. The presence of monetary incentives has a negative impact on price recall error. Similarly, allowing respondents not to express a price estimate if they lack the necessary information significantly reduces recall error. In addition, higher income levels are associated with lower levels of consumer price knowledge. These results are consistent with

Table 4
Weighted least square estimates of the effects of design and macro-economic variables on price recall error

Variable	Parameter estimate	T-value
Intercept	-7.412***	-5.726
<i>Macro-economic variables</i>		
Inflation rate	18.602***	3.525
Unemployment rate	0.048	-0.491
GDP growth rate	28.914***	5.491
Interest rate	-0.066*	-1.744
Year of publication	0.028***	3.871
Country (US = 1; Non-US = 0)	-0.086	-0.471
<i>Research design variables</i>		
Monetary incentive	-0.450***	-2.603
No response allowed	-0.745***	-5.378
Task size	0.029*	1.653
Purchase frequency	-1.545***	-2.367
Percentage of female respondents	-1.092***	-3.354
Income	0.001**	5.692

* Significant at the $p < 0.1$ level.

** Significant at the $p < 0.05$ level.

*** Significant at the $p < 0.01$ level.

earlier work documenting the impact of research design variables on price recall measures (e.g., Estelami and Lehmann, 2001; Schindler and Wiman, 1989; Wakefield and Inman, 1993), and highlight the importance of including these variables in the regression analyses.

Table 4 results also indicate a positive relationship between inflation and price recall error. The positive sign of the inflation coefficient concurs with the positive relationship observed in Table 4 between inflation and price recall error. There also exists a negative relationship between GDP growth and price recall accuracy. GDP growth rate is positively related to price recall error and the effect is notably significant in light of its relatively large t -value. These observations are consistent with Table 3 and Hypotheses 1 and 3 regarding the negative effect of economic growth and inflation on consumer price knowledge.

In addition, interest rates have a negative effect on price recall error. The negative coefficient implies that at higher interest rates, lower levels of price recall error (higher levels of consumer price knowl-

edge) can be expected. While this is supportive of Hypothesis 4, it is important to note that this relationship is relatively weak, considering the low t -value associated with interest rates. However, in contrast to Hypothesis 2, unemployment rate seems to not have any significant influence on price recall error. This may be due to the fact, that as speculated earlier, unemployment only has a direct effect on a small segment of the population. Therefore, unless unemployment is personally experienced by a large proportion of the samples recruited in the studies utilized in this meta-analysis, its effects are likely to be minimal.

Table 4 results also indicate a positive relationship between the year of the study's publication and price recall error. The positive coefficient estimate for year of the publication implies that consumer price knowledge is declining, as suggested by Hypothesis 5. The results, however, indicate no cross-country variations in price knowledge between American and non-American consumers. Hypothesis 6, which intended to explore cross-country variations in consumer price knowledge, was not supported, as evident by the insignificant coefficient estimate for the country of the study. The absence of significant cross-country variations may be partially attributed to the disproportionately large number of observations from studies conducted in the United States.

5. Discussion

The meta-analysis shows that certain macro-economic variables have a significant influence on price recall accuracy measures obtained from consumers. In particular, economic expansion, as reflected by GDP growth rates, decreases consumer price knowledge. Apparently, prosperity reduces the need to pay attention to price information. Inflation was also found to have a negative effect on price recall accuracy, presumably due to price instability. Still, inflation has less of an effect on consumer price knowledge than economic growth, as reflected by the relative size of their t -values.

Interestingly, interest rates had a relatively smaller impact on price recall accuracy. This may be due to the fact that interest rate information is neither actively possessed, nor easily processed by consumers.

Generally, consumers have an inaccurate knowledge of interest rates (Kensey and McAlister, 1981), and even with the availability of interest rate information, consumer ability to quantify the impact of interest rates on daily expenditures is questionable. For example, Estelami (1997) has shown that in communicating automobile leases, complicating the terms of the lease by adding incremental lease attributes such as down payments and balloon payments hinder consumer ability to evaluate the lease. Such effects have been attributed to consumer inability to accurately conduct mental arithmetic required to appreciate the impact of interest rates and the time value of money, and a tendency to simplify decision making (e.g., Estelami, 1999; Morwitz et al., 1998). The net result is consumer inaccuracy in accounting for interest rate variations in consumption decisions.

The results also indicate no significant effect of unemployment rate on consumer price knowledge. This is expected as unemployment typically directly influences only a small proportion of a population, and is not equally experienced across economic subgroups (Bartell and Bartell, 1985; Warr, 1984). As a result, it may not be a direct motivator for every individual consumer. Considerable evidence suggests that consumers who are not affected by unemployment are neither necessarily aware of the rate of unemployment (Warr, 1984), nor do they act on such information, unless a large array of indicators challenge their economic well-being (Levin, 1985). As a result, changes in unemployment rate may not directly influence consumer confidence (Van Raaij and Antonides, 1991). It is important to note, however, that this observation may also be a result of the sample selection procedures used in studies of price knowledge. All 297 studies have utilized convenience based sampling procedures such as mall intercepts, community group recruitment, or student subjects. Therefore, the samples may not be representative of the population at large, and may also be less likely to include unemployed respondents. As a result, the impact of unemployment may be more difficult to determine. In addition, no significant differences were observed between American and non-American consumers. However, a generally negative influence on consumer price knowledge resulting from the passage of time was observed. This is an interesting observation as it contrasts with those

of Bates and Gabor (1987) and Gabor (1988), who suggest the consumer price knowledge is a relatively stable construct.

6. Conclusion

The results of this study have implications from both practical and academic perspectives. The meta-analysis results demonstrate that economic factors have as much influence as research design variables in explaining variations in consumer price knowledge. This is important considering that most existing research has focused purely on research design influences on consumer price knowledge, and that a general lack of academic inquiry on the impact of the economic environment on price knowledge exists. This line of inquiry is becoming especially more important in light of considerable turbulence expected in emerging new economies of the industrial world. Declining GDP growth rates and increasing interest rates are evidence of a global economic slowdown, and further highlight the importance of examining the role of economic factors on consumer behavior. From a public policy perspective, the positive but weak influence of interest rates on consumer price knowledge suggests that a consumer's motivation to become a more careful shopper is weakly influenced by macro-economic policy changes such as interest rate hikes. Moreover, the fact that price recall accuracy has decreased over time suggests that consumer protection bodies may need to more closely monitor the quality of price communications in the marketplace and in the media. Therefore certain market environments may be breeding grounds for deceptive communication of price information, requiring increased attention by public policy makers. Results of this study indicate that inflationary and growing economies may facilitate such confusion about prices, thereby increasing potential vulnerability of consumers to deceptive pricing tactics. The meta-analysis results also indicate that certain environmental factors (e.g., unemployment rate and the country of study) have no significant impact on consumer price knowledge.

From a marketing management perspective these results also highlight the role of the market environ-

ment on one's choice of pricing approaches. Pricing tactics such as comparative and auction-based pricing, which may depend on a lack of consumer knowledge of prices, are likely to be more effective in economic environments which experience high economic growth and inflation rates, and low interest rates. From an academic perspective this study suggests that the economic environment may have notable effects on price recall. Therefore, in examining and comparing multiple studies, researchers may need to take into account the potential effects of environmental factors as well as research design factors. This research also helps build on previous works, which have used subjects in laboratory experiments simulating economic environment changes. Since such simulated environments lack both internal and external validity (Shamir, 1985), they may not reflect the true impact of economic trends on consumption behavior. The meta-analytic approach used here provides a unique perspective on the role of economic variables on consumer behavior, which could not be obtained through alternative means.

It is important to acknowledge several limitations of to this work. The first relates to the dependent measure used in the studies utilized in the meta-analysis. As Monroe and Lee (1999) and Monroe et al. (1986) suggest, consumer knowledge of prices may not necessarily be stored in long-term memory in numeric form. As a result, price recall may not be an appropriate test of consumer price knowledge, and alternative measures, such as price recognition and rankings, are likely to be more representative of the underlying structure of consumer's price knowledge held in long-term memory. However, the majority of existing price knowledge studies have utilized recall as the basis of price knowledge measurement (Estelami and Lehmann, 2001; Monroe and Lee, 1999), and those studies which report rankings or recognition could not be integrated into the meta-analysis because of the incomparable nature of the dependent variable. In addition, a series of independent variables were not included in the analyses due to lack of data. For example, sample characteristics such as psychographics, employment status, brand loyalty, and product category usage levels were not available in any of the studies. Moreover, environmental factors such as product category promotional and price advertising intensity were not reliably

available for use as predictors of consumer price knowledge.

7. Future research

This line of research can be expanded in several directions. One possibility is to conduct individual price knowledge studies, which expand the array of variables examined in existing research. For example, given that the majority of existing studies have been conducted in the United States, future price knowledge studies can focus on examining variations in consumer price knowledge across countries and cultures. Future researchers may also want to capture additional psychographic and consumption measures such as consumer attitudes towards credit and consumer savings rate to determine their potential impact on price knowledge measures.

Given the growing interest on the topic and the accumulation of new research, there will likely be new avenues for an expanded meta-analysis exploring the effects of additional variables on consumer price knowledge. For example, the impact of the Internet on consumer price knowledge may be examined once a sufficient number of studies of Internet price response behavior have accumulated. Therefore, in the near future it may be possible to study consumer price knowledge in an Internet-based economy where supposedly price information is widely available, competition is intense and little price memorization by consumers is required. The addition of more studies to the database of existing findings may also facilitate a more detailed examination of economic variables, for example by studying the components of GDP (e.g., retail sales, durable product sales) rather than overall GDP growth rate.

Several research design opportunities also emerge from this work. For example, the various studies utilized in the meta-analysis were conducted at different points in time with different samples. It would be useful for future researchers to utilize consumer panels to obtain a more accurate picture of the dynamics and shifts in consumer price knowledge. Had a sufficient number of international studies existed, it would also have been interesting to conduct a broader international comparison (e.g., including developing economies) of price knowledge dynam-

ics, especially since several industrial countries have sustained periods of double-digit inflation, weak GDP performance, high unemployment, and high interest rates during parts of the last four decades. Moreover, the wide use of convenience samples in existing studies calls for sampling approaches which would be more reflective of the population they are intended to represent. It is hoped that these new avenues of research will provide sufficient additional data points in coming years to enable further examination of this fundamental and fascinating aspect of consumer behavior.

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